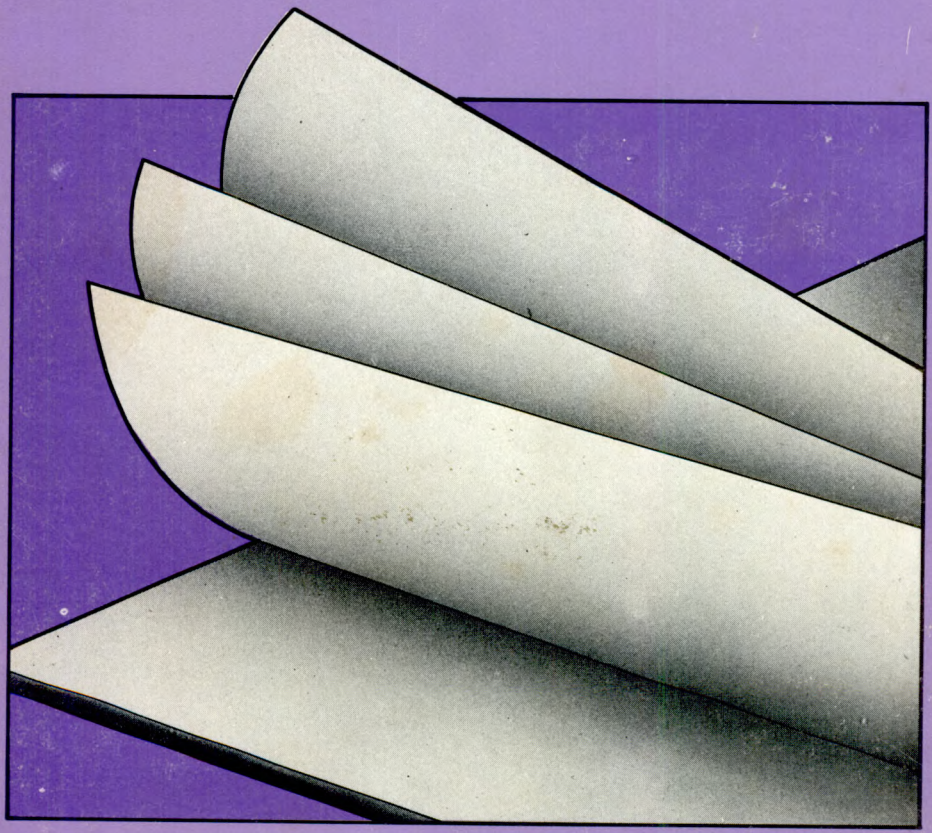
ISBN 958-9183-21-2

Cassava Utilization in Animal Feed
Supplement 1989



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ISBN 958-9183-21-2

Cassava Utilization in Animal Feed
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Apartado Aéreo 6713
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ISBN 958-9183-21-2
April 1990
200 cc.
Printed in Colombia

Citation:
Best, Rupert
Cassava utilization in animal feed. Supplement / Rupert Best, Lynn Menéndez. — 1989- . — Cali, Colombia : Centro Internacional de Agricultura Tropical, 1990- 134 p.

1. Cassava as feed — Bibliography. I. Menéndez, Lynn. II. Centro Internacional de Agricultura Tropical. III. Title

CONTENTS

INTRODUCTION

Cassava is the most important root and tuber crop grown in the tropical developing regions of the world. While the greater part of cassava production is destined for human food uses, the potential for the use of cassava and cassava products in animal feeding has increased considerably over the past 20 years.

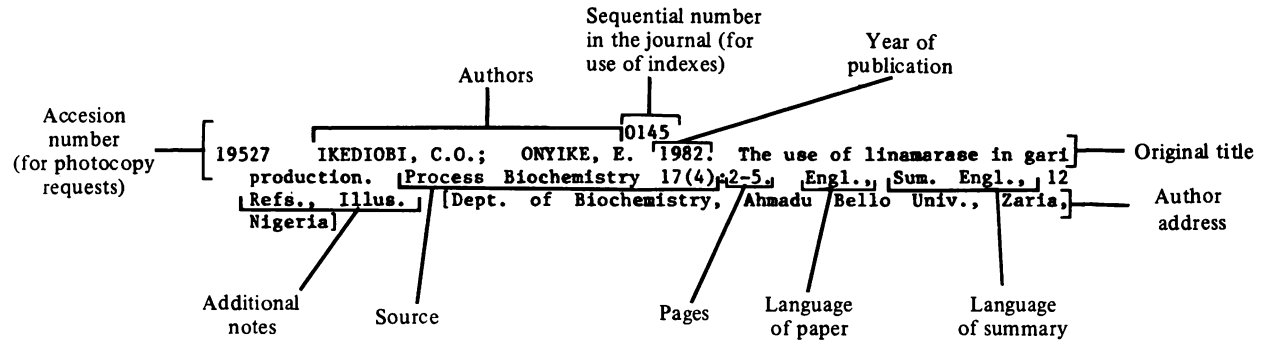
The interest in the use of cassava as a carbohydrate source to replace, partially or totally, feed grains in rations for swine, poultry, ruminants, and other animals has generated a vast amount of information on the subject. With the objective of systematizing this information and of making it more widely available to researchers, producers, and agroindustrialists, CIAT produced the bibliography "Cassava utilization in animal feed" in 1985 which contained 578 references. The present supplement updates that bibliography with an additional 279 entries.

ORGANIZATION

The references are organized in broad subject categories, and within each category alphabetically by author.

For easier consultation, author and subject indexes are provided. Authors and co-authors are listed in the author index, in alphabetical order. Numbers below each author's name refer to the consecutive number of the corresponding reference in the bibliography. The subject index presents an alphabetical list of descriptors, which are also accompanied by the corresponding consecutive numbers; many descriptors are combined with others to allow the identification of more specific topics. A list of abbreviations and acronyms used in the abstracts and bibliographic citations is also included.

COMPONENTS OF AN ABSTRACT



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FRESH CASSAVA

GENERAL

0001

35229 KOSHELEVA, G.; VERESHCHAK, V. 1986. (Tapioca) Mukomol'no-Elevatornaya i Kombikormovaya Promyshlennost no.10:36-37. Ru.

CASSAVA; CASSAVA MEAL; CASSAVA ROOTS (VEGETABLE); COMPOSITION; FEEDS AND FEEDING; POULTRY; SWINE; CATTLE; USSR.

Data are given on the composition of fresh cassava roots and CM. Fresh roots contain 65.0, 30.0, 1.4, 1.5, 1.3, and 1.0 percent moisture, starch, fat, fiber, protein, and ash, resp. Its mineral content consists of 42 percent potassium oxide, 11 percent calcium oxide, and 16 percent phosphorus pentoxide; its vitamin content (mg/kg) is 400 vitamin C, 1.6 thiamin, and 0.8 riboflavin. Data indicate that CM has 14.0, 3.8, 3.0, 0.6, 2.6, and 78.6 percent moisture, ash, CP, crude fat, crude fiber, and N-free extract, resp. It is poor in protein; when added to chicken and pig rations at over 15 percent, its glycoside content affects animal growth. When ruminant diets contain non-protein N compounds, CM can be added as a carbohydrate source. In diets for lactating cows, the level of CM should not exceed 20-40 percent by wt. For pigs, the optimum level is 20-40 percent; however, when the diet contains sufficient protein and amino acids, up to 60-75 percent can be included. When used in pelleted feeds, CM utilization improved. (CIAT)

SWINE

0002

25798 DOMINGUEZ, P.L. 1985. Utilizacion de la yuca como fuente de energia en la alimentacion de los cerdos. (Use of cassava as energy source in swine nutrition). Asociacion Cubana de Produccion Animal no.2:14-16. Es. Il.

CASSAVA; FEED CONSTITUENTS; SWINE; CUBA.

The chemical composition and nutritional value of cassava as animal feed, especially as a source of energy, is briefly reviewed. A trial was conducted in Cuba with 276 pigs (initial live wt. of approx. 47 kg), which were divided into 3 equal groups that received 3 different diets during 91 days: (1) fresh ground cassava cv. Senorita (47.4 percent) + commercial concentrate (52.6 percent); (2) cassava (16.2 percent) + commercial concentrate (29.1 percent) + mixture of processed wastes and molasses (54.7 percent); (3) commercial concentrate (30.0 percent) + mixture of processed wastes and molasses (70.0 percent). The final live wt. and gains were higher for treatments 1 (92.6 and 0.55 kg/day, resp.) and 2 (92.0 and 0.54 kg/day, resp.) than for treatment 3 (85.8 and 0.47 kg/day, resp.). Feed conversion rates were 4.36, 4.92, and 5.49 for treatments 1, 2, and 3, resp. Increases in live wt. gains were due to a higher feed efficiency of cassava-based diets, perhaps related to the high digestibility of cassava. Including fresh cassava as a substitute for the mixture of processed wastes and molasses is convenient from an animal performance viewpoint since wt. gains increased by approx. 70 g/day. (CIAT)

0003

34229 DOMINGUEZ, P.L.; ANUEZ, M. 1985. Utilizacion de la yuca en la ceba de cerdos. Rasgos de comportamiento. (Utilization of cassava in the fattening of pigs. Performance characteristics). Ciencia y Tecnica en la Agricultura. Ganado Porcino 8(2):43-49. Es. Sum. Es., En., 16 Ref. (Inst. de Investigaciones Porcinas, Apartado 10132, Punta Brava, Ciudad de La Habana, Cuba)

CASSAVA; ANIMAL NUTRITION; SWINE; ROOTS; DIETS; ANIMAL PHYSIOLOGY; CUBA.

A total of 276 commercial crossbred, castrated male and female pigs, with an initial live wt. of 43 kg, were distributed in 3 treatments according to a random block design. The pigs were allotted in 12 pens of a commercial fattening house. Treatments were a mixture of swill and molasses (PLT) at 1:1 dry basis and a commercial feed with a 22 percent CP (70 and 30 percent dry basis, resp.); in the 2nd treatment, 16.2 percent dry basis of PLT was sustituted for fresh ground cassava and in the 3rd treatment, pigs were given a mixture of fresh ground cassava (52.6 percent dry basis) and a commercial feed (47.4 percent dry basis). Final wt. (kg), consumption (kg DM/day), wt. gain (kg/day), and consumption/wt. gain were 85.8, 2.56, 0.47, and 5.49; 92.0, 2.64, 0.54, and 4.92; and 92.6, 2.38, 0.55, and 4.36 for each treatment, resp. The inclusion of fresh ground cassava as a substitute of PLT is convenient from the viewpoint of animal performance since wt. gain increased by 70 g/day, allowing an annual production increase of over 160 t meat (live wt.)/commercial fattening house. (AS)

0004

35300 FIGUEROA, M.; PANEQUE, G.; MARRERO, L. 1986. Estudio de seis variedades de yuca (Manihot esculenta) en dos epocas de cosecha con vistas a la alimentacion de cerdos. (Study of six cassava varieties, harvested on two different days, to be used in swine nutrition). Ciencia y Tecnica en la Agricultura. Viandas Tropicales 9(2):27-38. Es. Sum. Es., En., 16 Ref.

CASSAVA; CULTIVARS; ANIMAL NUTRITION; SWINE; HARVESTING; TIMING; ROOT PRODUCTIVITY; DRY MATTER; COMPOSITION; CUBA.

In a double classification expt., 6 cassava var. (Senorita, Pinera, CMC-40, CEMSA 74-725, CEMSA 74-207, and CEMSA 74-110) were studied on a Santa Clara clay soil at the U. Central de Las Villas (Cuba). Cuttings were planted on ridges at a depth of 5-7 cm and inclined at 30-45 degrees; planting distance was 0.9 x 0.9 m. A complete fertilizer (100 kg/ha) was applied and weed control practiced; neither pests nor diseases were detected. Two harvests (at 8 and 12 mo.) were carried out. Yields (t/ha on both humid and dry bases) were determined as well as the chemical composition in DM, total fat, crude fiber, and ash. Regarding yields (humid basis) obtained at 8 mo., the best performing var. were CEMSA 74-725, CMC-40, Senorita, and Pinera, and at 12 mo. they were CEMSA 74-207, CEMSA 74-725, and Pinera. On dry basis, the highest yielders at 8 mo. were CEMSA 74-725, Senorita, CMC-40, and Pinera, and at 12 mo. CEMSA 74-207 and Pinera. Commercial yield increase from 8 to 12 mo. was significant for all var., except for CMC-40; DM increase was significant only for var. Senorita, Pinera, and CEMSA 74-207. The best var. regarding DM yield (t/ha) and yield increase between 8 and 12 mo. were CEMSA 74-207, CEMSA 74-725, Senorita, and Pinera; it is therefore suggested that these var. be used in swine nutrition, taking advantage of their harvest at 12 mo. (AS-CIAT)

0005

34297 LEKULE, F.P.; MTENGA, L.A.; JUST, A. 1988. Total replacement of cereals by cassava and rice polishings in diets of growing-finishing pigs Tropical Agriculture (Trinidad) 65(4):321-324. En. Sum. En., 18 Ref. (Dept. of Animal Science & Production, Sokoine Univ. of Agriculture, P.O. Box 3004, Chuo Kikuu, Morogoro, Tanzania)

CASSAVA; CASSAVA ROOTS (VEGETABLE); CASSAVA MEAL; ANIMAL NUTRITION; SWINE; DIETS; FOOD ENERGY; DIGESTIBILITY; ANIMAL PHYSIOLOGY; TANZANIA.

The effects of feeding soaked, fresh cassava roots (CR), CM, and rice polishings (RP) as the only energy sources for growing-finishing pigs were examined in growth and digestibility studies. The diets were compared with a control (maize, sorghum) diet simulating a widely used commercial diet. The CR and RP diets had significantly higher coefficients of digestion of DM and OM and higher ME content than the control and CM diets (P less than 0.001). Feed intake, feed efficiency, and growth rate did not differ sig-

nificantly between treatment groups. Pigs on the control diet had a significantly low empty body wt. and a greater length and fill of the large intestine (P less than 0.05). Cassava and rice polishings are excellent energy sources for growing-finishing pigs and could totally replace cereals in pig diets, provided that the diets are formulated to meet requirements for essential nutrients. (AS)

0006

22085 MAKHAMBORA, P.E. 1971. The economics of using a cassava-based ration in pork production. Lilongwe, University of Malawi. Bunda College of Agriculture. Research Bulletin no.9:46-50. En. Sum. En., 3 Ref.

AFRICA; ANIMAL NUTRITION; CEREALS; COSTS; DOMESTIC ANIMALS; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING; MAIZE; MALAWI; STARCH CROPS; SWINE; USES.

Eighteen litters of Large White x Landrace crossbred pigs were used in a feeding trial to determine the performance of pigs fed a maize-based ration (F1), a peeled cassava-based ration (F2), and an unpeeled cassava-based ration (F3). A completely randomized design was employed. The av. daily live wt. gains of the pigs were 0.47, 0.49, and 0.44 kg for F1, F2, and F3, resp., and the differences were significant (P less than 0.01). Pigs fed the F2 ration had the highest feed conversion efficiency (3.3 kg feed/kg of live wt. gain) seconded by those on the F3 ration (3.9 kg feed/kg of live wt. gain); those on the F1 ration had the lowest (4.2 kg feed/kg of live wt. gain). It was estimated that the pigs fed on the F2 ration would give the highest gross margin followed by those on the F3 and F1 rations. (AS)

0007

24090 MANER, J.H.; BUITRAGO, J.; PORTELA, R.; JIMENEZ, I. 1971. La yuca en la alimentacion de cerdos. (Cassava in swine feeding). Palmira, Instituto Colombiano Agropecuario. Centro Internacional de Agricultura Tropical. 115p. Es. Il.

ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; COLOMBIA; COMPOSITION; CULTIVARS; DETOXIFICATION; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; FIBER CONTENT; FORAGE; FRESH PRODUCTS; HARVESTING; LEAVES; PLANT ANATOMY; PROCESSED PRODUCTS; PROTEIN CONTENT; ROOTS; SILAGE; SODIUM; SOUTH AMERICA; STORAGE; SWINE; TOXICITY; USES; WATER CONTENT.

A literature review on swine feeding with cassava, and the results of 16 expt. with fresh, dry, or ensiled cassava to feed growing and finishing pigs or in-pig or suckling sows, are presented. In 6 expt. with growing and finishing pigs fed fresh cassava, it was observed that groups receiving a max. consumption of 4.0-4.5 kg fresh cassava/animal/day with controlled amounts of a protein supplement grew slower than those fed with a maize-based control diet and than those fed fresh cassava + supplement ad libitum; this latter group consumed more protein supplement to partially meet its daily energy needs since the daily ration of fresh chopped cassava was not sufficient. Cassava palatability was improved in diets supplemented with sugar or molasses. Supplements with protein levels of only 20 percent rendered adequate yields in terms of wt. increase and feed conversion, and avoided protein overconsumption observed in previous expt. In expt. 7, 8, 9, and 10, also with growing and finishing pigs but fed with dry cassava and CM, it was observed that the progressive reduction in wt. increase was associated with increasing levels of CM substituting maize in the ration. A slight favorable response was obtained when adding 0.1 percent met. to the CM and soybean cake-based diets. In expt. 11, 12, and 13 (ensiled cassava fed to growing and finishing pigs), it was observed that the inclusion of stems and foliage into the silage reduced diet acceptability by the animals; animals fed ensiled cassava and protein supplement increased wt. at the same rate as pigs fed maize-based diets and protein supplement. Consumption of ensiled cassava was less than that of fresh cassava. A more active HCN detoxification mechanism was observed in pigs fed with ensiled cassava. In expt. 14 with fresh cassava supplied to in-pig sows, good results were

obtained. In expt. 15 (fresh cassava and CM supplied to suckling sows), it was found that litters from sows consuming fresh cassava were less numerous but with increased individual wt. and the av. wt. of litters at weaning were higher. However, total litter wt. at weaning indicated that there were no considerable differences in the overall performance of sows between all 3 treatments. In expt. 16 (ensiled cassava fed to suckling sows), it was found that sow and litter performance was adequate at any lactation stage when fed with ensiled cassava. (CIAT)

0008

24543 MORENO, E.A.H. 1981. Mandioca, potencial energetico na alimentacao do suino. (Cassava, energetic potential for swine feeding). Londrina-PR, Brasil, Fundacao Instituto Agronomico do Parana. Circular no.27. 53p. Pt. Sum. Pt., 121 Ref., Il.

ANIMAL NUTRITION; BRAZIL; CASSAVA MEAL; CASSAVA PRODUCTS; DIETARY VALUE; DOMESTIC ANIMALS; FEEDS AND FEEDING; FOOD ENERGY; FORAGE; FRESH PRODUCTS; PROCESSED PRODUCTS; PROTEINS; SILAGE; SOUTH AMERICA; SWINE; USES.

A literature review on the use of cassava in swine nutrition is presented. The geographical distribution and production of cassava, its utilization, chemical composition, and methods to reduce its toxicity are reviewed. The use of fresh cassava and CM for feeding pigs during their growing, finishing, pregnancy, lactation, and preinitiation periods is also reviewed. The use of cassava silage during the growing, finishing, and lactation periods, and of the cassava forage and SCP during the growing and finishing periods are also discussed. It is concluded that fresh cassava, CM, or cassava silage are excellent energy sources that, if used properly, can partially or totally substitute maize or other cereals in rations for pigs, without eliminating the possibility of having, in the future, an excellent protein source produced from cassava energy. (CIAT)

0009

29431 VIVES, G.; SAAVEDRA, D. 1983. Evaluacion de dos niveles de yuca fresca y dos de yuca secada al sol en raciones para cerdos en crecimiento y ceba. (Evaluation of two levels of fresh cassava and two of sun-dried cassava in rations for growing and fattening pigs). Tesis Ing.Agr. Panama, Universidad de Panama. 78p. Es. Sum. Es., 23 Ref., Il.

CASSAVA; FEEDS AND FEEDING; SWINE; ANIMAL NUTRITION; SUBSTITUTES; DIETARY VALUE; CASSAVA CHIPS; PANAMA.

An expt. was carried out at the Centro de Ensenanzas e Investigaciones Agropecuarios of Tocumen, Panama, with 15 weaned pigs (8 females and 7 castrated males), all dewormed and weighed at the beginning of the expt. Six were of the Yorkshire breed and 9 of a cross-bred sow and Landrace male, distributed randomly among the 3 exptl. groups. They consumed: (1) concentrate, (2) concentrate and fresh cassava, and (3) concentrate and sun-dried cassava. Initially, group 1 (check) received 4.302 kg concentrate and groups 2 and 3, 1.529 kg concentrate and 0.660 kg cassava. Statistical analysis of the data on wt., feed consumption, and feed efficiency revealed no significant difference in the av. daily consumption, av. daily gain, or cumulative efficiency for any of the 3 groups. Thus rations with cassava are comparable nutritionally. Economic analysis showed a satisfactory profit for the expt. as a whole as well as economic superiority for rations with fresh cassava. Less difference was noted between groups 2 and 3 than between them and the check group. Furthermore, group 2 was slightly superior nutritionally and group 3 was the most economic. No important sanitary, nutritional, toxic or physiological digestive problems were observed, suggesting good acceptance of both fresh and sun-dried cassava. (AS (extract)-CIAT)

RUMINANTS

0010

26868 BREGEAT, M. 1986. Fattening young steers with cassava and Leucaena. Alafua Agricultural Bulletin 11(1):45-49. En. 2 Ref., Il. (Inst. d'Elevage et de Medecine Veterinaire des Pays Tropicaux, B.P. 186, Noumea, New Caledonia)

CASSAVA; FEEDS AND FEEDING; CATTLE; LEUCAENA; BEEF CATTLE; DIETS; NUTRITIVE VALUE; NEW CALEDONIA.

A smallholder-scale fattening trial was conducted at the Institut d'Elevage et de Medecine Veterinaire des Pays Tropicaux in Port-Laguerre, New Caledonia. Three young Charolais x Limousin steers (av. live wt. of 345 kg) were housed in small fenced paddocks and given a mixture of green grass + chopped fresh cassava roots + Leucaena branches + salt as feed. Cassava was totally consumed (7.8 kg/steer/day), green grass 10 percent (8.4 kg/steer/day), and Leucaena branches up to 30 percent (8.8 kg/steer/day). Av. daily gain was 856, 739, and 8889 g for the 3 animals in 183, 118, and 183 days, resp.; the total intake of cassava fresh matter was 3895 kg, with 1950 forage units (1 forage unit = 1650 calories for beef fattening). The digestible protein:energy ratio was about 97. A better growth rate could be achieved by increasing the level of cassava and decreasing that of green grass so that the DM intake/100 kg live wt. could exceed 1.6 kg, while maintaining a digestible protein:energy ratio of at least 80. All the constituents of this feed, except salt, are home-produced. (CIAT)

OTHER ANIMALS

See also 0235

SILAGE

GENERAL

0011

22312 FELIPA L., V.R. 1981. Preparacion de ensilaje para la zona de selva alta con pasto elefante, cana de azucar y yuca. (Preparation of silage for the high jungle area with elephant grass, sugar cane, and cassava). Tesis Ing. Zootecnista. Lima, Peru, Universidad Nacional Agraria La Molina. 95p. Es. Sum. Es., 39 Ref.

ANIMAL NUTRITION; COMPOSITION; FEEDS AND FEEDING; FERMENTATION; FORAGE; NUTRITIVE VALUE; PALATABILITY; PERU; PROCESSING; SILAGE; SOUTH AMERICA; USES.

A study was carried out at the U. Nacional Agraria La Molina, Peru, to determine the optimal combination level of elephant grass (Pennisetum purpureum) with sugar cane (15, 30, and 45 percent) or cassava (5, 10, and 15 percent) to obtain a silage of good lactic fermentation for the high jungle areas. The silage was prepared using microsilos made with polyethylene bags, with a total wt. (including grass) of 4 kg. Six treatments and a control (elephant grass), replicated twice, were used. These combinations were vacuum-sealed and stored for 38 days, after which they were opened and evaluated (organoleptically and for nutritive quality, before and after the silage). The nutritive examination determined using proximal analysis, in vitro DM digestibility, and estimated TDN, showed that the best silages of elephant grass are obtained with 30 and 45 percent sugar cane. The use of cassava in silage preparation did not affect nutritive value. (AS-CIAT)

See also 0154

SWINE

0012

24091 BUITRAGO A., J.; GOMEZ, G.G.; PORTELA, R.; SANTOS, J.; TRUJILLO, C. 1971. Yuca ensilada para alimentacion de cerdos. (Ensiled cassava for swine nutrition). Cali, Colombia, Centro Internacional de Agricultura Tropical. 50p. Es. Sum. Es., 6 Ref., Il.

ANIMAL NUTRITION; ASH CONTENT; BONE MEAL; CASSAVA MEAL; CASSAVA PRODUCTS; COLOMBIA; COMPOSITION; COTTONSEED CAKE; DOMESTIC ANIMALS; FAT CONTENT; FEED CONSTITUENTS; FEEDS AND FEEDING; FERMENTATION; FIBER CONTENT; FLOURS; FRESH PRODUCTS; LACTIC ACID; MAIZE MEAL; MEALS; NUTRITIVE VALUE; PH; PLANT ANATOMY; PROCESSING; PROTEIN CONTENT; ROOTS; SOUTH AMERICA; SWINE; USES; WASHING; WATER CONTENT.

Research work carried out at CIAT demonstrated that it is possible to develop swine feeding programs based on the utilization of cassava roots ensiled during periods ranging from 2 wk. to over 1 yr. In all studies conducted, simple and practical ensilage methods, within the reach of the producers, were used. Ensiled roots were used as main constituent of swine rations during the various production phases, especially during growth and finishing. A slightly inferior consumption in relation to that obtained with recently harvested cassava roots was observed, but swine yields did not present important differences. Ensilage duration did not result in differences in swine yields, according to comparisons done with cassava roots ensiled for more than 6 mo. vs. less than 5 mo. Addition of salt decreased, and addition of molasses increased, ensilage intake; a tendency to improve swine yield in terms of wt. increase and efficiency of feed conversion was also observed. Ensiled cassava roots, as well as recently harvested roots, require high protein supplementation due to the low concn. of this nutrient in cassava. Various products can be used as protein source to supplement rations based on root ensilage, but in each case controlled amounts of supplement must be provided to avoid overconsumption of protein and underconsumption of cassava. According to the studies carried out, the use of soybean cake or a mixture of soybean and cotton cakes results in higher yields with rations having ensiled cassava roots as the source of carbohydrates. These results offer a new alternative in the preservation and use of cassava roots in swine feeding, through a simple and inexpensive storage system that allows small or large vol. of the product to be handled, from the moment of harvest up to periods over 1 yr. (AS (extract)-CIAT)

0013

28548 CENTRO INTERNACIONAL DE AGRICULTURA TROPICAL. 1983. La utilizacion de las raices de yuca en la alimentacion de cerdos; unidad audiotutorial. (Utilization of cassava roots in swine nutrition; audiotutorial unit). Contenido cientifico Gomez, G.; Valdivieso G., M.; produccion Fernandez O., F. Cali, Colombia. 37 diap. color 5 x 5 cm.; 1 cassette 19 min.; guion 12p.; guia de estudio 20p. Es. Il.

CASSAVA; ROOTS; USES; FEEDS AND FEEDING; ANIMAL NUTRITION; AUDIOTUTORIAL; CIAT-1; COLOMBIA.

Precise information is presented on the composition of swine rations, based on ensiled or sun-dried cassava roots, and on amounts to be given according to the growth stage of the animals. (AS-CIAT)

0014

32081 EAKPITAKDUMRONG, P. 1985. (Effect of different protein supplement methods in growing pigs fed cassava silage as the energy source). M.Sc. Thesis. Bangkok, Thailand, Kasetsart University. 86p. Thai. Sum. Thai., En., 62 Ref., Il.

CASSAVA; SILAGE; ANIMAL NUTRITION; PIGLETS; DIETS; ANIMAL PHYSIOLOGY; COSTS; PROTEIN CONTENT; THAILAND.

Four dietary treatments were assessed in a completely randomized design with 3 replications and 2 piglets/exptl. unit (1 castrated male and 1 female): (1) broken rice (control); (2) dry cassava; (3) wet ensiled cassava; and (4) dry ensiled cassava. Initial av. live wt. of the pigs was 29 kg. At the end of the 84- day exptl. period, live wt. av. were 49, 55, 49, and 53 kg for treatments 1, 2, 3, and 4, resp., while av. daily wt. gain were 585, 654, 581, and 634 g, resp. Differences in daily wt. gain among treatments were not statistically significant. In another expt. 4 feeding methods were assessed in a randomized complete block design with 3 replications and 2 piglets/exptl. unit (1 castrated male and 1 female): (1) control (conventional method) ad libitum; (2) protein supplement diet mixed with wet ensiled cassava ad libitum; (3) protein supplement diet fed separately from wet ensiled cassava ad libitum; and (4) protein supplement diet separately fed in limited quantities but wet ensiled cassava fed ad libitum. Initial av. live wt. of the pigs was 23 kg. The av. live wt. of the pigs at the end of 85-day exptl. period were 59.90, 50.27, 58.73, and 50.00 kg for methods 1, 2, 3, and 4, resp., and av. daily wt. gains were 705, 597, 691, and 588 g, resp. Statistically significant (P less than 0.05) differences were observed for av. daily gains between methods 1 and 3 and between methods 2 and 4. Av. daily wt. gain and feed consumption rate were highly correlated. The analysis of feed cost/gain, amount protein consumption, PER, and body fat composition are also included. (AS)

0015

31696 GOMEZ, G.; VALDIVIESO, M.; SANTOS, J. 1988. Cassava whole-root chips silage for growing-finishing pigs. Nutrition Reports International 37(5):1081-1092. En. Sum. En., 12 Ref. (2813 Rue Sans Famille, Raleigh, NC 27607, USA)

CASSAVA; SILAGE; ROOTS; CASSAVA CHIPS; ANIMAL NUTRITION; SWINE; DIETS; MOLASSES; NUTRITIVE VALUE; BONE MEAL; FISH MEAL; COTTONSEED MEAL; ANIMAL PHYSIOLOGY; COLOMBIA; CIAT-1.

Three expt. were carried out to evaluate cassava whole-root chips silage (CWRS) with growing-finishing pigs. Weaned, 60- to 70-day-old pigs were fed the exptl. diets until a body wt. of 90-95 kg, except in expt. 2 in which insufficient amount of CWRS forced the trial to end when pigs averaged about 80 kg body wt. Expt. 1 consisted of 1 individual and 1 group feeding trial, and expt. 2 and 3 were both individual feeding trials. The diets used in expt. 1 were as follows: (1) sorghum + a protein supplement based on SBM, (2) CWRS + protein supplement mixed, and (3) CWRS + protein supplement fed separately. Those of expt. 2 were: (1) sorghum + protein supplement based on SBM and cottonseed meal, (2) CWRS + protein supplement based on SBM-cottonseed meal, (3) CWRS + protein supplement based on SBM and fishmeal, and (4) CWRS + protein supplement based on cottonseed meal-fishmeal. Expt. 3 diets were: (1) sorghum + protein supplement based on SBM-cottonseed meal, (2) CWRS + protein supplement supplied daily, (3) CWRS fed daily + protein supplement supplied every other day, (4) CWRS + 10 percent sugarcane molasses + protein supplement supplied daily, and (5) CWRS + 10 percent sugarcane molasses fed daily and protein supplement fed every other day. In all expt., diet 1 was fed in automatic feeders whereas CWRS diets were fed in open troughs. In the individual feeding trial of expt. 1, pigs fed diet 2 had lower (P less than 0.05) body wt. gain and feed intake than those fed the control diet 1, but superior (P less than 0.05) performance to those fed diet 3. In the group feeding trial, however, practically all 3 groups performed similarly (P greater than 0.05). In expt. 2, pigs fed CWRS in combination with any of the protein supplement evaluated showed similar (P less than 0.05) results to those fed diet 1. In expt. 3, pigs fed diets 4 and 5 reached the final live body wt. 10 and 17 days earlier (P less than 0.05), resp., than the other exptl. groups. The addition of sugarcane molasses to CWRS improved (P less than 0.05) the feed/gain ratio when compared with the control diet and tended (P greater than 0.05) to be superior to CWRS-based diets (2 and 3) with no addition of sugarcane molasses. Similar results were obtained when the protein supplement was fed daily or every other day. These results indicate that CWRS kept in silos for at least 4-6 mo., if properly supplemented, produced satisfactory results when fed to growing-finishing pigs. (AS)

0016

34484 MENDEZ R., A.; MARTINEZ C., S. 1988. Ensilado de yuca en granjas porcinas de Chontalpa. (Using ensiled cassava at Chontalpa hog farms). Yuca Boletin Informativo 12(2):1-4. Es. Il. Also in English.

CASSAVA; SILAGE; ANIMAL NUTRITION; SWINE; COSTS; MEXICO; CIAT-1.

The use of ensiled cassava for hog feeding at pig lots in Tabasco, Mexico, was evaluated; alternatives are presented for improving the operation. A survey was designed and directly administered to all farms using cassava as of Nov. 1986. In 75 percent of the farms more than 1000 t of fresh cassava have been ensiled and consumed. Pros and cons of ensiled cassava are discussed. Its use reduced hog feeding costs at the Chontalpa farms. Prospects for production are encouraging; an increase in demand is foreseen. Further promotion of the advantages of its use among hog producers is needed as well as a greater participation of farmer organizations in the ensiling process. Data are given on the amounts of cassava ensiled and protein concentrate provided to pigs at different stages of growth compared with the amounts recommended. (CIAT)

0017

34954 RAMIAL, H.; HOSEIN, A.; SEESAHAI, A.; HARRICHARAN, H. 1987. Feeding of cassava silage to pigs. Trinidad, West Indies, Ministry of Food Production. Research Division. 12p. En. Sum. En., 19 Ref. Paper presented at the First Annual Workshop Seminar on Agricultural Research, Trinidad, West Indies, 1987.

CASSAVA; ROOTS; SILAGE; ANIMAL NUTRITION; SWINE; DIETS; MOLASSES; ANIMAL PHYSIOLOGY; TRINIDAD AND TOBAGO.

Freshly harvested cassava roots were chopped manually with a machete into slices of 1-5 cm thickness and ensiled in 180-liter barrels on the following day. In expt. 1, chopped cassava was ensiled with either 2 percent salt or 50 percent liquid molasses by wt. and in expt. 2, it was ensiled with molasses only. Pigs were fed for 23 and 67 days (expt. 1 and 2, resp.). In expt. 1, av. daily gains of the pigs fed the control (maize + SBM + mineral/vitamin supplement), cassava-salt, and cassava-molasses silage were 0.51, 0.51, and 0.48 kg, resp.; there were no significant (P greater than 0.05) differences. In expt. 2, daily gains of the pigs fed the control and cassava-molasses rations were 0.35 and 0.30 kg, resp., not being significantly (P greater than 0.05) different. The av. back fat thickness of 3.15 and 2.34 cm of the pigs on the control and molasses/cassava diets in expt. 2 (3.15 and 2.34 cm, resp.) was significantly (P less than 0.05) different. (AS)

See also 0007 0008

RUMINANTS

0018

32037 GEOFFROY, F. 1984. Le manioc: interet fourrager et problemes specifiques. (Cassava, its significance as a forage plant and specific problems). In Reunion Interinstituts INRA, ORSTOM, GERDAT, Cayenne, Suzini, 1981. Prairies guyanaises et elevage bovin. Resultats preliminaires. Paris, France, Institut National de la Recherche Agronomique. Colloques de l'INRA no.24 pp.203-218. Fr. Sum. Fr., En., 32 Ref., Il. (INRA, Centre de Recherches Agronomiques Antilles-Guyane Station de Recherches Zootechniques, 97170 Petit-Bourg, Guadeloupe)

CASSAVA; USES; FORAGE; ROOTS; LEAVES; STEMS; PRODUCTIVITY; COMPOSITION; DRY MATTER; FAT CONTENT; PROTEIN CONTENT; NUTRITIVE VALUE; TOXICITY; DETOXIFICATION PROCESSES; HARVESTING; FOLIAGE; SILAGE; FRENCH GUIANA.

Cassava productivity, feed value, and chemical composition is compared with those of other tropical forage plants. Although it contains to a certain extent an agent toxic for livestock, several detoxification processes exist; for French Guiana silage appears to be the only one that can be considered. Crop management techniques (choice of var., cultivation, pathology, harvesting, and ensilage) will soon be released. (AS)

0019

25597 MOORE, C.P.; COCK, J.H. 1981. Cassava forage silage as a feed source for Zebu calves in the tropics. Tropical Agriculture (Trinidad) 62(2):142-144.. En. Sum. En., 15 Ref. (International Mineral & Chemical Corporation, Box 207, Terre Haute, IN 47808, USA)

ASH CONTENT; CALVES; COLOMBIA; COMPOSITION; DRY MATTER; FAT CONTENT; FEEDS AND FEEDING; FIBER CONTENT; FORAGE; PROTEIN CONTENT; SILAGE; SOUTH AMERICA; STORAGE; USES.

Five-mo.-old Zebu calves were fed for 112 days either (1) cassava forage silage alone, (2) silage + 0.50 kg dried cassava chips, or (3) silage + 0.50 kg dried cassava chips + 0.25 kg cottonseed meal. Body wt. gains, feed efficiency, and protein utilization were significantly low for animals on the pure cassava forage diet. The addition of dried cassava chips to the silage diet improved growth rate (59 percent) and feed efficiency (34 percent) over that of the base diet (1). The addition of cottonseed meal to the diet did not improve animal performance, suggesting that energy was more limiting than protein in the pure silage diet. Based on 2 harvests during a 210-day period, the annual production of cassava forage/ha was calculated to be 75.50 t of fresh forage (14 t DM/ha) and 3.48 t of protein (N x 6.25). (AS)

0020

26851 OLIVEIRA, J.P. DE; TIESENHAUSEN, I.M.E.V. VON; FALCO, J.E.; CORREA, H.; MUNIZ, J.A.; CARVALHO, V.D. DE 1984. Composicao quimica e consumo voluntario do feno e da silagem da parte aerea da mandioca (Manihot esculenta Crantz). (Chemical composition and voluntary intake of hay and silage from cassava aerial parts). Ciencia e Pratica 8(2):203-213. Pt. Sum. Pt., En., 31 Ref., Il.

CASSAVA; FEEDS AND FEEDING; SHEEP; LEAVES; STEMS; FOLIAGE; FEED CONSTITUENTS; DRY MATTER; PROTEIN CONTENT; FIBER CONTENT; SILAGE; BRAZIL.

The voluntary intake and chemical composition of hay and silage made of the aerial part of 1-yr-old cassava cv. IAC 12-829 were evaluated at the Escola Superior de Agricultura de Lavras (Minas Gerais, Brazil) during 1982-83. Four treatments were studied, namely, T1, hay of the whole aerial part; T2, silage of the whole aerial part; T3, hay of the upper third of the whole aerial part; and T4, silage of the upper third of the aerial part. The chemical composition of multiple samples offered to sheep was determined using the following parameters: DM, CP, crude fiber, soluble carbohydrates, Ca, P, GE, and pH. Twenty wethers were kept for 21 days in individual metabolic cages in order to estimate voluntary intake using a randomized block design with 5 replications and 4 treatments. DM voluntary intake, digestible DM, digestible protein, and digestible energy were determined. Better quality was achieved, both with silage or hay, by using the upper third of the aerial part. Voluntary intake of protein was higher with silage. (AS)

0021

28396 OLIVEIRA, J.P. DE 1984. Valor nutritivo do feno e da silagem da parte aerea da mandioca (Manihot esculenta Crantz) cv. IAC 12-829. (Nutritive value of hay and silage of the aerial part of cassava cv. IAC 12-829). Tese Mestrado. Minas Gerais-MG, Brasil, Escola Superior de Agricultura de Lavras. 66p. Pt. Sum. Pt., 64 Ref., Il.

CASSAVA; CULTIVARS; NUTRITIVE VALUE; SILAGE; DIGESTIBILITY; DRY MATTER; ANIMAL NUTRITION; DIETARY VALUE; DIETS; COMPOSITION; SHEEP; STEMS; LEAVES; BRAZIL.

To verify the nutritional value of hay and silage from the aerial part (total and upper 3rd) of the cassava plant, cv. IAC 12-829 was planted in 1981 in Curvelo (Minas Gerais, Brazil) and the aerial part was harvested at 12 mo. Hay and silage were made and apparent digestibility trials were conducted with rams. DM, CP, crude fiber, soluble carbohydrates, Ca, P, GE and pH were determined. DM contents were similar among the different hay and silage samples. Silage of the upper 3rd of the plant showed higher CP and Ca values and the lowest crude fiber content. P contents and GE values were similar in all treatments. The different hay samples showed similar soluble carbohydrate composition; the same held true for the silages. pH values were in the limit acceptable for a good silage. To study the nutritive value, 20 rams caged in individual metabolism stalls were used in a single trial, with a randomized block exptl. design and 4 treatments and 5 replications. The voluntary intake of DM, digestible DM, digestible protein, and digestible energy were determined. The coefficient of apparent digestibility of DM, CP, crude fiber, and GE was also determined, as well as the index of nutritive value and N balance. The silage of the upper 3rd of the plant showed higher values for all of the parameters, except the coefficient of apparent digestibility of CP and N balance. The hay of the upper 3rd of the plant showed higher values for these last 2 parameters. (AS)

0022

29466 TIESENHAUSEN, I.M.E.V. VON 1987. O feno e a silagem da rama de mandioca na alimentacao de ruminantes. (Hay and silage from cassava branches for ruminant feeding). Informe Agropecuario 13(145):42-47. Pt. 21 Ref., Il. (Depto. Zootecnia, ESAL, Caixa Postal 37, 37.200 Lavras-MG, Brasil)

CASSAVA; FEEDS AND FEEDING; SILAGE; COMPOSITION; TOXICITY; CATTLE; PROTEIN CONTENT; USES; BRAZIL.

The use of hay and silage from cassava branches for cattle feeding is briefly reviewed, with emphasis on chemical composition, toxicity, preparation, consumption, and exptl. silos. Hay and silage from cassava branches are excellent for ruminant feeding, especially if the upper third of the plant is used; for an improved protein content, the stem:leaf ratio should be less than 1. A final recommendation is that fresh branches be chopped in an aerated site. (CIAT)

See also 0125 0129 0142

DRY CASSAVA (Chips, Flour, Pellets)

GENERAL

0023

33836 AGENCE DE COOPERATION CULTURELLE ET TECHNIQUE. FRANCE. 1981. Le manioc, sa culture et sa transformation. (Cassava: its cultivation and processing). Paris, France, 64p. Fr. 81 Ref., Il.

CASSAVA; PROCESSING; USES; HUMAN NUTRITION; ANIMAL NUTRITION; NUTRITIVE VALUE; CULTIVATION; FRANCE.

Detailed information is given regarding the following aspects of cassava: generalities (origin, classification, morphology, and root composition), cultivation (soil, climate, planting, and planting system), diseases and pests, harvesting (methods, time, and yields), and factors to be taken into account for its processing (var., toxicity, and nutritive value). Information is presented on cassava products for human (CF, gari, atieke, and baton), and animal consumption (chips, granules, and pellets), as well as on industrial products

(starch, glucose, dextrose, and dextrin). Some considerations are also given on the appraisal of cassava by-products (leaves, stems, and peels); new forms to appraise by-products are described in detail such as that of cassava alcohol by fermentation and protein fermentation. Annexes are included with information on the nutritive value of cassava as compared with other foodstuffs, the evolution of cassava composition as a function of processing, a simplified scheme of cassava cultivation and of the manufacture of CM, atieke, gari, baton, chips, and pellets. A description is given of the peeling, grinding, fermentation and steeping, and drying stages. (CIAT)

0024

27685 ALMANZAR, L.J. 1984. Procesamiento de las raices de yuca para alimentacion animal. (Cassava root processing for animal feeding). Agro (Republica Dominicana) 13(115):10-11. Es. 1 Ref., Il.

CASSAVA; CASSAVA ROOTS (VEGETABLE); ANIMAL NUTRITION; DRYING; SUBSTITUTES; SUPPLEMENTS; LATIN AMERICA.

Considerations on the growing demand for dry cassava for the animal feed industry in Latin America are discussed, with a brief description of the available cassava drying methods (continuous artificial drying in rotary or conveyor dryers, batch drying in static bed dryers using forced air, and natural drying on concrete floors or trays). This latter method is described in more detail because of its low cost and easy application. It is recommended to create the bases among processing plant owners to prepare cassava-based balanced feeds as a substitute for maize and sorghum and to build a cassava drying pilot plant in a cassava growing region with farmer participation in the drying process. (CIAT)

0025

26305 BEST, R.; OSPINA P., B., COMP. 1985. El desarrollo agro-industrial del cultivo de la yuca en la Costa Atlantica de Colombia. Cuarto informe sobre el desarrollo de la agroindustria de yuca seca durante el periodo julio 1984-junio 1985. (The agroindustrial development of cassava on the Atlantic Coast of Colombia. Fourth report on the development of the dried cassava agroindustry from July 1984 to June 1985). Cali, Colombia, Centro Internacional de Agricultura Tropical. Proyecto Cooperativo DRI-CIAT. v.1,49p. Es. Sum. Es. (CIAT, Apartado Aereo 6713, Cali, Colombia)

CASSAVA; CASSAVA CHIPS; COLOMBIA; COSTS; DEVELOPMENT; DISTRIBUTION; ECONOMICS; LABOR; MARKETING; PRODUCTION; SOLAR DRYING; STATISTICAL DATA; TECHNOLOGY TRANSFER.

From July 1984 to June 1985, 13 new drying plants were established on the Atlantic Coast of Colombia for a total of 20 plants. During the 1984-85 campaign, these plants processed 7158 t fresh cassava (total of 3006 t dry cassava), representing an increase of 217 percent over the previous campaign. Of the 20 plants, only 14 gave profits. Plants giving losses were late in initiating operations due to delays in the construction; these are expected to operate normally during the next campaign. The profitability of some of the new plants was also affected by the fact that the groups established to operate them were conformed by farmers of low or no capacity to produce cassava. Therefore, the enterprises were subjected to the supply of cassava by non-members, representing no guarantee of attraction for membership to the cooperative or association. The attraction price of fresh cassava continues to be the main factor in determining the economic profitability of the drying process. During the 1st semester of 1985, a program was established to produce improved cassava seed, at both the farmer and national research center levels. The technical advisory teams in each department have favorably increased their no. and coverage of cassava plants; new markets for dry cassava have also been established. Trade union actions among farmers involved in the project have increased. Likewise, significant advances were achieved in the creation of an officially recognized federation of dry cassava producers of the Atlantic Coast, FEPROYUSCA. Future plans include the establishment of 6 new cassava drying plants in Cordoba, 6 in Sucre, 7 in Bolivar, 1 in Atlantico, and 1 in Cesar. It is estimated that dry cassava production in the 35 plants

that will operate on the Atlantic Coast during the 1985-86 campaign will reach a total of approx. 5500 t. (AS-CIAT)

0026

26142 BORREN, C.; JANSSEN, W. 1984. El futuro del cultivo de sorgo en la Costa Atlantica. (The future of sorghum cultivation on the Atlantic Coast). In Best, R., ed. Plan piloto para el desarrollo agro-industrial del cultivo de la yuca en algunos departamentos de la Costa Atlantica de Colombia. Tercer informe junio 1983-junio 1984. Cali, Colombia, Centro Internacional de Agricultura Tropical. Proyecto Cooperativo DRI-CIAT. pp.45-50. Es.

CASSAVA; SORGHUM; PRODUCTION; COSTS; MARKETING; DEVELOPMENTAL RESEARCH; CASSAVA PROGRAMS; COLOMBIA.

The future development of sorghum in Sucre, Colombia, is discussed aiming at the estimate of the potential market of dried cassava as a substitute for sorghum imports. The deficiency in sorghum production to supply the Colombian animal feed industry urges and facilitates the development of alternate carbohydrate sources such as dried cassava. (CIAT)

0027

26861 BROHAN, M. 1986. Tough competition from Thai cassava. Farmline May 1986:12-13. En. Il.

CASSAVA; TRADE; COSTS; MARKETING; FEEDS AND FEEDING; PRODUCTION; PRICES; INCOME; STATISTICAL DATA; THAILAND.

The competition between Thai cassava and US maize for the world coarse grain market is analyzed. Aggressive and successful campaigns, based on the product's low prices, low production costs, and exportable surpluses, have been launched by Thai traders to expand their markets. Until 1985, about 85 percent of cassava exports went to the EEC, but recently about 1.7 million t of cassava were shipped to Japan, Portugal, the Soviet Union, Taiwan, South Korea, and North Korea. Although increased sales of cassava (exports rose from 340,000 t in 1967 to 6 million t in 1978) may have displaced up to 1 million t of US maize, its impact has not been entirely negative, as they also promoted soybean purchases as a protein supplement to cassava-based rations. The effects of EEC annual import quota on cassava production and competition are briefly discussed. (CIAT)

0028

31630 COMITE ECONOMIQUE ET SOCIAL DE LA CEE. 1980. Manioc: necessite de stabiliser les importations. (Cassava: the need to stabilize imports). Producteur Agricole Francais 56(266):9-10. Fr. Il.

CASSAVA; TRADE; STATISTICAL DATA; ANIMAL NUTRITION; EUROPE.

The main reasons for the increase in EEC imports of several substitute foodstuffs (among them cassava) for animal feed during 1978 are analyzed. The economic consequences of decreasing the use of cereals in animal rations in ECC countries are also discussed. Recommendations are given on elements to be considered for the stabilization of imports of substitute products. Statistics are presented on the evolution of substitute foodstuffs imports from 1966 to 1978 and on the use of cereals in animal rations from 1970 to 1978 in the EEC. (CIAT)

0029

22756 FALCON, W.P.; JONES, W.O.; PEARSON, S.R.; DIXON, J.A.; NELSON, G.C.; ROCHE,F.C.; UNNEVEHR, L.J. 1984. The cassava economy of Java. California, Stanford University Press. 226p. En. Sum. En., 169 Ref., Il.

CASSAVA; CASSAVA STARCH; CLIMATIC REQUIREMENTS; CONSUMPTION; COSTS; CULTIVATION SYSTEMS; DEVELOPMENT; DISTRIBUTION; ECONOMICS; FEEDS AND FEEDING; FERTILIZERS; FOOD ENERGY; GAPLEK; INCOME; INDONESIA; LABOR; MARKETING; NUTRITIVE VALUE; PELLETS; PRICES; PRODUCTION; PRODUCTIVITY; RAINFALL DATA; SOCIOECONOMIC ASPECTS; TRADE.

A study was carried out on Java to determine whether increases in cassava production are technically and economically feasible, and, if so, whether increased production might improve food security in Indonesia. Although the major emphasis is on Java, the study has much broader application. The insights that can be obtained from analyzing a complete commodity system are illustrated; empirical meaning is given to global interdependence, since much of Java's cassava economy is conditioned by the Commonwealth Agricultural Policy, thus contributing substantially to the meagre research on cassava. After an introductory chapter that includes a description of cassava's place in the world food system, subsequent chapters analyze the prospects for and implications of expanding cassava production on Java by considering several related topics: the principal cassava producing systems in upland areas of southern Java; the demand for fresh and processed cassava for human consumption; starch manufacture and trade; the export market for gaplek pellets (a dried form of cassava); marketing efficiency and price formulation; and cassava policy in the broader context of Indonesia's food policy. (World Agricultural Economics and Rural Sociology Abstracts)

0030

26310 JANSSEN, W. 1986. La demanda de yuca seca en Colombia. (The demand for dried cassava in Colombia). In Best, R.; Ospina P., B., comp. El desarrollo agro-industrial del cultivo de la yuca en la Costa Atlantica de Colombia. Cuarto informe sobre las investigaciones realizadas en apoyo al establecimiento de las plantas de secado natural de yuca periodo julio 1984-junio 1985. Cali, Colombia, Centro Internacional de Agricultura Tropical. Proyecto Cooperativo DRI-CIAT. v.2,pp.41-50. Es. 1 Ref., Il. (CIAT, Apartado Aereo 6713, Cali, Colombia)

CASSAVA; DRIED ROOTS; SOCIOECONOMIC ASPECTS; PROCESSED PRODUCTS; TRADE; STATISTICAL DATA; FEEDS AND FEEDING; INDUSTRIALIZATION; CASSAVA PROGRAMS; DEVELOPMENTAL RESEARCH; COLOMBIA.

The results of a survey conducted in late 1984 to determine the demand for dried cassava in Colombia are presented. The survey covered the animal feed industry and pig, broiler chick, and egg producers. It was estimated that dried cassava, at a relative price equivalent to 78 percent the price of sorghum, would have an annual demand of 144,000 t; however, the demand for dried cassava is very sensitive to price fluctuations. Dried cassava would be mostly used to elaborate feed concentrates for egg and pig production. At an 8 percent growth rate of the feed industry, the demand for 1990 can be expected to be 200,000 t dry cassava. The Atlantic Coast region is expected to provide at least 50 percent of this dried cassava (250,000 t fresh cassava). (CIAT)

0031

33640 KONJING, C. 1987. Analysis of trends and prospects for cassava in Thailand. Washington, D.C., International Food Policy Research Institute. 99p. En. Il. Paper prepared for Workshop on Trends and Prospects of Cassava in the Third World, Washington, D.C., 1987.

CASSAVA; PRODUCTION; TRADE; PRICES; CASSAVA PRODUCTS; ROOT PRODUCTIVITY; LABOR; INCOME; COSTS; FEEDS AND FEEDING; SWINE; POULTRY; STATISTICAL DATA; THAILAND.

The current situation of cassava in Thailand is described. Trends in production, utilization, trade, and prices of cassava and cassava products are presented and analyzed as well as those in livestock production, and the production and trade of cereals and other feeds. Cassava yield tendencies and the substitutability of cassava and protein supplements for feedgrains are also discussed. The current situation and tendencies of compound feeds is also analyzed. Prospects for production and utilization of cassava products both on short- and long-term bases are discussed; main conclusions and policy implications of the findings are also provided. (CIAT)

0032

22082 LEHNER, D.E. 1985. Integrierte maniok-erzeugung und -verarbeitung in Kolumbien. (Integrated cassava production and processing in Colombia). Entwicklung Landlicher Raum 19(6):20-22. De. Sum. En., 5 Ref., Il. (Universitat Hohenheim, Institut fur Pflanzenproduktion in den Tropen und Subtropen, Kirchnerstrabe 5, 7000 Stuttgart-Hohenheim, Germany)

CASSAVA; CASSAVA CHIPS; COLOMBIA; DEVELOPMENT; MARKETING; PRODUCTION; SOLAR DRYING.

In cooperation with the International Development Research Center and the Colombian integrated rural development service DRI, CIAT has initiated a pilot project on the northern coast of Colombia directed toward the fragmentation and solar drying of cassava for the feed industry, i.e. the integrated production, processing, and marketing of cassava. This project is liable to become an extraordinary success, particularly because all processes, from production to marketing, remain in the hands of the farmers themselves and because they are able to carry them out by their own simple means. Likewise, the process provides employment at a season when manpower is particularly abundant. There is a secure and growing demand on the part of the feedstuff industry, on the regional level and far beyond it. Since 1983, the idea and its realization have spread from the north coast of Colombia to Panama, Dominican Republic, and Mexico, in form of a series of smallholder self-aid organizations among the cassava producers. The pilot project represents thus a successful example of how technology development by research can be transferred into practice, and how it is in a position to positively influence the living standard of the rural population in a larger geographical scope. (AS)

0033

34282 LYNAM, J.K. 1987. Thailand: rapid growth driven by export markets. In Lynam, J.K. The cassava economy of Asia: adapting to economic change. Cali, Colombia, Centro Internacional de Agricultura Tropical. Global Cassava Research and Development 55p. En. Il. (Rockefeller Foundation, 1133 Avenue of the Americas, New York, NY 10036, USA)

CASSAVA; PRODUCTION; CONSUMPTION; TRADE; PRICES; CULTIVATION SYSTEMS; ROOT PRODUCTIVITY; COSTS; LABOR; INCOME; CASSAVA STARCH; PELLETS; CASSAVA CHIPS; FEEDS AND FEEDING; TECHNOLOGY; STATISTICAL DATA; THAILAND; CIAT-1.

In Thailand cassava is produced mainly for export. The Thai cassava industry was based on starch export until the 60s when West Germany began to use CSW for animal feed. As this was a by-product of starch manufacturing, shortages resulted, leading to the market for CM. Chips became the dominant export in 1964 and so did native pellets in 1969, and hard pellets in 1983. Thailand went from a minor producer of cassava in the 50s to presently the 2nd largest in the world. Data are provided on production trends, yields (av. 13-14 t/ha), production systems, production costs, and labor utilization. Mechanization has been introduced to decrease costs. Research by the Huai Pong Expt. Station in Rayong (created in 1956) emphasized soil management and fertilization for 2 decades until lack of progress in this area led to a var. improvement program. Increasing yields will be critical in the future. Processing costs have been reduced substantially. Not

only has the country adjusted rapidly to changing EEC policies, but has also restructured its export markets. (CIAT)

0034

28313 MATTEI, R. 1984. Sun-drying of cassava for animal feed: a processing system for Fiji. Suva, Fiji, Food and Agriculture Organisation of the United Nations, RAS/83/001. Field Document 3. 45p. En. Sum. En., 21 Ref., Il.

CASSAVA; SOLAR DRYING; ANIMAL NUTRITION; FEEDS AND FEEDING; INDUSTRIAL MACHINERY; STORAGE; COSTS; INCOME; LABOR; FIJI.

A system of producing dry cassava chips for use as a cereal substitute in animal feeding, developed at Koronivia Research Station (Suva, Fiji), is described. The equipment consists of a chipping machine having an output of 1 t/h, a washing-peeling machine made from locally available materials, and 40 drying trays having a total area of 200 square meters. During unfavorable weather the drying trays are stacked under 8 portable covers. The use of cassava in animal feeding, quality standards, and storage requirements for cassava chips are discussed, together with projected economic returns to cassava producers, producer-processors, and full-time processors. Although the drying capacity of the equipment varies throughout the year depending on weather conditions, annual drying capacity of 120 t of chips (equivalent to 300 t of fresh cassava) is expected. Detailed instructions on the manufacture of the equipment are included in the appendices. (AS (extract))

0035

18936 MONTILLA, J.J. 1981. Valor actual y potencial de la raiz y el follaje de yuca en la alimentacion animal. (Present value and potential of cassava roots and foliage in animal nutrition). In Seminario Nacional de Yuca, Maracay, Venezuela, 1980. Revista de la Facultad de Agronomia. Alcance no.31:551-611. Es. 147 Ref., Il.

AMINO ACIDS; ANIMAL NUTRITION; ASH CONTENT; CARBOHYDRATE CONTENT; CIAT-2; COMPOSITION; CULTIVARS; CYANOGENIC GLUCOSIDES; DRY MATTER; DRYING; ENZYMES; FAT CONTENT; FEEDS AND FEEDING; FIBER CONTENT; FORAGE; HCN CONTENT; IODINE; PROCESSING; PROTEIN CONTENT; PROTEIN ENRICHMENT; RHODANESE; ROOTS; SOLAR DRYING; TOXICITY; USES.

The possible utilization of the cassava canopy and roots in animal nutrition is reviewed on the basis of data presented by several authors. Root composition of 11 var. ranges between 28.0-48.0, 1.3-4.3, 2.6-11.2, 0.4-1.3, 1.3-2.5, and 80.7-93.5 percent DM, CP, crude fiber, ether extract, ash, and N-free extract, resp. N content/100 g varies between 183-500 mg in CF; S-containing amino acids are limiting, but the energy value is similar to that of corn or sorghum meal. The use of cassava roots for producing protein through microorganisms (3 kg CF produce 0.5 kg protein) is expensive. Satisfactory results are obtained when CF containing nonprotein N (urea-cassava root complex) is combined with a basal ration (Digitaria decumbens straw) and another supplement of sesame seed flour. The process of root drying on cement floors and on trays is described; drying takes 1-2 days with loads of 5 and 10 kg/m(2) on cement floors and inclined trays, resp. Proximate composition of cassava leaves is 77.0, 8.2, 3.3, 1.2, and 7.2 percent water, CP, soluble carbohydrates, fat, and crude fiber, resp. Leaf protein content on dry basis ranges between 17.8-34.8 percent for Brazilian var. and between 18.5-32.4 percent for Jamaican var. Approx. 75 percent of leaf CP is true protein and its nutritive value is similar to that of alfalfa. Drying cassava foliage on floors eliminates the HCN present in fresh material. A protein concentrate can be obtained through the addition of an acid to the forage juice, and the coagulated protein is separated by centrifugation. Several aspects that determine the HCN content of cassava are described: root anatomy, fertilization, soil moisture, var., plant age, and also physiological mechanisms of animals that prevent intoxication. Recommendations are given on how to balance cassava-based feed rations. Tables that complete the information given are included. (CIAT)

0036

22761 NELSON, G.C. 1984. Gaplek. In Falcon, W.P.; Jones, W.O.; Pearson, S.R.; Dixon, J.A.; Nelson, G.C.; Roche, F.C.; Unnevehr, L.J. The cassava economy of Java. California, Stanford University Press. pp.110-135. En. Sum. En., 19 Ref.

ANIMAL NUTRITION; CASSAVA; CASSAVA CHIPS; COSTS; DEVELOPMENT; FEEDS AND FEEDING; GAPLEK; INDONESIA; PELLETS; PRICES; PROCESSING; TRADE.

The export market for gaplek chips and pellets in Indonesia is analyzed. Since the establishment of the agricultural policies of the European Community and the binding of the import tariff on gaplek products to 6 percent, the European market has been the major determinant of international trade in gaplek. The development of this trade during the 1970's is reviewed, and the policies of the European Community during the last years are discussed. (CIAT)

0037

33797 OSPINA, B. 1986. El secado natural de la yuca para alimentos balanceados. (Natural cassava drying for balanced feeds). In Romanoff, S.; Toro, G., eds. Seminario Anual sobre la Yuca, 1, Portoviejo, Ecuador, 1985. La yuca en la costa ecuatoriana y sus perspectivas agroindustriales: memorias. Quito, Ecuador, Instituto Nacional de Investigaciones Agropecuarias; Instituto Interamericano de Cooperacion para la Agricultura; Centro Internacional de Agricultura Tropical. pp.86-93. Es.

CASSAVA; SOLAR DRYING; TECHNOLOGY; FEEDS AND FEEDING; DRIED ROOTS; COSTS; PRODUCTION; COLOMBIA; CIAT-1.

The cassava drying technology used to produce balanced feeds is described. The technique is simple and immediately applicable; it is well accepted in Colombia where it is used by 36 producer associations. The advances of the DRI (Desarrollo Rural Integrado)-CIAT project are described for the stages of experimentation, demonstration, production, and replication. In only 5 yr these associations have 873 members and 29,000 square meters of drying floor built. It is also indicated that Mexico, Panama, and now Ecuador, are using this technology. (CIAT)

0038

29576 OSPINA, B.; BEST, R. 1986. Secado natural de yuca para la alimentacion animal: una nueva agroindustria en Colombia. (Natural cassava drying for animal feeding: a new agroindustry in Colombia). Cali, Colombia, Centro Internacional de Agricultura Tropical. 18p. Es. Sum. Es., 10 Ref., Il. Trabajo presentado en el 4 Congreso Brasileiro de Mandioca, Santa Catarina, Brasil.

CASSAVA; DRYING; FEEDS AND FEEDING; INDUSTRIALIZATION; SMALL-SCALE PROCESSING; PRODUCTION; COSTS; TECHNOLOGY TRANSFER; TECHNOLOGY EVALUATION; TRADE; COLOMBIA; CIAT-1.

A collaborative project of the Colombian Integrated Rural Development Program (DRI) and CIAT, aimed at establishing small agroindustrial firms to produce dry cassava on the Atlantic Coast of Colombia, is described. It began with the installation of a pilot plant for natural drying of cassava, with the collaboration of a group of 15 farmers. This plant operated on an exptl. basis in 1981 to obtain information about the efficiency of the process under the conditions existing on the Colombian Atlantic Coast and to determine the product's acceptability by the animal feed industry. In 1982, during the project's 2nd phase, the pilot plant was operated semicommercially to obtain data on production costs; likewise, it showed the economical and technical feasibility of the process. In 1983, the 3rd phase began, consisting in the replication of the project in other cassava-producing areas of the region. In 1984 and 1985, the project grew considerably, with 20 drying

plants functioning in 1984 and 36 in 1985. To establish small-scale natural cassava drying plants, the following requisites are essential: (1) selection of a processing technology that can be assimilated, controlled, and easily managed by farmers; (2) implementation of integrated programs of processing, production, and commercialization that reduce the risks and increase net incomes of farmers; and (3) provision of institutional support that is adequate in terms of technical assistance, credit facilities, management and fiscal training, and of advice in the formation and consolidation of cooperative and associative groups for agricultural production. (AS-CIAT)

0039

26302 RANGEL M., R.E.; RUEDA P., C.C. 1984. Evaluacion economica y bondades nutritivas de la yuca para el montaje de una planta procesadora de harina para alimentos concentrados. (Economic evaluation and nutritional qualities of cassava to establish a cassava meal/processing plant for animal concentrates). Tesis Ing. Industrial. Bucaramanga, Colombia, Universidad Industrial de Santander. 236p. Es. 14 Ref., Il.

CASSAVA; NUTRITIVE VALUE; ECONOMICS; FACTORIES; SOCIOECONOMIC ASPECTS; LABOR; COSTS; PRICES; CASSAVA MEAL; PRODUCTION; CULTIVATION; ROOT PRODUCTIVITY; PRESSING; DRYING; GRINDING; SCREENING; COLOMBIA.

The economic feasibility of establishing a CM processing plant for animal concentrates in Santander, Colombia, was evaluated. The technical aspects of cassava production and crop availability in the region are reviewed and the results of a survey to identify the best localization for plant are given. A tentative design of the plant is presented. Aspects covered by the project include the present status of cassava in the region, existing infrastructure, markets, processing plant organization and management, CM production process and equipment, and commercialization. The social, technical, and economic benefits of establishing the project are evaluated. Blueprints are included. (CIAT)

0040

34289 SANINT, L. 1987. Paraguay: potential demand for cassava. In Centro Internacional de Agricultura Tropical. The cassava economy of Latin America: a food staple in transition. Cali, Colombia, Centro Internacional de Agricultura Tropical. Global Cassava Research and Development 38p. En. 16 Ref.

CASSAVA; DEVELOPMENT; CONSUMPTION; PRODUCTION; ECONOMICS; TRADE; PRICES; CASSAVA ROOTS (VEGETABLE); DRIED ROOTS; FEEDS AND FEEDING; SWINE; POSTHARVEST TECHNOLOGY; ROOT PRODUCTIVITY; STATISTICAL DATA; PARAGUAY; CIAT-1.

A brief analysis is made of colonization, price and commercialization, credit, research, and extension policies and their impact on agriculture in Paraguay. The present status of cassava consumption, production, and distribution is then reviewed to determine potential and projected demand. Time series data were used to calculate the effects of changes in income, prices, and urbanization trends on the per capita consumption of cassava. Cassava is very important in Paraguay, where it (1) generates more employment than other crops; (2) produces the most by volume; (3) is 3rd in terms of gross domestic product (after soybeans and cotton); and (4) is the most important source of carbohydrates. Together with maize, cassava constitutes the basic source of feed for pigs, which supply 43 percent of all the meat consumed in the country. The use of dried cassava in animal feed is not economically attractive because farmers get twice as much per kg selling cassava in the fresh market. There is great potential for CIAT's fresh cassava storage technology. Colonization policies have indirectly led to increased production, beyond already high levels. To meet the projected demand by the yr 2000, an additional 80,000 ha will have to be planted. (CIAT)

0041

33809 SANINT, L.R. 1986. Apendice B. Consumo de carnes en Ecuador y sus aplicaciones para la yuca. (Annex B. Meat consumption in Ecuador and its implications for cassava). In Romanoff, S.; Toro, G., eds. Seminario Anual sobre la Yuca, 1, Portoviejo, Ecuador, 1985. La yuca en la costa ecuatoriana y sus perspectivas agroindustriales: memorias. Quito, Ecuador, Instituto Nacional de Investigaciones Agropecuarias; Instituto Interamericano de Cooperacion para la Agricultura; Centro Internacional de Agricultura Tropical. pp.155-157. Es. 5 Ref. (CIAT, Apartado Aereo 6713, Cali, Colombia)

CASSAVA; FEEDS AND FEEDING; DRIED ROOTS; DEVELOPMENT; ECUADOR; CIAT-1.

A brief analysis is made of meat consumption trends (beef, pork, fowl, and others) in Ecuador vs. cereal grain production trends (maize, sorghum, and soybean). Data indicate that the demand for balanced feeds will continue; the current policies of self- sufficiency and reduced imports make conditions for dry cassava production for the animal feed industry very favorable. (CIAT)

See also 0001 0035

POULTRY

0042

26769 ANDAYANI, S.; SUSANTO, S.; ERLINA, H. 1985. Penggunaan tepung ubi Kayu sebai bahan penyusun ransun ternak ayam pedaging. (Use of cassava flour in rations for broilers). In Nugroho, W.H.; Guritno, B.; Utomo, W.H.; Sugito, Y., eds. Seminar Pengembangan Ubi Kayu di Jawa Timur, Indonesia, 1985. Prosiding. Malang, Pusat Penelitian Tanaman Ubi-Ubian Universitas Brawijaya. pp.164-172. In. Sum. In., En., 5 Ref.

CASSAVA; POULTRY; CASSAVA FLOUR; NUTRITIVE VALUE; ANIMAL HEALTH; FEED CONSTITUENTS; FEED MIXTURES; INDONESIA.

The feasibility of using CF in rations for broilers was studied and its effect on broiler performance was determined. Ninety-six male Indian River broilers, 5-wk.-old and with an initial av. wt. of 896.46 g, were used. Treatments consisted of 4 different percentages of CF in the total ration (0, 5, 10, and 15 percent). Each treatment was placed into 6 blocks according to the location of the poultry run. Feed intake, body wt. gain, and feed conversion were observed for 4 days. The feed ration and water were given ad libitum. Best results were obtained with the 2nd treatment: 3952.58 g, 1170.84 g, and 3.38 for feed consumption, body wt. gain, and food conversion, resp. (AS)

0043

18429 BECKER, J.; SCHULZE, W.D.; SCHMIDT, A.; KNAPE, G. 1981. Weitere Ergebnisse zum Einsatz von Tapioka im Mischfutter. (Further results on the inclusion of cassava in feed mixtures). Tierzucht 34(12):564-565. De. Sum. De.

AMINO ACIDS; ANIMAL NUTRITION; COMPOSITION; DOMESTIC ANIMALS; EUROPE; FEEDS AND FEEDING; FEDERAL REPUBLIC OF GERMANY; LYSINE; METHIONINE; POULTRY; PROTEIN CONTENT; SWINE; USES.

Trials to demonstrate the quality of cassava indicated that it can be used to replace wheat and maize, without affecting performance, in animal feed rations at 30, 15, 18, and 30 percent for pigs, layers, chicks (1 g met. at 20 percent should be added), and ducks, resp. Due to the low lysine content of the feeds, it is necessary to add 1.0-1.5 percent of soy cake for each 10 percent of cassava. (AS-CIAT)

0044

34489 DAGURO, A.E.; RIVAS, E.T. 1987. Cassava as a source of energy for broiler production. CMU Journal of Agriculture, Food and Nutrition 9(1):49-59. En. Sum. En., 4 Ref.

CASSAVA; CASSAVA MEAL; FEEDS AND FEEDING; CHICKS; ANIMAL PHYSIOLOGY; INCOME; PHILIPPINES.

Sixty day-old broiler chicks were fed with 4 exptl. rations that contained 4 levels of CM (0, 35, 65, and 100 percent) as energy source. Body wt. gain, feed consumption, and feed conversion efficiency of the birds were determined. Birds fed rations containing 35 percent CM performed exceedingly well. Those fed rations containing 65 percent CM had a performance similar to that of birds fed the control ration (0 percent CM); however, the birds fed with 100 percent CM had the lowest av. daily wt. gain. Only 65 percent CM should be used in feed rations for broiler chicks. Birds fed rations with 35 percent CM had the highest net return; rations containing 35 and 0 percent CM, in descending order, also gave good results. Further studies should be undertaken to determine its nutritive value in poultry rations. (AS)

0045

29453 DEVEGOWDA, G.; RAMAPPA, B.S.; SHASHIKUMAR, S.K. 1986. True metabolizable energy values of some feedstuffs in chickens. Indian Journal of Poultry Science 21(1):29-31. En. Sum. En., 9 Ref. (Dept. of Poultry Science, Univ. of Agricultural Sciences, Bangalore-560024, India)

CASSAVA; ANIMAL NUTRITION; POULTRY; DIGESTIBILITY; CASSAVA MEAL; INDIA.

Male broilers 8 wk. old were used to estimate the true ME values of solvent-extracted Guizotia abyssinica seed oilmeal, solvent-extracted sunflower oilmeal, maize oilmeal, silkworm pupae meal, meat meal, cassava pulp, sorghum, molasses, Leucaena leucocephala leaf meal, and lucerne leaf protein concentrate. The resp. values were 2266, 2408, 2702, 2435, 2326, 2106, 3513, 2059, 983, and 3225 kcal/kg. (AS)

0046

26831 EKPENYONG, T.E.; OBI, A.E. 1986. Replacement of maize with cassava in broiler rations. Archiv Fuer Gefluegelkunde 50(1):2-6. En. Sum. En., De., Fr., Rus., 22 Ref. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

CASSAVA; POULTRY; FEEDS AND FEEDING; NUTRITIVE VALUE; CASSAVA MEAL; FEED CONSTITUENTS; FEED MIXTURES; PRODUCTIVITY; ANIMAL HEALTH; NIGERIA.

Three levels of cassava-based diets (0, 37.5, and 50.0 percent cassava) were supplemented with 3 levels of Zn to determine their effects on broiler performance. Cassava roots were previously peeled, grated, squeezed, and sun-dried. Zn supplementation had little effect on wt. gain efficiency. Feed intake increased with increase in cassava level and the addition of 50 ppm Zn. Carcass quality was affected by dietary treatment. There was a Zn x cassava interaction on dressing percentage, plucked wt., and abdominal fat. Abdominal fat decreased as levels of cassava and Zn increased. Although 50.0 percent cassava supplemented with 50 ppm Zn gave optimum results, diets with 37.5 percent cassava supplemented with 100 ppm Zn were satisfactory. (AS)

0047

33793 FERNANDEZ C., R. 1986. La industria avicola de Manabi y su demanda por yuca. (The poultry industry in Manabi and the demand for cassava). In Romanoff, S.;

Toro, G., eds. Seminario Anual sobre la Yuca, 1, Portoviejo, Ecuador, 1985. La yuca en la costa ecuatoriana y sus perspectivas agroindustriales: memorias. Quito, Ecuador, Instituto Nacional de Investigaciones Agropecuarias; Instituto Interamericano de Cooperacion para la Agricultura; Centro Internacional de Agricultura Tropical. pp.63-64. Es.

CASSAVA; FEEDS AND FEEDING; POULTRY; PRODUCTION; ECUADOR; CIAT-1.

The demand for cassava by the poultry industry in Manabi, Ecuador, is analyzed. This industry has recovered from the floods occurring in 1982. Estimates indicate that 300 ha of cassava, with yields of 20 MT/ha, are needed, whereas with the current yields obtained (10 MT/ha), 600 ha would be needed. (CIAT)

0048

27621 GERPACIO, A.L.; PASCUAL, F.S.; QUERUBIN, L.J.; VERGEL DE DIOS, A.F.; MERCADO, C.I. 1978. Evaluation of tuber meals as energy sources. 1. Sweet potato- and cassava-based rations for broilers. Philippine Agriculturist 61:395-410. En. Sum. En., 15 Ref., Il.

CASSAVA; CASSAVA MEAL; NUTRITIVE VALUE; CHICKS; FEEDS AND FEEDING; FEED CONSTITUENTS; DIGESTIBILITY; FOOD ENERGY; ANIMAL NUTRITION; PHILIPPINES.

The performance of 2-wk.-old birds fed with rations containing sweet potato or cassava root meals at 0, 25.0, 37.5, and 50.0 percent levels in the rations (0, 50, 75, and 100 percent replacement of maize) to 6 wk. of age were studied. Parameters used were feed intake, wt. gains, feed efficiency, dressing percentages, and digestibility or availability of the major nutrients (DM, fiber, protein, energy). Response to CM substitution was very favorable for all parameters, except for a depression in feed intake at the 50 percent level which caused a significant decline in 6-wk. body wt. Performance of birds fed with sweet potato, especially at the higher levels, was less satisfactory as compared with cassava and/or 50 percent maize. Supplementation with 0.1 percent lysine and 0.1 percent met. further improved DM digestibility, crude fiber digestibility, ME, and metabolizable protein of cassava-based rations. (AS (extract))

0049

24031 GOMEZ, G.; SANTOS, J.; VALDIVIESO, M. 1981. Least-cost rations containing cassava meal for broilers and growing pigs. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.393-400. En. Sum. En., 13 Ref. (CIAT, Apartado Aereo 6713, Cali, Colombia)

ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; COLOMBIA; COMPOSITION; COSTS; DOMESTIC ANIMALS; DRYING; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING; HCN CONTENT; INCOME; POULTRY; PRICES; PROCESSED PRODUCTS; PROCESSING; SOLAR DRYING; SOUTH AMERICA; SWINE; USES.

A least-cost formulation computer program using CM at a price equivalent to 80 percent of the current price of sorghum indicated that cassava could be incorporated into rations at levels of 20-30 percent for broilers (0-8 wk.) and 30-40 percent for growing pigs (weaning to market wt.). CM was used as a substitute for cereal grains, sorghum, or maize. Results of feeding trials with broilers and growing pigs showed that even CM prepared from roots of high cyanide-containing var., such as M Col 1684, can be satisfactorily incorporated if properly dried, at the levels mentioned above in compound or balanced feeds for these species, producing results similar to those obtained with standard rations. Exptl. data on body wt. gain, feed consumption, feed conversion, and economic evaluation are presented and discussed. (AS)

0050

31695 GOMEZ, G.; TELLEZ, G.; CAICEDO, J. 1987. Effects of the addition of vegetable oil or animal tallow to broiler diets containing cassava root meal. Poultry Science 66(4):725-731. En. Sum. En., 26 Ref. (2813 Rue Sans Famille, Raleigh, NC 27607, USA)

CASSAVA; CASSAVA MEAL; TALLOW; FEED MIXTURES; DIETS; DIETARY VALUE; POULTRY; FEEDS AND FEEDING; ANIMAL NUTRITION; ANIMAL PHYSIOLOGY; COLOMBIA; CIAT-1.

Two expt. were carried out to evaluate the effects on broiler performance of increasing by 5 percent the ME level of diets containing CM (0, 20, and 30 percent) by adding either vegetable oil (expt. 1) or animal tallow (expt. 2). The CM used was detoxified by sundrying whole root chips of a bitter cv. (CMC-84) on a concrete floor. All exptl. diets were supplied in mash form. Supplementary vegetable oil or animal tallow did not affect (P greater than 0.05) growth rate. Feed conversion (feed/gain) was improved (P less than 0.05) during the starter (0-28 days) period as well as at the end of the expt. (56 days). Body wt. gain, feed consumption, and feed conversion were not affected (P greater than 0.05) by any of the dietary treatments during the finishing (28-56 days) period of both expt. Diets containing 20 percent CM produced somewhat higher (P greater than 0.05; expt. 1) or significantly higher (P less than 0.05; expt. 2) final body wt. (AS)

0051

28577 HUYGHEBAERT, G.; DE GROOTE, G. 1984. Eclairage intermittent chez les poules pondeuses et remplacement des cereales dans les rations de ponte distribuees sous forme de farine et de granules. (Intermittent lighting for laying hens and substitution of cereals in laying rations given as meal or pellets). Revue de l'Agriculture 37(5):1245-1260. Fr. Sum. Fr., En., 29 Ref., Il. (Centrum voor Kleinveeteelt, Sektie 1 (I.W.O.N.L.) Burgem, Van Gansberghelaan, 92 B-9220 Merelbeke, Belgium)

CASSAVA; FEEDS AND FEEDING; ANIMAL HEALTH; NUTRITIVE VALUE; DIETARY VALUE; ANIMAL NUTRITION; DIETS; PELLETS; BELGIUM.

In a 3 x 2 x 2 factorial expt., laying hens were given pelleted feed (maize or cassava plus 25 percent soybean oil and 75 percent animal fat) ad libitum, meal ad libitum, or pelleted feed restricted to the same amount as that consumed by hens given meal. The effect of continuous (16 h light:8 h dark) or intermittent lighting (16 h of 1/4 light and 3/4 dark: 8 h dark) was also studied. When pelleted diets were given freely, there was higher feed intake (7-8 percent), lower feed conversion (8-9 percent), and lower egg production (0.8 percent) than when meal was given. There was no significant difference in performance of hens given diets of different composition. Intermittent lighting significantly reduced feed intake (3-4 percent) and improved feed conversion efficiency (3-4 percent) despite a significantly lower egg wt. Intermittent lighting also reduced lighting costs by 50 percent. (AS (extract))

0052

22035 KADIRVEL, R. 1980. Tapioca as poultry feed. Poultry Adviser 9(8):21-24. En.

ANIMAL NUTRITION; ASIA; INDIA; POULTRY; USES.

The characteristics of cassava and its products (chips; CM; thippi, a by-product in the manufacture of cassava starch extensively used in SE Asia for animal feeding; CLM) are analyzed in relation to poultry feeding in south India. For chicks up to 6 wk. old, 10-15 percent substitution of maize by cassava is recommended; for chicks from 7 to 12 wk. old, 30 percent; above that age, 40 percent substitution is suggested. A level of 25-30 percent cassava is recommended for layer rations. Contradictory results about egg production have been recorded. To improve yolk color, synthetic carotenoids or CLM should be included. CLM can also replace alfalfa (5 percent) in cattle and poultry feeds. Factors limiting the extensive use of cassava and cassava products are discussed. The

success of cassava utilization depends on the availability of cheap protein sources, levels of incorporation, and precautions taken to prevent possible undesirable effects. (CIAT)

0053

26726 KALBANDE, V.H.; KADUSKAR, M.R.; THATTE, V.R.; KHIRE, D.W. 1984. Non-cereal rations for broilers. Indian Journal of Poultry Science 19(4):270-271. En. 5 Ref. (Nagpur Veterinary College, Nagpur-440 006, India)

CASSAVA; FEEDS AND FEEDING; CHICKS; FEED CONSTITUENTS; COSTS; ANIMAL NUTRITION; INDIA.

Diets based on rice polishings with 18 percent CM, or 5 percent CM with 5 percent sal seed (Shorea robusta) meal were given to broilers from 1 wk. until 8 wk. old. A maize-based diet (58 percent maize) was used as control. Broilers given the maize-based diet had greatest wt. gains and meat yields. (Nutrition Abstracts and Reviews)

0054

30109 KWATIA, J.T. 1986. Animal feed rations using cassava meal. In Kwatia, J.T. Rural Cassava Processing and Utilization Centre: report. Nigeria, United Nations Children's Fund. p.62. En.

CASSAVA; CASSAVA MEAL; ANIMAL NUTRITION; DIETS; FEEDS AND FEEDING; POULTRY; SWINE; NIGERIA.

The percentage rates at which dry CM can be used in animal feed rations are given as well as the full composition of a CM-based diet (40.8 percent) for layers to be prepared by farmers in Nigeria. Max. dry CM levels indicated for feeding several animal categories are 10 percent for broiler-starter chicks (0-4 wk.), 20 percent for broiler-finisher chicks (4 wk.), 10 percent for chick starter, 25 percent for pullet grower, 40 percent for layers, 30 percent for sow/boars, 10 percent for piglets (to 8 wk.), 25 percent for pigs from 8 to 16 wk., and 30 percent for pigs from 16 wk. to maturity. (CIAT)

0055

32294 MONCADA M., E. 1976. Efecto de la suplementacion de los aminoacidos limitantes en la yuca en dietas sin cereales para pollos de engorda. (Effect of supplementing limiting amino acids existing in cassava in noncereal diets for broiler chicks). Tesis Vet. Zootecnista. Mexico, D.F., Universidad Nacional Autonoma de Mexico. 29p. Es. 30 Ref.

CASSAVA; CASSAVA MEAL; POULTRY; FEEDS AND FEEDING; ANIMAL PHYSIOLOGY; AMINO ACIDS; COSTS; HCN CONTENT; MEXICO.

The inclusion of CM at rates over 40 percent of the total ration for broilers reduced animal growth; this effect can be counterbalanced by adding either the limiting amino acids found in cassava (met. and lysine) or a balanced mixture of amino acids (casein). CM can be used if it reduces production costs; however, further research is required to determine if the reduction in growth is a result of long-term HCN accumulation. (CIAT)

0056

24728 MONTILLA S., J. DE J. 1981. Recursos alimenticios energeticos no convencionales para aves. (Nonconventional energetic feed resources for poultry). Maracay, Universidad Central de Venezuela. 15p. Es. Sum. Es., 28 Ref. (Facultad de Ciencias Veterinarias, Univ. Central de Venezuela, Apartado 4563, Maracay 2101A, Venezuela)

ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; CIAT-2; FEED CONSTITUENTS; FEEDS AND FEEDING; POULTRY; PROCESSED PRODUCTS; SOUTH AMERICA; USES; VENEZUELA.

A literature review on the use of CM, sweet potato, banana and plantain, sugar cane products and by-products, and palm oil in poultry nutrition is presented. The divergence in the results obtained by different authors is discussed. (CIAT)

0057

32049 NATIONAL ROOT CROPS RESEARCH INSTITUTE. 1980. Project 5. Processing and utilization of cassava tubers. A) Studies on the use of cassava products in poultry feeds. In National Root Crops Research Institute. Cassava Program. Annual Report 1980. Umudike, Nigeria, pp.42-43. En.

CASSAVA; CASSAVA MEAL; FEEDS AND FEEDING; ANIMAL NUTRITION; DIETS; POULTRY; EGGS; NIGERIA.

Mashed unpeeled cassava roots fermented for 48 h, with 100 ml effluent from fermented cassava/kg as inoculum, were satisfactory for CM preparation for use in poultry feeds in Nigeria. Maize in diets was substituted by CM at rates of 0, 25, 50, and 100 percent and CP content of diets was provided by fish meal. Layers were left on all treatments for 11 days before recording exptl. results. No adverse effects were observed from inclusion of cassava even at the 100 percent level. After 341 days of treatment, the highest no. of eggs/layer (199) was obtained with diets containing 50 percent cassava, 50 percent maize, and fish meal supplement, followed by the diet containing 100 percent cassava and fish meal supplement (191). Yolk color was definitely changed to white at cassava substitution levels above 50 percent. Egg size/wt. was highest when either cassava or maize were used at 100 percent (70.3 and 70.8 g). Shell thickness and yolk/albumin ratio were not significantly affected by CM. (CIAT)

0058

22730 NGOKA, D.A.; CHIKE, E.C.; AWONIYI, A.B.; ENYINNIA, T.; ODURIKWE, S.O. 1981. Effects of cassava meal on the hatchability of chicken eggs. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.117-119. En. Sum. En., 13 Ref. (National Root Crops Research Inst., P.M.B. 1006, Umudike, Umuahia, Nigeria)

AFRICA; ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; CEREALS; DOMESTIC ANIMALS; FEED CONSTITUENTS; MAIZE; NIGERIA; POULTRY; PROCESSED PRODUCTS; STARCH CROPS.

Yaffa hens and Rhode Island red cocks were fed CM in maize-based rations at 4 dietary levels, substituting maize at 0, 50, 75, and 100 percent; 800 eggs were collected from the hens and incubated in 5 replicate batches for all the treatments. The no. of infertile eggs, mortality in the shell, salability, and incubation period were recorded. The eggs from the birds fed the highest level of cassava showed a significantly (P less than 0.05) higher infertility and lower hatchability than the others. Other differences were not significant. The results suggest that CM can be substituted for maize up to 75 percent in breeders' rations without deleterious effects on the hatchability of chicken eggs. (AS)

0059

29362 OKPOKIRI, A.O.; UGWU, B.O. 1982. Processing and utilization of cassava tubers. Effect of cassava-based rations on the performance of a laying flock. In National Root Crops Research Institute. Cassava Improvement Program. Annual Report 1982. Umudike, Nigeria, pp.30-32,34. En.

CASSAVA; FEEDS AND FEEDING; DIETS; POULTRY; EGGS; ECONOMICS; COSTS; NIGERIA.

Cassava was used to replace maize at 4 substitution levels (0, 40, 60, and 100 percent) in diets for layers from birth to the laying period. Mortality occurring up to the 20th wk. could be attributed to other factors different from feed treatments. Cassava at 100 and 60 percent substitution levels significantly reduced the no. of eggs laid/yr: 1755 and 1728 eggs/yr, resp., vs. 2002 and 2119 eggs/yr for cassava substitution levels of 40 and 0 percent, resp. No significant differences in fresh egg wt., shell wt., albumin wt., and cull wt. were recorded, however, between treatments. A significantly lower yolk wt. was recorded for cassava at the 100 percent substitution level (16.7 g/egg) compared with the 0 substitution level (17.5 g/egg). Economic analysis showed that egg production is cheaper when cassava is used compared with maize. (CIAT)

0060

25509 RAVINDRAN, V.; RAJAGURU, A.S.B. 1981. Nutrient contents of some unconventional poultry feeds. Indian Journal of Animal Sciences 55(1):58-61. En. Sum. En., 21 Ref. (Univ. of Peradeniya, Peradeniya, Sri Lanka)

ASH CONTENT; ASIA; CASSAVA MEAL; CASSAVA PRODUCTS; COMPOSITION; DIETARY VALUE; DOMESTIC ANIMALS; FAT CONTENT; FEEDS AND FEEDING; FIBER CONTENT; FOOD ENERGY; HCN CONTENT; INDIA; LEAVES; PLANT ANATOMY; POULTRY; PROCESSED PRODUCTS; PROTEIN CONTENT; STORAGE; USES.

The nutrient and N-corrected ME contents of 10 nonconventional poultry feed ingredients were determined. The chromic oxide indicator method was employed to assay the ME values. The ME contents for undetoxified and detoxified cassava root meal were 3197 and 3805 kcal/kg, resp. This difference suggested that HCN interfers with the utilization of energy by poultry. The ME content of CLM was 1870 kcal/kg. (AS)

0061

32095 REDDY, T.S. 1987. Use of non-conventional feed items in poultry rations, their effect on growth and egg production. Poultry Adviser 20(1):33-36. En. (Regional Poultry Farm, Kolar, Karnataka, India)

CASSAVA; CASSAVA MEAL; POULTRY; DIETS; FOOD ENERGY; INDIA.

Nonconventional feeds used as sources of protein and energy in poultry rations in India are listed. CM is used as an energy source; it can be included up to 5-18 percent in broiler rations with rice polish and salseed meal and up to 10-20 percent in layer rations with 60-70 percent rice bran. The problem of HCN toxicity can be overcome by sun drying. (CIAT)

0062

32415 SANTOS V., E.; LOPEZ G., A.; GIRALDO C., A. 1986. La harina de yuca en la alimentacion de pollas de reemplazo. (Cassava meal in rations for replacement poultry). Actualidades Tecnicas ICA 2(3):3-4. Es. 1 Ref., Il. (Centro Nacional de Investigaciones Agropecuarias, Apartado Aereo 233, Palmira, Colombia)

CASSAVA; FEED MIXTURES; FEED CONSTITUENTS; POULTRY; ANIMAL NUTRITION; COSTS; COLOMBIA.

Indications are given that CM can be used up to 30 percent in rations for replacement poultry. Other ration components would be sorghum, soybean cake, molasses, bone meal, iodized salt, premix (vitamins and minerals), and coccidiostat at 36.50, 25.45, 5.00, 2.50, 0.30, 0.20, and 0.05 percent, resp. The inclusion of CM (30 percent) to replace sorghum reduces feed costs. Furthermore, an av. wt. gain/bird of 1286 g is obtained along with a cumulative feed intake of 3877 g and a mortality rate of 0.7 percent. (CIAT)

0063

22098 STEVENSON, M.H. 1981. The nutritional value of cassava root meal in laying hen diets. Journal of the Science of Food and Agriculture 35(1):36-40. En. Sum. En., 13 Ref. (Agricultural & Food Chemistry Research Division, Dept. of Agriculture for Northern Ireland, & The Queen's Univ. of Belfast, Newforge Lane, Belfast BT9 5PX, Northern Ireland)

ANIMAL NUTRITION; CASSAVA MEAL; DOMESTIC ANIMALS; FEED CONSTITUENTS; NUTRITIVE VALUE; PELLETS; POULTRY.

A total of 288 layer hens (144 Hixes White, 144 Hisex Brown) were randomly allocated to 1 of 12 dietary treatments and fed ad libitum for ten 28-day periods. The diets, fed either as mash or pelleted, were a control diet and 5 other diets with increasing levels of added CM (100, 200, 300, 400, and 500 g/kg diet). At the end of the expt., 4 Hixes White birds from each treatment were taken for the measurement of water intake. The apparent ME content of the diets was measured by the total collection method. The inclusion of high levels of CM had no detrimental effect on egg production or food intake. However, as the level of cassava increased, there was a tendency towards a decrease in food consumption in the meal-fed birds. Water consumption was significantly greater in the birds given pelleted feed than in those given mash. Also, at the higher levels of cassava inclusion in the meal-fed birds, water consumption was greater. The apparent ME content of the CM was 14.1 MJ/kg DM. (AS)

0064

22097 STEVENSON, M.H.; JACKSON, N. 1981. The nutritional value of dried cassava root meal in broiler diets. Journal of the Science of Food and Agriculture 34(12):1361-1367. En. Sum. En., 21 Ref. (Agricultural & Food Chemistry Research Division, Dept. of Agriculture for Northern Ireland, & The Queen's Univ. of Belfast, Newforge Lane, Belfast BT9 5PX, Northern Ireland)

ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; METABOLISM; NUTRITIVE VALUE; POULTRY; PROCESSED PRODUCTS; USES.

In each of 2 expt., 600 male broiler chicks (Ross 1) were randomized into 24 groups, each containing 25 birds. From the age of 7 days they were given 1 of 6 exptl. diets: a control diet having ground wheat as the main cereal source and 5 other diets in which mainly the wheat was replaced by increasing amounts (100, 200, 300, 400, and 500 g/kg diet) of dried CM. Neither body wt. nor food intake were significantly affected in either expt. by the inclusion of dried CM at levels up to 500 g/kg. Food conversion efficiency was not affected by dietary treatment except in expt. 1 after 4 wk., when the diet with 100 g CM/kg resulted in a better food conversion efficiency than in the case of the other dietary treatments. The carcass and abdominal fat wt. and the chemical composition of the carcasses were not affected by dietary treatment. In the cecal contents the proportion of acetic acid was increased and that of propionic and valeric acids reduced by the inclusion of dried CM. The MC of the litter was not significantly affected by the presence of CM although the litter became wet and sticky in the groups given the 2 highest levels of CM in expt. 1. For this reason, the max. recommended level of inclusion of dried CM in broiler diets is 30 percent. (AS)

0065

26381 STEVENSON, M.H. 1985. Effect of added cassava root meal, ZnO and their interaction on the production and quality of eggs from laying hens. Journal of the Science of Food and Agriculture 36(10):909-914. En. Sum. En., 25 Ref. (Agricultural & Food Chemistry Research Division, Dept. of Agriculture for Northern Ireland, & The Queen's Univ. of Belfast, Newforge Lane, Belfast BT9 5PX, Northern Ireland)

CASSAVA; CASSAVA MEAL; EGGS; FEED CONSTITUENTS; POULTRY; STATISTICAL ANALYSIS; UNITED KINGDOM.

A total of 216 (108 Hisex Brown, 108 Warren Studler) laying hens were given 1 of 12 dietary treatments. These were 4 basic diets with 0, 200, 400, and 600 g added cassava/kg, and each basic diet was further subdivided and ZnO added to provide 100 and 200 mg Zn/kg. None of the production traits measured was significantly affected by either added cassava or ZnO but there was a quadratic response in food intake to added cassava. ZnO addition significantly improved egg quality (assessed by Haugh score) but did not affect shell thickness. Haugh score was significantly affected by added cassava, the responses being significant after 2 wk. of storage. The interaction between Zn level and cassava level significantly affected egg quality. (AS)

0066

26195 TULLER, R.; SCHMITZ-DU-MONT, M. 1982. Austausch von getreide gegen tapiokamehl im legehennenalleinfutter. (Use of cassava meal as substitute for cereal grains as sole layer rations). Deutsche Gefluegelwirtschaft und Schweineproduktion 34(3):67-69. De.

CASSAVA; POULTRY; CONCENTRATES; FEEDS AND FEEDING; PROTEIN CONTENT; FAT CONTENT; SUGAR CONTENT; CA; EUROPE.

0067

23709 WYLLIE, D.; MTUI, M.; OLOYA, J.D.; KETEGILE, J.A. 1981. The processing of cassava meal for chicks. Nutrition Reports International 30(5):1127-1136. En. Sum. En., 20 Ref. (School of Agriculture, West Mains Road, Edinburgh, Scotland)

AFRICA; ANIMAL NUTRITION; BOILING; CASSAVA MEAL; CASSAVA PRODUCTS; CHICKS; COMPOSITION; DOMESTIC ANIMALS; DRY MATTER; DRYING; FEED CONSTITUENTS; FEEDS AND FEEDING; FERMENTATION; FIBER CONTENT; HCN CONTENT; METABOLISM; NUTRITIVE VALUE; POULTRY; PROCESSED PRODUCTS; PROCESSING; PROTEIN CONTENT; SOLAR DRYING; TANZANIA; USES.

The effect of different methods of processing CM on its nutritive value was studied in 2 expt. carried out with chicks to develop simple methods of producing CM for poultry feeding in rural situations. In the 1st expt. 132 day-old chicks were fed for 9 wk. on cassava-based diets, prepared either by sun drying, boiling, roasting, or after fermenting in water. Chicks fed the diet containing cassava fermented in water grew fastest and those fed sun-dried cassava, the slowest. There were no statistically significant differences for feed conversion efficiency but chicks fed boiled cassava tended to perform better than those fed roasted or sun-dried cassava. In the 2nd expt. 180 day-old chicks were fed for 8 wk. on the same basal diet but using cassava prepared by one of the following methods: (a) sun drying; (b) sun drying followed by placement and fermentation under leaves and inclusion of the molds so produced; (c) as for (b) but removal of the molds with a scraper; (d) fermentation in water only; (e) fermentation in water with sodium sulphate added; (f) fermentation in water only but with sodium sulphate added to the final diet. Fermentation under leaves and the addition of sulphate in the water during fermentation reduced the level of HCN comparable with sun drying. Wt. gain and feed conversion efficiency were highest for the diets containing cassava fermented in water, the treatment without any added sulphate tending to give the highest gains. Lowest wt. gain and conversion efficiency were found with the sun drying treatment. Performance improved after fermentation under leaves, especially when the molds so produced were removed before the cassava was incorporated in the diet. (AS)

0068

22769 YEONG, S.W.; SYED ALI, A.B. 1971. The use of tapioca in broiler diets. MARDI Research Bulletin 5(1):95-103. En. Sum. En., Mal., 6 Ref.

ANIMAL NUTRITION; ASIA; CASSAVA CHIPS; CASSAVA PRODUCTS; CEREALS; DOMESTIC ANIMALS; DRIED ROOTS; FEED CONSTITUENTS; FEEDS AND FEEDING; MAIZE; MALAYSIA; METABOLISM; NUTRITIVE VALUE; PELLETS; POULTRY; PROCESSED PRODUCTS; STARCH CROPS; USES.

Five expt. were conducted to study the possibility of replacing maize with cassava chips in broiler-finisher diets. In the 1st 2 trials, 5 isonitrogenous and isocaloric diets with graded levels of ground cassava chips (0, 15, 30, 40, and 50 percent) substituting maize, were fed to commercial broiler chickens from wk. 5 to 10. It was observed that as cassava levels increased, body wt. and feed efficiency decreased linearly (P less than 0.01), although the essential amino acids content in all diets was as high as the requirement levels. Pelleting the cassava diets slightly improved feed efficiency but could not overcome the adverse effect completely. In the subsequent trials, diets with graded levels of cassava were supplemented with different levels of met. Results showed that 40 or 50 percent cassava supplemented with 0.2 percent met. were comparable with maize control diets in terms of body wt. gains and feed efficiency. No significant difference was found in the carcass of broilers fed maize and cassava diets in terms of percent of ready-to-cook (total giblets, carcass, and neck) and meat to bone ratio. Absence of yellow pigment in the skin, shanks, and depot fat was observed in broilers fed high cassava diets. (AS)

See also 0085 0088 0192 0220 0222 0225 0233

SWINE

0069

23723 PORCS: UTILISATION du manioc. (Pigs: cassava utilization). 1982. Cultivar no.153:141-142. Fr. Il.

ANIMAL NUTRITION; CASSAVA; COMPOSITION; FEED CONSTITUENTS; FRANCE; HCN CONTENT; PIGLETS; STARCH CONTENT; SWINE.

The effect of substituting cassava from Thailand (poorer quality) or from Malawi (better quality) for maize in the feeding of growing pigs and piglets was compared. In the 1st trial with growing pigs, cassava from Thailand was supplied at 2 levels (15 and 30 percent) and that from Malawi at only 1 level (30 percent). To supplement the lack of amino acids the diets also contained soybeans and were isoenergetic. In the 2nd trial with piglets, maize was replaced by cassava from Thailand at 10 and 20 percent and by cassava from Malawi at 10 percent. The substitution of high quality cassava for maize in the feeding of piglets is possible up to 20 percent and in the ration for growing pigs up to 30 percent, as long as the N balance is maintained with soybean supplementation. For each 15 percent of cassava that is introduced in the ration, 1 point of soybean cake must be added in relation to maize and 2 in relation to wheat or barley. (CIAT)

0070

34983 ACOSTA E., J. 1976. Potencial del cultivo de la yuca en la alimentacion del ganado porcino. (Potential of cassava in swine nutrition). Yucatan, Mexico, Campo Agricola Experimental de Uxmal. 10p. Es. Sum. Es. Ciclo de Seminarios 1976.

CASSAVA; ANIMAL NUTRITION; SWINE; CASSAVA MEAL; ROOTS; COMPOSITION; DETOXIFICATION PROCESSES; ANIMAL PHYSIOLOGY; COLOMBIA; CULTIVARS; MEXICO.

The feasibility of using cassava as an alternative to the deficit of 50 million kg of carbohydrates necessary for swine nutrition in the state of Yucatan, Mexico, is discussed. Plans include the opening of several areas available for commercial cassava plantations and thus

achieve a profitable operation in pig raising. The chemical components of cassava roots, simple HCN detoxification processes, and the use of CM in swine nutrition are briefly reviewed. (CIAT)

0071

24055 AUMAITRE, A. 1971. Le manioc convient-il aux porcs. (Cassava, is it suitable for pigs?). La Revue de l'Elevage 27:83,85,87. Fr. Il.

ANIMAL NUTRITION; CIAT-2; COMPOSITION; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; EUROPE; FRANCE; SWINE.

The chemical composition of cassava is presented and discussed, and the need to complement its use in animal nutrition with N sources is indicated. Its use in swine nutrition is recommended as a cereal substitute considering its digestibility, positive effect on animal growth, and low price. However, it should be used moderately because of its toxicity. (CIAT)

0072

22795 BALOGUN, O.O.; FETUGA, B.L. 1981. Influence of methionine and palm oil supplementation of cassava flour-soybean meal diets on performance, nitrogen retention and rate of tissue deposition in weanling pigs. Livestock Production Science 11(3):315-327. En. Sum. En., Fr., De., 30 Ref. (Dept. of Animal Production, Faculty of Agriculture, Univ. of Ilorin, P.M.B. 1515, Ilorin, Nigeria)

AFRICA; ANIMAL NUTRITION; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; FEED CONSTITUENTS; METABOLISM; NIGERIA; SWINE.

Thirty-six 8-wk.-old weanling Large White x Landrace pigs, initially averaging 7.8 kg body wt., were used to evaluate the effect of palm oil and met. supplementation on growth performance, N retention, plasma urea concn., and rate and proportion of tissue deposition of pigs fed CF-SBM diets. Palm oil levels of 3.00, 6.35, and 9.70 percent, and met. levels of 0.47, 0.55, and 0.63 percent were used. All diets had a common protein level of 20 percent. Increasing the palm oil level from 3.00 to 6.35 percent of the diet significantly improved growth rate of pigs on all dietary met. levels. Daily N retention was not significantly influenced by increased dietary palm oil, although levels higher than 3.00 percent depressed the efficiency of retention of ingested N at all dietary met. levels. Increased caloric density due to increased palm oil levels resulted in a greater proportion of fat relative to lean in the carcass. Calculated daily rate of lean deposition reached a max. in the group of pigs fed the 0.63 percent met. diet containing 6.35 percent palm oil, while max. efficiency of feed conversion to lean was reached on the same met. level but with 9.70 percent palm oil. Min. plasma urea concn. was obtained on a diet containing 0.63 percent met. and 3.00 percent palm oil. (AS)

0073

22040 BALOGUN, O.O.; FETUGA, B.L.A.; OYENUGA, V.A. 1983. The response of the muscles of weanling Large White x Landrace pigs to methionine and palmoil supplementation to cassava flour-soya-bean meal diet. Journal of Agricultural Science 101(3):757-762. En. 12 Ref. (Dept. of Animal Production, Faculty of Agriculture, Univ. of Ilorin, Ilorin, Nigeria)

AFRICA; AMINO ACIDS; ANIMAL NUTRITION; ANIMAL PHYSIOLOGY; CASSAVA FLOUR; CASSAVA PRODUCTS; COMPOSITION; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; FLOURS; LABORATORY EXPERIMENTS; METHIONINE; NIGERIA; PHYSIOLOGY; PROCESSED PRODUCTS; PROTEIN CONTENT; RESEARCH; SWINE; USES.

An expt. was carried out to study whether dietary factors such as increased digestible energy consequent to increasing the amount of palm oil in the diet have any influence on

the differential response of muscles to dietary met. concn. when pigs were given CF-SBM diets. Thirty-six 8-wk.-old Large White x Landrace pigs were allocated to 9 groups of 4 pigs each on the basis of sex, live wt., and litter origin. There were 3 dietary met. concn.: (a) 4.7 g/kg diet (7.3 g met. + cystine/kg diet); (b) 5.5 g/kg diet (8.1 g met. + cystine/kg diet); and (c) 6.3 g/kg diet (8.9 g met. + cystine/kg diet). At each met. concn., 3 supplements of palm oil were added at 30, 63.5, or 97 g/kg diet and gave, on analysis, estimated digestive energy of 14.63, 15.27, and 15.94 MJ/kg diet, resp. The expt. lasted 42 days. After 21 days on the test diets, the pigs were transferred to specialized metabolic cages with facilities for separate collection of feces and urine. Animals were slaughtered on day 42 and dressed; carcasses were halved longitudinally and chilled for 24 h. Ten muscles were sequentially removed from the trunk, hind limb, and fore limb of the left side of each carcass. With met. concn. of 4.7 g/kg diet, there was a decline in muscle wt. when dietary palm oil was increased from 30 to 63.5 or 97 g/kg diet. With total met. of 5.5 g/kg diet, there was a significant (P less than 0.01) increase in the wt. of individual muscles with increasing palm oil in diet. The max. concn. required in a CF-SBM diet is 6.3 g total met. not only to promote satisfactory body wt. gain and muscle growth but also to provide additional met. (CIAT)

0074

30144 BARBOSA, A.S.; VIANA, L. DE S.; SANTOS, E.C. DOS; BARBOSA, R.B. 1986. Mandioca e derivados nas racoes de suinos em crescimento-terminacao e sua influencia na composicao de acidos graxos do toucinho. (The effects of cassava and cassava by-products in growing-finishing pig rations on the fatty acid composition of pork fat). Arquivo Brasileiro de Medicina Veterinaria e Zootecnia 38(6):943-953. Pt. Sum. Pt., En., Fr., Es., 10 Ref., Il. (Escola de Veterinaria da Univ. Federal de Minas Gerais, Caixa Postal 567, 30.161 Belo Horizonte-MG, Brasil)

CASSAVA; SWINE; FEEDS AND FEEDING; CASSAVA FLOUR; CASSAVA MEAL; ANIMAL NUTRITION; SUBSTITUTES; BRAZIL.

A comparative study was carried out in Minas Gerais, Brazil, to study the effects of replacing maize in growing-finishing pig rations with CF, dried ground cassava roots, and CM, at levels of 50 and 100 percent, on the fatty acid composition of pork fat. A randomized exptl. design was used with 7 treatments and 3 replicates (4 pigs/group for a total of 84 pigs). Myristic acid content was low in the treatment with 50 percent CF and palmitic acid increased in that with 100 percent CM (P equal to or less than 0.05). Linoleic acid decreased in treatments with 100 percent CF or CM and in the check treatment (maize), but increased in the 50 percent dried ground cassava root treatment (P equal to or less than 0.05). It was difficult to detect variations in the composition of fatty acids present in small quantities in pork fat when using GLC. (AS)

0075

24708 CALEFFI, A.; BROCCAIOLI, A. 1981. La farina di manioca nell'ingrasso dei suini. (Cassava flour for fattening pigs). Mantova Agricola e Zootecnica 32(19):1-2. It.

ASH CONTENT; CASSAVA MEAL; CASSAVA PRODUCTS; COMPOSITION; DOMESTIC ANIMALS; EUROPE; FAT CONTENT; FATTENING; FEED CONSTITUENTS; FEEDS AND FEEDING; FIBER CONTENT; ITALY; PROCESSED PRODUCTS; PROTEIN CONTENT; SODIUM; STORAGE; SWINE; USES; WATER CONTENT.

Three groups of pigs, of 17 animals each, received, resp., a diet of maize (A) or with 30 (B) or 15 percent CM (C); the diets were not isoproteid. The wt. gain/day, the food conversion indexes, and the linoleic acid contents were 0.649, 0.605, and 0.625 g; 4.336, 4.697, and 4.440; and 12.45, 9.77, and 10.71 percent, resp. The use of cassava is recommended as long as its price, in relation to that of maize, is 25 percent lower. (CIAT)

0076

24706 CASTAGNETTI, G.B. 1982. Manioca nel razionamento dei suini. (Cassava in swine rations). Informatore Zootecnico 29(22):24-28. It. Sum. It., 14 Ref., Il. (Istituto di Microbiologia e Industrie, Facolta di Agraria, Universita di Bologna, Bologna, Italy)

CASSAVA; CASSAVA CHIPS; CASSAVA MEAL; COMPOSITION; FEED CONSTITUENTS; ITALY; PELLETS; SWINE.

The chemical composition and the nutritive characteristics of cassava are reviewed. The advantages and disadvantages of CM, cassava chips, and pellets are discussed as well as their potential use for swine feeding in Italy. Finally, the protein enrichment of cassava by fermentation with Candida tropicalis and the price of cassava in relation to that of cereals are analyzed. (CIAT)

0077

29441 CHRISTENSEN, K. 1986. Influence of different dietary concentrations of linoleic acid on the essential fatty acid (EFA) status and functional characteristics of porcine hepatic and cardiac mitochondria. Comparative Biochemistry and Physiology 85(2):419-425. En. Sum. En., 43 Ref. (Royal Veterinary & Agricultural Univ., Inst. of Animal Physiology, Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark)

CASSAVA; DIETS; SWINE; FEEDS AND FEEDING; FAT CONTENT; ANIMAL PHYSIOLOGY; ANIMAL HEALTH; DENMARK.

The effect of different dietary concn. of linoleic acid on the essential fatty acid (EFA) status and the functional characteristics of hepatic and cardiac mitochondria was investigated in pigs raised for 140 days from 10 to 105 kg live wt. on their resp. diets. Concn. were 0.2, 1.1, and 2.1 percent of GE in expt. 1 and 0.7, 1.6, and 2.3 percent of GE in expt. 2. The exptl. diet included CM at 300, 202, and 204 g/kg for expt. 1 and 201, 203, and 205 g/kg for expt. 2. As judged from the ratios of 20:3n9 to 20:4n6 of hepatic and cardiac mitochondrial total lipids, the pigs receiving 0.2 percent of dietary GE as linoleic acid were EFA-deficient, while the pigs receiving 0.7 percent of dietary GE as linoleic acid were on the borderline of EFA deficiency. Mitochondrial protein yield and the functional parameters as measured in both hepatic and cardiac mitochondria with 2 substrates (pyruvate plus malate and succinate in the presence of rotenone) were not significantly (P greater than 0.05) affected by the different dietary concn. of linoleic acid. The findings indicate a slow turnover of EFA and a low desaturation/elongation activity of the associated enzymes in the pig. (AS)

0078

29585 CURTARELLI, S.M. 1985. Aproveitamento de raspa de mandioca e farelo de arroz integrais na alimentacao de suinos em crescimento e acabamento. (Use of cassava chips and brown rice bran in growing and finishing pig nutrition). Tese Mestrado. Piracicaba-SP, Brasil, Escola Superior de Agricultura Luiz de Queiroz da Universidade de Sao Paulo. 173p. Pt. Sum. Pt., En., 79 Ref., Il.

CASSAVA; CASSAVA MEAL; SWINE; FEEDS AND FEEDING; ANIMAL NUTRITION; DIETS; CASSAVA CHIPS; BRAZIL.

Several levels of CM and rice bran were used in isoproteic diets for growing and finishing pigs. Twenty-seven Large White x Wessex x Duroc crossbred gilts were allotted on the basis of body wt. in 3 lots in a 3 x 2 factorial (3 levels of CM and 3 levels of rice bran replacing maize-SBM in the basal diet) in a completely randomized block design with 9 treatments and 1 animal/lot. Treatments were as follows: T1, maize-soybean basal diet; T2, 15 percent CM; T3, 30 percent CM; T4, 15 percent rice bran; T5, 15 percent CM and 15 percent rice bran; T6, 30 percent CM and 15 percent rice bran; T7, 30 percent rice bran; T8, 15 percent CM and 30 percent rice bran; and T9, 30 percent CM and 30 per-

cent rice bran. CM and rice bran replaced maize and SBM, maintaining 13 and 15 percent CP in growing diets (23.86-58.29 kg body wt.) and finishing diets (52.29-93.47 kg body wt.), resp. The diets were supplemented with vitamins, minerals, antibiotics, and an antioxidant. In the growing phase daily feed intake was depressed by CM (P less than 0.01) and rice bran (P less than 0.05) but there were no effects of these ingredients on av. daily gain and feed:gain ratio. Av. daily gain (P less than 0.01), daily feed intake, and feed:gain ratio (P less than 0.05) were depressed when rice bran was added to finishing diets. In the growing-finishing phase, av. daily gain was depressed (P less than 0.05) by rice bran. Daily ration intake was lower (P less than 0.05) when CM and rice bran were added to the diets. Feed:gain ratio was not affected (P more than 0.05) by these ingredients. Up to 15 percent CM in the diet reduced loin-eye area but an increase was observed in back fat thickness when the diet contained 30 percent CM. Thus, rice bran and CM, alone or mixed, can be used up to 15 percent in diets for growing, finishing, and growing-finishing pigs. When rice bran and/or CM represented up to 30 percent in the diets, the performance, loin-eye area, and back fat thickness were affected. (AS (extract))

0079

29521 FABBRI, R.; DELLA CASA, G.; ROSI, M.A.; BERGONZINI, E. 1985. Uso della manioca nell'ingrasso del suino pesante. (Use of cassava in fattening of pigs). Annali dell'Istituto Sperimentale per la Zootecnia 18(2):139-152. It. Sum. It., En., 21 Ref.

CASSAVA; SWINE; DIETS; SUBSTITUTES; PROTEIN CONTENT; HCN CONTENT; ITALY.

A trial was carried out with 80 Landrace x Large White crossbred pigs (40 barrows and 40 gilts) to compare several diets, 3 of which contained pelleted cassava (6.54 percent crude fiber, 5.52 percent ash, and 43 ppm HCN). Diets were (a) control, (b) 30 percent cassava up to about 100 kg and control diet from 100 kg to slaughter wt., (c) 30 percent cassava for the entire period, and (d) 75 percent cassava for the entire period. The feed was weighed daily, fed wet at a 1:3 feed:water ratio, and weekly adjusted up to the residue appearance limit. At about 100 kg live wt., the protein content was modified in all diets. Initial live wt. and at slaughtering was about 46 and 152 kg, resp. Pig wt. was recorded at 28-day intervals. Sectioning of carcasses was carried out 24 h after slaughtering. No significant differences were observed among the groups in av. daily live wt. gain and in dressing percentage, percentage pluck, percentage ham, loin, lean cuts and fat cuts, longissimus dorsi area, and back fat thickness. The conversion ratio was lower in the group in which cassava was substituted for the control diet after 100 kg live wt. The use of this type of cassava does not affect fattening performance. Sex significantly influenced most of the carcass characteristics studied. (AS)

0080

29515 FABBRI, R.; DELLA CASA, G.; ROSI, M.A.; BERGONZINI, E. 1986. Uso della manioca nell'alimentazione del suino pesante. (Use of cassava in the feeding of heavy pigs). Rivista di Suinicoltura 27(5):91-95. It. Sum. It., En., 21 Ref.

CASSAVA; SWINE; FEED MIXTURES; MAIZE MEAL; ANIMAL NUTRITION; FATTENING; COMPOSITION; ITALY.

Four groups of 20 male and female Landrace x Large White pigs (mean live wt. of 46 kg) were given a liquid mixed feed based on maize, without or with cassava at 30 or 75 percent, or with 30 percent cassava up to 100 kg live wt. only. Mean daily gains were 660, 676, 659, and 644 g and feed intake 3.83, 3.72, 4.08, and 3.93 kg/kg gain, resp. Slaughter values did not differ among the different groups. (CIAT)

0081

28165 FARINU, G.O.; FETUGA, B.L. 1986. Organ growth in two breeds of pigs fed diets varying in protein and energy levels. Nutrition Reports International 34(1):109-117. En. Sum. En., 17 Ref., Il. (Biochemistry Dept., Univ. of Ilorin, Ilorin, Nigeria)

CASSAVA; DIETS; ANIMAL HEALTH; FEEDS AND FEEDING; SWINE; CASSAVA FLOUR; NUTRITIVE VALUE; DIETARY VALUE; NIGERIA.

Large White x Landrace and Nigerian indigenous pigs were given a 24 percent CP weaning diet until av. body wt. were 9.33 and 6.05 kg, resp. Three different diets were then given for 84 days: (1) a control diet consisting of maize meal (55.0 percent) and soybean oilmeal (31.2 percent); (2) a low-protein, low-energy diet consisting of maize meal (10.00 percent), soybean oilmeal (6.24 percent), cellulose (35.12 percent), and CF (42.84 percent); or (3) a low-protein, high-energy diet consisting of maize meal (10.00 percent), soybean oilmeal (6.24 percent), cellulose (8.00 percent), and CF (63.96 percent). Control pigs of both breeds gained significantly more wt. than those given diets 2 or 3. Large White x Landrace pigs on diets 2 and 3 showed gross changes in appearance of skin and hair, and Nigerian indigenous pigs had smaller body size and rougher skin and hair. The diet and breed significantly affected mean organ and gland wt. Results indicate that the Nigerian indigenous pig could be a suitable model for protein-calorie deficiency studies, especially using the kidney, spleen, liver, and pancreas as marker organs. (CIAT)

0082

26756 FIOCRE-ISSARTEL, F. 1981. Consequences economiques de la substitution du manioc aux cereales dans l'alimentation des porcins. (Economic consequences of substituting cassava for cereals in swine feeding). These Doctorat. France, Ecole Nationale Veterinaire d'Alfort. 74p. Fr. 27 Ref., Il.

CASSAVA; FEEDS AND FEEDING; SWINE; COSTS; FEED CONSTITUENTS; STATISTICAL DATA; FRANCE.

The economic effects of substituting cassava for cereals (mainly barley) in swine rations in the EEC and France (1981) are analyzed. The use of cassava as swine feed tends to increase as the EEC presently commercializes only 40 percent of the overall production of cassava (116 million t). The role of cassava in Thailand, the main exporter country of pellets and chips, and its use (15, 30, and 40 percent) in cassava-based rations for pigs are examined. The economic interest of cassava is related to the quality of the product upon its arrival in Europe. The costs of using cassava are analyzed at the pig breeders' level. They depend on 4 factors: price of cassava, prices of soybeans and barley, and the consumption index value. The main points of disagreement between cereal and feed producers are discussed: (1) the unwanted dependency of EEC on foreign products; (2) the resulting unfavorable trade balance; (3) marked distortions between pig breeders and the EEC regarding the supply and the monetary exchange rate. (CIAT)

0083

30004 GEDEO, A.S.; FINLEY, R.M. 1982. The economics of cassava and sweet potatoes in the Liberian economy. Suakoko, Liberia, Central Agricultural Research Institute. Economic and Social Analysis Office. 8p. En.

CASSAVA; ECONOMICS; HUMAN NUTRITION; ANIMAL NUTRITION; LIBERIA.

The role cassava could play in Liberia's economy, with special reference to reduced swine ration costs, is discussed. Two cassava-based rations (16 percent CP and 74.8 total digestible nutrients) containing 20 and 50 percent cassava chips are presented and their costs estimated. Also included is the standard cassava-based diet used as a control in pig feeding in Suakoko, in which cassava powder accounts for 30 percent of the diet and provides 1.2 percent CP. (CIAT)

0084

28317 GERHARD, L.F. 1986. Aproveitamento integral da mandioca na alimentacao dos suinos. (Integral utilization of cassava in swine feeding). Vera Cruz-RS, Brasil, Empresa de Assistencia Tecnica e Extensao Rural do Rio Grande do Sul. 31p. Pt. Il.

CASSAVA; CASSAVA ROOTS (VEGETABLE); SWINE; DIETS; DIETARY VALUE; ANIMAL NUTRITION; ECONOMICS; DRYING; TECHNOLOGY; BRAZIL.

The utilization by small farmers of cassava roots and aerial parts as an alternative for feeding pigs is described. A table formulating cassava-based rations (initial, growth, and finishing) was evaluated in a group of 9 Landrace piglets, weaned at 58 days. The gains of the animals in the 3 phases were 0.411, 0.814, and 0.685 kg/animal/day, resp. The costs of using (1) cassava chip flour, (2) bran made from cassava aerial parts, (3) soybean bran, (4) ground millet, and (5) a polyvitamin product were analyzed for the following rations: initial domestic, initial commercial, growing domestic, growing commercial, finishing domestic, and finishing commercial. Diagrams of the drying oven for cassava aerial parts and roots are included, with details of materials used and the cost. (CIAT)

0085

23432 GOMEZ, G.; VALDIVIESO, M.; SANTOS, J.; HOYOS, C. 1981. Evaluation of cassava root meal prepared from low- or high-cyanide containing cultivars in pig and broiler diets. Nutrition Reports International 28(4):693-704. En. Sum. En., 17 Ref. (CIAT, Apartado Aereo 6713, Cali, Colombia)

ANIMAL NUTRITION; ASH CONTENT; BITTER CASSAVA; CASSAVA MEAL; CASSAVA PRODUCTS; COLOMBIA; COMPOSITION; CULTIVARS; CYANIDES; DOMESTIC ANIMALS; DRYING; FAT CONTENT; FEED CONSTITUENTS; FEEDS AND FEEDING; FIBER CONTENT; FOOD ENERGY; GRINDING; POULTRY; PROCESSED PRODUCTS; PROCESSING; PROTEIN CONTENT; SOLAR DRYING; SOUTH AMERICA; SWEET CASSAVA; SWINE; USES; WATER CONTENT.

Cassava roots from low- (CMC-40 and Llanera) or high-cyanide (MCol 1684) cv. were chipped and sun dried on a concrete floor, and after grinding the meal was evaluated in diets for growing-finishing pigs, lactating sows, and baby pigs as well as for broilers. Cyanide content of sun-dried chips was below 100 mg/kg, which is the max. permissible level for animal feeding. Results of feeding trials with pigs and broilers indicated that CM of both the low- and high-cyanide containing cv. was satisfactorily used by these species and animal performance was similar to those fed sorghum-based diets. Roots of so-called bitter cassava cv. such as MCol 1684 are, therefore, suitable for animal feeding, if properly processed and sun dried on a concrete floor. (AS)

0086

22985 GOMEZ, G.; SANTOS, J.; VALDIVIESO, M. 1981. Evaluation of methionine supplementation to diets containing cassava meal for swine. Journal of Animal Science 58(4):812-820. En. Sum. En., 17 Ref. (Centro Agronomico Tropical de Investigacion y Ensenanza, Apartado 7170, Turrialba, Costa Rica)

AMINO ACIDS; ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; CEREALS; COLOMBIA; COMPOSITION; COSTS; COTTONSEED MEAL; DOMESTIC ANIMALS; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING; FLOURS; METHIONINE; PROCESSED PRODUCTS; PROTEIN CONTENT; SORGHUM; SOUTH AMERICA; STARCH CROPS; SWINE; USES.

The effect of met. supplementation to diets containing high levels of CM (approx. 65 percent) was studied with gestating and lactating gilts as well as with growing-finishing pigs. In both expt., met. supplementation did not improve (P greater than 0.05) the re-

sults obtained with the unsupplemented diets. Handling of the feed during the gestation period could explain the differences found in relation to data previously reported; group feeding appeared to be responsible for the poorer reproductive performance previously obtained with CM-based diets. Diets for growing-finishing pigs based on CM and SBM produced results similar to those of the control diet (yellow maize + SBM), irrespective of met. supplementation. Further studies using least-cost diets formulated to include 30 percent CM for gestating and lactating gilts, 40 percent CM for baby pigs, and 20 and 30 percent CM for growing-finishing pigs produced normal performance and required balancing, when necessary, with less than 0.06 percent met. The CM price used was equivalent to 80 percent of the current sorghum price. Combinations of CM with SBM or with SBM-cottonseed meal-fish meal resulted in well-balanced least-cost diets. (AS)

0087

22036 GOMEZ, G.; VALDIVIESO, M. 1983. Cassava meal for baby pig feeding. Nutrition Reports International 28(3):547-558. En. Sum. En., 16 Ref. (CIAT, Apartado Aereo 6713, Cali, Colombia)

CASSAVA; FEEDS AND FEEDING; PIGLETS; FEED CONSTITUENTS; SWINE; CASSAVA MEAL; DRY MATTER; FEED MIXTURES; SORGHUM; HCN; COSTS; COLOMBIA.

Two palatability tests with baby pigs fed diets containing different levels of CM: 0, 14, and 28 percent (expt. 1) and 0, 20, and 40 percent (expt. 2). Throughout the lactation and postweaning (42-56 days) periods were performed using a free choice method. A comparison of cassava- and sorghum-based diets for baby pigs and lactating sows by the single-feed method was also evaluated. There was a definite baby pig preference for diets containing the highest proportions of CM throughout the entire exptl. period. Both expt. showed a consistent improvement of dietary CP in vitro digestibility associated with the increasing levels of inclusion of CM in the diets. However, there was no significant difference between the cassava- and sorghum-based diets when they were compared by the single-feed method. The exptl. results clearly indicate that CM is an excellent carbohydrate source for pig feeding in improving the palatability and the digestibility, notably of CP, of baby pig diets. Baby pig diets containing 40 percent CM performed similar to those based on sorghum. (AS)

0088

30005 KAYKAY, J.M. 1985. Basic knowledge of how to formulate feed for pigs and poultry from locally available feed ingredients. Suakoko, Liberia, Central Agricultural Research Institute. Division of Animal Nutrition. 5p. En.

CASSAVA; SWINE; POULTRY; FEEDS AND FEEDING; ANIMAL NUTRITION; DIETS; CASSAVA MEAL; LIBERIA.

Examples are given of a series of energy and protein feed sources found in Liberia that can be used in diets for feeding swine and poultry. Percentage composition of 5 diets for different animal categories (young pigs, weaned piglets, adult pigs, broiler chicks, laying hens) is provided. Ground cassava roots maize can be used at a 40 percent rate in diets for young pigs (7.5-37.3 kg); cassava powder at 12.5 percent in diets for weaned piglets; powdered cassava roots at 40-50 percent in diets for adult pigs (after 29.9 kg); and CM up to 20 percent for broiler chicks. (CIAT)

0089

35255 KITPANIT, N. 1984. A preliminary study of substituting cassava root meal for cereals and their by-products in swine ration. Experiment 2. Memoirs of the Tokyo University of Agriculture 26:11-18. En. Sum. En., Il.

CASSAVA; ANIMAL NUTRITION; SWINE; DIETS; CASSAVA MEAL; ANIMAL PHYSIOLOGY; THAILAND.

Ninety pigs were used in a randomized complete block expt. with 5 dietary treatments and 6 replications, to evaluate the substitutional value of cassava for cereals. Three pigs in each pen were fed diets containing an av. cassava level of 0, 17, 33, 49, and 65 percent during growth from 25 to 95 kg body wt. The cost of production increased with the increasing cassava level in the diets, whereas the rate of wt. gain and efficiency of feed utilization progressively decreased. Daily feed consumption was reduced in the higher cassava-based diets. The inferiority of cassava diets when compared with cereal-based control diets could be possibly caused by the physical form, met. deficiency, energy level, and quality of Thai cassava. Cassava can be used in pig rations to a max. level of 33 percent of the diets. The use of a higher level of cassava in the pig diet is possible if the diet is supplemented with 0.2 percent met. and fed in pelletized or wet form. (AS)

0090

35254 KITPANIT, N. 1984. Determination of chemical composition of various Thai cassava root products. Experiment 1. Memoirs of the Tokyo University of Agriculture 26:8-11. En. Sum. En., Il.

CASSAVA; ANIMAL NUTRITION; SWINE; PELLETS; CASSAVA CHIPS; COMPOSITION; THAILAND.

A total of 1037 samples of Thai cassava root products were analyzed for basic chemical composition. Although all products contained small quantities of CP, EE, Ca, and P, N-free extract was relatively high. Specially prepared cassava root chips had lower moisture, crude fiber, and ash contents than other cassava products but HCN content was high. Cassava pellets had higher ash and insoluble ash contents than other cassava root products. (AS)

0091

35256 KITPANIT, N. 1984. Effect of crude fibre on the digestibility of cassava based diets for pigs. Experiment 7. Memoirs of the Tokyo University of Agriculture 26:42-50. En. Sum. En.

CASSAVA; ANIMAL NUTRITION; SWINE; DIETS; WASTES; FIBER CONTENT; DIGESTIBILITY; ANIMAL PHYSIOLOGY; THAILAND.

The digestibility of cassava-based diets with 3.5, 4.0, 5.0, and 6.0 percent crude fiber was evaluated in a 4 x 4 Latin square expt. One pig was placed per exptl. unit, with an initial wt. of approx. 32 kg. Although the differences in digestible energy, rate of wt. gain, feed/gain, and true digestibility of protein were not statistically significant, digestibility tended to decrease with increasing crude fiber in the diets. Results indicate that a level of up to 6 percent crude fiber can be allowed in cassava-based diets without significantly affecting the energy digestibility and growth performance of pigs. (AS)

0092

35253 KITPANIT, N. 1984. The utilization of Thai cassava root products in swine ration. Memoirs of the Tokyo University of Agriculture 26:1-58. En. 101 Ref., Il.

CASSAVA; ANIMAL NUTRITION; SWINE; DIETS; PELLETS; CASSAVA CHIPS; CASSAVA MEAL; COMPOSITION; DIGESTIBILITY; ANIMAL PHYSIOLOGY; THAILAND.

Results are given of several expt. carried out in Thailand to determine (1) the chemical composition (MC, EE, CP, crude fiber, GE, N-free extract, ash, and HCN) of several cassava products; (2) the max. level of cassava products in pig diets; (3) the substitutional value for rice by-products in semi-commercial pig rations; and (4) the metabolism of energy in cassava-based diets with various levels of crude fiber. Efforts were also directed towards formulating simple and economic cassava-based diets. Expt. indicated that

cassava is an excellent source of energy for pigs; however, its low protein content and its excessive crude fiber are drawbacks to its efficient utilization. Among cassava products, pellets have a high crude fiber content while cassava chips a relatively low one. A high level of cassava in mash diets reduces feed intake. Pelletization of high cassava diets (50-70 percent) is recommended. Animal performance was best with pellets. A mixture of cassava-SBM (83/17 percent, resp.) can substitute conventional feeds; the price of this mixture is also significantly lower. The energy digestibility of cassava-based diets tended to decrease with increasing levels of crude fiber. In general, carcass characteristics of cassava-fed pigs are similar to those of pigs fed conventional feed. No evidence of HCN toxicity was found. (CIAT)

0093

22303 LE MEUR, D. 1982. Le manioc: une vacherie... qu'il faut utiliser. (Usefulness of cassava in swine nutrition). A la Pointe de l'Elevage no.133:21-24. Fr. Il.

AMINO ACIDS; ANIMAL NUTRITION; CASSAVA PRODUCTS; COMPOSITION; CYSTINE; DISTRIBUTION; DOMESTIC ANIMALS; ECONOMICS; EUROPE; FEED CONSTITUENTS; FEEDS AND FEEDING; FRANCE; LYSINE; METHIONINE; PRICES; PROTEIN CONTENT; STORAGE; SWINE; USES.

Background information on the use of cassava in swine nutrition in France during 1978-82 is reviewed. Its usefulness is highlighted, proved experimentally by institutions dedicated to research on fattening pigs such as the Institut National de Recherches Agronomiques, the Institut Technique des Cereales et des Fourrages, and the Institut Technique du Porc. Tables are included on the composition of different forms of cassava, composition of feed rations, and animal performance. Based on the forage value (1 forage unit/gross kg of common cassava), several examples of feed formulas with maize, wheat, and oats are given, considering the limiting factors lysine, met., and cystine. For incorporating 20 percent cassava into the ration, it is not necessary to add met.; for 40 percent cassava, it is recommended to add only 0.05 percent met. The limitations to using cassava are discussed as well as its price in relation to that of the other components of the swine ration and the solutions given by pig breeders to the difficulties that the maintenance of cassava presents during reception, storage, recovery, pulverization, and distribution. (CIAT)

0094

27636 LOUGNON, J. 1982. Utilization of cassava as a source of energy in pig feeding. In Jainudeen, M.R.; Omar, A.R., eds. Asian Australasian Animal Science Congress, 1., Serdang, Selangor, Malaysia 1980. Animal Production and Health in the Tropics: Proceedings. Selangor, Malaysia, Universiti Pertanian Malaysia Press. pp.293-299. En. Sum. En., 30 Ref.

CASSAVA; FEEDS AND FEEDING; SWINE; SUBSTITUTES; ANIMAL NUTRITION; DIETARY VALUE; DIETS; MALAYSIA.

A literature review of work carried out during 1967-77 on cassava substitution for cereals in pig feeding is presented; data are also given on dried cassava root composition, energy value of cassava for pigs, and digestibility of cassava diets for growing and early weaned piglets. An expt. compared 5 diets to study the influence of a DL-met. supplementation in a 50 percent cassava diet, deficient in essential S-containing amino acids. Piglets weighing 20.7 kg and 72 days old were used to calculate feed consumption every 7 days until slaughter wt. (97 kg body wt.). No significant difference was found in feed conversion between castrated males and females. The addition of met. at levels of 0.08 and 0.16 percent significantly improved performance. Although cassava can entirely replace cereals, tallow has to be added and the level of soybean and wheat bran increased. Cassava offers potential as a feed constituent for fattening pigs. (CIAT)

0095

24557 MAKHAMBERA, P.E.; KANYENDA, E.E. 1981. Reproductive performance of sows/gilts fed cassava. LUSO: Journal of Science and Technology 4(1):47-51. En. 2 Ref. (Dept. of Livestock Production, Bunda College of Agriculture, Univ. of Malawi, P.O. Box 219, Lilongwe, Malawi)

AFRICA; ANIMAL NUTRITION; COMPOSITION; CORTEX; FEED CONSTITUENTS; FEEDS AND FEEDING; MALAWI; METABOLISM; PLANT ANATOMY; ROOTS; SWINE; USES.

Eighteen Landrace x Large White crossbred sows/gilts were randomly fed with either a maize-based ration (G1), a peeled, dried cassava-based ration (G2), or an unpeeled, dried cassava ration (G3). The gestation periods and the feed consumed during the gestation period did not differ significantly, although the pigs fed with G3 tended to have a slightly shorter gestation period and their feed consumption rate was the lowest. There was no significant difference among the treatments for piglets born alive; however, with G1 there was a significantly higher no. of piglets born dead. (CIAT)

0096

21478 MULLER, H.L.; KIRCHGESSNER, M. 1983. Energetische verwertung von cellulose beim schwein. (Utilization of cellulose as energy source in pigs). Zeitschrift fuer Tierphysiologie, Tierernahrung und Futtermittelkunde 49(3):127-133. De. (Institut fur Ernahrungsphysiologie der Technischen, Univ. Munchen, D-8050 Freising-Weihenstephan, Germany)

ANIMAL NUTRITION; CELLULOSE; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; METABOLISM; NITROGEN; SWINE.

A respiration trial with 10 adult sows was conducted as a cross-over design to study the effect of pure cellulose on energy metabolism. The basal ration contained barley, wheat, cassava, SBM, and fish meal. The cellulose ration consisted of 70 percent basal ration and 30 percent cellulose. The level of energy intake was slightly above the maintenance requirement. The partial digestibility of the energy of cellulose amounted to 30 percent. Methane production was 10 percent of the digested cellulose. This higher methane loss was compensated for by a lower loss of urinary energy, so that the ratio ME/digestible energy was not markedly affected by the treatment. The apparent digestibility of N decreased by the addition of cellulose to the basal diet by 13 percent units. The partial efficiency of utilization of cellulose ME amounted to 68 percent. Consequences of the results for energetic feed evaluation are discussed. (AS (extract))

0097

25783 NICOLAIEWSKY, S.; DAGOSTIN, J.; CAETANO, L.A.P. 1984. Substituicao parcial ou total do milho por farinha de mandioca em racoes para suinos em crescimento e terminacao. (Partial or total substitution of maize by cassava meal in rations for growing and finishing pigs). Porto Alegre-RS, Brasil, Universidade Federal do Rio Grande do Sul. 11p. Pt. Sum. Pt., En., 15 Ref.. (Univ. Federal do Rio Grande do Sul, Depto. de Zootecnia, Caixa Postal 776, 90.000 Porto Alegre-RS, Brasil)

ANIMAL NUTRITION; BRAZIL; CASSAVA; CASSAVA MEAL; FEEDS AND FEEDING; MAIZE; METABOLISM; SWINE.

To evaluate the effect of 50 or 100 percent substitution of CM for maize in growing and finishing pig rations, 2 expt. were conducted, each using 48 castrated Large White x Landrace males. In the 1st expt. the animals received the exptl. rations from 54.0 to 98.0 kg (slaughter wt.) and in the 2nd, from 23.7 to 97.0 kg. The animals were killed 24 h after reaching the slaughter wt. The hot carcass was evaluated by the Brazilian method of carcass classification, described by Associacao Brasileira de Criadores de Suinos (1973). A completely randomized design was used with 3 treatments, 4 replications/treatment,

and 4 animals/replication. The substitution of 50 or 100 percent CM for maize improved the av. daily gain and did not affect feed efficiency and carcass characteristics. Although the 50 percent substitution did not affect av. daily gain, feed efficiency, or carcass characteristics in the 2nd expt., the 100 percent substitution affected feed efficiency. (AS)

0098

23450 OKE, O.L. 1981. The use of cassava as pig feed. Nutrition Abstracts and Reviews (Series B) 54(7):301-314. En. Sum. En., 54 Ref.

AMINO ACIDS; ANIMAL NUTRITION; CASSAVA CHIPS; CASSAVA LEAVES (VEGETABLE); CASSAVA MEAL; CASSAVA PRODUCTS; CEREALS; CIAT-2; COMPOSITION; CYSTINE; DRIED ROOTS; FEED CONSTITUENTS; FEEDS AND FEEDING; LYSINE; MAIZE; METHIONINE; PELLETS; PROCESSED PRODUCTS; PROTEIN CONTENT; PROTEIN ENRICHMENT; STARCH CROPS; SWINE; USES.

Amino acid imbalance, especially with respect to lysine and S-containing amino acids (SAA), is one of the numerous problems involved in substituting cassava for maize in pig rations. Imbalance with respect to SAA leads to lower efficiency of feed conversion, and this increases as the amount of cassava in the diet increases, as more SAA will be needed for detoxification. As a 1st step towards solving some of these problems it is suggested that workers in this field should record the cyanide content of the cassava used, the theoretical content of lysine and SAA in the ration formulation, whether palm oil (or any other oil) is used, and in what form the cassava is fed. Some of the results reported in this review suggest that certain min. amounts of lysine and SAA are needed for high efficiency. If properly supplemented with a good source of protein and with vitamins and minerals, cassava can be used as the only source of energy for pigs. (AS (extract))

0099

25265 PAPADOPOULOS, G.; ZIRAS, E.; KALAISSAKIS, P. 1981. (Replacement of cereals by tapioca in rations of fattening pigs). Bulletin of the Hellenic Veterinary Medical Society 34(1):22-31. Gr. Sum. En., 10 Ref.

ANIMAL NUTRITION; ASIA; CIAT-2; DOMESTIC ANIMALS; FATTENING; FEEDS AND FEEDING; STORAGE; SWINE.

Forty-four Large White x Landrace hybrid pigs (av. initial wt. 22 kg) were divided into 7 groups and fed ad libitum with rations consisting of maize, barley, cassava, SBM, fish meal, and wheat bran. During the prefattening period the rations contained 13.1-13.4 MJ digestible energy/kg, 16.2-16.5 percent CP, and 0, 20, and 40 percent cassava. In the final fattening period, however, the rations contained 12.8-13.6 MJ digestible energy/kg, 13.0-13.6 percent CP, and 0, 20, 40, and 60 percent cassava. Partial replacement of cereals by cassava reduced the linoleic acid content of the rations, which was added to 1.00 percent, except for 1 group where the linoleic acid content of the ration was 0.45 percent. Results suggest that cassava given to fattening pigs up to 40 and 60 percent during the prefattening and final fattening periods, resp., did not significantly affect the av. daily live wt. gain nor improved the feed conversion coefficient for P less than 0.05. Carcass characteristics were not affected and during the replacement of cereals by cassava to the above proportions, the addition of linoleic acid to the ration was not necessary. For the use of cassava to be economical under current Greek conditions, its price should be less than 80 percent that of cereals. (AS)

0100

32423 PARAKSA, S.; SAEOW, N. 1987. (Use of cassava enriched with protein (Aspergillus sp. and yeast) in the growing-fattening pig diets). Kasetsart Journal Natural Sciences 21(1):25-32. Thai. Sum. En., Thai., 13 Ref.

CASSAVA; CASSAVA MEAL; PROTEIN ENRICHMENT; ASPERGILLUS; DIETS; SWINE; FEEDS AND FEEDING; ANIMAL PHYSIOLOGY; CASSAVA CHIPS; COMPOSITION; THAILAND.

The use of CM enriched with protein (Aspergillus and yeast) in diets for growing-finishing pigs was studied in a randomized complete block expt. using 24 Landrace pigs (12 males and 12 females) with an av. body wt. of 25 kg. Pigs were fed 0, 20, 40, and 60 percent protein-enriched cassava in growing and finishing diets containing 16 and 14 percent protein, resp. Each treatment was replicated 6 times. The use of 40 percent protein-enriched CM did not affect the av. daily wt. gain and feed conversion ratio in growing pigs. Protein-enriched CM can be used to replace broken rice in the finishing pig diet. Back fat thickness of pigs fed protein-enriched CM decreased, although not significantly, with increasing levels of protein-enriched CM in the diet. Protein-enriched CM can therefore be used to replace broken rice in rations for fattening pigs without detrimental effects. (AS)

0101

29036 PARTRIDGE, I.G. 1985. The digestion of diets containing manioc by young growing pigs. Animal Feed Science and Technology 12(2):119-123. En. Sum. En., 9 Ref. (National Inst. Research in Dairying, Shinfield, Reading, RG2 9AT, England)

CASSAVA; DIETS; CASSAVA MEAL; ANIMAL NUTRITION; SWINE; FEED AND FEEDING; DIGESTIBILITY; UNITED KINGDOM.

Six pigs were fitted with a simple cannula in the terminal ileum. From 20 kg live wt., they were given cereal diets containing 0, 150, or 300 g cassava/kg in a changeover expt., with 10-day periods. Ileal digesta and feces were collected on the 8th and 10th day of each period, and digestibility coefficients were calculated by the Cr2O3 ratio method. There were no significant differences in the ileac or overall digestibility of DM, energy, starch, or CP between the diets containing 0 and 150 g cassava/kg. The diet containing 300 g cassava/kg had lower ileac digestibility but higher overall digestibility than the other 2 diets. For the high cassava diet, the apparent absorption of energy from the large intestine represented 10.7 percent of the total absorption, compared with 3.2 percent for the diet without cassava. This may partly explain the poorer performance which has sometimes been observed with cassava diets formulated on the basis of digestible energy. (AS)

0102

22070 PEDRANA, C. 1971. Processing of root crop products, especially taro and cassava, in Western Samoa. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.258-265. En. Sum. En., 1 Ref.

CASSAVA CHIPS; CASSAVA FLOUR; CASSAVA PRODUCTS; COCOYAMS; DOMESTIC ANIMALS; DRIED ROOTS; FEEDS AND FEEDING; GRINDING; OCEANIA; PROCESSED PRODUCTS; PROCESSING; STARCH CROPS; SWINE.

The processing of taro in Western Samoa, where it is a major crop, is presented and several by-products are discussed. Pig feeding trials with cassava chips (45 percent in the ration) indicated that chips steeped overnight in potassium metasulphite solution, then drained and dried, were superior to those that were straight chipped, dried, and with met. added. (CIAT)

0103

24043 PERALTA D., S.V. 1981. Utilizacion de tres niveles de harina de yuca en raciones de cerdos, durante la etapa de ceba. (Utilization of three levels of cassava flour in swine rations, during the fattening period). Tesis Ing.Agr. Panama, Universidad de Panama. 53p. Es. Sum. Es., 22 Ref., Il.

ANIMAL NUTRITION; CASSAVA FLOUR; CASSAVA PRODUCTS; CENTRAL AMERICA; COMPOSITION; DOMESTIC ANIMALS; ECONOMICS; FATTENING; FEED CONSTITUENTS; FEEDS AND FEEDING; METABOLISM; PANAMA; PROCESSED PRODUCTS; STATISTICAL ANALYSIS; SWINE; USES.

Different types of CF-based rations were evaluated to substitute maize in diets for pigs during the fattening period. Forty-eight pigs were divided into groups of 12 and supplied the following diets twice a day: group 1, 36.33 percent maize and no CF; group 2, 17.26 percent maize and 20.00 percent CF; group 3, 8.25 percent maize and 36.33 percent CF; and group 4, no maize and 60.00 percent CF. During the fattening period, the pigs remained 90 days in confinement. Best results were obtained with animals receiving the highest levels of CF. Utilization of levels of 36.33 and 60.00 percent CF in rations notoriously affected wt. gain of pigs and av. net gain/pig. (AS (extract)-CIAT)

0104

22039 RAVINDRAN, V.; KORNEGAY, E.T.; CHERRY, J.A. 1981. Feeding values of cassava tuber and leaf meals. Nutrition Reports International 28(1):189-196. En. Sum. En., 22 Ref. (Virginia Polytechnic Inst. & State Univ., Blacksburg, VA 24061, USA)

ALFALFA; ANIMAL NUTRITION; CASSAVA LEAVES (VEGETABLE); CASSAVA MEAL; CASSAVA PRODUCTS; CEREALS; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; MAIZE; METABOLISM; OATS; POULTRY; PROCESSED PRODUCTS; STARCH CROPS; SWINE; USES.

Two trials were conducted to evaluate the feeding values of cassava root and leaf meals. In trial 1, 40 starter pigs weighing 7.3 kg were randomly assigned to one of the following 5 dietary treatments in 4 replicates: (1) maize-soybean basal (B); (2) B + 10 percent CM; (3) B + 20 percent CM; (4) B + 10 percent oats; and (5) B + 20 percent oats. Inclusion of CM or ground oats had no significant effect on daily gain, daily feed intake, or feed/gain of the starter pigs. In trial 2, the feeding value of CLM was compared with that of dehydrated alfalfa meal (ALM) using 288 two-week-old Japanese quails. A maize-soybean diet served as the control and the leaf meals were incorporated at the levels of 2.5, 5.0, 7.5, and 10.0 percent. All diets were isonitrogenous and isocaloric. Body wt. gains were not significantly different between birds fed the control and diets containing leaf meals. However, there was a trend for birds fed diets containing 2.5 percent CLM or ALM to gain faster and more efficiently than the controls. Feed intake and feed/gain were linearly (P less than 0.05) increased as the leaf meals were incorporated above 5 percent level. The performance of birds fed CLM and ALM diets was similar. (AS)

0105

22984 RAVINDRAN, V.; KORNEGAY, E.T.; RAJAGURU, A.S.B. 1981. Utilization of the whole cassava plant as a swine feed. World Review of Animal Production 19(1):7-14. En. 65 Ref. (Dept. of Animal Science, Virginia Polytechnic Inst. & State Univ., Blacksburg, VA 24061, USA)

AMINO ACIDS; ANIMAL NUTRITION; CARBOHYDRATE CONTENT; CASSAVA LEAF MEAL; CASSAVA MEAL; CASSAVA PRODUCTS; CIAT-2; COMPOSITION; CYANOGENIC GLUCOSIDES; DOMESTIC ANIMALS; FAT CONTENT; MINERAL CONTENT; NUTRITIVE VALUE; PROCESSED PRODUCTS; PROTEIN CONTENT; SWINE; VITAMIN CONTENT.

The literature available on the nutritional values of both cassava root and leaf meals in swine diets is reviewed. Carbohydrate, protein (amino acid profile), lipid, mineral, vitamin, and cyanogenic glucoside contents of each one of the meals are discussed. The review shows that if cassava root meal is properly processed and supplemented, it can be incorporated into swine diets at levels up to 40-70 percent. CLM can be included up to 30 percent without affecting swine performance. (CIAT)

0106

30807 TAYLOR, J.A.; PARTRIDGE, I.G. 1987. A note on the performance of growing pigs given diets containing manioc. Animal Production 44(3):457-459. En. 8 Ref. (AFRC Inst. for Grassland & Animal Production, Church Lane, Shinfield, Reading RG2 9AQ, England)

CASSAVA; PELLETS; SWINE; FATTENING; FEEDS AND FEEDING; ANIMAL NUTRITION; UNITED KINGDOM.

The results are presented of an expt. with 4 isonitrogenous and isoenergetic diets (0, 150, 300, and 450 g cassava/kg), fed to 80 pigs in 20 replicates. In a separate trial, 8 groups of 8 pigs (2 groups for each one of the 4 diets) were fed dry pelleted diets ad libitum. There was no evidence of digestive disorders or other health problems in any of the exptl. animals. For the pigs fed ad libitum, there was an apparent decrease in both av. daily food and av. daily gain at the level of 450 g cassava/kg (without statistical analysis). The only significant differences in carcass measurements between treatments in the restricted feeding trial were those of dressing proportion, although there was no trend with increasing levels of cassava. There appeared to be no loss in performance or carcass quality with cassava levels up to 300 g/kg in the diet. With greater amounts, food intakes may be reduced in ad libitum feeding, with a resulting loss in performance. (CIAT)

0107

26824 THOMAS, K.; SINGH, R.A. 1984. Feeding pigs in tropics: 1. Effect of plane of feeding and feed particle size on growth. Kerala Journal of Veterinary Science 15(2):51-60. En. Sum. En., Arm., 16 Ref. (Dept. of Animal Management, College of Veterinary & Animal Sciences, Mannuthy, Kerala, India)

CASSAVA; FEEDS AND FEEDING; SWINE; FEED CONSTITUENTS; COMPOSITION; FEED MIXTURES; COSTS; ANIMAL HEALTH; FATTENING; INDIA.

For 170 days 36 Large White pigs, initially weighing 11.2 kg and 70 days old, were given diets with 100, 90, or 85 percent of the recommended amounts of digestible energy, and with particle size of feed 2-3 mm or less than 1 mm in diameter. Feed was based on dried cassava chips, groundnut oilmeal, and maize, and was given freely for 2 1-h periods daily. Different particle size of feed did not affect wt. gain or nutrient digestibility. There was a significant reduction in daily wt. gain and in digestibilities of DM, OM, ether extract, crude carbohydrates, and CP with decreasing amounts of dietary digestible energy. (Kerala Journal of Veterinary Science)

0108

26823 THOMAS, K.; SINGH, R.A. 1984. Feeding pigs in tropics: 2. Effect of plane of feeding and carcass characteristics. Kerala Journal of Veterinary Science 15(2):61-68. En. Sum. En., Arm., 23 Ref. (Dept. of Animal Management, College of Veterinary & Animal Sciences, Mannuthy, Kerala, India)

CASSAVA; SWINE; FEEDS AND FEEDING; DIETS; PRODUCTION; ANIMAL HEALTH; INDIA.

For 170 days 36 Large White pigs (initially weighing 11.2 kg at 70 days old) were given diets based on dried cassava chips, groundnut oilmeal, and maize to provide 100, 90, or 85 percent of the recommended amount of digestible energy with particle size of feed 2-3 mm or less than 1 mm in diameter. Particle size of feed had no significant effect on pig performance. Dressing percentage, carcass length, eye muscle area, and backfat thickness decreased with decreasing amounts of dietary digestible energy. (Kerala Journal of Veterinary Science)

0109

27640 WALDROUP, P.W.; RITCHIE, S.J.; REESE, G.L.; RAMSEY, B.E. 1984. The use of blends of cassava flour and extruded full-fat soybeans in diets for broiler chickens. Archivos Latinoamericanos de Nutricion 34(3):550-563. En. Sum. En., Es., 27 Ref. (Univ. of Arkansas, Division of Agriculture, 104 Animal Sciences Building, Fayetteville, AR 72701, USA)

CASSAVA; CASSAVA MEAL; FEED AND FEEDING; ANIMAL NUTRITION; DIETS; POULTRY; PROTEIN CONTENT; SUBSTITUTES; USA.

The effects of blending different levels of a low-HCN acid CM with extruded full-fat soybeans in diets for growing broiler chickens were studied. The full-fat soybeans contributed oil which increased the energy content of the diet, aided in overcoming the powdery nature of cassava, and provided high-quality protein. CM replaced 1/3, 2/3, and all the maize in diets with 0, 12.5, and 25.0 percent extruded full-fat soybeans. Diets were fed in pelleted form to broiler chickens for a 47-day feeding trial. Replacement of 1/3 of the maize with cassava had no adverse effects on body wt. gains, with a reduction in wt. at higher levels at the end of the study. Feed utilization was reduced more severely than was anticipated; however, growth rate on the higher levels of cassava was reasonably good, indicating that producers might feed these diets for a slightly longer period of time and produce chickens more economically if CM were available at a cost significantly lower than that of maize. (AS)

0110

27603 WALKER, N. 1985. Cassava and tallow in diets for growing pigs. Animal Production 40(2):345-350. En. Sum. En., 21 Ref. (Agricultural Research Inst. of Northern Ireland, Hillsborough, Co. Down BT26 6DP, Northern Ireland)

CASSAVA; DIETS; SWINE; FIELD EXPERIMENTS; FEED AND FEEDING; DIETARY VALUE; SUBSTITUTES; NORTHERN IRELAND.

In 2 expt. 480 and 360 pigs were housed in groups of 10 and given diets containing different proportions of cassava from 35 to 87 kg live wt. The cassava contained 672, 34, 57, and 39 g starch, crude fiber, total ash, and insoluble ash/kg DM, resp. The diets in the 1st expt. contained 0, 238, 475, or 713 kg cassava/t. In the 2nd expt. the different levels of dietary cassava (0, 150, 300, or 450 kg/t) were combined in a factorial design with different levels of tallow (0, 50, or 100 kg/t). The pigs were given quantities of food calculated to give isoenergy intakes on the assumption that air-dry cassava contained 14.2 MJ digestible energy/kg. The feeding scale increased with time to give a max. daily allowance of digestible energy of 31.8 MJ/pig. Relative to each MJ of digestible energy, the calculated levels of lysine and of met. plus cystine in the diets were 0.64 and 0.39 g, resp. In both expt., increasing levels of cassava resulted in significant reductions in growth rate but had no effect on the conversion of food to live wt. or on carcass wt. In both expt., the diets with the highest inclusions of cassava produced pigs with the thickest back fat. The effect was not significant in the 2nd expt., but in the 1st expt. the differences were significant between diets with the highest and intermediate levels of cassava. There was a significant interaction between cassava and tallow on growth rate, with the depression due to high levels of cassava being reduced when 100 kg tallow/t was included in the diet. The results of these growth expt. suggested that this type of cassava was of similar value to barley on an energy basis when used in diets based on barley and soybean meals. (AS)

0111

27654 WU, J.F.; HUANG, M.D.; CHEN, S.Y. 1985. Effect of dietary sweet potato chips, cassava chips and cassava pomace on nutritional value for growing pigs. Journal of the Agricultural Association of China 131:49-55. Ch. Sum. Ch., En., 14 Ref.

CASSAVA; CASSAVA PRODUCTS; DIGESTIBILITY; DIETS; NUTRITIVE VALUE; CHINA.

Nine crossbred gilts averaging 35 kg were used to determine apparent digestibilities, energy and N metabolism of diets containing (1) sweet potato chips, (2) cassava chips, and (3) cassava pomace. Apparent DM and energy digestibilities of diets 1 and 2 were significantly higher than those of diet 3. Apparent N digestibility of diet 2 was significantly higher than those of diets 1 and 3, but differences were not significant between diets 1 and 3. Apparent cell wall, acid detergent fiber, and hemicellulose digestibilities of diet 3 were significantly lower than those of diets 1 and 2 due to its high content of acid detergent fiber. Digestible energy and ME for diet 3 were significantly lower than for diets 1 and 2. The excretion of fecal N for diet 3 was significantly higher than for diet 2, but urinary N excreted for diet 3 was lower than for diet 2. N retention showed no significant difference between dietary treatments. Based on these results, nutritive values of diet 3 were slightly lower than those of diets 2 or 1. Although cassava pomace contained higher percentage of cell wall, most of it could be utilized by growing pigs. (AS)

0112

35373 YARURO, M.L.; FIGUEROA, F.; LOPEZ G., A.; BUITRAGO, J. 1988. Utilizacion de harina de yuca y soya integral cocida en dietas con dos formas de presentacion para lechones de prelevante. (Use of cassava meal and cooked whole soybean in diets, presented in two forms, for postweaning pigs). Acta Agronomica 38(2):87-95. Es. Sum. Es., En., 9 Ref.

CASSAVA; PIGLETS; CASSAVA MEAL; DIETS; SUBSTITUTES; ANIMAL PHYSIOLOGY; COLOMBIA.

In postweaning pigs (35 days, 20 kg) the replacement of 50 and 100 percent maize with CM, using SBM and cooked whole soybean in the form of meal or pelleted, was evaluated. The trial had a factorial arrangement 2 x 2 x 2 + 1, with 5 replications. Each exptl. unit or litter consisted of at least 6 piglets, pure or crossbred (Yorkshire, Duroc, Landrace). There were no differences (P less than 0.05) in feed consumption, wt. gain, feed conversion, and days to reach 20 kg live wt. due to the replacement of maize with CM. There were differences (P less than 0.05) in wt. gain due to the protein source used; best results were obtained in animals fed SBM + oil compared with those fed the cooked grain. Also, there were differences (P less than 0.01) in feed consumption due to type of diet (meal or pelleted). Animals eating meal diets had a higher feed consumption and wt. gain; feed efficiency, however, was better in pelleted diets. Economically, the best alternative was the diet containing 100 percent CM + SBM as protein source. (AS)

See also 0005 0007 0008 0009 0013 0043 0049 0054 0230 0236

RUMINANTS

0113

25244 BALDIZAN, A.; DIXON, R.; PARRA, O. DE; PARRA, R. 1981. Efecto de la adicion de harina de yuca a una dieta de heno (Cenchrus ciliaris) sobre la digestibilidad de la materia seca y pared celular en ovejas y chiguires. (Effect of addition of cassava meal to a diet of Cenchrus ciliaris hay on dry matter and cell wall digestibility in sheep and capybaras). In Instituto de Produccion Animal. Venezuela. Informe Anual 1982. Maracay, Universidad Central de Venezuela. pp.27-28. Es. (Inst. de Produccion Animal, Univ. Central de Venezuela, Maracay, Venezuela)

ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; PROCESSED PRODUCTS; SHEEP; SOUTH AMERICA; VENEZUELA.

Three sheep and 3 capybaras were fed Cenchrus ciliaris hay with the addition of 1 percent minerals, 15 percent CM + 1 percent minerals or 30 percent CM + 1 percent minerals. In sheep, addition of CM increased DM digestibility from 48.7 to 52.4 percent but re-

duced cell wall digestibility from 53.6 to 46.0 percent; in capybaras, cell wall digestibility did not increase (50.7 and 52.0 percent) but DM digestibility increased from 44.6 to 56.6 percent. (Nutrition Abstracts and Reviews)

0114

30561 BASYA, S.; NURAINI, M. 1979. Penggunaan bungkil kacang tanah dengan dedak padi, jagun atau lepung gaplek dalam susunan makanan penguat sapi perah muda. (Utilization of peanut waste cake, rice bran, corn, and cassava flour in ration formulas of young dairy cattle). Lembaran Lembaga Penelitian Peternakan Bogor 9(1):9-14. In. Sum. In., 15 Ref.

CASSAVA; CASSAVA MEAL; FEEDS AND FEEDING; DAIRY CATTLE; DIETS; INDONESIA.

0115

22318 COCKBURN, J.E.; WILLIAMS, A.P. 1984. The simultaneous estimation of the amounts of protozoal, bacterial and dietary nitrogen entering the duodenum of steers. British Journal of Nutrition 51(1):111-132. En. Sum. En., 93 Ref. (National Inst. for Research in Dairying, Shinfield, Reading, Berkshire RG2 9AT, England)

AMINO ACIDS; ANALYSIS; ANIMAL NUTRITION; CATTLE; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; METABOLISM; NITROGEN; USES.

Four steers were given straw and cassava diets, twice daily, in a 4 x 4 Latin square design. These diets, containing 4.2 g N/kg DM, were further supplemented with either urea, decorticated groundnut meal, untreated casein or formaldehyde-treated casein to give a total of 19.7 g N/kg DM and 10.5 MJ/kg DM daily. Concurrent samples of rumen bacteria and protozoa and abomasal digesta were collected for each period of the expt. and the concn. of 2-aminoethyl phosphonic acid, diamonopimelic acid, total N, total P, amino acids, and hexosamines were determined in the dried preparations. The nature of the dietary supplements had little effect on the concn. of most of these constituents or on the protozoal no. (AS (extract))

0116

20766 EISFELD, VON D. 1982. Stickstoff-Verwertung des Rehes (C. capreolus L.) bei Stickstoff-Mangel. (Nitrogen usage of Capreolus capreolus in conditions of nitrogen deficiency). Zentralblatt fuer Veterinaermedizin (Reihe A) 29(4- 5):375-386. De. Sum. De, En., Fr., Es., 43 Ref., Il. (Forstzoologisches Inst. der Albert-Ludwigs-Universitat, Bertoldstr. 17, D-7800, Freiburg i. Br., West Germany)

ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; DIETARY VALUE; DIGESTIBILITY; FEED CONSTITUENTS; FEEDS AND FEEDING; METABOLISM; NITROGEN; PROCESSED PRODUCTS; USES.

In N balance studies deer were given feed mixtures based on CM and oat husks, while the N intake was varied by adding soybean protein. To describe the greatest possible utilization of N, the 30 best utilization results in 158 trials were selected as the assessment (N content of dry feed matter, 0.55-1.45 percent). Considering metabolic body wt., there was a clear linear relationship between N balance and the supply of apparently digestible N: 92 percent of the apparently digestible N can replace urinary N loss (72 mg/kg body wt.) and only 8 percent of the N appears in the urine. Urinary loss of N is mainly purines derived from bacterial nucleic acids. Urea N in urine is limited to approx. 2.6 percent of apparently digestible N (+ 10 mg/kg body wt.). Maximal N utilization results from the most complete usage of N from the body by bacteria in the alimentary tract and can only be attained when there is no surplus of N available, either for the deer or for its rumen bacteria. The literature shows comparatively extreme values for domestic ruminants. (AS)

0117

20765 EISFELD, VON D. 1982. Zur Stickstoff-Verdaulichkeit beim Reh (C. capreolus L.) 1. Mitteilung. (Nitrogen digestibility in Capreolus capreolus. 1. Report). Zeitschrift fuer Tierphysiologie, Tierernahrung und Futtermittelkunde 48(1-2):75-89. De. Sum. De, En., 24 Ref., Il. (Fortzoologisches Inst., Bertoldstr. 17, D-7800, Freiburg i. Br., West Germany)

ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; DIETARY VALUE; DIGESTIBILITY; FEED CONSTITUENTS; FEEDS AND FEEDING; FORAGE; PROCESSED PRODUCTS; USES.

Roe deer, kept in metabolism crates, were fed diets based on CM and cereals. The N content of the diets was varied using soybean products. During 158 trials, N in the feces as well as amount and composition of feed were determined. Regressions of fecal N on 6 variables influencing this parameter were calculated. Two fractions of fecal N were taken into consideration: undigestible dietary N and metabolic fecal N (MFN). The amount of MFN depends on the intake of DM, the intake of digestible OM, and probably, on the metabolic body size (W(0.75)). The true digestibility of N changes with the quality of the feed. In concn. it was 94 percent. The value for N from resistant roughages (approx. 50 percent) is less reliable. For forage selected by free-ranging roe deer true N digestibilities between (according to season) 90-60 percent can be assumed. True N digestibility and MFN allow the calculation of apparently digestible N, which is the starting point for a factorial estimate of requirements. (AS)

0118

23472 GORDON, C.I. 1981. Cassava utilization in animal feed ration. Kingston, Jamaica, Ministry of Agriculture. 17p. En. Paper prepared for a Symposium on Cassava—Its Potential to the Jamaican Economy, Kingston, Jamaica, 1985.

ANIMAL NUTRITION; CARIBBEAN; CASSAVA MEAL; CATTLE; CIAT-2; DOMESTIC ANIMALS; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING; GOATS; JAMAICA; PROCESSING; USES.

Literature on the utilization of CM in animal feed rations and results of 2 expt. on the use of these rations to feed goats and heifers in Jamaica are briefly reviewed. The nutritional value of CM is analyzed, emphasis being placed on carbohydrates, proteins and amino acid profile, lipids, minerals, vitamins, and cyanogenic glucosides. In expt. 1, the objective was to reach a slaughter goat wt. of 27.24 kg at 6 mo. Results were favorable, with a final wt. of 26.20 kg compared with 29.20 kg obtained with commercial flour; wt. gain with CM was 13.25 kg, whereas with commercial flour it was 15.44 kg. In expt. 2, with 15- to 18-mo.-old heifers until mating season, the control diet again showed better results than the CM-based diet. Utilization of cassava in cattle rations is not economical. The literature review and the expt. indicate that CM can be a good feed source for cattle; its limitations can be overcome easily with complementary ingredients such as SBM or fish meal. However, so that its use can be feasible, higher yields and lower production costs must be achieved. (CIAT)

0119

26812 HASSAN, S.A.; BRYANT, M.J. 1986. The response of store lambs to protein supplementation of a roughage-based diet. Animal Production 42(1):73-79. En. Sum. En., 21 Ref. (Dept. of Agriculture & Horticulture, Univ. of Reading, Earley Gate, Reading RG6 2AT, England)

CASSAVA; FEEDS AND FEEDING; SHEEP; ANIMAL HEALTH; NITROGEN; FEED CONSTITUENTS; FEED MIXTURES; ANALYSIS; UNITED KINGDOM.

The response of 35-kg store lambs to diets containing increasing rumen-undegradable N concn. was measured by live wt. gain and N balance. A range of undegradable N concn.

from 2.4 to 7.2 g/kg dietary DM was achieved by supplementing a basal diet of NaOH-treated barley straw. Cassava (145-239 g/kg DM), extracted rapeseed meal, and minerals with both formaldehyde-treated rapeseed meal and fish meal. Sufficient diet to provide maintenance and a growth rate of 150 g/day was given to the lambs, according to live wt. Increasing levels of undegradable N promoted a linear increase in live wt. gain and N retention. However, the response to fish meal was greater than that for formaldehyde-treated rapeseed meal. (AS)

0120

24062 KIRILOV, M.P.; BUZIK, R.B.; ILYUKHINA, L.A.; SAMOKHIN, A.V. 1981. Tapioca in diets for lactating cows. Zhivotnovodstvo no.3:38-39. Ru.

ANIMAL NUTRITION; CATTLE; CONCENTRATES; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; METABOLISM; USES.

Lactating cows were distributed in 4 groups and fed for 145 days on a basal diet of silage, haylage, grass briquettes, and fodder beet, together with a feed mixture containing (percentage) barley 30, 10, 0, or 10; oat 10, 10, 0, or 10; wheat 12, 10, 0, or 10; wheat bran 35, 31, 35, or 30; urea concentrate 5, 5, 5, or 0; cassava 0, 20, 40, or 20; sunflower oilmeal 4, 10, 16, or 16; feed concentrate 2 in all groups; NaCl 1 in all; and a premix (P 60-1) 1 in all. Av. daily yield of 4 percent fat-corrected milk was, resp., 12.3, 11.5, 13.3, and 12.1 kg. Cassava had no adverse effect on nutrient digestibility. (Nutrition Abstracts and Reviews)

0121

26822 KUNJIKUTTI, N.; KURIAN, A.; THOMAS, C.T.; JAMES, C.S. 1984. Energy requirements of adult female Malabari goats for maintenance. Kerala Journal of Veterinary Science 15(2):79-85. En. Sum. En., Arm., 12 Ref. (Dept. of Nutrition, College of Veterinary & Animal Sciences, Mannuthy, Trichur, India)

CASSAVA; FEEDS AND FEEDING; GOATS; DIETS; ANIMAL HEALTH; FEED CONSTITUENTS; FEED MIXTURES; ANIMAL PHYSIOLOGY; INDIA.

For 125 days twelve 4- to 5-yr-old female Malabari goats were given diets based on jack (Canavalia ensiformis) leaves and 70, 100, or 120 g CF, resp., to provide 75, 100, or 125 percent of a feeding standard (41 g digestible CP and 409 g starch/45 kg body wt.). All goats given 75 or 100 percent of the feeding standard lost wt.: initial wt. were 26.1 and 26.6 kg and final wt. were 23.2 and 25.4 kg, resp. Total daily digestible nutrient requirement for maintenance was 8.73 plus or minus 0.34 g/kg body wt., corresponding to 7.59 plus or minus 0.30 g starch equivalent. (Kerala Journal of Veterinary Science)

0122

33798 LOZANO, C. 1986. Utilizacion de concentrados a base de harina de yuca y gallinaza para vacas lecheras. (Use of cassava flour/farmyard manure-based concentrates for dairy cows). In Romanoff, S.; Toro, G., eds. Seminario Anual sobre la Yuca, 1, Portoviejo, Ecuador, 1985. La yuca en la costa ecuatoriana y sus perspectivas agroindustriales: memorias. Quito, Ecuador, Instituto Nacional de Investigaciones Agropecuarias; Instituto Interamericano de Cooperacion para la Agricultura; Centro Internacional de Agricultura Tropical. pp.94-95. Es. (CIAT, Apartado Aereo 6713, Cali, Colombia)

CASSAVA; DAIRY CATTLE; FEEDS AND FEEDING; FEED CONSTITUENTS; CASSAVA MEAL; DUNG; COLOMBIA; CIAT-1.

The positive experience of a farmer who fed dairy cows with dried cassava is mentioned. This is important in coastal regions where there is a shortage of forage during certain mo. The formula, which uses CM as energy source and FYM as N and mineral source, is included with brief indications on its use. (CIAT)

0123

24585 MAMCHAK, I.V.; PEIKA, M.D. 1983. El engorde de terneros mediante el uso de la semola de tapioca. (Fattening steers using cassava semolina). Zhivotnovodstvo no.11:51-52. Ru.

ANIMAL NUTRITION; CASSAVA; CASSAVA MEAL; CATTLE; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING.

Thirty calves of black race between 14-15 mo. old were separated into 3 groups of 10 animals each to study the effect of cassava semolina on the fattening of the animals. During the balance period (36 days) the 3 groups received a sole ration of 30 kg granulated semolina and concentrate. In the basic period (96 days), 40 kg cassava semolina (85.7 and 14.3 percent CF and maize seed, resp.) were given to group 1, 57 kg to group 2, and 71 kg to group 3. The 3 groups also received concentrate in decreasing amounts with increased cassava semolina. The increase in the amount of the cassava semolina given did not have a negative effect on animal growth. The 3 diets were also profitable. Cassava semolina can be given to calves for 24 h up to a value of 70 kg/head. (CIAT)

0124

22310 MCALLAN, A.B.; SMITH, R.H. 1983. Factors influencing the digestion of dietary carbohydrates between the mouth and abomasum of steers. British Journal of Nutrition 50(2):445-454. En. Sum. En., 35 Ref., Il. (National Inst. for Research in Dairying, Shinfield, Reading RG2 9AT, England)

ANIMAL NUTRITION; CARBOHYDRATE CONTENT; CASSAVA STARCH; CATTLE; COMPOSITION; DIGESTIBILITY; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; GLUCOSE; SUGAR CONTENT; USES.

Six protozoa-free steers with simple rumen and abomasal cannulas were given basal diets consisting of a concentrate mixture of flaked maize and cassava with either barley straw or alkali-treated barley straw. Other diets used were supplemented with urea or contained fish meal in place of cassava. The diets were given in a 6 x 6 Latin square design. Diets were isoenergetic and provided sufficient ME to support a growth rate of approx. 0.5 kg/day. Basal diets, urea- and fish meal-supplemented diets had estimated rumen-degradable N:ME values (g/MJ) of 0.5, 1.2, and 0.8, resp. (103)Ru and polyethylene glycol were given as flow markers, and flows (g/24 h) as the abomasum of OM and carbohydrate components were calculated. True digestibility coefficients of OM between mouth and abomasum were significantly greater for diets containing alkali-treated straw (approx. 0.63) than for those containing untreated straw (approx. 0.55) but were not significantly affected by N supplementation. Digestibility coefficients of the neutral sugar components of dietary polysaccharides between mouth and abomasum were 0.28, 0.34, 0.31, 0.23, 0.31, and 0.87 for mannose, galactose, arabinose, xylose, cellulose-glucose, and starch-glucose, resp., for the barley straw diet. Corresponding values were 0.37, 0.42, 0.56, 0.51, 0.40, and 0.88 for alkali-treated barley straw diet. All but the mannose and starch-glucose values were significantly greater for the latter diet. N supplementation also led to increases in digestibility of all neutral sugars except mannose and starch-glucose. Fish meal produced a markedly greater effect than urea but only significantly so for cellulose-glucose. The highest digestibilities were seen for the alkali-treated barley straw diet supplemented with fish meal and were 0.68, 0.67, 0.74, and 0.64 g for galactose, arabinose, xylose, and cellulose-glucose, resp. Of all these sugars, xylose consistently showed the greatest response in digestibility to NaOH treatment or N supplementation. (AS)

0125

25297 MELO, J.F.; VIANA, J. DE A.C.; MOREIRA, H.A.; MELLO, R.P. DE 1981. Farelo de arroz e mandioca (raiz dessecada e feno) como suplementos de dieta basica de cana-de-acucar + ureia para novilhas leiteiras. (Rice bran and cassava (dried roots and hay) as supplements to a basic diet of sugar cane + urea for dairy heifers). Arquivo Brasileiro de Medicina Veterinaria e Zootecnia 35(6):871-886. Pt. Sum. Pt., En., Fr., Es., 32 Ref.

ASH CONTENT; BRAZIL; CASSAVA MEAL; CASSAVA PRODUCTS; CATTLE; COMPOSITION; DAIRY CATTLE; DIETARY VALUE; DOMESTIC ANIMALS; DRY MATTER; FEED CONSTITUENTS; FEEDS AND FEEDING; FIBER CONTENT; FOOD ENERGY; METABOLISM; PROCESSED PRODUCTS; PROTEIN CONTENT; SODIUM; SOUTH AMERICA; STORAGE.

The potential of using sugar cane combined with urea:ammonium sulphate (9:1) and minerals, supplemented with different energy levels (rice bran, cassava roots with or without hay), as feed for dairy heifers during the dry season was evaluated. Twenty-four Holstein x Zebu heifers, with mean initial wt. and age of 240 kg and 21 mo., resp., were used. The completely randomized design included the following 3 treatments: A, sugar cane + urea:ammonium sulphate + rice bran; B, sugar cane + urea:ammonium sulphate + cassava roots; C, sugar cane + urea:ammonium sulphate + cassava roots + hay. Mean daily wt. gains/heifer during the exptl. period were 0.588, 0.415, and 0.278 kg, resp., for treatments A, B, and C. Treatment A differed significantly (P less than 0.05) from B and C; however, no significant differences were observed between B and C. Total mean DM intakes (heifer/day) were 6.9, 6.5, and 6.2 kg, resp., and no significant differences were observed among the treatments. (AS)

0126

30816 MENDOZA M., G.D. 1984. Uso de la harina de yuca (Manihot esculenta) en la alimentacion de ganado lechero. (Use of cassava meal for feeding dairy cattle). Chapingo, Mexico, Universidad Autonoma de Chapingo. Colegio de Postgraduados. 137p. Es. Sum. Es., 122 Ref., Il.

CASSAVA; CASSAVA MEAL; FEEDS AND FEEDING; DAIRY CATTLE; SUBSTITUTES; COMPOSITION; DRY MATTER; DIGESTIBILITY; MILK; ANIMAL PHYSIOLOGY; MEXICO.

A series of 5 expt. (4 in vitro and 1 in vivo) were conducted in an attempt to evaluate the use of CM for feeding dairy cattle, as a partial or total substitute for sorghum in concentrates. Expt. 1 determined the composition and the fermentation rate of CM obtained from peeled and nonpeeled cassava. The fermentation constants obtained were K0.5 = 0.773 and DM = 34.28 for nonpeeled CM, and K0.5 = 1.663 and DM = 47.01 for peeled CF. In expt. 2, CM was incubated with 11 sources of N and varying levels of CM (between 36-88 percent). Differences (P less than 0.05) in DM digestibility of the combinations were observed and a positive correlation (r = 0.81) was found between the level of CM and the in vitro DM digestibility. Combinations with chemical treatment and urea demonstrated that CM digestibility can be limited by the amount of N available for the microorganisms. Expt. 3 determined fermentation rates of alfalfa (leaf and stem), sweet sorghum, and bitter sorghum. Expt. 4 determined the DM digestibility of 24 concentrates for dairy cattle based on CM, sweet sorghum, bitter sorghum (levels of 53-68 percent), CM + sweet sorghum, and CM + bitter sorghum, with various protein sources. These concentrates were 1st incubated alone and then with alfalfa in a 40:60 ratio, resp. Results were analyzed by orthogonal contrasts. No significant differences were found in the DM digestibility of the concentrates with and without CM (alone and with alfalfa); the DM digestibility of the concentrates with high CM levels (53 and 68 percent) was greater (P less than 0.01) than that of a lower level (26 percent) of CM, but no significant differences were observed when combined with alfalfa. The DM digestibility of concentrates with CM + bitter sorghum was greater than with sweet sorghum, but there were no significant differences when incubated with alfalfa. In expt. 5, carried out with dairy cat-

tle, partial or total substitution of sorghum with CM did not significantly affect milk production, DM intake, milk fat content, and live wt. change. Results indicate that CM is an ingredient that can provide energy to ruminal microorganisms during a period close to 24 h. Its in vitro digestibility can be modified by the type and degradability of the N supplement used, and by the level of CM itself. CM can be used with a compatible N source, as an energy supplement for the digestion of forages with different degrees of lignification. If economically feasible, CM (nonpeeled) can be used in levels ranging from 30 to 60 percent in dairy cattle concentrates, partially or totally substituting sorghum. (AS (extract)-CIAT)

0127

30157 NAIDU, S.; NUSRATH, M. 1986. Studies on the incidence of Rhizopus and its toxin in cattle feed from Andhra Pradesh, India. International Journal of Tropical Plant Disease 4(1):85-91. En. Sum. En., 10 Ref.

CASSAVA; RHIZOPUS STOLONIFER; RHIZOPUS NIGRICANS; CASSAVA FLOUR; CASSAVA CHIPS; STORAGE; INDIA.

Rhizopus stolonifer and R. nigricans were frequently isolated from mixed feed samples (obtained from large- and small-scale manufacturing units) stored in gunny bags and also from their ingredients, particularly CF and cassava chips. Rhizopus toxin was identified and recorded for the 1st time in India in Rhizopus-infested samples. The usual storing structure (gunny bags) should be avoided or in case of use, stored at lower temp. (below 22 degrees Celsius). (AS)

0128

22043 NITIS, I.M. 1981. Use of by-products to feed Bali cattle. In Kiflewahid, B.; Potts, G.R.; Drysdale, R.M., eds. By-product utilization for animal production: proceedings of a workshop on applied research, Nairobi, Kenya, 1982. Ottawa, Canada, International Development Research Centre. pp.26-36. En. Sum. En., Fr., Es., 10 Ref. (Dept. of Animal Nutrition & Tropical Pasture Production, Udayana Univ., Denpasar, Bali, Indonesia)

ANIMAL NUTRITION; ASIA; CASSAVA CHIPS; CASSAVA PRODUCTS; CATTLE; COSTS; DOMESTIC ANIMALS; DRIED ROOTS; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING; INDONESIA; PROCESSED PRODUCTS; USES.

Two feeding expt. were carried out in a mixed-farming village in Indonesia to study the effect of replacing 30 percent of the green roughage with readily available agroindustrial by-products (copra meal, rice bran, hen manure, and cassava chips) on the performance of Bali steers with an av. initial live wt. of 101-114 kg. The completely randomized block design arrangement consisted of 5 treatments (1 diet with 100 percent green roughage and 4 diets of 70 percent green roughage + 30 percent various concentrate mixtures) and 4 replications, with 2 steers/replication. Sixteen steers were raised using traditional methods for comparison. In expt. 1, the concentrate-supplemented diet was formulated to meet the requirements for the 100-200, 200-300, and 300-400 kg live wt. ranges. In expt. 2, the best diet in expt. 1 was compared with the cheapest concentrate-supplemented diet. Expt. 1 and 2 lasted 200 and 68 wk., resp. Cattle supplemented with various concentrate mixtures gained 2.7-3.9 times more wt. (P less than 0.05) and were 50.5-67.7 percent more efficient in utilizing the feed than those fed on green roughage alone. Among the concentrate-supplemented groups, the response varied according to the growth stages. Cattle supplemented with concentrate mixtures required 2.25 yr to reach 375 kg (market wt.), whereas those fed green roughage were expected to take 2-3 times longer to reach the same wt. Simple benefit-cost analysis showed that the gross profit from cattle receiving concentrate mixtures was 55.5 percent more than those receiving only green roughage. The greatest live wt. gain (av. 349 g/day) occurred in cattle supplemented with 10 percent copra meal + 10 percent rice bran + 10 percent cassava chips, whereas the highest gross profit resulted from cattle supplemented with 20 percent

rice bran + 10 percent hen manure. The constraint was not on the concentrate but on the availability and cost of the green roughage. (AS)

0129

30548 PANDITHARATNE, S. 1984. Ensiling characteristics, digestibility and palatability of tropical grasses as affected by growth stage, chopping length and additives. Ph.D. Thesis. Blacksburg, Virginia Polytechnic Institute and State University. 125p. En. Sum. En., 95 Ref., Il.

CASSAVA; CASSAVA MEAL; USES; FEEDS AND FEEDING; SILAGE; ANALYSIS; SRI LANKA.

Research was conducted in Sri Lanka to study the effects of growth stage, chopping length, and additives on ensiling characteristics of Panicum maximum Ecotype-A and NB-21 (Pennisetum purpureum x Pennisetum americanum). In the 1st study, the forages were harvested 1, 2, and 3 wk. after growth, chopped, and ensiled in small lab. silos alone or with additions of CM, coconut oil meal, and formic acid. Cutting grass at 1 wk. increased (P less than 0.05) acetic and lactic acids of silage, compared with 3 wk. Addition of CM and coconut oil meal increased (P less than 0.05) lactic acid and decreased (P less than 0.05) pH and acetic acid of silage, compared with the control. The effects were greater for CM. (AS (extract))

0130

29465 PEREIRA, J.P. 1987. Utilizacao de raspas e residuos industriais da mandioca na alimentacao bovina. (Utilization of cassava chips and industrial wastes in cattle feeding). Informe Agropecuario 13(145):28-42. Pt. 50 Ref. (EPAMIG, Caixa Postal 176, 37.200 Lavras-MG, Brasil)

CASSAVA; FEEDS AND FEEDING; CASSAVA CHIPS; WASTE UTILIZATION; NUTRITIVE VALUE; SUBSTITUTES; DIETS; PRICES; STORAGE; BRAZIL.

The use of cassava chips and industrial wastes in animal feeding is reviewed. Emphasis is placed on their chemical composition and nutritional value, their use as a means of supplying urea to bovine cattle, the nutritional value of rations containing cassava chips, their use for fattening confined cattle and in dairy cattle feeding. It is concluded that cassava chips can totally or partially substitute cereals, molasses, and chopped sugarcane in cattle feeding. Cassava industrial wastes can be used as energy sources in animal feeding provided they are adequately supplemented with protein sources and there are no transportation costs. Cassava chips can replace maize or sorghum in diets for steers, and dried cassava roots can replace rice in diets for dairy heifers. The use of cassava chips and wastes is determined by competitive prices compared with other energy sources. Cassava roots can be stored for 2-3 mo. if cassava chipping is impossible immediately after harvesting. (CIAT)

0131

26706 RAO, K.N.; PRASAD, D.A.; KRISHNA, N. 1985. Development and nutritional evaluation of extruded tapioca flour and urea product (Tapurea-70). Cheiron 14(3):104-112. En. Sum. En., 16 Ref. (Dept. of Animal Nutrition, College of Veterinary Science, Andhra Pradesh Agricultural Univ., Tirupati-517 502, India)

CASSAVA; TAPUREA; NUTRITIVE VALUE; PROCESSING; CASSAVA FLOUR; CASSAVA CHIPS; UREA; NITROGEN; DIETS; FEEDS AND FEEDING; PROTEIN ENRICHMENT; ANIMAL PHYSIOLOGY; PROTEINS; CATTLE; INDIA.

Extrusion cooking of Tapurea-70 (cassava and urea 77:23) increased (P less than 0.01) swelling potential, reducing activity, and microbial protein synthesis and reduced (P less than 0.01) ammonia N production in vitro. In a 3 x 3 Latin square expt. with crossbred bullocks, extrusion cooking lowered (P less than 0.01) rumen NH3-N concn. at 4 and 6

h after feeding but did not affect blood NH3-N or blood urea-N. In a 2nd expt. with young Nellore rams, extrusion cooking lowered (P less than 0.01) ether extract digestibility but did not affect digestibility of DM, crude fiber, N-free extract and N, or N retention. Extrusion cooking significantly lowered (P less than 0.01) rumen NH3-N and blood urea-N concn. (AS)

0132

26853 REDDY, E.P.; PRASAD, D.A. 1985. Evaluation of economic concentrate mixtures for dairy cattle. Cheiron 14(4):164-172. En. Sum. En., 13 Ref. (Dept. of Animal Nutrition, College of Veterinary Science, Andhra Pradesh Agricultural Univ., Tirupati-517 502, India)

CASSAVA; FEEDS AND FEEDING; DAIRY CATTLE; FEED CONSTITUENTS; FEED MIXTURES; COSTS; NITROGEN; ANIMAL HEALTH; ANIMAL PHYSIOLOGY; INDIA.

Three isonitrogenous and isocaloric concentrate mixtures using mostly nonconventional ingredients were formulated with rumen degradable protein values of 0.38 (mixture 2, 5 percent cassava), 0.36 (mixture 3, 15 percent cassava) and 0.38 (mixture 4, 0 percent cassava) and compared with a conventional mixture (mixture 1, 0 percent cassava) having a rumen-degradable protein value of 0.29 in in vivo expt. In a 56-day growth expt. with 16 crossbred calves (143 kg), av. daily gain of calves fed mixtures 3 or 4 was higher (P less than 0.01) than those fed mixtures 1 or 2. Feed efficiency was superior for mixture 4 than for mixtures 1 or 2. Av. daily gain and feed efficiency (kg concentrate mixture DM/kg gain) for mixtures 2 and 3 were 518 plus or minus 50 and 732 plus or minus 439 and 4.45 plus or minus 0.48 and 3.11 plus or minus 0.18, resp. The cost/kg gain was lower by 21, 39, and 45 percent in calves fed mixtures 2, 3, and 4, resp., than those fed mixture 1. In a 4 x 4 Latin square N balance expt. with crossbred male calves (166 kg), N retention was higher (P less than 0.05) in calves fed mixtures 2 or 4 than those fed mixture 1. In a 4 x 4 Latin square expt. with fistulated Ongole x Holstein Friesian bullocks (430 kg), rumen NH3- N concn. at 2 (P less than 0.05), 4 (P less than 0.01), or 6 (P less than 0.01) h after feeding was lower in bullocks fed concentrate mixtures 2, 3, and 4 than those fed mixture 1. Differences in total VFA concn. among the treatments were not significant. The blood urea N values in bullocks fed mixture 4 were lower (P less than 0.05) at 2 or 6 h after feeding than those fed mixture 2. (AS)

0133

30600 RODRIGUEZ O., A.; VELEZ C., G. 1987. La yuca, alternativa energetica para la alimentacion bovina. (Cassava, an energy alternative for bovine nutrition). Cebu 19(239):16-18,20-21. Es. Il.

CASSAVA; CATTLE; ROOTS; FEEDS AND FEEDING; ANIMAL NUTRITION; COLOMBIA.

A literature review on the use of cassava as an alternative energy source in livestock feeding, with particular reference to its combination with other feedstuffs, is given. Preferred var. in Colombia and their corresponding yields are listed. Studies indicate that dehydrated cassava can partially substitute maize in poultry rations and can replace maize as an energy supplement in rations for beef cattle in the tropics. Dehydrated cassava and cocoa husks are lightly superior to maize in milk production in the tropics. Furthermore, the N in urea is more efficiently used by rumen microorganisms for amino acid and vitamin synthesis, when the energy source is starch. The advantages of partially replacing sugarcane molasses by cassava, in various feed combinations, are discussed. (CIAT)

0134

28106 SPEAR, P.T.; RODEL, M.G.W. 1982. Substitution of maize by cassava in high-energy diets for fattening steers. In Zimbabwe. Department of Research and Specialist

Services. Division of Livestock and Pastures. Annual Report 1981-1982. Zimbabwe. pp.83-85. En.

CASSAVA; CASSAVA MEAL; ANIMAL NUTRITION; DIETARY VALUE; DIETS; FEEDS AND FEEDING; ECONOMICS; ZIMBABWE.

High-energy, maize-based diets in which CM was substituted for maize at levels of 33, 67, and 100 percent were fed to fattening steers during an 83-day period. In terms of body mass, diets with 33 and 67 percent CM resulted in slightly greater gains (144.6 and 144.1 kg, resp.) compared with the standard high-energy diet (142.2 kg), gains with the diet with 100 percent CM being slightly less (133.3 kg). Carcass gains were, however, lower at all substitution levels (94.1, 90.8, and 79.9 kg, resp.) compared with the standard diet (94.9 kg). The economics of substituting cassava for maize in finishing rations will depend on the relative costs of both feeds but 33 percent CM could be substituted for maize without losses in animal performance. (CIAT)

0135

28106 SPEAR, P.T.; RODEL, M.G.W. 1982. Substitution of maize by cassava in high-energy diets for fattening steers. In Zimbabwe. Department of Research and Specialist Services. Division of Livestock and Pastures. Annual Report 1981-1982. Zimbabwe. pp.83-85. En.

CASSAVA; CASSAVA MEAL; ANIMAL NUTRITION; DIETARY VALUE; DIETS; FEEDS AND FEEDING; ECONOMICS; ZIMBABWE.

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0136

26817 TUAH, A.K.; TAIT, R.M. 1985. Protein metabolism of sheep fed formaldehyde treated forage supplemented with iso-acids and sulfur. Nutrition Reports International 32(4):893-900. En. Sum. En., 14 Ref. (Faculty of Agriculture, Univ. of Science & Technology, Kumasi, Ghana)

CASSAVA; FEEDS AND FEEDING; SHEEP; PROTEINS; NITROGEN; FEED CONSTITUENTS; FEED MIXTURES; ANALYSIS; DRY MATTER; ANIMAL HEALTH; ANIMAL PHYSIOLOGY; BIOCHEMISTRY; CANADA.

The effects of formaldehyde treatment of dehydrated forage with and without supplements of S and iso-acids on protein utilization were assessed at the U. of British Columbia (Canada). Twenty-five Dorset ram lambs (av. wt. 29 kg) were allocated to 5 diets, all of which contained 50 percent dehydrated forage and approx. 38 percent cassava. Diet 1 contained untreated forage while diets 2 to 5 contained forage treated with 1 percent (wt./wt.) formaldehyde. Diet 3 was supplemented with isovaleric and isobutyric acids, diet 4 was supplemented with S, and diet 5 with both S and the iso- acids. N balance was improved significantly (P less than 0.05) by formaldehyde treatment as a result of reduced (P less than 0.05) urinary N excretion. The nonprotein and microbial protein percentages of abomasal contents were reduced (P less than 0.05) by formaldehyde treatment indicating a greater proportion of dietary protein having escaped degradation in the rumen. The molar proportions of acetic, propionic, and butyric acids in rumen fluid were not affected (P greater than 0.05) by treatment. (AS)

0137

23765 TUDOR, G.D. 1981. Intensive beef production from dried cassava tubers. Proceedings of the Australian Society of Animal Production 15:763. En. 2 Ref. (Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia)

ANIMAL NUTRITION; AUSTRALIA; CASSAVA PRODUCTS; CATTLE; CEREALS; CONCENTRATES; DOMESTIC ANIMALS; DRIED ROOTS; FEED CONSTITUENTS; METABOLISM; OCEANIA; PLANT ANATOMY; PROCESSED PRODUCTS; ROOTS; SORGHUM; STARCH CROPS.

The performance of 48 Hereford steers fed on high concentrate diets based on dried cassava roots or rolled sorghum grains was measured during a period of 85 + 13 days. The diets consisted of 90 percent concentrate and 10 percent Chloris gayana chaff. Sixty cattle were classified on live wt. into blocks of 5 and then randomly allocated into 5 treatments, each with 3 replicates of 4 animals. Cattle fed the grain diet ate more OM and gained live wt. faster than cattle fed cassava. The differences between the treatments in estimated daily carcass gain were not significant, resulting in better conversions of OM to hot carcass wt. for the cattle fed cassava. This latter group of animals ate many small rations rather than 2-4 large rations and had more butyric acid to total acids in rumen fluid than cattle fed grain. (CIAT)

0138

20750 TUDOR, G.D.; NORTON, B.W. 1982. The nutritive value of cassava for cattle. Proceedings of the Australian Society of Animal Production 14:599. En. 2 Ref. (Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia)

ANIMAL NUTRITION; CASSAVA CHIPS; CASSAVA PRODUCTS; CATTLE; CEREALS; COMPOSITION; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; DRIED ROOTS; FOLIAGE; PROCESSED PRODUCTS; SORGHUM; STARCH CROPS.

The nutritive value of a cassava diet of dried chipped tubers (3.9 percent CP in DM) and tops (4.4 percent CP), was compared with a cereal grain diet of rolled sorghum (11.4 percent CP) and cottonseed hulls (CSH, 4.4 percent CP), both given as 80:20 diets in a 4 x 4 Latin square digestibility expt. with periods of 21 days. Four diets (2 cassava and 2 sorghum) were prepared with either 4 or 8 percent peanut meal (PM) (C4, C8, S4, and S8) plus minerals and urea. The urea was used to balance the diets with different levels of PM. Steers were fed once daily at just above maintenance levels. A diet predominantly of cassava tubers and tops with 4-8 percent PM as a protein supplement was more highly digested than a diet of sorghum grain and CSH with similar proportions of PM. Cattle given cassava utilized absorbed dietary N with 34 percent lower efficiency than did steers given sorghum and this may be attributed to the higher levels of urea in the cassava diets compared with the sorghum diets. The isonitrogenous replacement of urea with PM in both diets did not increase N retention or efficiency of N use, suggesting that PM was little better than urea as a protein source. (Nutrition Abstracts and Reviews)

0139

20751 TUDOR, G.D.; MCGUIGAN, K.R. 1982. The potential intake and growth rate of young cattle fed a predominantly cassava based diet. Proceedings of the Australian Society of Animal Production 14:600. En. 2 Ref. (Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia)

ANIMAL NUTRITION; AUSTRALIA; CASSAVA PRODUCTS; CATTLE; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; NUTRITIVE VALUE; PELLETS; USES.

For 89 days Droughmaster steers, mean initial fasted live wt. 173 kg, were given pelleted diets of cassava or cereal grain. The cassava tubers (4.7 percent CP in DM) were sup-

plemented with either nonprotein N (NPN, urea 4 percent) or true protein (TP, meat-and-bone meal 15 percent), but the grain was only supplemented with NPN. The cassava (chipped, dried, and rolled) and grain (finely rolled sorghum) were prepared as concentrate mixes with minerals and the necessary N supplement. The concentrate mixture was pelleted with lucerne meal (23.4 percent CP) in the proportion 90:10. CP content of the grain, cassava + NPN, and cassava + TP diets was 18.2, 19.8, and 18.4 percent, resp. Steers on the cassava diet + TP had lower rates of gain and lower intakes than those given sorghum, with the steers given cassava + NPN having the lowest growth rate and intake. The apparent digestibilities of OM of the cassava diets were better than for the grain diet but the feed conversion efficiencies were slightly lower. Rumen fluid analyses showed there was a lower ratio of acetate:propionate in animals given grain compared with those given cassava. The concn. of butyric acid in the rumen of steers given cassava was nearly twice that of grain-fed animals. (Nutrition Abstracts and Reviews)

0140

26816 TUDOR, G.D.; MCGUIGAN, K.R. 1985. The effects of three protein sources on the growth and feed utilization of cattle fed cassava. Journal of Agricultural Science 104(1):11-18. En. Sum. En., 24 Ref., Il. (Queensland Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Brisbane, 4105, Australia)

CASSAVA; FEEDS AND FEEDING; CATTLE; FEED CONSTITUENTS; FEED MIXTURES; DRY MATTER; COMPOSITION; ANIMAL HEALTH; AUSTRALIA.

The nutritive value of diets predominantly of dried cassava tubers supplemented with protein concentrates and roughage was measured in 3 expt. using steers. In expt. 1 the digestibility of diets of dried, chipped cassava tubers and tops (80:20) or rolled sorghum grain and cotton seed hulls, supplemented with 4 or 8 percent groundnut meal and urea, was determined. The apparent digestibility coefficients of OM of the cassava diets with 4 or 8 percent groundnut meal, were significantly (P less than 0.01) higher than those of the grain diets. Starch digestibility in the cassava diets was significantly (P less than 0.01) higher than in the grain diets (1.00, 0.99, 0.94, and 0.93, resp.). There were no significant differences in the digestibility of the N component. The N retained (g/day) was lower (P greater than 0.05) with cassava and was utilized less efficiently (P greater than 0.05). The high apparent digestibility of the cassava diet suggests that cassava could replace cereal grains in intensive finishing diets. The N retention data suggest that groundnut meal is no better than urea as a N source. In expt. 2, 15 steers with a mean initial wt. of 173 kg were individually fed pelleted diets of sorghum grain, cassava + urea, or cassava + meat and bone meal (90 concentrate:10 roughage). The cattle fed the grain diet ate significantly more OM and grew faster and slightly more efficiently than cattle fed cassava + urea. Cattle fed cassava + meat and bone meal were intermediate between the 2 treatments for intake and daily gain (3.7 and 1.06 kg/kg, resp.) but had the best feed conversion (3.5 kg/day). The acetic:propionic acid ratio was similar on all 3 diets (1.2, 1.6, and 1.4:1, resp.), but the ratio of propionic:butyric acids was significantly (P less than 0.01) different (5.8, 2.7, and 2.7:1, resp). In expt. 3, 15 other steers with mean initial wt. of 195 kg were individually fed pelleted cassava diets with 0, 5, or 10 percent fishmeal (82 cassava:18 roughage). The intake of OM, daily live wt. gain, and feed conversion were all better in cattle fed cassava + fishmeal. The proportions of VFA in the rumen fluid were similar to those recorded in cassava-fed cattle in the earlier trial. It was concluded that cattle fed high-energy diets based on dried cassava tubers can perform well. Although feed intake and daily gain of cattle fed cassava may be lower than for cattle fed grain diets, the conversion of food to live wt. gain should be similar or better. (AS)

0141

26154 TUDOR, G.D.; INKERMAN, P.A. 1986. Intensive production for large ruminants based on cassava or bagasse. Yeerongpilly, Queensland, Department of Primary Industries, Animal Research Institute. 23p. Paper presented at Australian Asian Fibrous Agricultural Residues Research Workshop, Los Banos, Philippines, 1986. En. Sum. En., 9 Ref., Il. (Dept. of Primary Industries, Animal Research Inst., Yeerongpilly, Qld. 4105, Australia)

ANIMAL NUTRITION; AUSTRALIA; CASSAVA; CASSAVA CHIPS; CATTLE; CONCENTRATES; FEED CONSTITUENTS; FEEDS AND FEEDING; METABOLISM; STATISTICAL ANALYSIS.

Two separate expt. were conducted to determine the production potential of cassava roots and bagasse as animal feed. Cattle fattened on a high energy grain-based feedlot diet (90 percent concentrate/10 percent roughage) consumed significantly (P less than 0.01) more OM (8.8 kg/day) and gained (P less than 0.05) live wt. faster (1.23 kg/day) than the best cassava diet, which was also 90 percent concentrate/10 percent roughage (6.2 and 0.99, resp.). The conversion of feed to live wt. gain was, however, 13 percent better in cattle fed cassava than those fed grain (6.6 vs. 7.2 kg OM/kg live wt. gain) and significantly (P less than 0.01) better (26 percent) for feed to carcass gain (7.3 vs. 9.9 kg OM/kg hot carcass wt. gain). Although feed intake and daily gain of cattle fed the cassava-based diet were lower than for cattle fed grain diets, the conversion of food to carcass gain was significantly better. This better conversion would possibly be associated with the continuous, simultaneous release of N and starch in the rumen resulting from the many small feeds. (AS (extract))

0142

32083 UNNANUNTANA, A. 1985. (Nutritive values and digestibility of sugarcane top silage treated with different additives in sheep). M.Sc. Thesis. Bangkok, Thailand, Kasetsart University. 110p. Thai. Sum. Thai., En., 42 Ref.

CASSAVA; CASSAVA CHIPS; FEED MIXTURES; NUTRITIVE VALUE; DIGESTIBILITY; SHEEP; ANIMAL NUTRITION; THAILAND.

An expt. was carried out to evaluate the nutritive values and the digestibility of sugarcane top silage with different kinds and levels of additives, among them cassava chips, for a total of 60 treatments. Using Murdoch's method (1962), the 3 best treatments were (1) sugarcane tops with 0.5 percent urea and 15.0 percent cassava chips on wet basis; (2) sugarcane tops with 0.5 percent urea and 10.0 percent molasses on wet basis; and (3) sugarcane tops with 0.5 percent urea and 15.0 percent liquid glucose by product on wet basis. Results of the digestibility trial using sheep are also included. Percentage digestibility of OM, CP, crude fiber, and GE for treatment 1 were 54.48, 60.78, 50.51, and 64.73, resp. (AS (extract))

0143

34492 VAN EYS, J.E.; PULUNGAN, H.; RANGKUTI, M.; JOHNSON, W.L. 1987. Cassava meal as supplement to napier grass diets for growing sheep and goats. Animal Feed Science and Technology 18(3):197-207. En. Sum. En., 26 Ref. (North Carolina State Univ., Raleigh, NC 27695-7621, USA)

CASSAVA; CASSAVA MEAL; ANIMAL NUTRITION; LAMBS; GOATS; ANIMAL PHYSIOLOGY; USA.

Twenty growing male lambs and 20 growing male goats were used in 2 expt. to evaluate CM as a supplement to chopped Pennisetum purpureum fed ad libitum. Four animals of each species were randomly allocated to 5 treatment groups. CM, enriched with 2.0 percent urea and 0.2 percent inorganic S, was fed at 0, 0.45, 0.90, 1.35, and 1.80 percent live wt. All animals received a mixture of coconut meal, rice bran, and minerals to meet min. requirements of protein and minerals. A 16-wk. growth trial and a 7-day digestibility trial were carried out. CM supplementation increased (P less than 0.01) av. daily gain (ADG) in both species, but differences among supplementation levels were small. Goats, fed P. purpureum of lower quality, showed a larger effect of supplementation than sheep. ADG, feed efficiency, and carcass wt. were maximized when CM represented 30 percent of the DM intake for sheep and 40 percent for goats. Performance decreased when cassava was fed at 50 percent. In terms of DM intake, CM replaced P. purpureum on a 1:1 basis. DM digestibility increased and NDF digestibility decreased (P less than 0.05)

with cassava supplementation. ADG can be increased by feeding cassava-urea at up to 40 percent of DM intake with a diet of P. purpureum plus a concentrate supplement of 13-17 percent of the total DM intake in sheep and 11-16 percent in goats; however, intake and digestibility of P. purpureum decreased at all exptl. levels of cassava supplementation. (AS)

0144

22100 WILLIAMS, P.E.V. 1981. Digestibility studies on ammonia-treated straw. Animal Feed Science and Technology 10(2-3):213-222. En. Sum. En., 21 Ref. (Rowett Research Inst., Bucksburn, Aberdeen AB2 9SB, Great Britain)

ANIMAL NUTRITION; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; SHEEP; USES.

Barley straw (cv. Sonja, a winter var.), either treated with anhydrous ammonia (30 g NH_3/kg straw DM) in an oven at 90 degrees Celsius for 16 h or left untreated, was offered to 8 sheep in digestibility trials. The digestibility of DM of ammonia-treated and untreated straw was 0.50 and 0.42, of OM 0.52 and 0.45, and of acid detergent fiber 0.59 and 0.47, resp. A series of digestibility trials is summarized in which ammonia-treated straw was offered with supplements of either rolled barley, turnips, fish meal, cassava, or molasses to either sheep or cattle. When the straw constituted less than 50 percent of a diet which included either rolled barley or turnips, the digestibility of acid detergent fiber in the diet was lower than recorded when straw was offered alone. The apparent digestibility of the straw DM, in the diets with rolled barley or turnips, was also lower than when the straw was offered alone. However, when the supplement constituted approx. 5 percent of the DM of the diet, supplementation of ammonia-treated straw with either fish meal, cassava, or molasses tended to increase the digestibility of acid detergent fiber and the apparent DM digestibility of the straw. Results suggest that changes in bacterial lysis occurred depending on the levels of supplementation used; high levels of rapidly fermentable carbohydrates in diets with straw tended to depress digestion of cellulose by bacteria, but small additions of either protein or rapidly fermentable carbohydrates stimulated it. (AS)

0145

27652 YUSOFF, S.M. 1985. Feeding value of palm kernel cake for growing heifers. Kajian Veterinar 17(1):49-54. En. Sum. En., Mal., 9 Ref. (Inst. Haiwan, Kluang, Johor, Malaysia)

CASSAVA; CASSAVA CHIPS; USES; FEEDS AND FEEDING; ANIMAL NUTRITION; SUPPLEMENTS; CATTLE; MALAYSIA.

A trial was conducted to determine the optimum combination of urea, cassava chips, and palm kernel cake in supplementary rations for growing Sahiwal-Friesian heifers. The rations were (1) 4 percent urea plus 94 percent cassava chips, (2) 3 percent urea plus 75 percent cassava chips plus 20 percent palm kernel cake, (3) 2 percent urea plus 56 percent cassava chips and 40 percent palm kernel cake, (4) 1 percent urea plus 37 percent cassava chips plus 60 percent palm kernel cake. These rations were given at 2 kg/animal/day to the animals, with Pennisetum purpureum or Panicum maximum ad libitum. Animals given 4 percent urea in their feeds with no palm kernel cake performed the poorest in daily gain and feed efficiency. Heifers given up to 3 percent urea supplementation performed similarly well. It can be concluded that growing heifers need some protein supplementation in their daily rations for max. performance and are able to tolerate up to 3 percent urea supplementation in their rations. (AS)

0146

29511 YUSOFF, S.M.; CHEAH, P.F.; AZIZ, T.M. 1984. Performance of post-weaning calves fed ad libitum and restricted diets. Kajian Veterinar 16(1):8-14. En. Sum. En., Mal., 16 Ref. (Inst. Haiwan, Kluang, Johor, Malaysia)

CASSAVA; FEEDS AND FEEDING; CALVES; CASSAVA CHIPS; ANIMAL NUTRITION; DIETARY VALUE; MALAYSIA.

An expt. was conducted to determine the performance of 3-mo.-old postweaning calves subjected to 4 dietary treatments: (1) ad libitum feeding of calf starter ration containing 20 percent protein; (2) ad libitum feeding of urea-based dairy ration (16 percent protein); (3) restricted feeding of 1.5 kg calf starter; and (4) restricted feeding of 1.5 kg dairy ration. The calf starter ration was made up of palm kernel cake (10.0 percent), maize (55.5 percent), cassava chips (5.0 percent), SBM (15.0 percent), fish meal (12.0 percent), dicalcium phosphate (1.0 percent), salt (1.0 percent), and mineral premix (0.5 percent). The dairy ration was composed of palm kernel cake (solvent extracted, 25.0 percent), palm kernel cake (expeller pressed, 25.0 percent), maize (20.0 percent), cassava chips (15.0 percent), rice bran (11.0 percent), urea (1.5 percent), dicalcium phosphate (1.0 percent), salt (1.0 percent), and mineral premix (0.5 percent). The calves in each treatment group were given their resp. concentrate ration plus fodder provided ad libitum. Calves given ration 1 gained more than those calves on the other diets; however, they also incurred the highest cost of feed/day and per kg gain. The next highest daily gain was achieved by calves given ration 3. Since the costs of feed/day were not significantly different among these 3 treatments, it can be concluded that restricted feeding of calf starter was more suitable for postweaning calves. Postweaning calves of 3-6 mo. of age performed better with a 20 percent protein starter ration compared with the adult ration of urea-based 16 percent protein dairy ration. (AS)

See also 0019

OTHER ANIMALS

0147

33894 ECUADOR USA yuca en la cria de camarones. (Rising tide in Ecuador for cassava shrimp farming). 1988. CIAT Internacional 7(2):3-6. Es. Il. Also in English.

CASSAVA; ANIMAL NUTRITION; SHRIMP; FOOD BINDERS; SOCIOECONOMIC ASPECTS; CASSAVA PROGRAMS; ECUADOR; CIAT-1.

The use of cassava as an agglutinant for shrimp feed in Manabi Province, Ecuador, in replacement of imported agglutinants that contain formaldehyde and are considered toxic, is discussed. A brief review is also given of the evolution of farmer associations to produce and process cassava; social and economic benefits are mentioned. The support given by the Ecuadorian government to these enterprises is highlighted; this has been accomplished through breeding programs, the development and evaluation of processing and production technologies, and, with the collaboration of CIAT, training in postharvest technology and crop management. (CIAT)

0148

26865 ADAMSON, I.; MBAJIORGU, N. 1985. Tissue lipids and intestinal ATPases in rabbits fed cassava (Manihot uttilisima) and plantain (Musa paradisica) diets. Nutrition Research 5(12):1359-1373. En. Sum. En., 45 Ref., Il. (Dept. of Biochemistry, Univ. of Benin, P.M.B. 1154, Benin City, Nigeria)

CASSAVA; RABBITS; FEEDS AND FEEDING; BANANA-PLANTAINS; ANIMAL HEALTH; ENZYMES; FIBER CONTENT; FEED CONSTITUENTS; TIMING; FAT CONTENT; NIGERIA.

The effect of 2 vegetable sources of dietary fiber from Africa, plantain and cassava, on lipid metabolism and intestinal ATPases in cholesterol-fed rabbits was studied. In an 8-wk. expt., it was shown that both sources of dietary fiber are capable of reducing serum cholesterol levels in rabbits by diverting cholesterol from the blood to the liver. The

dietary fiber from plantain had more effect. When the rabbits were switched from test to control and back to the test diets, only those on the plantain diet maintained a steady-state level of serum cholesterol. The other diets caused a drop in serum cholesterol levels in the absence of dietary cholesterol and a sharp rebound on the introduction of cholesterol-based diets. The cassava diet was hypertriglyceridimic at all times. The ATPases were highly elevated in the ileum of rabbits fed the cassava diet and this was associated with the higher content of insoluble and particulate components of cassava, which may cause cell sloughing and alteration in the morphology of the intestine. Also, because the available minerals will be distributed between those that will physically interact with dietary fiber and those to be transported, a rise in specific activity of the vectorial enzyme was stimulated to meet the challenge of competition for minerals. (AS)

0149

22729 FOMUNYAM, R.T.; ADEGBOLA, A.A.; OKE, O.L. 1981. Cassava-based diets for rabbits. In Terry, E.R.; Doku, E.V.; Arene, O.B.; Mahungu, N.M., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 2nd., Douala, Cameroon, 1983. Tropical root crops: production and uses in Africa; proceedings. Ottawa, Canada, International Development Research Centre. pp.114-116. En. Sum. En., 2 Ref. (Inst. of Animal Research, Mankon, Cameroon)

AFRICA; ANIMAL NUTRITION; CASSAVA FLOUR; CASSAVA PRODUCTS; CEREALS; COSTS; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING; MAIZE; METABOLISM; NIGERIA; PROCESSED PRODUCTS; STARCH CROPS.

Rabbits, New Zealand White and Californian breeds, fed maize- or cassava-based diets had comparable reproductive, growth, and carcass traits, although feed intake and av. daily gain were significantly (P less than 0.05) greater for rabbits fed the cassava-based diets. It was more profitable to raise rabbits on cassava-based diets than on maize-based diets. (AS)

0150

23500 FOMUNYAM, R.T.; ADEGBOLA, A.A.; OKE, O.L. 1981. The reproductive, growth and carcass traits of rabbits fed cassava-based diets supplemented with palm oil. Food Chemistry 14(4):263-272. En. Sum. En., 14 Ref. (Univ. of Ife, Dept. of Animal Science, Ile-Ife, Nigeria)

AFRICA; ANIMAL NUTRITION; CASSAVA PRODUCTS; DOMESTIC ANIMALS; DRIED ROOTS; FEEDS AND FEEDING; LEGUME CROPS; NIGERIA; PROCESSED PRODUCTS; USES.

Female rabbits of New Zealand White crosses (New Zealand x California) and Chinchilla crosses (Chinchilla x California), when fed a palm oil-supplemented cassava-based diet, with Stylosanthes guianensis as part of the dietary protein, had reproductive, growth, and carcass traits comparable with those of crosses fed a maize-based diet containing 8 percent fish meal. (AS)

0151

25520 LAW, A.T. 1981. Nutritional study of jelawat, Leptobarbus hoevenii (Bleeker), fed on pelleted feed. Aquaculture 41(3):227-233. En. Sum. En., 11 Ref., Il. (Faculty of Fisheries & Marine Science, Universiti Pertanian Malaysia, Serdang, Selangor, Malaysia)

ANIMAL NUTRITION; ASIA; FEED CONSTITUENTS; FEEDS AND FEEDING; MALAYSIA; PELLETS; SODIUM; STORAGE; USES; FISH.

The digestion coefficients of the nutrients in the ingredients used in formulating the diet (Malaysian Agricultural Research and Developing Institute-37 percent) for the culturing of jelawat were evaluated. Cr2O3 was used as an internal marker for the evaluation of

digestibility. Jelawat digested 100 percent of the protein, fat, carbohydrate, and gross energy in fish meal, but only 69.50 percent protein, 60.70 percent fat, 73.82 percent carbohydrate, and 59.30 percent gross energy in SBM. This fish digested copra cake meal, an agricultural by-product in Malaysia, better than SBM; the values were 75.39 percent protein, 98.36 percent fat, 50.03 percent carbohydrate, and 73.21 percent gross energy. Digestibility of maize, rice bran, and cassava was poor in this fish. There were no significant differences in the digestibility of DM, protein, fat, carbohydrate, ash, and gross energy of the reference diet in jelawat specimens whose total length was more than 12 cm; in fish less than 12 cm, digestibility was significantly lower. (AS)

0152

23710 MOHAMED, K.H.; MUTHU, M.S.; PILLAI, N.N.; ALI, S.A.; PANDIAN, S.K. 1981. A simplified hatchery technique for mass production of penaeid prawn seed using formula feed. Indian Journal of Fisheries 30(2):320-332. En. Sum. En., 13 Ref., Il. (Central Marine Fisheries Research Inst., P.B. No. 1912, Cochin-682 018, India)

ANIMAL NUTRITION; ASIA; FEEDS AND FEEDING; INDIA; USES; FISH.

A technique for large-scale production of penaeid prawn seed using a dry microparticulate formula feed, NPCL-17, is described. The details of preparing the feed from inexpensive, locally available raw materials such as groundnut oil cake, fish meal, dried mantis shrimp, prawn waste, and cassava and fortified with vitamins and minerals, are given. The larvae were grown in outdoor tanks filled with 2 m(3) of seawater, filtered through 60-micron mesh nylobolt cloth. The daily ration of formula feed was offered in 4 equal installments at 6-h intervals and the larval tanks were vigorously aerated. Apart from providing nutrition for the larvae, the feed, under the influence of sunlight, helped create a natural ecosystem conducive for their survival. The easy-to-dispense dry feed greatly simplified the larval rearing procedures and gave an av. survival rate of 66.7 percent from nauplius to postlarva. The rationale of the feeding schedules and the particle size of the feed offered are discussed in the light of the changes taking place in the functional morphology of the feeding appendages during larval development. (AS)

0153

23727 NAIR, K.S.S.; MATHEW, G. 1981. Dried tapioca tuber for laboratory rearing of the bamboo borer, Dinoderus minutus Fabr. (Coleoptera:Bostrychidae). Material und Organismen 19(1):49-54. En. Sum. En., De., Fr., Es., 12 Ref., Il. (Division of Entomology, Kerala Forest Research Inst., Peechi-680 653, Kerala, India)

ANIMAL NUTRITION; ASIA; CASSAVA CHIPS; CASSAVA PRODUCTS; DRIED ROOTS; ENTOMOLOGY; INDIA; PROCESSED PRODUCTS; USES.

Dried cassava root was found suitable for the lab. rearing of the bamboo borer Dinoderus minutus. Up to a 10-fold increase in the beetle population was obtained on this diet within 60 days. Cassava root is more suitable than reed or bamboo in which survival of the insect is known to be dependent on the starch content, and therefore unpredictable. In addition, it is easy to retrieve the insects from the comparatively soft cassava medium for exptl. studies. (AS)

0154

22328 OBIOHA, F.C.; OKEKE, G.C.; ONUA, E.C.; OBOEGBUNAM, S.I. 1981. The effect of varying protein and energy levels on the utilization of processed cassava peels by mice. Nutrition Reports International 28(3):531-545. En. Sum. En., 18 Ref. (Dept. of Animal Science, Univ. of Nigeria, Nsukka, Nigeria)

AFRICA; ANIMAL NUTRITION; COMPOSITION; CORTEX; COSTS; DRYING; ECONOMICS; FEEDS AND FEEDING; LABORATORY ANIMALS; NIGERIA; PROCESSING; SILAGE; SOLAR DRYING; USES.

Four levels of cassava peel meal (CPM)--0, 10, 20, and 40 percent--in either ensiled, sun-dried, or frozen form, were incorporated into 10 diets containing 19, 20, 21, or 22 percent protein and 3.1, 2.9, 2.7, or 2.3 mcal/kg ME, resp., and fed to growing mice, such that CPM levels increased with protein but decreased with energy levels. Feed intake was not depressed by CPM inclusion even at high levels; feed intake/g metabolic wt. was significantly enhanced at high CPM levels. However, gains and PER were maximized while liver fat was minimized by the maize control diet (P less than 0.05). Performance was influenced more by CPM levels than by mode of CPM processing. Increasing protein and amino acids and decreasing energy proved effective in moderating the effects of high CPM and HCN levels. Up to 40 percent CPM can be fed to mice preferably in ensiled or frozen form, with substantial savings in feed costs. (AS)

0155

28594 OKEKE, E.C.; OBIZOBA, I.C. 1986. The nutritive value of all-vegetable protein diets based on legume, cereal and tuber in weanling rats. Qualitas Plantarum Plant Foods for Human Nutrition 36(3):213-222. En. Sum. En., 7 Ref. (Dept. of Home Science & Nutrition, Univ. of Nigeria, Nsukka, Nigeria)

CASSAVA; FEEDS AND FEEDING; ANIMAL HEALTH; DIETS; LABORATORY ANIMALS; NUTRITIVE VALUE; ANIMAL PHYSIOLOGY; NIGERIA.

Thirty albino weanling male rats (45-55 g) were divided into 5 groups of 6 rats each on the basis of body wt. and fed combinations of dehulled brown beans, parboiled rice, and CM providing 10 percent protein for 35 days. Casein served as the reference protein. Combinations of dehulled brown beans (50-80 percent) with rice (18-48 percent) and CM (2 percent) produced varied effects on body wt., N intake, N digestibility and retention, BV, liver wt., and plasma albumin (P less than 0.05). The dehulled brown beans:rice:CM (70:28:2) blend induced decreases in all the parameters tested, except for the BV and PER values. The control group produced digested and retained N, PER, wt. gain, and liver wt. that were significantly higher than for those of the test diets (P less than 0.05). These results suggest that starchy foods when blended with legumes at low levels produced good quality protein comparable with casein. (AS)

0156

30801 RENUKARADHYA, K.M.; VARGHESE, T.J. 1986. Protein requirement of the carps, Catla catla (Hamilton) and Labeo rohita (Hamilton). Proceedings of the Indian Academy of Sciences 95(1):103-107. En. Sum. En., 15 Ref., Il. (Univ. of Agricultural Sciences, College of Fisheries, Mangalore 575002, India)

CASSAVA; FISH; USES; FEED CONSTITUENTS; ANIMAL NUTRITION; INDIA.

In order to determine the optimum protein requirement in the feeds for Catla catla and Labeo rohita, isocaloric pelleted feeds containing 20, 30, 40, and 45 percent protein were formulated using casein as the main source of protein; other ingredients were rice bran, groundnut oilmeal, cassava powder, cellulose, and minerals. Cassava powder was included at 28.70, 18.00, 6.70, and 0.78 percent, resp. The best growth of C. catla and L. rohita was observed when fed on feeds containing 30 percent protein and poorest when fed on the feed containing 45 percent protein. The results revealed that the protein requirement of both C. catla and L. rohita was around 30 percent. It also indicated that more than the optimum level of protein in feeds has an adverse effect on the growth of the species investigated. (AS)

0157

33720 SOCOLA, J.A.S. 1986. Breve estudio sobre el uso de harina de yuca para la elaboracion de alimento balanceado para camarones. (Brief study on the use of cassava flour for the elaboration of balanced feed for shrimp). Guayaquil, Ecuador, Instituto Nacional de Investigaciones Agropecuarias. 14p. Es. Estudio preparado para una Conferencia en el INIAP de Portoviejo.

CASSAVA; CASSAVA FLOUR; COMPOSITION; HCN CONTENT; TOXICITY; FEEDS AND FEEDING; SHRIMP; ECUADOR.

The chemical composition and the main nutritional characteristics of CF are analyzed from the viewpoint of its use in balanced rations for shrimp in coastal Ecuador. Cassava toxicity is considered and the advantages of the binding properties of CF are discussed. Parameters that should be considered in microbiological and physical evaluations of the by-product are indicated. To increase the percentage of CF in the balanced ration, further studies are required to determine HCN tolerance thresholds in this bioaquatic species. (CIAT)

0158

26840 THOMAS, M.M.; EASTERSON, D.C.V.; KATHIRVEL, M. 1984. Energy conversion in the prawn Metapenaeus dobsoni (Miers) fed on artificial feed. Indian Journal of Fisheries 31(2):309-312. En. Sum. En., 3 Ref. (Central Marine Fisheries Research Inst., Cochin, India)

CASSAVA; FISH; METAPENAEUS DOBSONI; DIETS; NUTRITIVE VALUE; ANIMAL PHYSIOLOGY; ENERGY PRODUCTIVITY; FEEDS AND FEEDING; ANIMAL HEALTH; INDIA.

Measured quantities of feed containing 33.33 percent (wt.) CF, 16.67 percent rice bran, 41.67 percent fish meal, and 8.33 percent mineral supplements (Starmin PS), made into pellets using agar-agar as binding agent, were fed to Metapenaeus dobsoni. Mean gross and net conversion (growth) efficiencies were 39.62 and 49.34 percent, resp. Av. assimilation efficiency was about 80.99 percent. (AS)

0159

30578 WEE, K.L.; NG, L.T. 1986. Use of cassava as an energy source in a pelleted feed for the tilapia, Oreochromis niloticus L. Aquaculture and Fisheries Management 17(2):129-138. En. Sum. En., 30 Ref., Il. (Asian Inst. of Technology, P.O. Box 2754, Bangkok 10501, Thailand)

CASSAVA; ROOTS; FISH; NUTRITIVE VALUE; FEEDS AND FEEDING; DIETARY VALUE; ANIMAL NUTRITION; THAILAND.

The nutritive value of cassava as an energy source in a pelleted tilapia diet was assessed. Four isonitrogeneous diets containing 15, 30, 45, and 60 percent cassava were formulated and fed to groups of Oreochromis niloticus for 10 wk. Good growth and food utilization efficiencies were obtained with all diets; there was a trend of improved growth and food utilization with increased cassava incorporation in the diet although there were no significant differences (P less than 0.05) in food conversion ratio, PER, or apparent NPU between the exptl. diets. No nutritionally related pathology was observed in fish fed high cassava levels. Increased incorporation of cassava led to an increase in the carcass fat content although it was within the acceptable limits for tilapia. Phytoplankton growth occurred in all exptl. tanks due to the fertilization effects of uneaten feeds and feces as the water within the exptl. tank system was not exchanged; the contribution of phytoplankton to the nutrition of the exptl. fish was not quantified but was considered to be min. since the phytoplankton biomass was approx. an order of magnitude less than in fertilized systems. (AS)

See also 0113 0224

STARCH

0160

32413 ALBINO, L.F.T.; FIALHO, E.T.; BLUME, E. 1986. Energia metabolizavel e composicao quimica de alguns alimentos para frangos de corte. (Metabolizable energy and chemical composition of some broiler feedstuffs). Revista da Sociedade Brasileira de Zootecnia 15(3):184-192. Pt. Sum. Pt., En., 20 Ref. (EMBRAPA, Centro Nacional de Pesquisa de Suinos e Aves, Caixa Postal D-3, 89.700 Concordia-SC, Brasil)

CASSAVA; CASSAVA STARCH; FEEDS AND FEEDING; POULTRY; COMPOSITION; FOOD ENERGY; DRY MATTER; PROTEIN CONTENT; FIBER CONTENT; MINERAL CONTENT; BRAZIL.

From Oct. to Nov. 1983, 16 feedstuffs utilized in broiler rations in Brazil were analyzed for chemical composition and energy value. Apparent ME, N-corrected ME (MEn), and DM apparently metabolizable (DMAM) were determined. A total of 540 Cobb Dourado chicks were reared in wire-floored starter batteries. A 18 x 2 factorially arranged randomized design (16 feedstuffs + 2 reference rations and 2 different ages of 21 and 42 days) was used with 3 replicates and 10 chicks/exptl. unit. Cassava starch was one of the feedstuffs analyzed. It presented 86.39, 0.67, 0.09, 0.15, and 0.08 percent DM, CP, ether extract, crude fiber, and minerals, resp.; GE was 3571 kcal/kg. Apparent ME and MEn (kcal/g) at 21 days were 4169 plus or minus 24 and 4156 plus or minus 28, resp., and at 42 days were 4114 plus or minus 73 and 4042 plus or minus 105, resp. The studied feedstuffs showed chemical composition and energy values different from those found in foreign literature. (CIAT)

0161

32088 PAJE, N.F.; RAYMUNDO, A.K.; DALMACIO, I.F.; SAKAI, H. 1986. Amylase activity of local strain of Streptococcus bovis on raw cassava starch. Philippine Journal of Science 115(2):129-138. En. Sum. En., 14 Ref., Il. (Inst. of Biological Sciences, UPLB College, Laguna 3720, Philippines)

CASSAVA; CASSAVA STARCH; ENZYMES; INDUSTRIAL MICROBIOLOGY; GLUCOSE; MALTOSE; HYDROLYSIS; ANALYSIS; PHILIPPINES.

The amylase activities of 51 bacterial isolates from bovine rumen were determined. The top 3 amylase-producing isolates were characterized and identified as Streptococcus bovis. Their activity and digesting ability on raw cassava starch were determined. The amylase of the highest producing isolate (no.17) was partially purified and greater hydrolytic activity than the enzyme from a known strain TUA 148 (55 vs. 24 percent) was observed. Main products (glucose, maltose, and maltotriose) observed after hydrolysis of raw cassava starch were identified by paper chromatography. Max activity was observed after 10 h of incubation with a final pH of 6.0; this also coincided with the peak of growth measured by optical density readings. (AS)

0162

35243 WOOD, J.F. 1987. The functional properties of feed raw materials and their effect on the production and quality of feed pellets. Animal Feed Science and Technology 18(1):1-17. En. Sum. En., 17 Ref., Il. (Tropical Development & Research Inst., 56-62 Grays Inn Road, London, Great Britain)

CASSAVA; PELLETS; PROCESSING; CASSAVA STARCH; COMPOSITION; FEEDS AND FEEDING; GREAT BRITAIN.

The functional properties of the protein and starch fractions of a model feed system had a greater effect on pellet quality (durability and hardness) of mixed pelleted feed than the method of conditioning. Max. pellet durability (93 percent) was obtained with mixtures containing raw soybean protein and pre-gelatinized cassava starch and min. durability with mixtures containing denatured soybean protein and native cassava starch. Improvements due to the inclusion of raw protein were greater than those from inclusion

of pre-gelatinized starch. Hardness and durability of pellets were related logarithmically. Specific output (kg/kWh) and output rate (kg/h) increased with increase in pre-gelatinized starch content, indicating a lubricating action by the pre-gelatinized starch during pellet compression. Implications of these findings on the known behavior of certain feed ingredients are discussed. (AS)

See also 0164

CASSAVA PROCESSING PRODUCTS

0163

24070 LONGE, O.G.; ADETOLA, J.A. 1983. Metabolisable energy values of some agricultural wastes and industrial by-products for layers and the effects of these ingredients on gut dimensions. Journal of Animal Production Research 3(1):1-13. En. Sum. En., 24 Ref. (Dept. of Animal Science, Univ. of Ibadan, Nigeria)

AFRICA; ASH CONTENT; COMPOSITION; CORTEX; DIETARY VALUE; DOMESTIC ANIMALS; DRY MATTER; FAT CONTENT; FEED CONSTITUENTS; FEEDS AND FEEDING; FIBER CONTENT; FOOD ENERGY; METABOLISM; NIGERIA; PLANT ANATOMY; POULTRY; PROTEIN CONTENT; ROOTS; USES; WASTE UTILIZATION.

A maize-based diet with or without 20 percent agricultural wastes and industrial by-products (cowpea shell, cassava starch residue, maize cob, sawdust, maize starch residue, cassava peel, brewer's grain, and palm kernel meal) were offered to 24-wk.-old layers for 8 wk. and their effects on gut dimensions measured at the end of the period. Approximate digestibility and ME values of the materials were also determined. ME values ranged between 0.382-2.332 kcal/g; ME values for cassava starch residue and cassava peel were 1.417 and 1.588 kcal/g, resp. All fibrous ingredients resulted in larger gut size, particularly the caeca, compared with the control. The duodenal fold was not affected. Effects exerted on gut size appear to depend on the nature of the fiber. (AS (extract))

0164

29445 LONGE, O.G. 1984. Effects of increasing the fibre content of a layer diet. British Poultry Science 25(2):187-193. En. Sum. En., 33 Ref. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

CASSAVA; DIETS; POULTRY; CORTEX; CASSAVA STARCH; FEEDS AND FEEDING; NUTRITIVE VALUE; ANIMAL NUTRITION; NIGERIA.

The fiber content of a basal diet fed to laying hens was increased from 149.2 to 218.6-292.3 g/kg by the inclusion of various fibrous farm wastes and by-products at 200 g/kg diet. The fibrous ingredients lowered the ME of the basal diet from 11.82 to 9.31-11.21 MJ/kg. Utilization (g food/kg egg) of the basal diet was not significantly different from values for diets containing maize cob, cassava (peel or starch), or maize starch residues. The diet containing maize cob supported a performance similar to that of the basal diet, despite a lower energy content (10.08 MJ/kg). Diets containing cowpea shell, cassava peel, or sawdust, with lower energy contents, and those containing maize starch residue, palm kernel meal, or dried brewers grains, with higher energy contents, were not as good. The diet containing cassava starch residue supported similar egg production to the basal but egg size was smaller. Inclusion of some of the fiber sources caused slight decreases in yolk cholesterol, although this could not be correlated with dietary fiber content. Additional dietary fiber caused slight increases in gizzard wt. but this was also not simply related to dietary fiber content. (AS)

0165

33748 NAIDU, M.M.; VENKATA KRISHNAN, R. 1987. Incorporation of thippi (tapioca by-product) in the rations of sheep. Livestock Adviser 12(1):30-32. En. Sum. En., 5 Ref. (College of Veterinary Sciences, Hyderabad-500 030, India)

CASSAVA; WASTE UTILIZATION; THIPPI; ANIMAL NUTRITION; SHEEP; FEED CONSTITUENTS; COMPOSITION; DIGESTIBILITY; ANIMAL PHYSIOLOGY; COSTS; INDIA.

The use of thippi, an industrial cassava waste by-product, to replace maize in rations for sheep was studied over a 5-mo. period using 25 Mandya lambs 4 mo. old. The control group was fed a concentrate mixture containing groundnut cake, maize, wheat bran, bone meal, salt, and molasses at 35, 25, 27, 2, 1, and 10 percent, resp. The exptl. feed contained groundnut cake, thippi, wheat bran, bone meal, and salt at 40, 20, 27, 2, and 1 percent, resp., in addition to Rovimix (vitamin A and D complex). Thippi contains 12.49 moisture, 5.77 total ash, 3.20 CP, 9.25 crude fiber, 0.47 ether extract, 68.82 N-free extract, 4.36 insoluble ash, 0.29 Ca, 0.27 P, and an energy value of 3.89 kcal/g. Daily feed intake records were maintained and wt. was recorded at weekly intervals. There was a significant difference in feed efficiency (11.28 and 13.56, resp.) and feed intake (814.50 and 887.32 kg, resp.) between the control and the exptl. diet. There were no significant differences in daily DM intake (3.13 and 3.27 kg), av. daily wt. gain (56.0 and 45.3 g), and DM digestibility (78.8 and 70.3 percent). Resp. values for digestible CP were 19.82 and 19.45, for total digestible nutrients 70.82 and 62.14, and for nutritive ratio 1:2.57 and 1:2.19. Although the cost of feed/unit of wt. gain is slightly higher in the exptl. group, thippi can replace maize in sheep rations if the use of maize for human consumption is taken into consideration. (CIAT)

0166

27642 OBIOHA, F.C.; UJOH, S.C.; OKORO, E.O.; OZIGBU, D. 1985. The complete substitution of cassava peel meal for maize in pig grower-finisher rations. Nutrition Reports International 31(1):35-41. En. Sum. En., 8 Ref. (Dept. of Animal Science, Univ. of Nigeria, Nsukka, Nigeria)

CASSAVA; ANIMAL NUTRITION; FEEDS AND FEEDING; CASSAVA PEEL MEAL; DIETS; SWINE; LABORATORY ANIMALS; MAIZE; HCN CONTENT; SUBSTITUTES; NIGERIA.

Five isocaloric and isonitrogenous pig grower-finisher diets, in which maize was progressively replaced by processed cassava peel (CPM) from 60 to 0 percent of the whole diet, were fed to 30 pigs averaging 22.50 plus or minus 3.82 kg until slaughter wt. of 38.80 plus or minus 7.44 kg. There was a progressive decline in av. daily gain, feed efficiency, and PER from the zero CPM ration to the zero maize ration, but these comparisons were not significant. The control ration was, however, inferior to the zero maize ration in dressing percentage and back fat thickness. Percent liver wt., heart wt., and spleen wt. were slightly higher in the CPM diets than in the control diet. (AS)

0167

28342 OKEKE, G.C.; OJI, U.I.; UBA, F.N. 1986. Maize replacement values of cassava peels in the diet of growing rabbits. Beitrage zur Tropischen Landwirtschaft und Veterinarmedizin 24(2):221-226. En. Sum. En., De., Ru., Fr., Es., 8 Ref. (Dept. of Animal Science, Faculty of Agriculture, Univ. of Nigeria, Nsukka, Anambra State, Nigeria)

CASSAVA; CORTEX; RABBITS; FEEDS AND FEEDING; USES; HCN CONTENT; DETOXIFICATION PROCESSES; DRYING; SILAGE; DIETARY VALUE; ANIMAL NUTRITION; NIGERIA.

In a feeding expt. with 48 growing New Zealand rabbits carried out for 56 days, maize was replaced by 15, 30, and 45 percent cassava peel meal. The addition of up to 30 per-

cent meal from ensiled peels or 15 percent from sun-dried peels gave live wt. gains similar to those of the control group. From 30 percent on, sun-dried peel meal affected the feed uptake, and serum SCN content increased. Kidney wt., liver wt., and liver fat were also affected. Sun-dried cassava peel meal can be included up to 15 percent and ensiled cassava peel meal up to 30 percent in the feed ration, provided that the diet is sufficiently fortified with met. or fish meal. (AS)

0168

34258 OLUBAJO, F.O.; OGUNYEYE, J.A. 1983. Utilization of poor quality grass hay, ensiled cattle waste-hay with and without cassava peels by West African dwarf sheep. In World Conference on Animal Production, 5th, Tokyo, Japan, 1983. New strategies for improving animal production for human welfare: proceedings. Tokyo, Japanese Society of Zootechnical Science. v.2,pp.399-400. En. Sum. En., 11 Ref. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

CASSAVA; CORTEX; USES; ANIMAL NUTRITION; SHEEP; DIETS; SILAGE; ANIMAL PHYSIOLOGY; NUTRITIVE VALUE; DIGESTIBILITY; NIGERIA.

Four West African dwarf rams with a mean live wt. of 23.0 plus 4.0 kg were used in 3 separate digestibility trials to evaluate the utilization of poor quality Cynodon nlemfuensis var. nlemfuensis hay (control) and of hay (control) ensiled with cattle fecal waste (silage 1) and of hay-cattle waste-cassava peels (silage 2). Results indicated that, on the metabolic wt. basis, the mean intake of DM, OM, CP, GE, digestible energy, or ME from either silage by sheep was significantly (P less than 0.001) higher than for the control. More CP, GE, digestible energy, or ME (P less than 0.05) was ingested from silage 2 than from silage 1. The DM, CP, or GE in the silages was digested to a greater extent (P less than 0.05) than the control; however, more N was excreted (P less than 0.01) by sheep from the ingested silages. N retention for silage 1 was negative (P less than 0.05) in contrast to similar positive N retention (P greater than 0.05) by sheep when fed either the control or silage 2. (AS)

0169

21471 OMOLE, T.A.; ONWUDIKE, O.O. 1981. Efecto del aceite de palma sobre el uso de harina de cascara de yuca para conejos. (The effect of palm oil on the use of cassava peel meal by rabbits). Produccion Animal Tropical 8(1):30-37. Es. Sum. Es., 9 Ref. (Dept. of Animal Science, Univ. of Ife, Ile-Ife, Nigeria)

AFRICA; ANIMAL NUTRITION; CASSAVA MEAL; CASSAVA PRODUCTS; CORTEX; CYANIDES; CYANOGEN; DETOXIFICATION; FEED CONSTITUENTS; FEEDS AND FEEDING; METABOLISM; NIGERIA; PLANT ANATOMY; PROCESSED PRODUCTS; ROOTS; USES.

Two studies were carried out to determine the effect of palm oil on the use of cassava peel meal by rabbits. Without palm oil there was a significant reduction in the rate of gain of rabbits when cassava peel exceeded 30 percent of the diet. With palm oil supplements the drops in rate of gain and feed efficiency with increasing levels of cassava peel were less than with the unsupplemented diets. Without palm oil, feed intake dropped significantly with more than 40 percent of cassava peel; with the supplemented diets, feed intake was not significantly affected even with up to 50 per cent of cassava peel. With palm oil supplements, serum thiocyanate remained about the same for rabbits given 0-50 percent of cassava peel, while there was a significant increase in urine thiocyanate. With the unsupplemented diet the reverse was the case. Since urine is a pathway of excretion, it would appear that palm oil supplements allowed a higher rate of removal of cyanide from the body than when no palm oil was given. (AS)

0170

26890 RAJANGAM, R.K.; VENKATAKRISHNAN, R. 1985. Metabolizable energy of thippi for poultry. Cheiron 14(5):278-279. En. 4 Ref. (Dept. of Animal Nutrition, Madras Veterinary College, Madras 600 007, India)

CASSAVA; WASTE UTILIZATION; FEEDS AND FEEDING; POULTRY; FOOD ENERGY; ANIMAL NUTRITION; INDIA.

The ME value of thippi, a by-product of the cassava starch industry, was biologically assayed employing growing chicks and was found to be 120 kcal/g DM. (CIAT)

0171

29474 TAKAHASHI, M. 1987. Aproveitamento da manipueira e de residuos do processamento. (Utilization of cassareep and cassava processing wastes). Informe Agropecuario 13(145):83-87. Pt. 14 Ref., Il. (Depto. Tecnologia dos Produtos Agropecuarios, Faculdade de Ciencias Agronomicas/UNESP, 18.600 Botucatu-SP, Brasil)

CASSAVA; WASTE UTILIZATION; CASSAREEP; SOIL AMENDMENT; HERBICIDES; NEMATODES; BIOMASS PRODUCTION; INDUSTRIALIZATION; TECHNOLOGICAL PACKAGE; BRAZIL.

The uses of cassareep or waste water and other cassava processing wastes (peels and cassava mass or coarse meal) are reviewed. Peels can be incorporated into the soil as a source of OM or used as animal feed. Cassava mass can also be used in animal feeding due to its high starch content. Waste water has been tested as a source of OM for soil applications, as a nematicide and herbicide, and as a source for biomass production. The treatments of waste water are described; these include the use of sedimentation and filtration tanks, forced-air tanks and stabilization lakes, and anaerobic treatments with biodigesters. (CIAT)

0172

24056 TEWE, O.O. 1981. Cyanogenic glucoside, protein interaction in cassava peel based rations: effect on some haematological parameters in growing pigs. Nutrition Reports International 30(2):425-431. En. Sum. En., 10 Ref. (Nutritional Biochemistry Division, Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

AFRICA; ANALYSIS; ANIMAL NUTRITION; ANIMAL PHYSIOLOGY; CIAT-2; COMPOSITION; CORTEX; DOMESTIC ANIMALS; DRYING; HCN CONTENT; METABOLISM; NIGERIA; PHYSIOLOGY; PLANT ANATOMY; PROCESSING; PROTEINS; ROOTS; SOLAR DRYING; STATISTICAL ANALYSIS; SWINE; USES.

For 90 days 64 Large White x Landrace weanling pigs were given, in a 2 x 4 factorial design, diets without or with 40 percent cassava peel and 20, 15, 10, or 5 percent protein. The cassava peel contained 280.6 ppm total HCN. There were highly significant decreases in most hematological values except monocyte and red cell counts in pigs given diets low in protein. Pigs given cassava peel had increased lymphocyte count and decreased neutrophil and total white blood cell counts. Interaction of cassava peel and protein deficiency decreased white blood cell count. (Nutrition Abstracts and Reviews)

0173

22037 TEWE, O.O.; OKE, O.L. 1981. Performance, carcass characteristics and economy of production of growing pigs on varying dietary cassava peel levels. Nutrition Reports International 28(2):235-243. En. Sum. En., 10 Ref. (Dept. of Animal Science, Univ. of Ibadan, Nigeria)

AFRICA; ANIMAL NUTRITION; COMPOSITION; CORTEX; COSTS; DOMESTIC ANIMALS; ECONOMICS; FEED CONSTITUENTS; FEEDS AND FEEDING; HCN CONTENT; NIGERIA; SWINE; USES.

Twenty-four pigs were divided into 4 groups of 6 animals each, and fed 4 diets formulated to contain 20 percent protein and different levels of cassava peels, 0, 10, 20, and 30 percent in diets 1-4, resp. The cassava peel contained 280.6 ppm HCN. Feed intake increased with higher dietary cassava peel level while body wt. gain was highest (P less than 0.05) on diet 1 and least on diet 2. Feed efficiency and protein efficiency ratios were poorer on diets containing cassava peel. Significant differences (P less than 0.05) were obtained in dressing percent, carcass length, trimmed fat, dissected fat, and belly wt. Pigs on 20 and 30 percent cassava peel-based rations produced leaner carcasses than others. The profit margin was highest on the 20 percent cassava peel ration. (AS)

0174

32217 TEWE, O.O. 1987. Cassava peel utilization in poultry diets. In Terry, E.R.; Akoroda, M.O.; Arene, O.B., eds. Triennial Symposium of the International Society for Tropical Root Crops-Africa Branch, 3rd, Owerri, Nigeria, 1986. Tropical root crops; root crops and the African food crisis: proceedings. Ottawa, Canada, International Development Research Centre. pp.150-151. En. Sum. En., 10 Ref. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

CASSAVA; CORTEX; WASTE UTILIZATION; POULTRY; ANIMAL NUTRITION; ANIMAL PHYSIOLOGY; EGGS; NIGERIA.

Three trials with broilers and layers assessed their performance on diets based on cassava peels. In trial 1, diets contained 0, 7.5, 15.0, 22.5, and 30.0 percent cassava peels as a replacement for maize for broilers. Cassava peel increased feed intake, reduced body wt. gain, and reduced nutrient utilization. In trial 2, diets containing 0, 7.5, 15.0, and 22.5 percent cassava peel with or without food energy (palm oil) or protein supplementation were fed to broilers. Nutrient supplementation of the cassava peel diets did not greatly affect the biological performance of the birds. In trial 3, the inclusion of up to 27 percent cassava peels in the diet of layers at the expense of maize gave satisfactory feed intake, egg production, and feed/unit egg produced. In each trial, the economy of feed conversion was better on the cassava peel diets than on the maize control diet. (AS)

See also 0052 0130 0154 0231 0235 0238 0239

FERMENTED CASSAVA AND SINGLE CELL PROTEIN

0175

29457 FOMUNYAM, R.T.; ADEGBOLA, A.A.; OKE, O.L. 1984. The stability of cyanohydrins. Food Chemistry 17(3):221-225. En. 8 Ref., Il. (Dept. of Animal Science, Univ. of Ife, Ile-Ife, Nigeria)

CASSAVA; CYANOGENIC GLUCOSIDES; TOXICITY; FERMENTATION; HUMAN NUTRITION; ANIMAL NUTRITON; PROCESSED PRODUCTS; NIGERIA.

Acetone cyanohydrin, a product of the hydrolysis of the cyanogenic glucoside linamarin found in cassava, and mandelonitrile were synthesized to investigate their stability at pH 2-9, with and without palm oil. Mandelonitrile hydrolysis was low (10-20 percent) at pH 4 and 5, and high (55-80 percent) as pH values increased from 7 to 9. Acetone cyanohydrin hydrolysis was very low (5-15 percent) at pH 3-7, and followed the same pattern as that for mandelonitrile at pH 9, being irregular and difficult to explain at pH 8. Neither compound hydrolyzed in palm oil, and hydrolysis in palm oil/buffer mixture was lower than in buffer alone. The implications of these results are discussed in terms of reactivity in the digestive tract. The stability of these products at low pH values and their extreme solubility in water can be used effectively in the processing of cassava by

employing several water changes during fermentation. Also, using palm oil for frying cassava may remove residual cyanohydrins and make cassava products safer for consumption. (CIAT)

0176

29318 MSABAHA, M.A.M. 1982. Review of national root and tuber crops improvement. Tanzania, Tanzania Agricultural Research Organization. 6p. En. 11 Ref.

CASSAVA; CASSAVA AFRICAN MOSAIC VIRUS; CULTIVARS; MONONYCHELLUS TANAJOA; PRODUCTION; INTERCROPPING; POULTRY; FEEDS AND FEEDING; TANZANIA.

Highlights of research on potato, cassava, and sweet potato in Tanzania are reviewed. The program continued pursuing a cassava var. with resistance to CAMD, one of the major cassava production constraints in the country. Local cassava var. Mzimbitala, Kanyanzige, Njema, Kongolo, and Dalama were selected for resistance to Mononychellus tanajoa, but were poor in root yield, susceptible to CAMD, or showed poor flowering. In Ukiriguru, cassava should be planted in Nov.-Dec. at 0.75 x 1.50 m spacing; 4 weedings at monthly intervals, beginning the 1st mo., are recommended. Cassava/maize and cassava/groundnut intercrops showed favorable improved root yield and gross economic returns. Higher wt. gains and food conversion efficiency was obtained in broilers when fed with a meal containing cassava roots fermented in water for 7 days, which reduced HCN content. Recommendations on future research are given. (CIAT)

See also 0008 0057 0067

CASSAVA LEAVES AND FORAGE

GENERAL

0177

29369 ALMEIDA, E.X. DE; SALERNO, A.R.; MENDONCA, R.; TERNES, M. 1987. Parte aerea da mandioca na alimentacao animal. (Cassava aerial parts for animal feeding). Florianopolis-SC, Brasil, Empresa Catarinense de Pesquisa Agropecuaria. Pesquisa em Andamento no.75. 4p. Pt. 3 Ref., Il. (EMPASC-Estacao Experimental de Ituporanga, Caixa Postal 98, 88.400 Ituporanga-SC, Brasil)

CASSAVA; FEEDS AND FEEDING; CULTIVARS; DRY MATTER; TIMING; CUTTINGS; DIGESTIBILITY; PRODUCTIVITY; FORAGE; BRAZIL.

An expt. was conducted in Ituporanga exptl. Station of the Empresa Catarinense de Pesquisa Agropecuaria (Brazil) to study the effect of 2 cutting heights (10 cm from the ground and at the 1st branching) during 2 cycles on the quality of the aerial part of cassava cv. Mico for potential use in animal feeding. Trials were carried out during 4 different seasons of the year: Feb. 1986-Jan. 1987, March 1986-Feb. 1987, April 1986-March 1987, and May 1986-April 1987; cassava was planted on Nov. 2, 1985. Results are only available for the 1986 cropping cycle and show that DM contents of aerial parts were 18.0, 20.3, 24.9, and 24.0 percent for Feb., March, April, and May, resp. DM production/ha increased with later cuttings and when carried out at 10 cm height, but CP and digestibility decreased. Based on these results and taking into account that effects on root yields have not been measured yet, the best cutting treatment for increased productivity levels and forage quality is that applied during the 1st days of March and at 1st branching height. (CIAT)

0178

30477 CARVALHO, V.D. DE; PAULA, M.B. DE; STEINER, E.; JUSTE JUNIOR, G. 1985. Efeito da epoca de colheita no rendimento e composicao quimica de fenos da parte

aerea de dez cultivares de mandioca. (Effect of harvesting time on yield and chemical composition of hay from the aerial part of ten cassava cultivars). Revista Brasileira de Mandioca 4(1):43-59. Pt. Sum. Pt., En., 11 Ref. (Empresa de Pesquisa Agropecuaria de Minas Gerais, Caixa Postal 176, Lavras-MG, Brasil)

CASSAVA; CULTIVARS; HARVESTING; TIMING; PRODUCTIVITY; FOLIAGE; FORAGE; STARCH PRODUCTIVITY; PROTEIN CONTENT; FIBER CONTENT; WATER CONTENT; BRAZIL.

To select optimum harvesting time and cv. for hay production, the productivity of the upper 3rd and the lower 2/3 of the aerial part of cassava was determined as well as the hay production and chemical composition of 10 different cv. harvested 8, 12, 16, 20, and 22 mo. after planting. The cv. showed the highest yields of high-protein hay at 12 and 16 mo. after planting. Cv. Engana Ladrao and Guaxupe, at 12 mo. after planting, and Engana Ladrao, Guaxupe, Iracema, and IAC 1418, at 16 mo. after planting, were considered the best. The use of the lower 2/3 of the aerial part was best at 20 mo. after planting. At this time, the cv. showed high hay yields, with higher protein and starch contents and lower fiber contents. Cv. Riqueza, Engana Ladrao, and Iracema were selected as the best cv. for hay production; cv. Iracema could also be used as a source of starch due to high starch productivity and content. (AS)

0179

30849 CARVALHO, V.D. DE; PAULA, M.B. DE; JUSTE JUNIOR, E.S.G.; KATO, M. DO S.A. 1986. Caracteristicas nutritivas de fenos do terco superior e das folhas de cultivares de mandioca. (Nutritional characteristics of hay made from the upper third and from the leaves of cassava cultivars). Revista Brasileira de Mandioca 5(1):63-70. Pt. Sum. Pt., En., 13 Ref. (Empresa de Pesquisa Agropecuaria de Minas Gerais, Caixa Postal 176, 37.200 Lavras-MG, Brasil)

CASSAVA; USES; FOLIAGE; FORAGE; VITAMIN CONTENT; MINERAL CONTENT; PROTEIN CONTENT; BRAZIL.

Ten cassava cv. (Sonora, Branca de Santa Catarina, Mantiqueira, Mico, Engana Ladrao, IAC-1418, Guaxupe, Riqueza, Iracema, and IAC-12829) were assessed for the nutritional characteristics of leaves and the upper 3rd of the canopy for hay production. Aerial parts of 12-mo.-old plants were collected, and the total vitamin C, beta-carotene, protein, Ca, P, and Fe contents were determined. The hay from leaves had higher protein, total vitamin C, beta-carotene, and P contents, while that from the upper 3rd of the canopy had higher Ca and Fe contents. The mineral and vitamin composition of hay from leaves and the upper 3rd of the canopy differed among the different cv.; the hays were considered as one of the best vegetable sources of vitamin C, beta-carotene, and minerals (Ca, Fe, and P). (AS)

0180

29464 CARVALHO, V.D. DE; KATO, M. DO S.A. 1987. Potencial de utilizacao da parte aerea da mandioca. (Potential utilization of the aerial part of cassava). Informe Agropecuario 13(145):23-28. Pt. 19 Ref. (EPAMIG, Caixa Postal 176, 37.200 Lavras-MG, Brasil)

CASSAVA; ANIMAL NUTRITION; CULTIVARS; USES; COMPOSITION; LEAVES; PROTEIN CONTENT; STARCH CONTENT; HARVESTING; TIMING; BRAZIL.

Aspects of the potential utilization of the aerial part of the cassava plant for human and animal nutrition are reviewed. The physical and chemical characteristics of the aerial part of cassava and the effect of var. on its chemical composition are discussed. In general, the upper 3rd of the plant and the leaves produce high-protein hays (20.00 and 24.98-31.90 percent, resp.), and the lower 2/3 produce high-starch hays. The effect of harvesting age and other factors (pests, diseases, and nutritional deficiencies) on the chemical composi-

tion of the aerial part of the cassava plant are also discussed briefly. To obtain high-protein hays from the aerial part of cassava, the upper 3rd of the plant is best and should be harvested 12-16 mo. after planting. (CIAT)

0181

29467 CHAVES, J.G. 1987. Extrato proteico das folhas de mandioca. (Protein extract from cassava leaves). Informe Agropecuario 13(145):47-52. Pt. 21 Ref., Il. (CETEC, Caixa Postal 2306, Av. Jose Candido da Silveira, 2000, Horto, 31.170 Belo Horizonte-MG, Brasil)

CASSAVA; LEAVES; PROTEIN CONTENT; HUMAN NUTRITION; ANIMAL NUTRITION; TIMING; NUTRITIVE VALUE; COMPOSITION; ANALYSIS; TECHNOLOGY TRANSFER; PLANT ANATOMY; BRAZIL.

The extraction of the protein fraction of cassava leaves for use as a low-fiber protein concentrate for human and animal nutrition is reviewed. The chemical composition of the aerial part of the cassava plant, as influenced by harvesting season, and of different parts of the plant is discussed. The general process of protein extraction from cassava leaves is described, and the nutritional value of the protein extract is discussed in terms of amino acid composition and results of biological tests. The stages (maceration, extraction of a raw juice, filtration, anaerobic fermentation, concentrate separation, and drying) and the equipment required to extract the protein fraction at the farm level are described. (CIAT)

0182

33646 ESCALANTE D., J.A. 1982. Evaluacion de tres cultivares de yuca (Manihot esculenta Crantz) con fines forrajeros. (Evaluation of three cassava cultivars for forage production). Tesis Ing.Agr. Maracay, Universidad Central de Venezuela. 94p. Es. Sum. Es., 33 Ref., Il.

CASSAVA; FOLIAGE; PRODUCTIVITY; NUTRITIVE VALUE; FERTILIZERS; N; P; K; HARVESTING; TIMING; ANALYSIS; LEAVES; BRANCHES; PETIOLES; COMPOSITION; PROTEIN CONTENT; CELLULOSE; HCN CONTENT; CULTIVARS; VENEZUELA.

In Experta (Maracay, Venezuela) a preliminary forage evaluation trial was performed with 3 cassava cv. (UVC-2203, UCV-2353, and UCV-2365) to determine the effect of different fertilization levels and cutting ages on the yields and nutritive value of the foliage. Plants were spaced at 1 x 1 m (10,000 plants/ha). Twenty days after planting, 3 levels of N were applied (0, 150, and 250 kg/ha/yr) and 100 kg P and K/ha/yr for the last 2 levels. Harvests took place at 90, 120, and 150 days, cutting at an approx. height of 20 cm from the ground. The laminae, petioles, and branches/stems were then separated to measure total and plant part yields. Representative samples of the treatments were taken for chemical and biological analyses. The rate of regrowth was observed after each cutting. Cassava leaves were rich in proteins (22-25 percent), had low cell wall values (23-25 percent), and good in vitro digestibility (50-56 percent). Fertilization apparently had no effect on the chemical composition of cassava foliage but affected its development and yield, especially in cv. UCV-2203. Although cutting age affected foliage yields and chemical composition, it had very little effect on regrowth. The highest production of foliage (green and dry) and proteins was observed at 150 days. Cv. UCV-2203 had the highest yields (1653.3 kg DM/ha) and cv. UCV-2203 and UCV-2365 showed the best establishment ability (growth and regrowth); cv. UCV-2203 was the most resistant to drought. The first cutting should be done between 90 and 120 days when foliage quality is superior. Leaf contents of tannins, lignin, and cellulose are less during this period than at 150 days; this allows 3-4 cuttings to be performed each year at 3- to 4-mo. intervals. (AS-CIAT)

0183

32202 FURTADO, M.J. 1987. Producao de forragem em seis cultivares de mandioca (Manihot esculenta Crantz), no Estado do Espirito Santo. (Forage production of six cassava cultivars in the state of Espirito Santo). Tese Mestrado. Lavras-MG, Brasil, Escola Superior de Agricultura de Lavras. 80p. Pt. Sum. Pt., En., 62 Ref., Il.

CASSAVA; FORAGE; PRODUCTIVITY; ROOT PRODUCTIVITY; CULTIVARS; PRUNING; HARVESTING; TIMING; DRY MATTER; PROTEIN CONTENT; PLANTING; SPACING; PLANT HEIGHT; STEMS; LEAVES; CANOPY; CARBOHYDRATE CONTENT; STARCH CONTENT; HARVEST INDEX; BRAZIL.

The forage production of cassava cv. Sao Pedro Mirim, Cacau Branco, Pao do Chile, Vassourinha, Bahia Rosa, and Chagas was studied from Nov. 1984 to May 1986 in Cachoeiro de Itapemirim (Espirito Santo, Brazil). The effects of pruning the green parts at 4 mo. of age and the harvest age (12 and 18 mo. after planting) on forage and root yields were assessed. A randomized block design in a 6 x 2 x 2 factorial was used with 24 treatments and 4 replications. Planting distances between rows and between plants were 0.80 and 0.50 m, resp. By the time of pruning, the av. production was 25.36 t forage/ha, with 19.70 percent DM (17.92 percent soluble carbohydrates and 12.60 percent CP); the performance of cv. Pao do Chile was outstanding. The technique of pruning did not affect root production of plants harvested 12 mo. after planting but reduced root yield and starch content by 37.5 and 3.6 percent, resp., in plants harvested at 18 mo. after planting. (AS)

0184

30817 GIBSON, T. 1987. Northeast Thailand. A ley farming system using dairy cattle in the infertile uplands. World Animal Review no.61:36-43. En. 18 Ref., Il. (Dept. of Agriculture, Univ. of Queensland, St. Lucia, Qld. 4067, Australia)

CASSAVA; CULTIVATION SYSTEMS; ROTATIONAL CROPS; MACROPTILIUM; STYLOSANTHES; FERTILIZERS; P; S; K; DAIRY CATTLE; FEEDS AND FEEDING; SOCIOECONOMIC ASPECTS; PRODUCTIVITY; THAILAND.

The results of a pilot ley farming extension project using dairy cattle in the infertile uplands of NE Thailand over a 5-yr period are discussed. Cassava, one of the few crops that can be grown in these upland infertile soils, was found to yield more when planted after a ley crop such as Macroptilium atropurpureum cv. Siratro or Stylosanthes hamata cv. Verano fertilized with P, S, and K. Cassava yields in 1984 after unfertilized and fertilized rotational schemes in 1980, 1981, and 1982 were 7.0 and 7.1 t/ha, resp., for cassava/cassava/cassava; 5.3 and 8.3 t/ha, resp., for cassava/Siratro/Siratro (grazed legume); 7.7 and 10.5 t/ha, resp., for cassava/Siratro/Siratro but the 2nd Siratro pasture was mown; and 9.3 and 12.9 t/ha, resp., for cassava/Siratro/Siratro but both legume pastures mown. In 1982 in 1-yr ley treatments (1980 and 1981), the cassava/cassava rotations with and without fertilization yielded 13 and 11 t/ha, resp., while the Siratro/cassava rotations yielded 28 and 17 t/ha, resp. Cassava yields in 1983 and 1984 were further reduced to 9.1 and 4.4 t/ha, resp., with fertilization in 1980-81, and to 10.1 and 4.2 t/ha, resp., with no fertilization in continuous cropping systems. Low-cost milk production was considered feasible in Thailand on legume pastures and farm-grown feed, such as cassava. (CIAT)

0185

21465 HERRERA F., E. 1981. Efecto de tres distancias de siembra y tres alturas de corte en yuca (Manihot esculenta Crantz) para la produccion de materia seca y proteina. (The effect of three planting distances and three cutting heights in cassava on dry matter and protein production). Tesis Ing.Agr. Guatemala, Universidad de San Carlos de Guatemala. 26p. Es. Sum. Es., 14 Ref.

CENTRAL AMERICA; COMPOSITION; CULTIVATION; DRY MATTER; FEEDS AND FEEDING; FORAGE; GUATEMALA; HARVESTING; PLANT HEIGHT; PLANTING; PRODUCTIVITY; PROTEIN CONTENT; SPACING; USES.

Annual DM and crude protein yield of cassava was evaluated using 3 distances in square planting (0.3, 0.6, and 0.9 m) and 3 cutting heights (1.0, 1.4, and 1.8 m) on a Tiquisate soil in the tropical dry zone of Guatemala. A randomized split plot design was used with 9 treatments and 4 replications. Weed control was done by hoeing in all treatments. At planting 50 kg 46-0-0 were incorporated per hectare. Optimum planting distance was 0.3 X 0.3 m, regardless of cutting height. (AS-CIAT)

0186

33895 PAREDES C., R.M. 1988. Procedimiento para la obtencion de harina a base de hojas y tallos de la Manihot esculenta, Grantz (yuca). (Procedure for obtaining meal from cassava leaves and stems). Agro Enfoque 3(19):39-40. Es. Il.

CASSAVA; CASSAVA LEAF MEAL; COMPOSITION; PROTEIN CONTENT; FAT CONTENT; FIBER CONTENT; ASH CONTENT; FEEDS AND FEEDING; CATTLE; POULTRY; PERU.

The protein content of cassava leaves and stems was determined to assess its use in human and animal feeding as well as its industrial application. Samples were processed as meal, which was analyzed for protein, fat, fiber, ash, N-free extract, and carotenes. Drying and milling characteristics for meal production and its uses are indicated. Results of expt. with cattle and fryers indicate that this crop has a high industrializing potential in Peru. (CIAT)

0187

32091 RAVINDRAN, V.; KORNEGAY, E.T.; RAJAGURU, A.S.B. 1987. Influence of processing methods and storage time on the cyanide potential of cassava leaf meal. Animal Feed Science and Technology 17(4):227-234. En. Sum. En., 16 Ref. (Dept. of Animal Science, Univ. of Peradeniya, Sri Lanka)

CASSAVA; CASSAVA LEAF MEAL; LEAVES; PROTEIN CONTENT; HCN CONTENT; DETOXIFICATION PROCESSES; DRYING; STORAGE; ANIMAL NUTRITION; SRI LANKA.

The effects of 3 processing methods (drying, chopping, and wilting), their combinations, and the storage time on the HCN potential (NCHp) and the CP content of CLM were evaluated at the U. of Peradeniya, Sri Lanka. Limited observations were also made on the effects of processing treatments on the tannin content of CLM. Fresh cassava leaves contained an av. of 1436 mg HCNp/kg DM and simple drying (sun or oven) eliminated almost 90 percent of the HCNp. A combination of chopping and 3-day wilting before drying proved most effective, lowering the cyanide potential of the final product to about 55 mg/kg DM. The processing treatments had little effect on the CP and tannin contents of CLM. The HCNp and CP content of CLM declined by 58.2 and 10.6 percent, resp., during an 8-mo. postprocessing storage. The results demonstrate that low-cyanide CLM, which is safer for use as an animal feed, could be produced using simple processing methods. (AS)

0188

26697 TERGAS, L.E.; URREA, G.A. 1985. Seleccion de especies forrajeras para corte adaptadas a suelos acidos de baja fertilidad en un Ultisol de Colombia. (Selection of forage species for cutting adapted to low fertility acid soils in an Ultisol of Colombia). Turrialba 35(2):179-186. Es. Sum. Es., En., 32 Ref., Il.

CASSAVA; FORAGE; ADAPTATION; SOIL FERTILITY; PH; FERTILIZATION; DRY MATTER; N; P; K; ECOLOGY; COLOMBIA.

The following fertilizer treatments were applied to Pennisetum purpureum cv. H504, Saccharum officinarum cv. Poj, Axonopus scoparius cv. Comun, Leucaena leucocephala cv. Cunningham, Cajanus cajan cv. Comun, and Manihot esculenta cv. M Col 22: (a) no fertilizer, (b) 150 kg dolomitic lime + 100 kg N + 44 kg P/ha, or (c) 2 t dolomitic lime + 200 kg N + 88 kg P + 42 kg K/ha + S, B, and Cu. Cuts were performed every 8 wk. during the dry season and every 6 wk. during the rainy season. The fertilizer increased the av. rate of DM production by 41-54 and 67-77 percent in treatments b and c, resp. The interaction with the species was significant. Although C. cajan and M. esculenta adapted well to the soil conditions, they were not persistent with the cropping system utilized. (CIAT)

See also 0035 0232

POULTRY

0189

19522 AGUDELO T., J.C.; BENEDETTI M., R.J. 1981. Utilizacion de la harina de hoja de yuca como fuente parcial de proteina. (Cassava leaf meal utilization as a partial source of proteins). Tesis Med.Vet.Zoot. Monteria, Colombia, Universidad de Cordoba. Es. Sum. Es., 13 Ref., Il.

ANIMAL NUTRITION; CASSAVA LEAVES (VEGETABLE); COLOMBIA; DOMESTIC ANIMALS; DRYING; FEEDS AND FEEDING; POULTRY; PROCESSING; SOLAR DRYING; SOUTH AMERICA; USES.

The effect of using CLM at levels of 0 (check), 7.5, 11, and 15 percent in starter and finishing diets for chickens (1-42 and 45-56 days, resp.) was studied. There was no significant difference in the av. wt. of the animals during both phases; however, the highest av. wt. were obtained with the diet containing 7.5 percent CLM. A significant difference in wt. gain/animal/day was observed during the starter phase. Av. consumption/animal did not show significant differences. Data suggest that age improves the use of CLM since the excess fiber may affect younger chickens. It was also observed that CLM favored chicken pigmentation. (CIAT)

0190

29524 AGUILERA S., R.C.; ARROYO L., A.; LOPEZ, J.; AVILA G., E. 1984. Harina de hojas de yuca (Manihot esculenta) como fuente de proteina en dietas para pollos de engorda. (Cassava leaf meal as protein source in diets for broiler chicks). Tecnica Pecuaria en Mexico no.47:9-15. Es. Sum. Es., En., 12 Ref. (Centro Experimental Pecuario La Posta, Paso del Toro, Ver., Apartado Postal 898, Veracruz, Ver., Mexico)

CASSAVA; CASSAVA LEAF MEAL; DIETS; POULTRY; SUBSTITUTES; FEEDS AND FEEDING; MEXICO.

Two expt. were conducted to partially replace SBM for high and low levels of CLM, with and without oil supplementation, resp., in sorghum + soybean + fish meal diets for broiler chicks. In the 1st trial, high levels (0, 5, 10, 15, and 20 percent) of CLM were included in isoproteic and isocaloric diets. Data obtained at the 9th wk. of age indicated (P greater than 0.05) that levels up to 15 percent CLM did not affect growth. Feed intake was higher (P less than 0.05) in chicks fed CLM. Feed conversion significantly increased (P less than 0.05) in diets including 15 and 20 percent CLM. In the 2nd trial low levels (0, 2, 4, and 6 percent) of CLM were included in isoproteic, but not isocaloric, diets. Data obtained at the 9th wk. of age showed (P greater than 0.05) similar results for all the parameters studied. (AS)

0191

27672 CIOCCIA R., A.M.; SANCHEZ R., J.; BRITO A., O. 1986. Valor energetico del follaje de yuca en la alimentacion de pollos. (Energy value of cassava foliage for feeding chicks). Acta Cientifica Venezolana 37:83-88. Es. Sum. Es., En., 28 Ref. (Depto. de Tecnologia de Procesos Biologicos y Bioquimicos, Univ. Simon Bolivar, Apartado Postal 80659, Caracas, Venezuela)

CASSAVA; FOLIAGE; SUBSTITUTES; POULTRY; DIETS; VENEZUELA.

Cassava foliage was evaluated as a source of energy partially replacing maize starch and soybeans in rations for growing chicks. Diets with 3 levels of cassava foliage (2, 4, and 8 percent) were fed to male chicks (Delkalb 127) during 14 days. All diets were enriched with 0.46 percent met. Results indicated that the addition of cassava foliage up to a level of 8 percent (by wt.) did not reduce wt. gain, feed efficiency, PER, and energy utilization of growing chicks. Cassava foliage presented a high ME value (4.40 kcal/g), indicating that approx. 98 percent of the GE of the foliage (4.50 kcal/g) was metabolized. Results indicated that cassava foliage is a good source of ME and that its use in rations for growing chicks could be promoted. (AS)

0192

24032 MONTILLA, J.J. 1981. Cassava root and foliage meals in laying hen diets. In Symposium of the International Society for Tropical Root Crops, 6th., Lima, Peru, 1983. Proceedings. Lima, International Potato Center. pp.401-409. En. Sum. En., 12 Ref. (Facultad de Ciencias Veterinarias, Univ. Central de Venezuela, Apartado Correo 4563, Maracay 2101A, Venezuela)

CASSAVA; CASSAVA LEAF MEAL; CASSAVA MEAL; CASSAVA PRODUCTS; CEREALS; DOMESTIC ANIMALS; DRYING; EGGS; FEED CONSTITUENTS; FOLIAGE; MAIZE; METABOLISM; POULTRY; PROCESSED PRODUCTS; PROCESSING; SOLAR DRYING; SOUTH AMERICA; STARCH CROPS; VENEZUELA.

The use of cassava foliage meal (CFM), particularly in combination with root meal was studied. In expt. I, corn meal and cassava root meal dried above 100 degrees Celsius (CRM) in combination with 5 levels of CFM (0, 5, 10, 15, and 20 percent), were evaluated in a 5 x 2 factorial arrangement; Leghorn hens were used with 4 groups of 12 pullets and 10 layers assigned to each treatment. In expt. II, corn meal, CRM, and sun-dried cassava root meal (SCRM), in combination with 3 levels of CFM (0, 10, and 20 percent), were evaluated. Black Sex Link hens were used with 4 groups of 15 pullets and 12 layers assigned to each treatment. Hens were placed in individual metal cages and daily records were made of feed consumption and egg production. With CRM and SCRM satisfactory body wt. and 50 percent egg production were obtained, although inferior to those obtained with maize. Rations based on CRM adversely affected egg production. A slight decrease of egg production observed with SCRM may be due to the deterioration of cassava quality caused by the long drying period. With CFM egg production was normal up to the 20 percent level combined with maize, and only up to 10 percent with SCRM. A strong root x foliage interaction was observed that adversely affected the productive performance when the CFM level was increased, possibly due to the increase in HCN concn. (AS)

0193

26745 PHALARAKSH, K. 1984. The feasibility studies of geese production in the Northeast of Thailand. Memoirs of the Tokyo University of Agriculture 26:186-247. En. Sum. En., 118 Ref., Il. (Dept. of Animal Science, Khon Kaen Univ., Khon Kaen, Thailand)

CASSAVA; GEESE; FEEDS AND FEEDING; POULTRY; ECONOMICS; COSTS; PRICES; FEED MIXTURES; LEAVES; CASSAVA MEAL; PROCESSED PRODUCTS; ANIMAL HEALTH; DRY MATTER; PROTEINS; THAILAND.

A series of 9 expt. was conducted over 6 yr to provide significant information on egg production rate, reproductive rate, nutrition, and the appropriate husbandry of geese to the government should goose production be promoted in NE Thailand. The research results will be used to develop and improve goose production in Thailand and possibly other developing countries with similar climatic environments and resources, as well. The final target is to provide extra income and animal protein for human consumption. Expt. 3 tried to visualize utilization of the surplus cassava leaves in the goose production. In a completely randomized design with 5 treatments (0, 10, 20, 30, and 40 percent CLM in the goose ration) and 4 replications, 80 female Grey Chinese goslings were fed from 4 to 14 wk. of age. It was concluded that the greater percentages of CLM incorporated in the rations showed more adverse effects on body wt. and feed conversion, presumably due to HCN toxicity. On the other hand, considering the economic point of view, using CLM at a 20 percent level in the ration gave the min. feed cost/kg body wt. gain. (AS (extract))

0194

34260 PRAWIROKUSUMO, S.; PURNAMA, F. 1983. Treated cassava leaf meals as protein sources for broiler production. In World Conference on Animal Production, 5th, Tokyo, Japan, 1983. New strategies for improving animal production for human welfare: proceedings. Tokyo, Japanese Society of Zootechnical Science. v.2,pp.521-522. En. Sum. En., 6 Ref.

CASSAVA; CASSAVA LEAF MEAL; CHICKS; FEEDS AND FEEDING; HCN CONTENT; ANIMAL PHYSIOLOGY; INDONESIA.

Three types of CLM were produced by sun drying, boiling in water for 15 min, and oven drying at 50 degrees Celsius for 7 days. HCN contents were 37.6, 35.5, and 19.5 ppm, resp. The treated meals were fed in a 7-wk. expt. with 1-wk.-old chicks at levels of 5, 10, and 15 percent in a 3 x 3 factorial design with 3 replicates of 6 chicks in each treatment. A ration without CLM was included as positive control. Daily wt. gains (g) were 42.4, 43.2, and 43.1 and feed/unit of gain 2.65, 2.60, and 2.64 for the sun-dried, boiled, and oven-dried meals, resp. Differences were not significant. Daily gains were 44.4, 43.7, 42.8, and 40.6 for the 0, 5, 10, and 15 percent levels with corresponding feed conversions of 2.50, 2.57, 2.65, and 2.80. Levels up to 10 percent of treated CLM can be fed with satisfactory results. (AS)

0195

35354 RAVINDRAN, V. 1985. Development of cassava (Manihot esculenta Crantz) leaf meal as an animal feed. (Microforma) Ph.D. Thesis. Blacksburg, Virginia Polytechnic Institute and State University. 139p. En. Sum. En., 165 Ref. 2 microfiches (15x11 cm.) in envelope.

CASSAVA; CASSAVA LEAF MEAL; DIETS; POULTRY; SWINE; NUTRITIVE VALUE; DIGESTIBILITY; LEAVES; COMPOSITION; ANIMAL PHYSIOLOGY; HCN CONTENT; DETOXIFICATION PROCESSES; STORAGE; TIMING; LEAVES; HARVESTING; ROOT PRODUCTIVITY; DRY MATTER; SRI LANKA.

The feasibility of developing CLM as an animal feed was studied in Sri Lanka. In feeding trials with broilers, improvements in performance were observed at 10 percent inclusion of CLM. High levels (20 and 30 percent) of CLM depressed gain, feed intake, and feed/gain. Wt. of spleen and liver (percentage of body wt.) linearly increased with increasing levels of CLM. Carcass pigmentation values favored the CLM-based diets. Dietary additives (met., sodium thiosulfate, or soybean oil plus met.) improved the growth of broilers fed the 20 percent CLM diet without having any beneficial effect when added to the basal diet. Gain of broilers tended to decrease with increasing dietary levels of cyanide. Feeding trials with growing pigs showed that CLM can be included up to 26.7 percent without affecting performance. Gain and feed/gain were improved at 13.3 percent CLM, whereas marked depressions were noted at 40 percent CLM. Results of the balance trials indicated that cassava leaf protein is utilized more efficiently by pigs, although

the nutrients in CLM are not as digestible as those in coconut oil meal. Overall results suggest that bulkiness, low energy content, met. deficiency, and presence of anti-nutritional factors are the major factors limiting the high level use of CLM in nonruminant diets. Studies on the processing of CLM revealed that simple drying is sufficient to eliminate almost 90 percent of the initial cyanide level in fresh cassava leaves. A combination of chopping and 3-day wilting prior to drying proved most effective in lowering the cyanide level of CLM. Field trials conducted with an early-maturing cassava var., MU 22, demonstrated the possibility of increasing cassava leaf DM yields by defoliating once during the growing season and to producing within 86 percent of the normal root yield. Two defoliations during the growing season depressed the root crop by more than half. (AS)

0196

29451 RAVINDRAN, V.; KORNEGAY, E.T.; RAJAGURU, A.S.B.; POTTER, L.M.; CHERRY, J.A. 1986. Cassava leaf meal as a replacement for coconut oil meal in broiler diets. Poultry Science 65(9):1720-1727. En. Sum. En., 19 Ref.

CASSAVA; CASSAVA LEAF MEAL; POULTRY; FEEDS AND FEEDING; DIETS; ANIMAL PHYSIOLOGY; DIETARY VALUE; HCN CONTENT; SRI LANKA.

Eight feeding trials lasting 8 wk. were conducted to evaluate CLM as a replacement for coconut oil meal (COM) in tropical broiler diets. Diets containing 0, 10, 20, and 30 percent CLM that replaced COM were fed in trials 1 and 2. Broiler performance was improved at the 10 percent CLM level; however, 20 and 30 percent levels of CLM resulted in depressions in wt. gain, feed intake, and feed efficiency. Liver and spleen wt. (percent of body wt.) increased linearly with increasing levels of CLM. Carcass pigmentation values, as measured by a Roche color fan, favored CLM-based diets. Results of trial 3 showed that broilers can tolerate a level of 15 percent CLM without adversely affecting their growth. In trials 4 and 5, supplementation of met. improved the gains of birds fed the 20 percent CLM diet but had no beneficial effect when added to the basal diet. All response criteria were improved when 3 percent soybean oil was added to the basal or the 20 percent CLM diet in trials 6 and 7. Further addition of met. had no effect on the performance of birds fed the basal diet, but improved growth of those fed the 20 percent CLM diet. In trial 8, gains of broilers tended (P less than 0.10) to decrease linearly with increasing levels of cyanide; however, gains were reduced only 4.6 percent at the highest level (200 ppm) of added cyanide, and there were no deaths. In conclusion, the use of a high level of CLM in broiler diets is limited by its bulkiness, low energy content, met. deficiency, and the presence of antinutritional factors. (AS)

See also 0052 0197 0220 0225 0233

SWINE

0197

26767 KOENTJOKO 1985. Daun ubi kayu untuk makanan babi dan ayam. (Use of cassava leaves for feeding swine and chicken). In Nugroho, W.H.; Guritno, B.; Utomo, W.H.; Sugito, Y., eds. Seminar Pengembangan Ubi Kayu di Jawa Timur, Indonesia, 1985. Prosiding. Malang, Pusat Penelitian Tanaman Ubi-Ubian Universitas Brawijaya. pp.128-137. In. Sum. In., En., 22 Ref.

CASSAVA; LEAVES; FEEDS AND FEEDING; COMPOSITION; PROTEIN CONTENT; CASSAVA PRODUCTS; CYANOGENIC GLUCOSIDES; SWINE; CHICKS; ANIMAL HEALTH; INDONESIA.

The use of cassava leaves as animal feed is reviewed regarding production and composition in swine and chicken rations. It was found that cassava can not be used in more than 10 percent of the ration. Cassava leaves are a source of protein for swine and chicken. Limiting factors are met., energy, fiber, and cyanide contents. (AS)

0198

31648 NWOKOLO, E. 1987. Leaf meals of cassava (Manihot esculenta Crantz) and siam weed (Eupatorium odoratum L.) as nutrient sources in poultry diets. Nutrition Reports International 36(4):819-826. En. Sum. En., 15 Ref. (Rivers State Univ. of Science & Technology, PMB 5080, Port Harcourt, Nigeria)

CASSAVA; CASSAVA LEAF MEAL; FEEDS AND FEEDING; POULTRY; ANALYSIS; COMPOSITION; MINERAL CONTENT; AMINO ACIDS; DRY MATTER; FIBER CONTENT; PROTEIN CONTENT; ASH CONTENT; NIGERIA.

CLM and siam weed (Eupatorium odoratum L.) leaf meal, prepared by milling sun-dried leaves, were analyzed for proximate constituents, minerals, and amino acid content. Broiler chick assays were used to determine true digestibility (availability) of minerals and amino acids in the leaf meals. Protein content was higher in CLM than in Eupatorium leaf meal. Similarly, K, Ca, and Zn contents (16,300, 12,300, and 119 mg/kg, resp.) were higher in CLM than in Eupatorium leaf meal, which itself had higher contents of P, Mg, Cu, Mn, and Fe (4352, 3202, 37, 71, and 79 mg/kg, resp.). Mineral availability was av. in both meals but slightly higher in CLM (53.7 percent) than in Eupatorium leaf meal (47.9 percent). Cystine and met. contents were low, and lysine content moderate in both leaf meals. The S amino acids might be the limiting amino acids in these leaf meals. Amino acid availability was low in Eupatorium leaf meal (65.4 percent) and only moderately high in CLM (77.8 percent). (AS)

0199

30802 RAVINDRAN, V.; KORNEGAY, E.T.; RAJAGURU, S.B.; NOTTER, D.R. 1987. Cassava leaf meal as a replacement for coconut oil meal in pig diet. Journal of the Science of Food and Agriculture 41(1):45-53. En. Sum. En., 24 Ref. (Dept. of Animal Science, Univ. of Peradeniya, Peradeniya, Sri Lanka)

CASSAVA; CASSAVA MEAL; LEAVES; FEED CONSTITUENTS; FEEDS AND FEEDING; SWINE; DIETS; DIGESTIBILITY; METABOLISM; FOOD ENERGY; PROTEIN CONTENT; HCN CONTENT; ANIMAL NUTRITION; SRI LANKA.

Two feeding trials were conducted to evaluate CLM as a replacement for coconut oil meal (COM) in tropical pig diets. In each trial, 36 pigs (initial wt., 14.5 kg) were fed diets containing 0, 133, 267, and 400 g CLM/kg, substituted for equal amounts (wt./wt.) of COM in a 179 g/kg protein basal diet. An extra-period Latin square changeover design with 2-wk. periods was used. Av. daily gain and feed efficiency were improved when diets containing 133 g CLM/kg were fed, which may be attributed to the higher lysine content of CLM. Daily gain and feed efficiency of pigs fed diets containing 267 g CLM/kg were similar to those on the basal diet. Poor performance of pigs fed the 400 g CLM/kg diets may be explained by the low energy content and the presence of antinutritional factors, such as cyanide and tannin, in CLM. Two balance trials were conducted using 16 barrows (initial wt., 37.2 kg). Apparent digestibility coefficients for DM, energy, protein, cell contents, cell wall, and hemicellulose were depressed, whereas those for ash and lignin were improved as CLM was substituted for COM. The data indicate that cassava leaf protein is utilized efficiently, although other nutrients in CLM are not as digestible as those in COM. (AS)

See also 0007 0008 0052 0084 0098 0104 0105 0220 0225 0233

RUMINANTS

0200

28121 HOJAS DE yuca y rastrojo de maiz en la alimentacion de bovinos en crecimiento. (Cassava leaves and maize stubble in nutrition for growing bovine cattle). 1985. ICA Informa 19(4):10-12. Es. Il.

CASSAVA; CASSAVA LEAVES; ANIMAL NUTRITION; DAIRY CATTLE; SUPPLEMENTS; COLOMBIA.

Ground cassava leaves were given to 12 Holstein heifers, with an initial live wt. of 190 kg, for 95 days as a supplement to grazing Digitaria decumbens pastures, compared with the supply of green alfalfa. At the end of the trial, the final av. wt. of the heifers fed ground cassava leaves was 256.3 kg, corresponding to a total wt. gain of 67.3 kg and a wt. gain/day/yr of 0.684 kg. Heifers fed green alfalfa reached a total wt. gain of 57.7 kg and a wt. gain/day/yr of 0.589 kg. Animals that consumed cassava leaves had a 40 percent higher energy intake, which accounted for the higher wt. gain and the more efficient production. (CIAT)

0201

25598 COSTA, J.B.; SILVA, V.G. DA; RODRIGUES, F. DE M.; SILVA, U.R. DA 1981. Efeito da ureia associada a mistura mineral e do feno de mandioca sobre o ganho de peso de novilhos. (The effect of urea associated with a mineral mixture and of cassava forage on the weight gain of steers). Salvador-BA, Brasil, Empresa de Pesquisa Agropecuaria da Bahia. Pesquisa em Andamento no.21. 4p. Pt. (Empresa de Pesquisa Agropecuaria da Bahia, Caixa Postal 1222, 40.000 Salvador-BA, Brasil)

BEEF CATTLE; BRAZIL; CATTLE; DOMESTIC ANIMALS; FEED CONSTITUENTS; FEEDS AND FEEDING; FORAGE; MINERALS; SODIUM; SOUTH AMERICA; STORAGE; USES.

The preliminary results of an expt., projected for 3 yr and carried out at the Itaberaba Exptl. Station (Bahia, Brazil), are presented; it intends to evaluate the effect of urea supplementation to the mineral mixture and of cassava forage on the wt. gain of steers. The animals were kept under a grazing regime during the dry season. A completely randomized exptl. design with 3 treatments and 10 animals/treatment was used. The treatments were pasture (Digitaria decumbens) + mineral mixture (control), T1; pasture + urea/mineral mixture (50 + 50 percent), T2; and pasture + cassava forage + mineral mixture, T3. This 1st exptl. period lasted 112 days. The av. wt. gain/day was -1.3, 0.7, and 20.0 kg for T1, T2, and T3, resp. The superiority of the cassava forage supplement in daily wt. gain is evident. (CIAT)

0202

27547 DEVENDRA, C. 1983. Physical treatment of rice straw for goats and sheep and the response to substitution with variable levels of cassava (Manihot esculenta), leucaena (Leucaena leucocephala) and gliricidia (Gliricidia maculata) forages. MARDI Research Bulletin 11(3):272-290. En. Sum. Mal., En., 23 Ref. (Malaysian Agricultural Research & Development Inst., Serdang, Selangor, Malaysia)

CASSAVA; CASSAVA LEAVES; SUBSTITUTES; FEEDS AND FEEDING; DIETARY VALUE; ANIMAL NUTRITION; GOATS; SHEEP; MALAYSIA.

The results of 5 nutritional balance studies with goats and sheep are presented concerning the utilization of rice straw, treated or untreated, and its substitution with cassava leaves, Leucaena leucocephala leaves, L. leucocephala leaves plus stems plus pods, or Gliricidia maculata leaves. DM intake with older straw increased (46.3-55.2 g/W(0.75) kg), compared with fresh straw (40.5-41.0 g/W(0.75) kg). Goats consumed significantly more DM than sheep (P less than 0.05), and the digestibility of crude fiber and ash were significantly better in the older straw (P less than 0.05). Wetting the straw at 1 kg/liter of water reduced DM intake (59.9 vs. 51.6 g/W(0.75) kg) and DM digestibility significantly (P less than 0.05). Feeding chopped straw was associated with increased CP digestibility and N retention compared with long straw. The ME content of fresh (chopped), stored (chopped), or long rice straw was 6.09-6.19, 5.38-6.04, and 6.39 MJ/kg, resp. Substituting rice straw with 33-34 percent cassava leaves significantly (P less than 0.05) increased DM intake by 34-37 percent and also improved the digestibility of OM, CP, crude fiber, ether extract, and N-free extract (P less than 0.05). Substituting rice straw with 30 percent of

either cassava or Leucaena leaves, Leucaena leaves plus stems plus pods, or G. maculata leaves gave no differences in DM intake; however, there were significant differences in OM, CP, ether extract, and N-free extract digestibility (P less than 0.05). Dietary energy supply, N, and mineral balance indicated that, in all instances, the effect of the substitution was to increase dietary ME, N, and also mineral supply (Ca, P, and Mg). The results emphasize the feeding value of especially cassava and Leucaena leaves for improving the dietary quality of basal roughage diets for ruminants. (AS)

0203

22038 GUERRA, P. 1980. Utilizacion del forraje de yuca como fuente de proteina y fibra. 1. Aspectos agronomicos, composicion quimica, digestibilidad y consumo del forraje integral de yuca. (Utilization of cassava fodder as a source of protein and fiber. 1. Agronomic aspects, chemical composition, digestibility, and consumption of cassava leaf meal). Carta Informativa Pecuaria (Panama) no.9:9-12. Es. 6 Ref.

ANIMAL NUTRITION; COMPOSITION; FEEDS AND FEEDING; FORAGE; TOXICITY; USES.

Data from USA, Costa Rica, Peru, Vietnam, Venezuela, and the Dominican Republic are reviewed; tables on the chemical composition, apparent digestibility, consumption, DM production, and other characteristics of cassava, in relation to its utilization as a source of protein and fiber for cattle nutrition in Panama, are presented. Edaphoclimatic aspects such as temp., humidity, soils, and pH are discussed, as well as the toxicity of the product and the effect of population density on yield. The high protein content of the CLM is highlighted; cassava leaf hay has a higher protein and fat content than alfalfa hay and besides that, it has a low cellulose content which makes it suitable for bovine nutrition. (CIAT)

0204

34259 MATHIUS, I.W.; VAN EYS, J.E.; DJAJANEGARA, A.; RANGKUTI, M. 1983. Effects of cassava leaf supplementation on the utilization of napier grass by sheep and goats. In World Conference on Animal Production, 5th, Tokyo, Japan, 1983. New strategies for improving animal production for human welfare: proceedings. Tokyo, Japanese Society of Zootechnical Science. v.2,pp.401-402. En. Sum. En., 8 Ref.

CASSAVA; CASSAVA LEAVES (VEGETABLE); ANIMAL NUTRITION; LAMBS; GOATS; ANIMAL PHYSIOLOGY; SUPPLEMENTS; INDONESIA.

Feeding and digestion trials were conducted to determine the effect of cassava leaf supplementation on the utilization of Pennisetum purpureum diets and the performance of Indonesian sheep and goats. Twenty growing male lambs (Javanese thin-tail) and goats (kacang) were fed chopped P. purpureum ad libitum supplemented with wilted cassava foliage at 4 levels: 0, 500, 1000, and 1500 g/day. Changes in body wt. and intake were recorded over a 10-wk. period. This was followed by a 7-day digestion trial. Cassava leaf supplementation increased (P less than 0.05) DM intake in goats but had no effect on DM consumption in sheep. CP intake increased (P less than 0.01) with supplementation but NDF intake remained constant at 36.0 plus or minus 0.3 g/kg body wt. (0.75) for goats and 40.9 plus or minus 1 g/kg body wt. (0.75) for sheep. Only in goats was intake of digestible CP and DM related (R(2) = 0.74; P less than 0.001). DM consumption (g/kg body wt. (0.75)) was higher (P less than 0.05) in sheep as compared with goats. Supplementation had no effect on DM digestibility in either species. In sheep, digestibility of NDF decreased while apparent digestibility of CP increased in both species (P less than 0.05) with increasing levels of supplementation. At all levels of cassava leaf supplementation goats digested DM, CP, and NDP better (P less than 0.05) than sheep. Supplementation had a linear effect (P less than 0.05) on av. daily gain in goats (R(2) = 0.89) and sheep (R(2) = 0.87). P. purpureum alone was sufficient only for maintenance of body wt. while at the highest levels of supplementation the av. daily gain of goats was 23.2 g and that of sheep 67.0 g. (AS)

0205

34230 MATHIUS, I.W.; VAN EYS, J.E.; PULUNGAN, H.; RANGKUTI, M. 1985. Evaluation of wilted cassava leaves as protein supplement to napier grass diets for growing lambs. In AAAP Animal Science Congress, 3rd, Seoul, Korea, 1985. Efficient animal production for Asian welfare: proceedings. Seoul, Korea, v.2,pp.826-828. En. Sum. En., 10 Ref. (SR-CRSP, Research Int. for Animal Production, P.O. Box 210, Bogor, Indonesia)

CASSAVA; LEAVES; SUPPLEMENTS; DIETS; ANIMAL NUTRITION; LAMBS; ANIMAL PHYSIOLOGY; INDONESIA.

A 12-wk. feeding and 7-day digestion trial was carried out to evaluate wilted cassava leaves as a source of dietary protein for growing sheep fed Pennisetum purpureum. Twenty Javanese thin-tail ram lambs with initial body wt. of 14.2 plus or minus 1.4 kg were stratified on the basis of body wt. and allocated to 4 treatments: basal diet alone (0) or supplemented with 5 g urea/head (U), 50 g fish meal (F), or 65 g corn meal (C). Diets U and F were similar in rumen-soluble N; diets F and C had similar levels of digestible energy. All animals were fed chopped P. purpureum ad libitum, wilted cassava leaves at 1.4 percent of the body wt., and a 5 g complete mineral mixture with 75 g corn meal as a carrier. Intake of DM and cell wall constituents (CWC) did not differ (P greater than 0.05) among treatments. Av. DM intake was 3.9 plus or minus 0.2 percent of body wt. DM intake from P. purpureum did not differ significantly among treatments. Digestibilities of DM, CP, and acid detergent fiber were higher (P less than 0.05) for U, F, and C diets relative to A. Digestibility of CWC showed a similar (P less than 0.01) response. Daily wt. gains, averaging 49 plus or minus 8 g/head, did not differ (P greater than 0.05) among treatments. (AS)

0206

35375 SANCHEZ, E.E.; RUIZ, L.; PORTIELES, J.M.; MILIAN, O.; MARTINEZ, B.; ARCE, R. 1988. Evaluacion del potencial forrajero de la coleccion cubana de yuca (Manihot esculenta). (Evaluation of the forage potential of the Cuban cassava collection). Tropicales 11(1):31-47. Es. Sum. Es., En., 15 Ref., Il. (Inst. Nacional de Investigaciones en Viandas Tropicales, Apartado no.8, Santo Domingo, Villa Clara, Cuba)

CASSAVA; CULTIVARS; FORAGE; HARVESTING; PRODUCTIVITY; DRY MATTER; ANIMAL NUTRITION; PLANT HEIGHT; CUBA.

During 1983-86, 160 clones from the Cuban cassava collection were evaluated on a red ferralitic soil near the Cascajal Plantain and Seed Exptl. Station in Villa Clara, Cuba. Ten clones were selected for their performance as forage producers, using clone Pinera as check. A 1st cut was carried out 150 days after planting, after which 3 additional cuttings were made at 90-day intervals. There was a positive and highly significant ($r = 0.60$) correlation between plant height and DM yield/cutting. The best clones were Yuca Arroba and Siboney, with DM yields over the 3 cuttings of 11.25 and 10.80 t/ha, resp. It is recommended to multiply these 2 clones for their use as forage in cattle-raising. (AS)

0207

23286 TORRE V., M.J. DE LA 1981. Utilizacion de forraje de yuca en la alimentacion de terneros de lecheria. (Utilization of cassava forage for feeding dairy calves). Tesis Mag.Sc. Turrialba, Universidad de Costa Rica. Centro Agronomico Tropical de Investigacion y Ensenanza. 64p. Es. Sum. Es., En., 85 Ref., Il.

ANIMAL NUTRITION; CALVES; CATTLE; CENTRAL AMERICA; CIAT-2; COMPOSITION; CONCENTRATES; COSTA RICA; COSTS; CULTIVARS; DIETARY VALUE; DIGESTIBILITY; DOMESTIC ANIMALS; FEEDS AND FEEDING; FOOD ENERGY; FORAGE; HCN CONTENT; NUTRITIVE VALUE; PROTEIN CONTENT; USES.

At the Centro Agronomico Tropical de Investigacion y Ensenanza in Costa Rica, a study was carried out to determine the levels of cassava forage as protein supplement in the feeding of weanling dairy calves. The animals, with an av. age of 3 mo. and wt. 47.5 kg, were allocated in 5 groups of 6 each. Every group received a diet of cassava forage, concentrates, Cynodon nlemfluensis, and molasses. The treatments, given completely randomized, consisted in the replacement of the protein in the ration by protein provided in the cassava forage; the amounts of the latter in the diets were 0, 0.36, 0.73, 1.12, and 1.49 kg DM/100 kg live wt./day, giving 0, 13, 27, 41, and 56 percent CP, resp. There were no differences in the total DM consumption, wt. gain, and food conversion efficiency among the different treatments. Neither were there HCN intoxication symptoms, even though its content in the forage varied from 8.41 to 25.92 mg/100 g fresh wt. To insure an adequate consumption of an energy supplement, the level of cassava forage can not exceed 23 percent of the total DM given to calves with 75 kg or less. This level provides 26 percent of the total protein. From the economic point of view, the use of cassava forage as a source of protein to replace protein sources, such as the meat and bone meal, represents a 22 percent saving in the costs/unit of protein. (CIAT)

0208

26384 WANAPAT, M.; PRASERDSUCK, S.; CHANTAI, S. 1985. Efecto de ensilaje de paja de arroz con urea y suplementacion con hojas de yuca secas sobre la digestion de bufalos de agua. (Effect of rice straw ensilage with urea and supplementation with dried cassava leaves on the digestion of water buffalos). Produccion Animal Tropical 10(1):46-52. Es. Sum. Es., 16 Ref. (Dept. of Animal Science, Khon Kaen Univ., Khon Kaen 4000, Thailand)

CASSAVA; WATER BUFFALO; FEEDS AND FEEDING; LEAVES; SILAGE; DRY MATTER; PROTEIN CONTENT; COMPOSITION; THAILAND.

The effects of rice straw ensiled with urea and a min. amount of dried cassava leaves on the digestibility of straw and the wt. change in yearling buffalos were studied. A 3 x 3 Latin square design with 6 animals was used. The treatments were: (a) nontreated rice straw supplied ad libitum; (b) rice straw ensiled with urea offered in restricted amounts, based on the consumption of nontreated rice straw; and (c) rice straw ensiled with urea offered in restricted amounts, based on the consumption of nontreated rice straw + dry cassava leaves at 200 g/day. Three exptl. 7-wk. periods were used with 7 preliminary days, 14 days of adjustment, and 30-day feeding periods. Ensiling rice straw with urea during 3 wk. significatively increased DM, OM, CP, acid detergent fiber, and GE digestibilities. By supplementing rice straw ensiled with urea with a min. amount of dry cassava leaves, nutrient digestibility tended to increase (P less than 0.05). Digestion coefficients, determined by acid-insoluble ash and lignin (72 percent H2SO4) used as internal indicators, were comparable; however, the values obtained by lignin tended to be lower. Wt. change of the buffalos fed treatments (a), (b), and (c) were -383, 136, and 182 g/day (P less than 0.05), resp. (AS-CIAT)

See also 0007 0008 0020 0021 0022 0138 0140 0221

OTHER ANIMALS

0209

30851 CARVALHO, V.D. DE; SILVA, A.T. DA; CLEMENTE, E. 1986. Efeito da suplementacao de racoes a base de fuba com feno da parte aerea de mandioca em alguns parametros nutricionais de ratos. (Effect of supplementing corn meal-based rations with hay from the aerial parts of cassava on some nutritional parameters of rats). Revista Brasileira de Mandioca 5(1):77-82. Pt. Sum. Pt., En., 9 Ref., Il. (EPAMIG, Caixa Postal 176, 37.200 Lavras-MG, Brasil)

CASSAVA; FOLIAGE; FORAGE; NUTRITIVE VALUE; LABORATORY ANIMALS; BRAZIL.

The effect of supplementing corn meal-based diets with increasing levels of hay from the upper 3rd part of the cassava canopy (0, 10, 15, 20, 30, 40, and 100 percent) on the nutritional characteristics of rats was determined. A casein check ration was also included. Results indicate that 20 percent cassava hay was the best level of supplementation; rats had better wt. gains and higher food efficiency ratio values. Levels above 20 percent caused harmful effects: with 30 percent rat wt. decreased, at 40 percent wt. loss occurred, and at 100 percent animal death. (AS)

0210

28575 DEVAIAH, M.C.; RAJASHEKHARGOUDA, R.; SUHAS, Y.; GOVINDAN, R. 1985. Growth and silk production in Samia cynthia ricini Boisduval fed on four different host plants. Indian Journal of Sericulture 24(1):33-35. En. Sum. En., 1 Ref. (Dept. of Sericulture, VAS, 6KVK, Bangalore-560 065, India)

CASSAVA; FEEDS AND FEEDING; CASSAVA LEAVES; ANIMAL NUTRITION; INSECT BIOLOGY; USES; INDIA.

Changes in the larval wt., silk production, and silk gland wt. in relation to 4 host plants of the eri silkworm (including cassava) were evaluated and quantified. The studies conducted on the 5th instar of the silkworm (white race) revealed that max. larval wt. and max. silk gland wt. were recorded when fed Ricinus communis (4.648 plus or minus 0.617 and 0.926 plus or minus 0.151 g, resp.) while the lowest values were recorded on cassava-fed silkworms (1.861 plus or minus 1.099 and 0.416 plus or minus 0.312, resp.). Cocoon wt. and shell wt. were also max. on R. communis (2.116 and 0.292 g, resp.), followed by cassava (1.884 and 0.250 g, resp.). R. cummunis was found to be the best host plant. (CIAT)

0211

26329 NAIR, G.M.; RAGHAVAN, K.V.; NAMBISAN, B. 1979. Prospects of rearing eri silk worms with cassava leaves. In Central Tuber Crops Research Institute. Annual progress report 1978-1979. Trivandrum, India. pp.30-32. En.

ANIMAL NUTRITION; CASSAVA; DEFOLIATION; DRY MATTER; ECONOMICS; HCN CONTENT; INCOME; INDIA; LEAVES; ROOT PRODUCTIVITY; SILKWORM; STARCH CONTENT; USES.

In a randomized block design with 3 replications, the effect of the defoliation caused by the rearing of silk worms on the root yield and DM, starch, and HCN contents of cassava was studied. Cassava root yield was reduced by the defoliation treatments. Starch, DM, and HCN contents did not show variations due to defoliation. The economics of rearing silk worms on cassava proved to be unprofitable. (CIAT)

0212

32063 OKIY, D.A.; OKE, O.L. 1986. Nutritional evaluation of thermally deteriorated palm oil. Oleagineux 41(2):77-81. En. Sum. En., Fr., Es., 23 Ref. (Chemistry Dept., Nigerian Inst. for Oilpalm Research, P.M.B. 1030, Benin City, Nigeria)

CASSAVA; LEAVES; PROTEIN CONTENT; DIETS; LABORATORY ANIMALS; SUPPLEMENTS; DIGESTIBILITY; NIGERIA.

Cassava leaf protein diets were supplemented with either fresh unheated palm oil, heated palm oil, heated palm oil containing 1 percent pepper, or heated palm oil containing 1 percent table salt, and fed to test rats. PER, NPU, true digestibility, and BV were measured to test the effect of thermally deteriorated palm oil on the protein. Although the true digestibility of the diet supplemented with fresh unheated palm oil was significantly greater than that of the control and those of the diets supplemented with heated palm oil and pepper-treated oil, it was similar to the true digestibility of the diet supplemented

with the salt-treated sample of palm oil. PER, NPU, and BV did not differ significantly in the diets, signifying that the thermally deteriorated samples of palm oil did not effect irregularities in the diets of this study. (AS)

0213

30586 RAHARJO, Y.C.; CHEEKE, P.R.; PATTON, N.M.; SUPRIYATI, K. 1986. Evaluation of tropical forages and by-product feeds for rabbit production. 1. Nutrient digestibility and effect of heat treatment. Journal of Applied Rabbit Research 9(2):56-66. En. 54 Ref. (Rabbit Research Center, Oregon State Univ., Corvallis, OR 97331, USA)

CASSAVA; RABBITS; DOMESTIC ANIMALS; USES; FORAGE; DIGESTIBILITY; FEEDS AND FEEDING; ANIMAL NUTRITION; INDONESIA.

Tropical forages, including woody legumes, nonwoody legumes, grasses, and cassava tops, were evaluated as rabbit feeds as to nutrient content and digestibility. There were dramatic differences in the digestibility of protein and energy between tropical legumes and grasses. Cassava tops had crude protein, gross energy, and crude fiber comparable to woody legumes. Sun drying and steam pelleting did not change the composition of the forages, except for a considerable increase of neutral detergent fiber in Calliandra and cassava tops. Most of the grasses were almost useless as sources of nutrients. It is suggested that tropical grass be supplemented with concentrates in diets for rabbits. (CIAT)

0214

35381 RAHMAN, S.; KHAN, A.R.; NURULLAH 1982. Effect of different foods on the larval and pupal mortalities of the eri silkworm, Philosamia ricini Biosduval (Lepidoptera: Saturniidae). Journal Asiatic Society of Bangladesh 8(2):101-103. En. Sum. En., 5 Ref.

CASSAVA; LEAVES; ANIMAL NUTRITION; PHILOSAMIA RICINI; BANGLADESH.

The effect of castor and cassava leaves on the larval and pupal mortalities of the eri silkworm, Philosamia ricini, was studied. Cassava leaves produced a significantly (P greater than 0.01) higher mortality than castor leaves (38.89 and 28.05 percent, resp.). (AS)

0215

29031 RAVINDRAN, V.; RAJADEVAN, P.; GOONEWARDENE, L.A.; RAJAGURU, A.S.B. 1986. Effects of feeding cassava leaf meal on the growth of rabbits. Agricultural Wastes 17(3):217-224. En. Sum. En., 17 Ref. (Dept. of Animal Science, Univ. of Peradeniya, Peradeniya, Sri Lanka)

CASSAVA; CASSAVA LEAF MEAL; ANIMAL HEALTH; DIETS; METHIONINE; AMINO ACIDS; TECHNOLOGY TRANSFER; CASSAVA PROGRAMS; SRI LANKA.

CLM, prepared from leaves remaining after the harvest of cassava roots, contained CP 20.1 percent, acid detergent fiber 30.3 percent, P 0.39 percent and Ca 1.16 percent in DM, GE 4.6 Mcal/kg, and 84, 622, 9, 178, and 223 mg/kg of HCN, Fe, Cu, Mn, and Zn, resp. CLM was a rich source of essential amino acids except met. In 2 trials, New Zealand white crossbred rabbits (av. body wt. 545 g) were given a diet based on maize, rice polishings, and coconut oilcake (25, 25, and 40 percent), without or with CLM added to replace 50 or 100 percent of the coconut oilcake. The results suggest that CLM could be used up to the 40 percent level in growing rabbit diets without any adverse effects on growth performance or carcass characteristics. CLM could be a cheaper alternative for coconut oilcake, especially in tropical areas where sun drying of cassava leaves is feasible. (AS)

0216

29031 RAVINDRAN, V.; RAJADEVAN, P.; GOONEWARDENE, L.A.; RAJAGURU, A.S.B. 1986. Effects of feeding cassava leaf meal on the growth of rabbits. Agricultural Wastes 17(3):217-224. En. Sum. En., 17 Ref. (Dept. of Animal Science, Univ. of Peradeniya, Peradeniya, Sri Lanka)

CASSAVA; CASSAVA LEAF MEAL; ANIMAL HEALTH; DIETS; METHIONINE; AMINO ACIDS; TECHNOLOGY TRANSFER; CASSAVA PROGRAMS; SRI LANKA.

CLM, prepared from leaves remaining after the harvest of cassava roots, contained CP 20.1 percent, acid detergent fiber 30.3 percent, P 0.39 percent and Ca 1.16 percent in DM, GE 4.6 Mcal/kg, and 84, 622, 9, 178, and 223 mg/kg of HCN, Fe, Cu, Mn, and Zn, resp. CLM was a rich source of essential amino acids except met. In 2 trials, New Zealand white crossbred rabbits (av. body wt. 545 g) were given a diet based on maize, rice polishings, and coconut oilcake (25, 25, and 40 percent), without or with CLM added to replace 50 or 100 percent of the coconut oilcake. The results suggest that CLM could be used up to the 40 percent level in growing rabbit diets without any adverse effects on growth performance or carcass characteristics. CLM could be a cheaper alternative for coconut oilcake, especially in tropical areas where sun drying of cassava leaves is feasible. (AS)

0217

31665 SALGADO, J.M.; SANTOS, A.C. 1986. Estudo do concentrado proteico da folha de mandioca. Obtencao, analises quimicas e suplementacao com aminoacidos. (Study of cassava leaf protein concentrate. Preparation, chemical analysis, and supplementation with amino acids). Archivos Latinoamericanos de Nutricion 36(3):483-494. Pt. Sum. Pt., En., 14 Ref. (Escola Superior de Agricultura Luiz de Queiroz, Univ. de Sao Paulo, Depto. de Quimica, Area de Nutricao Humana, Piracicaba, Caixa Postal 13.400-SP, Brasil)

CASSAVA; LEAVES; PROTEIN CONTENT; PROCESSING; LABORATORY EXPERIMENTS; LABORATORY ANIMALS; COMPOSITION; AMINO ACIDS; DRY MATTER; FIBER CONTENT; ASH CONTENT; DIETS; CONCENTRATES; DIETARY VALUE; ANIMAL PHYSIOLOGY; DIGESTIBILITY; BRAZIL.

A cassava leaf protein concentrate was prepared by introducing some new procedures to well-known methods: (1) with adjustment of pH and without centrifugation; (2) without adjustment of pH and without centrifugation; (3) same as (1) but with 10 min centrifugation; (4) same as (2) but with 10 min centrifugation. The chemical composition of the different protein concentrates is given. Although method 4 gave the highest protein content, method 2 was used due to the ease and rapidness of extraction. The nutritive value (PER, digestibility, NPU, and BV) of diets fed to Wistar rats (21-23 days old) containing cassava leaves or cassava leaf concentrate was determined. Both protein concentrate and cassava leaves were supplemented with 0.5 percent met. and 0.7 percent lysine, alone or combined. Protein content (N x 6.25) of concentrate and leaves was 34.0 and 25.2 percent, resp. Rats given the protein concentrate or leaves alone lost wt. The addition of either met. or lysine alone did not improve rat growth. A better response was obtained when both met. and lysine supplemented the test materials, as indicated by biological criteria, PER, true digestibility, and BV. Histological tests of different animal organs examined proved to be normal. (AS)

0218

30536 SCAPINELLO, C. 1984. Utilizacao do feno de rama de mandioca na alimentacao de coelhos em crescimento. (Use of cassava branch hay in growing rabbit rations). Tese Mestrado. Lavras, Minas Gerais, Escola Superior de Agricultura de Lavras. 80p. Pt. Sum. Pt., En., 51 Ref., Il.

CASSAVA; RABBITS; FORAGE; FOLIAGE; FEEDS AND FEEDING; DIGESTIBILITY; NUTRITIVE VALUE; ANIMAL NUTRITION; BRAZIL.

The digestibility of hay made from the upper 3rd of the canopy of 15-mo.-old plants of cassava var. Mantiqueira was assessed in growing White New Zealand rabbits. The performance and several carcass characteristics of the rabbits were evaluated. In the digestibility trial, sixteen 50-day-old rabbits were kept in cages in a randomized 2 x 2 factorial design (2 rations x 2 sexes), with 8 animals/treatment (4 males and 4 females). Each animal constituted a replicate. Apparent digestibility of DM, OM, CP, crude fiber, and crude energy coefficients of cassava hay were 41.29, 41.95, 43.72, 33.77, and 36.63 percent, resp. Sex had no effects on the digestibility of cassava hay. Results showed that the hay made from the upper 3rd of the cassava canopy has a substantial nutritive value for rabbits. To verify the effects of the levels of cassava hay in the rations (0, 10, 20, and 30 percent) on performance and carcass characteristics, 32 White New Zealand rabbits, 50-70 days old, were allocated in a randomized block design per sex, with 8 animals/block. A 4 x 2 factorial scheme (4 rations x 2 sexes) was used with 2 replicates/block. Each animal was a replicate. The inclusion of cassava hay did not cause any significant effects on performance and carcass characteristics. A tendency was observed, however, of better performance in animals fed with rations containing 20 percent hay. (AS)

0219

24075 THANGAVELU, K.; PHUKON, J.C.D. 1981. Food preference of eri silkworm (Philosamia ricini Hutt.) (Saturniidae:Lepidoptera). Entomology 8(4):311-315. En. Sum. En., 5 Ref. (Regional Sericultural Research Station, Central Silk Board, Titabar, India 785 632)

ANIMAL NUTRITION; ASIA; INDIA; USES.

Among 4 different food plants evaluated for suitability to the eri silkworm (Philosamia ricini), the order of preference was castor, kesseru (Heteropanax fragans), cassava, and barkesseru (Ailanthus excelsa). The no. of eggs/laying varied from 395 on castor to 331 on barkesseru, cassava presenting 342. The highest hatching percent was on castor (90.0 percent) and the lowest on barkesseru (74.0 percent), cassava presenting 77.0 percent. Larval period was shorter (16 days) and larval mortality lower (32.6 percent) on castor, with corresponding values of 19.25 days and 63.4 percent for cassava. Effective rearing rate was higher on castor and kesseru, and lower on cassava and barkesseru (67.4, 64.9, 36.6, and 18.6 percent, resp.). Green cocoon and shell wt. were higher on castor and cassava than on kesseru and barkesseru (2.81 and 0.265, 2.67 and 0.250, 2.52 and 0.228, and 2.18 and 0.203 g, resp.). (AS)

TOXIC EFFECTS

0220

26849 APARICIO T., M.A. 1983. Evaluacion de harina de yuca con bajo y alto contenido de cianuro en dieta para pollos de engorde. (Evaluation of low- and high-cyanide cassava meal diets for broiler chicks). Tesis Zootecnista. Palmira, Universidad Nacional de Colombia. 118p. Es. Sum. Es., En., 52 Ref., Il.

CASSAVA; FEEDS AND FEEDING; CHICKS; HCN; CASSAVA MEAL; FEED CONSTITUENTS; CASSAVA LEAF MEAL; ANIMAL PHYSIOLOGY; AFLATOXINS; TOXICOLOGY; FEED MIXTURES; COSTS; COLOMBIA.

At the U. Nacional in Palmira, Colombia, 2 expt. were conducted to assess the possible toxic effects of high levels of cyanide in CM when used in diets for broiler chicks. In the 1st expt. (5 treatments, 4 replications), 2 CM, one with a low and the other with a high cyanide content, were evaluated at 2 levels of inclusion in the exptl. diets (20 and 40 per-

cent). In the 2nd expt. (4 treatments, 4 replications), CM was used at 3 levels in the diets (10, 20, and 30 percent). In both expt., 3 percent cassava foliage meal was additionally incorporated. Except for a commercial diet fed in the 2nd expt., all the diets were balanced to least-cost by linear programming. Wt. gain, feed intake, and feed conversion (wt. gain/feed intake) were recorded every 2 wk., and data of the starting (0-4 wk.), finishing (4-7 wk. in the 1st and 4-8 wk. in the 2nd expt.), and whole fattening period (0-7 and 0-8 wk., resp.) were analyzed by variance analysis. Whole root CM, obtained by natural solar drying, showed a total cyanide concn. of 25-29 mg/kg and those obtained by artificial drying, 300-329 mg/kg. Total cyanide concn. for cassava foliage meal varied from 83 to 145 mg/kg. Results of the 1st expt. showed that the final live wt./chick decreased as the level of cyanide in the diet increased. As the level of CM in the diet increased from 20 to 40 percent, feed intake decreased, due probably to the levels of CM and cyanide per se; this was evidenced by a similar feed intake (P greater than 0.05) to that of groups fed diets with 40 percent CM, regardless of their cyanide content (3607 vs. 3553 g for CM with low and high cyanide levels, resp.). Results of the 2nd expt. indicated a marked superiority in growth rate from the 2nd wk. onward of those chicks fed the commercial diet. These results suggest that increasing levels of CM and cyanide did not affect diet consumption, but growth patterns suggest an adverse effect of cyanide on diet digestibility and feed conversion. The high mortality rate observed in both expt. was not correlated with the diet cyanide content. Except for SCM concn. in blood serum, hematological parameters and thyroid wt. were not affected by the cyanide level in the diet. (AS (extract))

0221

30563 BAHRI, S. 1984. Kadar tiosianat pada kambing dan kemungkinannya untuk menduga keracunan sianida. (Thiocyanate concentrations in blood of goats fed cassava). Penyakit Hewan 16(28):207-211. En. Sum. En., 10 Ref., Il. (Balai Penelitian Penyakit Hewan, Bogor, Indonesia)

CASSAVA; TOXICITY; THIOCYANATES; ANIMAL HEALTH; GOATS; INDONESIA.

The range of SCN levels in sera from 63 goats consuming a small amount or no cassava leaves was 0.9-7.1 micrograms/ml and the mean 4.2 micrograms/ml. SCN levels for 97 goats that always consumed leaves ranged from 6.7 to 34.0 micrograms/ml, and the mean was 14.1 micrograms/ml. Increased SCN levels were detected 20 min after eating bitter cassava leaves. SCN levels in groups of goats that consumed the same ration showed little variation. Therefore, in a case of cyanide poisoning of a goat, the diagnosis can be made by determining the serum SCN level of the animal. (AS)

0222

25767 BAHRI, S.; HAMID, H.; GINTING, N.; ARIFIN, Z.; YUNINGSIH 1984. Pengaruh pemberian singkong pahit (Manihot esculenta) terhadap pertumbuhan dan keadaan kelenjar thyroid ayam pedaging. (Effect of bitter cassava on growth and the thyroid of chickens). Penyakit Hewan 16(27):173-178. Mal. Sum. En., Mal., 14 Ref., Il. (Balai Penelitian Penyakit Hewan, Bogor, Indonesia)

ANIMAL NUTRITION; BITTER CASSAVA; CASSAVA; INDONESIA; POULTRY.

Diets containing cassava at 0, 15, 30, 45, and 60 percent were given to chickens from 1 day until 7 wk. old, at Balai Penelitian Penyakit Hewan (Bogor, Indonesia). Mean daily body wt. gain was decreased significantly when diets with more than 30 percent cassava were given. The wt. of the thyroid gland was not affected by dietary cassava up to 60 percent, but chickens given 60 percent cassava had slight hyperplasia of thyroid epithelial cells and colloid deficiency in the small follicles. (AS)

0223

29475 CARVALHO, V.D. DE 1987. O acido cianidrico em produtos de mandioca. (Hydrocyanic acid in cassava products). Informe Agropecuario 13(145):88-91. Pt. 4 Ref., Il. (EPAMIG, Caixa Postal 176, 37.200 Lavras-MG, Brasil)

CASSAVA; HCN CONTENT; DRYING; SILAGE; CASSAVA CHIPS; CULTIVARS; FEEDS AND FEEDING; PROCESSING; BRAZIL.

The effects of cassava leaf and root preparation methods and the type of drying and silage on HCN reduction are discussed. Washing after partial boiling of macerated leaves for 15 min resulted in practically total reduction of HCN content. Results showed that for max. HCN level reduction, cassava roots for human consumption should be chopped into small pieces and boiled in sufficient water at a ratio of at least 5:1 (water:roots). In expt. on the effects of cassava chip size, drying method and temp. on HCN reduction, the following conclusion was reached: HCN reduction was greater in larger chips at a given drying temp. and lower at higher temp. for a given chip size. Root silage obtained from high HCN cassava cv. was observed to be safe for use in animal feeding since HCN is reduced to low levels. (CIAT)

0224

29022 FRAKES, R.A.; SHARMA, R.P.; WILLHITE, C.C.; GOMEZ, G. 1986. Effect of cyanogenic glycosides and protein content in cassava diets on hamster prenatal development. Fundamental and Applied Toxicology 7(2):191-198. En. Sum. En., 28 Ref., Il. (Toxicology Program, UMC56, Utah State Univ., Logan, UT 84322, USA)

CASSAVA; ANIMAL NUTRITION; HUMAN NUTRITION; CASSAVA MEAL; HCN; HCN CONTENT; FEED CONSTITUENTS; DIETARY VALUE; CYANOGENIC GLUCOSIDES; PROTEIN CONTENT; DIETS; USA.

Groups of pregnant hamsters were fed diets consisting of CM:lab chow (80:20) during days 3-14 of gestation. One low cyanide (sweet) CM and 1 high cyanide (bitter) CM were studied. One additional group was fed a diet which resembled cassava in nutritional value, but which lacked the cyanogenic glycosides. SCN concn. increased significantly in the urine and blood of dams fed cassava diets. Increased tissue SCN concn. were observed in fetuses recovered from cassava-fed dams. Cassava-fed dams gained significantly less wt. than did control animals and their offspring showed evidence of fetotoxicity. Reduced fetal body wt. and reduced ossification of sacrocaudal vertebrae, metatarsals, and sternebrae were associated with cassava diets. High cyanide cassava diets were also associated with a significant increase in the no. of runts compared with litters from dams fed either low protein or lab stock diets. (AS)

0225

33689 GOMEZ, G.; APARICIO, M.A.; WILLHITE, C.C. 1988. Relationship between dietary cassava cyanide levels and broiler performance. Nutrition Reports International 37(1):63-75. En. Sum. En., 21 Ref. (2813 Rue Sans Famille, Raleigh, NC 27607, USA)

CASSAVA; CASSAVA MEAL; CASSAVA LEAF MEAL; DIETS; COMPOSITION; DRY MATTER; PROTEIN CONTENT; FIBER CONTENT; ASH CONTENT; MINERAL CONTENT; POULTRY; FEEDS AND FEEDING; ANIMAL PHYSIOLOGY; CYANOGENIC GLUCOSIDES; THIOCYANATES; COLOMBIA; CIAT-1.

The hematologic and histopathological effects of increasing dietary cassava cyanide in relation to the performance of broiler chicks were assessed in 2 expt. A high-cyanide containing CM from cv. M Col 1684, supplying 300 mg total cyanide/kg mostly in the form of cyanogenic glycosides, was studied in the 1st expt. Three percent cassava foliage meal (leaves, petioles, and green stems) containing 156 mg total cyanide/kg was included along with CM in diets of the 2nd study. CM was mixed in chick starter (0-28 days) and finisher (28-63 and 28-56 days for expt. 1 and 2, resp.) diets at 0, 10, 20, and 30 percent.

In expt. 1 the diets were fed to 4 groups of 26 day-old chicks each, raised in batteries. In expt. 2, 720 day-old chicks were distributed into 18 groups of 40 chicks each; the 4 diets with 4 replicates each, plus 2 additional groups fed a commercial diet, were assayed. Chicks fed the CM + cassava foliage meal diets were raised on concrete floors. The addition of up to 30 percent CM failed to adversely affect broiler survival, performance, or feed efficiency, but the inclusion of cassava foliage meal to exptl. diets increased mortality and decreased wt. gain and feed efficiency. In both expt., increased quantities of dietary cassava cyanide were associated with increased (P less than 0.05) blood serum SCN concn. A histophatological study of the chicks' thyroids, livers, and kidneys indicated that there were no appreciable (P greater than 0.05) alterations in any of the sections other than the thyroids; however, there was no conclusive evidence of the cyanide or the SCN effects on thyroid activity. Aflatoxin contamination appeared to have contributed to the high mortality rate associated with cassava foliage meal diets. Results showed that broilers were tolerant to relatively high levels of dietary cyanogenic glycosides. (AS)

0226

30547 GROPP, J. 1986. Schadstoffaspekte. Eine ironisch ernste Betrachtung. (Aspects of toxic substances. Ironically serious reflexions). Kraftfutter 69(3):86-88,90-91. De. (Institut fur Physiologie, Physiologische Chemie und Ernahrungsphysiologie: Tierarztliche Fakultat der Universitat Munchen, Veterinarstrabe 13.8000 Munchen 22)

CASSAVA; TOXICOLOGY; LEGAL ASPECTS; FEEDS AND FEEDING; FEDERAL REPUBLIC OF GERMANY.

0227

26882 HARRIS, J.R.; MERSON, G.H.J.; HARDY, M.J.; CURTIS, D.J. 1980. Determination of cyanide in animal feeding stuffs. Analyst 105:974-980. En. Sum. En., 14 Ref.

CASSAVA; HCN; CYANOGENIC GLUCOSIDES; FEEDS AND FEEDING; ANALYSIS; LABORATORY EXPERIMENTS; HCN CONTENT; ANIMAL HEALTH; HYDROLYSIS; UNITED KINGDOM.

A method for determining cyanide in feeding stuffs was developed. Naturally occurring cyano-substituted glycosides were subjected to enzymatic hydrolysis; the liberated cyanide was isolated by aeration and determined either by a spectrophotometric method or by gas chromatography. Recoveries of cyanide added to feedstuffs at concn. of 10 and 20 mg/kg were approx. 98 percent. Cyanide contents of a cassava matrix were 159,. 157, and 150 micrograms/g. Cyanide recoveries were 96.3, 96.8, and 99.1 (amygdalin-fortified cassava) for the spectrophotometric method and 95.9, 96.3, and 97.1 percent (linamarin-fortified cassava) for gas chromatography. The method is sensitive to as little as 1 mg cyanide/kg. (AS)

0228

26741 HERSHMAN, J.M.; PEKARY, A.E.; SUGAWARA, M.; ADLER, M.; TURNER, L.; DEMETRIOU, J.A.; HERSHMAN, J.D. 1985. Cassava is not a goitrogen in mice. Proceedings of the Society for Experimental Biology and Medicine 180(1):72-78. En. Sum. En., 18 Ref., Il. (Endocrine Research Laboratory, Univ. of California, Los Angeles, CA 90073, USA)

CASSAVA; LABORATORY ANIMALS; CYANIDES; IODINE; ENDEMIC GOITER; DIETS; DIETARY VALUE; ANIMAL HEALTH; CLINICAL MANIFESTATIONS; THIOCYANATES; HUMAN HEALTH; USA.

To examine the effect of cassava on the thyroid function of mice, fresh cassava roots were fed to mice and this diet was compared with a low I diet and Purina. Cassava provided a low I intake and increased urine SCN excretion and serum SCN levels. Mice on cassava lost wt. The thyroid glands of mice on cassava were not enlarged, even when normalized for body wt. The 4- and 24-h thyroid uptakes of mice on cassava were similar

to those of mice on low I diets. Protein-bound ((125)I)I at 24 h was high in mice on either the cassava or low I diets. The thyroid I trap (T/M) was similar in mice on cassava and low I diets. When SCN was added in vitro to the incubation medium, T/M was reduced in all groups of mice; under these conditions, SCN caused a dose-related inhibition of T/M. The serum thyroxine (T4) and triiodothyronine (T3) concn. of mice on cassava were reduced compared with mice on Purina diet. Thyroid T4 and T3 contents of mice on cassava were relatively low compared with mice on Purina diet. Hepatic T3 content and T4 5'-monodeiodination in liver homogenates were reduced in mice on cassava compared with other groups. The data show that cassava does not cause goiter in mice. The SCN formed from ingestion of cassava is insufficient to inhibit thyroid iodide transport or organification of iodide. The cassava diet leads to rapid turnover of hormonal I because it is a low I diet. It also impairs 5'-monodeiodination of T4, which may be related to nutritional deficiency. These data in mice do not support the concept that cassava per se has goitrogenic action in man. (AS)

0229

33683 JESTIN, A.; MADEC, F.; POPOFF, M.R. 1987. Le syndrome de la diarrhee recurrente chez le porc charcutier: approches ecopathologique et microbiologique. (Ecopathological and epidemiological studies of a diarrheic syndrome in pigs raised for sausage manufacturing). Annales de Zootechnie 36(1):59-72. Fr. Sum. Fr., En., 18 Ref., Il.

CASSAVA; DIETS; SWINE; ANIMAL HEALTH; FRANCE.

Recurrent diarrhea, a new diarrheic syndrome, was observed in pigs approx. 3 wk. after they initiated the fattening stage. An ecopathological study was performed in 70 herds for which data on feeding and housing conditions were collected. The infectious agents associated with diarrhea were isolated and their pathogenicity tested. Dietary components such as cassava (30 percent), molasses, green peas, and fat were found to contribute to the diarrheic syndrome. The rotavirus, the Clostridium perfringens enterotoxin, and protozoa inoculated orally produced diarrhea. The development of diarrhea was mainly associated with herd management conditions: feed distribution on the floor, deficient heating and ventilation, and a restricted surface area of slatted floor. (AS)

0230

27647 LAPLACE, J.P.; DARCY-VRILLON, B. 1984. Motricite de l'intestin grele et digestibilite ileale d'un regime a base de manioc chez le porc. (Small intestine motility and ileac digestibility of a cassava diet in pigs). Annales de Zootechnie 33(4):489-508. Fr. Sum. Fr., En., 14 Ref., Il. (Inst. National de la Recherche Agronomique, Laboratoire de Physiologie de la Nutrition, Centre de Recherches Zootechniques, F 78350 Jouy-en-Josas, France)

CASSAVA; SWINE; DIETS; ANIMAL PHYSIOLOGY; DIGESTIBILITY; ANALYSIS; LABORATORY EXPERIMENTS; DRY MATTER; TOXICOLOGY; FRANCE.

Four Large White castrated male pigs, averaging 50 kg live wt., were used to estimate the effects of incorporating cassava into the diet on the motility of the small intestine and the apparent digestibility in the distal small intestine. Two of the pigs, fitted with chronic electrodes implanted at 7 sites along the small intestine, were used to study the motility pattern of myoelectric migrating complexes during ingestion of semipurified diets including 72.4 percent CM or 68.3 percent purified maize starch. Each diet contained 16 percent total CP, mainly supplied by fish meal. Parallel to that, a commercial standard diet including 30 percent CM was tested in the same exptl. conditions. The other 2 pigs, subjected to ileo-colic postvalvular fistulation, were used in a qualitative and quantitative study of digested matter collected at the ileo-caeco-colic junction after intake of a semipurified diet containing CM. The results were compared with those previously obtained with a diet based on purified maize starch. The amounts of fresh and dry matter collected in the distal small intestine were, resp., 2.5 and 1.7 times larger with the semipurified cassava diet than with the maize starch diet. The DM content of digested matter averaged

only 7 percent for the cassava diet vs. 11 percent for the maize diet. The apparent ileac digestibility of starch was subtotal for the 2 diets, while those of DM and N were highly reduced (78 percent for cassava vs. 87 percent for maize). The motility pattern of myoelectric complexes was almost maintained with the semipurified cassava diet; however, some important changes in the characteristics of the complexes may be directly related to the increase in the vol. of the more fluid cassava digested matter. The rise in the level of intake when feeding the standard diet aggravated these effects and led to a real disturbance of the motility pattern. These observations can be associated with the presence in CM of almost 5 percent simple carbohydrates probably responsible for the afflux of water toward the intestinal lumen and thus for the motility changes; furthermore, the presence of phenol compounds and tannins is most likely responsible for the reduced ileac digestibility of DM and N. These characteristics together with the irregular qualitative properties of the raw materials may lead to pathological situations such as the recurrent diarrhea syndrome. (AS)

0231

25734 OKEKE, G.C.; OBIOHA, F.C.; UDEOGU, A.E. 1985. Comparison of detoxification methods for cassava-borne cyanide. Nutrition Reports International 32(1):139-147. En. Sum. En., 16 Ref. (Dept. of Animal Science, Univ. of Nigeria, Nsukka, Nigeria)

ASH CONTENT; BITTER CASSAVA; BOILING; CALCIUM; CASSAVA; COOKING; CORTEX; DETOXIFICATION PROCESSES; DRYING; FAT CONTENT; FIBER CONTENT; HCN CONTENT; MINERAL CONTENT; NIGERIA; PHOSPHORUS; PROTEIN CONTENT; SILAGE; STATISTICAL ANALYSIS.

Five different methods for the processing of bitter cassava peels are described, and compared in relation to their effectiveness in rapid reduction of HCN. Results show that a significant negative correlation exists between HCN decline and time for each of the methods. Regression analyses also indicate that the min. processing times required to achieve safe HCN levels for monogastric animal feeding are 6.95 min, 30.16 min, 15.38 h, 3.24 days, and 7.61 days for boiling, roasting, soaking, ensiling, and sun drying, resp. (AS)

0232

29504 PEREIRA, J.F.; SPLITTSTOESSER, W.E. 1987. Exudate from cassava leaves. Agriculture, Ecosystems and Environment 18(3):191-194. En. Sum. En., 11 Ref., Il. (Laboratory of Plant Physiology, Univ. de Oriente, Jusepin, Monagas, Venezuela)

CASSAVA; LEAVES; HCN CONTENT; EXUDATE; CULTIVARS; BIOCHEMISTRY; CARBOHYDRATE CONTENT; SUGAR CONTENT; AMINO ACIDS; USA.

The composition and possible function of the exudate from the midribs and petioles of leaves of 6 cassava cv. were evaluated. It was found to be composed mostly of fructofuranosides and reducing sugars with few amino acids and no cyanide. Serial sections of the specific sites where the exudate appeared did not reveal the presence of structural nectaries. The fresh exudate was harmless to both common houseflies and mosquitoes, which may indicate that the exudate is not a protective factor against insect attack to the cassava plants. It is considered that the exudate is simply secretion from the sieve elements or the companion cells while translocation is taking place at night. (AS)

0233

26389 RAJAGURU, S.B.; RAVINDRAN, V. 1985. Metabolisable energy values for growing chicks of some feedstuffs from Sri Lanka. Journal of the Science of Food and Agriculture 36(11):1057-1064. En. Sum. En., 43 Ref. (Dept. of Animal Science, Univ. of Peradeniya, Peradeniya, Sri Lanka)

CASSAVA; NUTRITIVE VALUE; FEEDS AND FEEDING; FOOD ENERGY; CHICKS; METABOLISM; FEED CONSTITUENTS; TOXICITY; HCN CONTENT; CASSAVA MEAL; ANIMAL HEALTH; SRI LANKA.

Seven biossays were conducted with 600 1-wk.-old White Leghorn cockerels to determine the zero N-corrected ME values of 23 Sri Lankan-produced feedstuffs. The N-corrected ME values (MJ/kg DM) of the feedstuffs were: maize 14.28, sorghum 14.42, broken rice 12.35, rough rice 9.21, rice bran grade I 14.28, rice bran grade II 9.30, wheat feed flour 9.31, wheat bran 7.66, undetoxified CM 13.38, detoxified CM 15.92, coconut oil meal 7.46, sesame oil meal 11.48, rubber seed meal 11.25, kapok seed meal 8.75, urd bean 12.68, CLM 7.82, local fish meal 11.97, skim milk powder 10.41, meat and bone meal 8.02, sugar filter-press mud 8.85, cocoa husk meal 7.46, mango seed kernel meal 10.84, and tea refuse 6.02. The difference between the N-corrected ME values of undetoxified and detoxified CM indicate that HCN interfers with energy utilization in poultry. (AS)

0234

27599 TEWE, O.O.; MANER, J.H. 1980. Cyanide, protein and iodine interactions in the performance, metabolism and pathology of pigs. Research in Veterinary Science 29:271-276. En. Sum. En., 17 Ref., Il. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

CASSAVA; CYANIDES; HCN; IODINE; PROTEIN; ANIMAL PHYSIOLOGY; ENDEMIC GOITRE; DIETS; DIETARY VALUE; LABORATORY ANIMALS; SWINE; ANIMAL HEALTH; NIGERIA.

Performance and metabolic and pathological changes were evaluated in 48 growing pigs fed different levels of dietary protein, cyanide, and I. Protein deficiency reduced urinary I excretion and the serum concn. of protein, protein-bound I, and SCN. It also reduced liver rhodanese activity and caused a decrease in urinary SCN excretion that was not significant. Dietary cyanide increased urinary SCN and I excretion and serum SCN concn. while the basal diet reduced urinary I excretion and serum protein-bound I. Pathological studies showed that cyanide treatment had no marked effect on the microanatomy of the tissues examined. Dietary protein deficiency caused histological changes in the thyroid gland and bone which suggested a decline in metabolic activity. I deficiency caused hyperplastic goiter in the exptl. animals. (AS)

0235

22092 TEWE, O.O. 1981. Effect of cassava-based diets varying in cyanide content on the performance and physiopathology of the African giant rat (Cricetomys gambianus Waterhouse). Animal Feed Science and Technology 11(1):1-9. En. Sum. En., 19 Ref. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

AFRICA; ANIMAL NUTRITION; CASSAVA PRODUCTS; CEREALS; COMPOSITION; CORTEX; FEED CONSTITUENTS; FEEDS AND FEEDING; HCN CONTENT; LABORATORY ANIMALS; MAIZE; METABOLISM; NIGERIA; PROCESSED PRODUCTS; PULP; ROOTS; STARCH CROPS; USES.

Twenty-four male weanling African giant rats were allocated to 4 treatment groups in a 16-wk. trial. Their diets were based on (1) maize, (2) cassava peel, (3) whole cassava roots, and (4) cassava pulp. HCN content of diets was 0, 597, 150, and 110 mg/kg, resp. Diets were isocaloric and isonitrogenous. Feed consumption was similar on all diets. Growth rate, feed efficiency, and PER were better (P less than 0.05) on diets 1 and 4. Serum, organ, and urinary SCN were higher (P less than 0.05) on the cassava-based diets. Serum urea concn. increased proportionally with dietary HCN level. No pathological lesions were observed in spleen, kidney, liver, and thyroid glands of animals on all treatments. (AS)

0236

21692 TEWE, O.O.; AFOLABI, A.O.; GRISSOM, F.E.G.; LITTLETON, G.K.; OKE, O.L. 1984. Effect of varying dietary cyanide levels on serum thyroxine and protein metabolites in pigs. Nutrition Reports International 30(5):1249-1253. En. Sum. En., 16 Ref. (Nutritional Biochemistry Division, Dept. of Animal Science, Univ. of Ibadan, Nigeria)

ANIMAL NUTRITION; CASSAVA; CORTEX; FEED CONSTITUENTS; HCN CONTENT; HUMAN NUTRITION; NIGERIA; PHYSIOLOGY; SOLAR DRYING; SWINE.

Three cassava-based diets containing 0, 96, and 400 ppm cyanide (diets 1, 2, and 3) were fed to 30 pigs. The effects on serum thyroxine and protein metabolites were determined on days 35 and 72 of trial. Serum thyroxine decreased from diets 1 to 3 on day 35. A similar but not significant trend was observed on day 72. Values obtained on day 72 were slightly lower than day 35 on diets 1 and 2. Serum thyroxine was higher in males than females. Serum urea increased with higher dietary cyanide levels for both periods. Serum total proteins, serum albumin, glutamic oxaloacetic and glutamic-pyruvate transaminases were similar in all treatments. Cyanide intake in pigs has significant effects on thyroid and protein metabolism. (AS)

0237

26893 TEWE, O.O.; MANER, J.H. 1985. Cyanide, protein and iodine interaction in the performance and metabolism of rats. Journal of Environmental Pathology and Toxicology 6(1):69-78. En. Sum. En., 15 Ref., Il. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

CASSAVA; HCN; LABORATORY ANIMALS; ANIMAL PHYSIOLOGY; ANIMAL HEALTH; IODINE; PROTEIN DEFICIENCIES; FEED CONSTITUENTS; FEEDS AND FEEDING; FEED MIXTURES; THIOCYANATES; HCN ABSORPTION; NIGERIA.

Performance and metabolic traits were measured in 64 growing rats fed on varying levels of dietary cyanide, protein, and I. The presence of cyanide in the diets caused a nonsignificant reduction in both feed consumption and growth rate. Moreover, on protein-deficient diets, the lowest body wt. gain was obtained in the animals with 750 ppm cyanide. I deficiency did not have any marked influence on performance. Dietary cyanide significantly increased serum and urinary SCN concn. while I deficiency caused significant reductions in serum protein-bound I. Interactions of protein deficiency and dietary cyanide also significantly reduced serum SCN concn., while interactions of the 3 dietary variables significantly reduced kidney protein content. (AS)

0238

26857 TEWE, O.O. 1985. Protein metabolism in growing pigs fed corn or cassava peel based diets containing graded protein levels. Research in Veterinary Science 38(3):259-263. En. Sum. En., 13 Ref. (Dept. of Animal Science, Univ. of Ibadan, Ibadan, Nigeria)

CASSAVA; CORTEX; USES; SWINE; PROTEINS; FEEDS AND FEEDING; ANIMAL PHYSIOLOGY; ANIMAL NUTRITION; NIGERIA.

Sixty-four Large White x Landrace weanling pigs were randomly allotted to 8 treatments in a 2 x 4 factorial arrangement. The 2 dietary variables were cassava peel (0 and 40 percent) and CP (20, 15, 10, and 5 percent). Total serum protein concn. was significantly (P less than 0.01) reduced by protein deficiency and by its interaction with cassava peel. The multiple coefficient of determination (R(2)) showed that protein intake was the primary factor determining changes in serum protein. R(2) values for cyanide intake (independent variable) on serum protein (dependent variable) increased from day 30 to 90 of

the trial. Serum urea was increased on the 5 percent protein diets on days 60 and 90 of the trial. The R(2) values for cyanide and protein intake on serum urea concn. increased from day 30 to 90 of the trial. Serum creatinine increased (P less than 0.05) on the 5 percent protein diet on day 90 of the trial. The R(2) value for the effects of protein intake on serum creatinine was higher than for cyanide intake on days 30 and 90. The results confirm the progressive and pronounced effects of long-term cyanide intake on serum nitrogenous metabolites in pigs consuming between 110-120 ppm HCN, especially in diets containing 10 percent or less protein. (AS)

0239

26729 TEWE, O.O.; KASALI, O.B. 1986. Effect of cassava peel processing on the performance, nutrient utilization and physiopathology of the African giant rat (Cricetomys gamhianus Waterhouse). Tropical Agriculture 63(2):125-128. En. Sum. En., 22 Ref. (Dept. of Animal Science, Univ. of Ibadan, Nigeria)

CASSAVA; CORTEX; ANIMAL PHYSIOLOGY; FERMENTATION; METABOLISM; DRYING; HCN; THIOCYANATES; NITROGEN; FERMENTED PRODUCTS; FEED CONSTITUENTS; ENDEMIC GOITER; DIETS; LABORATORY ANIMALS; DIGESTIBILITY; NIGERIA.

Four diets were prepared that contained 31.12 percent of either maize (diet 1) or processed cassava peel, which was sun dried, oven dried, or fermented, constituting diets 2-4, resp. They were fed to weanling giant rats in a 42-day trial. HCN contents of the rations were 0, 130.20, 595.20, and 42.16 ppm, resp. Performance was best on diet 1 and poorest on diet 3. ME and N retention were poorer in giant rats fed the cassava peel rations. Serum and urinary SCN values were higher (P less than 0.01) in the giant rats fed either diet 2 or 3 than in those fed diet 1 or 4. Cyanide intake was significantly (P less than 0.05) correlated with daily wt. gain, serum protein, urea, SCN, urinary SCN and N retention values. There were no gross or histological lesions in the tissues in any of the test animals. (AS)

0240

29030 UMOH, I.B.; MADUAGWU, E.N.; AMOLE, A.A. 1986. Fate of ingested linamarin in malnourished rats. Food Chemistry 20(1):1-9. En. Sum. En., 18 Ref. (Dept. of Biochemistry, College of Medical Sciences, Univ. of Calabar, Nigeria)

CASSAVA; LINAMARIN; ANIMAL NUTRITION; DIETS; ANIMAL HEALTH; KWASHIORKOR; RIBOFLAVIN; CYANOGENIC GLUCOSIDES; CYANIDES; THIOCYANATES; NIGERIA.

Pure linamarin at a dose level of 30 g/100 g body wt. was administered in food to a group of Wistar rats maintained on vitamin B2-deficient, sufficient, and excess diets for 5 wk. and to another group of kwashiorkor rats. Free and total cyanide, intact linamarin, and SCN levels were estimated in urine and feces obtained at 0-, 24-, 48-, and 72-h periods and in blood samples obtained in the 72nd h after the drug had been administered. There was no detectable cyanide or intact linamarin in the fecal samples. Vitamin B2-sufficient and excess groups of rats excreted higher total and free cyanide than the resp. vitamin B2-deficient groups. Most of the linamarin was degraded after the 1st 24 h. The rate of breakdown of the glucoside within the 1st 24 h was slowest for the zero and half normal vitamin B2 status, resp., as evidenced by its appearance in large quantities in the urine. The kwashiorkor rats, on the other hand, excreted less SCN than the controls. In addition, their control group excreted most of the SCN- in the 1st 24 h while the kwashiorkor rats excreted theirs in the 1st 48 h. Dietary protein deficiency prolongs the time of metabolism and hence increases the toxicity of cyanogenic glycoside in the body. It is also suggested that excessive exposure of malnourished humans to cyanide could be a contributary factor in the rampant cases of tropical ataxic neuropathy. (AS)

See also 0020 0058 0061 0085 0127 0154 0157 0172 0187 0195 0196 0209

0241

29565 CASSAVA: MORE than a famine reserve crop. 1985. Radix 7(1):1-3. En. Sum. En., 5 Ref., Il.

CASSAVA; USES; HUMAN NUTRITION; FEEDS AND FEEDING; BREADS; CASSAVA PRODUCTS; SUBSTITUTES; MARKETING; FOOD SECURITY; PHILIPPINES.

The numerous uses of cassava for human consumption, animal feeds, industrial purposes, and in breadmaking and baked goods are briefly indicated. The multiple uses of cassava, especially in industry, as a substitute for wheat flour and as an ingredient in animal feeds, and its entry into the export market, have raised its status of a famine reserve to one of a highly valued versatile crop. (CIAT)

0242

31321 PROJET MANIOC - ovins de Toumodi. (Toumodi's cassava-sheep project). 1985. Terre et Progres no.63:17-19. Fr. Il.

CASSAVA; CASSAVA PROGRAMS; STATISTICAL DATA; PRODUCTION; ROOT PRODUCTIVITY; SHEEP; ANIMAL NUTRITION; IVORY COAST.

The importance of cassava in human and animal nutrition and in industries in Ivory Coast is highlighted. The objectives and different stages of Toumodi's cassava project are briefly described. The role of each component involved is explained and major results obtained from 1977 to 1984 are reported. Statistics are presented on industrial and village plantings (area planted to cassava, area harvested, production, and yields) and on the evolution of the sheep flock. (CIAT)

0243

21479 THE GROWING role of cassava. West African Farming 1984:13-15. January/February 1984. En. Il.

ANIMAL NUTRITION; FEEDS AND FEEDING; LEGAL ASPECTS; MARKETING; TRADE; USES.

The growing interest of Europe (particularly Holland, West Germany, and Belgium) in cassava as a cereal substitute in animal feeds is discussed. The high price of cereals and the stimulation of exports due to the agricultural policies of the EEC, will probably increase the demand for cassava in the next few years. The world trade of cassava, in which Thailand is the major exporter (over 7 millions of t in 1983), is analyzed; other exporters are China, Indonesia, and Brazil. The importance of using the potential of production in African countries is highlighted. The Centre for Industrial Development (CID) is promoting the industrial processing of cassava in West Africa. The use of cassava pellets, cyanide content, supplementation, and the advantage of using cassava in animal feeds are discussed. (CIAT)

0244

30090 ADAMU, S.O. 1987. Trends and prospects for cassava in Nigeria. Washington, D.C, International Food Policy Research Institute. 213p. En. 38 Ref., Il. Paper prepared for Workshop on Trends and Prospects of Cassava in the Third World, Washington, D.C., 1987.

CASSAVA; PRODUCTION; ECONOMICS; USES; TRADE; PRICES; CONSUMPTION; STATISTICAL DATA; FARM SIZE; CULTIVARS; COSTS; CULTIVATION; ROOT PRODUCTIVITY; SOCIOECONOMIC ASPECTS; HUMAN NUTRITION; ANIMAL NUTRITION; DEVELOPMENT; FARMING SYSTEMS; WOMEN; FOOD SECURITY; GARI; CASSAVA FLOUR; FOOFOO; CASSAVA STARCH; PROCESSING; SURVEYS; USES; NIGERIA.

The role of cassava in Nigerian farming systems is examined, as well as the effect of technological improvements on rural employment and income. Fresh and processed cassava consumption prospects in rural and urban areas and its scope for use in animal feeds are also examined. Starch production and other uses are studied as well as processing and storage technologies and their impact on increased cassava production and consumption. Cassava supply and demand prospects for 1990 and 2000 are presented. Cassava production, utilization, and trade policies are recommended. (CIAT)

0245

34971 BACIGALUPO, A., ed 1986. Procesamiento inicial y final de alimentos. Raices: yuca. (Initial and final processing of foods. Root crops: cassava). In Bacigalupo, A., ed. Procesamiento de alimentos en pequenas agroindustrias: guia practica, parte 2. Santiago, Chile, Oficina Regional de Educacion de la UNESCO para America Latina y el Caribe. 62p. Es. Il.

CASSAVA; SWEET CASSAVA; BITTER CASSAVA; SMALL-SCALE PROCESSING; CASSAVA ROOTS (VEGETABLE); CASSAVA FLOUR; CASSAVA STARCH; CASSAVA BREAD; BAMI; FEEDS AND FEEDING; EXTENSION MATERIALS; QUESTIONNAIRES; LEGAL ASPECTS; CHILE.

Based on the concept of self-instruction, basic information is given on appropriate food processing technologies (including those for cassava) aimed at establishing small agroindustries to improve the standard of living and income of small farmers. Processing is divided into 2 stages: initial (carried out on the farm, at home, or by the rural community) and final processing of the product. Initial processing involves freezing and coating with solid paraffin. Final processing is indicated for CF, cassava starch, sour cassava starch, cassava bread, bami, and other sour cassava starch by-products (kwak, kokori, and bread). The preparation of cassava-based animal feed is briefly reviewed. (CIAT)

0246

34270 BALAGOPALAN, C.; PADMAJA, G.; NANDA, S.K.; MOORTHY, S.N. 1988. Cassava in animal feed. In Balagopalan, C.; Padmaja, G.; Nanda, S.K.; Moorthy, S.N. Cassava in food, feed, and industry. Boca Raton, FL, CRC Press. pp.73-96. En. 231 Ref.

CASSAVA; ANIMAL NUTRITION; FEEDS AND FEEDING; POULTRY; SWINE; DAIRY CATTLE; BEEF CATTLE; CALVES; GOATS; SHEEP; ANIMAL PHYSIOLOGY; DIETS; CASSAVA LEAF MEAL; SILAGE; WASTE UTILIZATION; INDUSTRIAL MICROBIOLOGY; PROTEIN ENRICHMENT; INDIA.

The ever-rising prices of cereals has led to a search for low-cost energy sources. Cassava roots offer great potential, but must be carefully combined with other ingredients given their low protein content, HCN toxicity, and lack of S-containing amino acids such as met. Although CLM is a highly nutritious protein-rich ingredient, it needs to be detoxified by drying. Both CM and CLM can be used for feeding poultry, swine, and ruminants; however, the palatability of CM is low. Molasses and/or fat must be added to reduce dustiness of the meal and improve taste. Experiences with cassava as a feed source for poultry, swine, and ruminants are reviewed; optimal levels of inclusion and the types of additives required for a balanced diet are included. Ca. 60-65 percent more protein supplement is required for a CM-based diet for swine than a maize-based diet; thus its potential rests on the availability of cheap protein sources. Results are also reported of expt. with small animals (guinea pigs, rats, turkeys, fish). The use of by-products such as

modified and unmodified starch, fermented cassava peel, and CSW is also reviewed. Production of silage is a means of preserving cassava as a feed without altering the nutritional quality of the roots even after long periods of storage. Silage supplemented with vegetable protein sources has been used successfully with pigs and ruminants. The fermentation of CM does not alter the chemical constituents substantially. The use of microbes to increase protein levels has been tried in both solid state and liquid fermentation systems; however, there is danger of toxicity to animals. Data are provided on yield of mycelia and protein during the fermentation of cassava starch and the nutritional value and protein content of heat-tolerant fungi. (CIAT)

0247

34265 BALAGOPALAN, C.; PADMAJA, G.; NANDA, S.K.; MOORTHY, S.N. 1988. Cassava in food, feed, and industry. Boca Raton, FL, CRC Press. 219p. En. 703 Ref., Il.

CASSAVA; CULTIVATION; PROCESSING; CASSAVA CHIPS; PELLETS; DRYING; TECHNOLOGY; USES; ANIMAL NUTRITION; DOMESTIC ANIMALS; FEEDS AND FEEDING; FOOD PRODUCTS; CASSAVA PRODUCTS; CONSUMPTION; NUTRITIVE VALUE; TOXICITY; HUMAN HEALTH; CLINICAL MANIFESTATIONS; DETOXIFICATION PROCESSES; ROOTS; DETERIORATION; STORAGE; CASSAVA STARCH; ANALYSIS; COMPOSITION; INDUSTRIALIZATION; INDIA.

State-of-the-art information is provided on cassava spoilage and preservation; processing technology; and utilization in feed, food, and industry. Extensive references are included. Aspects covered are consumption patterns, cooking quality, and utilization; botany, origin, distribution, and cultivation; nutritive value and toxic principles; postharvest deterioration and storage techniques; by-products (chips, flour, pellets, starch, tapioca, and pasta); root processing; and use in animal and human nutrition. The chemical structure and properties of cassava starch are discussed; applications are given for food and industry. Analytical techniques for estimating starch content, fractionation of amylose and amylopectin, soluble and reducing sugars, HCN, crude protein, phenols, and carotenes are described. (CIAT)

0248

29458 BUDHAKA, B.; ITHARATTANA, P.; OORAIKUL, S. 1984. Economic analysis of the use of cassava product in livestock rations and its market prospects; cassava/nutrition project. Bangkok, Thailand, Ministry of Agriculture and Cooperatives. Khon Kaen University. International Development Research Centre. 76p. En. 24 Ref., Il.

CASSAVA; DIETS; POULTRY; SWINE; FEEDS AND FEEDING; COSTS; MARKETING; PRICES; SUBSTITUTES; THAILAND.

The economic possibilities of using cassava for the animal feed industry were investigated using linear programming and a least cost ration model, based on data from the Khon Kaen U. (Thailand)/International Development Research Centre (Canada) Cassava Project. Results suggested that cassava-based rations are economically viable and price competitive with major cereals and grains available and used in the livestock feed industry. Among 10 cassava-based feed formulae applied for different age intervals of poultry and pigs, cassava could be substituted for other cereals in all feeds, except for layers 22-24 and 44-66 wk. old. More attention should be given and actions taken for the extensive use of cassava in the feed industry by policymakers. Cassava-based feed can play a more important role in market opportunities that exist in Asian countries; specific recommendations are provided for Thailand, especially regarding cassava-based mixed ration testing, and information and technology transfer to livestock raisers and feedmillers. (CIAT)

0249

33644 CABANILLA, L.S. 1988. Trends and prospects for cassava in the Philippines. Washington, D.C., International Food Policy Research Institute. 74p. En. 38 Ref., Il. Paper prepared for Workshop on Trends and Prospects of Cassava in the Third World, Washington, D.C., 1987.

CASSAVA; PRODUCTION; PRODUCTIVITY; TRADE; CONSUMPTION; USES; PRICES; INCOME; ANIMAL NUTRITION; PHILIPPINES.

The current situation of cassava cultivation in the Philippines is analyzed. More specifically, the past trends in cassava production, utilization, trade, and consumption in the country are examined. Future prospects are assessed, emphasizing its potential as a substitute for maize and sorghum and its use in compound feeds, human nutrition, and in manufactured products. Several policy recommendations are given to improve these prospects. (CIAT)

0250

33679 DALE, N.; FULLER, H.L. 1985. Energy content of corn and some alternative feedstuffs. In Georgia Nutrition Conference for the Feed Industry, Athens, GA, USA, 1985. Proceedings. Athens, University of Georgia. pp.93-96. En. 9 Ref. (Dept. of Poultry Science, Univ. of Georgia, Athens, GA 30602, USA)

CASSAVA; ANALYSIS; FEEDS AND FEEDING; FOOD ENERGY; PROTEIN CONTENT; USA.

Results of 31 assays to determine the individual true ME (corrected to zero N retention) of maize and alternative feedstuffs (including cassava) are given. For 2 cassava samples, true ME (corrected) ranged from 3.30 to 3.36 kcal/g with a mean of 3.33 kcal/g (DM basis). Proximate analysis indicated 2.5 percent CP for cassava. (CIAT)

0251

30031 DOROSH, P. 1987. Economics of cassava in Africa: an overview. Washington, D.C, International Food Policy Research Institute. 46p. En. 30 Ref., Il. Paper prepared for Workshop on Trends and Prospects of Cassava in the Third World, Washington, D.C., 1987.

CASSAVA; PRODUCTION; CASSAVA PROGRAMS; RESEARCH; PRODUCTIVITY; ECONOMICS; LABOR; CONSUMPTION; STATISTICAL DATA; SOCIOECONOMIC ASPECTS; FOOD PRODUCTS; CASSAVA PRODUCTS; FOOD SECURITY; USES; ECOSYSTEMS; HUMAN NUTRITION; ANIMAL NUTRITION; DEVELOPMENT; AFRICA.

Economic aspects of cassava production and utilization are explored to assess the future role of cassava in Africa and to aid in setting research priorities. Statistical information on cassava production and utilization aspects is summarized, and major production systems and constraints are discussed. A description is given on major consumption forms and an analysis is presented on major factors influencing consumption (population growth, urbanization, storability, ease of processing, income level, prices); the role of cassava in enhancing food security; and prospects for other end uses in Africa. factors influencing production and issues related to the spread of cassava are highlighted. Prospects of cassava cultivation in major production systems (forest and derived savanna of West Africa, Guinea savanna, forest and savanna of Central Africa, highlands of Rwanda, Burundi, Zaire and Uganda, and East and Southern Africa) and implications for research are discussed. (CIAT)

0252

24044 FURTADO, M.J. 1981. Mandioca na alimentacao animal. (Cassava for animal feed). Cariacica-ES, Brasil, Empresa Capixaba de Pesquisa Agropecuaria. 4p. Pt. (Empresa Capixaba de Pesquisa Agropecuaria, Caixa Postal 391, 29.000 Vitoria-ES, Brasil)

ANIMAL NUTRITION; BRAZIL; CASSAVA CHIPS; CASSAVA LEAVES (VEGETABLE); CASSAVA PRODUCTS; CATTLE; DIETARY VALUE; DOMESTIC ANIMALS; DRIED ROOTS; FEEDS AND FEEDING; FOLIAGE; FOOD ENERGY; FORAGE; NUTRITIVE VALUE; POULTRY; PROCESSED PRODUCTS; SOUTH AMERICA; SWINE; USES.

The use and nutritive value of fresh cassava and cassava products (leaves, foliage, chips, cortex) in the state of Espirito Santo, Brazil, are reviewed. (CIAT)

0253

33645 GEORGE, P.S. 1988. Trends and prospects for cassava in India. Washington, D.C., International Food Policy Research Institute. 81p. En. Sum. En., 47 Ref., Il. Paper prepared for Workshop on Trends and Prospects of Cassava in the Third World, Washington, D.C., 1987.

CASSAVA; PRODUCTION; PRICES; TRADE; COSTS; INCOME; FOOD SECURITY; USES; ROOT PRODUCTIVITY; CONSUMPTION; FEEDS AND FEEDING; INDIA.

An overview is given of the importance of cassava in India along with its different uses, regional characteristics, and role of cassava in food security. This assessment of the production and utilization patterns of cassava in the country allows the future potential of the crop to be determined. Past trends in area, yield, and production are analyzed; the supply and demand prospects of cassava in 1990 and 2000 are indicated. Appropriate policies for realizing the full potential of cassava production, utilization, and trade in India are suggested. (CIAT)

0254

28561 GONZALEZ M., M. 1985. La mandioca en la formulacion de las raciones alimenticias. (Cassava in the formulation of feed rations). Avances en Alimentacion y Mejora Animal 26(6-7):220-225. Es.

CASSAVA; CASSAVA FLOUR; FEEDS AND FEEDING; DIETS; SWINE; POULTRY; COSTS; SUBSTITUTES; SPAIN.

Using linear programming, exercises are presented to formulate cassava-based rations for pigs and poultry and compare them with the traditional cereal-based rations (especially barley in the EEC) in terms of their nutritional value and cost:benefit ratio. On the basis of the barley-based ration for pigs (ME = 3000 kcal/kg, CP = 10.5 percent, crude fiber = 5.0 percent, lysine = 0.36, and met. + cystine = 0.39), the cost of a cassava + soybean ration at the same CP level (10.5 percent) could be further reduced by using a sunflower + cassava ration at the same CP level. A cassava-based ration, similar in crude fiber content (5.0 percent) to that of barley, was calculated using the mixture cassava + soybeans and cassava + sunflower, which was still low in ME. Therefore, an isocaloric ration at 3000 kcal/kg was prepared using this same mixture, indicating that cassava can be used in the formulation of feed rations at lower costs than those of cereal-based rations. A final exercise, using various ingredients in pig and poultry feeding rations, demonstrated that, and especially in the case of fattening pigs, savings are definitely significant when cassava is incorporated into the rations. (CIAT)

0255

34287 IBANEZ-MEIER, C.; GONTIJO, A.; JANSSEN, W. 1987. Brazil: economic study of cassava. In Centro Internacional de Agricultura Tropical. The cassava economy of Latin America: a food staple in transition. Cali, Colombia, Centro Internacional de Agricultura Tropical. Global Cassava Research and Development 98p. En. 3 Ref.

CASSAVA; DEVELOPMENT; PRODUCTION; HUMAN NUTRITION; ANIMAL NUTRITION; MARKETING; CONSUMPTION; COSTS; PRICES; BRAZIL; CIAT-1.

A series of studies were carried out in Brazil, on a regional basis, to determine how cassava can fit into the Brazilian agricultural economy in the future so as to assist the country in reaching policy goals (improved welfare of the rural community and increased availability of low-priced food). The recent developments in the Brazilian agricultural sector are summarized with emphasis on agricultural policies and on the balance between food production and exports. Urbanization as well as wheat subsidies have reduced the importance of cassava. Current policies, however, are found to favor food crops such as cassava that are produced by the small farmers. Trends in cassava for human food and its future potential role are also analyzed. The role of farinha as a staple food should be improved; increased per capita consumption will depend on better availability, better quality, and lower prices. To increase the consumption of fresh cassava, it is necessary to reduce marketing margins. The reduction of production costs of cassava starch is also crucial. The rapidly expanding feed industry is discussed with reference to cassava supply. Improved production technology would mean increased benefits to both producers and consumers. A dried cassava industry would reduce the need to import maize, stabilize on-farm prices of cassava, and extend the market size of the crop, particularly in NE Brazil. The cost structure of cassava production and processing is analyzed from the viewpoint of the cassava's future role as a source of rural income and its contribution to the food and feed supply. (CIAT)

0256

30470 JANSSEN, F. 1981. Ergebnisse mehrjahriger Untersuchungen von importierten Einzelfuttermitteln auf chlorierte Kohlenwasserstoffpesticide. (Results of analyses carried out for several years to detect chlorinated hydrocarbon pesticides in animal feeds). Landwirtschaftliche Forschung 34(3):81-87. De. Sum. De., En., Fr., 4 Ref.

CASSAVA; CASSAVA MEAL; FEEDS AND FEEDING; LEGAL ASPECTS; ANALYSIS; FEDERAL REPUBLIC OF GERMANY.

From 1976 to 1980, 1795 samples of imported animal feeds, including cassava, were analyzed for chlorinated hydrocarbons. Of the samples, 8.5 percent showed residue levels of 1 or more pesticides above official German tolerance values, whereas another 7.6 percent was contaminated with 50 percent of the threshold values. Of these samples, most contaminations were caused by DDT. Main suppliers of highly contaminated samples were countries from South America, followed by Asian and African countries. The results show that future control of imports is necessary for the animal feed industry and agriculture. (AS)

0257

33638 KASRYNO, F. 1988. Trends and prospects for cassava in Indonesia. Washington, D.C., International Food Policy Research Institute. Working Paper no.3 115p. En. 50 Ref., Il. Paper prepared for Workshop on Trends and Prospects of Cassava in the Third World, Washington, D.C., 1987.

CASSAVA; PRODUCTION; STATISTICAL DATA; TRADE; ANIMAL NUTRITION; SUBSTITUTES; PRICES; COSTS; INCOME; CONSUMPTION; ROOT PRODUCTIVITY; MAPS; INDONESIA.

The performance and prospects of cassava production in Indonesia are assessed. Past trends in production, area planted, yield/ha, and domestic utilization of cassava are analyzed and an attempt is made to give broad indications of the supply and demand prospects of cassava for the 1990's and the year 2000. On the basis of this analysis, appropriate policies for cassava production, utilization, and trade in Indonesia are suggested. The emphasis of the study was on expanded use of cassava as livestock feed; in this sense the price levels of cassava and protein supplements with which cassava can be economically substituted for maize and sorghum as livestock and poultry feed were determined. The level of yields and the prices that would make cassava profitable to producers were examined. The feasibility for increasing the supply of protein supplements for the cassava feed industry was also studied. Secondary data (national data series and results of household surveys, cost of production, and other studies) were mainly used as well as data from research and expt. stations. (CIAT)

0258

25238 KHAJARERN, S.; KHAJARERN, J.M. 1981. Aspecto economico y aceptacion publica de raciones basadas en yuca en Tailandia. (The economics and public acceptance of cassava-based rations in Thailand). Produccion Animal Tropical 9(2):138-150. Es. Sum. Es., 38 Ref. (Faculty of Agriculture, Khon Kaen Univ., Khon Kaen, Thailand)

ANIMAL NUTRITION; ASIA; CASSAVA CHIPS; CASSAVA PRODUCTS; DRIED ROOTS; ECONOMICS; FEEDS AND FEEDING; NUTRITIVE VALUE; PELLETS; PROCESSED PRODUCTS; STORAGE; THAILAND; USES.

Market prices of important feedstuffs and biological responses from 15 feeding trials including some 3320 broilers, 1600 replacement birds, 768 layers, and 182 growing-finishing pigs are analyzed to evaluate the economic feasibility of cassava-based feeds for Thailand. Cassava could replace cereals only when its price was lower than 50 percent of the cereal price. In the EEC such substitution was possible when the cassava/maize price quotient was lower than 75 percent. Public acceptance of cassava-based feeds in Thailand is still low since cassava has been uneconomical to use and there have been wide fluctuations in the market price and irregular supplies of root products. Stiff competition among feedmillers has prevented them from using cassava products in their compound feeds. (AS-Nutrition Abstracts and Reviews)

0259

26175 KLOOSTER, A.T. VAN'T; MALESTEIN, A.; PRINS, R.A. 1983. Composition of feedstuffs and DL-lactic acid accumulation in the rumen. Zeitschrift fuer Tierphysiologie Tierernaehrung und Futtermittelkunde 50(1-2):2-4. En.

CASSAVA; LACTIC ACID; ANIMAL HEALTH; FEED MIXTURES; GLUCOSE; FRUCTOSE; SUGAR CONTENT; CARBOHYDRATE CONTENT; UNITED KINGDOM.

The results of in vitro and in vivo expt. with 7 feedstuffs, including cassava, to determine their effect on rumen acidosis and dextro-levo lactic acid accumulation are reported. When feedstuffs used were ranked with respect to lowest pH and highest lactic acid concn. observed, relative to the values of citrus pulp (100 percent), cassava ranked last at a 16 percent level. The sequence in vitro agreed with that in vivo. The potential risk of in vivo acidosis was highly correlated with the sum of glucose + fructose and soluble protein content of the feeds. When mixtures of 2 or more feedstuffs were administered into the rumen, pH levels were lower and lactate concn. higher than the values calculated based on the assumption that the influences of the single feedstuffs on the parameters were additive. Thus, the risk of lactic acid acidosis of single feedstuffs can be predicted from in vitro incubations of them, but not that of feed mixtures. (CIAT)

0260

26766 KOENTJOKO 1985. Ubi kayu untuk pakan ternak. (Use of cassava as animal feed). In Nugroho, W.H.; Guritno, B.; Utomo, W.H.; Sugito, Y., eds. Seminar Pengembangan Ubi Kayu di Jawa Timur, Indonesia, 1985. Prosiding. Malang, Pusat Penelitian Tanaman Ubi-Ubian Universitas Brawijaya. pp.116-127. In. Sum. In., En., 24 Ref.

CASSAVA; FEEDS AND FEEDING; NUTRITIVE VALUE; CYANOGENIC GLUCOSIDES; CARBOHYDRATE CONTENT; AMINO ACIDS; ANIMAL HEALTH; INDONESIA.

The use of cassava as animal feed and its chemical composition are reviewed. It was found that cassava can substitute almost all cereals in animal rations if carefully formulated in order to meet nutrient requirements. (AS)

0261

22067 LAMBERT, M. 1971. Storage and processing of root crops in the South Pacific. In Plucknett, D.L., ed. Small-scale processing and storage of tropical root crops. Boulder, Colorado, Westview Press. Westview Tropical Agricultural Series no.1. pp.47-52. En. Sum. En., 1 Ref.

ANIMAL NUTRITION; OCEANIA; PROCESSING; STORAGE.

Yam, taro, cassava, sweet potato, arrowroot, and Irish potato are discussed in terms of storage problems associated with each. Less widely distributed than yam and taro but no less significant is cassava, which is rising to prominence as part of a new animal feed industry in both Tonga and New Caledonia. (AS (extract))

0262

30053 LARSEN, R.E. 1975. Root cassava and its by-products in livestock and poultry feeding. Accra, University of Ghana. 11p. En.

CASSAVA; ANIMAL NUTRITION; FEEDS AND FEEDING; SWINE; POULTRY; CATTLE; NUTRITIVE VALUE; TOXICITY; HCN; DETOXIFICATION; SILAGE; GHANA.

The nutritional value, toxicity (HCN), and use of cassava in swine, poultry, and bovine feeding is reviewed. It is concluded that adequate evidence is available indicating that cassava can be used in diets for practically all species and classes of livestock, but the optimum or max. level for each species and production objectives is not clear. Cassava silage has excellent potential as a livestock feed, but there are several limitations to the use of cassava as an animal feed, such as (1) the balance of nutrients in cassava is not equivalent to cereal grains, thus more proteins, minerals, and vitamins from other sources should be included in cassava-based diets; (2) while HCN levels can be high in some var., HCN can be released through proper treatments; and (3) raw cassava storage is a problem, but roots can be dried and stored or silage could be made for certain animal feeds. (CIAT)

0263

34280 LYNAM, J.K. 1987. Malaysia: cassava vs. tree crops in the competition for land. In Lynam, J.K. The cassava economy of Asia: adapting to economic change. Cali, Colombia, Centro Internacional de Agricultura Tropical. Global Cassava Research and Development 29p. En. Il. (Rockefeller Foundation, 1133 Avenue of the Americas, New York, NY 10036, USA)

CASSAVA; LAND USE; PRODUCTION; TRADE; PRICES; CULTIVATION SYSTEMS; COSTS; LABOR; ROOT PRODUCTIVITY; TECHNOLOGY; CASSAVA

STARCH; FEEDS AND FEEDING; CASSAVA CHIPS; STATISTICAL DATA; MALAYSIA; CIAT-1.

The agricultural economy of Malaysia has traditionally been export-oriented. Cassava was the 1st of the export crops, established in the 1850s. Malaysia is a land-surplus, labor-scarce economy; thus cassava was planted in a shifting cultivation system giving it the image of a soil-depleting crop. Data are also provided on yields, production systems, production costs and labor utilization, and pricing and market efficiency. The national plan through 2000 emphasizes tree crops, which could affect cassava production. (CIAT)

0264

33639 LYNAM, J.K. 1987. The meat of the matter: cassava's potential as a feed source in tropical Latin America. Washington, D.C, International Food Policy Research Institute. 79p. En. 30 Ref., Il. Paper prepared for Workshop on Trends and Prospects of Cassava in the Third World, Washington, D.C., 1987.

CASSAVA; MARKETING; DRIED ROOTS; PRICES; COSTS; FEEDS AND FEEDING; POULTRY; LATIN AMERICA.

The interaction between changing demand conditions, policy interventions, and production response for meat and grains is reviewed. The context for evaluating the opportunities of cassava to play a more fundamental role in this sector is then provided. Postwar changes on the production side were matched by significant changes in food demand and major changes in the organization of food wholesaling and retailing. Changing consumption patterns and rapid demand growth in income-elastic food commodities created significant growth markets and income generation potential for domestic producers, especially in the feed-livestock sector in Latin America. The gap between supply and demand for beef was met not only by beef imports but by increases in the production of alternative meats, especially poultry. The derived demand for feed components, especially carbohydrate sources, increased; dried cassava is an alternative feed component although it will not completely replace maize or sorghum. The current economic climate in tropical Latin America is appropriate to bring cassava into the agricultural policy process; except for Venezuela, cassava is competitive with feed grains under existing grain pricing policies. It can be a means of raising labor and land productivity in marginal agricultural areas, increasing small farmer incomes, and reducing feed grain imports. (CIAT)

0265

34283 LYNAM, J.K. 1987. World and Asian markets for cassava products. In Lynam, J.K. The cassava economy of Asia: adapting to economic change. Cali, Colombia, Centro Internacional de Agricultura Tropical. Global Cassava Research and Development 49p. En. Il. (Rockefeller Foundation, 1133 Avenue of the Americas, New York, NY 10036, USA)

CASSAVA; PRODUCTION; TRADE; PRICES; COSTS; CASSAVA STARCH; FEEDS AND FEEDING; PELLETS; DEVELOPMENT; STATISTICAL DATA; ASIA; CIAT-1.

This analysis of global and Asian markets looks at protectionism and substitution (decline in starch trade, rise in trade of cassava feedstuffs) and the Asian regional market for cassava feedstuffs. The degree of substitution between cassava and grains has increased measurably during the postwar period. Cassava's future in world markets depends on its ability to compete with grains; so far this has depended on grain pricing policies and tariff structures of importing countries, making cassava trade more vulnerable than the international grain trade. Cassava competes on a cost, not a price basis. If growth in cassava exports is based on small farm production, initial growth would be based on small-scale processing units, which would call for developing a critical production vol. based on domestic markets, in the 1st place. Except for Thailand, production has not been able to meet the rising demand for products. Improved var. and production technology could provide the increased vol. necessary to meet the domestic demand. Then, if surpluses de-

velop resulting in cost reductions, the country could compete in international markets. (CIAT)

0266

25725 MCALLAN, A.B.; GRIFFITH, E.S. 1981. Evaluation of detergent extraction procedures for characterising carbohydrate components in ruminant feeds and digesta. Journal of the Science of Food and Agriculture 35(8):869-877. En. Sum. En., 28 Ref. (National Inst. for Research in Dairying, Shinfield, Reading RG2 9AT, England)

ANALYSIS; ANIMAL NUTRITION; CARBOHYDRATE CONTENT; CASAVE; CATTLE; COMPOSITION; DOMESTIC ANIMALS; EUROPE; FEED CONSTITUENTS; FEEDS AND FEEDING; FIBER CONTENT; METABOLISM; PROTEIN CONTENT; SODIUM; STORAGE; SUGAR CONTENT; UNITED KINGDOM; USES.

Steers fitted with simple rumen and abomasal cannulas were given isoenergetic diets of approx. equal amounts of untreated barley straw and concentrates (flaked maize + cassava) alone (BSA) or with urea (BSU) or fishmeal (BSF). Similar diets were also given in which the barley straw had been treated with NaOH (BSA, BSAU, and BSAF, resp.). The diets were given in a 6 x 6 Latin square design. Feed components and abomasal digesta samples were analyzed for neutral (NDF) and acid (ADF) detergent fibers and for monosaccharide constituents of structural polysaccharides. Hemicellulose contents were estimated as the sum of xylose + arabinose and by the difference between ash-free NDF and ash-free ADF (NDF-ADF). Cellulose was estimated as beta-linked glucose and by the difference between ash-free ADF and lignin (ADF-L). (103)Ruthenium and polyethylene glycol were given as flow markers; flows (g/24 h) at the abomasum of carbohydrate components estimated in these ways were also calculated. Approx. 98 percent (by wt.) of the cellulose found in original feed and digesta samples was recovered in both NDF and ADF. Recoveries of hemicellulose in NDF from untreated straw, treated straw, and abomasal digesta were approx. 92, 48, and 50 percent, resp. The ADF fraction of feeds and digesta contained 3-6 and 10-17 percent of the N and xylose, resp., present in the original samples. Mouth to abomasum digestibilities of hemicellulose (NDF-ADF) for diets BS, BSU, BSF, BSA, BSAU, and BSAF were 35, 62, 67, 29, 61, and 76 percent, resp. Corresponding values for cellulose were 37, 34, 50, 45, 48, and 63 percent, resp. The use of NDF-ADF and ADF-L as measures of hemicellulose and cellulose contents, resp., of feeds and digesta, and the digestibility of these carbohydrate fractions between mouth and abomasum of steers are discussed. (AS)

0267

28179 OKEKE, J.E. 1986. Alternative uses of cassava in view of anticipated increased production. Umudike, Nigeria, National Root Crops Research Institute. 10p. En. Sum. En., 16 Ref. Paper presented at the 4th Joint NAFPP Workshop, Ibadan, Nigeria, 1986. (National Root Crops Research Inst., Umudike, Umuahia, Nigeria)

CASSAVA; USES; ANIMAL NUTRITION; SWINE; POULTRY; CASSAVA STARCH; NIGERIA.

The importance of cassava in the domestic economy of Nigeria is examined in the light of a fluctuating production trend. Two alternative uses, as animal feed (swine and poultry) and as industrial starch, are described and their implications on fresh root supply are analyzed. A deficit in supply for human consumption exists while competition from animal feed and industrial starch imposes higher production targets. The potential of the crop assures adequate national output upon increased research support for efficient production technologies. (AS)

0268

19554 PELTJES, J.H. 1981. Tapioca de meest omstreden veevoedergrondstof. (Cassava, the most controversial feedstuff). In Asseldonk, J.S.O. Van; Box, L., eds. Cassave of

tapioca? Verslag van het Symposium Recente Ontwikkelingen in Onderzoek en Gebruik van Cassava, Amsterdam, 1981. Amsterdam, Stichting Onderzoek Wereldvoedselvoorziening. pp.35-43. Nl.

CASSAVA; TRADE; PRICES; FEEDS AND FEEDING; NETHERLANDS.

During the transportation of cassava to the processing factories several problems may occur such as pollution, fluctuating quality, labor-technical problems, problems with the Communal Border Tariff, and agricultural policy problems. Manufacturers of animal feed, however, continue to use cassava because of its low price and high nutritional value. An increase in the demand for cassava in 1979 caused prices to raise, reducing the amount of cassava used in animal feeds. Currently the supply is sufficient to maintain a price level with which it is profitable to process a max. quantity of cassava in feed for pigs and a restricted quantity in feed for chickens in the Netherlands, Belgium, and Germany. In other countries belonging to the EEC, it is not profitable to increase the amount of cassava used. It is important for the economy and the agriculture of the Netherlands to continue importing cassava. (CIAT)

0269

22335 PREMAKUMARI, K.; KURUP, P.A. 1981. Effect of feeding cooked tapioca as compared to rice on the metabolism of glycosaminoglycans in rats. Indian Journal of Biochemistry and Biophysics 20(3):163-166. En. Sum. En., 26 Ref. (Dept. of Biochemistry, Univ. of Kerala, Trivandrum 695034, India)

ANIMAL NUTRITION; ASIA; CASSAVA CHIPS; CASSAVA PRODUCTS; CEREALS; COOKING; DRIED ROOTS; INDIA; LABORATORY ANIMALS; METABOLISM; PROCESSED PRODUCTS; RICE; STARCH CROPS.

Feeding young male albino rats cassava, when compared with rice, resulted in a decrease in the concn. of many glycosaminoglycans (Glg) in the aorta, heart, liver, and kidney. The activity of glucosamine phosphate isomerase (glutamine forming) and UDPG dehydrogenase decreased while the pattern of change in the activity of enzymes concerned with degradation of Glg was not uniform. Concn. of PAPS (3'-phosphoadenosine-5'-phosphosulfate) and the activity of sulfate activating system (sulfate adenyltransferase and adenylsulfate kinase) in the liver were increased. (AS)

0270

29572 REEVES, J. 1987. La yuca para alimentacion animal. (Cassava for animal feeding). El Surco 92(3):8. Es. Il.

CASSAVA; DEVELOPMENT; FEEDS AND FEEDING; CULTIVATION; ECONOMICS; RESISTANCE; COLOMBIA; CIAT-1.

The importance of cassava, particularly in animal nutrition, is briefly discussed. The adaptability of cassava to infertile soils and low inputs, its production of more calories per land and labor unit than any other food crop, and its resistance to pests and diseases are highlighted. CIAT's objectives in Latin America and Colombia are presented. (CIAT)

0271

33786 ROMANOFF, S.; TORO, G., eds. 1986. La yuca en la costa ecuatoriana y sus perspectivas agroindustriales: memorias. (Cassava on the Ecuadorian coast and its agroindustrial perspectives: proceedings). Seminario Anual sobre la Yuca, 1. Portoviejo, Ecuador. 1985. Quito, Ecuador, Instituto Nacional de Investigaciones Agropecuarias. Instituto Interamericano de Cooperacion para la Agricultura. Centro Internacional de Agricultura Tropical. 192p. Es. Il. (CIAT, Apartado Aereo 6713, Cali, Colombia)

CASSAVA; PRODUCTION; USES; TRADE; ROOTS; COMPOSITION; ROOT PRODUCTIVITY; ECONOMICS; TECHNOLOGY; TISSUE CULTURE;

SMALL-SCALE PROCESSING; INTERCROPPING; CASSAVA PROGRAMS; ECUADOR; CIAT-1.

In Portoviejo (Manabi Province, Ecuador), a workshop was carried out with small- and large-scale cassava producers, national and foreign researchers, executives of the public sector, and technicians to study the new perspectives for cassava commercialization and the latest technological innovations in cassava production and utilization. (CIAT)

0272

34969 SANCHEZ, S.L. 1988. Cassava as feed for animals. In Pamplona, F.L.; Lantican, C.M., eds. State of the art and abstract bibliography: cassava research. Los Banos, Laguna, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development. Crops SOA-AB Series no.15. pp.69-74. En. 9 Ref. (Dept. of Animal Science & Veterinary Medicine, Visayas State College of Agriculture, Baybay, Leyte, Philippines)

CASSAVA; ANIMAL NUTRITION; POULTRY; SWINE; PROTEIN ENRICHMENT; FEEDS AND FEEDING; RESEARCH; PHILIPPINES.

Research activities carried out in the Philippines on the use of cassava in animal nutrition are reviewed. The nutritional value, toxicity, and processing of cassava are briefly discussed on the basis of results of these as well as other studies. Levels of cassava in poultry and swine rations are indicated. Problem areas in using cassava as feed are (1) the need for indigenous protein sources to replace SBM, (2) cassava enrichment with microorganisms, and (3) indigenous pigment sources for cassava-based poultry feed. Results are given of studies on the verification/substitution of maize with cassava and sweet potato in growing-finishing pigs, piloting of commercial formulation of root-crop based animal feeds in Eastern Visayas and the Bicol region, evaluation of protein-enriched cassava in growing-finishing pigs, and the suitability of cowpea as protein source in commercial swine rations. Research gaps are identified and recommended research activities for the period 1989-93 are listed. (CIAT)

0273

33830 STONE, B. 1983. An examination of economic data on cassava production, utilization and trade in China. Washington, D.C., International Food Policy Research Institute. 72p. En. 82 Ref., Il.

CASSAVA; PRODUCTION; PRICES; TRADE; TAPIOCAS; FEEDS AND FEEDING; LABOR; COSTS; MAPS; PLANT GEOGRAPHY; STATISTICAL DATA; CHINA.

Available agroeconomic information on cassava in China, appearing in Chinese source materials, is summarized; historical trends in production and geographical distribution are discussed. Data from FAO on crop production, utilization, and trade in the country are examined. The basis of Chinese competitiveness in the European feed grain market is analyzed given the rapid expansion of Chinese cassava exports to the EEC beginning in 1979. Although China is capable of considerable production expansion, per unit costs to the state would not increase significantly. (CIAT)

0274

26301 THIEDE, G. 1983. Auslandsfutter und tierische erzeugung in der EG zusammenschau und Landeruberblick. (Foreign forage and animal production in the European Economic Community: a global overview and by countries). Kraftfutter 66(9):346-351. De. Sum. De. (Chaussee St. Martin 18, L-6989 Luxemburg)

CASSAVA; ANIMAL NUTRITION; PROTEIN CONTENT; TRADE; FEEDS AND FEEDING; STATISTICAL DATA; EUROPE.

0275

34968 TRUONG, VAN DEN 1988. Processing and utilization of cassava. In Pamplona, F.L.; Lantican, C.M., eds. State of the art and abstract bibliography: cassava research. Los Banos, Laguna, Philippine Council for Agriculture, Forestry and Natural Resources Research and Development. Crops SOA-AB Series no.15 pp.55-68. En. 68 Ref. (Dept. of Agricultural Chemistry & Food Science, Visayas State College of Agriculture, Baybay, Leyte, Philippines)

CASSAVA; PROCESSING; TECHNOLOGY; USES; FOOD PRODUCTS; FEEDS AND FEEDING; RESEARCH; PHILIPPINES.

Major findings of research carried out to develop appropriate processing technologies to improve the storage life of cassava are briefly reviewed. Different techniques used to prepare cassava for human consumption are mentioned for fried chips, dried chips, grates, CF, dried pellets (landang), and cubes. The use of cassava as feed and in industries (starch and fuel alcohol) is mentioned. Current research in the Philippines focuses on the use of cassava in ethanol production, protein enrichment of CM, substitution of cassava chips for maize in animal feeds and of CF for wheat flour in bakery products, socioeconomic impact of introduced technologies, and processing/utilization aspects of cassava for food. Research and development gaps are identified. (CIAT)

0276

26357 VIEIRA, J.R.R.; SANTOS, A.R. DOS 1981. Raspa de mandioca; racao para o rebanho e alcool para o Brasil. (Cassava chips: rations for animal feed and alcohol for Brazil). Fortaleza-CE, Brasil, Empresa de Assistencia Tecnica e Extensao Rural do Ceara. 2p. Pt. Il.

CASSAVA; ANIMAL NUTRITION; FEEDS AND FEEDING; ALCOHOL; STORAGE; SUBSTITUTES; BRAZIL.

The advantages of producing cassava chips for use in animal nutrition and alcohol production in the state of Ceara, Brazil, are indicated. When CF production is high, farmers can use part of their production for cassava chips for animal nutrition or alcohol production. Cassava chips can be mixed in rations to increase beef, milk, and egg production, replacing maize which is, in turn, released for human consumption. Roots for cassava chip production can be left undried and stored for up to 6 mo. New lands can be incorporated into agricultural production by planting cassava, and new jobs will be created. (CIAT)

0277

28535 WALTERS, P.R. 1987. Industrial uses of cassava. Courier no.101:74-77. En. Sum. En., Il. (Marketing & Economic Dept. of the Tropical Development & Research Inst., London, England)

CASSAVA; INDUSTRIALIZATION; STATISTICAL DATA; TRADE; CASSAVA STARCH; FEEDS AND FEEDING; FRUCTOSE; AMERICA; AFRICA; ASIA; OCEANIA; EUROPE.

The main industrial uses of cassava in the world are described, with indications on the world trade of these products. The balance of cassava production is processed and used industrially for the manufacture of compound animal feed, especially in the EEC (mainly imported from Thailand), and of cassava starch (the main producers being Indonesia and Thailand, followed by Brazil) for use in the food, textile, and paper industries. Cassava starch is also used in the manufacture of plywood, veneer, adhesives, glucose, and dextrine. Other uses briefly discussed are the production of ethanol, SCP, and high fructose sweeteners. (CIAT)

0278

26768 WARDHANI, N.K.; AHMAD, M. 1985. Penggunaan ubi kayu untuk pakan ternak. (Use of cassava as animal feed). In Nugroho, W.H.; Guritno, B.; Utomo, W.H.; Sugito, Y., eds. Seminar Pengembangan Ubi Kayu di Jawa Timur, Indonesia, 1985. Prosiding. Malang, Pusat Penelitian Tanaman Ubi-Ubian Universitas Brawijaya. pp.138-163. In. Sum. In., En., 27 Ref.

CASSAVA; FEEDS AND FEEDING; LEAVES; FEED CONSTITUENTS; PROCESSED PRODUCTS; HCN; WASTE UTILIZATION; STATISTICAL DATA; INDONESIA.

The use of cassava products and waste for feeding animals such as cows, buffaloes, sheep, goats, swine, and chickens is discussed. When a shortage of grasses exists, cassava leaves can be used. Fresh cassava tubers, dried cassava (gaplek), and waste (onggok) are rich sources of carbohydrates. One of the limiting factors of cassava products and waste used as animal feed is the high HCN content of the tubers. Therefore, a special treatment should be applied before they are used as animal feed. (AS)

0279

26701 WOLFFRAM, R.; MOCKELMANN, T. 1981. Entwicklung der markte fur getreide und getreidesubstitute. (Development of markets for grains and grain substitutes). Tierzuchter 33(7):294-297. De. Sum. De., 5 Ref., Il. (Lehrstuhl Marktforschung der Universitat Bonn, Nuballee 21, 5300 Bonn 1)

CASSAVA; SUBSTITUTES; MARKETING; TRADE; ALCOHOL; PRICES; FEEDS AND FEEDING; EUROPE.

A	Angstrom(s)
ABA	Abscisic acid
ac	Acre(s)
Af.	Afrikaans
a.i.	Active ingredient
Al.	Albanian
alt.	Altitude
AMV	Alfalfa mosaic virus
approx.	Approximate(ly)
Ar.	Arab
AS	Author summary
atm.	Atmosphere
ATP	Adenosine 5'-triphosphate
av.	Average
BAP	6-Benzylaminopurine
BBMV	Broad bean mosaic virus
BCMV	Bean common mosaic virus
Bg.	Bulgarian
BGMV	Bean golden mosaic virus
BGYMV	Bean golden yellow mosaic virus
BLPMV	Bean line pattern mosaic virus
BOD	Biochemical oxigen demand
BPMV	Bean pod mottle virus
BRMV	Bean rugose mosaic virus
BSMV	Bean southern mosaic virus
BV	Biological value
BYMV	Bean yellow mosaic virus
BYSV	Bean yellow stipple virus
ca.	Circa, approximately
CAMV	Cassava African mosaic virus
CCMW	Cassava chip meal wastes
CBB	Cassava bacterial blight
CBSV	Cassava brown streak virus
CEC	Cation exchange capacity
CER	CO2 exchange rate
CF	Cassava flour
CGR	Crop growth rate
Ch.	Chinese
CIAT	International Center for Tropic Agriculture
CLM	Cassava leaf meal
CLV	Cassava latent virus
CM	Cassava meal
cm	Centimeter(s)
CMV	Cassava mosaic virus
COD	Chemical oxigen demand
concn.	Concentration(s)
CP	Crude protein
Cs.	Czech
CSL	Calcium stearyl lactylate
CSW	Cassava starch wastes
CV	Coefficient of variation
cv.	Cultivar(s)
2,4-D	2,4-dichlorophenoxyacetic acid
Da.	Danish
De.	German
DM	Dry matter
DNA	Deoxyribonucleic acid
Dpt.	Department
DW	Dry weight
EC	Emulsifiable concentrate
EDTA	Ethylenediaminetetraacetic acid
EE	Ether extract
EEC	European Economic Community
e.g.	Exempli gratia, for example
ELISA	Enzyme-linked immunosorbent assays
EMS	Ethyl methane sulfonate
En.	English
EP	Preliminary Trials
Es.	Spanish
expt.	Experiment(s)
exptl.	Experimental
Fi.	Finnish
Fr.	French
ft-ca	Foot candle(s) (10.76 lux)
FW	Fresh weight
FYM	Farmyard manure
g	Gram(s)
G	Giga (10(9))
GA	Gibberellic acid
gal	Gallon(s)
GE	Gross energy
GER	Glucose entry rate(s)
GLC	Gas-liquid chromatography
Gr.	Greek
h	Hour(s)
ha	Hectare(s)
HCN	Hydrocyanic acid
HDP	Hydroxypropyl distarch phosphate
He.	Hebrew
Hi.	Hindi
HI	Harvest index
hp	Horsepower
Hu.	Hungarian
IAA	Indoleacetic acid
IBA	Indolebutyric acid
IBYAN	International Bean Yield and Adaptation Nursery
i. e.	Id est, that is
Il.	Illustrations

in.	Inch(es)
In.	Indonesian
It.	Italian
IU	International unit
J	Joule(s)
Ja.	Japanese
kat	Katal
kcal	Kilocalorie(s)
kg	Kilogram(s)
km	Kilometer(s)
KNap	Potassium naphthenate
Ko.	Korean
kR	Kiloroentgen(s)
l	Liter(s)
La.	Latin
lab.	Laboratory(ies)
LAD	Leaf area duration
LAI	Leaf area index
lat.	Latitude
lb	Pound(s)
LD50	Mean lethal dose
LER	Land efficiency ratio
LFR	Leaf formation rate
LPC	Leaf protein concentrate
lx	Lux
M	Mega (10(6))
m	Meter(s)
Mal.	Malay
m.a.s.l.	Meters above the sea level
max.	Maximum
MC	Moisture content
ME	Metabolizable energy
meq	Milliequivalent(s)
met.	Methionine
mg	Milligram(s)
mho	Reciprocal ohm(s)
min.	Minimum
min	Minute(s)
ml	Milliliter(s)
mm	Millimeter(s)
mM	Millimolar
mo.	Month(s)
mol. wt.	Molecular weight
mp	Melting point
MT	Metric ton(s)
NAA	Alpha-naphthalene acetic acid
NAD	Nicotinamide adenine dinucleotide
NADH	Nicotinamide adenine dinucleotide, reduced form
NAR	Net assimilation rate
NCE	Net CO2 exchange
NE	Northeast
NER	Net energy ratio
Nl.	Dutch
nm	Nanometer(s) (10-9 m)
no.	Number(s)
No.	Norwegian
NPF	Negative production factor(s)
NPR	Net protein ratio
NPU	Net protein utilization
NW	Northwest
OM	Organic matter
oz	Ounce(s)
p.	Page
P	Probability
Pa	Pascal(s)
PAN	Peroxyacetic nitrate
PCNB	Pentachloronitrobenzene
PDA	Potato dextrose agar
PER	Protein efficiency ratio
pH	Hydrogen ion concentration
Pl.	Polish
kJ	Kilojoule
PAGE	Polyacrylamide gel electrophore
pp.	Pages
pphm	Parts per hundred million
PPI	Preplanting incorporation
ppm	Parts per million
PSA	Potato sucrose agar
Pt.	Portuguese
pv.	Pathovar
Ref.	Reference(s)
resp.	Respective(ly)
Rf	Retardation factor chromatography
RGR	Relative growth rate
RH	Relative humidity
RNA	Ribonucleic acid
Ro.	Romanian
rpm	Revolutions per minute
Ru.	Russian
s	Second(s)
SBM	Soybean meal
SCN	Thiocyanate
SCP	Single cell protein
SDS	Sodium dodecyl sulfate
Sk.	Slovak
Sn.	Slovene
sp.	Species (singular)
spp.	Species (plural)
SSL	Sodium stearyl-2-lactylate
Sum.	Summary
Sv.	Sweddish
t	Ton(s)
Tai.	Thai
TDN	Total digestible nutrients
temp.	Temperature(s)
TIA	Trypsin inhibitor activity
TIBA	2,3,5-Triiodobenzoic acid
TLC	Thin-layer chromatography
TMV	Tobacco mosaic virus
Tr.	Turkish
TSH	Thyroid-stimulating hormone
UDPG	Uridine diphosphate glucose
Uk.	Ukrainian
UMS	Unmodified cassava starch
Ur.	Urdu
UV	Ultraviolet
VAM	Vesiculo-arbuscular mycorhizae
var.	Variety(ies), varietal

VEF	Bean Team Nursery	vs.	Versus
VFA	Volatile fatty acids	W	West, watt(s)
VICAR	Central American Yield and Adaptation Nursery	wk.	Week(s)
		WP	Wettable powder
vol.	Volume	wt.	Weight
VPD	Vapor pressure deficit	yr	Year(s)
vpm	Volume per million	/	Per