Facts and Figures on Cassava[a]

Major cassava producing and consuming countries and regions	CASSAVA 1991: Area (1000 ha)	Area: Annual % variat 82/91	Yields (t/ha)	Yields: Annual % variat 82/91	Production (1000 t)	Production: Annual % variat 82/91	TRADE 1990 (1000 t): Imports	TRADE 1990 (1000 t): Exports	CASSAVA UTILIZATION (1000 t) 1990[d]: Food	Feed	Waste	Other uses
World	15671	1 0	9 8	0 7	153689	1 8	36412	29752	96437	45593	18637	4780
Africa	8922	1 5	7 7	1 0	68931	2 8	4	186	61681	1140	11440	148
Angola	500	0 0	3 [illegible]	1 4	1850	1 6	0	0	1900	0	0	0
Benin	120	2 8	7 4	1 2	889	4 6	0	0	832	0	124	0
Burundi	52	3 0	11 2	0 0	580	3 1	0	0	590	0	100	0
Cameroon	92	0 0	13 4	5 5	1230	1 2	0	0	900	120	180	0
Central African Rep	167	0 0	3 1	0 0	520	0 0	0	0	515	0	5	0
Chad	73	1 2	4 [illegible]	2 1	342	4 3	0	0	297	17	17	0
Comoros	9	0 0	5 1	4 0	46	1 5	0	0	42	0	3	0
Congo	100	0 6	7 8	1 1	780	2 0	0	0	756	2	12	0
Côte d Ivoire	257	2 2	5 6	0 6	1435	3 0	0	0	1184	70	139	0
Gabon	45	1 0	5 6	1 2	250	2 5	0	0	137	0	113	0
Ghana	535	10 6	6 7	0 0	3600	4 6	0	2	2410	54	250	0
Guinea	70	0 0	6 4	0 0	450	0 0	0	0	383	23	45	0
Kenya	67	0 0	9 7	4 6	650	6 7	0	0	631	0	20	0
Liberia	47	0 4	6 4	0 0	300	0 0	0	0	300	0	0	0
Madagascar	343	0 9	6 7	0 9	2290	2 1	0	40	1453	229	4 4	96
Malawi	72	3 1	2 3	0 0	168	0 0	0	2	143	0	0	0
Mozambique	972	0 3	3 8	0 0	3690	0 2	4	0	3931	55	65	8
Niger	28	0 0	7 7	1 6	216	0 0	0	0	172	0	41	0
Nigeria	1700	3 6	11 8	2 0	20000	7 1	0	0	20834	260	4906	0
Rwanda	50	0 9	11 2	0 0	560	0 0	0	0	533	0	1	0
Sierra Leone	22	0 0	4 1	1 9	90	1 0	0	2	122	0	0	0
Tanzania	604	0 3	10 4	0 0	6266	0 0	0	140	5662	34	1034	26
Togo	65	0 0	7 7	5 6	500	3 6	0	0	593	0	0	0
Uganda	380	1 5	8 8	0 0	3350	0 7	0	0	2905	100	334	0
Zaire	2388	2 1	7 6	0 6	1822[illegible]	2 8	0	0	13904	176	3520	0
Zambia	4	2 3	3 6	0 9	2[illegible]0	3 5	0	0	24	0	13	0
Zimbabwe	23	2 1	3 9	1 9	90	5 0	0	0	86	0	5	0
•Asia	3950	0 8	13 0	0 5	51460	1 3	7 79	28340	21320	5299	2776	1837
China	231	0 0	14 4	0 0	3320	0 0	2930	5[illegible]5	1660	2893	97	921
India	289	0 0	19 4	1 5	5600	0 6	0	0	5396	0	284	0
Indonesia	1318	0 0	12 4	2 0	16330	2 5	0	5160	9299	300	2100	245
Laos	5	0 0	13 2	0 0	66	0 0	0	0	52	7	7	0
Malaysia	40	1 4	10 4	0 0	414	1 0	166	36	454	21	21	4[illegible]
Philippines	221	0 9	8 6	1 2	1900	2 4	76	34	1625	108	0	159
Sri Lanka	43	0 0	9 5	0 0	410	0 0	7	1	306	0	130	0
Thailand	1500	3 8	13 5	0 0	20300	1 4	0	22457	215	0	0	0
Viet Nam	285	0 0	10 5	2 6	3000	0 5	0	57	2069	253	126	0
Oceania	1	1 3	11 2	0 4	191	1 9	37	3	177	8	21	2
Fiji	2	10 0	18 0	1 1	36	12 5	0	0	35	0	1	0
Papua New Guinea	11	1 0	10 2	0 0	112	0 9	0	0	95	0	17	0
South America	2593	0 0	12 4	0 9	32155	0 9	9	8	12594	11853	4278	2555
Argentina	15	3 8	10 0	1 0	150	0 0	0	0	70	60	10	0
Bolivia	46	10 0	10 8	0 0	499	7 3	0	0	253	161	3	0
Brazil	1959	0 0	12 6	1 0	24632	0 2	0	7	9722	8586	3643	2326
Colombia	220	2 9	9 5	0 4	2081	3 4	0	0	1245	494	58	144
Ecuador	35	7 5	3 7	0 0	130	0 0	0	0	101	27	7	0
Paraguay	240	3 3	16 3	1 4	3900	5 5	0	0	22	2445	355	28
Peru	38	0 0	11 6	0 1	440	0 0	3	0	345	43	43	2
Venezuela	39	0 0	7 9	0 3	310	0 3	0	0	131	30	87	52
C America and Caribbean	188	1 7	5 1	0 0	951	1 3	217	64	665	131	122	184
Costa Rica	9	8 0	4 9	1 4	44	11 0	0	42	1	0	0	0
Cuba	72	2 0	4 2	1 2	300	0 7	0	0	190	60	35	15
Dominican Republic	20	10 0	6 7	0 0	134	7 6	0	17	98	0	13	0
Haiti	68	0 6	4 3	0 5	290	1 2	0	0	209	31	60	0
Nicaragua	6	2 0	11 8	0 7	71	2 9	0	0	36	0	7	26
Panama	5	0 0	7 4	0 5	37	0 6	0	0	27	5	2	0

CASSAVA CONSUMPTION: Cassava consumption per capita (kg/year) (1990)	Cassava daily calorie supply per capita	Cassava in total calorie supply (%)	Rice in total calorie supply (%)[e]	GNP per capita (US$ curr pr) (1990)	POPULATION 1992: Population total	Agr labor force (%)	Rural pop (%)	LAND USE 1990: Agric area (1000 ha)[f]	Arable land (as percentage of agric area)	Perm crops (as percentage of agric area)	Major cassava producing and consuming countries and regions
18 3	46	2	21		5484692	20	54	4846294	28	2	World
96 2	247	11	6		681966	23	65	1081852	15	[illegible]	Africa
189 6	5[illegible]1	30	4		10578	28	70	32400	9	2	Angola
179 8	542	23	4		4928	28	61	2302	61	20	Benin
107 8	203	11	2	210	5806	46	94	2252	50	10	Burundi
76 0	228	10	5	960	12661	21	57	15306	39	7	Cameroon
169 5	433	23	3	390	3218	28	52	5006	38	2	Central African Rep
52 3	158	10	5	190	5974	25	69	48205	7	0	Chad
77 1	232	13	37	480	590	34	71	115	68	19	Comoros
332 9	966	42	3	1010	2423	22	58	10168	1	0	Congo
98 7	297	12	19	750	12948	20	58	16690	18	8	Cote d Ivoire
116	326	13	5	3470	1252	29	53	5157	6	[illegible]	Gabon
160 4	483	24	4	390	16047	18	66	7720	15	20	Ghana
66 5	200	9	29		6119	31	73	6878	9	2	Guinea
2 2	9	4	1	370	25853	31	75	40530	5	1	Kenya
131 9	397	19	44		2 46	25	52	6073	2	4	Liberia
121 0	302	14	50	230	12802	32	75	37102	7	1	Madagascar
16 4	29	1	2	200	9406	29	88	4259	56	1	Malawi
251 1	751	42	4	80	16508	42	70	47130	6	0	Mozambique
22 3	67	3	7	310	8242	43	9	12510	29	0	Niger
191 9	432	20	6	290	115866	24	63	[illegible]2300	41	4	Nigeria
73	210	11	1	310	7753	44	92	1617	53	19	Rwanda
2[illegible] 3	88	5	45	240	4373	21	66	2854	18	5	Sierra Leone
207 3	394	18	-	110	29435	37	64	38367	7	2	Tanzania
16 9	506	22	6	410	3761	27	73	2459	24	3	Togo
154 6	421	19	1	220	20249	34	89	8510	59	20	Uganda
390 9	1123	54	4	220	37930	24	59	22860	32	3	Zaire
2[illegible] 2	88	4	0	420	9117	22	48	35268	15	0	Zambia
8 8	26	1	1	640	10338	26	71	7668	35	1	Zimbabwe
6 9	17	1	35		3231096	27	64	1215284	35	3	Asia
1 5	4	0	3	370	1173009	39	63	496563	19	1	China
6 3	14	1	30	350	889348	25	72	181130	91	2	India
50 5	123	5	58	570	191259	19	68	33800	47	18	Indonesia
12 6	35	1	0	200	4398	32	80	1711	52	1	Laos
25 4	68	3	29	2320	18791	12	55	4907	21	78	Malaysia
26 0	[illegible]2	3	41	730	64428	17	56	9230	49	37	Philippines
17 7	49	2	42	470	17654	19	78	2339	40	42	Sri Lanka
3 9	14	1	55	1420	57247	34	6	22920	83	14	Thailand
31 3	87	4	68		69664	[illegible]9	77	6940	82	13	Viet Nam
6 7	18	1	8		27455	7	29	482194	10	0	•Oceania
46 9	130	5	18	1780	772	13	60	300	51	29	Fiji
24 6	68	3	15	860	4053	30	83	478	7	75	Papua New Guinea
42 4	98	4	13		308225	8	24	607833	16	3	•South America
2 2	5	0	2	2400	33100	4	13	169400	15	1	Argentina
34 6	85	4	10	630	7735	13	47	28908	7	1	Bolivia
64 7	148	5	16	2680	156275	8	24	244200	21	4	Brazil
37 8	91	4	13	1260	34242	8	29	45820	9	3	Colombia
9 5	23	1	16	980	11117	9	42	7875	22	13	Ecuador
168 7	397	15	5	1110	4520	16	51	23316	9	3	Paraguay
16 0	39	2	21	1160	22436	11	29	30850	11	1	Peru
6 7	16	1	7	2560	20720	4	9	21595	15	3	Venezuela
1 6	4	0	3		436649	5	28	638305	42	1	•C America and Caribbean
0 4	1	0	16	1900	3160	8	52	2859	10	9	Costa Rica
17 9	53	2	15		10828	8	24	6300	41	11	Cuba
13 6	37	2	21	830	7471	11	38	3538	28	13	Dominican Republic
32 2	71	4	9	370	6787	27	71	1402	40	25	Haiti
9 3	23	1	13		4131	12	39	6673	16	3	Nicaragua
11 2	28	1	19	1850	2515	9	46	2214	23	7	Panama

Footnotes

a Year of compilation 1993

b FAO reports 92 cassava producing countries Of these 52 were selected for analysis

c Major cassava importers are countries of the European Community Japan Korea and Taiwan

d Domestic utilization only excluding the volume of cassava processed for export

e The consumption of rice the world s most important grain staple in each country is included as a means of comparison

f Agric area includes arable land land under permanent crops and land under permanent meadows and pastures

SOURCES FAO Agrostat Database 1992
World Bank World Tables 1992
CIAT Cassava Program

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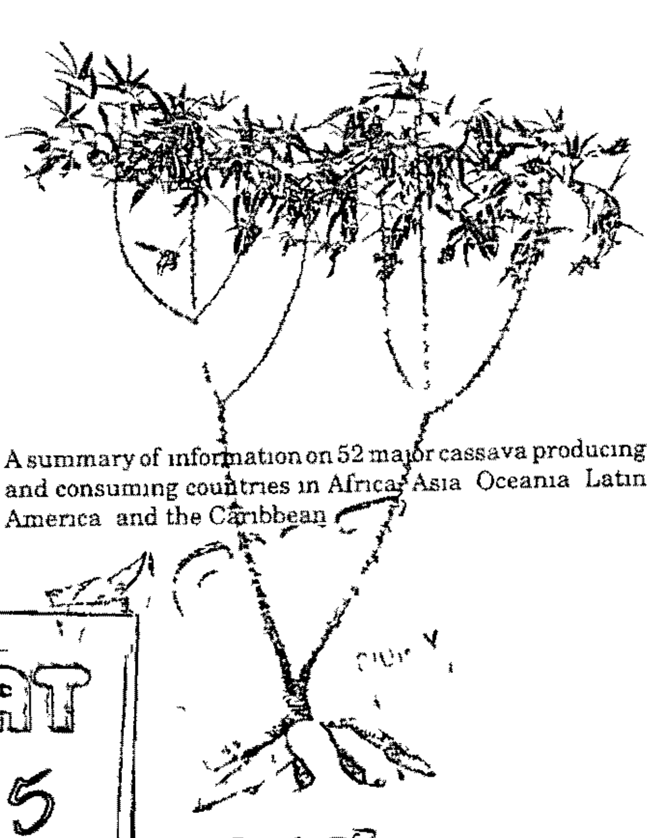
Cassava: The Latest Facts About an Ancient Crop



A summary of information on 52 major cassava producing and consuming countries in Africa Asia Oceania Latin America and the Caribbean

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An Ancient Crop Becomes Modern

Cassava a starchy root crop has been cultivated in tropical America for over 5 000 years Before 1600 during the European exploration of America Portuguese traders took it to the Congo in Africa and later to eastern Africa and Asia By the end of the 19th century it was growing throughout the tropical world It now feeds about 500 million people and is grown in 92 countries in the tropics and subtropics

For a long time the crop was unknown outside the tropics and received very little research until the 1960s when the "Green Revolution" based on new varieties of wheat and rice stimulated the founding of several International Agricultural Research Centers that worked on tropical crops Two of the Centers developed cassava research programs the International Center for Tropical Agriculture (CIAT) based in Colombia has a global mandate whereas the International Institute of Tropical Agriculture (IITA) based in Nigeria has a regional mandate for Africa These two Centers also encouraged the development of national cassava research programs particularly as the advantages of cassava as a food crop and industrial raw material became evident

The Plant

Although each of the more than 5 000 known varieties of cassava has its own distinctive plant form genetic structure and adaptability to different environments the generalized cassava plant is a perennial woody shrub that grows from about 1 m to about 3 m (3 to 9 feet) tall The woody stems are topped by hand shaped (i e palmate) dark green sometimes purplish leaves

Flowering cassava varieties have small inconspicuous flowers that lack petals Male and female flowers grow on the same plant and are cross pollinated by insects Fruits are dehiscent and seed production is low and erratic Seeds are oval about 10 mm long, and mottled brown and gray

The cone shaped roots vary in number and size according to variety and environmental conditions Normally, they have a dark or light brown papery bark which often peels off, leaving a pink or cream cortex This too can be peeled off to expose the white starchy flesh Through the center of the root runs a (usually) thin and fibrous pith

Cassava is almost always grown from mature cuttings of the woody stems—this is unusual because the stems are not otherwise an economically important part of the plant The 7 to 30 cm long cuttings are planted horizontally vertically or inclined with or without tillage

Taxonomy

Scientifically cassava is known as *Manihot esculenta* Crantz and is a member of the Euphorbiaceae No wild direct ancestor of cassava has been proven to exist Cassava was probably domesticated at different locations A major center of diversity is found in the Amazon/Orinoco basin and another in Mesoamerica

Yields

Under favorable experimental conditions cassava as a single crop can yield as much as 90 tons of fresh roots per hectare (25 to 30 tons of dry matter per hectare) But cassava is usually grown under marginal soil conditions and harsh climate and in association with crops such as maize cowpeas and other root or tuber crops

Under these conditions average yields in tons of fresh roots per hectare are much lower worldwide—9 8 Africa—7 7, Latin America—12 4, and Asia—13 0 In tons of grain per hectare these yields are equivalent to 3 1 2 5 4 0 and 4 2 tons respectively Cereal crops grown under similar conditions would produce 1 to 2 tons of grain per hectare

One ton of fresh cassava yields 280 kg of flour 230 kg of starch or 330 kg of dried chips Researchers have also obtained 170 liters of gasoline alcohol from one ton

Production and Consumption

Most cassava is produced by poor small scale farmers as a crop for food, feed and cash They use traditional farming methods and work marginal lands

World production grew from 70 millions tons in 1960 to 154 million tons of fresh roots in 1991 The five major cassava producing countries are Brazil (25 million tons) Nigeria (20) Thailand (20) Zaire (18) and Indonesia (16)

The total area harvested is about 16 million hectares with 57% in Africa 25% in Asia, and 18% in Latin America

Annual consumption is greatest in Africa averaging 96 kg per capita with the greatest consumption in Zaire at 391 kg per capita (or 1 123 calories per day) Average world consumption is 18 kg per capita About 85% of the world s cassava crop is used domestically food—58% animal feed—28%, industrial uses—3% and wastage—11% The remaining 15% (i e about 30 million tons) is exported to Europe and Japan as either chips or pellets and starch Thailand accounts for 75% of exports followed by Indonesia and China

Nutritional Value and Food Products

The cassava root contains between 30% and 40% of dry matter which is principally carbohydrate (124 kcal per 100 grams—the potato contains 76 kcal per 100 grams) It is rich in vitamin C and calcium has acceptable levels of B vitamins and provides other minerals But it is low in protein (1% of fresh weight) In contrast the leaves contain high levels of protein 8% to 10% of fresh weight Various parts of the cassava plant also have medicinal value

As human food the cassava root is prepared in many ways for example boiled baked fried as meal flour and even as beer Starch extracted from the root is also used to make a wide range of sweet and savory foods such as crackers tapioca pearls noodles or cheese breads Fresh leaves are eaten as a vegetable especially in West and Central Africa Indonesia and parts of Brazil

Other Uses

As animal feed fresh roots are a good source of carbohydrates and the leaves can be used as a protein supplement for beef and dairy cattle Dried cassava is used to make concentrates for poultry swine and cattle The countries of the European Community import more than 5 million tons of cassava pellets annually to incorporate into animal feed rations

In industry cassava starch is used directly in food processing paper making textiles adhesives or as lubricant in oil wells It is also used in the manufacture of many chemical products such as monosodium glutamate citric acid mannitol sorbitol glucose high fructose syrup and alcohol

Most cassava is processed on a small scale in rural areas where it generates considerable employment Because of the crop s flexibility in processing some African and Latin American governments are using cassava to improve the economic status of socially "depressed" areas Even in areas where cassava processing is carried out on an industrial scale as in Thailand Indonesia China the Philippines India and southern Brazil most cassava is supplied from small scale farms rather than from plantations

Advantages as a Sustainable Crop

Cassava is well known for its ability to tolerate drought and yet maintain yields Several factors are involved (1) leaf stomata are sensitive to humidity closing whenever the air becomes dry (2) roots can extract water from deep soils even as much as 2 5 m (7 to 8 feet) and (3) the plant possesses a carbon fixation system that allows cassava to continue effective photosynthesis under prolonged water stress

The crop also survives in soils with low contents of phosphorus—an essential plant nutrient—by forming associations with certain soil fungi (mycorrhizae) It can also grow and produce well in poor acid soils with high aluminum content

The plant accepts rainfall regimes that range from less than 600 mm (24 inches) to more than 3 000 mm (120 inches) per year but does not survive flooding It grows at altitudes from sea level to 2 300 m (7 667 feet) Although it can tolerate light frosts it produces best in a warm climate with temperatures ranging from 25 to 35 °C (77 to 95 °F)

The plant can be harvested at any time from 7 months to 3 years after planting Being able to keep the roots in the ground is a particular advantage in countries opening up agricultural frontiers or suffering natural disasters like drought and locust attacks or social conflicts such as war Such flexibility is highly useful considering that the roots once harvested perish within 3 or 4 days and must be consumed at once or be processed into products such as flour or starch that can be stored for longer periods

Diseases and Pests

Although cassava is a hardy plant yield losses occur through diseases and pests Significant foliar and stem diseases are the cassava bacterial blight which is widespread and in Africa the African cassava mosaic virus Root rots also cause considerable yield losses Because they damage the most economically valuable part of the plant they are potentially the most harmful diseases

Major pests are those that suck or eat leaves the green spider mite mealybug whitefly lacebug and hornworm Root damaging pests are the burrowing bug and subterranean mealybug

Cyanide Production

The cassava plant contains a substance linamarin which releases the poisonous cyanide or hydrocyanic acid when plant tissues are damaged "Sweet" varieties produce as little as 20 mg of acid per kilogram of fresh roots whereas "bitter" varieties may produce more than 1 000 mg No acyanogenic varieties are known

Traditional methods of food preparation are effective in reducing cyanogenic content to innocuous levels But if roots of bitter varieties are underprocessed and the diet lacks protein and iodine as occurs during famines and wars cyanide poisoning can cause serious health problems

Despite the disadvantages of linamarin some farmers actively select for bitter or cyanogenic varieties Why they do this when processing bitter varieties is such hard work is not yet known but possible reasons are that the cyanide helps protect the plant from potential pests and certain food products if made from bitter varieties have better texture than those made from sweet varieties

Research

Cassava researchers aim to develop the full potential of the crop so that those farmers and processors who depend on cassava for their livelihood can improve their incomes and general well being

Because cassava is usually grown on poor soils with low rainfall and has a potential for multiple end uses scientists need to integrate different fields of research that is breeding and crop management with postharvest processing and market research

Through breeding scientists develop varieties that are well adapted to major diseases pests and soil and climatic constraints These varieties also need to have qualities suitable for different end uses

Research in crop management offers a particular challenge because cassava is mostly grown in fragile and socioeconomically marginal environments where solutions to soil and water degradation are needed The integrated management of pests and diseases including biological control, is particularly appropriate to a long cycle crop like cassava

If technology developments are to benefit cassava farmers then links between farmers and markets must be strengthened—which research on processing can help do by developing new products

Biotechnology—a new field in cassava research—will accelerate investigations in most of the areas mentioned

Interinstitutional relations are important for advancing cassava research Regional and global cassava networks link scientists from national institutions of developing countries with those from developed country universities and research laboratories international organizations and donor agencies These networks significantly increase the flow of information among collaborators and help prioritize research for more effective and rapid results in the common endeavor of alleviating hunger and poverty