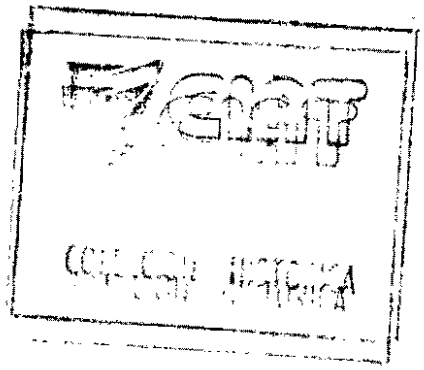

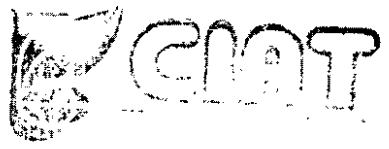

SECOND AFRICAN BEAN YIELD AND ADAPTATION NURSERY (AFBYAN II)

J.B. Smithson, H.E. Gridley and W. Youngquist

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PREFACE

Research on common bean conducted by national programmes in Africa in coordination with CIAT is documented in three series of publications containing: the proceedings of workshops; reports of regional activities; and reprints of journal articles.

Here (CIAT African Occasional Publications Series No. 14), we present our summary and interpretation of the results from the second African Bean Yield and Adaptation Nurseries, carried out between 1988 and 1991. The nurseries were initiated with several objectives: foremost was to establish the basis of an international trials network to facilitate the exchange of common bean cultivars among national programmes; important also was to attempt to classify environments to develop more efficient evaluation strategies and interpret genotypic performance in terms of environmental features.

The data from AFBYAN I were reported in Parts 3A and 3B of this series (Smithson, 1990; Smithson and Grisley, 1992).

The trials were conducted by national programme staff. Regional organisation was due to: the CIAT Regional Programme on Beans in Eastern Africa, Debre Zeit, Ethiopia; the Southern African Development Coordination Conference/Centro Internacional de Agricultura Tropical (SADCC/CIAT) Regional Programme on Beans in Southern Africa, Arusha, Tanzania (the bean component of the Grain Legume Improvement Programme of the Southern African Centre for Cooperation in Agricultural Research and Training (SACCAR)); and the Reseau Regional pour l'Amelioration du Haricot dans la Region des Grands Lacs, Butare, Rwanda. Funding was provided by: national programmes; the Canadian International Development Agency (CIDA); the Swiss Development Corporation (SDC): and the United States Agency for International Development (USAID).

Further information on research activities on bean in Africa that are part of these projects is available from:

Pan-Africa Coordinator, CIAT Regional Programme on Beans in Eastern Africa, P.O. Box 23294, Dar es Salaam, Tanzania.

Regional Coordinator, SADCC/CIAT Regional Programme on Beans in Southern Africa, P.O. Box 2704, Arusha, Tanzania.

Coordinateur Regional, CIAT, Programme Regional pour l'Amelioration du Haricot dans la Region des Grands Lacs, B.P. 259, Butare, Rwanda.

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Bukalasa, Kachwekano, Kawanda	Kawanda Research Station, P.O. Box 7065, Kampala, Uganda.
Huambo	Estacao Experimental da Chianga, Huambo, Angola.
Machache, Maseru	Maseru Research Station, P.O. Box 829, Maseru 100, Lesotho.
Lichinga	Estacao Agraria de Lichinga, C.P. 238, Lichinga, Niassa, Mozambique.
Uitkomst	Uitkomst Research Station, P.O. Box 297, Grootfontein, Namibia.
Lambo, Mabughai, Miwaleni, Selian	Lyamungu Agricultural Research and Training Institute, P.O. Box 3004, Moshi, Tanzania.
Mbala	EPAD Project, Msekera Regional Research Station, P.O. Box 510089, Chipata, Zambia.
Gwebi	Department of Research and Specialist Services, P.O. Box 8100, Causeway, Harare, Zimbabwe.
Kisozi, Moso	Institut des Sciences Agronomiques du Burundi (ISABU), B.P. 795, Bujumbura, Burundi.
Gandajika	Programme National Legumineuses (PNL), B.P. 22, Mbuji Mayi, Zaire.

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PUBLICATIONS OF THE NETWORK ON BEAN RESEARCH IN AFRICA

Workshop Series

No. 1. Bean Fly Workshop, Arusha, Tanzania, 16-20 November 1986.
No. 2. Bean Research in Eastern Africa, Mukono, Uganda, 22-25 June 1986.
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No. 4. Bean Varietal Improvement in Africa, Maseru, Lesotho, 30 January-2 February 1989.
No. 5. Troisieme Seminaire Regional sur L'Amelioration du Haricot dans la Region des Grands Lacs, Kigali, Rwanda, 18-21 Novembre 1987.
No. 6. First SADCC Regional Bean Research Workshop, Mbabane, Swaziland, 4-7 October 1989.
No. 7. Second Workshop on Bean Research in Eastern Africa, Nairobi, 5-8 March 1990.
No. 8. Atelier sur la Fixation Biologique d'Azote du Haricot en Afrique, Rubona, Rwanda, 27-29 October 1988.
No. 9. Quatrieme Seminaire Regional sur L'Amelioration du Haricot dans la Region des Grands Lacs, Bukavu, Zaire, 21-25 Novembre 1988.
No. 10. National Research Planning for Bean Production in Uganda, Kampala, Uganda, 28 January-1 February 1991.
No. 11. First Meeting of the Pan-African Working Group on Bean Entomology, Nairobi, Kenya, 6-9 August, 1989.
No. 12. African Bean Research Workshop, Morogoro, Tanzania, 17-22 September, 1990.
No. 13. Virus Diseases of Beans and Cowpea in Africa, Kampala, Uganda, January 17-21, 1990
No. 14. First Meeting of the SADCC/CIAT Working Group on Drought in Beans, Harare, Zimbabwe, May 9-11, 1988.
No. 15. First Pan-African Working Grop Meeting on Anthracnose of Beans, Ambo, Ethiopia, February 17-23, 1991.
No. 16. Cinquieme Seminaire Regional sur l'Amelioration du Haricot dans la Region des Grands Lacs, Bujumbura, Burundi, 13-18 Novembre, 1989.
No. 17. Sixieme Seminaire Regional sur l'Amelioration du Haricot dans la Region des Grands lacs, 21-25 Janvier 1991.
No. 18. Conference sur le Lancement des Varietes, la Production et la Distribution de Semaines de Haricot dans la Region des Grands Lacs, Goma, Zaire, 2-4 Novembre 1989.
No. 19. Recommendations of Working Groups on Cropping Systems and Soil Fertility Research for Bean Production Systems, Nairobi, Kenya, 12-14 February 1990.
No. 20. First African Bean Pathology Workshop, Kigali, Rwanda, 14-16 November, 1987.
No. 21. Soil Fertility Research for Maize and Bean Production Systems of the Eastern Africa Highlands - Proceedings of a Working Group Meeting, Thika, Kenya, 1-4 September 1992.
No. 22. Atelier sur les Strategies de Selection Varietale dans la Region des Grands Lacs, Kigali, Rwanda, 17-20 Janvier 1991.

No. 23. Pan-African Pathology Working Group Meeting, Thika, Kenya, 26-30 May 1992.
No. 24. Bean Research Planning in Tanzania: Uyole Research Centre, 18-24 May 1992.

No. 25. Second Meeting of the Pan-African Working Group on Bean Entomology, Harare, 19-22 September 1993.
No. 26. Bean Improvement for Low Fertility Soils in Africa: Proceedings of a Working Group Meeting, Kampala, Uganda, 23-26 May 1994.
No. 27. Third SADC/CIAT Bean Research Workshop, Mbabane, Swaziland, 5-7 October 1992.
No. 28. Third Multidisciplinary Workshop on Bean Research in Eastern Africa, Thika, Kenya, 19-22 April 1993.
No. 29. SADC Working Group Meeting of Bean Breeders, Lilongwe, Malawi, 26-29 September 1994.
No. 30. Regional Planning of the Bean Research Network in Southern Africa, Mangochi, Malawi, 6-8 March, 1991.

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No. 1. D. J. Allen, M. Dessert, P. Trutmann and J. Voss. Common beans in Africa and their constraints. P.9-31 in: H. F. Schwartz and M. A. Pastor-Corrales (eds.), Bean Production Problems in the Tropics, 2nd Ed. CIAT, Cali, Colombia.

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No. 4. C. S. Wortmann, T. Sengooba and S. Kyamanywa. 1992. Banana and Bean Intercropping Research: Factors affecting Bean Yield and Land Use Efficiency. Expl. Agric. 28: 287-294; and C. S. Wortmann and T. Sengooba. 1993. The Banana-Bean Intercropping System - Bean Genotype x Cropping System Interactions. Field Crops Research 31: 19-25.

No. 5. C. S. Wortmann. 1993. Contribution of Bean Morphological Characteristics to Weed Suppression. Agron. J. 85(4): 840-843.

No. 6. L. Sperling and M. E. Loevinsohn. 1993. The Dynamics of Adoption: Distribution and Mortality of Bean Varieties among Small Farmers in Rwanda. Agric. Systems 41: 441-453.

No. 7. M. S. Nahdy. 1994. Bean sieving, a possible control measure for the dried bean beetles, *Acanthoscelides obtectus* (Say)(Coleroptera: Bruchidae). J. Stored Prod. Res. 30 (1): 65-69; and An additional character for sexing the adults of the dried bean beetle *Acanthoscelides obtectus* (Say)(Coleroptera: Bruchidae). J. Stored Prod. Res. 30 (1): 61-63.

No. 8. Wortmann, C.S., M. Isabirye and S. Musa. 1994. *Crotalaria ochroleuca* as a green manure crop in Uganda. African Crop Science J. 2(1):55-61.

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No. 10. K. E. Giller, F. Amijee, S. J. Brodrick, S. P. McGrath, C. Mushi, O. T. Edje and J. B. Smithson. 1992. Toxic concentrations of iron and manganese in leaves of *Phaseolus vulgaris* L. growing on freely-drained soils of pH 6.5 in Northern Tanzania. Communications in Soil Science and Plant Analysis, 23 (15&16), 1663-1669.

CONTENTS

Page

GLOSSARY

Abbreviations

Environments

Eastern Africa

ALE 90	Alemaya, 1990
AWA 89	Awasa, 1989
MEL 88	Melkassa, 1988
MEL 89	Melkassa, 1989
PAW 89	Pawe, 1989
ARI 90	Arivonimamo, 1990
BK0 9F	Bukalasa, first season, 1989,
BK1 9F	Bukalasa, first season, 1989,
KAC 8S	Kachwekano, second season, 1988
KC0 9F	Kachwekano, first season, 1989
KC1 9F	Kachwekano, first season, 1989
KAW 8S	Kawanda, second season, 1988

Southern Africa

HUA 89	Huambo, 1989
MAC 89	Machache, 1989-90
MAS 88	Maseru, 1988-89
MAS 89	Maseru, 1989-90
LIC 90	Lichinga, 1990
UIT 91	Uitkomst, 1991
LAM 90	Lambo, 1990
MAB 90	Mabughai, 1990
MIW 90	Miwaleni, 1990
SEL 90	Selian, 1990
SEL 91	Selian, 1991
MBA 89	Mbala, 1989
GWE 91	Gwebi, 1991

Great Lakes

KIS 9S	Kisozi, second season, 1989
MOS 9F	Moso, first season, 1989
MOS 9S	Moso, second season, 1989
GAN 9F	Gandajika, first season, 1989

Environmental variables

ALT	Altitude (masl)
LAT	Latitude (°)
SC	Soil class
SR	Soil rank
DL	Daylength at sowing (hr)
CDL	Change in daylength in first month after sowing (hr)
DI	Disease index
PSR	Rainfall during month before sowing (mm)
VR	Rainfall from sowing to flowering (mm)
RR	Rainfall from sowing to maturity (mm)
TR	Total rainfall during growing season
V+T	Mean maximum temperature from sowing to flowering (°C)
R+T	Mean maximum temperature from flowering to maturity (°C)
M+T	Mean maximum temperature from sowing to maturity (°C)
V-T	Mean minimum temperature from sowing to flowering (°C
R-T	Mean minimum temperature from flowering to maturity (°C)
M-T	Mean minimum temperature from sowing to maturity (°C)
VMT	Mean temperature from sowing to flowering (°C)
RMT	Mean temperature from flowering to maturity (°C
MT	Mean temperature from sowing to maturity (°C)

Plant characters

CH	Canopy height (cm)
CW	Canopy width (cm)
CS	Canopy size (cm^2)
DFF	Days to 50% flowering
DM	Days to 85% maturity
STH	Stand/m^2 at harvest
PM2	Pods/m^2
SPP	Seeds/100 pods
SW	Weight/1000 seeds (g)
SY	Seed yield (kg/ha)

Diseases

Anth	Anthracnose
ALS	Angular leaf spot
ALT	Alternaria blight
AB	Ascochyta blight
RR	Root rots
WB	Web blight
FLS	Floury leaf spot
WM	White mould
CBB	Common bacterial blight
HB	Halo blight
BCMV	Bean common mosaic
BSM	Bean stem maggot
NEM	Nematodes

INTRODUCTION

The original objectives of the African Bean Yield and Adaptation Nursery (AFBYAN) were: to establish the basis of a regional nursery network; to facilitate exchange of promising materials; to aid in classification of ecological zones; and to interpret variation in performance of genotypes in terms of physical and biotic factors.

The first series of trials (AFBYAN I) was reported in CIAT African Occasional Papers Nos. 3A and 3B. This series made some progress towards the attainment of the objectives. The nuclei of regional trial series were established in eastern and southern Africa, expanding into over 25 AFBYAN II trials. Promising materials were exchanged, two of them being already released for cultivation in Uganda.

In AFBYAN I, environments accounted for most of the variation in seed yields and other plant characters and clustering according to seed yields apportioned most of this variation between rather than within clusters. There was evidence that soil fertility and reproductive period rainfall were the most important environmental features. However, It was not possible to define ecological zones, arguably because of the small number of trials and imprecision of environmental data.

Clustering genotypes according to seed yields also substantially reduced the within cluster variation and distinguished groups differing principally in plant type and seed size. Stability characteristics were also related to plant type. Genotypes diverging most from environmental indices fell in the indeterminate bush and spreading groups and so their responses differed from determinate genotypes. Because environmental indices would have been heavily weighted by the larger number of determinate genotypes in the trials, we can conclude only that the two groups differed in stability and not that determinate plant types are more stable than indeterminate genotypes (Smithson and Gridley, 1991). G 2816 and Carioca diverged conspicuously from the other genotypes, whilst Red Wolaita, Black Dessie and T-3 and Kirundo, Kilyumukwe, A 197 and Muhinga fell in relatively compact groups, which reacted differently to other genotypes.

The 25 genotypes composing AFBYAN II included 13 of the entries from AFBYAN I, chosen for their diversity and performance, and 12 new contributions from national programmes in eastern and southern Africa. Data were received from 29 trials grown in 12 countries between 1988 and 1991. In this report, we use these data to examine the relationships among the genotypes and environments of AFBYAN II.

MATERIALS AND METHODS

Genotypes

The origins and characteristics of the 25 genotypes included in AFBYAN II are summarised in Table 1. The 13 chosen from AFBYAN I are indicated by asterisks in the table. The AFBYAN I entries, Black Dessie and T 3 were omitted because they were similar in performance to Red Wolaita; PVA 1272, T 23, Kabanima, Rubona 5, PVA 880 and PVA 563 because they were similar to K 20 and Calima in seed and plant type; and Mbala Local, Urubonobono, Kirundo and Muhinga because of inferior performance. The 12 new entries are: three each contributed from Ethiopia (Ex-Rico 23, A 176, 997-CH-173), Kenya (GLP 24, GLP 1004, GLPx 92) and Mozambique (INIA 10, INIA 12 and HF 465-63-1); and one each from Burundi (A 410), Rwanda (Ubusosera 6) and Zaire (A 370). AFBYAN IIthus includes a more diverse range of genotypes and a more even spread of seed and plant types than AFBYAN I.

Environments

The 29 environments from which data were obtained are listed in Table 2, together with selected environmental features considered to be important for bean growth, development and yield. They include: latitudes, altitudes, sowing dates and photoperiods (all of phenological importance); soil ranks (SR) (on a scale of 1-10, where 1 is the least and 10 the most fertile); and disease index (DI) (mean of five largest mean disease scores in each environment) to provide a measure of disease severity.

The soil ranks were derived from soil chemical and physical soil analyses of samples from trial sites (Tables 3 and 4). Scores were allotted to each soil as shown in Table 5 and used to rank the soils in order of fertility (Table 6).

Rainfall and temperature data during the vegetative (sowing to flowering) and reproductive (flowering to maturity) periods and rainfall during one month prior to sowing are shown in Table 7. These data were recorded during actual growing seasons except in a few cases (indicated by asterisks) where temperatures were long term records.

Soil and weather information were not received from Arivonimamo in Madagascar and Machache in Lesotho and there was no soils data from Gwebi in Zimbabwe and the Great Lakes region sites, so these trials were omitted from regression analyses. Maximum and minimum temperature data were not available for Kachwekano (Uganda) and Mabughai (Tanzania).

Nonetheless, the available environments provide a much greater range of conditions than AFBYAN I with: day lengths at sowing from 11.98 (Mabughai in Tanzania) to 13.22 (Maseru in Lesotho) hours; total rainfall during the growing season from 202 (Uitkomst in Namibia) to 1344 (Pawe in Ethiopia) mm; and mean temperatures from 15.0 (Mabughai) to 24.2°C (Miwaleni), both in Tanzania.

Experimental design and layout

The experimental design and layout and the data collected were as for AFBYAN I. Briefly the trials were 5 x 5 triple lattices with three replicates and plot sizes of 4 rows of 4 m length, the centre two of which were used for data collection. The crops were grown according to local practice, including time of sowing, spacing and fertilizer application.

Data collection

The plant character data requested were: canopy height and per cent ground cover at flowering (the latter was converted to cm of canopy width to derive the variable canopy size, the product of canopy height and width); the number of days to flowering and to maturity; stand count at harvest; and disease scores. Seed yields were recorded and the yield components (pods/m^2, seeds/pod and seed size) were estimated from a sample of 30 pods from each plot. Threshing percentages calculated from the pod samples enabled the detection and correction of cases of misweighing. Stand counts at harvest are presented as stands/m^2 for comparison among environments. Seeds/pod are presented as seeds/100 pods and seed size as g/1000 seeds to eliminate decimal points. Diseases were scored on a scale of 1-9, where 1 indicates absence and 9 most severe (complete defoliation or plant mortality). None of the above data were collected in all environments, so combined analyses are based on different sets and numbers of trials.

Data analysis

The methods of analysis used were:

Individual trials. Analyses of variance were computed for data from individual environments. The correlations and multiple regressions of yield with other plant characters and disease reactions were also computed using values predicted from the substitution of dummy variables for replicates and entries. This reduces the effects of character association specific to these variables. Note that none of the data were transformed, so that non-normality and heterogeneity could prejudice interpretation of the results.

Pooled analysis of variance. Pooled analysis of variance was computed for each variable in the form of a split plot analysis with replicates as main plots and genotypes as sub-plots. The denominator for the F test of the E mean square was the pooled reps and reps x E terms. The G mean square was tested against the G x E mean square and the G x E mean square against the sub-plot error term.

Cluster analysis. Environments and genotypes were clustered by two-way classificatory analyses of seed yields using Ward's (1963) agglomerative, hierarchical minimum variance method and the E, G and G x E interaction sums of squares were partitioned into components due to the variation among and within clusters in the manner of Byth *et al.* (1976). See Everitt (1980) for a summary of methods of cluster analysis.

Stability analysis. The stability of seed yields was explored using the method of Eberhart and Russell (1966) by which the mean yield of each genotype in each environment are regressed on indices derived from the environment mean yields. The significance of the divergence of each regression coefficient (b) from unity is determined by comparison with the standard error of the deviations from regression by standard 't' tests. The significance of the deviation from regression is tested by comparison of their deviation mean squares with the pooled error mean square by means of 'F' tests.

Multiple regression. Multiple regressions of plant characteristics on various combinations of environmental variables were investigated using the model:

$$Y = a + b_1X_1 + b_2X_2 + \ldots + b_nX_n + e$$

where: Y represents an individual plant character variable; a is the Y axis intercept; b_1-b_n are the regression coefficients of the environmental variables X_1-X_n; and e is the error. The b values estimate the change in the plant character for every unit change in each environmental variable. Each regression is associated with a coefficient of determination (R^2) which measures the proportion of the total variation accounted for by the regression.

The general procedure was as follows. First, correlations among all possible environmental variables were computed and one member of each of the pairs of variables that were very highly correlated was rejected, as large correlations are known to distort the results of multiple regression analyses. Plant characters of individual genotypes in each environment were then regressed on the remaining eight environmental variables, omitting those variables that were obviously inappropriate such as soil rank, reproductive rainfall and disease index in the case of days to flower. Finally, the regressions were repeated omitting the variables for which none of the regression coefficients were significantly greater than zero. The variables involved are identified below in the section on multiple regression. The effects of environments on disease severity were explored by regressing the score of the most susceptible genotype to each disease in each environment on environmental variables.

RESULTS AND DISCUSSION

Approach

The data presented are from tests of 25 common bean genotypes in AFBYANs (II) grown in 28 environments in 12 countries in Africa between 1988 and 1991. Wortmann and Allen (1994) have recently devised a classification of bean growing areas in Africa and listed their characteristics and constraints. While the AFBYAN II trials represent only a small sample of these environments and the genotypes grown in them, they afford a much wider spread than AFBYAN I and should enable a more reliable interpretation of performance.

Analysis of G x E interaction in variety trial series is usually restricted to combined analysis of variance of seed yields followed, at best by the application of some form of stability analysis, most commonly by regressing the yields of individual genotypes on environmental mean yields. Combined analysis of variance merely estimates the relative contributions of environments (E), genotypes (G) and the G x E interaction to the total variation. It does not pretend to examine the sources of the interactions, which is extremely difficult when more than very few genotypes are tested in several environments. The stability analysis advances understanding by partitioning the G x E variance into components due to regression on environment yields and the deviations of the yields of individual genotypes from regression but it does not identify the causes of these effects and can be misleading as the parameters derived vary with the genotypes and the environments in which they are tested. In the following, we apply the above procedures, but also explore the possibility of acquiring a better understanding of the nature and causes of the interactions that occur when a set of genotypes is grown in a diverse series of environments by the use of less conventional methods of analysis.

Firstly, we compute analyses of variance of individual trials and correlations and multiple regressions of yield with plant characters and disease scores. Correlations and regressions from individual trials can benotoriously misleading but lend greater credence if they are consistent across environments. Secondly, we apply cluster analysis to group environments and genotypes according to their seed yields. An important benefit of clustering is to facilititate identification of the sources and nature of interactions by considerably reducing the size of the two-way matrix of genotypes and environments. Cluster analysis ought also to provide a basis for grouping environments and genotypes for more efficient testing.

G x E interactions arise from differences in response of genotypes to the environment. The effects of the biotic and physical environment on crop phenology, physiology and morphology are comparatively well understood but the nature and importance of the factors operating in specific crop:environment systems are difficult to establish. Here, we first attempt to relate the genotype groups formed by cluster analysis of seed yields to the stability parameters of the genotypes. Then, we compute multiple regressions to identify the factors which contribute most to the variation in the yields and other characteristics of individual genotypes across environments. Presumably, only those environmental features to which genotypes respond differently contribute to G x E interaction: those features to which genotypes respond similarly will make no contribution, irrespective of the magnitudes of their effects. Also the members of the same genotype group formed by cluster analysis should respond similarly (and

differently from other groups) to the environmental features contributing to G x E interaction.

Environment and plant variables

As indicated in the AFBYAN I report, the set of environment and crop variables requested represented a balance between comprehensiveness and feasibility. All measure features associated with seed yields either directly or indirectly, through their effects on plant characters which contribute to yield. Daylength (and change in daylength) and temperature are indirectly associated with yields through their effects on time to flowering and maturity. Temperature also affects yields through its effects on disease and insect incidence and severity and evapotranspiration. Soil fertility, rainfall and disease severity are expected to have both direct and indirect effects on seed yields.

The environmental information requested from each site included: altitude, latitude and sowing date; soil chemical and physical data (in most cases we received soil samples and arranged for soil analysis at NRI or Wye College); and daily records of maximum and minimum temperature and rainfall from sowing to maturity and rainfall during the month prior to sowing. From these we ranked soils in order of fertility and derived rainfall totals and mean temperatures during presowing, vegetative and reproductive periods of crop growth, daylength at sowing and change in daylength during the month after sowing. We also included plant stand as an environmental variable, since sowing densities varied among environments, and derived three indices of disease severity from disease scores.

Plant characters contributing directly to yield include plant stand, disease severity (in susceptible genotypes) and the yield components, pod number, seeds/pod and seed size, and indirectly, crop growth and time to flowering and maturity. We used the product of canopy height and canopy width (canopy size) as a measure of crop growth. Canopy size is a better indicator of crop growth than the usual vigour score, which is not only subjective but also provides no comparison among environments. Obviously, total dry matter at some stage after flowering would have been an even better measure but drying facilities were inadequate at most sites. Conventional measurements of other plant characters were used as they were considered satisfactory.

Not all variables were recorded at some sites but, rather than eliminate those environments lacking complete data and lose information, we based each analysis on all environments with the necessary data. Thus, combined analysis of variance of seed yields involves data from 27 environments while stability parameters and cluster analysis for seed yields include an additional trial (MOS9S) for which we received only mean yields. Similarly only 16 environments were involved in combined analyses of canopy sizes and 17 for pod numbers and seeds/pod. Multiple regressions were based on fewer environments because soils data and disease scores were not available in all cases. As a result, while we avoid discarding useft.. information, some analyses are not strictly comparable. With this *proviso*, we will now consider what these analyses can tell us about the relationships among yield, other plant characters and environment.

Individual trials

Tables 8-58 show mean values for plant characters and disease scores of each genotype in individual trials, together with their overall means, standard errors and coefficients of variation. Plant characters and disease scores are summarised in separate tables, so there are two tables for those trials where diseases were rated. Columns for plant characters that were not recorded have been left blank. Data from environments in eastern Africa are in Tables 8-29; southern Africa data can be found in Tables 30-52; and data from the Great Lakes are in Tables 53-58. These tables are included for the information of cooperators and require no further explanation.

Correlations between yield and other plant characters and disease scores in individual environments are shown in Tables 59 (eastern Africa), 60 (southern Africa) and 61 (Great Lakes) and corresponding coefficients from their regressions in Tables 62-64. Yield was correlated with plant stand in 17 out of 26 environments, increasing by up to 267 kg/ha (in MEL89) for every additional stand/m^2.

Yield was significantly correlated with canopy height and canopy width in more than half of the environments where the characters were recorded. The majority of the correlations were positive, so better yields tended to be produced from vegetatively larger crops (yield increased by up to 81 kg/ha for every additional cm of height and 89 kg/ha for each additional cm of width, both at Awassa in 1989). Such relationships are not inevitable as poor yields can be associated with continuing vegetative growth in indeterminate genotypes. Negative correlations between yield and canopy size were observed in a few cases in AFBYAN II and these tended to be concentrated in higher latitude environments where flowering was delayed, vegetative growth prolonged and yields reduced in photoperiod sensitive genotypes. Time to flowering and maturity were significantly correlated with seed yield in half of the 26 environments where they were recorded. Yields improved with earlier flowering or maturity (by up to 170 kg/ha (ALE90) with each day less to flowering and up to 168 kg/ha (GWE91) with each day less to maturity) in about two thirds of these cases, mostly in southern Africa, and with later flowering or maturity in the remainder. Earlier flowering and maturity can be expected to favour yield when rainfall is deficient but may be deleterious when rainfall is ample. In these trials, there was no obvious relationship between amounts of rainfall and the magnitude and direction of the correlations but distribution of rainfall will also be important.

Ninety five disease scores were conducted in 23 trials. Diseases were not rated at Uitkomst in Namibia, Miwaleni in Tanzania and Gwebi in Zimbabwe and at Huambo in Angola they were recorded only present or absent. At Uitkomst and Miwaleni, cooperators indicated that disease incidence was insufficient to score. Bean stem maggot and nematodes were recorded only at Lichinga in Mozambique. Where correlations between yield and disease were significant, they were usually (but not always) negative. CBB was most common (scored in all environments in eastern Africa and 18 out of all 25 environments). Rust and BCMV were scored in 13 environments, ALS in 11 environments and anthracnose in 10 environments. With BCMV in MEL88, seed yields increased by 1274 kg/ha with each unit decrease in disease score but this is an aberrant result and responses in other environments and to other diseases were much smaller.

Assuming the absence of scores for a disease in trials where other diseases were scored indicates that particular disease to be absent or unimportant, observations were made of a total of 12 different diseases in 26 environments. Diseases were therefore considered sufficiently important to score in less than one third of the 312 possible disease:environment combinations and were significantly negative in only 23 cases. In addition, in some cases responses were positive, so yields improved as disease became more severe. The reasons for this are unclear but correlations and regressions in individual environments provide little support for the notion that diseases are important constraints to common bean yields in this series of trials.

Pods/m^2 were significantly and positively correlated with yields in all but one of the environments in which they were recorded (yields increased by 5-12 kg/ha for every additional pod/m^2) and is clearly the most important determinant of seed yields. Seeds/pod were significantly correlated with yield in 7 out of 17 environments. All the significant correlations were positive so yields increased with increasing numbers of seeds per pod (by up to 6 kg/ha for each additional seed/100 pods). Seed size was significantly correlated with yields in only four environments (three positive and one negative), so is not an important determinant of seed yield.

Plant characters and disease scores accounted for up to 79% of the variation in seed yields in individual trials, R^2 being significantly greater than zero in all but two trials (Tables 62-64). Yield components accounted for up to 93% of the variation in seed yields in individual trials, R^2 being significant in all trials where the three components were recorded.

Pooled analysis of variance

Pooled analyses of variance showed that environments mean squares were significantly greater than the error mean squares for all characters except white mould score and genotype mean squares for all except anthracnose, web blight and white mould scores (Table 65). G x E mean squares were significantly greater than the errors for all characteristics so genotypes did not perform similarly across environments.

In general, environments accounted for the major part of the total variation followed by the G x E interaction and then genotypes which accounted for relatively minor proportions of the variation (Table 66). The exceptions were the yield components, pod number, seeds/pod and seed size and some of the disease scores. The greater genotypic contributions of the yield components reflects the greater heritability of these characters compared with the other plant characters associated with yield.

For disease scores, environmental contributions tended to be less because only those environments where a disease was present were included in the combined analysis and random errors were greater because of variable and often low scores. The magnitudes of the G x E interactions reflect the specialisation of the pathogens to some extent, being greater for BCMV, rust and anthracnose than for ascochyta blight, floury leaf spot and CBB.

For plant stand, differences among environments arose mainly from the sparser sowing densities in trials in Uganda, which were about half those used elsewhere, due to wider spacing between and within rows. There is a case for re-examination of sowing practices in Uganda with a view to increasing sowing densities. Seedling emergence and plant survival were evidently depressed by flooding at Miwaleni, root rots at Lichinga, termites at Uitkomst and halo blight and black root in Lesotho trials and at Gwebi.

Combined tables of means across environments for each of the plant characters and disease ratings are summarised in Tables 67-86 together with S.Es. of trial, genotype and interaction means and C.Vs. At this point, we will consider only the environment and genotype means as all but the most drastic interactions are impossible to interpret with data from 25 genotypes in up to 27 environments.

Canopy heights. Canopy heights were measured in 18 environments (Table 67). They ranged between 53.8 cm in MEL88 in Ethiopia and 22.7 cm in UIT91 in Namibia. G 2816 (35.5 cm) and Ikinimba (36.7 cm) were the shortest genotypes and G 12470 (46.1 cm) was the tallest.

Canopy widths. Canopy widths were recorded in 20 environments (Table 68). They were widest in two trials (BK09F and BK19F) at Bukalasa in Uganda and in SEL90 in Tanzania (over 50 cm) and narrowest in LIC90 in Mozambique (21.7 cm) and MAC89 in Lesotho (22.7 cm). Differences among genotypes were less pronounced. ZPv 292 (30.3 cm) exhibited the narrowest canopy and Nain de Kyondo (39.9 cm), the widest.

Canopy sizes. Canopy sizes were calculable for 16 environments (Table 69). The largest canopies occurred in the two Bukalasa trials (BK09F and BK19F) (2617 and 2746 cm^2) and the smallest in UIT91 (427 cm^2). Among genotypes, ZPv292 (1228 cm^2) had the smallest canopy and G 12470 (1750 cm^2) the largest.

Days to flowering. Days to flowering were recorded in 26 environments (Table 70). Flowering was earliest in PAW89 in Ethiopia (34.1 days) and latest at Kachwekano in Uganda and Machache and Maserua in Lesotho (all around 60 days or more). ZPv 292 was the earliest genotype to flower (39.3 days) and Nain de Kyondo was the latest (52.7 days).

Days to maturity. Days to maturity were recorded in 25 environments (Table 71). They did not correspond completely with days to flowering. One trial at Kachwekano and the three in Lesotho all took over 100 days to mature but MAB90 in Tanzania (111.7 days) and Kisozi in Zaire (128.1 days) were also among the late-maturing environments. Among genotypes, Calima (85.3 days) matured the earliest and G 13671 (98.4 days) matured the latest.

Stands/m^2. Stands were counted at harvest in 26 environments (Table 72). They were fewest in the six trials in Uganda (at Bukalasa, Kachwekano and Kawanda) and in UIT91 in Namibia. Otherwise, stands were more than 20/m^2 at Melkassa in Ethiopia, in SEL91 in Tanzania, in MBA89 in Zambia and in MOS9F in Zaire. Differences among genotypes were very much smaller, ranging from 14.5 (Red Wolaita, GLP 24, Kilyumukwe and G 12470) to 16.6 (XAN 76).

Yield components. Pod samples were processed in 17 environments. Pods/m^2 ranged from 23.4 in UIT91 in Namibia to over 200 in MEL89 (Ethiopia) (Table 73). Ex-Rico 23 (189.7/m^2) produced the most pods and G 12470 (74.0) the least. Seeds/pods were fewest in MIW90 (Tanzania) and most numerous in PAW89 in Ethiopia (Table 74). Among genotypes, K 20 (322/100 pods) produced the fewest seeds/pod and Carioca (502) produced the most. Seed sizes ranged from 254 g/1000 seeds in KAW89 to 393 g in KAC8S (Table 75). Ex-Rico 23 was smallest seeded (180 g) and A 197 had the largest seeds (518 g).

Seed yields. Seed yields were recorded in 27 environments (Table 76). The heaviest yield was produced in MEL88 (over 3 t/ha) and the smallest in UIT91 (273 kg/ha). Among genotypes, Red Wolaita (944 kg/ha) produced the smallest yield and XAN 76 (1634 kg/ha) produced the heaviest. There were spectacular interactions for seed yields - the genotypes, GLPx 92, Ikinimba, G 13671 and G 2816, produced no yield in Lesotho because they flowered too late.

Disease scores. Anthracnose was recorded in nine environments (Table 77) but was never severe, with a maximum mean score of 2.75 in KC19F. Differences among genotypes were small and no genotype was completely disease-free. Angular leaf spot was recorded in 11 environments (Table 78). Mean scores ranged up to 5.2 in KAW8S. Again, no genotype was completely disease-free, the best being XAN 76, with a score of 2. Ascochyta blight was rated in 9 environments (Table 79). The maximum mean score was 7.64 in MBA89 in Zambia. Differences among genotypes were small, ranging from 2.95 to 4.71. Floury leaf spot was recorded in only four environments (Table 80) and was never severe. Rust was most widespread of the fungal diseases, being rated in 12 environments (Table 81). Scores were characterised by conspicuous differences in reactions within environments but overall, no genotype was completely free of the disease. The best was XAN 76, with a mean score of 1.46. Other fungal diseases (web blight and white mould) were relatively rare, though web blight was severe in PAW89 (score 5.80) and GAN9F (6.64), both lowland environments (Tables 82 and 83). For web blight, mean disease scores among genotypes ranged from 3.44 in XAN 76 to 6.56 in Carioca.

Common bacterial blight was the most widespread of all the diseases, being recorded in 17 environments (Table 84). The disease was most severe (mean score 5.63) in BK09F in Uganda. Differences among genotypes were small ranging from 2.70 in Nain de Kyondo to 3.91 in INIA 12. Halo blight was rated in 7 environments (Table 85). Mean scores ranged up to 4.41 in MAC89 in Lesotho. There were significant differences among genotypes in individual environments but no genotype was completely disease-free. Mean genotype scores ranged from 1.62 in XAN 76 to 3.76 in INIA 10. BCMV was observed in 12 environments (Table 86), mean scores ranging up to 3.63 in KIS9F in Zaire. Despite spectacular differences within environments, mean genotype scores were quite similar - XAN 76 (1.80) had the smallest score and Ubososera 6 (2.97) the largest.

Cluster analysis

Cluster analysis of seed yields distinguished 12 environment (ECGs) and 10 genotype (GCGs) clusters (Table 87; Figures 1 and 2). Their means are shown in Table 88 and hierarchical partitioning of the variation among and within clusters in Table 89.

Clustering accounted for 97.8% of the variation among environments and 89.2% of that among genotypes, eliminating almost all of the variation within both environment and genotype clusters. Clustering also accounted for 72.7% of the E x G and 75.8% of the G x E interactions but the Within E Groups x Genotypes Mean Square was significant, arising from interactions involving all the environmental clusters except ECGs 5 and 10. There was also significant variation within all but GCG 1 x environments.

Clustering was related both to environment mean yield and differential genotype responses. The major discontinuity involved ECGs 1-9 (mean yields 543-1992 kg/ha) and ECGs 10-12 (2318-3095 kg/ha). There was overlap between the members of ECG 1, 2 and 9 and ECGs 3, 5 and 6 which must be attributable to differential genotype responses. Otherwise, even groups which fused early were distinguished by differences in mean yields. ECGs 2 and 8 comprised the three environments in Lesotho (MAS88, MAC89 and MAS89) in which four genotypes flowered too late to produce seed because of their sensitivity to photoperiod. The Lesotho trials in 1989 (ECG 2) appeared to separate from the trial in 1988 (ECG 8) due to differences in mean yield and to the behaviour of GCGs 6 and 7 which were conspicuously superior to most other genotypes in 1989 but not in 1988.

Two of the three trials at Kachwekano occurred in the same cluster, as did two trials at Melkassa and two at Bukalasa. Otherwise, apart from the Lesotho trials, there was no obvious relationship between clusters and environment characteristics. The two trials at Selian in Tanzania fell in separate clusters and the trial at Kawanda appeared in a different cluster from the trials at Bukalasa, which is only a few kilometers from and very similar in environment to Kawanda. Some of these discrepancies may arise from seasonal differences but note that ECG 4 grouped environments with latitudes as diverse 1.23° (Kachwekano) and 13.30° (Lichinga), altitudes of 1100 and 2200 m, soil ranks of 3 and 10, rainfalls of 221 and 1344 mm and temperatures of 13.9 and 22.4°C, so cluster analysis of seed yields evidently provides little basis for stratification of environments for testing purposes.

The major discontinuity among genotypes involved GCGs 9 and 10, which comprised the four genotypes (GLPx 92, Ikinimba, G 13671 and G 2816) that produced no yield in Lesotho, compared with the remaining genotypes, which then separated into two groups differing in mean yield. However, there was complete overlap of the yields of GCGs 9 and 10 with those of GCGs 2, 5, 6 and 7, so response patterns were much more important in defining clusters of genotypes than in grouping environments. Although they failed to produce yields in Lesotho, the components of GCGs 9 and 10 produced heavier yields than any of the other genotypes in ECGs 7 (SEL91), 10 (Melkassa) and 12 (Alemaya) and all but one in ECG 3 (Huambo, SEL90 and Mbala).

Unlike AFBYAN I, the clustering was not consistently associated with plant type, seed size or origin. The four components of GCG 7 (Carioca, A 370, A 410 and XAN 76) all had small or medium size seeds and were of Plant Type 2 or 3. GCG 5 comprised A 176 and Ex-Rico 23, both of which had small seeds, were of Plant Type 2a and have recently been released for cultivation in Ethiopia. Ikinimba, G 13671 and GLPx 92 (GCG 9) have medium-sized to large seeds and are all Plant Type 3, but their grouping presumably owes more

to their response to photoperiod than to their morphology. INIA 10 and INIA 12, which are currently cultivated in Mozambique, clustered together in GCGs 1 and 2 but the five Plant Type 1 genotypes (K 20, G 12470, A 197, GLP 1004 and Calima) fell in separate groups except K 20 and G 12470, which were in GCG 1. Note though, that these were selected on account of their occurrence in separate groups in AFBYAN I, so they are apparently diverse in attributes other than plant type and seed size.

Stability parameters

Regression coefficients (b), coefficients of determination (r^2) and standard errors of deviations from regression (s_b) for the 25 genotypes are shown in Table 90. In this and subsequent tables, the genotypes have been rearranged to conform with the cluster analyses to facilitate identification of features associated with the clusters. There were significant differences among genotypes in their regressions on the environmental index. The regressions accounted for most of the variation (78-97%) in all genotypes but deviations from regression were significantly greater than the error in several genotypes.

The regression coefficients of genotypes in GCGs 1-4 tended to be less than unity, six of them significantly so, while those of GCGs 5-10 were similar to or greater than unity, though only one (GLPx 92) was significant. The regression coefficients of genotypes in GCG 4 (Ubososera 6 and Red Wolaita) were conspicuously smaller than those of the other genotypes except K 20 and INIA 10 (GCG 1) and HF 465-63-1 (GCG 2). Similarly significant deviations from regression were concentrated in GCGs 4 (Nain de Kyondo), 6 (ZPv 92 and GLP 1004), 8 (997 CH 173), 9 (GLPx 92, Ikinimba and G 13671) and 10 (G 2816), so differences in stability characteristics may explain at least some of the interactions between genotypes and environments.

Multiple regressions

Large correlations (highlighted in bold in Table 91) were found: between latitude and daylength (89%); between altitude and all the temperature variables (71-91%); among all the temperature variables (48-96%); between soil class and soil rank (96%); and among the three disease indices (62-94%). Based on these correlations the nine variables, stand/m^2 at harvest, daylength, change in daylength, presowing, vegetative and reproductive period rainfall, mean temperature, soil rank and the disease index derived from the five largest scores were selected to be independent variables. For simplicity, these variables will from hereon be referred to as stand, daylength, change in daylength, presowing, vegetative and reproductive rainfall, temperature, soil fertility and disease.

The coefficients and the R^2 values for each of the plant characters (dependent variables) (after omission of the environmental variables that were all non-significant) are shown in Tables 92 and 94-99.

Seed yield. Vegetative rainfall was omitted from the final regression. R^2 values ranged from 46 to 67% and were all significantly greater than zero ($P<0.001$) (Table 92). The coefficients for stand were positive and significant in all genotypes - yields increased by 72.1 (Red Wolaita)

to 158.5 (GLP 1004) kg/ha for each additional stand but, since most genotypes responded similarly, this variable was apparently little implicated in the clustering. The coefficients for disease severity were all positive (i.e. yields increased as diseases became more severe) and most of them were significant. Yields tended to increase with improving soil fertility and longer days and to decrease with heavier presowing and reproductive rainfall and lengthening days. Responses to temperature were inconsistent.

The pattern of responses to environments differed among GCGs. Group responses are classified greater than (+), equal to (=) or less than the means of the b coefficients of each environmental variable, according to the approximate standard errors of the b coefficients (Table 93). Responses differed among cluster groups. For example, the yields of GCG 1 appeared to be less affected by stand, reproductive rainfall and day length than most other GCGs but more affected by presowing rainfall.

Also, members of the same cluster tended to behave similarly. For example the coefficients of members of GCG 1 for presowing rainfall are all small and non-significant while those for GCGs 6 and 8 are all larger and mostly significant. The losses in yield are much greater in response to change in day length in GCGs 9 and 10 and much less in GCGs 2 and 3. Similar associations can be observed for temperature, where responses of some GCGs are positive and others negative, and other variables. Note also that larger responses tend to be concentrated in GCGs 4-10 and smaller responses in GCGs 1-3. Differences in the patterns of response to environmental variables therefore offer some explanation for the compositions of the clusters and presumably the G x E interactions.

Canopy size. Neither stand/m^2 nor disease appeared important for the determination of canopy size and were omitted from the second regression calculation. R^2 values were relatively uniform across genotypes, ranging from 53 to 76%, all of them being significantly greater than zero ($P<0.001$) (Table 94). Canopy sizes were larger in environments with more fertile soils, heavier presowing rainfall, warmer temperatures and longer and lengthening days. Temperature and daylength would presumably affect canopy size through their effects on time to flowering and maturity. Canopy size decreased in environments with heavier vegetative and reproductive rainfall, suggesting that rainfall was not deficient in these trials.

As with seed yields, responses differed among GCGs. The canopy sizes of GCGs 3 and 9 appeared to be less affected by environment and those of GCG2 4, 5 and 10 more affected. There was greater diversity within groups than with seed yields but this would be expected as the clustering was based on yields and canopy sizes were not measured in some environments notably those in Lesotho, which had contributed most to G x E interactions.

Days to flowering. Only temperature, day length and change in day length were included in the regression equation since these are known to be the principal determinants of time to flower. All three showed significant effects on one or more genotypes. The regressions accounted for 58-81% of the variation in time to flower, all the R^2 values being significantly greater than zero ($P<0.001$) (Table 95). Temperature and daylength alone accounted for only 40-69% of the variation, so the extent to which days were shortening or lengthening during the month after sowing was obviously important especially with members of GCGs 9 and 10.

As expected, flowering was expedited in warmer environments with shorter and shortening days. Genotype responses were conspicuously different, the times to flowering of the four members of GCGs 9 and 10 being substantially delayed in environments with longer and lengthening days. These features account for the failure of the members of these clusters to yield in environments in Lesotho and their early separation from other genotypes by cluster analysis. GCGs 4, 7, 9 and 10 tended to be more responsive to temperature and GCG 3 tended to be less sensitive to environment than other genotype clusters. The response patterns of members of the same group were quite similar, indicating the regulation of time to flower through temperature and daylength to be an important contributor to G x E interaction.

Days to maturity. Stand and disease were omitted from the initial regression calculations. Vegetative rainfall was subsequently also omitted because of absence of significant genotype responses. R^2 values were relatively variable, accounting for 45-85% of the variation and being largest in GCGs 9 and 10 (Table 96). All were again significantly greater than zero ($P<0.001$).

As with time to flower, time to maturity was shorter in warmer temperatures and longer with longer and lengthening days. It increased with improved soil fertility and presowing rainfall and shortened with increasing rainfall during the reproductive period. These responses accord with expectation except for reproductive period rainfall which could, however, expedite maturity by improving podfill.

The responses of GCGs 9 and 10 were conspicuously different from those of the other GCGs. They matured much later as soil fertility improved, presowing rainfall increased and in longer and lengthening days; and much earlier with increasing reproductive rainfall. The responses of other cluster groups were less than average to one or more of the environmental variables. Within group responses were again quite similar, so time to maturity was probably an important component of the G x E interaction for seed yields, through the effects of soil fertility, rainfall, temperature and daylength.

Pod number. There were significant effects of all the environmental variables on pod number in one or more genotypes (Table 97). The regressions accounted for 53-83% of the total variation within genotypes, tending to be smaller in GCGs 1 and 4 than in the other clusters.

More pods were harvested in environments with better plant stands, poorer soils, less vegetative rainfall, warmer temperatures, longer and lengthening days and less severe disease. Relationships with presowing and vegetative rainfall were small and inconsistent.

Clusters exhibited distinct patterns of response. Nain de Kyondo (GCG 3) was among the most or the least responsive genotypes to all environmental variables. Red Wolaita tended to be less responsive than other genotypes. As with seed yields, the greatest responses appeared to be concentrated in GCGs 4-10. Within GCGs, responses tended to be less consistent than with seed yields but as with canopy sizes, yield components were estimated in relatively few environments, notably omitting the Lesotho trials.

Seeds/pod. There were significant effects of all variables on seeds/pod in one or more genotypes (Table 98) but the regressions accounted for only 10-69% of the variation within

genotypes and were non-significant in five cases. There were more seeds/pod in environments with better presowing and reproductive rainfall, warmer temperatures and longer and lengthening days and fewer with heavier vegetative rainfall. The effects of plant stand, soil fertility and disease severity were small and inconsistent.

The responses of Nain de Kyondo (GCG 4), 997-CH-173 (GCG 8) and GCG 9 to environmental variables tended to be above or below average but those of most genotypes were about average and not particularly consistent within clusters, so the regression did not correspond well with the results of the cluster analysis.

Seed size. All variables but disease index affected seed size. R^2 values were very diverse, ranging from 12 to 75% (Table 100). They were smallest in GCGs 3, 4, 7, 8 and 9 and largest in GCGs 2, 6 and 10 and were quite consistent within clusters. Relationships with environmental variables were small and inconsistent.

Disease incidence and severity. Regressions of mean disease scores of the most susceptible genotype to each disease on environmental variables accounted for significant proportions of the variation in anthracnose (85%), angular leaf spot (71%), ascochyta blight (56%), floury leaf spot (58%) and rust (76%) (Table 101). Anthracnose, ascochyta blight and rust were more severe in environments with cooler temperatures and floury leaf spot in warmer temperatures; angular leaf spot and floury leaf spot were less severe when vegetative rainfall was heavier; anthracnose and angular leaf spot were more severe where days were shorter. The bacterial (common bacterial and halo blight) and viral (BCMV) diseases were widespread but their severities appeared unaffected by environment. Other diseases were too localised for the regressions to be meaningful.

SUMMARY AND CONCLUSIONS

In individual environments, heavier yields were generally obtained from better stands of larger plants that flowered and matured earlier. Among yield components, pod number was the best determinant of yield, which was sometimes positively correlated with seeds/pod and rarely with seed size. There was little evidence that diseases were deleterious to seed yield.

Combined analysis of variance illustrated the overriding contributions of differences among environments and G x E interactions to the total variation of most plant characters and disease scores, emphasising the importance of understanding the environmental factors involved. Genotypes accounted for minor proportions of variation, except for seeds/pod and seed size, because of their greater heritabilities. Disease scores were often small and highly variable and differences among environments were smaller. Genotype differences were also small and G x E interactions tended to be larger with more specialised pathogens.

Cluster analysis of seed yields defined 12 environment and 10 genotype groups. Differences among groups accounted for almost all the variation among environments and genotypes and most of the E x G and G x E interactions, merely demonstrating the effectiveness of the clustering. There was still, however, significant residual variation within E x G groups. Environment clusters appeared to be based chiefly on differences in mean yields while differences in response to environments accounted for the genotype groupings. Reduction of the two-way matrix facilitated inspection of interactions, which appeared to arise mainly from differences in responses of GCGs 9 and 10 to ECGs 2 and 8 compared with 3, 7 and 12.

There was no obvious association between environment groupings and environmental features. In some cases, the same locations fell in different clusters, presumably because of seasonal differences or the operation of unrecognised environmental effects. Whatever the reason, environmental characteristics did not appear to have obvious associations with G x E interactions in these trials. There was some relationship of genotype groupings with plant type, seed size and region of adaptation but this was not so obvious as in AFBYAN I. Stability parameters of genotypes were in close agreement with genotype clusters, so may partially explain the grouping and G x E interaction.

There were large correlations among environmental variables. Knowledge of these relationships enabled the exclusion of variables that would have distorted multiple regressions through collinearity. The knowledge may also help to rationalise the collection of environmental data. In this set of environments for example, latitude could have substituted for daylength and altitude for temperature and mean growing season temperature adequately represented maximum, minimum and temperatures during different growth stages. Correlations between the two measures of soil fertility and among the three disease indices were also large, even though the derivation of both these variables requires further attention.

Yields were heavier in environments with better plant stands and more fertile soils. The former was associated with more pods and the latter with larger canopy size. In general, seed yields, canopy sizes and yield components were either little affected or decreased as rainfall became heavier, especially during the reproductive period, so lack of rainfall did not appear to

constrain growth and yield in these trials.

The effects of temperature and daylength on yield must be considered in relation to times to flowering and maturity. Times to flowering and maturity were shorter and yields larger in warmer temperatures and shorter and shortening days. These relationships are consistent with expected flowering responses of common bean to temperature and daylength and to the tendency for heavier yields with earlier flowering and maturity in individual trials.

Seed yields were larger in environments where diseases were more severe. Pod numbers were fewer where diseases were more severe but otherwise, regression analysis provides no evidence that diseases were deleterious to yield in these trials. This relationship reflects the complexity of relationships among yield, other plant characters and environments and/or the statistical objections listed below. Environmental variables accounted for less of the variation in seeds/pod and seed size than in other plant characters. This is somewhat surprising as seeds/pod and seed size are phenotypically and genetically less complex than yield for example, but may reflect their greater heritability and the compensatory mechanisms that operate among yield components. The relationships of anthracnose, ascochyta blight, rust and floury leaf spot with temperature accorded well with observations of the distributions of these diseases.

For seed yields, patterns of response to environments tended to vary more among than within GCGs, suggesting an explanation for the groupings and therefore, a basis for G x E interaction. The yield of Red Wolaita (GCG 3) appeared to respond little to environment, as did its canopy size and time to flowering. In AFBYAN I, Red Wolaita formed a distinct cluster with Black Dessie and T 3 (also small-seeded facultative climbers), which fused relatively early and differed conspicuously from other GCGs in its responses to environment.

GCGs 9 (Ikinimba, G 13671 and GLPx 92) and 10 (G 2816) also exhibited very different responses to environment than other GCGs, notably in their times to flowering and maturity. Their members flowered much later than all other genotypes in longer and lengthening days and flowered earlier, together with GCGs 4 (Nain de Kyondo) and 7 (Carioca, A 370, A 410 and XAN 76) in warmer temperatures. In Lesotho environments, the delay in flowering of GCGs 9 and 10 reduced their yields to zero. In other environments (ECGs 3, 7 and 12), GCGs 9 and 10 produced heavier yields than other genotypes. Although AFBYAN I environments included a much smaller range of latitudes and the daylength variables were not included in regressions, G 2816 was the sole member of a distinctive cluster and G 13671 grouped separately with genotypes that were omitted from AFBYAN II.

Our results are in agreement with those of White and Masaya (1991) who examined the effects of daylength and temperature on time to flowering of entries in CIAT international bean trials from 1976 to 1982. They found that daylength and temperature accounted for 27-72% of the variation in time to flowering of individual entries and that flowering was generally hastened by warmer temperatures. Among the genotypes which were also included in AFBYAN II, Carioca and Ex-Rico 23 were day-neutral and Calima was intermediate in response to photoperiod. White and Laing (1989) also found Carioca to be day-neutral and Calima to be intermediate in artificially extended days in Colombia. In the same study, GLP 24 (which did not appear to respond to photoperiod in AFBYAN II) was found to be highly sensitive. The

reasons for this discrepancy are not clear but The extended daylength (18 hours) of White and Laing (1989) was much longer then the daylengths encountered in AFBYAN II. Note that Summerfield *et al.* (1991) advocate the examination of flowering responses in terms of rate of progress towards flowering, which exhibits close linear relationships with mean daily temperature and photoperiod from sowing to flowering in all crops which have been investigated including common bean. We are in the process of applying this analysis to the AFBYAN flowering data.

Our conclusions must obviously be treated with caution. Untransformed data were used and may lack normality and homogeneity (especially where they are scores or ranks) but biases may not be too large and there can be risks in using transformed data. We used linear regression analysis, so non-linear associations will be undetected. Multiple regressions can also be distorted by collinearity. In these analyses, we omitted one of each pair of variables that were highly correlated but significant correlations remain (for example, between disease and reproductive rainfall). The inclusion of variables that are themselves associated with some combinations of the others can also affect results. Here, plant stand was included as an independent variable to reduce the effects of sowing density and plant loss and the disease index to estimate the effects of diseases on yield and both may be affected by other independent variables.

Further, we have observed that the addition of variables with large effects can cause appreciable increases in R^2 and drastic changes in the coefficients of other independent variables. However, the addition of independent variables of small effect made little difference to the regression coefficients associated with the other independent variables or to R^2. The introduction of additional variables is therefore, less likely to affect regression coefficients where existing variables already account for a large proportion of the total variation. Here, R^2 values ranged up to 87% (for time to flowering of some genotypes) but were as small as 10% for seed size. Where R^2 is small, deviations from regression must be due to independent variables not included in the regression or to random variation. Environmental features not assessed in these trials were bean stem maggot and weed infestation, both of which seriously constrain bean yields in Africa. These variables may well have accounted for much of the residual variation and ought to be collected in future.

What is always abundantly clear is the overwhelming nature of the contributions of environments and G x E interactions to the variation in most plant characters. Conventional statistical procedures adequately describe and measure these effects but contribute little to understanding their nature and causes. Here, we used correlation and regression methods to examine the relationships among yield and other plant characters. Cluster analysis then defined environment and genotype groups and attempted to relate the groupings to known features and environmental responses. The clustering satisfactorily minimised the variation among environments and among genotypes but environment clusters showed little relationship with known environment features. Differences in plant type, seed size, origin and stability parameters explained genotype groupings to some extent. Environmental variables accounted for significant proportions of the variation in most plant characteristics and patterns of responses to environmental features corresponded well with genotype clusters and provided a basis for G x E interactions. Notably, interactions involving the seed yields of GCGs 9 and 10 with

environments traced to the effects of daylength on time to flowering. Patterns of response of other genotypes were less dramatic but may be as real and deserving of further investigation. Determination of priorities and formulation of correct breeding objectives requires recognition of the principal environmental constraints to production: understanding of the ways in which other plant characteristics influence seed yields enables development of effective selection procedures: establishment of appropriate testing strategies necessitates knowledge of the distributions of major environmental features. All depend on understanding of the relationships among yield, plant characters and environments. The application of multivariate techniques to analysis of sets of relevant plant and environment information from trials such as the present series provides a possible approach to improving our understanding of these relationships.

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Table 1. Contributing countries, sources and characteristics of entries in AFBYAN II between 1988 and 1991.

Entries	Other identities	Contributing countries	Sources	Seed types: Sizes	Seed types: Colours	Plant type
Red Wolaita*	-	Ethiopia	Ethiopia	S	Red	3b
Ex-Rico 23	Awash 1	Ethiopia	Colombia	S	White	2a
A 176	Roba	Ethiopia	CIAT	S	Cream-beige	2a
997-CH-173		Ethiopia	CIAT	M	Cream	2b
K 20*	Nambale	Uganda	Uganda	L	Red/white fleck	1
GLP 24		Kenya	Kenya	M	Red	3
GLP 1004	Mwezi Moja	Kenya	Kenya	L	Purple mottle	1
GLPx 92	Mwitemania	Kenya	Kenya	L	White/brown fleck	3
ZPv 292*	Gayaza 8	Zambia	Uganda	L	Purple mottle	3b
Carioca*	-	Zambia	Brazil	S	Brown/cream striped	2b
INIA 10		Mozambique	Mozambique	M	Cream	
INIA 12		Mozambique	Mozambique	M	Cream	
HF 465-63-1		Mozambique	Mozambique	S	Cream	
Calima*	-	Burundi	Colombia	L	Red/cream fleck	1
Ikinimba*		Rwanda	Rwanda	M	Black	3
Ubusosera 6		Rwanda	Rwanda	S	Brown	
A 197*	Ikinyange	Rwanda	CIAT	L	Cream	1
A 370		Zaire	CIAT	S	Dark brown	3
A 410	Khaki	Burundi	CIAT	M	Brown	3
Kilyumukwe*		Rwanda	Rwanda	L	Purple	2
Nain de Kyondo*		Zaire	Zaire	S	White	3
G 13671*	Japones	Rwanda	Mexico	L	Cream/black fleck	3
G 2816*	Flor de Mayo	Rwanda	Mexico	S	Cream	3
G 12470*	Peru 14-2	Rwanda	Ecuador	L	Purple/white fleck	1
XAN 76*	BAC 76	Rwanda	CIAT	S	Cream	2

* genotypes included in AFBYAN II; S, M and L indicates weight of seeds/100 g less than 25, 25-40 and greater than 40, respectively.

Table 2. Environments in which AFBYAN II was grown between 1988 and 1991.

Environments	Countries	Environmental features						
		LAT	ALT	SR	SD	DL	CDL	DI
Eastern Africa								
ALE 90	Ethiopia	9.33N	2000	6	16 Jul	12.63	-0.18	2.53
AWA 89	Ethiopia	7.13N	1700	7	1 Jul	12.53	-0.10	4.60
MEL 88	Ethiopia	8.42N	1550	7	5 Jul	12.58	-0.12	2.80
MEL 89	Ethiopia	8.42N	1550	7	3 Jul	12.60	-0.13	2.06
PAW 89	Ethiopia	12.00N	1100	8	12 Jul	12.78	-0.23	3.33
ARI 90	Madagascar	18.63S	1330	n	10 Dec	n	n	n
BK0 9F	Uganda	0.57N	1196	7	6 Apr	12.12	0.02	6.00
BK1 9F	Uganda	0.57N	1196	7	6 Apr	12.12	0.02	5.93
KAC 8S	Uganda	1.23S	2200	9	7 Oct	12.13	0.03	4.80
KC0 9F	Uganda	1.23S	2200	9	17 Mar	12.12	-0.03	4.80
KC1 9F	Uganda	1.23S	2200	9	17 Mar	12.12	-0.03	4.60
KAW 8S	Uganda	0.57N	1196	6	20 Sep	12.12	-0.02	6.20
Southern Africa								
HUA 89	Angola	12.27S	1700	2	5 Nov	12.60	0.23	n
MAC 89	Lesotho	29.42S	n	n	9 Nov	13.43	0.53	3.47
MAS 88	Lesotho	29.30S	1510	6	31 Oct	13.22	0.63	2.07
MAS 89	Lesotho	29.30S	1510	6	19 Oct	12.88	0.78	3.40
LIC 90	Mozambique	13.30S	1500	4	23 Feb	12.45	-0.33	4.00
UIT 91	Namibia	19.50S	1500	5	5 Feb	12.92	-0.50	1.00
LAM 90	Tanzania	3.27S	1100	10	26 Mar	12.10	-0.08	4.00
MAB 90	Tanzania	4.50S	1590	3	26 Apr	11.98	-0.08	3.73
MIW 90	Tanzania	3.42S	850	8	23 Mar	12.11	-0.08	1.00
SEL 90	Tanzania	3.33S	1387	9	29 Mar	12.08	-0.08	3.67
SEL 91	Tanzania	3.33S	1387	9	13 Apr	12.05	-0.05	2.67
MBA 89	Zambia	8.85S	1673	1	16 Jan	12.57	-0.20	3.47
GWE 91	Zimbabwe	17.75S	1488	n	10 Jan	13.13	-0.36	n
Great Lakes								
KIS 9S	Burundi	3.55S	2155	n	22 Mar	12.12	-0.10	7.20
MOS 9F	Burundi	4.00S	1250	n	3 Nov	12.27	0.08	3.67
MOS 9S	Burundi	4.00S	1250	n	n	n	n	n
GAN 9F	Zaire	6.75S	780	n	2 Feb	12.40	-0.16	3.53

LAT = latitude (°); ALT = altitude (masl); SR = soil rank; SD = sowing date; DL = daylength (hr) at sowing; CDL = change in daylength in first month (hr); DI = drought index; n = no information

Table 3. Chemical analysis of soils of sites where AFBYAN II trials were grown between 1988 and 1991.

Location	pH	% O.M.	% N	Meq/100 g CEC	K	Na	Ca	Mg	% Base	ppm P	Source
Eastern Africa											
Alemaya	7.7	0.98	0.08	17.9	0.8	0.1	27.2	2.2	100	13	NRI
Awasa	6.7	2.10	0.14	20.9	3.2	0.4	13.4	2.7	94	4	"
Melkasa	8.0	1.91	0.13	29.4	5.4	0.4	22.3	3.7	100	14	"
Pawe	5.7	2.37	0.23	27.3	0.4	0.1	13.1	6.0	72	38	"
Bukalasa	6.5	3.97	0.19	18.5	0.8	0.1	12.7	2.9	89	5	"
Kachwekano	6.2	4.21	0.30	17.2	1.0	0.1	10.0	3.3	100	25	"
Kawanda	6.4	2.32	0.14	11.2	0.3	0.0	7.3	1.5	81	7	"
Southern Africa											
Huambo	5.0(4.4)[1]	-	0.103	-	0.60	-	0.60	0.23	36.8[2]	4.99	Station
Maseru	5.8	0.57	0.06	5.1	0.4	0.2	3.0	1.2	94	23	NRI
Lichinga	5.3	2.1	0.2	11.0	0.62	0.15	3.68	0.15		40.3	Station
Uitkomst	7.6	0.41	0.03	4.0	0.2	0.1	5.0	0.9	100	16	NRI
Lambo	6.5	4.4	0.25	29.8	2.63	0.08	17.28	3.08	83	50.2	Wye
Mabughai	5.3	4.8	0.59	0.2[3]	0.52	0.31	3.84	0.45	4.75	4.0	Station
Miwaleni	8.4	1.87	0.13	49.5	1.2	0.9	36.1	17.5	100	38	NRI
Selian	7.0	3.39	0.17	32.4	6.6	0.3	19.6	4.1	94	26	NRI
Mbala	5.1	1.20	0.07	3.2	0.2	0.2	0.7	0.2	38	4	NRI

[1] in $CaCl_2$; [2] Al+H = 2.46; [3] SMP = 7.0 (?)

Table 4. Physical analysis of soils of sites where AFBYAN II trials were grown between 1988 and 1991.

Location	Percentages Coarse sand	Fine sand	Silt	Clay
Eastern Africa				
Alemaya	10	53	11	26
Awasa	16	26	30	28
Melkasa	11	28	35	26
Pawe	2	6	24	68
Bukalasa	14	28	18	40
Kachwekano	17	20	19	44
Kawanda	16	28	11	45
Southern Africa				
Huambo	16	16	10	58
Maseru	3	78	4	15
Lichinga	24	35	15	26
Uitkomst	19	72	1	8
Miwaleni	2	5	25	69
Selian	6	39	30	25
Mbala	37	41	4	18

Table 5. Scores for important soil chemical analysis data of soils from sites where AFBYAN II trials were grown between 1988 and 1991.

Analysis	Scores allotted				
	1	2	3	4	5
pH	<5/ >8.5	5-5.5/ 8-8.5	5.5-6/ 7-8	6-7	-
N (%)	<0.1	0.1-0.2	>0.2	-	-
K (meq/100g)	<0.15	0.15-0.3	0.3-0.6	>0.6	-
Mg (meq/100g)	<0.2	0.2-0.4	0.4-0.8	>0.8	-
Base saturation (%)	<20	20-40	40-60	60-80	>80
P (ppm)	<10	11-15	16-25	26-45	>46

Table 6. Soil fertility classes of sites where AFBYAN II trials were grown between 1988 and 1991.

Location	pH	N	K	Mg	Base	P	Mean	Rank
Eastern Africa								
Alemaya	3	1	4	4	5	2	3.17	6
Awasa	4	2	4	4	5	1	3.33	7
Melkasa	3	2	4	4	5	2	3.33	7
Pawe	3	3	3	4	4	4	3.50	8
Bukalasa	4	2	4	4	5	1	3.33	7
Kachwekano	4	3	4	4	5	3	3.83	9
Kawanda	4	2	3	4	5	1	3.17	6
Southern Africa								
Huambo	2	2	3	2	2	1	2.00	2
Maseru	3	1	3	4	5	3	3.17	6
Lichinga	2	3	4	1	n	4	2.80	4
Uitkomst	3	1	2	4	5	3	3.00	5
Lambo	4	3	4	4	5	5	4.17	10
Mabughai	2	3	3	3	3	1	2.50	3
Miwaleni	2	2	4	4	5	4	3.50	8
Selian	4	2	4	4	5	4	3.83	9
Mbala	1	1	1	1	1	1	1.00	1

Table 7. Rainfall and temperature data for environments where AFBYAN II was grown between 1988 and 1991.

Environments	Rainfall (mm)				Temperature °C								
					Maximum			Minimum			Mean		
	PS	VP	RP	FS	VP	RP	FS	VP	RP	FS	VP	RP	FS
Eastern Africa													
ALE 90	64	201	49	314	23.6	23.6	23.6	12.8	9.8	11.3	18.2	16.7	17.5
AWA 89	161	106	177	444	24.4	25.5	25.0	12.9	12.4	12.6	18.7	19.0	18.8
MEL 88	69	255	225	549	25.4	26.5	26.0	16.5	15.4	16.0	21.0	20.9	21.0
MEL 89	85	187	280	552	26.5	26.6	26.6	15.9	14.7	15.3	21.2	20.7	20.9
PAW 89	289	399	656	1344	27.0	28.0	27.6	17.3	17.0	17.1	22.2	22.5	22.4
BK0 9F*	237	166	90	493	26.8	26.0	26.4	16.7	16.0	16.4	21.8	20.8	21.3
BK1 9F*	237	166	90	493	26.8	26.0	26.4	16.7	16.0	16.4	21.8	20.8	21.3
KAC 8S*	187	55	46	288	n	n	n	n	n	n	15.5	15.4	15.5
KC0 9F*	29	189	68	286	n	n	n	n	n	n	15.2	15.1	15.2
KC1 9F*	29	189	68	286	n	n	n	n	n	n	15.2	15.1	15.2
KAW 8S*	158	133	161	452	27.2	27.4	27.3	16.3	16.1	16.2	21.8	21.8	21.8
Southern Africa													
HUA 89	64	415	257	736	24.8	24.7	24.8	14.7	14.3	14.5	19.8	19.5	19.7
MAC 89	n	n	n	n	n	n	n	n	n	n	n	n	n
MAS 88	65	192	108	365	22.7	25.2	23.7	10.5	14.4	12.1	16.6	19.8	17.9
MAS 89	65	192	108	365	26.2	26.7	26.4	12.2	14.5	13.1	19.2	20.6	19.8
LIC 90	179	176	194	549	25.3	24.9	25.1	15.6	14.6	15.0	20.4	19.8	20.0
UIT 91	99	103	0	202	27.2	26.5	26.9	17.5	16.3	17.0	22.4	21.4	22.0
LAM 90	102	89	30	221	27.8	24.1	25.8	16.9	16.5	16.7	22.4	20.2	21.3
MAB 90	337	164	0	501	n	n	n	n	n	n	16.0	14.0	15.0
MIW 90	149	560	24	733	29.7	28.2	29.0	19.6	18.9	19.3	24.7	23.6	24.2
SEL 90	397	257	16	670	24.9	22.9	23.8	16.4	14.6	15.4	20.7	18.8	19.6
SEL 91	133	141	7	281	25.1	22.8	23.9	18.0	15.8	16.8	21.6	19.3	20.4
MBA 89*	237	238	253	728	23.0	24.2	23.6	14.6	14.8	14.7	17.9	18.2	18.1
GWE 91*	41	298	66	405	25.7	25.2	25.5	15.4	12.5	14.0	19.7	18.3	19.0
Great Lakes													
KIS 9S*	200	334	82	616	21.0	21.1	21.1	10.8	7.7	9.3	14.6	13.1	13.9
MOS 9F	66	169	531	766	27.6	26.8	27.2	16.4	16.3	6.3	22.0	21.6	21.8
MOS 9S*	n	n	n	n	n	n	n	n	n	n	20.0	19.5	19.8
GAN 9F	137	237	180	554	29.1	29.3	29.2	18.0	18.1	18.0	23.6	23.7	23.6

PS = presowing period (one month prior to sowing);
VP = vegetative period (sowing to flowering);
RP = reproductive period (flowering to maturity);
FS = full season (sowing to maturity);
* = temperature data long term averages; n = no data

Table 8. Agronomic and yield data of entries in AFBYAN II at Alemaya in 1990.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand /m²	DM	Thresh-ing %	Pods/ m²	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	43.0	36.7	42.3	15.0	94.0				185	936
Ex-Rico 23	44.3	38.3	41.7	15.1	93.7				170	2210
A 176	48.7	38.3	46.3	17.1	92.7				176	1755
997-CH-173	48.3	40.0	42.0	18.0	93.3				274	2841
K 20	42.3	36.7	38.7	16.5	93.3				394	1722
GLP 24	52.3	38.3	43.0	17.5	95.3				275	1940
GLP 1004	48.7	38.3	42.3	17.4	91.3				457	3039
GLPx 92	37.0	40.0	40.7	15.8	94.0				469	3849
ZPv 292	38.3	33.3	34.7	18.6	89.3				541	2376
Carioca	46.7	40.0	43.7	17.7	94.0				188	2328
INIA 10	40.3	28.3	41.0	12.1	92.0				387	1710
INIA 12	41.0	38.3	39.0	18.0	92.0				373	1952
HF 465-63-1	41.7	36.7	41.7	17.8	94.7				402	1373
Calima	37.7	28.3	36.7	17.4	92.3				591	2176
Ikinimba	38.0	33.3	39.7	18.1	93.7				428	2818
Ubososera 6	42.7	38.3	43.0	17.3	95.7				219	2054
A 197	41.3	36.7	39.0	20.0	93.7				555	2451
A 370	41.0	38.3	43.0	13.2	97.3				214	1816
A 410	38.0	38.3	37.3	15.3	94.0				365	3094
Kilyumukwe	45.7	38.3	37.3	17.3	92.7				565	2049
Nain de Kyondo	44.7	40.0	45.3	15.9	100.3				168	1904
G 13671	41.0	40.0	40.3	18.1	95.7				339	3120
G 2816	34.3	38.3	38.3	16.7	94.0				403	3900
G 12470	47.3	40.0	42.3	19.9	96.7				407	1970
XAN 76	40.0	38.3	44.0	19.7	95.7				171	2572
Mean	42.6	37.3	40.9	17.0	94.1				349	2318
S.E. ±	4.40	2.86	2.44	1.54	0.90				13.7	240.0
C.V (%)	14.3	13.3	10.3	15.6	1.7				6.8	16.7
Significance	NS	NS	NS	NS	***				***	***

Table 9. Disease reactions of entries in AFBYAN II at Alemaya in 1990.

Entries	Anth	Rust	CBB
Red Wolaita	1.00	5.00	3.67
Ex-Rico 23	1.00	1.33	3.00
A 176	1.00	1.00	3.00
997-CH-173	1.00	1.00	2.67
K 20	1.67	3.33	3.67
GLP 24	1.33	3.67	3.00
GLP 1004	1.00	3.00	3.00
GLPx 92	1.00	1.00	3.33
ZPv 292	1.00	4.00	3.00
Carioca	1.00	1.33	4.00
INIA 10	1.67	3.00	3.67
INIA 12	1.33	3.00	3.33
HF 465-63-1	1.33	3.33	3.67
Calima	1.67	4.00	3.67
Ikinimba	1.00	1.67	3.33
Ubososera 6	1.00	2.67	3.33
A 197	1.67	3.00	3.00
A 370	1.00	1.67	2.67
A 410	1.00	1.00	3.33
Kilyumukwe	1.33	3.33	4.00
Nain de Kyondo	1.00	1.00	3.00
G 13671	1.00	1.00	3.67
G 2816	1.33	1.00	3.00
G 12470	1.33	4.33	3.00
XAN 76	1.00	1.00	3.00
Mean	1.19	2.39	3.28
S.E. ±	0.283	0.605	0.252
C.V (%)	41.3	43.9	13.3
Significance	NS	***	**

Table 10. Agronomic and yield data of entries in AFBYAN II at Awassa in 1989.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita	28.3	35.0	44.7	16.8	94.7	77.1	133.7	527	239	1690
Ex-Rico 23	36.7	35.0	43.0	21.9	90.7	82.2	349.5	502	237	3944
A 176	31.7	33.3	46.3	16.9	93.3	75.9	197.1	560	261	2844
997-CH-173	35.0	35.0	47.0	20.7	89.7	81.0	270.4	438	369	4008
K 20	33.3	33.3	46.7	19.3	90.7	76.5	175.0	310	472	2583
GLP 24	33.3	33.3	45.3	18.4	95.0	73.7	129.9	419	427	2342
GLP 1004	36.7	30.0	48.0	19.6	86.7	80.5	130.1	476	453	2813
GLPx 92	31.7	26.7	41.7	20.1	89.0	84.1	192.7	426	431	3208
ZPv 292	36.7	25.0	42.3	20.8	85.0	73.6	123.9	383	473	2267
Carioca	35.0	28.3	43.3	16.6	89.0	76.5	202.2	499	243	2434
INIA 10	30.0	33.3	44.0	20.6	86.7	78.9	144.5	380	444	2436
INIA 12	31.7	33.3	47.7	20.5	89.0	77.1	141.7	361	542	2793
HF 465-63-1	33.3	33.3	43.7	20.4	95.7	80.7	203.5	388	383	3015
Calima	31.7	28.3	45.3	19.1	88.3	85.7	120.0	357	581	2536
Ikinimba	28.3	30.0	45.3	20.4	88.3	84.8	128.0	496	373	2220
Ubososera 6	33.3	36.7	44.0	18.3	93.7	77.1	197.0	500	285	2789
A 197	35.0	28.3	46.3	19.7	91.0	76.6	166.5	351	510	2978
A 370	31.7	36.7	42.7	18.0	95.0	75.1	166.7	514	327	2745
A 410	31.7	30.0	43.7	18.9	88.3	80.5	154.0	478	317	2333
Kilyumukwe	40.0	28.3	42.7	21.4	88.3	73.6	122.7	373	571	2573
Nain de Kyondo	41.7	40.0	45.3	20.6	99.0	74.1	329.7	479	263	3940
G 13671	31.7	35.0	43.7	16.9	91.7	68.8	167.8	420	392	2922
G 2816	33.3	28.3	41.3	17.9	92.3	86.7	157.6	474	332	2471
G 12470	38.3	30.0	47.0	17.6	96.7	75.0	160.9	406	424	2747
XAN 76	35.0	35.0	46.0	20.9	97.3	84.5	211.5	526	363	3237
Mean	33.8	32.1	44.7	19.3	91.4	78.4	179.1	442	389	2795
S.E. ±	2.78	2.22	1.83	1.06	1.82	4.37	27.13	46.3	51.2	367.9
C.V (%)	14.2	12.0	7.1	9.5	3.4	9.7	26.5	18.2	22.8	22.8
Significance	NS	**	NS	**	***	NS	***	*	***	**

Table 11. Disease reactions of entries in AFBYAN II at Awassa in 1989.

Entries	ALS	Alt	Rust	FLS	CBB	BCMV
Red Wolaita	3.33	1.00	3.33	2.00	2.00	4.33
Ex-Rico 23	1.33	2.00	1.00	2.33	1.00	1.00
A 176	1.00	3.00	1.00	2.33	2.00	1.00
997-CH-173	1.67	2.00	1.00	2.33	1.33	1.00
K 20	3.67	1.00	1.00	1.00	2.00	1.00
GLP 24	1.67	1.67	1.00	1.33	2.00	2.00
GLP 1004	1.00	1.00	1.00	1.00	2.67	1.00
GLPx 92	1.00	2.00	2.33	3.00	2.67	1.00
ZPv 292	5.67	1.00	1.00	1.00	2.33	1.00
Carioca	1.00	1.67	1.00	1.67	3.67	1.00
INIA 10	4.33	2.67	1.00	1.33	1.00	1.00
INIA 12	2.67	2.33	1.00	2.33	1.33	1.00
HF 465-63-1	1.00	1.67	1.33	1.33	2.33	1.00
Calima	3.33	1.00	1.00	1.67	1.00	1.00
Ikinimba	1.00	2.33	1.00	1.33	2.00	1.00
Ubososera 6	1.00	1.00	1.67	1.67	3.33	1.00
A 197	3.00	2.33	1.00	2.00	1.33	1.00
A 370	1.00	1.00	1.00	2.67	2.00	1.00
A 410	3.33	3.00	1.00	2.67	1.00	1.00
Kilyumukwe	2.67	1.00	1.00	3.00	1.33	1.00
Nain de Kyondo	1.00	1.00	1.00	1.67	1.33	1.00
G 13671	2.00	4.00	1.00	2.67	1.67	1.00
G 2816	1.00	5.67	1.00	3.67	1.67	1.00
G 12470	1.00	1.67	1.00	1.67	1.00	1.00
XAN 76	1.00	1.00	1.00	1.67	1.00	1.00
Mean	2.03	1.92	1.19	1.97	1.80	1.17
S.E. ±	0.606	0.654	0.350	0.594	0.540	0.212
C.V (%)	51.8	59.0	51.1	52.2	51.9	31.3
Significance	***	***	**	NS	*	***

Table 12. Agronomic and yield data of entries in AFBYAN II at Melkassa in 1988.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds 100 pods	Weight/ 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita	51.7	30.0	40.7	20.4	94.0				232	2042
Ex-Rico 23	58.3	21.7	39.3	20.3	85.3				185	3217
A 176	53.3	30.0	42.7	21.6	88.7				197	3294
997-CH-173	56.7	36.7	40.0	22.0	87.0				305	4109
K 20	53.3	33.3	38.0	21.4	86.3				445	2548
GLP 24	58.3	40.0	41.3	20.6	90.0				351	2933
GLP 1004	56.7	30.0	39.0	22.7	81.3				429	3106
GLPx 92	48.3	28.3	34.7	21.8	83.3				489	4248
ZPv 292	51.7	35.0	35.3	21.8	83.0				535	3174
Carioca	56.7	33.3	43.3	22.5	84.3				240	3627
INIA 10	53.3	33.3	36.0	22.4	85.7				420	2265
INIA 12	55.0	38.3	36.0	21.4	84.0				435	2453
HF 465-63-1	51.7	33.3	45.0	20.4	92.0				183	2989
Calima	50.0	38.3	35.3	23.9	84.7				622	3623
Ikinimba	56.7	30.0	56.0	20.9	87.0				446	3986
Ubososera 6	55.0	33.3	38.3	21.0	87.3				257	2812
A 197	58.3	40.0	36.0	21.4	84.3				588	3267
A 370	51.7	26.7	41.7	20.7	92.3				287	3465
A 410	55.0	35.0	36.0	21.4	83.3				363	3906
Kilyumukwe	46.7	26.7	34.7	18.8	86.3				534	2728
Nain de Kyondo	58.3	28.3	45.3	22.9	93.7				238	3267
G 13671	56.7	31.7	42.0	21.1	91.3				378	3267
G 2816	48.3	28.3	36.0	23.2	87.3				392	4671
G 12470	58.3	40.0	38.7	23.0	92.3				518	2745
XAN 76	45.0	26.7	44.3	22.5	90.7				198	3842
Mean	53.8	32.3	39.8	21.6	87.4				370	3263
S.E. ±	2.60	1.93	0.69	0.83	1.66				11.8	247.8
C.V (%)	8.3	10.4	3.0	6.7	3.3				5.5	13.2
Significance	**	***	***	*	***				***	***

Table 13. Disease reactions of entries in AFBYAN II at Melkassa in 1988.

Entries	AB	CBB	HB	BCMV
Red Wolaita	1.33	3.33	1.67	1.00
Ex-Rico 23	1.00	3.33	2.33	1.00
A 176	1.33	3.33	1.00	1.00
997-CH-173	1.00	2.33	1.33	1.33
K 20	1.00	2.67	2.67	1.67
GLP 24	1.33	3.00	1.33	1.00
GLP 1004	2.00	3.33	1.33	1.33
GLPx 92	1.00	4.00	1.00	1.00
ZPv 292	1.33	4.33	2.00	1.00
Carioca	1.00	4.00	2.67	1.00
INIA 10	1.00	5.67	3.33	1.00
INIA 12	1.00	5.33	3.67	1.00
HF 465-63-1	1.33	4.00	1.00	1.00
Calima	1.00	2.33	1.33	1.67
Ikinimba	1.00	5.33	2.33	1.00
Ubososera 6	1.00	3.67	1.00	1.00
A 197	1.00	2.33	1.00	1.00
A 370	1.00	2.00	1.00	1.00
A 410	1.00	4.33	1.00	1.00
Kilyumukwe	1.33	4.00	2.33	1.00
Nain de Kyondo	2.00	2.33	1.00	1.00
G 13671	1.67	3.00	3.00	1.00
G 2816	1.00	2.67	1.00	1.00
G 12470	1.67	2.00	1.33	1.00
XAN 76	1.00	2.67	1.00	1.00
Mean	1.21	3.41	1.71	1.08
S.E. ±	0.318	0.398	0.674	0.137
C.V (%)	45.4	20.2	68.4	21.8
Significance	NS	***	NS	*

Table 14. Agronomic and yield data of entries in AFBYAN II at Melkassa in 1989.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita	53.3	40.0	41.7	21.0	86.3	74.1	156.2	467	262	1848
Ex-Rico 23	50.0	38.3	39.0	21.3	72.7	67.8	347.8	431	212	3140
A 176	60.0	38.3	42.0	22.1	75.3	69.3	323.9	509	221	3469
997-CH-173	46.7	38.3	40.3	21.1	75.0	73.2	268.3	500	274	3655
K 20	51.7	35.0	38.7	21.4	74.3	69.7	155.3	294	448	2020
GLP 24	50.0	40.0	41.7	22.2	76.3	72.0	133.2	404	330	1790
GLP 1004	50.0	40.0	39.7	22.8	74.3	72.5	180.9	422	424	3201
GLPx 92	45.0	38.3	34.0	22.3	74.7	80.8	283.9	373	438	4630
ZPv 292	45.0	26.7	33.3	18.3	67.0	67.8	127.4	367	421	1958
Carioca	53.3	40.0	41.7	21.7	76.3	75.1	306.7	533	221	3628
INIA 10	43.3	40.0	37.0	22.1	73.0	73.0	154.1	323	378	1858
INIA 12	48.3	36.7	38.3	20.4	73.3	69.4	158.1	426	355	2307
HF 465-63-1	56.7	40.0	43.3	21.5	81.7	76.2	245.9	587	182	2608
Calima	48.3	28.3	35.0	20.5	70.7	76.5	150.8	341	520	2668
Ikinimba	45.0	38.3	33.0	21.6	73.0	79.5	235.6	397	395	3673
Ubososera 6	50.0	40.0	40.0	20.8	81.0	72.0	199.4	440	231	1967
A 197	55.0	35.0	34.7	23.0	75.0	78.0	173.7	301	593	3033
A 370	50.0	40.0	40.7	21.3	82.0	76.5	249.5	464	280	3250
A 410	48.3	33.3	37.3	22.5	71.3	77.3	304.4	471	289	3897
Kilyumukwe	50.0	36.7	34.0	20.2	74.0	71.3	162.8	348	515	2889
Nain de Kyondo	55.0	40.0	42.3	19.7	93.3	74.4	191.9	560	219	2310
G 13671	50.0	40.0	41.0	22.4	86.7	79.0	210.1	440	382	3542
G 2816	45.0	36.7	35.0	23.1	73.0	83.9	226.7	402	395	3551
G 12470	65.0	40.0	40.0	20.9	87.7	61.6	207.4	387	376	2884
XAN 76	53.3	40.0	42.7	23.3	77.0	76.5	324.1	537	195	3380
Mean	50.7	37.6	38.7	21.5	77.0	73.9	219.1	429	342	2926
S.E. ±	2.33	1.47	0.44	0.97	2.94	2.07	27.30	38.7	23.6	363.4
C.V (%)	8.0	6.8	2.0	7.8	6.6	4.8	21.6	15.6	11.9	21.5
Significance	***	***	***	NS	***	***	***	***	***	***

Table 15. Disease reactions of entries in AFBYAN II at Melkassa in 1989.

Entries	CBB
Red Wolaita	4.67
Ex-Rico 23	5.00
A 176	5.67
997-CH-173	4.67
K 20	5.00
GLP 24	3.67
GLP 1004	4.67
GLPx 92	5.33
ZPv 292	4.00
Carioca	5.00
INIA 10	6.33
INIA 12	6.00
HF 465-63-1	5.67
Calima	3.67
Ikinimba	5.00
Ubososera 6	5.67
A 197	4.33
A 370	4.00
A 410	5.00
Kilyumukwe	5.33
Nain de Kyondo	3.33
G 13671	4.00
G 2816	5.33
G 12470	4.67
XAN 76	4.33
Mean	4.81
S.E. ±	0.572
C.V (%)	20.6
Significance	*

Table 16. Agronomic and yield data of entries in AFBYAN II at Pawe in 1989.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita	28.3	23.3	37.0	15.8	76.7	77.8	51.4	526	225	597
Ex-Rico 23	37.7	28.3	33.3	17.4	74.0	78.4	176.4	506	153	1352
A 176	40.0	30.0	36.0	20.8	75.3	78.8	143.9	493	215	1526
997-CH-173	37.7	28.3	36.0	18.1	76.7	79.2	90.9	497	273	1235
K 20	37.7	20.0	34.0	16.6	74.0	70.1	53.1	320	302	510
GLP 24	32.0	30.0	34.7	13.2	82.0	74.7	46.5	456	208	439
GLP 1004	36.0	18.3	30.7	15.9	69.0	73.7	32.9	547	226	421
GLPx 92	31.3	30.0	31.3	20.0	76.7	85.0	121.1	481	365	2002
ZPv 292	31.7	23.3	27.0	15.8	69.0	78.4	64.9	448	300	839
Carioca	31.0	28.3	34.7	14.8	74.0	81.5	117.2	529	214	1292
INIA 10	34.7	21.7	30.0	16.7	71.3	73.5	33.4	384	323	423
INIA 12	35.0	26.7	33.0	14.2	73.3	76.5	42.4	400	289	488
HF 465-63-1	40.3	26.7	35.3	18.4	72.7	77.7	120.2	489	196	1004
Calima	40.0	15.0	29.7	16.3	72.0	75.9	54.6	362	370	728
Ikinimba	27.7	33.3	28.3	17.5	75.3	82.2	89.1	489	314	1325
Ubososera 6	37.3	35.0	39.0	16.6	82.0	75.5	68.1	580	191	721
A 197	45.0	25.0	34.0	20.6	76.7	83.7	64.8	342	443	971
A 370	34.7	35.0	41.7	17.5	79.3	84.3	106.9	590	234	1436
A 410	31.0	30.0	31.7	17.1	75.3	79.9	107.5	491	288	1476
Kilyumukwe	35.0	25.0	28.3	14.4	75.3	74.8	50.2	389	391	760
Nain de Kyondo	36.7	35.0	43.0	12.6	82.0	79.7	90.5	554	189	938
G 13671	34.3	33.3	36.0	18.1	76.7	81.5	65.5	484	308	971
G 2816	32.0	30.0	31.3	15.6	75.3	83.3	97.5	494	327	1534
G 12470	44.3	33.3	37.7	15.6	84.0	70.5	49.1	383	299	565
XAN 76	32.7	31.7	39.3	16.3	75.3	76.9	137.9	500	181	1230
Mean	35.4	27.9	34.1	16.6	75.8	78.1	83.0	469	273	991
S.E. ±	2.74	2.41	1.04	1.87	1.11	2.51	12.42	41.2	28.1	140.3
C.V (%)	13.5	15.0	5.3	19.4	2.5	5.6	25.9	15.2	17.9	24.5
Significance	**	***	***	NS	***	**	***	***	***	***

Table 17. Disease reactions of entries in AFBYAN II at Pawe in 1989.

Entries	WB	CBB
Red Wolaita	7.00	4.67
Ex-Rico 23	6.67	5.00
A 176	6.67	4.67
997-CH-173	6.00	5.33
K 20	7.33	5.67
GLP 24	4.33	5.33
GLP 1004	7.67	4.33
GLPx 92	4.00	4.00
ZPv 292	7.67	5.00
Carioca	6.33	5.00
INIA 10	7.67	5.33
INIA 12	7.33	6.00
HF 465-63-1	7.33	5.00
Calima	5.67	5.00
Ikinimba	4.00	5.00
Ubososera 6	5.00	4.00
A 197	4.67	6.00
A 370	4.00	3.67
A 410	6.00	4.33
Kilyumukwe	6.67	5.67
Nain de Kyondo	4.33	4.00
G 13671	4.33	4.67
G 2816	4.33	4.67
G 12470	6.67	5.00
XAN 76	3.33	5.00
Mean	5.80	4.89
S.E. +	0.575	0.641
C.V (%)	17.2	22.7
Significance	***	NS

Table 18. Agronomic and yield data of entries in **AFBYAN** II (without N) at Bukalasa in 1989F.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita	33.3	50.3	41.0	6.8	84.3	61.3	88.9	439	184	701
Ex-Rico 23	56.7	53.0	38.7	9.3	79.7	63.7	205.3	480	192	1839
A 176	50.0	52.7	40.7	8.7	79.3	69.1	168.5	452	226	1696
997-CH-173	43.3	57.7	38.0	9.1	80.0	64.2	73.2	399	309	903
K 20	56.7	45.0	37.3	9.6	78.7	61.3	154.4	326	363	1709
GLP 24	43.3	57.7	39.0	9.0	84.3	61.5	84.3	320	301	775
GLP 1004	56.7	45.0	37.0	13.2	76.3	62.7	177.6	367	417	2721
GLPx 92	40.0	53.0	35.3	9.3	78.3	69.3	85.7	347	447	1309
ZPv 292	53.3	40.3	34.7	10.0	72.3	72.2	127.9	447	416	2359
Carioca	43.3	60.0	41.0	11.9	78.7	66.8	83.9	451	249	935
INIA 10	53.3	47.7	35.7	11.1	77.3	66.7	114.4	366	350	1349
INIA 12	50.0	53.0	36.7	9.4	78.7	55.4	189.7	319	288	1338
HF 465-63-1	53.3	57.7	41.0	11.3	81.0	68.5	163.2	486	160	1274
Calima	63.3	45.0	35.3	12.6	78.3	63.7	138.2	363	426	2037
Ikinimba	40.0	55.3	35.3	8.6	77.0	73.7	134.8	390	346	1811
Ubososera 6	43.3	50.3	40.3	3.9	88.7	64.0	39.6	462	210	383
A 197	60.0	47.7	36.0	9.6	80.7	68.0	115.6	354	511	2055
A 370	43.3	55.3	41.0	7.0	85.0	66.4	50.8	409	304	622
A 410	43.3	50.3	38.3	8.3	79.0	69.6	88.5	403	356	1259
Kilyumukwe	56.7	53.0	33.0	12.1	79.7	70.0	95.4	380	524	1895
Nain de Kyondo	46.7	60.0	42.0	10.2	84.7	69.5	150.6	428	235	1500
G 13671	40.0	50.3	37.7	8.7	81.0	70.9	67.9	460	328	1007
G 2816	43.3	52.7	37.7	8.7	81.0	73.2	166.5	426	317	2187
G 12470	66.7	45.0	38.0	8.9	83.3	59.9	67.3	339	405	911
XAN 76	50.0	57.7	41.0	12.8	80.3	58.4	228.4	369	189	1578
Mean	49.2	51.8	38.1	9.6	80.3	66.0	122.4	399	322	1446
S.E. ±	2.86	1.90	0.06	1.18	1.03	4.72	32.37	36.6	27.4	250.3
C.V (%)	10.1	6.3	2.3	21.3	2.2	12.4	45.8	15.9	14.8	30.0
Significance	***	***	***	***	***	NS	**	*	***	***

Table 19. Disease reactions of entries in AFBYAN II (without N) at Bukalasa in 1989F.

Entry	Anth	ALS	FLS	Rust	CBB	BCMV
Red Wolaita	1.00	4.00	6.33	3.33	6.00	7.00
Ex-Rico 23	1.00	2.33	6.00	2.67	5.67	2.33
A 176	1.00	2.00	6.00	3.00	5.00	2.67
997-CH-173	1.00	4.67	5.67	2.67	4.67	2.33
K 20	1.00	5.33	5.00	4.00	5.33	6.33
GLP 24	1.00	5.00	5.33	3.00	5.00	6.33
GLP 1004	1.00	5.00	3.33	3.67	6.67	3.67
GLPx 92	1.00	6.00	4.33	3.67	5.67	5.67
ZPv 292	1.00	5.00	5.67	4.00	6.67	4.67
Carioca	1.00	3.33	4.00	2.67	4.33	2.00
INIA 10	1.00	4.67	5.00	3.67	6.00	6.00
INIA 12	1.00	5.00	4.67	3.67	6.33	6.33
HF 465-63-1	1.33	3.67	6.00	3.00	6.33	5.00
Calima	1.00	6.00	6.33	3.33	6.33	4.67
Ikinimba	1.00	5.67	3.33	3.67	6.00	6.00
Ubososera 6	1.00	3.67	4.00	3.00	5.33	6.33
A 197	1.00	4.33	5.33	3.00	5.00	3.33
A 370	1.00	3.67	4.00	2.67	4.67	2.67
A 410	1.00	3.33	5.00	3.33	5.33	3.00
Kilyumukwe	1.00	4.33	5.67	3.00	6.33	5.33
Nain de Kyondo	1.00	2.00	3.00	2.33	5.00	2.33
G 13671	1.00	3.67	5.67	3.00	5.67	6.67
G 2816	1.00	3.67	6.33	2.67	5.67	3.00
G 12470	1.00	3.67	5.33	3.00	5.33	6.00
XAN 76	1.00	2.67	4.00	2.33	4.67	2.33
Mean	1.01	4.11	5.01	3.13	5.56	4.48
S.E. ±	0.066	0.354	0.579	0.382	0.335	0.553
C.V (%)	11.4	14.9	20.0	21.1	10.4	21.4
Significance	NS	***	***	NS	***	***

Table 20. Agronomic and yield data of entries in AFBYAN II (with N) at Bukalasa in 1989F.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Stand at harvest	DM	Pods/ m2	Seeds/ 100 pods	Seed size g/1000	Seed yield (kg/ha)
Red Wolaita	40.0	45.0	41.3	7.4	85.0	52.0	567	197	588
Ex-Rico 23	60.0	55.3	39.0	10.6	78.0	253.5	507	181	2322
A 176	50.0	55.3	40.0	12.3	78.0	217.5	536	198	2253
997-CH-173	43.3	52.7	37.0	10.4	79.3	79.6	492	278	1087
K 20	63.3	47.7	37.0	11.8	78.0	104.4	389	392	1589
GLP 24	53.3	53.0	38.3	7.4	86.3	61.2	472	301	877
GLP 1004	56.7	50.3	37.0	14.1	76.7	145.5	490	390	2763
GLPx 92	46.7	53.0	35.0	9.8	81.3	96.7	400	380	1469
ZPv 292	53.3	40.0	34.0	9.4	76.0	127.8	439	421	2356
Carioca	50.0	57.7	39.7	12.7	79.0	127.7	557	222	1487
INIA 10	50.0	47.7	36.3	11.8	77.7	78.8	406	321	1037
INIA 12	56.7	50.3	36.3	8.5	77.7	106.4	376	358	1428
HF	56.7	57.7	40.7	16.7	80.7	197.8	527	166	1688
Calima	70.0	45.0	34.7	15.3	77.3	142.1	368	498	2594
Ikinimba	40.0	57.7	35.7	10.8	78.0	117.4	453	332	1786
Ubososera 6	50.0	45.0	39.7	4.3	88.7	32.2	421	218	291
A 197	70.0	47.7	36.0	12.1	80.0	101.8	372	587	2221
A 370	46.7	60.0	40.3	8.2	87.7	76.2	522	275	1070
A 410	50.0	55.3	37.3	9.8	78.0	82.7	423	355	1244
Kilyumukwe	56.7	47.7	33.0	13.0	79.3	104.3	419	467	2036
Nain de Kyondo	50.0	60.0	41.0	8.3	87.0	131.4	549	200	1443
G 13671	43.3	53.0	38.7	10.4	82.0	62.8	413	428	1105
G 2816	46.7	55.3	38.7	10.8	80.3	153.5	454	313	2105
G 12470	70.0	47.7	38.3	10.6	81.0	74.0	431	416	1310
XAN 76	56.7	57.7	40.3	12.2	80.7	265.6	461	192	2244
Mean	53.2	51.9	37.8	10.7	80.5	119.7	458	324	1616
S.E. ±	2.97	2.93	0.74	1.82	0.97	20.51	31.2	15.4	203.1
C.V (%)	9.7	9.8	3.4	18.7	2.1	29.7	11.8	8.3	21.8
Significance	***	***	***	***	***	***	***	***	***

Table 21.Disease reactions of entries in AFBYAN II (with N) at Bukalasa in 1989F.

Entries	Anth	ALS	FLS	Rust	CBB	BCMV
Red Wolaita	1.00	4.33	4.67	3.67	6.33	6.33
Ex-Rico 23	1.00	2.33	6.33	2.67	5.00	2.33
A 176	1.00	3.00	5.00	2.67	5.00	2.33
997-CH-173	2.00	4.67	6.33	3.00	5.00	2.33
K 20	1.00	5.00	5.00	3.67	6.33	4.67
GLP 24	1.00	5.33	5.33	3.67	5.67	6.00
GLP 1004	1.00	4.67	4.00	3.67	6.33	5.00
GLPx 92	1.00	5.67	4.67	4.00	5.67	4.67
ZPv 292	1.00	4.67	4.33	4.00	6.33	4.33
Carioca	1.00	4.00	5.00	2.67	5.33	2.67
INIA 10	1.00	4.67	4.67	3.67	6.33	6.67
INIA 12	1.00	4.67	5.00	4.67	6.33	5.67
HF	1.00	2.67	5.33	3.00	5.67	5.00
Calima	1.00	5.33	6.00	3.00	5.67	4.33
Ikinimba	1.33	5.00	3.33	4.00	6.00	5.00
Ubososera 6	1.00	3.67	5.00	3.67	5.33	5.33
A 197	1.00	4.67	6.00	4.67	5.33	3.67
A 370	1.00	4.00	4.33	2.67	5.00	3.00
A 410	1.00	3.67	4.67	2.67	5.33	3.00
Kilyumukwe	1.00	4.00	6.00	3.00	6.33	5.33
Nain de Kyondo	1.00	2.00	3.33	2.00	5.00	2.00
G 13671	1.00	4.00	6.00	3.00	6.33	6.33
G 2816	1.00	4.00	6.33	3.33	6.00	4.33
G 12470	1.00	3.33	6.33	3.33	4.67	5.33
XAN 76	1.00	2.33	5.00	2.67	4.33	2.67
Mean	1.05	4.07	5.12	3.32	5.63	4.33
S.E. ±	0.351	0.334	0.547	0.349	0.292	0.597
C.V (%)	34.2	14.2	18.5	18.2	9.0	23.9
Significance	ns	***	**	***	***	***

Table 22. Agronomic and yield data of entries in AFBYAN II at Kachwekano in 1988S.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	33.3		57.0	6.7		66.7	50.0	488	274	667
Ex-Rico 23	26.7		60.0	6.6		60.6	86.4	449	220	844
A 176	25.0		69.7	8.6		55.6	129.2	412	211	989
997-CH-173	26.7		56.0	6.9		66.7	68.3	454	296	911
K 20	30.0		55.7	8.3		68.3	61.9	330	437	900
GLP 24	30.0		58.3	7.9		64.4	50.8	382	406	800
GLP 1004	31.7		56.3	7.9		65.6	46.9	401	497	878
GLPx 92	33.7		55.3	8.3		66.7	103.3	372	360	1378
ZPv 292	26.7		51.3	7.4		64.4	57.8	397	363	839
Carioca	28.3		73.3	8.1		64.4	94.3	416	295	1178
INIA 10	30.0		56.3	7.3		72.2	44.2	383	460	722
INIA 12	28.3		55.3	7.3		71.0	37.3	374	442	650
HF 465-63-1	26.7		70.0	8.9		63.9	136.1	444	229	1294
Calima	28.3		53.7	8.9		73.1	39.8	370	576	822
Ikinimba	26.7		55.0	8.0		68.3	82.2	396	365	1172
Ubososera 6	35.0		56.0	8.2		64.4	97.8	429	291	1217
A 197	31.7		56.0	8.0		70.6	51.3	373	565	1083
A 370	21.7		60.7	7.3		66.7	79.2	424	316	1056
A 410	28.3		56.3	7.0		61.1	35.8	309	438	478
Kilyumukwe	31.7		51.0	6.2		75.0	41.9	361	645	983
Nain de Kyondo	30.0		71.0	8.1		71.1	88.3	438	305	1178
G 13671	30.0		62.0	8.0		73.8	91.8	396	394	1400
G 2816	23.3		55.3	8.2		69.4	47.5	346	455	733
G 12470	31.7		56.7	7.7		68.6	36.4	358	540	639
XAN 76	21.7		72.7	7.4		63.9	70.6	314	433	689
Mean	28.7		59.2	7.7		67.1	69.2	393	393	940
S.E. ±	2.61		0.92	0.81		4.68	13.13	39.0	43.8	143.3
C.V (%)	15.8		2.7	18.2		12.1	32.9	17.2	19.4	26.4
Significance	*		***	NS		NS	***	NS	***	***

Table 23. Disease reactions of entries in AFBYAN II at Kachwekano in 1988S.

Entries	Anth	ALS	AB	Rust	FLS	CBB	HB	BCMV
Red Wolaita	3.00	4.33	5.00	6.33	1.67	4.33	1.67	1.67
Ex-Rico 23	2.33	2.33	2.33	4.33	2.33	3.00	1.67	3.00
A 176	2.33	2.33	2.33	3.00	2.33	3.00	2.33	1.67
997-CH-173	3.00	3.67	4.33	3.67	1.67	4.33	1.00	1.67
K 20	3.00	4.33	4.33	3.67	1.67	3.67	1.67	1.67
GLP 24	1.67	6.33	2.33	6.33	1.67	3.67	1.67	1.67
GLP 1004	2.33	5.67	3.00	6.33	2.33	4.33	3.00	1.67
GLPx 92	3.00	5.00	2.33	7.00	1.67	4.33	1.67	3.00
ZPv 292	1.67	6.33	3.67	5.00	2.33	4.33	1.67	1.67
Carioca	3.00	3.67	3.67	3.00	3.00	3.67	1.67	2.33
INIA 10	2.33	5.67	3.00	5.67	1.67	5.00	1.67	2.33
INIA 12	1.67	6.33	2.33	5.00	2.33	5.00	1.00	2.33
HF 465-63-1	2.33	2.33	1.67	5.00	2.33	3.00	1.67	1.00
Calima	1.00	7.67	2.33	5.00	3.00	4.33	1.00	1.00
Ikinimba	3.00	3.67	3.67	6.33	1.67	3.00	2.33	1.67
Ubososera 6	3.00	4.33	4.33	5.00	1.67	4.33	3.00	3.00
A 197	1.67	6.33	3.00	3.67	2.33	4.33	3.00	1.67
A 370	3.67	3.67	3.67	3.67	2.33	3.00	1.67	2.33
A 410	2.33	2.33	2.33	3.00	2.33	3.67	1.00	2.33
Kilyumukwe	2.33	5.67	3.00	5.00	1.67	4.33	1.00	1.67
Nain de Kyondo	3.00	4.33	3.67	5.00	1.67	3.67	2.33	1.67
G 13671	3.00	3.00	3.67	3.00	2.33	4.33	1.67	2.33
G 2816	3.00	3.00	3.00	3.00	2.33	3.67	1.00	1.67
G 12470	3.00	5.00	3.00	6.33	3.00	3.67	2.33	1.67
XAN 76	2.33	2.33	3.67	3.00	1.67	3.67	1.67	1.00
Mean	2.52	4.39	3.19	4.65	2.12	3.91	1.77	1.91
S.E. ±	0.484	0.619	0.682	0.673	0.409	0.586	0.604	0.579
C.V (%)	33.3	24.5	37.1	25.1	33.4	26.0	59.0	52.6
Significance	ns	***	ns	***	ns	ns	ns	ns

Table 24. Agronomic and yield data of entries in AFBYAN II (uninoculated) at Kachwekano in 1989F.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita			67.7	2.0	111.3					333
Ex-Rico 23			57.7	4.7	108.0					678
A 176			69.0	6.3	111.3					922
997-CH-173			61.7	5.8	110.3					656
K 20			57.7	4.8	107.3					528
GLP 24			67.7	4.7	118.3					700
GLP 1004			63.0	5.2	107.3					422
GLPx 92			57.3	5.7	104.0					689
ZPv 292			51.0	3.4	103.3					361
Carioca			69.0	4.7	112.0					656
INIA 10			58.0	6.3	106.0					467
INIA 12			57.7	5.8	107.0					556
HF 465-63-1			74.0	5.3	113.3					994
Calima			55.7	6.1	99.3					556
Ikinimba			53.0	7.2	105.3					1000
Ubososera 6			63.0	7.2	112.0					933
A 197			55.0	8.3	108.0					972
A 370			70.0	6.6	111.0					1050
A 410			56.0	6.0	111.3					600
Kilyumukwe			53.7	7.4	103.0					700
Nain de Kyondo			72.7	5.8	117.0					817
G 13671			68.0	6.6	110.0					856
G 2816			58.0	4.9	115.7					411
G 12470			57.0	6.4	111.0					528
XAN 76			69.0	5.3	113.3					711
Mean			61.7	5.7	109.5					684
S.E. ±			1.37	0.70	2.26					117.2
C.V (%)			3.9	21.4	3.6					29.7
Significance			***	***	***					***

Table 25. Disease reactions of entries in AFBYAN II (uninoculated) at Kachwekano in 1989F.

Entries	Anth	ALS	AB	Rust	CBB	HB
Red Wolaita	1.67	4.00	3.67	2.33	1.33	1.33
Ex-Rico 23	2.00	2.33	4.67	4.00	1.67	2.33
A 176	2.00	2.00	4.00	2.00	1.67	1.33
997-CH-173	3.33	3.33	4.00	1.67	2.67	2.00
K 20	2.33	3.67	5.00	1.00	2.00	1.67
GLP 24	1.67	2.67	3.33	1.67	1.00	2.33
GLP 1004	3.33	4.33	4.00	2.33	1.00	1.33
GLPx 92	3.33	5.00	5.67	5.00	1.00	1.00
ZPv 292	3.00	3.00	5.00	1.00	1.00	1.33
Carioca	2.00	2.00	4.00	1.00	1.33	1.67
INIA 10	3.67	4.67	5.33	1.00	1.00	2.00
INIA 12	3.00	3.00	5.67	1.33	1.00	1.33
HF 465-63-1	2.00	2.00	3.67	1.67	1.00	2.00
Calima	3.00	5.00	4.33	1.00	2.33	1.00
Ikinimba	2.00	4.67	6.33	6.33	1.00	1.00
Ubososera 6	2.00	3.33	4.67	2.33	1.67	1.67
A 197	3.67	3.67	4.33	1.00	1.00	1.67
A 370	2.33	2.33	4.33	1.00	2.00	1.67
A 410	2.00	2.67	4.67	1.00	1.33	1.67
Kilyumukwe	3.00	3.67	4.67	1.00	1.33	1.67
Nain de Kyondo	1.67	2.00	3.67	6.00	1.33	2.33
G 13671	2.33	3.00	4.67	2.00	2.00	1.67
G 2816	3.00	2.00	5.33	1.00	1.67	2.67
G 12470	2.00	4.33	4.00	4.33	1.00	1.67
XAN 76	3.00	2.00	5.33	1.00	1.33	2.00
Mean	2.53	3.23	4.57	2.16	1.43	1.69
S.E. ±	0.362	0.614	0.642	0.564	0.424	0.459
C.V (%)	24.8	33.0	24.3	45.2	51.5	46.9
Significance	***	**	NS	***	NS	NS

Table 26. Agronomic and yield data of entries in AFBYAN II (inoculated) at Kachwekano in 1989F.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita			64.0	3.3	92.3					433
Ex-Rico 23			66.3	5.1	94.7					456
A 176			64.7	5.3	91.7					567
997-CH-173			59.3	6.4	89.0					756
K 20			54.3	6.4	85.0					822
GLP 24			69.7	3.7	93.3					556
GLP 1004			60.3	9.3	89.3					900
GLPx 92			59.7	6.6	96.0					833
ZPv 292			58.3	4.1	78.7					200
Carioca			77.0	7.0	92.0					889
INIA 10			66.3	6.1	89.0					461
INIA 12			62.0	6.5	90.3					539
HF 465-63-1			64.0	7.2	90.0					978
Calima			56.3	5.7	87.3					656
Ikinimba			59.0	7.2	83.7					994
Ubososera 6			58.3	8.3	92.0					1167
A 197			57.3	8.3	87.0					456
A 370			67.7	6.4	92.7					1083
A 410			60.0	5.3	88.0					722
Kilyumukwe			58.7	7.5	85.3					1089
Nain de Kyondo			69.7	4.9	95.7					678
G 13671			61.0	5.4	96.7					817
G 2816			63.0	6.4	93.3					750
G 12470			56.0	6.2	90.0					489
XAN 76			60.3	8.0	91.7					922
Mean			62.1	6.3	90.2					728
S.E. ±			4.33	0.70	3.12					117.4
C.V (%)			12.1	19.3	6.0					27.9
Significance			NS	***	*					***

Table 27. Disease reactions of entries in AFBYAN II (inoculated) at Kachwekano in 1989F.

Entries	Anth	ALS	AB	Rust	CBB	HB
Red Wolaita	1.67	4.00	4.00	2.67	1.33	1.67
Ex-Rico 23	2.67	3.00	4.00	2.33	1.67	2.67
A 176	2.33	2.67	4.33	4.33	1.00	2.00
997-CH-173	4.00	5.00	4.00	2.00	3.00	2.67
K 20	2.00	4.00	4.00	2.33	1.33	2.33
GLP 24	1.67	4.00	3.67	2.33	1.67	1.67
GLP 1004	3.00	5.33	5.00	2.67	1.00	2.67
GLPx 92	2.67	4.67	5.33	4.33	1.00	1.00
ZPv 292	2.33	3.00	4.33	1.33	1.00	1.67
Carioca	3.00	2.67	4.33	2.67	1.67	2.00
INIA 10	4.00	4.67	3.33	1.00	1.00	3.67
INIA 12	3.33	4.33	3.00	1.33	1.33	4.00
HF 465-63-1	2.00	2.67	4.33	1.00	1.33	1.00
Calima	3.33	4.33	4.00	3.00	1.00	2.33
Ikinimba	2.33	4.67	4.33	4.33	1.00	1.00
Ubososera 6	2.00	4.00	3.67	2.33	1.00	1.33
A 197	3.33	5.00	5.00	1.00	1.00	1.67
A 370	2.33	2.33	3.67	1.67	2.00	1.33
A 410	3.67	3.00	4.33	1.67	1.33	1.33
Kilyumukwe	3.00	3.33	5.33	1.33	1.33	3.33
Nain de Kyondo	1.67	2.67	3.00	3.67	1.33	3.67
G 13671	2.33	2.67	5.33	1.33	1.33	2.33
G 2816	3.00	2.33	4.33	1.33	2.00	2.00
G 12470	3.33	3.00	3.33	3.33	1.00	2.67
XAN 76	3.67	2.33	4.00	1.00	2.00	1.33
Mean	2.75	3.59	4.18	2.25	1.39	2.13
S.E. ±	0.456	0.788	0.611	0.896	0.430	0.841
C.V (%)	28.7	38.1	25.4	68.9	53.7	68.3
Significance	**	NS	NS	NS	NS	NS

Table 28. Agronomic and yield data of entries in AFBYAN II at Kawanda in 1988S.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds 100 pods	Weight of 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita	36.3	55.3	42.7	9.2	83.0	69.8	96.5	551	165	867
Ex-Rico 23	40.7	55.3	45.7	8.5	82.3	62.3	364.4	451	119	1918
A 176	39.0	53.0	49.0	8.3	83.0	73.5	177.7	577	154	1574
997-CH-173	34.3	47.7	41.3	8.1	81.0	66.6	100.2	401	192	764
K 20	38.0	37.7	40.0	7.8	81.0	70.2	101.7	348	297	1033
GLP 24	31.0	45.3	44.0	8.3	83.0	70.9	78.9	399	229	723
GLP 1004	42.0	42.7	39.3	7.0	86.0	78.4	65.1	503	326	1068
GLPx 92	32.7	47.7	39.0	7.1	86.0	73.6	96.0	318	340	1032
ZPv 292	34.0	35.3	36.3	7.4	68.0	62.4	109.2	333	214	607
Carioca	35.0	45.3	44.0	6.6	81.0	75.4	87.0	548	175	834
INIA 10	35.7	43.0	40.0	6.7	81.0	73.7	62.6	494	271	734
INIA 12	36.0	40.3	39.7	8.9	86.0	74.3	57.7	387	329	737
HF 465-63-1	36.3	57.7	49.0	8.9	83.0	67.8	256.9	503	117	1495
Calima	34.7	40.3	37.7	8.5	86.0	78.2	68.1	357	372	876
Ikinimba	30.3	45.3	37.7	8.9	86.0	71.8	79.1	344	294	799
Ubososera 6	35.0	45.3	45.7	7.3	89.0	85.0	90.5	464	198	837
A 197	34.3	32.7	40.0	7.3	86.0	75.8	81.7	289	464	1084
A 370	34.0	47.7	45.7	6.8	88.0	74.0	103.6	441	196	900
A 410	36.0	50.3	40.0	6.9	81.7	72.1	132.8	382	227	1084
Kilyumukwe	36.3	32.7	38.0	7.3	86.0	74.5	76.9	357	481	1311
Nain de Kyondo	40.0	57.7	45.7	7.3	89.0	80.1	113.3	548	204	1230
G 13671	37.0	47.7	40.0	7.3	81.7	73.6	138.3	431	250	1481
G 2816	31.7	47.7	39.7	7.1	81.0	71.3	151.6	414	210	1355
G 12470	42.0	42.7	39.7	7.7	83.0	71.2	75.5	376	386	1092
XAN 76	41.7	45.0	47.3	8.3	83.0	75.0	162.3	499	143	1160
Mean	36.2	45.7	41.9	7.8	83.4	72.9	117.1	429	254	1064
S.E. ±	1.86	3.83	0.90	0.72	0.31	2.91	21.11	34.2	19.9	131.6
C.V (%)	8.9	14.5	3.7	16.1	0.7	6.9	23.9	13.8	13.6	21.4
Significance	***	***	***	NS	***	***	***	***	***	***

Table 29. Disease reactions of entries in AFBYAN II at Kawanda in 1988S.

Entries	ALS	AB	Rust	WB	CBB	BCMV
Red Wolaita	5.67	4.00	1.33	3.67	4.00	4.00
Ex-Rico 23	2.00	4.67	1.00	1.00	2.67	2.00
A 176	2.00	4.67	1.00	6.33	2.33	2.33
997-CH-173	6.33	5.67	1.33	6.33	3.67	3.00
K 20	6.67	2.67	1.67	1.00	3.33	2.00
GLP 24	6.67	3.00	2.67	1.00	3.33	3.00
GLP 1004	7.00	2.33	3.00	1.00	5.33	2.33
GLPx 92	7.67	3.33	1.67	1.00	5.67	4.67
ZPv 292	8.00	3.00	3.00	1.00	6.00	2.00
Carioca	3.33	3.67	1.00	6.33	3.67	4.00
INIA 10	7.00	2.33	2.33	1.00	4.00	3.33
INIA 12	7.33	3.33	3.00	1.00	5.33	2.67
HF 465-63-1	2.00	5.33	1.00	1.00	2.67	3.00
Calima	7.33	4.00	3.33	1.00	5.67	2.33
Ikinimba	7.00	4.00	1.67	3.67	6.33	5.00
Ubososera 6	4.00	3.67	1.00	3.67	3.33	4.00
A 197	7.33	2.67	2.67	1.00	3.33	2.00
A 370	3.33	4.67	1.00	3.67	3.33	3.33
A 410	3.67	5.67	1.00	6.33	4.00	3.00
Kilyumukwe	6.67	3.67	2.00	1.00	5.67	3.00
Nain de Kyondo	2.67	3.67	1.00	1.00	2.33	3.67
G 13671	3.33	5.33	1.00	1.00	3.67	2.33
G 2816	4.67	5.67	1.00	1.00	4.33	2.67
G 12470	6.00	3.00	1.67	1.00	3.00	2.00
XAN 76	2.33	4.33	1.00	1.00	2.33	2.33
Mean	5.20	3.93	1.69	2.28	3.97	2.96
S.E. ±	0.420	0.462	0.372	1.493	0.303	0.310
C.V (%)	14.0	20.3	38.0	113.4	13.2	18.2
Significance	***	***	***	*	***	***

Table 30. Agronomic and yield data of entries in AFBYAN II at Huambo in 1989.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stands/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds (g)	Seed yield (kg/ha)
Red Wolaita	71.0	33.3	43.0	16.3	79.0	71.5	115.4	547	200	1261
Ex-Rico 23	62.7	26.7	44.7	13.7	84.7	68.2	97.2	469	164	726
A 176	29.7	30.0	47.0	18.1	78.7	71.2	130.8	440	199	1182
997-CH-173	52.0	33.3	45.0	14.7	84.0	70.2	117.2	439	250	1304
K 20	27.7	30.0	40.0	20.8	76.7	63.9	117.1	279	314	982
GLP 24	59.0	33.3	42.7	20.4	79.0	66.7	71.0	401	242	701
GLP 1004	78.7	26.7	39.0	16.1	75.7	68.1	87.4	418	343	1231
GLPx 92	72.3	33.3	38.7	18.5	77.7	73.7	116.7	412	338	1661
ZPv 292	28.7	26.7	32.3	20.3	74.0	67.8	77.1	318	421	1023
Carioca	58.7	36.7	42.7	25.1	82.0	69.0	169.7	553	184	1899
INIA 10	66.3	33.3	38.7	14.5	77.0	64.3	115.1	356	357	1460
INIA 12	66.3	33.3	40.7	14.1	76.0	62.2	124.1	398	325	1576
HF 465-63-1	29.3	26.7	45.7	14.8	85.7	69.1	159.5	431	176	1211
Calima	29.0	26.7	36.3	18.9	75.0	75.5	86.7	297	457	1136
Ikinimba	84.0	43.3	38.7	21.2	79.3	74.9	178.8	469	307	2589
Ubososera 6	70.0	36.7	43.7	15.4	85.7	69.9	86.8	440	235	909
A 197	29.0	30.0	36.7	16.0	77.0	76.1	70.0	320	507	1123
A 370	45.3	30.0	46.0	14.8	83.7	71.4	128.5	417	210	1106
A 410	73.7	33.3	38.3	20.4	77.3	72.8	129.5	382	304	1503
Kilyumukwe	66.7	26.7	32.0	13.8	73.3	67.1	69.1	333	409	968
Nain de Kyondo	77.7	30.0	48.3	16.7	90.0	68.8	84.7	410	186	657
G 13671	87.0	40.0	46.7	19.0	94.0	66.1	121.4	402	263	1284
G 2816	67.7	30.0	38.3	18.1	82.0	76.2	131.8	407	270	1440
G 12470	34.3	30.0	41.3	13.8	85.0	65.9	49.2	372	363	711
XAN 76	22.3	30.0	45.7	16.8	84.7	73.9	119.5	456	183	1082
Mean	55.6	31.6	41.3	17.3	80.7	69.8	110.2	407	288	1229
S.E. ±	4.60	4.93	1.39	2.09	1.22	2.05	19.46	33.0	20.2	231.9
C.V. (%)	14.3	36.5	5.8	20.9	2.6	5.1	30.8	14.1	12.1	32.7
Significance	***	ns	***	*	***	***	**	***	***	***

Table 31. Disease reactions of entries in AFBYAN II at Huambo in 1989.

Entries	Anth	ALS	AB	CBB	BCMV
Red Wolaita	1.00	3.67	3.67	1.00	1.00
Ex-Rico 23	1.00	5.00	5.00	1.00	1.00
A 176	1.00	3.67	5.00	1.00	1.00
997-CH-173	1.00	3.67	5.00	2.33	2.33
K 20	1.00	3.67	5.00	1.00	1.00
GLP 24	1.00	3.67	3.67	1.00	1.00
GLP 1004	1.00	3.67	3.67	1.00	1.00
GLPx 92	1.00	5.00	5.00	1.00	1.00
ZPv 292	2.33	5.00	3.67	1.00	1.00
Carioca	1.00	3.67	5.00	1.00	3.67
INIA 10	1.00	3.67	3.67	1.00	1.00
INIA 12	1.00	5.00	5.00	1.00	1.00
HF 465-63-1	1.00	3.67	5.00	1.00	1.00
Calima	2.33	3.67	5.00	1.00	1.00
Ikinimba	1.00	3.67	5.00	2.33	2.33
Ubososera 6	1.00	3.67	5.00	1.00	2.33
A 197	1.00	5.00	5.00	1.00	1.00
A 370	1.00	5.00	5.00	1.00	1.00
A 410	1.00	5.00	5.00	1.00	2.33
Kilyumukwe	1.00	5.00	2.33	1.00	1.00
Nain de Kyondo	1.00	2.33	3.67	1.00	2.33
G 13671	1.00	3.67	5.00	1.00	1.00
G 2816	1.00	2.33	5.00	1.00	1.00
G 12470	1.00	5.00	3.67	1.00	1.00
XAN 76	1.00	5.00	5.00	1.00	1.00
Mean	1.11	4.09	4.52	1.11	1.37
S.E. ±					
C.V. (%)					
Significance					

Note - diseases rated present and absent - plots rated 5 if disease present and 1 if absent - data not analysed

Table 32. Agronomic and yield data of entries in AFBYAN II at Machache in 1989.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yields (kg/ha)
Red Wolaita	99.0	36.7	61.7	14.0	93.3					678
Ex-Rico 23	72.0	40.0	50.0	11.0	90.0					439
A 176	99.0	40.0	52.0	15.0	95.0					1195
997-CH-173	100.7	40.0	66.7	15.0	95.0					1097
K 20	68.3	30.0	63.3	11.4	110.0					879
GLP 24	90.0	20.0	70.0	12.1	104.3					674
GLP 1004	99.3	30.0	42.0	9.0	93.3					342
GLPx 92	150.0	45.0	80.0	12.5	170.0					0
ZPv 292	66.7	30.0	50.0	9.0	85.0					252
Carioca	91.0	40.0	70.0	16.6	120.0					2103
INIA 10	90.7	33.3	70.0	12.5	106.7					517
INIA 12	91.0	30.0	70.0	8.8	110.0					291
HF 465-63-1	108.0	30.0	60.0	15.7	90.0					1114
Calima	72.3	35.0	60.0	11.9	90.0					909
Ikinimba	100.0	30.0	80.0	12.5	170.0					0
Ubososera 6	125.0	23.3	66.7	15.6	110.0					1308
A 197	102.0	30.0	60.0	11.8	90.0					819
A 370	87.7	30.0	60.0	14.3	90.0					1371
A 410	90.0	35.0	60.0	17.1	90.0					1638
Kilyumukwe	100.3	30.0	70.0	10.0	110.0					714
Nain de Kyondo	104.7	45.0	70.0	11.3	110.0					537
G 13671	143.0	30.0	80.0	12.5	170.0					0
G 2816	150.0	45.0	80.0	12.5	163.3					0
G 12470	90.0	30.0	60.0	8.8	100.0					448
XAN 76	85.0	45.0	60.0	18.1	90.0					1865
Mean	99.0	34.1	64.5	12.8	109.8					768
S.E. ±	1.85	1.00	4.13	1:34	4.29					137.1
C.V (%)	3.2	5.1	11.1	18.2	6.8					30.9
Significance	***	***	***	***	***					***

Table 33. Disease reactions of entries in AFBYAN II at Machache in 1989.

Entries	CBB	HB
Red Wolaita	4.00	4.00
Ex-Rico 23	3.33	4.67
A 176	2.33	3.33
997-CH-173	2.00	2.33
K 20	4.00	4.00
GLP 24	3.00	5.00
GLP 1004	4.67	4.67
GLPx 92	2.00	3.33
ZPv 292	5.00	5.00
Carioca	2.33	4.00
INIA 10	4.67	7.33
INIA 12	6.00	5.67
HF 465-63-1	5.33	6.33
Calima	5.33	5.00
Ikinimba	1.33	2.33
Ubososera 6	2.33	4.33
A 197	3.33	3.67
A 370	2.00	3.00
A 410	3.00	4.33
Kilyumukwe	3.33	5.33
Nain de Kyondo	2.33	3.67
G 13671	2.33	7.33
G 2816	1.67	2.00
G 12470	6.67	7.67
XAN 76	2.33	2.00
Mean	3.39	4.41
S.E. ±	0.635	0.512
C.V (%)	32.5	20.1
Significance	***	***

Table 34. Agronomic and yield data of entries in AFBYAN II at Maseru in 1988.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita		38.3	53.3		92.7					2173
Ex-Rico 23		31.7	54.0		88.3					2198
A 176		43.3	59.3		91.7					2571
997-CH-173		43.3	55.7		92.0					2555
K 20		41.7	53.7		89.0					1706
GLP 24		36.7	62.0		93.3					1873
GLP 1004		35.0	60.0		88.7					2275
GLPx 92		43.3	80.0		150.0					0
ZPv 292		45.0	46.0		85.7					2678
Carioca		41.7	59.0		99.3					2128
INIA 10		46.7	56.7		90.0					1585
INIA 12		46.7	69.7		99.7					1864
HF 465-63-1		41.7	57.0		88.7					1747
Calima		41.7	52.7		90.7					2773
Ikinimba		48.3	70.0		150.0					0
Ubososera 6		41.7	58.3		88.7					1860
A 197		40.0	61.3		94.7					2393
A 370		38.3	58.3		89.0					1945
A 410		41.7	57.0		91.7					1595
Kilyumukwe		41.7	57.0		89.3					1837
Nain de Kyondo		35.0	64.3		95.0					1418
G 13671		48.3	80.0		150.0					0
G 2816		41.7	80.0		150.0					0
G 12470		36.7	63.7		111.7					1473
XAN 76		41.7	55.3		89.7					2231
Mean		41.3	61.0		101.6					1715
S.E. ±		1.90	1.40		1.44					165.2
C.V (%)		8.0	4.0		2.5					16.7
Significance		***	***		***					***

Table 35. Disease reactions of entries in AFBYAN II at Maseru in 1988-89.

Entries	CBB	HB	BCMV
Red Wolaita	2.00	1.67	1.00
Ex-Rico 23	1.67	1.67	1.00
A 176	1.67	1.67	1.00
997-CH-173	1.33	1.33	1.00
K 20	1.67	1.67	1.00
GLP 24	1.67	1.67	1.00
GLP 1004	1.67	1.67	1.00
GLPx 92	1.67	2.33	1.00
ZPv 292	1.33	1.00	1.00
Carioca	1.33	1.33	1.00
INIA 10	1.67	1.33	1.00
INIA 12	2.00	1.33	1.00
HF 465-63-1	1.33	1.33	1.00
Calima	1.00	1.33	1.00
Ikinimba	1.67	2.00	1.00
Ubososera 6	1.67	1.33	1.00
A 197	1.33	1.67	1.00
A 370	1.67	1.67	1.00
A 410	1.33	1.33	1.00
Kilyumukwe	2.00	1.67	1.00
Nain de Kyondo	1.67	1.67	2.00
G 13671	1.67	1.67	4.00
G 2816	1.67	1.33	1.00
G 12470	1.67	2.00	1.00
XAN 76	2.00	1.67	1.00
Mean	1.61	1.57	1.16
S.E. ±	0.297	0.255	0.227
C.V (%)	31.9	28.1	33.9
Significance	NS	NS	***

Table 36. Agronomic and yield data of entries in AFBYAN II at Maseru in 1989.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	105.0	33.3	50.0	15.8	95.0					816
Ex-Rico 23	80.0	40.0	50.0	13.2	90.0					503
A 176	88.7	40.0	56.0	11.5	93.7					443
997-CH-173	103.0	40.0	55.0	18.1	95.0					2208
K 20	73.0	33.3	51.3	10.7	110.0					182
GLP 24	89.0	21.7	60.0	8.3	96.0					295
GLP 1004	98.7	28.3	55.0	7.4	91.7					116
GLPx 92	139.0	45.0	80.0	12.5	150.0					0
ZPv 292	72.0	40.0	46.0	13.5	81.7					396
Carioca	85.0	40.0	57.0	18.0	100.0					1263
INIA 10	82.0	28.3	58.0	8.9	96.7					212
INIA 12	89.0	33.3	64.7	10.4	123.3					59
HF 465-63-1	110.0	20.0	61.7	14.0	90.0					792
Calima	78.0	35.0	55.0	9.4	90.0					620
Ikinimba	137.0	40.0	80.0	12.5	150.0					0
Ubososera 6	115.7	31.7	59.0	7.1	106.7					219
A 197	101.7	30.0	60.0	8.5	90.7					316
A 370	86.7	30.0	58.0	18.5	90.0					1320
A 410	89.0	33.3	50.7	16.6	90.0					1323
Kilyumukwe	106.7	33.3	61.7	7.3	103.3					125
Nain de Kyondo	103.3	48.3	70.3	17.3	110.0					991
G 13671	147.0	36.7	80.0	12.5	150.0					0
G 2816	142.3	40.0	80.0	12.5	150.0					0
G 12470	88.7	38.3	60.0	8.8	100.0					250
XAN 76	86.0	40.0	50.0	14.7	90.0					948
Mean	99.9	35.2	60.4	12.3	105.3					536
S.E. ±	3.82	2.71	2.12	1.56	3.05					159.1
C.V (%)	6.6	13.3	6.1	22.0	5.0					51.4
Significance	***	***	***	***	***					***

Table 37. Disease reactions of entries in AFBYAN II at Maseru in 1989.

Entries	CBB	HB	BCMV
Red Wolaita	3.00	3.67	1.33
Ex-Rico 23	3.33	4.00	1.00
A 176	4.00	3.67	2.00
997-CH-173	2.67	4.33	1.33
K 20	4.00	4.33	1.67
GLP 24	2.33	4.33	1.00
GLP 1004	3.33	3.67	1.00
GLPx 92	2.00	2.00	1.33
ZPv 292	4.67	4.00	1.00
Carioca	3.33	3.00	1.67
INIA 10	5.00	7.00	1.67
INIA 12	6.00	5.67	1.33
HF 465-63-1	3.00	4.67	1.00
Calima	2.33	2.67	1.00
Ikinimba	2.33	2.33	1.00
Ubososera 6	2.67	3.00	1.00
A 197	2.67	3.67	1.00
A 370	2.00	2.67	1.00
A 410	3.67	3.67	1.00
Kilyumukwe	4.67	5.00	1.33
Nain de Kyondo	2.00	2.67	1.33
G 13671	4.00	4.67	1.67
G 2816	1.67	1.67	1.33
G 12470	3.67	4.00	1.00
XAN 76	2.00	1.67	1.00
Mean	3.21	3.68	1.24
S.E. ±	0.825	0.925	0.336
C.V (%)	44.5	43.5	47.0
Significance	*	*	NS

Table 38. Agronomic and yield data of entries in AFBYAN II at Lichinga in 1990.

Entries	Canopy height (cm)	Ground cover score	DFF	Stand at harvest	DM	Pods/ m2	Seeds/ pod	Seed size g/seed	Seed yield (kg/ha)
Red Wolaita	26.7	20.0	38.7	17.5	95.3	69.7	513	276	979
Ex-Rico 23	20.0	19.0	36.3	17.7	100.3	136.1	502	200	1360
A 176	23.3	22.3	48.0	15.0	95.3	67.9	513	181	630
997-CH-173	23.3	19.0	37.3	19.5	92.7	89.0	364	297	972
K 20	26.7	19.0	38.7	13.8	90.0	60.6	266	440	722
GLP 24	26.7	22.3	39.7	15.1	95.3	67.7	359	328	808
GLP 1004	30.0	23.7	38.7	15.4	90.0	47.3	416	377	806
GLPx 92	30.0	23.7	31.0	17.5	90.0	63.0	388	488	1190
ZPv 292	30.0	17.7	32.3	12.4	90.0	29.1	318	438	405
Carioca	30.0	25.0	45.7	17.7	98.0	127.4	537	247	1686
INIA 10	30.0	19.0	38.0	13.2	90.0	43.6	333	408	593
INIA 12	26.7	19.0	38.3	12.2	90.0	38.3	330	434	595
HF-465-63-1	30.0	23.7	47.7	17.8	98.0	113.7	513	173	1012
Calima	20.0	16.3	34.3	12.8	90.0	35.3	287	518	522
Ikinimba	30.0	22.3	27.7	16.3	90.0	70.2	387	430	1148
Ubososera 6	26.7	19.0	38.7	17.8	98.0	81.1	429	283	990
A 197	30.0	23.7	35.7	16.9	90.0	54.2	299	533	880
A 370	26.7	23.7	44.0	16.9	98.0	101.2	406	261	1070
A 410	20.0	16.7	34.3	15.6	92.7	48.4	412	381	764
Kilyumukwe	26.7	19.0	32.3	14.3	90.0	43.8	304	494	655
Nain de Kyondo	36.7	27.7	45.7	16.9	102.7	129.1	474	241	1517
G 13671	30.0	26.3	39.3	15.7	98.0	92.6	393	402	1470
G 2816	23.3	20.3	31.0	17.8	90.0	41.7	418	388	678
G 12470	30.0	20.3	39.3	15.6	92.7	43.3	279	448	541
XAN 76	30.0	23.7	48.3	20.9	102.7	126.4	512	204	1351
Mean	27.3	21.3	38.4	16.1	94.0	72.8	398	355	934
S.E. ±	2.79	1.76	0.75	1.45	1.34	11.82	17.2	13.7	167.0
C.V (%)	17.7	14.3	3.4	15.6	2.4	28.1	7.5	6.7	31.0
Significance	*	***	***	**	***	***	***	***	***

Table 39. Disease and pest reactions of entries in AFBYAN II at Lichinga in 1990.

Entries	RR	BSM	NEM
Red Wolaita	1.00	4.33	0.00
Ex-Rico 23	1.33	2.00	1.67
A 176	0.00	2.33	8.33
997-CH-173	1.00	2.33	5.33
K 20	2.67	6.00	5.00
GLP 24	1.00	4.33	5.67
GLP 1004	0.33	6.00	3.67
GLPx 92	2.00	3.33	6.33
ZPv 292	1.67	3.67	6.67
Carioca	1.67	2.67	0.00
INIA 10	0.00	3.67	4.67
INIA 12	1.33	7.00	5.33
HF-465-63-1	2.33	3.33	6.67
Calima	3.00	5.00	5.00
Ikinimba	1.00	2.33	3.67
Ubososera 6	0.33	6.67	2.67
A 197	1.00	3.67	4.33
A 370	0.00	7.67	4.67
A 410	1.33	4.00	0.33
Kilyumukwe	3.33	7.33	2.67
Nain de Kyondo	0.33	1.33	0.67
G 13671	2.67	5.00	0.67
G 2816	0.67	5.67	7.00
G 12470	3.00	5.33	6.67
XAN 76	0.00	4.33	0.33
Mean	1.32	4.37	3.92
S.E. ±	0.755	1.000	1.612
C.V (%	99.1	39.6	71.2
Significance	*	***	**

Table 40. Agronomic and yield data of entries in AFBYAN II at Uitkomst in 1991.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	26.3	20.0		3.8	83.0	71.1	17.3	453	211	166
Ex-Rico 23	20.3	16.7		3.8	83.0	73.2	63.8	558	186	678
A 176	24.7	20.0		4.1	83.0	72.9	15.7	320	398	198
997-CH-173	23.3	23.3		4.3	83.0	74.7	92.2	382	305	1145
K 20	26.7	26.7		4.8	83.0	68.2	58.0	428	288	648
GLP 24	26.0	20.0		4.4	85.7	70.9	14.3	389	260	144
GLP 1004	22.7	16.7		2.7	87.3	71.4	15.3	438	333	230
GLPx 92	18.0	13.3		2.7	83.0	81.7	13.9	401	372	208
ZPv 292	16.7	10.0		4.1	80.3	73.5	14.7	360	364	188
Carioca	21.7	20.0		3.9	85.7	73.4	22.1	502	198	210
INIA 10	20.0	16.7		3.3	92.7	67.4	47.1	354	328	652
INIA 12	24.0	20.0		4.6	83.0	71.3	15.0	412	311	196
HF 465-63-1	23.7	10.0		3.1	85.7	73.4	9.0	323	265	69
Calima	21.3	10.0		3.6	81.7	70.5	12.9	317	386	159
Ikinimba	21.0	16.7		2.5	83.0	79.0	16.6	493	244	193
Ubososera 6	27.7	16.7		3.1	91.0	72.4	12.8	429	271	141
A 197	26.0	13.3		2.1	87.3	66.9	17.2	410	237	162
A 370	24.0	23.3		2.5	87.3	72.8	20.2	437	244	205
A 410	19.3	16.7		2.9	83.0	72.2	15.8	368	352	202
Kilyumukwe	22.7	20.0		4.1	83.3	71.0	17.6	359	315	197
Nain de Kyondo	30.0	30.0		3.6	85.7	70.5	21.1	493	180	181
G 13671	20.0	26.7		3.8	87.3	73.4	17.0	488	232	190
G 2816	20.3	20.0		2.7	85.7	81.2	17.1	446	334	258
G 12470	23.7	13.3		2.4	88.3	74.3	5.8	331	338	67
XAN 76	18.0	16.7		2.6	84.7	75.2	11.4	554	225	140
Mean	22.7	18.3		3.4	85.1	72.9	23.4	418	296	273
S.E. ±	1.97	4.15		0.61	1.47	3.28	16.12	45.1	36.3	191.3
C.V (%)	15.1	39.4		30.9	4.7	7.8	119.5	18.7	21.9	121.4
Significance	**	ns		ns	ns	ns	ns	**	***	ns

Table 41. Agronomic and yield data of entries in AFBYAN I at Lambo in 1990.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	45.0	46.7	38.3	15.9	79.7	58.5	61.5	501	168	507
Ex-Rico 23	40.0	40.0	39.7	17.3	81.3	63.7	176.7	451	156	1274
A 176	43.3	36.7	45.3	18.3	84.0	66.4	177.4	518	172	1573
997-CH-173	50.0	41.7	40.7	18.4	83.3	47.3	59.1	347	200	408
K 20	45.0	41.7	35.3	18.9	84.0	57.1	111.0	297	303	993
GLP 24	50.0	43.3	38.7	17.9	86.3	62.9	98.1	471	214	975
GLP 1004	48.3	38.3	36.0	17.8	82.0	63.6	92.4	471	346	1483
GLPx 92	43.3	46.7	35.7	16.3	79.7	64.3	89.9	354	297	943
ZPv 292	51.7	45.0	33.7	18.6	77.0	68.8	103.6	390	401	1615
Carioca	45.0	40.0	42.3	18.5	79.3	64.7	99.6	430	228	891
INIA 10	53.3	43.3	39.3	19.1	82.7	66.0	88.0	343	401	1058
INIA 12	41.7	43.3	39.0	17.3	82.7	55.1	83.8	356	263	788
HF 465-63-1	40.0	41.7	46.7	18.8	83.7	63.5	161.0	491	121	958
Calima	50.0	43.3	37.0	18.3	82.7	66.6	113.3	307	447	1462
Ikinimba	38.3	35.0	37.3	17.0	81.3	75.3	83.1	412	324	1101
Ubososera 6	40.0	43.3	46.7	14.5	83.7	64.5	70.3	343	234	526
A 197	51.7	45.0	40.7	19.9	83.3	69.0	101.5	295	554	1662
A 370	40.0	40.0	44.7	16.0	83.3	66.8	80.5	355	245	655
A 410	46.7	43.3	39.7	17.3	78.3	69.0	134.2	422	283	1597
Kilyumukwe	41.7	40.0	39.7	15.5	82.0	59.9	75.5	299	468	993
Nain de Kyondo	43.3	43.3	47.0	15.3	93.0	60.7	37.9	471	167	314
G 13671	46.7	48.3	41.7	15.7	78.3	69.8	47.7	367	373	598
G 2816	43.3	40.0	38.0	14.8	81.3	67.4	124.3	433	270	1392
G 12470	53.3	48.3	39.7	18.4	86.7	57.2	71.5	302	324	697
XAN 76	41.7	43.3	44.7	17.9	82.3	70.7	165.6	414	218	1462
Mean	45.3	42.5	40.3	17.4	82.5	64.0	100.3	394	287	1037
S.E. ±	2.33	3.00	0.56	0.80	1.02	4.11	11.53	38.2	40.5	102.4
C.V (%)	8.9	12.1	2.4	8.0	2.1	11.1	19.9	16.8	24.4	17.1
Significance	***	ns	***	***	***	*	***	***	***	***

Table 42. Disease reactions of entries in AFBYAN II at Lambo in 1990.

Entries	ALS	Rust	WM	FLS	CBB	Y
Red Wolaita	2.33	3.67	2.67	2.00	3.33	1.00
Ex-Rico 23	2.67	1.00	1.00	2.67	3.67	1.67
A 176	2.67	1.33	2.33	2.33	1.67	1.00
997-CH-173	2.67	1.00	3.00	2.33	4.00	1.00
K 20	3.00	1.33	1.00	3.00	3.33	1.00
GLP 24	2.33	1.33	1.67	2.33	3.00	1.00
GLP 1004	2.33	1.67	2.33	1.67	3.33	1.67
GLPx 92	3.33	3.67	3.00	1.00	4.00	1.00
ZPv 292	5.00	1.00	1.00	3.00	4.00	1.00
Carioca	3.00	1.67	1.67	2.33	4.00	1.00
INIA 10	3.33	2.00	2.33	3.67	4.00	1.67
INIA 12	3.67	2.67	2.33	3.00	3.33	1.67
HF 465-63-1	2.33	1.00	1.67	1.67	3.67	1.00
Calima	4.67	1.33	1.00	2.67	3.00	1.00
Ikinimba	3.67	2.33	3.00	1.00	3.00	1.00
Ubososera 6	2.67	1.67	2.67	1.33	3.67	2.00
A 197	4.67	1.00	1.00	3.00	3.33	1.00
A 370	2.33	1.00	2.00	2.33	3.00	2.33
A 410	3.67	1.00	1.67	1.67	4.00	1.00
Kilyumukwe	2.67	1.00	1.33	3.00	4.00	1.33
Nain de Kyondo	2.33	1.00	1.67	1.67	2.33	1.00
G 13671	2.00	1.33	3.67	2.00	3.33	1.00
G 2816	3.00	1.00	3.33	1.00	3.67	1.33
G 12470	2.33	1.00	2.33	2.67	2.67	1.33
XAN 76	2.33	1.00	1.00	3.33	3.00	1.00
Mean	3.00	1.52	2.03	2.27	3.37	1.24
S.E. ±	0.382	0.358	0.660	0.615	0.326	0.447
C.V (%)	22.1	40.8	56.4	47.0	16.7	62.4
Significance	***	***	NS	NS	***	NS

Table 43. Agronomic and yield data of entries in AFBYAN II at Mabughai in 1990.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m^2	Seeds 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	35.0	30.0	52.7	19.1	96.0	72.9	76.3	447	229	784
Ex-Rico 23	28.3	28.3	54.0	18.5	115.3	72.0	136.2	458	155	962
A 176	30.0	30.0	56.7	19.6	114.7	72.6	80.6	522	164	685
997-CH-173	30.0	30.0	51.7	19.9	112.0	69.3	118.2	349	245	1016
K 20	33.3	28.3	50.0	17.8	111.3	67.7	95.7	287	331	906
GLP 24	33.3	30.0	53.7	18.9	115.3	71.0	77.3	389	363	1089
GLP 1004	38.3	31.7	53.7	19.0	111.0	68.2	72.7	330	404	969
GLPx 92	31.7	30.0	46.7	18.0	98.7	77.2	119.0	294	358	1237
ZPv 292	30.0	25.0	45.0	18.6	111.3	68.7	43.9	314	480	658
Carioca	32.7	35.0	57.3	19.9	102.0	71.4	122.3	463	197	1115
INIA 10	36.7	28.3	50.0	19.5	110.0	71.7	64.4	362	390	902
INIA 12	33.3	28.3	52.3	17.8	116.0	68.2	59.7	364	375	815
HF 465-63-1	31.7	31.7	58.3	20.1	115.3	71.4	123.7	467	167	961
Calima	36.7	30.0	46.0	18.5	113.3	70.4	83.0	299	469	1157
Ikinimba	31.7	30.0	44.0	20.6	98.0	76.6	118.8	354	349	1470
Ubososera 6	30.0	28.3	54.7	19.1	116.7	70.2	84.2	387	222	725
A 197	36.7	28.3	48.7	19.2	113.3	73.7	66.6	310	453	928
A 370	28.3	28.3	56.3	17.0	115.3	72.3	83.5	389	218	697
A 410	30.0	30.0	49.7	21.1	115.3	70.3	65.8	332	324	707
Kilyumukwe	41.7	36.7	44.0	19.6	110.0	68.1	76.3	360	463	1285
Nain de Kyondo	30.0	28.3	56.0	19.3	118.0	72.9	51.6	432	242	538
G 13671	28.3	26.7	53.0	18.4	115.3	71.8	104.9	342	305	1092
G 2816	28.3	28.3	53.7	20.2	115.3	73.3	49.2	339	393	658
G 12470	35.0	31.7	51.7	18.0	117.3	66.7	51.3	319	473	764
XAN 76	28.3	28.3	58.0	20.4	115.3	74.2	89.0	424	191	708
Mean	32.4	29.7	51.9	19.1	111.7	71.3	84.6	373	318	913
S.E. ±	2.33	1.90	1.04	0.90	0.86	1.24	9.69	14.2	10.4	109.1
C.V (%)	12.5	11.1	3.5	8.2	1.3	3.0	19.9	6.6	5.6	20.7
Significance	**	ns	***	ns	***	***	***	***	***	***

Table 44. Disease reactions of entries in AFBYAN II at Mabughai in 1990.

Entries	Anth	ALS	AB	Rust	WM
Red Wolaita	3.33	4.00	2.00	5.67	2.00
Ex-Rico 23	2.00	2.67	2.00	2.33	2.00
A 176	2.33	2.67	1.67	2.00	2.00
997-CH-173	3.00	3.67	2.00	2.33	2.00
K 20	2.67	3.00	2.00	2.00	2.00
GLP 24	2.67	3.00	2.00	2.67	2.00
GLP 1004	3.00	4.00	2.00	3.67	2.00
GLPx 92	2.67	2.67	2.00	2.33	2.00
ZPv 292	2.67	4.00	2.00	2.33	2.00
Carioca	2.33	2.67	2.00	2.67	2.00
INIA 10	3.00	4.33	2.33	5.00	3.00
INIA 12	3.00	3.67	2.00	3.00	2.33
HF 465-63-1	2.67	3.00	2.00	4.67	2.00
Calima	3.00	3.67	2.00	2.67	2.33
Ikinimba	2.33	2.00	1.67	2.33	1.67
Ubososera 6	3.00	2.33	1.67	2.67	2.00
A 197	3.00	4.00	2.00	4.00	3.00
A 370	2.33	2.00	2.00	2.33	2.00
A 410	2.33	2.67	2.00	2.00	1.67
Kilyumukwe	3.00	4.00	2.00	2.33	2.33
Nain de Kyondo	2.67	2.33	2.00	2.00	2.00
G 13671	2.33	2.67	2.00	2.00	1.67
G 2816	2.67	3.00	2.00	2.00	2.00
G 12470	3.00	4.00	2.00	3.00	2.33
XAN 76	2.33	2.33	2.00	2.00	2.00
Mean	2.69	3.13	1.97	2.80	2.09
S.E. ±	0.310	0.314	0.133	0.479	0.225
C.V (%)	19.9	17.4	11.7	29.7	18.6
Significance	NS	***	NS	***	*

Table 45. Agronomic and yield data of entries in AFBYAN II at Miwaleni in 1990.

Entries	Canopy height (cm)	Canopy width (cm)	DFP	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	36.7	25.7	40.0	15.4	76.3	52.9	67.6	294	244	548
Ex-Rico 23	36.3	30.0	40.7	16.4	79.0	61.9	87.9	340	199	590
A 176	38.0	29.0	39.0	16.6	74.7	58.0	115.5	348	221	767
997-CH-173	32.7	23.3	38.3	18.8	76.0	57.4	134.7	243	294	850
K 20	34.3	29.3	40.7	16.0	77.3	37.0	84.3	151	307	430
GLP 24	38.3	30.0	41.0	13.6	81.0	50.1	31.7	203	284	156
GLP 1004	26.7	23.3	36.0	16.2	79.0	55.9	70.7	226	369	571
GLPx 92	25.0	21.7	37.3	17.6	74.0	62.8	97.0	262	374	950
ZPv 292	37.0	26.7	33.0	12.8	74.0	53.7	97.2	235	365	878
Carioca	38.3	26.7	38.3	17.3	70.3	69.4	118.7	432	231	1152
INIA 10	38.0	28.3	36.7	17.0	73.3	54.5	79.3	403	224	524
INIA 12	38.3	27.7	37.7	16.4	73.3	46.0	78.9	251	287	566
HF 465-63-1	38.3	30.0	41.7	16.1	78.0	54.6	95.5	273	192	453
Calima	32.3	26.7	36.7	12.7	80.3	57.0	64.6	201	476	616
Ikinimba	28.3	20.0	35.3	16.3	74.0	66.2	101.3	296	300	900
Ubososera 6	35.7	26.7	41.7	10.8	73.0	51.7	77.7	184	221	360
A 197	40.0	28.3	37.7	16.8	81.7	58.3	51.5	183	481	467
A 370	30.0	25.0	41.7	17.0	80.7	48.9	101.2	219	237	521
A 410	35.7	26.7	37.7	14.6	75.7	57.1	76.1	294	319	712
Kilyumukwe	39.0	31.0	43.3	17.0	75.7	47.0	135.7	314	154	666
Nain de Kyondo	33.3	28.0	42.0	16.8	79.7	51.3	112.0	179	362	536
G 13671	35.0	27.7	38.7	15.9	74.0	67.9	79.9	319	338	828
G 2816	28.3	23.3	37.7	12.0	83.7	58.8	51.1	236	336	409
G 12470	40.7	37.7	43.3	14.6	87.0	29.6	38.2	108	364	169
XAN 76	40.7	29.3	42.7	17.0	76.7	54.5	136.0	342	196	902
Mean	35.1	27.3	39.1	15.7	77.1	54.5	87.4	261	295	621
S.E. $\pm$	3.75	3.04	0.60	1.38	2.21	6.81	16.95	60.3	43.2	141.8
C.V. (%)	18.5	19.3	2.6	15.3	5.0	21.7	33.6	40.0	25.4	39.6
Significance	NS	NS	***	*	***	NS	***	NS	***	***

Table 46. Agronomic and yield data of entries in AFBYAN II at Selian in 1990.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m²	DM	Thresh-ing %	Pods/ m²	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	41.7	50.0	36.7	19.8	84.0	72.6	85.1	479	239	955
Ex-Rico 23	38.3	40.0	35.3	19.4	94.0	71.3	143.9	460	201	1338
A 176	45.0	45.0	42.0	20.3	93.0	66.7	155.4	465	208	1458
997-CH-173	40.0	43.3	38.3	20.8	86.0	70.0	131.5	463	300	1814
K 20	43.3	45.0	36.7	19.8	91.0	67.0	107.4	342	388	1354
GLP 24	45.0	50.0	40.0	19.8	92.0	71.8	103.7	399	345	1436
GLP 1004	46.7	45.0	39.0	19.8	86.0	70.6	78.1	479	433	1620
GLPx 92	46.7	50.0	34.3	18.9	90.0	80.1	80.9	346	431	1193
ZPv 292	41.7	38.3	34.0	21.0	83.0	74.2	85.6	321	463	1211
Carioca	43.3	50.0	43.0	20.7	89.0	71.5	133.4	484	228	1421
INIA 10	38.3	38.3	38.3	18.9	86.7	65.5	91.3	348	371	1097
INIA 12	43.3	45.0	39.3	19.6	87.0	72.8	72.2	379	401	1073
HF 465-63-1	41.7	45.0	43.0	19.6	93.0	70.4	144.2	478	184	1260
Calima	41.7	38.3	35.0	18.6	83.0	72.4	70.5	302	552	1158
Ikinimba	50.0	50.0	34.0	20.6	89.0	80.2	102.8	384	451	1753
Ubososera 6	50.0	50.0	43.0	18.3	99.0	68.6	85.8	398	254	849
A 197	45.0	40.0	36.0	19.9	88.0	74.1	73.0	282	559	1101
A 370	50.0	50.0	45.3	17.3	96.0	66.0	142.7	310	268	1105
A 410	46.7	50.0	35.3	18.8	89.0	72.6	114.7	387	383	1685
Kilyumukwe	38.3	40.0	35.3	13.8	90.0	65.3	79.0	279	540	1170
Nain de Kyondo	50.0	48.3	43.7	19.9	98.0	68.7	86.5	442	247	899
G 13671	50.0	50.0	39.7	20.2	92.0	78.5	85.5	424	424	1523
G 2816	50.0	50.0	35.0	19.8	90.0	81.1	116.0	432	405	1996
G 12470	45.0	45.0	38.0	19.8	94.0	65.4	88.0	319	531	1424
XAN 76	45.0	46.7	42.7	20.8	95.0	72.2	160.6	443	204	1419
Mean	44.7	45.7	38.5	19.4	90.3	71.6	104.7	394	360	1332
S.E. ±	1.83	1.8	0.34	0.60	0.07	1.74	14.72	37.3	21.6	102.7
C.V (%)	7.1	7.1	1.5	5.3	0.1	4.2	24.4	16.4	10.4	13.4
Significance	***	***	***	***	***	***	***	***	***	***

Table 47. Disease reactions of entries in AFBYAN II at Selian in 1990.

Entries	Anth	ALS	Rust	FLS	Scab	CBB	BCMV
Red Wolaita	1.00	3.33	5.00	3.33	1.00	2.67	1.33
Ex-Rico 23	1.00	2.00	2.67	3.33	1.00	1.33	1.00
A 176	1.00	2.00	1.00	3.00	1.00	2.00	1.00
997-CH-173	1.00	3.33	1.00	3.33	1.00	1.33	1.00
K 20	1.00	3.00	1.00	1.33	2.00	2.00	1.00
GLP 24	1.00	3.00	1.33	2.33	1.00	1.00	1.00
GLP 1004	1.00	3.00	2.00	2.00	2.00	1.33	1.00
GLPx 92	1.00	3.33	3.67	1.33	1.00	2.67	1.33
ZPv 292	1.00	4.00	1.00	2.33	2.00	1.00	1.00
Carioca	1.00	2.67	1.00	4.00	1.00	2.33	1.00
INIA 10	1.67	3.33	3.33	2.67	1.33	1.33	2.00
INIA 12	1.67	4.00	3.00	2.67	1.00	1.33	1.00
HF 465-63-1	1.33	2.00	3.00	3.00	1.00	2.00	2.67
Calima	1.00	4.00	1.33	2.33	1.33	1.00	1.00
Ikinimba	1.00	2.33	3.00	1.33	1.00	2.67	1.00
Ubososera 6	1.00	2.67	1.67	3.00	1.00	2.00	1.00
A 197	1.00	4.00	1.33	4.00	1.00	2.33	1.00
A 370	1.00	2.33	1.00	3.00	1.00	1.33	1.00
A 410	1.00	2.33	1.00	3.33	1.00	1.33	1.00
Kilyumukwe	1.00	3.00	1.00	3.33	1.00	1.00	1.00
Nain de Kyondo	1.00	2.67	1.00	3.33	1.00	1.33	2.00
G 13671	1.00	1.67	1.00	2.33	1.00	2.00	1.00
G 2816	1.00	2.33	1.33	3.00	1.00	1.00	1.00
G 12470	1.00	3.00	1.00	3.00	1.00	1.33	1.00
XAN 76	1.00	2.33	1.00	3.33	1.00	1.67	1.00
Mean	1.07	2.87	1.79	2.80	1.15	1.65	1.17
S.E. ±	0.201	0.245	0.210	0.434	0.189	0.397	0.198
C.V (%)	32.6	14.8	20.4	26.9	28.6	41.7	29.3
Significance	NS	***	***	***	***	*	***

Table 48. Agronomic and yield data of entries in AFBYAN II at Selian in 1991.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Stand at harvest	DM	Pods/ m2	Seeds/ pod	Seed size g/seed	Seed yield (kg/ha)
Red Wolaita	35.0	35.0	47.0	15.2	94.0	145.6	404	252	1451
Ex-Rico 23	46.7	35.0	41.0	20.2	95.0	165.9	525	210	1769
A 176	41.7	28.3	50.0	16.8	96.0	172.8	531	202	1782
997-CH-173	48.3	28.3	52.0	21.8	93.3	111.0	465	284	1403
K 20	50.0	28.3	43.0	24.3	92.7	127.7	356	450	1991
GLP 24	53.3	35.0	45.0	20.3	95.0	95.3	395	404	1571
GLP 1004	53.3	30.0	45.0	23.5	93.0	107.1	435	508	2282
GLPx 92	41.7	31.7	35.3	27.8	93.3	159.4	383	456	2694
ZPv 292	48.3	26.7	37.0	25.7	92.0	101.1	439	563	2399
Carioca	46.7	25.0	48.0	20.3	93.0	193.6	534	230	2305
INIA 10	51.7	30.0	47.3	23.2	94.0	122.6	399	426	1988
INIA 12	51.7	35.0	41.0	23.8	94.0	133.1	354	434	2051
HF-465-63-1	50.0	26.7	52.0	24.8	92.3	208.0	551	202	2214
Calima	50.0	28.3	38.0	20.2	92.0	95.1	344	585	1893
Ikinimba	43.3	35.0	39.7	25.5	94.3	165.1	373	418	2389
Ubososera 6	36.7	35.0	52.0	21.8	102.0	125.1	457	248	1378
A 197	53.3	31.7	44.0	26.7	96.0	45.6	328	655	958
A 370	38.3	33.3	50.0	20.7	96.0	198.1	494	259	2474
A 410	45.0	30.0	39.0	19.0	93.0	152.9	365	389	2090
Kilyumukwe	46.7	30.0	39.0	23.7	93.0	123.1	280	592	2006
Nain de Kyondo	36.7	35.0	53.0	18.3	102.0	142.1	545	270	2092
G 13671	36.7	35.0	42.0	24.8	92.3	140.9	394	397	2156
G 2816	38.3	31.7	40.0	26.8	92.0	177.5	432	352	2533
G 12470	53.3	26.7	49.3	26.5	102.0	83.8	346	570	1633
XAN 76	45.0	28.3	51.0	20.3	95.7	223.0	445	241	2301
Mean	45.7	31.0	44.8	22.5	94.7	140.7	423	384	1992
S.E. ±	2.35	2.02	0.59	2.71	0.24	21.22	28.1	16.3	270.2
C.V (%)	8.9	11.2	2.3	20.9	0.5	26.1	11.5	7.4	23.5
Significance	***	**	***	ns	***	***	***	***	**

Table 49. Disease reactions of entries in AFBYAN II at Selian in 1991.

Entries	Anth	ALS	Scab	BCMV
Red Wolaita	1.33	1.33	2.67	3.67
Ex-Rico 23	1.00	1.00	2.33	2.67
A 176	1.00	1.00	3.00	2.00
997-CH-173	1.00	1.00	3.00	3.33
K 20	1.00	1.00	3.00	2.00
GLP 24	1.00	1.33	2.33	3.00
GLP 1004	1.33	2.67	2.67	2.33
GLPx 92	2.00	1.67	2.67	3.67
ZPv 292	1.67	1.33	3.00	2.00
Carioca	1.00	1.00	3.00	3.00
INIA 10	1.33	1.67	2.67	2.33
INIA 12	1.33	2.67	2.33	2.67
HF-465-63-1	1.00	1.00	3.33	3.00
Calima	1.67	2.00	2.67	2.33
Ikinimba	1.00	1.67	3.00	4.33
Ubososera 6	1.33	1.00	3.00	3.67
A 197	1.67	1.67	3.33	3.33
A 370	1.00	1.00	2.67	3.00
A 410	1.00	1.00	2.33	3.00
Kilyumukwe	1.33	1.00	2.67	2.67
Nain de Kyondo	1.33	1.33	3.00	3.33
G 13671	1.00	1.00	3.33	3.33
G 2816	1.33	1.00	2.33	3.33
G 12470	1.00	1.33	2.67	2.33
XAN 76	1.00	1.00	2.67	3.00
Mean	1.23	1.35	2.79	2.93
S.E. ±	0.224	0.304	0.294	0.266
C.V (%)	31.6	39.1	18.3	15.7
Significance	ns	**	ns	***

Table 50. Agronomic and yield data of entries in **AFBYAN II** at Mbala in 1989.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand/ m^2	DM	Thresh-ing %	Pods/ m2	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	27.3	26.7	44.3	23.3	61.0	76.6	109.0	389	228	899
Ex-Rico 23	25.3	20.0	47.0	21.3	70.3	68.6	163.1	392	125	773
A 176	29.7	30.0	50.3	22.0	76.3	80.5	222.7	608	183	2440
997-CH-173	26.0	20.0	45.0	22.5	75.7	78.8	193.2	441	284	2373
K 20	29.0	26.7	45.7	23.5	70.3	72.1	127.3	283	371	1346
GLP 24	27.3	33.3	48.3	20.4	75.7	75.9	95.3	348	244	787
GLP 1004	31.3	30.0	46.3	17.7	66.0	74.1	79.8	409	322	1016
GLPx 92	28.3	33.3	43.7	18.2	65.0	87.4	132.9	371	395	1998
ZPv 292	31.7	16.7	43.0	20.6	61.0	72.2	126.4	318	378	1428
Carioca	26.0	30.0	50.3	21.8	75.7	82.2	185.2	493	210	2018
INIA 10	32.0	26.7	45.0	21.1	66.0	70.9	93.3	336	314	985
INIA 12	36.0	30.0	45.7	23.8	66.0	69.4	119.0	299	335	1190
HF 465-63-1	25.0	30.0	52.3	22.8	70.3	78.4	176.6	511	159	1416
Calima	34.0	26.7	44.3	23.9	65.0	74.9	128.4	290	403	1509
Ikinimba	32.0	35.0	43.0	25.0	61.0	85.2	126.9	449	332	2003
Ubososera 6	28.7	38.3	45.7	23.7	69.3	77.4	142.6	364	220	1178
A 197	33.0	23.3	44.3	18.6	67.0	78.4	120.6	232	591	1463
A 370	26.7	26.7	49.7	20.1	78.3	76.2	163.6	424	255	1794
A 410	30.0	30.0	43.7	21.8	68.3	77.4	151.9	408	292	1814
Kilyumukwe	31.3	16.7	43.7	21.2	63.3	72.8	112.8	289	433	1457
Nain de Kyondo	30.7	38.3	52.3	18.4	79.0	77.1	96.3	446	194	869
G 13671	31.3	38.3	47.7	19.3	75.0	75.9	183.9	391	315	2355
G 2816	28.0	16.7	44.3	20.2	66.0	79.8	150.4	381	317	1835
G 12470	28.7	26.7	49.7	12.5	77.7	80.1	70.6	377	494	1275
XAN 76	23.0	20.0	52.3	22.5	74.3	80.1	130.4	538	186	1250
Mean	29.3	27.6	46.7	21.0	69.7	76.9	136.1	391	303	1499
S.E. ±	1.58	4.15	0.55	1.82	1.14	2.41	21.96	35.9	40.6	274.2
C.V. (%)	9.3	26.0	2.0	15.0	2.8	5.4	27.9	15.9	23.2	31.7
Significance	***	**	***	*	***	***	***	***	***	***

Table 51. Disease reactions of entries in AFBYAN II at Mbala in 1989.

Entries	AB	BCMV
Red Wolaita	8.67	1.33
Ex-Rico 23	9.00	1.00
A 176	4.67	1.00
997-CH-173	4.00	1.00
K 20	7.33	1.33
GLP 24	9.00	2.33
GLP 1004	8.67	1.00
GLPx 92	8.67	1.33
ZPv 292	9.00	1.00
Carioca	7.67	1.00
INIA 10	9.00	1.00
INIA 12	9.00	1.00
HF 465-63-1	6.67	1.00
Calima	8.67	1.00
Ikinimba	9.00	1.00
Ubososera 6	6.67	3.67
A 197	8.33	1.00
A 370	6.33	1.00
A 410	9.00	1.00
Kilyumukwe	9.00	1.00
Nain de Kyondo	6.33	5.33
G 13671	8.33	1.00
G 2816	7.67	1.00
G 12470	4.00	1.00
XAN 76	6.33	1.00
Mean	7.64	1.37
S.E. ±	0.709	0.759
C.V. (%)	16.1	95.8
Significance	***	*

Table 52. Agronomic and yield data of entries in AFBYAN II at Gwebi in 1991.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand /m²	DM	Pods/ m²	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita	71.0		54.0	21.3	101.0	105.9	477	185	833
Ex-Rico 23	50.0		50.7	16.6	96.7	270.3	532	164	2188
A 176	53.3		55.0	17.1	96.7	218.4	497	222	2154
997-CH-173	41.7		52.3	17.3	98.0	150.6	484	276	2008
K 20	41.7		48.0	13.7	98.0	87.2	473	360	1346
GLP 24	53.3		51.3	11.3	100.0	93.1	454	299	1242
GLP 1004	51.7		49.3	13.8	98.0	114.8	353	566	2296
GLPx 92	51.7		49.0	14.2	100.3	103.4	328	407	1379
ZPv 292	36.7		44.7	14.0	92.3	94.1	452	343	1433
Carioca	51.7		55.7	17.4	96.7	165.3	570	239	2204
INIA 10	45.0		49.0	15.2	97.3	70.1	406	383	1058
INIA 12	65.0		49.3	19.3	98.0	100.3	380	354	1338
HF 465-63-1	45.0		55.0	17.2	98.7	128.1	676	203	1708
Calima	41.7		47.7	17.9	96.0	115.4	373	426	1746
Ikinimba	53.3		49.3	16.8	98.7	103.3	417	357	1325
Ubososera 6	60.0		52.3	18.3	99.3	90.0	517	218	883
A 197	53.3		49.3	14.4	96.7	84.8	487	457	1838
A 370	63.3		55.0	14.1	99.3	112.5	547	244	1500
A 410	55.0		48.7	20.8	96.0	147.5	464	337	2183
Kilyumukwe	53.3		46.7	11.5	99.3	68.3	354	568	1367
Nain de Kyondo	61.7		58.0	16.2	102.0	109.1	504	267	1454
G 13671	65.0		63.0	17.1	106.0	25.9	394	344	346
G 2816	41.7		50.3	19.0	98.7	150.6	424	318	2008
G 12470	56.7		53.0	12.6	102.0	86.4	370	417	1279
XAN 76	53.3		56.7	16.3	98.0	253.8	551	201	2596
Mean	52.6		51.7	16.1	98.5	122.0	459	326	1589
S.E. ±	4.58		0.75	1.82	0.63	24.26	46.1	39.4	155.9
C.V (%)	15.1		2.5	19.6	1.1	34.4	17.4	20.9	17.0
Significance	***		***	*	***	***	***	***	***

Table 53. Agronomic and yield data of entries in AFBYAN II at Kisozi in 1989S.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand /m²	DM	Thresh-ing %	Pods/ m²	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita			53.0	15.7	131.7					1504
Ex-Rico 23			53.0	16.9	134.7					763
A 176			61.3	19.6	129.0					896
997-CH-173			55.3	21.4	129.0					1263
K 20			52.0	19.8	122.7					977
GLP 24			57.0	18.9	134.0					1273
GLP 1004			53.7	19.4	119.0					1486
GLPx 92			49.0	16.9	123.3					875
ZPv 292			47.0	20.5	117.0					760
Carioca			61.3	19.4	126.0					1413
INIA 10			52.7	19.1	122.7					1113
INIA 12			52.7	19.7	122.0					852
HF 46S-63-1			61.3	22.1	130.3					1608
Calima			48.0	19.7	117.0					914
Ikinimba			47.0	18.5	118.0					1158
Ubososera 6			55.3	18.9	133.3					1686
A 197			51.3	19.6	120.3					793
A 370			61.3	19.2	134.3					1560
A 410			53.7	13.8	133.7					738
Kilyumukwe			45.0	20.8	123.3					1374
Nain de Kyondo			62.3	21.6	148.0					1727
G 13671			60.7	16.0	132.7					1322
G 2816			55.0	18.1	131.7					1104
G 12470			52.3	20.5	133.7					1231
XAN 76			61.7	19.4	134.0					1388
Mean			54.5	19.0	128.1					1191
S.E. ±			6.03	1.01	1.40					131.0
C.V (%)			1.6	1.9	9.2					19.1
Significance			***	***	***					***

Table 54. Disease reactions of entries in AFBYAN II at Kisozi in 1989S.

Entries	Anth	ALS	AB	Rust	BCMV
Red Wolaita	7.33	6.33	4.00	1.00	5.00
Ex-Rico 23	6.67	1.00	5.00	1.00	7.00
A 176	7.00	1.67	6.67	1.00	5.33
997-CH-173	6.33	7.00	1.33	1.00	7.00
K 20	2.33	3.67	5.33	1.00	1.33
GLP 24	2.00	4.67	4.33	1.00	4.00
GLP 1004	5.33	6.33	3.67	1.00	2.33
GLPx 92	2.67	7.00	4.33	3.67	3.33
ZPv 292	2.33	7.67	7.67	1.00	2.00
Carioca	7.00	4.67	4.67	1.00	5.67
INIA 10	2.33	5.33	6.33	1.00	2.67
INIA 12	3.67	4.33	6.67	1.00	2.00
HF 465-63-1	6.00	1.00	5.33	1.00	4.67
Calima	1.67	6.00	5.67	1.00	2.33
Ikinimba	1.00	5.67	5.67	6.33	1.33
Ubososera 6	7.00	3.33	3.67	1.00	5.00
A 197	2.67	7.33	7.67	1.00	2.67
A 370	6.33	3.67	4.00	1.00	3.33
A 410	3.67	2.67	5.67	1.00	2.67
Kilyumukwe	2.67	5.67	6.33	1.00	2.00
Nain de Kyondo	5.00	2.00	3.00	1.00	5.67
G 13671	2.00	5.00	7.00	1.00	4.33
G 2816	2.67	4.67	5.00	1.00	2.00
G 12470	2.67	2.33	4.67	1.00	2.00
XAN 76	4.67	1.00	6.00	1.00	5.00
Mean	4.12	4.40	5.19	1.32	3.63
S.E. ±	0.85	0.77	0.95	0.25	0.65
C.V (%)	35.7	34.5	31.6	32.4	31.0
Significance	***	***	**	***	***

Table 55. Agronomic and yield data of entries in AFBYAN II at Moso in 1989F.

Entries	Canopy height (cm)	Canopy width (cm)	DFF	Harvest stand /m²	DM	Thresh-ing %	Pods/ m²	Seeds/ 100 pods	Weight/ 1000 seeds(g)	Seed yield (kg/ha)
Red Wolaita			39.3	18.3						922
Ex-Rico 23			39.0	20.8						1719
A 176			46.0	22.0						1748
997-CH-173			41.0	22.6						1634
K 20			39.0	19.1						1826
GLP 24			41.0	19.9						1520
GLP 1004			39.0	21.6						1530
GLPx 92			33.0	22.0						1303
ZPv 292			33.0	22.3						2011
Carioca			45.0	21.8						1493
INIA 10			38.7	21.8						1598
INIA 12			39.0	19.9						1631
HF 465-63-1			45.3	20.4						1770
Calima			37.0	22.7						2272
Ikinimba			32.0	23.3						1655
Ubososera 6			39.0	21.0						1002
A 197			38.3	22.9						1723
A 370			41.7	18.9						1780
A 410			39.0	20.7						2270
Kilyumukwe			33.0	20.6						1935
Nain de Kyondo			46.3	20.1						392
G 13671			41.3	23.9						1343
G 2816			34.0	21.7						2311
G 12470			40.7	20.2						1800
XAN 76			46.0	23.0						2252
Mean			39.5	21.3						1658
S.E. ±			0.61	1.25						175.8
C.V (%)			2.7	10.2						18.4
Significance			***	ns						***

Table 56. Disease reactions of entries in AFBYAN II at Moso in 1989F.

Entries	Rust	CBB	BCMV
Red Wolaita	6.33	3.33	3.67
Ex-Rico 23	1.00	1.00	1.33
A 176	2.67	1.33	1.00
997-CH-173	2.33	1.00	1.33
K 20	1.00	1.00	1.33
GLP 24	3.33	1.00	1.33
GLP 1004	3.00	2.00	2.33
GLPx 92	8.33	1.00	2.00
ZPv 292	3.67	2.33	2.00
Carioca	1.00	3.00	1.00
INIA 10	4.00	3.67	3.67
INIA 12	3.67	1.67	2.00
HF 465-63-1	5.33	1.00	2.67
Calima	4.33	1.67	1.67
Ikinimba	7.00	1.33	1.67
Ubososera 6	7.67	1.33	2.67
A 197	2.33	1.67	3.00
A 370	4.00	1.00	2.00
A 410	1.00	1.33	1.00
Kilyumukwe	2.67	3.33	2.33
Nain de Kyondo	9.00	1.00	2.33
G 13671	1.00	1.00	1.00
G 2816	1.33	1.33	2.00
G 12470	1.33	1.00	1.33
XAN 76	1.00	1.00	1.00
Mean	3.53	1.61	1.91
S.E. ±	0.596	0.718	0.397
C.V (%)	29.2	77.2	36.0
Significance	***	ns	***

Table 57. Agronomic and yield data of entries in AFBYAN II at Gandajika in 1989.

Entries	Canopy height (cm)	Ground cover score	DFF	Stand at harvest	DM	Thresh-ing %	Pods/ m2	Seeds/ pod	Seed size g/seed	Seed yield (kg/ha)
Red Wolaita			43.0	20.4	52.3					302
Ex-Rico 23			41.0	18.6	50.0					334
A 176			42.3	23.8	53.3					668
997-CH-173			42.0	21.3	52.0					224
K 20			38.0	23.2	51.7					44
GLP 24			42.0	21.8	51.0					14
GLP 1004			37.3	18.2	51.0					119
GLPx 92			34.0	15.4	48.7					751
ZPv 292			30.3	22.0	46.0					129
Carioca			41.3	19.9	53.7					531
INIA 10			35.7	19.3	47.3					124
INIA 12			35.0	19.7	46.3					96
HF 465-63-1			45.3	20.6	55.0					392
Calima			34.0	20.3	48.3					24
Ikinimba			32.7	21.8	47.0					768
Ubososera 6			41.0	21.3	52.3					70
A 197			35.3	19.3	48.3					15
A 370			44.7	19.1	54.0					433
A 410			35.3	21.1	49.0					388
Kilyumukwe			31.7	18.3	48.3					194
Nain de Kyondo			46.3	22.3	60.0					1370
G 13671			41.0	23.1	51.7					855
G 2816			35.3	20.6	49.0					1705
G 12470			40.0	20.4	51.0					27
XAN 76			43.3	22.9	53.3					667
Mean			38.7	20.6	50.8					410
S.E. ±			0.95	1.73	0.67					196.7
C.V (%)			4.3	14.6	2.3					83.2
Significance			***	ns	***					***

Table 58. Disease reactions of entries in AFBYAN II at Gandajika in 1989.

Entries	WB	CBB
Red Wolaita	5.33	4.67
Ex-Rico 23	7.33	5.00
A 176	6.00	3.33
997-CH-173	6.00	2.33
K 20	7.67	5.33
GLP 24	6.00	3.00
GLP 1004	7.67	4.00
GLPx 92	6.00	3.67
ZPv 292	7.00	4.00
Carioca	7.00	4.33
INIA 10	5.67	3.67
INIA 12	5.00	2.67
HF	7.00	5.33
Calima	6.67	4.67
Ikinimba	7.00	4.00
Ubososera 6	6.33	4.00
A 197	6.33	2.67
A 370	6.67	4.67
A 410	6.00	3.67
Kilyumukwe	8.00	4.00
Nain de Kyondo	7.67	5.33
G 13671	6.00	6.67
G 2816	8.00	4.67
G 12470	7.67	6.67
XAN 76	6.00	4.33
Mean	4.27	6.64
S.E. ±	0.456	0.521
C.V (%)	18.6	13.6
Significance	***	**

Table 59. Correlation coefficients ($x10^2$) between predicted values of plant characters and seed yields in AFBYAN II in eastern Africa between 1988 and 1991.

	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 89F	BK1 89F	RAC 88S	KC0 89F	KC1 89F	KAW 88S
Plant characters and disease reactions											
CH	6	47''	-16	-9	-21	43''	9	43''	-	-	43''
CW	37''	46''	-18	9	40**	-29'	-2	-	-	-	34''
DFF	26'	21	14	-13	5	-45''	-6	20	26'	3	36''
DM	8	22	-18	-11	5	-60''	-12	-	22	-2	11
STH	26'	47''	29'	39''	-29'	51''	12	47''	56''	61''	11
Anth	-10	-	-	-	-	-8	-2	30'	-20	-1	-
ALS	-	-17	-	-	-	17	-2	-6	1	22	-57''
ALT	-	-14	-	-	-	-	-	-	-	-	-
AB	-	-	-23'	-	-	-	-	-13	-4	12	-
FLS	-	-6	-	-	-	9	12	43''	-	-	36''
Rust	-27'	-15	-	-	-	29'	6	6	20	11	-44''
WB	-	-	-	-	-45''	-	-	-	-	-	-9
WM	-	-	-	-	-	-	-	-	-	-	-
CBB	-14	-16	-18	8	-34''	52''	4	25'	10	23	-41''
HB	-	-	-36''	-	-	-	-	-10	11	8	-
BCMV	-	-30'	0	-	-	-21	-2	-17	-	-	-32''
Components of yield											
PM2	-	61''	-	61''	74''	58''	32	68''	-	-	69''
SPP	-	11	-	19	36''	-10	3	20	-	-	22
SW	25'	-1	0	0	0	37''	0	-16	-	-	-17

*, **, *** - level of probability less than 0.05, 0.01 and 0.001, respectively.

Table 60. Correlation coefficients ($x10^2$) betweet predicted values of plant characters and seed yields in AFBYAN II in southern Africa between 1988 and 1991.

	HUA 89	MAC 89	MAS 88	MAS 89	LIC 90	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91
Plant characters and disease reactions													
CH	35''	-33**	-	-29'	24'	-4	18	41''	-8	16	-12	13	-17''
CW	63''	9	-32''	9	53''	23'	-25'	46''	-33''	22	-8	-25'	-
DFF	-12	-28'	-83''	-40''	27''	-	-33''	-36''	-32''	-24'	-25*	-4	-13
DM	-6	-51''	-88''	-45''	43''	-3	-34''	-41''	-57''	-15	-28*	12	-54''
STH	40''	68''	-	71''	50''	23'	42''	12	38''	29''	17	4	5
Anth	-	-	-	-	-	-	-	-5	-	-24'	5	-	-
ALS	-	-	-	-	-	-	-53''	0	-	-33''	4	-	-
ALT	-	-	-	-	-	-	-	-	-	-	-	-	-
ASC	-	-	-	-	-	-	-	-8	-	-	-	-22	-
FLS	-	-	-	-	-	-	19	-	-	-14	-	-	-
Rust	-	-	-	-	-	-	-23'	-	-	-24'	-	-	-
WB	-	-	-	-	-	-	-	-	-	-	-	-	-
WM	-	-	-	-	-	-	-39''	4	-	-	-	-	-
Scab	-	-	-	-	-	-	-	-	-	-	-12	-	-
RR	-	-	-	-	-20	-	-	-	-	-	-	-	-
CBB	-	-14	-22	-22	-	-	3	-	-	-4	-	-	-
HB	-	-	-31''	-1	-	-	-	-	-	-	-	-	-
BCMV	-	-22	-40''	-8	-	-	-	-	-	-25'	-1	-31''	-
BSM	-	-	-	-	-32''	-	-	-	-	-	-	-	-
Nem	-	-	-	-	-56''	-	-	-	-	-	-	-	-
Components of yield													
PM2	84''	-	-	-	73''	69''	67''	53''	58''	44''	45**	65''	73''
SPP	37''	-	-	-	54''	10	8	-20	52''	29'	4	28'	29'
SW	9	-	-	-	-35''	5	37''	19	-9	9	1	14	-8

Table 61. Correlation coefficients ($x10^2$) between seed yields and predicted values of plant characters in AFBYAN II in the Great Lakes in 1989.

	KIS 89S	MOS 89F	GAN 89F
Plant characters and disease reactions			
Canopy height	-	-	-
Canopy width	-	-	-
DFF	43**	-22	13
DM	40**	-	28*
Stand/m^2	31**	20	13
Anthracnose	28*	-	-
ALS	-19	-	-
ALT	-	-	-
AB	-45**	-	-
FLS	-	-	-
Rust	-10	-57**	-
WB	-	-	14
WM	-	-	-
CBB	0	05	19
HB	-	-	-
BCMV	27	-3	-
Components of yield			
Pods/m^2	-	-	-
Seed/pod	-	-	-
Seed size	-	-	-

Table 62. Coefficients from multiple regressions of seed yields on predicted values of plant characters in AFBYAN II in eastern Africa between 1988 and 1990.

	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BKO 89F	BKI 89F	KAC 88S	KCO 89F	KCI 89F	KAW 88S
Plant characters and disease reactions											
CH	18	81**	-48*	20	21	-4	13	21	-	-	-13
CW	76*	89***	-10	58	46***	-29	-2	-	-	-	6
DFF	170***	59	78***	-100*	-18	-84	-23	9	19*	2	4
DM	-3	-24	-132***	-12	-74***	40	-69	-	-10	1	23*
STH	44*	107	186**	267***	-9***	77	45	135*	144**	145***	55
Anth	117	-	-	-	-	155	76	165	-136*	159***	-
ALS	-	-67	-	-	-	-75	42	-2	27	-5	-79
ALT	-	94	-	-	-	-	-	-	-	-	-
AB	-	-	-439*	-	-	-	-	-23	46	10	-
FLS	-	69	-	-	-	-28	92	15	-	-	-87
Rust	-325***	531	-	-	-	143	6	-15	3	32	-333**
WB	-	-	-	-	-153***	-	-	-	-	-	-36*
WM	-	-	-	-	-	-	-	-	-	-	-
CBB	-202	-40	-353**	-106	-172**	312*	-24	82	4	196**	168*
HB	-	-	-118	-	-	-	-	25	109	0	-
BCMV	-	-475*	-1274**	-	-	-175*	11	5	-	-	-304**
R^2(%)	52***	53***	53***	21**	54***	58***	5	43***	52***	54***	55***
Components of yield											
PM2	-	12***	-	12**	10***	10***	9***	11***	-	-	5***
SPP	-	6***	-	5	3***	5***	3	2**	-	-	2**
SW	2*	6***	0	7	4***	5***	3	2***	-	-	2**
R^2(%)	6*	57**	0	61***	78***	69***	13*	61***	-	-	64***

Table 63. Coefficients from multiple regressions of seed yields on predicted values of plant characters in AFBYAN II in southern Africa between 1988 and 1991.

	HUA 89	MAC 89	MAS 88	MAS 89	LIC 90	UIT 91	LAM 90	MAB 90	MIN 90	SEL 90	SEL 91	OMBA 89	GWE 91
Plant characters and disease reactions													
CH	3	-4**	-	5	-18	-23	6	20	6	-10	-56***	11	-8
CW	33**	2	6	8	73***	16	-25*	34	-17	31**	-41	-174***	-
DPP	2	9	-13	-7	-9	-	-17	-26*	-17	-40**	10	-72	63***
DM	23	-12***	-31***	-13*	12	14	-64***	-7	-30**	-33**	-52	29	-168***
STH	34**	130***	-	99***	12	111	57	-14	42*	59**	75***	25	-6
Anth	-	-	-	-	-	-	-	-223	-	196	-316	-	-
ALS	-	-	-	-	-	-	132*	-96	-	-285***	265	-	-
ALT	-	-	-	-	-	-	-	-	-	-	-	-	-
ASC	-	-	-	-	-	-	-	-8	-	-	-	-145*	-
FLS	-	-	-	-	-	-	-103	-	-	-14	-	-	-
Rust	-	-	-	-	-	-	-149**	37	-	-127***	-	-	-
WB	-	-	-	-	-	-	-	-	-	-	-605**	-	-
WM	-	-	-	-	-	-	-127*	-2	-	-	-	-	-
RR	-	-	-	-	-2	-	-	-	-	-	-	-	-
CBB	-	-45	-455*	-141*	-	-	-235**	-	-	-76	-	-	-
HB	-	25	168	83*	-	-	-	-	-	-	-	-	-
BCMV	-	-	-54	71	-	-	-	-	-	-4	-100	-326**	-
BSM	-	-	-	-	-33	-	-	-	-	-	-	-	-
Nem	-	-	-	-	-68***	-	-	-	-	-	-	-	-
R^2	50***	69***	79***	71***	56***	11	60***	47***	41***	60***	30**	38***	40***
Components of yield													
PM2	11***	-	-	-	12***	12***	8***	10***	6***	8***	12***	11***	10***
SPP	3***	-	-	-	2***	0	2***	2**	2***	4***	2	3**	3***
SW	4***	-	-	-	3***	1	3***	3***	2***	3***	3***	4***	4***
R^2	93***	-	-	-	67***	48***	82***	63***	54***	71***	44***	61***	75***

Table 64. Coefficients from multiple regressions of seed yields on predicted values of plant characters in AFBYAN II in the Great Lakes in 1989.

Character	KIS 89S	MOS 89F	GAN 89F
Plant characters and disease reactions			
Canopy height	-	-	-
Canopy width	-	-	-
DFF	25*	-39***	-78*
DM	19	-	138**
Stand/M^2	63**	19	13
Anthracnose	29	-	-
ALS	39	-	-
ALT	-	-	-
AB	-56	-	-
FLS	-	-	-
Rust	43	-123***	-
WB	-	-	-66
WM	-	-	-
CBB	-	-71	60
HB	-	-	-
BCMV	-59	-1	-
R^2(%)	42***	44***	16*
Components of yield			
Pods/m^2	-	-	-
Seeds/pod	-	-	-
Seed size	-	-	-
R^2(%)	-	-	-

Table 65. Mean squares for plant characters and disease scores in AFBYAN II in 2-27 environments (E) between 1988 and 1991.

Plant characters/ disease scores	No. of E	Mean squares				
		Environments (E)	Error (a)	Genotypes (G)	G x E	Error (b)
Canopy height ($cmx10^{-1}$)	18	73.77***	1.40	2.91***	0.66***	0.23
Canopy width ($cmx10^{-1}$)	20	63.55***	2.03	2.68***	0.59***	0.23
Canopy size (cm^2x10^{-3})	16	34.03***	0.61	0.65***	0.19***	0.07
DFF ($x10^{-1}$)	26	69.28***	0.79	7.84***	0.54***	0.08
Stand/m^2 ($x10^{-1}$)	26	24.04***	0.26	0.32***	0.12***	0.06
DM ($x10^{-2}$)	25	189.81***	0.26	11.14***	2.21***	0.10
Pods/m^2 ($x10^{-2}$)	17	14.66***	0.42	4.65***	0.34***	0.12
Seeds/100pods ($x10^{-2}$)	17	16.40***	0.49	15.57***	0.67***	0.44
Seed size ($x10^{-2}$)	19	12.70***	0.42	54.94***	0.72***	0.27
Seed yield ($x10^{-3}$)	27	44.02***	0.78	31.88***	6.05***	0.12
Anth	10	84.04***	2.19	1.63^{NS}	1.81***	0.48
ALS	12	87.38***	3.08	32.03***	2.32***	0.83
AB	7	344.32***	4.49	4.20*	2.61***	1.19
FLS	7	138.96***	6.00	4.94***	1.55***	0.83
Rust	13	76.57***	2.63	18.68***	3.28***	0.76
WB	3	401.32***	4.52	6.25^{NS}	7.33***	2.83
WM	2	0.17^{NS}	1.17	0.93^{NS}	1.39*	0.73
CBB	18	154.23***	2.47	5.96***	1.76***	0.74
HB	7	97.69**	13.27	5.85***	2.14***	1.25
BCMV	13	119.24***	1.42	5.67***	2.60***	0.60

*, **, *** - level of probability less than 0.05, 0.01 and 0.001, respectively.

Table 66. Percentage contributions of sources of variation to total sums of squares in AFBYAN 2 in 2-27 environments between 1988 and 1991.

Plant characters/ disease scores	Environ- ments (E)	Error (a)	Genotypes (G)	G x E	Error (b)
Canopy height	68.1	2.7	3.8	14.7	10.6
Canopy width	65.5	4.4	3.5	14.5	12.1
Canopy size	76.4	2.9	2.3	10.2	8.1
DFF	73.9	0.2	8.0	13.8	4.0
Stand	79.0	1.8	1.0	9.1	9.1
DM	73.1	0.2	4.3	20.5	1.9
Pods/m^2	3.8	2.4	18.9	22.4	16.5
Seeds/100 pods	20.8	1.3	29.6	20.2	28.1
Seed size	10.8	0.8	62.1	14.7	11.6
Seed yield	63.7	2.4	4.3	21.0	8.6
Anth	51.7	3.0	2.7	26.7	15.8
ALS	33.2	2.5	26.5	21.2	16.6
AB	68.8	2.1	3.4	12.5	13.3
FLS	54.2	5.5	7.7	14.5	18.1
Rust	32.2	2.4	15.7	33.1	16.6
WB	46.2	1.6	8.6	20.2	23.4
WM	0.1	3.6	17.1	25.6	53.6
CBB	62.3	2.1	3.4	17.1	15.1
HB	35.7	11.3	8.6	18.8	25.6
BCMV	52.5	1.4	5.0	27.5	13.7

Table 67. Canopy heights (cm) of genotypes in AFBYAN II trials in 18 environments between 1988 and 1991.

	Environments									
Genotypes	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KAC 8S	KAW 8S	LIC 90
Red Wolaita	43.0	28.3	51.7	53.3	28.3	33.3	40.0	33.3	36.3	26.7
Ex-Rico 23	44.3	36.7	58.3	50.0	37.7	56.7	60.0	26.7	40.7	20.0
A 176	48.7	31.7	53.3	60.0	40.0	50.0	50.0	25.0	39.0	23.3
997-CH-173	48.3	35.0	56.7	46.7	37.7	43.3	43.3	26.7	34.3	23.3
K 20	42.3	33.3	53.3	51.7	37.7	56.7	63.3	30.0	38.0	26.7
GLP 24	52.3	33.3	58.3	50.0	32.0	43.3	53.3	30.0	31.0	26.7
GLP 1004	48.7	36.7	56.7	50.0	36.0	56.7	56.7	31.7	42.0	30.0
GLPx 92	37.0	31.7	48.3	45.0	31.3	40.0	46.7	33.7	32.7	30.0
ZPv 292	38.3	36.7	51.7	45.0	31.7	53.3	53.3	26.7	34.0	30.0
Carioca	46.7	35.0	56.7	53.3	31.0	43.3	50.0	28.3	35.0	30.0
INIA 10	40.3	30.0	53.3	43.3	34.7	53.3	50.0	30.0	35.7	30.0
INIA 12	41.0	31.7	55.0	48.3	35.0	50.0	56.7	28.3	36.0	26.7
HF 465-63-1	41.7	33.3	51.7	56.7	40.3	53.3	56.7	26.7	36.3	30.0
Calima	37.7	31.7	50.0	48.3	40.0	63.3	70.0	28.3	34.7	20.0
Ikinimba	38.0	28.3	56.7	45.0	27.7	40.0	40.0	26.7	30.3	30.0
Ubososera 6	42.7	33.3	55.0	50.0	37.3	43.3	50.0	35.0	35.0	26.7
A 197	41.3	35.0	58.3	55.0	45.0	60.0	70.0	31.7	34.3	30.0
A 370	41.0	31.7	51.7	50.0	34.7	43.3	46.7	21.7	34.0	26.7
A 410	38.0	31.7	55.0	48.3	31.0	43.3	50.0	28.3	36.0	20.0
Kilyumukwe	45.7	40.0	46.7	50.0	35.0	56.7	56.7	31.7	36.3	26.7
Nain de Kyondo	44.7	41.7	58.3	55.0	36.7	46.7	50.0	30.0	40.0	36.7
G 13671	41.0	31.7	56.7	50.0	34.3	40.0	43.3	30.0	37.0	30.0
G 2816	34.3	33.3	48.3	45.0	32.0	43.3	46.7	23.3	31.7	23.3
G 12470	47.3	38.3	58.3	65.0	44.3	66.7	70.0	31.7	42.0	30.0
XAN 76	40.0	35.0	45.0	53.3	32.7	50.0	56.7	21.7	41.7	30.0
S.E. ±					2.75					
Mean	42.6	33.8	53.8	50.7	35.4	49.2	53.2	28.7	36.2	27.3
S.E. ±					1.37					
C.V (%)					11.9					

Table 67 (continued).

Genotypes	Environments								Means
	UIT 90	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	
Red Wolaita	26.3	45.0	35.0	36.7	41.7	36.7	27.3	71.0	38.5
Ex-Rico 23	20.3	40.0	28.3	36.3	38.3	36.7	25.3	50.0	39.8
A 176	24.7	43.3	30.0	38.0	45.0	48.3	29.7	53.3	40.4
997-CH-173	23.3	50.0	30.0	32.7	40.0	50.0	26.0	41.7	38.2
K 20	26.7	45.0	33.3	34.3	43.3	51.7	29.0	41.7	40.9
GLP 24	26.0	50.0	33.3	38.3	45.0	53.3	27.3	53.3	40.9
GLP 1004	22.7	48.3	38.3	26.7	46.7	45.0	31.3	51.7	42.4
GLPx 92	18.0	43.3	31.7	25.0	46.7	53.3	28.3	51.7	36.8
ZPv 292	16.7	51.7	30.0	37.0	41.7	51.7	31.7	36.7	38.6
Carioca	21.7	45.0	32.7	38.3	43.3	41.7	26.0	51.7	39.7
INIA 10	20.0	53.3	36.7	38.0	38.3	50.0	32.0	45.0	39.8
INIA 12	24.0	41.7	33.3	38.3	43.3	46.7	36.0	65.0	41.2
HF 465-63-1	23.7	40.0	31.7	38.3	41.7	53.3	25.0	45.0	40.1
Calima	21.3	50.0	36.7	32.3	41.7	35.0	34.0	41.7	40.7
Ikinimba	21.0	38.3	31.7	28.3	50.0	43.3	32.0	53.3	36.7
Ubososera 6	27.7	40.0	30.0	35.7	50.0	50.0	28.7	60.0	39.8
A 197	26.0	51.7	36.7	40.0	45.0	38.3	33.0	53.3	44.4
A 370	24.0	40.0	28.3	30.0	50.0	46.7	26.7	63.3	37.9
A 410	19.3	46.7	30.0	35.7	46.7	53.3	30.0	55.0	38.3
Kilyumukwe	22.7	41.7	41.7	39.0	38.3	48.3	31.3	53.3	41.1
Nain de Kyondo	30.0	43.3	30.0	33.3	50.0	46.7	30.7	61.7	42.0
G 13671	20.0	46.7	28.3	35.0	50.0	41.7	31.3	65.0	39.3
G 2816	20.3	43.3	28.3	28.3	50.0	38.3	28.0	41.7	35.5
G 12470	23.7	53.3	35.0	40.7	45.0	36.7	28.7	56.7	46.1
XAN 76	18.0	41.7	28.3	40.7	45.0	45.0	23.0	53.3	38.9
S.E. ±					2.75				0.65
Mean	22.7	45.3	32.4	35.1	44.7	45.7	29.3	52.6	
S.E. ±					1.37				
C.V (%)					11.9				

Table 68. Canopy widths (cm) of genotypes in APBYAN II trials in 20 environments between 1988 and 1991.

	Environments									
Genotypes	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KAW 8S	HUA 89	MAC 89
Red Wolaita	36.7	35.0	30.0	40.0	23.3	50.3	45.0	33.3	36.3	26.3
Ex-Rico 23	38.3	35.0	21.7	38.3	28.3	53.0	55.3	26.7	40.7	20.3
A 176	38.3	33.3	30.0	38.3	30.0	52.7	55.3	25.0	39.0	24.7
997-CH-173	40.0	35.0	36.7	38.3	28.3	57.7	52.7	26.7	34.3	23.3
K 20	36.7	33.3	33.3	35.0	20.0	45.0	47.7	30.0	38.0	26.7
GLP 24	38.3	33.3	40.0	40.0	30.0	57.7	53.0	30.0	31.0	26.0
GLP 1004	38.3	30.0	30.0	40.0	18.3	45.0	50.3	31.7	42.0	22.7
GLPx 92	40.0	26.7	28.3	38.3	30.0	53.0	53.0	33.7	32.7	18.0
ZPv 292	33.3	25.0	35.0	26.7	23.3	40.3	40.0	26.7	34.0	16.7
Carioca	40.0	28.3	33.3	40.0	28.3	60.0	57.7	28.3	35.0	21.7
INIA 10	28.3	33.3	33.3	40.0	21.7	47.7	47.7	30.0	35.7	20.0
INIA 12	38.3	33.3	38.3	36.7	26.7	53.0	50.3	28.3	36.0	24.0
HF 465-63-1	36.7	33.3	33.3	40.0	26.7	57.7	57.7	26.7	36.3	23.7
Calima	28.3	28.3	38.3	28.3	15.0	45.0	45.0	28.3	34.7	21.3
Ikinimba	33.3	30.0	30.0	38.3	33.3	55.3	57.7	26.7	30.3	21.0
Ubososera 6	38.3	36.7	33.3	40.0	35.0	50.3	45.0	35.0	35.0	27.7
A 197	36.7	28.3	40.0	35.0	25.0	47.7	47.7	31.7	34.3	26.0
A 370	38.3	36.7	26.7	40.0	35.0	55.3	60.0	21.7	34.0	24.0
A 410	38.3	30.0	35.0	33.3	30.0	50.3	55.3	28.3	36.0	19.3
Kilyumukwe	38.3	28.3	26.7	36.7	25.0	53.0	47.7	31.7	36.3	22.7
Nain de Kyondo	40.0	40.0	28.3	40.0	35.0	60.0	60.0	30.0	40.0	30.0
G 13671	40.0	35.0	31.7	40.0	33.3	50.3	53.0	30.0	37.0	20.0
G 2816	38.3	28.3	28.3	36.7	30.0	52.7	55.3	23.3	31.7	20.3
G 12470	40.0	30.0	40.0	40.0	33.3	45.0	47.7	31.7	42.0	23.7
XAN 76	38.3	35.0	26.7	40.0	31.7	57.7	57.7	21.7	41.7	18.0
S.E. ±						2.78				
Mean	37.3	32.1	32.3	37.6	27.9	51.8	51.9	28.7	36.2	22.7
S.E. ±						1.64				
C.V (%)						13.7				

Table 68 (continued).

Genotypes	Environments										Means
	MAS 88	MAS 89	LIC 90	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	
Red Wolaita	43.3	30.0	20.0	33.3	46.7	30.0	25.7	50.0	35.0	26.7	35.6
Ex-Rico 23	40.0	30.0	19.0	35.7	40.0	28.3	30.0	40.0	35.0	20.0	34.6
A 176	50.0	30.0	22.3	32.7	36.7	30.0	29.0	45.0	28.3	30.0	36.3
997-CH-173	40.0	31.7	19.0	38.3	41.7	30.0	23.3	43.3	28.3	20.0	36.1
K 20	53.3	36.7	19.0	38.0	41.7	28.3	29.3	45.0	28.3	26.7	33.4
GLP 24	51.7	36.7	22.3	40.0	43.3	30.0	30.0	50.0	35.0	33.3	35.7
GLP 1004	46.7	30.0	23.7	35.7	38.3	31.7	23.3	45.0	30.0	30.0	32.7
GLPx 92	53.3	35.0	23.7	40.7	46.7	30.0	21.7	50.0	31.7	33.3	36.7
ZPv 292	41.7	33.3	17.7	38.3	45.0	25.0	26.7	38.3	26.7	16.7	30.3
Carioca	43.3	30.0	25.0	38.0	40.0	35.0	26.7	50.0	25.0	30.0	37.2
INIA 10	50.0	36.7	19.0	32.3	43.3	28.3	28.3	38.3	30.0	26.7	33.4
INIA 12	45.0	32.7	19.0	38.3	43.3	28.3	27.7	45.0	35.0	30.0	35.4
HF 465-63-1	48.3	38.3	23.7	26.7	41.7	31.7	30.0	45.0	26.7	30.0	35.0
Calima	45.0	35.0	16.3	36.7	43.3	30.0	26.7	38.3	28.3	26.7	31.3
Ikinimba	38.3	31.7	22.3	28.3	35.0	30.0	20.0	50.0	35.0	35.0	36.5
Ubososera 6	45.0	33.3	19.0	34.3	43.3	28.3	26.7	50.0	35.0	38.3	35.7
A 197	40.0	28.3	23.7	30.0	45.0	28.3	28.3	40.0	31.7	23.3	32.8
A 370	41.7	41.7	23.7	39.0	40.0	28.3	25.0	50.0	33.3	26.7	35.9
A 410	50.0	33.3	16.7	38.3	43.3	30.0	26.7	50.0	30.0	30.0	35.5
Kilyumukwe	51.7	30.0	19.0	37.0	40.0	36.7	31.0	40.0	30.0	16.7	32.7
Nain de Kyondo	40.0	28.3	27.7	36.3	43.3	28.3	28.0	48.3	35.0	38.3	39.9
G 13671	43.3	31.7	26.3	25.0	48.3	26.7	27.7	50.0	35.0	38.3	38.3
G 2816	43.3	28.3	20.3	28.3	40.0	28.3	23.3	50.0	31.7	16.7	35.2
G 12470	46.7	28.3	20.3	35.0	48.3	31.7	37.7	45.0	26.7	26.7	35.2
XAN 76	41.7	28.3	23.7	40.7	43.3	28.3	29.3	46.7	28.3	20.0	36.3
S.E. ±						2.78					0.62
Mean	45.3	32.4	21.3	35.1	44.7	29.3	45.7	52.6	31.0	27.6	
S.E. ±						1.64					
C.V (%)						13.7					

Table 69. Canopy sizes (cm^2) of genotypes in AFBYAN II trials in 16 environments between 1988 and 1991.

	Environments							
Genotypes	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KAW 8S
Red Wolaita	1567	992	1550	2133	675	1837	1800	2010
Ex-Rico 23	1715	1283	1258	1917	1068	3180	3320	2251
A 176	1870	1058	1608	2308	1208	2967	2767	2067
997-CH-173	1933	1233	2075	1792	1067	2400	2283	1633
K 20	1593	1117	1783	1808	725	2700	3037	1424
GLP 24	2002	1133	2333	2000	960	2507	2827	1411
GLP 1004	1880	1117	1700	2000	667	2550	2843	1794
GLPx 92	1480	833	1367	1725	957	2120	2473	1555
ZPv 292	1293	917	1808	1217	750	2143	2100	1191
Carioca	1867	1000	1883	2133	867	2600	2883	1596
INIA 10	1357	1008	1783	1733	767	2533	2383	1540
INIA 12	1597	1042	2117	1767	933	2650	2870	1468
HF 465-63-1	1557	1108	1733	2267	1068	3083	3283	2101
Calima	1227	892	1917	1408	600	2850	3150	1404
Ikinimba	1307	850	1700	1733	922	2213	2283	1409
Ubososera 6	1650	1208	1833	2000	1310	2507	2300	1601
A 197	1530	983	2333	1925	1142	3197	3337	1133
A 370	1587	1175	1383	2000	1220	2307	2800	1624
A 410	1478	958	1917	1617	908	2473	2767	1801
Kilyumukwe	1763	1125	1233	1842	883	2827	2683	1188
Nain de Kyondo	1787	1667	1650	2200	1270	3000	3000	2302
G 13671	1640	1117	1792	2000	1135	2297	2297	1761
G 2816	1320	942	1383	1650	990	2590	2567	1516
G 12470	1893	1167	2333	2600	1468	3150	3337	1790
XAN 76	1558	1225	1200	2133	1050	3000	3260	1885
S.E.±				153.0				
Mean	1618	1086	1747	1916	984	2627	2746	1658
S.E. ±				90.4				
C.V (%)				18.1				

Table 69 (continued).

Genotypes	Environments								Means
	LIC 90	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	
Red Wolaita	540	547	2100	1050	948	2083	1283	740	1353
Ex-Rico 23	380	370	1600	808	1105	1533	1283	520	1485
A 176	517	493	1592	900	1152	2025	1392	917	1523
997-CH-173	450	567	2092	917	753	1758	1333	520	1441
K 20	510	720	1892	967	1001	1958	1567	817	1457
GLP 24	600	523	2167	1000	1233	2250	1692	907	1607
GLP 1004	737	387	1850	1225	633	2108	1333	947	1504
GLPx 92	710	240	2025	942	550	2333	1433	967	1349
ZPv 292	530	167	2358	750	1005	1600	1808	537	1228
Carioca	750	433	1808	1143	1025	2167	1200	790	1508
INIA 10	570	320	2317	1067	1082	1475	1417	850	1397
INIA 12	523	493	1792	950	1060	1950	1175	1117	1509
HF 465-63-1	710	237	1683	1008	1158	1875	1625	750	1560
Calima	327	213	2167	1125	870	1592	1225	913	1379
Ikinimba	670	350	1350	950	567	2500	1517	1140	1341
Ubososera 6	510	453	1725	858	958	2500	1417	1110	1468
A 197	710	357	2333	1050	1150	1800	1283	777	1569
A 370	627	560	1600	808	800	2500	1408	700	1441
A 410	333	330	2017	900	1017	2333	1867	913	1426
Kilyumukwe	510	453	1667	1550	1224	1542	1283	553	1414
Nain de Kyondo	1023	900	1875	850	937	2417	1633	1200	1698
G 13671	790	520	2250	758	968	2500	1308	1205	1502
G 2816	490	407	1742	808	667	2500	1225	477	1312
G 12470	610	337	2583	1117	1524	2033	1283	773	1750
XAN 76	710	287	1817	800	1187	2108	1275	460	1490
S.E.±				153.0					38.3
Mean	593	427	1936	972	983	2058	1411	824	
S.E. ±				90.4					
C.V (%)				18.1					

Table 70. Days to 50% flowering of genotypes in AFBYAN II trials in 26 environments between 1988 and 1991.

	Environments													
Genotypes	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KAC 8S	KC0 9F	KC1 9F	KAW 8S	HUA 89	MAC 89	MAS 88
Red Wolaita	42.3	44.7	40.7	41.7	37.0	41.0	41.3	57.0	67.7	64.0	42.7	43.0	61.7	53.3
Ex-Rico 23	41.7	43.0	39.3	39.0	33.3	38.7	39.0	60.0	57.7	66.3	45.7	44.7	50.0	54.0
A 176	46.3	46.3	42.7	42.0	36.0	40.7	40.0	69.7	69.0	64.7	49.0	47.0	52.0	59.3
997-CH-173	42.0	47.0	40.0	40.3	36.0	38.0	37.0	56.0	61.7	59.3	41.3	45.0	66.7	55.7
K 20	38.7	46.7	38.0	38.7	34.0	37.3	37.0	55.7	57.7	54.3	40.0	40.0	63.3	53.7
GLP 24	43.0	45.3	41.3	41.7	34.7	39.0	38.3	58.3	67.7	69.7	44.0	42.7	70.0	62.0
GLP 1004	42.3	48.0	39.0	39.7	30.7	37.0	37.0	56.3	63.0	60.3	39.3	39.0	42.0	60.0
GLPx 92	40.7	41.7	34.7	34.0	31.3	35.3	35.0	55.3	57.3	59.7	39.0	38.7	80.0	80.0
ZPv 292	34.7	42.3	35.3	33.3	27.0	31.3	34.0	51.3	51.0	58.3	36.3	32.3	50.0	46.0
Carioca	43.7	43.3	43.3	41.7	34.7	41.0	39.7	73.3	69.0	77.0	44.0	42.7	70.0	59.0
INIA 10	41.0	44.0	36.0	37.0	30.0	35.7	36.3	56.3	58.0	66.3	40.0	38.7	70.0	56.7
INIA 12	38.3	47.7	36.0	38.3	33.0	36.7	36.3	55.3	57.7	62.0	39.7	40.7	70.0	69.7
HF 465-63-1	41.7	43.7	45.0	43.3	35.3	41.0	40.7	70.0	74.0	64.0	49.0	45.7	60.0	57.0
Calima	36.7	45.3	35.3	35.0	29.7	35.3	34.7	53.7	55.7	56.3	37.7	36.3	60.0	52.7
Ikinimba	39.7	45.3	56.0	33.0	28.3	35.3	35.7	55.0	53.0	59.0	37.7	38.7	80.0	70.0
Ubososera 6	43.0	44.0	38.3	40.0	39.0	40.3	39.7	56.0	63.0	58.3	45.7	43.7	66.7	58.3
A 197	39.0	46.3	36.0	34.7	34.0	36.0	36.0	56.0	55.0	57.3	40.0	36.7	60.0	61.3
A 370	43.0	42.7	41.7	40.7	41.7	41.0	40.3	60.7	70.0	67.7	45.7	46.0	60.0	58.3
A 410	37.3	43.7	36.0	37.3	31.7	38.3	37.3	56.3	56.0	60.0	40.0	38.3	60.0	57.0
Kilyumukwe	37.3	42.7	34.7	34.0	28.3	33.0	33.0	51.0	53.7	58.7	38.0	32.0	70.0	57.0
Nain de Kyondo	45.3	45.3	45.3	42.3	43.0	42.0	41.0	71.0	72.7	69.7	45.7	48.3	70.0	64.3
G 13671	40.3	43.7	42.0	41.0	36.0	37.7	38.7	62.0	68.0	61.0	40.0	46.7	80.0	80.0
G 2816	38.3	41.3	36.0	35.0	31.3	37.7	38.7	55.3	58.0	63.0	39.7	38.3	80.0	80.0
G 12470	42.3	47.0	38.7	40.0	37.7	38.0	38.3	56.7	57.0	56.0	39.7	41.3	60.0	63.7
XAN 76	44.0	46.0	44.3	42.7	39.3	41.0	40.3	72.7	69.0	60.3	47.3	45.7	60.0	55.3
S.E. ±							1.59							
Mean	40.9	44.7	39.8	38.7	34.1	37.9	37.8	59.2	61.7	62.1	41.9	41.3	64.5	61.0
S.E. ±							0.33							
C.V (%)							5.9							

Table 70 (continued).

Genotypes	Environments												
	MAS 89	LIC 90	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	KIS 9S	MOS 9F	GAN 9F	Means
Red Wolaita	50.0	38.7	38.3	52.7	40.0	36.7	47.0	44.3	54.0	53.0	39.3	43.0	46.7
Ex-Rico 23	50.0	36.3	39.7	54.0	40.7	35.3	41.0	47.0	50.7	53.0	39.0	41.0	45.4
A 176	56.0	48.0	45.3	56.7	39.0	42.0	50.0	50.3	55.0	61.3	46.0	42.3	49.9
997-CH-173	55.0	37.3	40.7	51.7	38.3	38.3	52.0	45.0	52.3	55.3	41.0	42.0	46.7
K 20	51.3	38.7	35.3	50.0	40.7	36.7	43.0	45.7	48.0	52.0	39.0	38.0	44.4
GLP 24	60.0	39.7	38.7	53.7	41.0	40.0	45.0	48.3	51.3	57.0	41.0	42.0	48.3
GLP 1004	55.0	38.7	36.0	53.7	36.0	39.0	45.0	46.3	49.3	53.7	39.0	37.3	44.7
GLPx 92	80.0	31.0	35.7	46.7	37.3	34.3	35.3	43.7	49.0	49.0	33.0	34.0	45.1
ZPv 292	46.0	32.3	33.7	45.0	33.0	34.0	37.0	43.0	44.7	47.0	33.0	30.3	39.3
Carioca	57.0	45.7	42.3	57.3	38.3	43.0	48.0	50.3	55.7	61.3	45.0	41.3	50.3
INIA 10	58.0	38.0	39.3	50.0	36.7	38.3	47.3	45.0	49.0	52.7	38.7	35.7	45.2
INIA 12	64.7	38.3	39.0	52.3	37.7	39.3	41.0	45.7	49.3	52.7	39.0	35.0	46.0
HF 465-63-1	61.7	47.7	46.7	58.3	41.7	43.0	52.0	52.3	55.0	61.3	45.3	45.3	50.8
Calima	55.0	34.3	37.0	46.0	36.7	35.0	38.0	44.3	47.7	48.0	37.0	34.0	42.2
Ikinimba	80.0	27.7	37.3	44.0	35.3	34.0	39.7	43.0	49.3	47.0	32.0	32.7	44.9
Ubososera 6	59.0	38.7	46.7	54.7	41.7	43.0	52.0	45.7	52.3	55.3	39.0	41.0	47.9
A 197	60.0	35.7	40.7	48.7	37.7	36.0	44.0	44.3	49.3	51.3	38.3	35.3	44.2
A 370	58.0	44.0	44.7	56.3	41.7	45.3	50.0	49.7	55.0	61.3	41.7	44.7	49.7
A 410	50.7	34.3	39.7	49.7	37.7	35.3	39.0	43.7	48.7	53.7	39.0	35.3	43.7
Kilyumukwe	61.7	32.3	39.7	44.0	43.3	35.3	39.0	43.7	46.7	45.0	33.0	31.7	42.3
Nain de Kyondo	70.3	45.7	47.0	56.0	42.0	43.7	53.0	52.3	58.0	62.3	46.3	46.3	52.7
G 13671	80.0	39.3	41.7	53.0	38.7	39.7	42.0	47.7	63.0	60.7	41.3	41.0	50.2
G 2816	80.0	31.0	38.0	53.7	37.7	35.0	40.0	44.3	50.3	55.0	34.0	35.3	46.4
G 12470	60.0	39.3	39.7	51.7	43.3	38.0	49.3	49.7	53.0	52.3	40.7	40.0	46.7
XAN 76	50.0	48.3	44.7	58.0	42.7	42.7	51.0	52.3	56.7	61.7	46.0	43.3	50.2
S.E. ±						1.59							0.31
Mean	60.4	38.4	40.3	51.9	39.1	38.5	44.8	46.7	51.7	54.5	39.5	38.7	
S.E. ±						0.33							
C.V (%)						5.9							

Table 71. Days to maturity of genotypes in AFBYAN II trials in 23 environments between 1988 and 1991.

	Environments												
Genotypes	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KC0 9F	KC1 9F	KAW 8S	HUA 89	MAC 89	MAS 88
Red Wolaita	94.0	94.7	94.0	86.3	76.7	84.3	85.0	111.3	92.3	83.0	79.0	93.3	92.7
Ex-Rico 23	93.7	90.7	85.3	72.7	74.0	79.7	78.0	108.0	94.7	82.3	84.7	90.0	88.3
A 176	92.7	93.3	88.7	75.3	75.3	79.3	78.0	111.3	91.7	83.0	78.7	95.0	91.7
997-CH-173	93.3	89.7	87.0	75.0	76.7	80.0	79.3	110.3	89.0	81.0	84.0	95.0	92.0
K 20	93.3	90.7	86.3	74.3	74.0	78.7	78.0	107.3	85.0	81.0	76.7	110.0	89.0
GLP 24	95.3	95.0	90.0	76.3	82.0	84.3	86.3	118.3	93.3	83.0	79.0	104.3	93.3
GLP 1004	91.3	86.7	81.3	74.3	69.0	76.3	76.7	107.3	89.3	86.0	75.7	93.3	88.7
GLPx 92	94.0	89.0	83.3	74.7	76.7	78.3	81.3	104.0	96.0	86.0	77.7	170.0	150.0
ZPv 292	89.3	85.0	83.0	67.0	69.0	72.3	76.0	103.3	78.7	68.0	74.0	85 0	85.7
Carioca	94.0	89.0	84.3	76.3	74.0	78.7	79.0	112.0	92.0	81.0	82.0	120.0	99.3
INIA 10	92.0	86.7	85.7	73.0	71.3	77.3	77.7	106.0	89.0	81.0	77.0	106.7	90.0
INIA 12	92.0	89.0	84.0	73.3	73.3	78.7	77.7	107.0	90.3	86.0	76.0	110.0	99.7
HF 465-63-1	94.7	95.7	92.0	81.7	72.7	81.0	80.7	113.3	90.0	83.0	85.7	90.0	88.7
Calima	92.3	88.3	84.7	70.7	72.0	78.3	77.3	99.3	87.3	86.0	75.0	90.0	90.7
Ikinimba	93.7	88.3	87.0	73.0	75.3	77.0	78.0	105.3	83.7	86.0	79.3	170.0	150.0
Ubososera 6	95.7	93.7	87.3	81.0	82.0	88.7	88.7	112.0	92.0	89.0	85.7	110.0	88.7
A 197	93.7	91.0	84.3	75.0	76.7	80.7	80.0	108.0	87.0	86.0	77.0	90.0	94.7
A 370	97.3	95.0	92.3	82.0	79.3	85.0	87.7	111.0	92.7	88.0	83.7	90.0	89.0
A 410	94.0	88.3	83.3	71.3	75.3	79.0	78.0	111.3	88.0	81.7	77.3	90.0	91.7
Kilyumukwe	92.7	88.3	86.3	74.0	75.3	79.7	79.3	103.0	85.3	86.0	73.3	110.0	89.3
Nain de Kyondo	100.3	99.0	93.7	93.3	82.0	84.7	87.0	117.0	95.7	89.0	90.0	110.0	95.0
G 13671	95.7	91.7	91.3	86.7	76.7	81.0	82.0	110.0	96.7	81.7	94.0	170.0	150.0
G 2816	94.0	92.3	87.3	73.0	75.3	81.0	80.3	115.7	93.3	81.0	82.0	163.3	150.0
G 12470	96.7	96.7	92.3	87.7	84.0	83.3	81.0	111.0	90.0	83.0	85.0	100.0	111.7
XAN 76	95.7	97.3	90.7	77.0	75.3	80.3	80.7	113.3	91.7	83.0	84.7	90.0	89.7
S.E. ±							1.82						
Mean	94.1	91.4	87.4	77.0	75.8	80.3	80.5	109.5	90.2	83.4	80.7	109.8	101.6
S.E. ±							0.59						
C.V (%)							3.5						

Table 71 (continued).

	Environments												
Genotypes	MAS 89	LIC 90	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	KIS 9S	GAN 9F	Means
Red Wolaita	95.0	95.3	83.0	79.7	96.0	76.3	84.0	94.0	61.0	101.0	131.7	52.3	88.6
Ex-Rico 23	90.0	100.3	83.0	81.3	115.3	79.0	94.0	95.0	70.3	96.7	134.7	50.0	88.5
A 176	93.7	95.3	83.0	84.0	114.7	74.7	93.0	96.0	76.3	96.7	129.0	53.3	88.9
997-CH-173	95.0	92.7	83.0	83.3	112.0	76.0	86.0	93.3	75.7	98.0	129.0	52.0	88.3
K 20	110.0	90.0	83.0	84.0	111.3	77.3	91.0	92.7	70.3	98.0	122.7	51.7	88.3
GLP 24	96.0	95.3	85.7	86.3	115.3	81.0	92.0	95.0	75.7	100.0	134.0	51.0	91.5
GLP 1004	91.7	90.0	87.3	82.0	111.0	79.0	86.0	93.0	66.0	98.0	119.0	51.0	86.0
GLPx 92	150.0	90.0	83.0	79.7	98.7	74.0	90.0	93.3	65.0	100.3	123.3	48.7	94.3
ZPv 292	81.7	90.0	80.3	77.0	111.3	74.0	83.0	92.0	61.0	92.3	117.0	46.0	81.7
Carioca	100.0	98.0	85.7	79.3	102.0	70.3	89.0	93.0	75.7	96.7	126.0	53.7	89.2
INIA 10	96.7	90.0	92.7	82.7	110.0	73.3	86.7	94.0	66.0	97.3	122.7	47.3	86.9
INIA 12	123.3	90.0	83.0	82.7	116.0	73.3	87.0	94.0	66.0	98.0	122.0	46.3	88.7
HF 465-63-1	90.0	98.0	85.7	83.7	115.3	78.0	93.0	92.3	70.3	98.7	130.3	55.0	89.6
Calima	90.0	90.0	81.7	82.7	113.3	80.3	83.0	92.0	65.0	96.0	117.0	48.3	85.3
Ikinimba	150.0	90.0	83.0	81.3	98.0	74.0	89.0	94.3	61.0	98.7	118.0	47.0	93.2
Ubososera 6	106.7	98.0	91.0	83.7	116.7	73.0	99.0	102.0	69.3	99.3	133.3	52.3	92.7
A 197	90.7	90.0	87.3	83.3	113.3	81.7	88.0	96.0	67.0	96.7	120.3	48.3	87.5
A 370	90.0	98.0	87.3	83.3	115.3	80.7	96.0	96.0	78.3	99.3	134.3	54.0	91.4
A 410	90.0	92.7	83.0	78.3	115.3	75.7	89.0	93.0	68.3	96.0	133.7	49.0	86.9
Kilyumukwe	103.3	90.0	83.3	82.0	110.0	75.7	90.0	93.0	63.3	99.3	123.3	48.3	87.4
Nain de Kyondo	110.0	102.7	85.7	93.0	118.0	79.7	98.0	102.0	79.0	102.0	148.0	60.0	96.6
G 13671	150.0	98.0	87.3	78.3	115.3	74.0	92.0	92.3	75.0	106.0	132.7	51.7	98.4
G 2816	150.0	90.0	85.7	81.3	115.3	83.7	90.0	92.0	66.0	98.7	131.7	49.0	96.1
G 12470	100.0	92.7	88.3	86.7	117.3	87.0	94.0	102.3	77.7	102.0	133.7	51.0	93.4
XAN 76	90.0	102.7	84.7	82.3	115.3	76.7	95.0	95.7	74.3	98.0	134.0	53.3	90.1
S.E. ±							1.82						0.39
Mean	105.3	94.0	85.1	82.5	111.7	77.1	90.3	94.7	69.7	98.5	128.1	50.8	
S.E. ±							0.59						
C.V (%)							3.5						

Table 72. Stands/m² at harvest of genotypes in AFBYAN II trials in 26 environments between 1988 and 1991.

	Environments													
Genotypes	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KAC 8S	KC0 9F	KC1 9F	KAW 8S	HUA 89	MAC 89	MAS 89
Red Wolaita	15.0	16.8	20.4	21.0	15.8	6.9	7.4	6.7	2.0	3.3	9.2	16.3	14.0	15.8
Ex-Rico 23	15.1	21.9	20.3	21.2	17.4	9.3	10.5	6.5	4.6	5.1	8.5	13.7	11.0	13.2
A 176	17.1	16.9	21.6	22.1	20.9	8.7	12.3	8.6	6.3	5.3	8.3	18.1	15.1	11.5
997-CH-173	18.0	20.7	22.0	21.1	18.1	9.0	10.4	6.9	5.8	6.4	8.1	14.7	15.0	18.1
K 20	16.5	19.3	21.4	21.4	16.6	9.6	11.8	8.3	4.8	6.5	7.8	20.8	11.4	10.7
GLP 24	17.5	18.4	20.6	22.2	13.2	9.0	7.4	7.9	4.7	3.7	8.3	20.5	12.1	8.3
GLP 1004	17.4	19.6	22.7	22.8	15.9	13.2	14.1	8.0	5.2	9.4	7.0	16.1	9.0	7.4
GLPx 92	15.8	20.1	21.8	22.3	20.0	9.3	9.8	8.3	5.7	6.5	7.1	18.5	12.5	12.5
ZPv 292	18.7	20.8	21.8	18.3	15.8	10.0	9.4	7.4	3.5	4.1	7.4	20.4	9.0	13.5
Carioca	17.7	16.5	22.5	21.7	14.8	12 0	12.7	8.1	4.7	7.0	6.6	25.1	16.6	18.0
INIA 10	12.1	20.6	22.4	22.1	16.7	11.0	11.8	7.3	6.3	6.1	6.7	14.5	12.5	8.9
INIA 12	18.0	20.5	21.4	20.4	14.2	9.4	8.5	7.3	5.8	6.5	8.9	14.1	8.8	10.4
HF 465-63-1	17.8	20.4	20.4	21.5	18.5	11.3	16.7	8.9	5.3	7.2	9.0	14.9	15.7	14.0
Calima	17.4	19.1	23.9	20.5	16.3	12.6	15.3	8.9	6.1	5.7	8.5	19.0	11.9	9.4
Ikinimba	18.1	20.4	20.9	21.6	17.5	8.6	10.8	8.0	7.2	7.2	8.9	21.2	12.5	12.5
Ubososera 6	17.3	18.3	21.0	20.8	16.6	4.0	4.3	8.2	7.2	8.3	7.3	15.5	15.6	7.1
A 197	20.0	19.8	21.4	23.1	20.6	9.6	12.1	8.0	8.3	8.3	7.3	16.0	11.8	8.5
A 370	13.2	18.0	20.7	21.3	17.5	7.0	8.2	7.3	6.5	6.4	6.8	14.9	14.3	18.5
A 410	15.3	18.9	21.4	22.5	17.1	8.3	9.8	7.0	6.0	5.3	7.0	20.4	17.1	16.7
Kilyumukwe	17.3	21.4	18.8	20.2	14.4	12.1	13.0	6.2	7.4	7.5	7.3	13.8	10.0	7.3
Nain de Kyondo	15.9	20.7	22.9	19.7	12.6	10.2	8.3	8.0	5.8	5.0	7.3	16.7	11.4	17.3
G 13671	18.1	16.9	21.1	22.4	18.1	8.7	10.4	8.0	6.6	5.4	7.3	19.0	12.5	12.5
G 2816	16.7	17.9	23.2	23.1	15.7	8.7	10.8	8.2	4.9	6.4	7.1	18.1	12.5	12.5
G 12470	19.9	17.6	23.0	21.0	15.6	8.9	10.6	7.7	6.4	6.2	7.7	13.8	8.8	8.8
XAN 76	19.7	20.9	22.5	23.4	16.2	12.8	12.2	7.4	5.3	8.0	8.3	16.9	18.1	14.7
S.E. ±								1.36						
Mean	17.0	19.3	21.6	21.5	16.6	9.6	10.7	7.7	5.7	6.3	7.8	17.3	12.8	12.3
S.E. ±								0.59						
C.V (%)								15.4						

Table 72 (continued).

Genotypes	LIC 90	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	KIS 9S	MOS 9F	GAN 9F	Means
						Environments							
Red Wolaita	17.5	3.8	15.9	19.1	15.4	19.8	15.2	23.4	21.3	15.7	18.3	20.4	14.5
Ex-Rico 23	17.7	3.8	17.3	18.5	16.4	19.4	20.2	21.3	16.6	16.9	20.9	18.7	14.8
A 176	15.0	4.1	18.3	19.7	16.6	20.4	16.8	22.0	17.1	19.6	22.0	23.7	15.7
997-CH-173	19.5	4.3	18.4	19.9	18.8	20.9	21.8	22.5	17.3	21.4	22.6	21.2	16.3
K 20	13.7	4.8	18.9	17.8	16.0	19.8	24.3	23.5	13.7	19.8	19.1	23.2	15.4
GLP 24	15.1	4.4	17.9	18.9	13.6	19.8	20.3	20.4	11.3	18.9	19.9	21.8	14.5
GLP 1004	15.4	2.7	17.8	19.0	16.2	19.8	13.5	17.7	13.8	19.4	21.6	18.2	15.1
GLPx 92	17.5	2.7	16.3	18.0	17.6	18.9	27.8	18.2	14.2	16.9	22.0	15.4	15.2
ZPv 292	12.4	4.1	18.6	18.6	12.8	21.0	25.7	20.6	14.0	20.5	22.3	22.0	15.1
Carioca	17.7	3.9	18.5	19.9	17.3	20.7	20.3	21.8	17.4	19.4	21.8	19.9	16.3
INIA 10	13.2	3.3	19.1	19.5	17.0	18.9	23.2	21.1	15.2	19.1	21.8	19.3	15.0
INIA 12	12.2	4.6	17.3	17.8	16.4	19.6	23.8	23.8	19.3	19.7	19.9	19.7	14.9
HF 465-63-1	17.8	3.1	18.8	20.1	16.1	19.6	24.8	22.8	17.2	22.1	20.4	20.6	16.3
Calima	12.8	3.6	18.3	18.5	12.7	18.6	20.2	23.9	17.9	19.7	22.7	20.3	15.5
Ikinimba	16.3	2.5	17.0	20.6	16.3	20.6	25.5	25.0	16.8	18.6	23.3	21.8	16.1
Ubososera 6	17.8	3.0	14.5	19.2	10.8	18.3	21.8	23.7	18.3	18.8	21.0	21.2	14.6
A 197	16.9	2.1	19.9	19.2	16.8	20.0	26.7	18.6	14.4	19.6	22.9	19.3	15.8
A 370	16.9	2.5	16.0	17.0	17.0	17.3	20.7	20.1	14.1	19.2	18.9	19.1	14.6
A 410	15.6	2.9	17.3	21.2	14.6	18.8	19.0	21.8	20.8	13.7	20.7	21.1	15.4
Kilyumukwe	14.3	4.1	15.5	19.6	17.0	13.7	23.7	21.2	11.5	20.8	20.6	18.3	14.5
Nain de Kyondo	16.9	3.6	15.3	19.3	16.8	19.9	18.3	18.4	16.2	21.6	20.1	22.3	15.0
G 13671	15.8	3.8	15.7	18.4	15.9	20.2	24.8	19.3	17.1	16.1	23.9	23.1	15.4
G 2816	17.8	2.7	14.8	20.2	12.0	19.8	26.8	20.2	19.0	18.1	21.7	20.6	15.4
G 12470	15.6	2.3	18.4	17.9	14.6	19.8	26.5	12.5	12.6	20.6	20.2	20.4	14.5
XAN 76	20.9	2.6	17.9	20.5	17.0	20.9	20.3	22.6	16.3	19.4	23.1	22.9	16.6
S.E. ±						1.36							0.27
Mean	16.1	3.4	17.4	19.1	15.7	19.5	22.5	21.1	16.1	19.0	21.3	20.6	
S.E. ±						0.59							
C.V (%)						15.4							

Table 73. Number of pods/m^2 of genotypes in AFBYAN II trials in 17 environments between 1988 and 1991.

Genotypes	Environments								
	AWA 89	MEL 89	PAW 89	BK0 9F	BK1 9F	KAC 8S	KAW 8S	HUA 89	LIC 90
Red Wolaita	133.7	156.2	51.4	88.9	52.0	50.0	96.5	115.4	69.7
Ex-Rico 23	349.5	347.8	176.4	205.3	253.5	86.4	364.4	97.2	136.1
A 176	197.1	323.9	143.9	168.5	217.5	129.2	177.7	130.8	67.9
997-CH-173	270.4	268.3	90.9	73.2	79.6	68.3	100.2	117.2	89.0
K 20	175.0	155.3	53.1	154.4	104.4	61.9	101.7	117.1	60.6
GLP 24	129.9	133.2	46.5	84.3	61.2	50.8	78.9	71.0	67.7
GLP 1004	130.1	180.9	32.9	177.6	145.5	46.9	65.1	87.4	47.3
GLPx 92	192.7	283.9	121.1	85.7	96.7	103.3	96.0	116.7	63.0
ZPv 292	123.9	127.4	64.9	127.9	127.8	57.8	109.2	77.1	29.1
Carioca	202.1	306.7	117.2	83.9	127.7	94.3	87.0	169.7	127.5
INIA 10	144.5	154.1	33.4	114.4	78.9	44.2	62.6	115.1	43.6
INIA 12	141.8	158.1	42.4	189.8	106.4	37.3	57.7	124.1	38.3
HF 465-63-1	203.5	245.9	120.2	163.2	197.8	136.1	256.9	159.5	113.7
Calima	120.0	150.8	54.6	138.2	142.0	39.8	68.1	86.7	35.3
Ikinimba	128.0	235.6	89.1	134.7	117.4	82.2	79.2	178.8	70.2
Ubososera 6	196.9	199.4	68.1	39.6	32.2	97.8	90.5	86.7	81.1
A 197	166.5	173.7	64.8	115.6	101.8	51.3	81.7	70.0	54.2
A 370	166.7	249.5	106.9	50.9	76.2	79.2	103.6	128.5	101.2
A 410	154.0	304.4	107.6	88.5	82.7	35.8	132.8	129.5	48.4
Kilyumukwe	122.7	162.8	50.1	95.4	104.3	41.9	76.8	69.1	43.8
Nain de Kyondo	329.8	191.9	90.5	150.6	131.4	88.3	113.4	84.7	129.1
G 13671	167.8	210.1	65.5	67.9	62.8	91.8	138.3	121.4	92.7
G 2816	157.6	226.6	97.5	166.5	153.5	47.5	151.6	131.8	41.7
G 12470	160.9	207.4	49.1	67.3	74.0	36.4	75.5	49.2	43.3
XAN 76	211.5	324.1	137.9	228.5	265.6	70.6	162.3	119.6	126.4
S.E. ±					19.93				
Mean	179.1	219.1	83.0	122.4	119.7	69.2	117.1	110.2	72.8
S.E. ±					7.51				
C.V (%)					31.0				

Table 73 (continued).

Genotypes	Environments								Means
	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	
Red Wolaita	17.3	61.5	76.3	67.7	85.1	145.6	109.0	106.0	87.2
Ex-Rico 23	63.8	176.7	136.2	87.9	143.9	165.9	163.1	270.3	189.7
A 176	15.7	177.4	80.6	115.4	155.4	172.8	222.7	218.5	159.7
997-CH-173	92.2	59.1	118.2	134.6	131.6	111.0	193.2	150.6	126.3
K 20	58.0	111.0	95.7	84.3	107.4	127.7	127.2	87.2	104.8
GLP 24	14.3	98.1	77.4	31.7	103.7	95.3	95.3	93.1	78.4
GLP 1004	15.3	92.4	72.7	70.7	78.1	107.1	79.9	114.8	90.9
GLPx 92	13.9	89.9	119.0	97.0	80.9	159.4	133.0	103.4	115.0
ZPv 292	14.7	103.5	43.9	97.2	85.6	101.1	126.4	94.1	88.9
Carioca	22.1	99.6	122.3	118.7	133.4	193.6	185.2	165.3	138.6
INIA 10	47.1	88.0	64.4	79.3	91.3	122.6	93.3	70.1	85.1
INIA 12	15.0	83.8	59.7	79.0	72.2	133.1	119.0	100.3	91.6
HF 465-63-1	9.0	161.0	123.7	95.5	144.2	208.0	176.6	128.2	155.5
Calima	12.9	113.3	83.0	64.6	70.5	95.1	128.4	115.4	89.3
Ikinimba	16.6	83.1	118.9	101.3	102.8	165.1	126.9	103.4	113.7
Ubososera 6	12.8	70.3	84.2	77.7	85.8	125.1	142.6	90.0	93.0
A 197	17.2	101.5	66.6	51.5	73.0	45.6	120.6	84.8	84.7
A 370	20.2	80.4	83.5	101.2	142.7	198.1	163.6	112.5	115.6
A 410	15.8	134.2	65.9	76.1	114.7	152.9	151.9	147.5	114.3
Kilyumukwe	17.6	75.5	76.3	135.7	79.0	123.1	112.8	68.3	85.6
Nain de Kyondo	21.1	38.0	51.6	112.0	86.5	142.1	96.3	109.1	115.7
G 13671	17.1	47.7	104.9	79.8	85.5	140.9	184.0	26.0	100.2
G 2816	17.1	124.4	49.2	51.1	116.1	177.5	150.4	150.6	118.3
G 12470	5.8	71.5	51.3	38.2	88.0	83.8	70.5	86.4	74.0
XAN 76	11.4	165.6	89.0	136.0	160.6	223.0	130.4	253.8	165.7
S.E. ±					19.93				4.83
Mean	23.4	100.3	84.6	87.4	104.7	140.6	136.1	122.0	
S.E. ±					7.51				
C.V (%)					31.0				

Table 74. Seeds/100 pods of genotypes in AFBYAN II trials in 17 environments between 1988 and 1991.

	Environments								
Genotypes	AWA 89	MEL 89	PAW 89	BK0 9F	BK1 9F	KAC 8S	KAW 8S	HUA 89	LIC 90
Red Wolaita	527	467	526	439	567	488	551	547	513
Ex-Rico 23	502	431	506	480	507	449	451	469	502
A 176	560	509	493	452	536	412	577	440	513
997-CH-173	438	500	497	399	492	454	401	439	364
K 20	310	294	320	326	389	330	348	279	266
GLP 24	419	404	456	320	472	382	399	401	359
GLP 1004	476	422	547	367	490	401	503	418	416
GLPx 92	426	373	481	347	400	372	318	412	388
ZPv 292	383	367	448	447	439	397	333	318	318
Carioca	499	533	529	451	557	416	548	553	537
INIA 10	380	323	384	366	406	383	494	356	333
INIA 12	361	426	400	319	376	374	387	398	330
HF 465-63-1	388	587	489	486	527	444	503	431	513
Calima	357	341	362	363	368	370	357	297	287
Ikinimba	496	397	489	390	453	396	344	469	387
Ubososera 6	500	440	580	462	421	429	464	440	429
A 197	351	301	342	354	372	373	289	320	299
A 370	514	464	590	409	522	424	441	417	406
A 410	478	471	491	403	423	309	382	382	412
Kilyumukwe	373	348	389	380	419	361	357	333	304
Nain de Kyondo	479	560	554	428	549	438	548	410	474
G 13671	420	440	484	460	413	396	431	402	393
G 2816	474	402	494	426	454	346	414	407	418
G 12470	406	387	383	339	431	358	376	372	279
XAN 76	526	537	500	369	461	314	499	456	512
S.E. ±					38.1				
Mean	442	429	469	399	458	393	429	407	398
S.E. ±					8.1				
C.V (%)					16.2				

Table 74 (continued).

Genotypes	Environments								Means
	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	
Red Wolaita	453	501	447	294	479	404	389	477	475
Ex-Rico 23	558	451	458	340	460	525	392	532	471
A 176	320	518	522	349	465	531	608	497	488
997-CH-173	382	347	349	243	463	465	441	484	421
K 20	428	297	287	151	342	356	283	473	322
GLP 24	389	471	389	203	399	395	348	454	392
GLP 1004	438	471	330	226	479	435	409	353	422
GLPx 92	401	354	294	262	346	383	371	328	368
ZPv 292	360	390	314	235	321	439	318	452	369
Carioca	502	430	463	432	484	534	493	570	502
INIA 10	354	343	362	403	348	399	336	406	375
INIA 12	412	356	364	251	379	354	299	380	363
HF 465-63-1	323	491	467	273	478	551	511	676	479
Calima	317	307	299	201	302	344	290	373	326
Ikinimba	493	412	354	296	384	373	449	417	412
Ubososera 6	429	343	387	184	398	457	364	517	426
A 197	410	295	310	183	282	328	232	487	325
A 370	437	355	389	219	310	494	424	547	433
A 410	368	422	332	294	387	365	408	464	400
Kilyumukwe	359	299	360	314	279	280	289	354	341
Nain de Kyondo	493	471	432	179	442	545	446	504	468
G 13671	488	367	342	319	424	394	391	394	409
G 2816	446	433	339	236	432	432	381	424	409
G 12470	331	302	319	108	319	346	377	370	341
XAN 76	554	414	424	342	443	445	538	551	464
S.E. ±					38.1				9.2
Mean	418	394	373	261	394	417	391	459	
S.E. ±					8.1				
C.V (%)					16.2				

Table 75. Weight/1000 seeds (g) of genotypes in AFBYAN II trials in 19 environments between 1988 and 1991.

	Environments									
Genotypes	ALE 89	AWA 89	MEL 88	MEL 89	PAW 9F	BK0 8S	BK1 9F	KAC 8S	KAW 89	HUA 89
Red Wolaita	185	240	232	262	226	184	197	274	165	200
Ex-Rico 23	170	237	185	212	153	192	181	220	119	164
A 176	176	261	197	221	215	226	198	211	154	199
997-CH-173	274	369	305	274	273	309	278	296	192	250
K 20	394	472	445	448	302	363	392	437	297	314
GLP 24	275	427	351	330	208	301	301	406	229	242
GLP 1004	457	454	429	424	226	417	390	497	326	343
GLPx 92	469	432	489	438	365	447	380	360	340	338
ZPv 292	541	474	535	421	300	416	421	363	214	421
Carioca	188	244	240	221	214	249	222	295	175	184
INIA 10	387	445	420	378	323	350	321	460	271	357
INIA 12	373	542	435	355	289	288	358	442	329	325
HF 465-63-1	402	384	183	182	196	160	166	229	117	176
Calima	591	582	622	520	370	426	498	576	372	457
Ikinimba	428	373	446	395	314	346	332	365	294	307
Ubososera 6	219	285	257	231	191	210	218	291	198	235
A 197	555	510	588	593	443	511	587	565	464	507
A 370	214	328	287	280	234	304	275	316	196	210
A 410	365	317	363	289	288	356	355	438	227	304
Kilyumukwe	565	572	534	515	391	524	467	645	481	409
Nain de Kyondo	168	263	238	219	189	235	200	305	204	186
G 13671	339	393	378	382	308	328	428	394	250	263
G 2816	403	333	392	395	327	317	313	455	210	270
G 12470	407	424	518	376	299	405	416	540	386	363
XAN 76	171	364	198	195	181	189	192	433	143	183
S.E. ±					30.0					
Mean	349	389	371	342	273	322	324	393	254	288
S.E. ±					7.5					
C.V (%)					15.9					

Table 75 (continued).

Genotypes	Environments									Means
	LIC 90	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	
Red Wolaita	276	211	168	229	244	239	252	228	185	221
Ex-Rico 23	200	186	156	155	199	201	210	125	164	180
A 176	181	398	172	164	221	208	202	183	222	211
997-CH-173	297	305	200	245	294	300	284	284	276	279
K 20	440	288	303	331	307	388	450	371	360	374
GLP 24	328	260	214	363	284	345	404	244	299	306
GLP 1004	377	333	346	404	369	433	508	322	566	401
GLPx 92	488	372	297	358	374	431	456	395	407	402
ZPv 292	438	364	401	480	365	463	563	378	343	416
Carioca	247	198	228	197	231	229	230	210	239	223
INIA 10	408	328	401	390	224	371	426	314	384	366
INIA 12	434	311	263	375	287	401	434	335	354	365
HF 465-63-1	173	265	121	167	192	184	202	159	203	203
Calima	518	386	448	469	476	552	585	403	426	488
Ikinimba	430	244	324	349	300	451	418	332	357	358
Ubososera 6	283	271	234	222	221	254	248	220	218	237
A 197	533	237	554	453	481	559	655	591	457	518
A 370	261	244	245	218	237	268	259	255	244	257
A 410	381	352	283	324	319	383	389	292	337	335
Kilyumukwe	494	315	468	463	154	540	592	433	568	481
Nain de Kyondo	241	180	167	242	362	247	270	194	267	230
G 13671	402	232	373	305	338	424	397	315	344	347
G 2816	388	334	270	393	336	405	352	317	318	344
G 12470	449	338	324	473	364	531	570	494	417	426
XAN 76	204	225	218	191	196	204	241	186	201	217
S.E. ±				30.0						6.9
Mean	355	287	287	318	295	360	384	303	326	
S.E. ±				7.5						
C.V (%)				15.9						

Table 76. Seed yields (kg/ha) of genotypes in AFBYAN II trials in 27 environments between 1988 and 1991.

Genotypes	Environments													
	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KAC 8S	KC0 9F	KC1 9F	KAW 8S	HUA 89	MAC 89	MAS 88
Red Wolaita	937	1690	2042	1848	597	701	588	667	333	433	867	1261	678	2173
Ex-Rico 23	2210	3944	3217	3140	1352	1839	2322	845	678	456	1918	726	439	2198
A 176	1755	2844	3294	3469	1526	1696	2253	989	922	567	1574	1182	1195	2571
997-CH-173	2841	4008	4110	3655	1235	903	1087	911	656	756	764	1304	1097	2555
K 20	1722	2583	2548	2020	510	1709	1589	900	528	822	1033	982	879	1706
GLP 24	1940	2342	2933	1790	439	775	877	800	700	556	723	701	674	1873
GLP 1004	3038	2813	3106	3201	421	2722	2763	878	422	900	1068	1231	342	2275
GLPx 92	3849	3208	4248	4630	2002	1310	1469	1378	689	833	1032	1661	0	0
ZPv 292	2376	2267	3174	1958	839	2359	2356	839	361	200	607	1023	252	2678
Carioca	2328	2434	3627	3628	1292	935	1487	1178	656	889	834	1899	2103	2128
INIA 10	1710	2437	2265	1858	423	1349	1037	722	467	461	734	1460	517	1585
INIA 12	1952	2793	2453	2307	488	1338	1428	650	556	539	737	1576	291	1864
HF 465-63-1	1373	3015	2989	2608	1004	1274	1688	1294	994	978	1495	1211	1114	1747
Calima	2176	2536	3624	2668	728	2037	2594	822	556	656	876	1136	909	2773
Ikinimba	2818	2220	3986	3673	1325	1811	1786	1172	1000	994	799	2589	0	0
Ubososera 6	2054	2789	2812	1967	721	383	291	1217	933	1167	837	909	1308	1861
A 197	2451	2978	3267	3033	971	2055	2221	1083	972	456	1084	1123	819	2393
A 370	1816	2745	3465	3250	1437	623	1070	1056	1050	1083	900	1106	1371	1945
A 410	3094	2333	3906	3897	1476	1259	1244	478	600	722	1084	1503	1638	1596
Kilyumukwe	2049	2573	2728	2889	760	1895	2036	983	700	1089	1311	968	714	1837
Nain de Kyondo	1904	3940	3267	2310	938	1500	1443	1178	817	678	1230	657	537	1418
G 13671	3120	2922	3267	3542	971	1007	1105	1400	856	817	1481	1284	0	0
G 2816	3900	2471	4671	3551	1534	2187	2105	733	411	750	1355	1440	0	0
G 12470	1970	2747	2745	2884	565	911	1310	639	528	489	1092	711	448	1473
XAN 76	2572	3237	3842	3380	1230	1578	2244	689	711	922	1160	1082	1865	2231
S.E. ±								199.1						
Mean	2318	2795	3263	2926	991	1446	1616	940	684	728	1064	1229	768	1715
S.E. ±								102.3						
C.V (%)								25.5						

Table 76 (continued).

	Environments													
Genotypes	MAS 89	LIC 90	UIT 91	LAM 90	MAB 90	MIW 90	SEL 90	SEL 91	MBA 89	GWE 91	KIS 9S	MOS 9F	GAN 9F	Means
Red Wolaita	816	979	166	507	784	548	955	1451	899	833	1504	922	302	944
Ex-Rico 23	503	1360	678	1274	962	590	1338	1769	773	2188	762	1719	334	1464
A 176	443	630	198	1573	685	767	1458	1782	2440	2154	896	1748	668	1529
997-CH-173	2208	972	1145	408	1016	850	1814	1403	2373	2008	1263	1634	224	1600
K 20	182	722	648	993	906	430	1354	1991	1346	1346	977	1826	44	1196
GLP 24	295	808	144	975	1089	156	1436	1571	787	1242	1273	1520	14	1053
GLP 1004	116	806	230	1483	969	571	1620	2282	1016	2296	1486	1530	119	1470
GLPx 92	0	1190	208	943	1237	950	1193	2694	1998	1379	875	1303	751	1520
ZPv 292	396	405	188	1615	658	878	1211	2399	1428	1433	761	2012	129	1289
Carioca	1263	1686	210	891	1115	1152	1421	2305	2018	2204	1413	1493	531	1597
INIA 10	212	593	652	1058	902	524	1097	1988	985	1058	1113	1598	124	1071
INIA 12	59	595	196	788	815	566	1073	2051	1190	1338	852	1631	96	1119
HF 465-63-1	792	1012	69	958	961	453	1260	2214	1416	1708	1608	1770	392	1385
Calima	620	522	159	1462	1157	616	1158	1893	1509	1746	914	2272	24	1413
Ikinimba	0	1148	193	1101	1470	900	1753	2389	2003	1325	1158	1655	768	1483
Uboseera 6	219	990	141	526	725	360	849	1378	1178	883	1686	1002	70	1084
A 197	316	880	162	1662	928	467	1101	958	1463	1838	793	1723	15	1378
A 370	1320	1070	205	655	697	521	1105	2474	1794	1500	1560	1780	433	1409
A 410	1323	764	202	1597	707	712	1685	2090	1814	2183	738	2270	388	1530
Kilyumukwe	125	655	197	993	1285	666	1170	2006	1457	1367	1374	1936	194	1332
Nain de Kyondo	991	1517	181	314	538	536	899	2092	869	1454	1727	391	1370	1285
G 13671	0	1470	190	598	1092	828	1523	2156	2355	346	1322	1343	855	1328
G 2816	0	678	258	1392	658	409	1996	2533	1835	2008	1104	2311	1705	1555
G 12470	251	541	67	697	764	169	1424	1633	1275	1279	1231	1800	27	1099
XAN 76	948	1351	140	1462	708	902	1419	2301	1250	2596	1388	2252	667	1634
S.E. ±							199.1							38.3
Mean	536	934	273	1037	913	621	1332	1992	1499	1589	1191	1658	410	
S.E. ±							102.3							
C.V (%)							25.5							

Table 77. Anthracnose reactions of genotypes in AFBYAN II trials in ten environments between 1988 and 1991.

Genotypes	Environments										Means
	ALE 90	BK0 9F	BK1 9F	KAC 8S	KC0 9F	KC1 9F	MAB 90	SEL 90	SEL 91	KIS 9F	
Red Wolaita	1.00	1.00	1.00	3.00	1.67	1.67	3.33	1.00	1.33	7.33	2.23
Ex-Rico 23	1.00	1.00	1.00	2.33	2.00	2.67	2.00	1.00	1.00	6.67	2.07
A 176	1.00	1.00	1.00	2.33	2.00	2.33	2.33	1.00	1.00	7.00	2.10
997-CH-173	1.00	1.00	2.00	3.00	3.33	4.00	3.00	1.00	1.00	6.33	2.57
K 20	1.67	1.00	1.00	3.00	2.33	2.00	2.67	1.00	1.00	2.33	1.80
GLP 24	1.33	1.00	1.00	1.67	1.67	1.67	2.67	1.00	1.00	2.00	1.50
GLP 1004	1.00	1.00	1.00	2.33	3.33	3.00	3.00	1.00	1.33	5.33	2.23
GLPx 92	1.00	1.00	1.00	3.00	3.33	2.67	2.67	1.00	2.00	2.67	2.03
ZPv 292	1.00	1.00	1.00	1.67	3.00	2.33	2.67	1.00	1.67	2.33	1.77
Carioca	1.00	1.00	1.00	3.00	2.00	3.00	2.33	1.00	1.00	7.00	2.23
INIA 10	1.67	1.00	1.00	2.33	3.67	4.00	3.00	1.67	1.33	2.33	2.20
INIA 12	1.33	1.00	1.00	1.67	3.00	3.33	3.00	1.67	1.33	3.67	2.10
HP 465-63-1	1.33	1.33	1.00	2.33	2.00	2.00	2.67	1.33	1.00	6.00	2.10
Calima	1.67	1.00	1.00	1.00	3.00	3.33	3.00	1.00	1.67	1.67	1.83
Ikinimba	1.00	1.00	1.33	3.00	2.00	2.33	2.33	1.00	1.00	1.00	1.60
Ubososera 6	1.00	1.00	1.00	3.00	2.00	2.00	3.00	1.00	1.33	7.00	2.23
A 197	1.67	1.00	1.00	1.67	3.67	3.33	3.00	1.00	1.67	2.67	2.07
A 370	1.00	1.00	1.00	3.67	2.33	2.33	2.33	1.00	1.00	6.33	2.20
A 410	1.00	1.00	1.00	2.33	2.00	3.67	2.33	1.00	1.00	3.67	1.90
Kilyumukwe	1.33	1.00	1.00	2.33	3.00	3.00	3.00	1.00	1.33	2.67	1.97
Nain de Kyondo	1.00	1.00	1.00	3.00	1.67	1.66	2.67	1.00	1.33	5.00	1.93
G 13671	1.00	1.00	1.00	3.00	2.33	2.33	2.33	1.00	1.00	2.00	1.70
G 2816	1.33	1.00	1.00	3.00	3.00	3.00	2.67	1.00	1.33	2.67	2.00
G 12470	1.33	1.00	1.00	3.00	2.00	3.33	3.00	1.00	1.00	2.67	1.93
XAN 76	1.00	1.00	1.00	2.33	3.00	3.67	2.33	1.00	1.00	4.67	2.10
S.E. ±						0.401					0.127
Mean	1.19	1.01	1.05	2.52	2.53	2.75	2.69	1.07	1.23	4.12	
S.E. ±						0.171					
C.V (%)						34.5					

Table 78. Angular leaf spot reactions of genotypes in AFBYAN II trials in 11 environments between 1988 and 1991.

Genotypes	Environments												Means
	AWA 89	BK0 9F	BK1 9F	KAC 8S	KC0 9F	KC1 9F	KAW 8S	LAM 90	MAB 90	SEL 90	SEL 91	KIS 9F	
Red Wolaita	3.33	4.00	4.33	4.33	4.00	4.00	5.67	2.33	4.00	3.33	1.33	6.33	3.92
Ex-Rico 23	1.33	2.33	2.33	2.33	2.33	3.00	2.00	2.67	2.67	2.00	1.00	1.00	2.08
A 176	1.00	2.00	3.00	2.33	2.00	2.67	2.00	2.67	2.67	2.00	1.00	1.67	2.08
997-CH-173	1.67	4.67	4.67	3.67	3.33	5.00	6.33	2.67	3.67	3.33	1.00	7.00	3.92
K 20	3.67	5.33	5.00	4.33	3.67	4.00	6.67	3.00	3.00	3.00	1.00	3.67	3.86
GLP 24	1.67	5.00	5.33	6.33	2.67	4.00	6.67	2.33	3.00	3.00	1.33	4.67	3.83
GLP 1004	1.00	5.00	4.67	5.67	4.33	5.33	7.00	2.33	4.00	3.00	2.67	6.33	4.28
GLPx 92	1.00	6.00	5.67	5.00	5.00	4.67	7.67	3.33	2.67	3.33	1.67	7.00	4.42
ZPv 292	5.67	5.00	4.67	6.33	3.00	3.00	8.00	5.00	4.00	4.00	1.33	7.67	4.81
Carioca	1.00	3.33	4.00	3.67	2.00	2.67	3.33	3.00	2.67	2.67	1.00	4.67	2.83
INIA 10	4.33	4.67	4.67	5.67	4.67	4.67	7.00	3.33	4.33	3.33	1.67	5.33	4.47
INIA 12	2.67	5.00	4.67	6.33	3.00	4.33	7.33	3.67	3.67	4.00	2.67	4.33	4.31
HF 465-63-1	1.00	3.67	2.67	2.33	2.00	2.67	2.00	2.33	3.00	2.00	1.00	1.00	2.14
Calima	3.33	6.00	5.33	7.67	5.00	4.33	7.33	4.67	3.67	4.00	2.00	6.00	4.94
Ikinimba	1.00	5.67	5.00	3.67	4.67	4.67	7.00	3.67	2.00	2.33	1.67	5.67	3.92
Ubososera 6	1.00	3.67	3.67	4.33	3.33	4.00	4.00	2.67	2.33	2.67	1.00	3.33	3.00
A 197	3.00	4.33	4.67	6.33	3.67	5.00	7.33	4.67	4.00	4.00	1.67	7.33	4.67
A 370	1.00	3.67	4.00	3.67	2.33	2.33	3.33	2.33	2.00	2.33	1.00	3.67	2.64
A 410	3.33	3.33	3.67	2.33	2.67	3.00	3.67	3.67	2.67	2.33	1.00	2.67	2.86
Kilyumukwe	2.67	4.33	4.00	5.67	3.67	3.33	6.67	2.67	4.00	3.00	1.00	5.67	3.89
Nain de Kyondo	1.00	2.00	2.00	4.33	2.00	2.67	2.67	2.33	2.33	2.67	1.33	2.00	2.28
G 13671	2.00	3.67	4.00	3.00	3.00	2.67	3.33	2.00	2.67	1.67	1.00	5.00	2.83
G 2816	1.00	3.67	4.00	3.00	2.00	2.33	4.67	3.00	3.00	2.33	1.00	4.67	2.89
G 12470	1.00	3.67	3.33	5.00	4.33	3.00	6.00	2.33	4.00	3.00	1.33	2.33	3.28
XAN 76	1.00	2.67	2.33	2.33	2.00	2.33	2.33	2.33	2.33	2.33	1.00	1.00	2.00
S.E. ±						0.527							0.152
Mean	2.03	4.11	4.07	4.39	3.23	3.59	5.20	3.00	3.13	2.87	1.35	4.40	
S.E. ±						0.203							
C.V (%)						26.5							

Table 79. Ascochyta blight reactions of genotypes in AFBYAN II trials in seven environments between 1988 and 1991.

	Environments							
Genotypes	MEL 88	KAC 8S	KC0 9F	KC1 9F	MAB 90	MBA 89	KIS 9F	Means
Red Wolaita	1.33	5.00	3.67	4.00	2.00	8.67	4.00	4.10
Ex-Rico 23	1.00	2.33	4.67	4.00	2.00	9.00	5.00	4.00
A 176	1.33	2.33	4.00	4.33	1.67	4.67	6.67	3.57
997-CH-173	1.00	4.33	4.00	4.00	2.00	4.00	1.33	2.95
K 20	1.00	4.33	5.00	4.00	2.00	7.33	5.33	4.14
GLP 24	1.33	2.33	3.33	3.67	2.00	9.00	4.33	3.71
GLP 1004	2.00	3.00	4.00	5.00	2.00	8.67	3.67	4.05
GLPx 92	1.00	2.33	5.67	5.33	2.00	8.67	4.33	4.19
ZPv 292	1.33	3.66	5.00	4.33	2.00	9.00	7.67	4.71
Carioca	1.00	3.66	4.00	4.33	2.00	7.67	4.67	3.91
INIA 10	1.00	3.00	5.33	3.33	2.33	9.00	6.33	4.33
INIA 12	1.00	2.33	5.67	3.00	2.00	9.00	6.67	4.24
HF 465-63-1	1.33	1.66	3.67	4.33	2.00	6.67	5.33	3.57
Calima	1.00	2.33	4.33	4.00	2.00	8.67	5.67	4.00
Ikinimba	1.00	3.66	6.33	4.33	1.67	9.00	5.67	4.52
Ubososera 6	1.00	4.33	4.67	3.67	1.67	6.67	3.67	3.67
A 197	1.00	3.00	4.33	5.00	2.00	8.33	7.67	4.48
A 370	1.00	3.66	4.33	3.67	2.00	6.33	4.00	3.57
A 410	1.00	2.33	4.67	4.33	2.00	9.00	5.67	4.14
Kilyumukwe	1.33	3.00	4.67	5.33	2.00	9.00	6.33	4.52
Nain de Kyondo	2.00	3.66	3.67	3.00	2.00	6.33	3.00	3.38
G 13671	1.67	3.66	4.67	5.33	2.00	8.33	7.00	4.67
G 2816	1.00	3.00	5.33	4.33	2.00	7.67	5.00	4.05
G 12470	1.67	3.00	4.00	3.33	2.00	4.00	4.67	3.24
XAN 76	1.00	3.66	5.33	4.00	2.00	6.33	6.00	4.05
S.E. ±				0.629				0.238
Mean	1.21	3.19	4.57	4.16	1.97	7.64	5.19	
S.E. ±				0.245				
C.V (%)				27.3				

Table 80. Floury leaf spot reactions of genotypes in AFBYAN II trials in seven environments between 1988 and 1991.

Genotypes	Environments							Means
	AWA 89	BK0 9F	BK1 9F	KAC 8S	KAW 8S	LAM 90	SEL 90	
Red Wolaita	2.00	6.33	4.67	1.67	4.00	2.00	3.33	3.43
Ex-Rico 23	2.33	6.00	6.33	2.33	4.67	2.67	3.33	3.95
A 176	2.33	6.00	5.00	2.33	4.67	2.33	3.00	3.67
997-CH-173	2.33	5.67	6.33	1.67	5.67	2.33	3.33	3.91
K 20	1.00	5.00	5.00	1.67	2.67	3.00	1.33	2.81
GLP 24	1.33	5.33	5.33	1.67	3.00	2.33	2.33	3.05
GLP 1004	1.00	3.33	4.00	2.33	2.33	1.67	2.00	2.38
GLPx 92	3.00	4.33	4.67	1.67	3.33	1.00	1.33	2.76
ZPv 292	1.00	5.67	4.33	2.33	3.00	3.00	2.33	3.10
Carioca	1.67	4.00	5.00	3.00	3.67	2.33	4.00	3.38
INIA 10	1.33	5.00	4.67	1.67	2.33	3.67	2.67	3.05
INIA 12	2.33	4.67	5.00	2.33	3.33	3.00	2.67	3.33
HF 465-63-1	1.33	6.00	5.33	2.33	5.33	1.67	3.00	3.57
Calima	1.67	6.33	6.00	3.00	4.00	2.67	2.33	3.71
Ikinimba	1.33	3.33	3.33	1.67	4.00	1.00	1.33	2.29
Ubososera 6	1.67	4.00	5.00	1.67	3.67	1.33	3.00	2.91
A 197	2.00	5.33	6.00	2.33	2.67	3.00	4.00	3.62
A 370	2.67	4.00	4.33	2.33	4.67	2.33	3.00	3.33
A 410	2.67	5.00	4.67	2.33	5.67	1.67	3.33	3.62
Kilyumukwe	3.00	5.67	6.00	1.67	3.67	3.00	3.33	3.76
Nain de Kyondo	1.67	3.00	3.33	1.67	3.67	1.67	3.33	2.62
G 13671	2.67	5.67	6.00	2.33	5.33	2.00	2.33	3.76
G 2816	3.67	6.33	6.33	2.33	5.67	1.00	3.00	4.05
G 12470	1.67	5.33	6.33	3.00	3.00	2.67	3.00	3.57
XAN 76	1.67	4.00	5.00	1.67	4.33	3.33	3.33	3.33
S.E. ±				0.526				0.199
Mean	1.97	5.01	5.12	2.12	3.93	2.27	2.80	
S.E. ±				0.283				
C.V (%)				27.5				

Table 81. Rust reactions of genotypes in AFBYAN II trials in 13 environments between 1988 and 1991.

	Environments													
Genotypes	ALE 90	AWA 89	BK0 9F	BK1 9F	KAC 8S	KC0 9F	KC1 9F	KAW 8S	LAM 90	MAB 90	SEL 90	KIS 9F	MOS 9F	Means
Red Wolaita	5.00	3.33	3.33	3.67	6.33	2.33	2.67	1.33	3.67	5.67	5.00	1.00	6.33	3.82
Ex-Rico 23	1.33	1.00	2.67	2.67	4.33	4.00	2.33	1.00	1.00	2.33	2.67	1.00	1.00	2.10
A 176	1.00	1.00	3.00	2.67	3.00	2.00	4.33	1.00	1.33	2.00	1.00	1.00	2.67	2.00
997-CH-173	1.00	1.00	2.67	3.00	3.67	1.67	2.00	1.33	1.00	2.33	1.00	1.00	2.33	1.85
K 20	3.33	1.00	4.00	3.67	3.67	1.00	2.33	1.67	1.33	2.00	1.00	1.00	1.00	2.08
GLP 24	3.67	1.00	3.00	3.67	6.33	1.67	2.33	2.67	1.33	2.67	1.33	1.00	3.33	2.62
GLP 1004	3.00	1.00	3.67	3.67	6.33	2.33	2.67	3.00	1.67	3.67	2.00	1.00	3.00	2.85
GLPx 92	1.00	2.33	3.67	4.00	7.00	5.00	4.33	1.67	3.67	2.33	3.67	3.67	8.33	3.90
ZPv 292	4.00	1.00	4.00	4.00	5.00	1.00	1.33	3.00	1.00	2.33	1.00	1.00	3.67	2.49
Carioca	1.33	1.00	2.67	2.67	3.00	1.00	2.67	1.00	1.67	2.67	1.00	1.00	1.00	1.74
INIA 10	3.00	1.00	3.67	3.67	5.67	1.00	1.00	2.33	2.00	5.00	3.33	1.00	4.00	2.82
INIA 12	3.00	1.00	3.67	4.67	5.00	1.33	1.33	3.00	2.67	3.00	3.00	1.00	3.67	2.79
HF 465-63-1	3.33	1.33	3.00	3.00	5.00	1.67	1.00	1.00	1.00	4.67	3.00	1.00	5.33	2.64
Calima	4.00	1.00	3.33	3.00	5.00	1.00	3.00	3.33	1.33	2.67	1.33	1.00	4.33	2.64
Ikinimba	1.67	1.00	3.67	4.00	6.33	6.33	4.33	1.67	2.33	2.33	3.00	6.33	7.00	3.85
Ubososera 6	2.67	1.67	3.00	3.67	5.00	2.33	2.33	1.00	1.67	2.67	1.67	1.00	7.67	2.79
A 197	3.00	1.00	3.00	4.67	3.67	1.00	1.00	2.67	1.00	4.00	1.33	1.00	2.33	2.28
A 370	1.67	1.00	2.67	2.67	3.67	1.00	1.67	1.00	1.00	2.33	1.00	1.00	4.00	1.90
A 410	1.00	1.00	3.33	2.67	3.00	1.00	1.67	1.00	1.00	2.00	1.00	1.00	1.00	1.59
Kilyumukwe	3.33	1.00	3.00	3.00	5.00	1.00	1.33	2.00	1.00	2.33	1.00	1.00	2.67	2.13
Nain de Kyondo	1.00	1.00	2.33	2.00	5.00	6.00	3.67	1.00	1.00	2.00	1.00	1.00	9.00	2.77
G 13671	1.00	1.00	3.00	3.00	3.00	2.00	1.33	1.00	1.33	2.00	1.00	1.00	1.00	1.67
G 2816	1.00	1.00	2.67	3.33	3.00	1.00	1.33	1.00	1.00	2.00	1.33	1.00	1.33	1.62
G 12470	4.33	1.00	3.00	3.33	6.33	4.33	3.33	1.67	1.00	3.00	1.00	1.00	1.33	2.67
XAN 76	1.00	1.00	2.33	2.67	3.00	1.00	1.00	1.00	1.00	2.00	1.00	1.00	1.00	1.46
S.E. ±							0.503							0.140
Mean	2.39	1.19	3.13	3.32	4.65	2.16	2.25	1.69	1.52	2.80	1.79	1.32	3.53	
S.E. ±							0.187							
C.V (%)							35.7							

Table 82. Web blight reactions of genotypes in AFBYAN II trials in three environments between 1988 and 1991.

Genotypes	Environments PAW 89	KAW 8S	GAN 9F	Means
Red Wolaita	7.00	3.67	5.33	5.33
Ex-Rico 23	6.67	1.00	7.33	5.00
A 176	6.67	6.33	6.00	6.33
997-CH-173	6.00	6.33	6.00	6.11
K 20	7.33	1.00	7.67	5.33
GLP 24	4.33	1.00	6.00	3.78
GLP 1004	7.67	1.00	7.67	5.44
GLPx 92	4.00	1.00	6.00	3.67
ZPv 292	7.67	1.00	7.00	5.22
Carioca	6.33	6.33	7.00	6.56
INIA 10	7.67	1.00	5.67	4.78
INIA 12	7.33	1.00	5.00	4.44
HF 465-63-1	7.33	1.00	7.00	5.11
Calima	5.67	1.00	6.67	4.44
Ikinimba	4.00	3.67	7.00	4.89
Ubososera 6	5.00	3.67	6.33	5.00
A 197	4.67	1.00	6.33	4.00
A 370	4.00	3.67	6.67	4.78
A 410	6.00	6.33	6.00	6.11
Kilyumukwe	6.67	1.00	8.00	5.22
Nain de Kyondo	4.33	1.00	7.67	4.33
G 13671	4.33	1.00	6.00	3.78
G 2816	4.33	1.00	8.00	4.44
G 12470	6.67	1.00	7.67	5.11
XAN 76	3.33	1.00	6.00	3.44
S.E. ±		0.971		0.561
Mean	5.80	2.28	6.64	
S.E. ±		0.246		
C.V (%)		34.3		

Table 83. White mould reactions of genotypes in AFBYAN II trials in two environments between 1988 and 1991.

Genotypes	Environments LAM 90	MAB 90	Means
Red Wolaita	2.67	2.00	2.33
Ex-Rico 23	1.00	2.00	1.50
A 176	2.33	2.00	2.17
997-CH-173	3.00	2.00	2.50
K 20	1.00	2.00	1.50
GLP 24	1.67	2.00	1.83
GLP 1004	2.33	2.00	2.17
GLPx 92	3.00	2.00	2.50
ZPv 292	1.00	2.00	1.50
Carioca	1.67	2.00	1.83
INIA 10	2.33	3.00	2.67
INIA 12	2.33	2.33	2.33
HF 465-63-1	1.67	2.00	1.83
Calima	1.00	2.33	1.67
Ikinimba	3.00	1.67	2.33
Ubososera 6	2.67	2.00	2.33
A 197	1.00	3.00	2.00
A 370	2.00	2.00	2.00
A 410	1.67	1.67	1.67
Kilyumukwe	1.33	2.33	1.83
Nain de Kyondo	1.67	2.00	1.83
G 13671	3.67	1.67	2.67
G 2816	3.33	2.00	2.67
G 12470	2.33	2.33	2.33
XAN 76	1.00	2.00	1.50
S.E. ±	0.493		0.349
Mean	2.03	2.09	
S.E. ±	0.125		
C.V (%)	41.4		

Table 84. CBB reactions of genotypes in AFBYAN II trials in 17 environments between 1988 and 1991.

Genotypes	Environments									
	ALE 90	AWA 89	MEL 88	MEL 89	PAW 89	BK0 9F	BK1 9F	KAC 8S	KC0 9F	KC1 9F
Red Wolaita	3.67	2.00	3.33	4.67	4.67	6.00	6.33	4.33	1.33	1.33
Ex-Rico 23	3.00	1.00	3.33	5.00	5.00	5.67	5.00	3.00	1.67	1.67
A 176	3.00	2.00	3.33	5.67	4.67	5.00	5.00	3.00	1.67	1.00
997-CH-173	2.67	1.33	2.33	4.67	5.33	4.67	5.00	4.33	2.67	3.00
K 20	3.67	2.00	2.67	5.00	5.67	5.33	6.33	3.67	2.00	1.33
GLP 24	3.00	2.00	3.00	3.67	5.33	5.00	5.67	3.67	1.00	1.67
GLP 1004	3.00	2.67	3.33	4.67	4.33	6.67	6.33	4.33	1.00	1.00
GLPx 92	3.33	2.67	4.00	5.33	4.00	5.67	5.67	4.33	1.00	1.00
ZPv 292	3.00	2.33	4.33	4.00	5.00	6.67	6.33	4.33	1.00	1.00
Carioca	4.00	3.67	4.00	5.00	5.00	4.33	5.33	3.67	1.33	1.67
INIA 10	3.67	1.00	5.67	6.33	5.33	6.00	6.33	5.00	1.00	1.00
INIA 12	3.33	1.33	5.33	6.00	6.00	6.33	6.33	5.00	1.00	1.33
HF 465-63-1	3.67	2.33	4.00	5.67	5.00	6.33	5.67	3.00	1.00	1.33
Calima	3.67	1.00	2.33	3.67	5.00	6.33	5.67	4.33	2.33	1.00
Ikinimba	3.33	2.00	5.33	5.00	5.00	6.00	6.00	3.00	1.00	1.00
Ubososera 6	3.33	3.33	3.67	5.67	4.00	5.33	5.33	4.33	1.67	1.00
A 197	3.00	1.33	2.33	4.33	6.00	5.00	5.33	4.33	1.00	1.00
A 370	2.67	2.00	2.00	4.00	3.67	4.67	5.00	3.00	2.00	2.00
A 410	3.33	1.00	4.33	5.00	4.33	5.33	5.33	3.67	1.33	1.33
Kilyumukwe	4.00	1.33	4.00	5.33	5.67	6.33	6.33	4.33	1.33	1.33
Nain de Kyondo	3.00	1.33	2.33	3.33	4.00	5.00	5.00	3.67	1.33	1.33
G 13671	3.67	1.67	3.00	4.00	4.67	5.67	6.33	4.33	2.00	1.33
G 2816	3.00	1.67	2.67	5.33	4.67	5.67	6.00	3.67	1.67	2.00
G 12470	3.00	1.00	2.00	4.67	5.00	5.33	4.67	3.67	1.00	1.00
XAN 76	3.00	1.00	2.67	4.33	5.00	4.67	4.33	3.67	1.33	2.00
S.E. ±					0.495					
Mean	3.28	1.80	3.41	4.81	4.89	5.56	5.63	3.91	1.43	1.39
S.E. ±					0.181					
C.V (%)					26.1					

Table 84 (continued).

Genotypes	Environments								Means
	KAW 8S	MAC 89	MAS 88	MAS 89	LAM 90	SEL 90	MOS 9F	GAN 9F	
Red Wolaita	4.00	4.00	2.00	3.00	3.33	2.67	3.33	4.67	3.59
Ex-Rico 23	2.67	3.33	1.67	3.33	3.67	1.33	1.00	5.00	3.13
A 176	2.33	2.33	1.67	4.00	1.67	2.00	1.33	3.33	2.94
997-CH-173	3.67	2.00	1.33	2.67	4.00	1.33	1.00	2.33	3.02
K 20	3.33	4.00	1.67	4.00	3.33	2.00	1.00	5.33	3.46
GLP 24	3.33	3.00	1.67	2.33	3.00	1.00	1.00	3.00	2.91
GLP 1004	5.33	4.67	1.67	3.33	3.33	1.33	2.00	4.00	3.50
GLPx 92	5.67	2.00	1.67	2.00	4.00	2.67	1.00	3.67	3.32
ZPv 292	6.00	5.00	1.33	4.67	4.00	1.00	2.33	4.00	3.69
Carioca	3.67	2.33	1.33	3.33	4.00	2.33	3.00	4.33	3.46
INIA 10	4.00	4.67	1.67	5.00	4.00	1.33	3.67	3.67	3.85
INIA 12	5.33	6.00	2.00	6.00	3.33	1.33	1.67	2.67	3.91
HF 465-63-1	2.67	5.33	1.33	3.00	3.67	2.00	1.00	5.33	3.46
Calima	5.67	5.33	1.00	2.33	3.00	1.00	1.67	4.67	3.33
Ikinimba	6.33	1.33	1.67	2.33	3.00	2.67	1.33	4.00	3.35
Ubososera 6	3.33	2.33	1.67	2.67	3.67	2.00	1.33	4.00	3.26
A 197	3.33	3.33	1.33	2.67	3.33	2.33	1.67	2.67	3.02
A 370	3.33	2.00	1.67	2.00	3.00	1.33	1.00	4.67	2.78
A 410	4.00	3.00	1.33	3.67	4.00	1.33	1.33	3.67	3.19
Kilyumukwe	5.67	3.33	2.00	4.67	4.00	1.00	3.33	4.00	3.78
Nain de Kyondo	2.33	2.33	1.67	2.00	2.33	1.33	1.00	5.33	2.70
G 13671	3.67	2.33	1.67	4.00	3.33	2.00	1.00	6.67	3.41
G 2816	4.33	1.67	1.67	1.67	3.67	1.00	1.33	4.67	3.13
G 12470	3.00	6.67	1.67	3.67	2.67	1.33	1.00	6.67	3.22
XAN 76	2.33	2.33	2.00	2.00	3.00	1.67	1.00	4.33	2.82
S.E. ±					0.495				0.117
Mean	3.97	3.39	1.61	3.21	3.37	1.65	1.61	4.27	
S.E. ±					0.181				
C.V (%)					26.1				

Table 85. Halo blight reactions of genotypes in AFBYAN II trials in seven environments between 1988 and 1991.

Genotypes	Environments							Means
	MEL 88	KAC 8S	KC0 9F	KC1 9F	MAC 89	MAS 88	MAS 89	
Red Wolaita	1.67	1.67	1.33	1.67	4.00	1.67	3.67	2.24
Ex-Rico 23	2.33	1.67	2.33	2.67	4.67	1.67	4.00	2.76
A 176	1.00	2.33	1.33	2.00	3.33	1.67	3.67	2.19
997-CH-173	1.33	1.00	2.00	2.67	2.33	1.33	4.33	2.14
K 20	2.67	1.67	1.67	2.33	4.00	1.67	4.33	2.62
GLP 24	1.33	1.67	2.33	1.67	5.00	1.67	4.33	2.57
GLP 1004	1.33	3.00	1.33	2.67	4.67	1.67	3.67	2.62
GLPx 92	1.00	1.67	1.00	1.00	3.33	2.33	2.00	1.76
ZPv 292	2.00	1.67	1.33	1.67	5.00	1.00	4.00	2.38
Carioca	2.67	1.67	1.67	2.00	4.00	1.33	3.00	2.33
INIA 10	3.33	1.67	2.00	3.67	7.33	1.33	7.00	3.76
INIA 12	3.67	1.00	1.33	4.00	5.67	1.33	5.67	3.24
HF 465-63-1	1.00	1.67	2.00	1.00	6.33	1.33	4.67	2.57
Calima	1.33	1.00	1.00	2.33	5.00	1.33	2.67	2.10
Ikinimba	2.33	2.33	1.00	1.00	2.33	2.00	2.33	1.91
Ubososera 6	1.00	3.00	1.67	1.33	4.33	1.33	3.00	2.24
A 197	1.00	3.00	1.67	1.67	3.67	1.67	3.67	2.33
A 370	1.00	1.67	1.67	1.33	3.00	1.67	2.67	1.86
A 410	1.00	1.00	1.67	1.33	4.33	1.33	3.67	2.05
Kilyumukwe	2.33	1.00	1.67	3.33	5.33	1.67	5.00	2.91
Nain de Kyondo	1.00	2.33	2.33	3.67	3.67	1.67	2.67	2.48
G 13671	3.00	1.67	1.67	2.33	7.33	1.67	4.67	3.19
G 2816	1.00	1.00	2.67	2.00	2.00	1.33	1.67	1.67
G 12470	1.33	2.33	1.67	2.67	7.67	2.00	4.00	3.10
XAN 76	1.00	1.67	2.00	1.33	2.00	1.67	1.67	1.62
S.E. ±				0.646				0.244
Mean	1.71	1.77	1.69	2.13	4.41	1.57	3.68	
S.E. ±				0.421				
C.V (%)				46.1				

Table 86. BCMV reactions of genotypes in AFBYAN II trials in 12 environments between 1988 and 1991.

	Environments													
Genotypes	AWA 89	MEL 88	BK0 9F	BK1 9F	KAC 8S	KAW 8S	MAS 88	MAS 89	SEL 90	SEL 91	MBA 89	KIS 9F	MOS 9F	Means
Red Wolaita	4.33	1.00	7.00	6.33	1.67	4.00	1.00	1.33	1.33	3.67	1.33	5.00	3.67	3.21
Ex-Rico 23	1.00	1.00	2.33	2.33	3.00	2.00	1.00	1.00	1.00	2.67	1.00	7.00	1.33	2.05
A 176	1.00	1.00	2.67	2.33	1.67	2.33	1.00	2.00	1.00	2.00	1.00	5.33	1.00	1.87
997-CH-173	1.00	1.33	2.33	2.33	1.67	3.00	1.00	1.33	1.00	3.33	1.00	7.00	1.33	2.13
K 20	1.00	1.67	6.33	4.67	1.67	2.00	1.00	1.67	1.00	2.00	1.33	1.33	1.33	2.08
GLP 24	2.00	1.00	6.33	6.00	1.67	3.00	1.00	1.00	1.00	3.00	2.33	4.00	1.33	2.59
GLP 1004	1.00	1.33	3.67	5.00	1.67	2.33	1.00	1.00	1.00	2.33	1.00	2.33	2.33	2.00
GLPx 92	1.00	1.00	5.67	4.67	3.00	4.67	1.00	1.33	1.33	3.67	1.33	3.33	2.00	2.62
ZPv 292	1.00	1.00	4.67	4.33	1.67	2.00	1.00	1.00	1.00	2.00	1.00	2.00	2.00	1.90
Carioca	1.00	1.00	2.00	2.67	2.33	4.00	1.00	1.67	1.00	3.00	1.00	5.67	1.00	2.10
INIA 10	1.00	1.00	6.00	6.67	2.33	3.33	1.00	1.67	2.00	2.33	1.00	2.67	3.67	2.67
INIA 12	1.00	1.00	6.33	5.67	2.33	2.67	1.00	1.33	1.00	2.67	1.00	2.00	2.00	2.31
HF 465-63-1	1.00	1.00	5.00	5.00	1.00	3.00	1.00	1.00	2.67	3.00	1.00	4.67	2.67	2.46
Calima	1.00	1.67	4.67	4.33	1.00	2.33	1.00	1.00	1.00	2.33	1.00	2.33	1.67	1.95
Ikinimba	1.00	1.00	6.00	5.00	1.67	5.00	1.00	1.00	1.00	4.33	1.00	1.33	1.67	2.39
Ubososera 6	1.00	1.00	6.33	5.33	3.00	4.00	1.00	1.00	1.00	3.67	3.67	5.00	2.67	2.97
A 197	1.00	1.00	3.33	3.67	1.67	2.00	1.00	1.00	1.00	3.33	1.00	2.67	3.00	1.97
A 370	1.00	1.00	2.67	3.00	2.33	3.33	1.00	1.00	1.00	3.00	1.00	3.33	2.00	1.97
A 410	1.00	1.00	3.00	3.00	2.33	3.00	1.00	1.00	1.00	3.00	1.00	2.67	1.00	1.85
Kilyumukwe	1.00	1.00	5.33	5.33	1.67	3.00	1.00	1.33	1.00	2.67	1.00	2.00	2.33	2.21
Nain de Kyondo	1.00	1.00	2.33	2.00	1.67	3.67	2.00	1.33	2.00	3.33	5.33	5.67	2.33	2.59
G 13671	1.00	1.00	6.67	6.33	2.33	2.33	4.00	1.67	1.00	3.33	1.00	4.33	1.00	2.77
G 2816	1.00	1.00	3.00	4.33	1.67	2.67	1.00	1.33	1.00	3.33	1.00	2.00	2.00	1.95
G 12470	1.00	1.00	6.00	5.33	1.67	2.00	1.00	1.00	1.00	2.33	1.00	2.00	1.33	2.05
XAN 76	1.00	1.00	2.33	2.67	1.00	2.33	1.00	1.00	1.00	3.00	1.00	5.00	1.00	1.80
S.E. ±							0.446							0.124
Mean	1.17	1.08	4.48	4.33	1.91	2.96	1.16	1.24	1.17	2.93	1.37	3.63	1.91	
S.E. ±							0.138							
C.V (%)							34.2							

Table 87. Environment and genotype clusters formed from two-way classification of seed yields in AFBYAN II, 1988-1991.

Clusters	Environments/genotypes
Environments	
1	KC09F, KC19F, MIW90, UIT91, GAN9F
2	MAC89, MAS89
3	HUA89, SEL90, MBA89
4	KAC8S, MOS9S, LIC90, PAW89, KAW8S, KIS9S, LAM90
5	BK09F, BK19F
6	GWE91, MOS9F
7	SEL91
8	MAS88
9	MAB90
10	MEL88, MEL89
11	AWA89
12	ALE90
Genotypes	
1	INIA 10, INIA 12, K20, GLP 24, G 12470
2	HF 465-63-1, Kilyumukwe
3	Red Wolaita, Ubososera 6
4	Nain de Kyondo
5	A 176, A 197, Ex Rico 23
6	ZPv 292, Calima, GLP 1004
7	Carioca, A 370, A 410, XAN 76
8	997 CH-173
9	GLPx 92, Ikinimba, G 13671
10	G 2816

Table 88. Means of clusters formed by two-way classification of seed yields in AFBYAN II, 1988-1991.

Genotype clusters	Environment clusters												
	1	2	3	4	5	6	7	8	9	10	11	12	Means
1	380	381	1160	789	1232	1464	1847	1700	895	2380	2580	1859	1108
2	573	686	1247	1121	1723	1695	2110	1792	1124	2804	2794	1711	1358
3	445	755	1009	925	491	910	1415	2017	755	2167	2239	1496	1014
4	716	764	809	1151	1472	923	2092	1419	538	2789	3940	1904	1285
5	529	619	1289	1176	2065	1895	1503	2387	858	3237	3255	2139	1457
6	401	439	1259	918	2472	1882	2191	2575	928	2955	2539	2530	1391
7	635	1479	1508	1141	1305	2035	2292	1975	807	3624	2687	2452	1542
8	726	1653	1830	926	995	1822	1403	2555	1016	3882	4008	2841	1600
9	722	0	1818	1187	1415	1225	2413	0	1267	3891	2783	3262	1443
10	707	0	1757	1133	2146	2160	2533	0	659	4111	2471	3900	1555
Means	543	652	1354	1026	1531	1623	1992	1715	913	3095	2795	2318	

Table 89. Environment (E) and genotype (G) cluster components of E, G and G x E sums of squares for seed yields (kg $ha^{-1}x10^{-1}$).

Sources of variation		df	MS	%SS
Environments (E)		26	440152***	
Among E groups		11	1017569***	97.8
Within E groups		15	16720	2.2
Within E group	1	4	28297	1.0
	2	1	20133*	0.2
	3	2	13919	0.2
	4	5	6887	0.3
	5	1	10805	0.1
	6	1	1781*	0.0
	10	1	42619*	0.4
Error		54	7848	
Genotypes (G)		24	31881***	
Among G groups		9	75803***	89.2
Within G groups		15	5528	10.8
Within G group	1	4	2499	1.3
	2	1	1156	0.2
	3	1	7913	1.0
	5	2	4617	1.2
	6	2	6961	1.8
	7	3	7967*	3.1
	9	2	8401	2.2
G x E		624	6049***	
Among E groups x G		264	10395***	72.7
Within E groups x G		360	2862***	27.3
In E group 1 x G		96	2248***	5.7
	2	24	3248***	2.1
	3	48	2861***	3.6
	4	120	3371***	10.7
	5	24	1058	0.7
	6	24	3727***	2.4
	10	24	3325	2.1
Among G groups x E		234	12231***	75.8
Within G groups x E		390	2340	24.2
In E group 1 x E		104	1345	3.7
	2	26	1602*	1.1
	3	26	2970***	2.0
	5	52	2748***	3.8
	6	52	2318***	3.2
	7	78	2846***	5.9
	9	52	3240***	4.9
Error		1296	1189	

Table 90. Stability parameters for seed yields (kg/ha) of 25 genotypes in AFBYAN II grown in 28 environments between 1988 and 1991.

Genotypes	b	r^2	s_b
INIA 10	0.74***	0.91	0.066
INIA 12	0.93	0.95	0.061
K 20	0.81**	0.93	0.064
GLP 24	0.83*	0.92	0.073
G 12470	1.02	0.97	0.049
HF 465-63-1	0.86*	0.93	0.069
Kilyumukwe	0.93	0.94	0.066
Ubusosera 6	0.77*	0.81	0.111*
Red Wolaita	0.54***	0.78	0.086
Nain de Kyondo	0.91	0.81	0.134***
A 176	1.02	0.90	0.098
A 197	1.07	0.92	0.094
Ex Rico 23	1.11	0.90	0.109
ZPv 292	1.01	0.86	0.123**
Calima	1.09	0.91	0.099
GLP 1004	1.18	0.90	0.115*
Carioca	0.95	0.87	0.106
A 370	0.95	0.89	0.096
A 410	1.14	0.90	0.111*
XAN 76	1.13	0.94	0.085
997 CH 173	1.17	0.85	0.145***
GLPx 92	1.39*	0.86	0.162***
Ikinimba	1.09	0.81	0.111*
G 13671	1.05	0.81	0.153***
G 2816	1.32	0.84	0.169***

Table 91. Correlations among environmental variables in AFBYAN II, 1988-1991.

	Environmnental variables																			
	ALT	DL	CDL	PSR	VR	RR	TR	V+T	R+T	M+T	V-T	R-T	M-T	VMT	RMT	MT	SC	SR	DI1	DI3	DI5
LAT	25	89	43	-44	-1	-3	-17	-23	10	-9	-50	-13	-35	-24	-1	-21	-29	-37	-20	-40	-50
ALT		28	2	-18	-10	-13	-20	-88	-71	-83	-76	-91	-87	-81	-87	-89	-5	-4	10	25	25
DL			16	-47	3	13	-5	-23	-19	-3	-42	-17	-32	-28	-1	-19	-33	-37	-13	-41	-53
CDL				-23	-1	-2	-10	-15	3	-9	-5	0	-28	-12	4	-15	3	1	10	10	6
PSR					12	18	47	-6	-16	-11	21	10	16	17	-5	1	-14	10	17	25	26
VR						21	65	7	14	12	14	6	11	8	6	8	-21	-15	-18	-26	-24
RR							82	10	35	25	8	20	14	17	27	20	-22	-15	53	16	-3
TR								9	27	20	19	20	20	21	21	18	-30	-22	35	9	-2
V+T									78	94	81	83	87	78	88	95	47	46	-17	-24	-24
R+T										94	48	72	63	58	90	81	6	3	1	-19	-27
M+T											69	81	79	72	93	93	28	26	-8	-22	-27
V-T												79	95	78	70	86	30	37	-22	-27	-25
R-T													94	85	93	93	21	28	-17	-31	-35
M-T														86	85	94	27	34	-20	-30	-31
VMT															77	82	26	30	-9	-12	-10
RMT																96	29	28	-15	-32	-38
MT																	7	7	-17	-36	-38
SC																		96	-31	-2	11
SR																			-24	1	12
DI1																				82	62
DI3																					94

Table 92. Coefficients from regression of environmental variables on seed yields (kg/ha) of individual genotypes on AFBYAN II in 20 environments, 1988-1991.

	Environmental variables								
			Rainfall periods						
Genotypes	Stands/m²	Soil rank	Pre-sowing	Repro-ductive	Mean temper-ature	Day length	Change in day length	Disease index	R^2 (%)
INIA 10	102.5***	95.2'	-0.83	-2.83***	-2.3	1646***	-1095***	300.3***	61
INIA 12	119.3***	99.0'	-1.51	-1.69'	10.9	1231**	-1116**	358.3***	64
K 20	106.7***	87.6'	-1.03	-2.40**	10.7	1385**	-1227***	392.9***	57
GLP 24	114.7***	119.1**	-1.40	-1.46'	-40.0	1252**	-705'	287.6***	64
G 12470	103.2***	2.3	-1.64	-0.42	-14.7	1112	-693	288.5**	48
HF 465-63-1	107.0***	82.1	-2.90**	-0.28	-18.6	756	-754	306.7***	55
Kilyumukwe	108.6***	76.7	-1.39	-0.78	7.8	810	-674	303.3***	50
Ubusosera 6	90.3***	97.5'	-2.48'	-0.84	-38.0	1090'	-742'	235.8**	58
Red Wolaita	72.1***	52.4	-1.81'	-0.26	0.8	265	-364	131.0'	49
Nain de Kyondo	128.9***	121.9'	-3.06'	-0.92	10.4	1571'	-1550**	487.5***	53
A 176	133.7***	45.0	-3.61**	-0.62	62.5	752	-984'	419.9***	58
A 197	112.5***	40.7	-1.85	-2.14	42.8	1888**	-1033'	523.5***	59
Ex Rico 23	124.5***	142.7'	-2.09	-2.16'	64.4	1862**	-1693***	545.4***	57
ZPv 292	110.4***	71.0	-2.04	-1.67	94.0'	696	-1007'	357.3***	55
Calima	139.4***	84.0	-2.34'	-1.98'	48.4	1067'	-520	322.0***	66
GLP 1004	158.5***	109.3'	-1.49	-3.77***	52.9	2152***	-1137**	541.8***	67
Carioca	127.9***	34.6	-3.93***	1.06	-30.6	376	-955'	137.2	61
A 370	119.1***	74.5	-3.35**	0.30	-50.5	849	-1034'	221.7'	57
A 410	133.1***	109.5	-3.92**	-0.18	32.9	989	-997	216.2	57
XAN 76	139.4***	155.9'	-3.43'	-1.12	49.4	1322'	-1102'	367.0***	59
997 CH 173	134.8***	96.2	-1.77	-1.55	68.0	2708***	-821	282.9'	58
GLPx 92	146.3***	36.0	-4.29'	0.22	-59.2	1115	-1877**	265.1	57
Ikinimba	116.8***	74.9	-2.79	-0.08	-8.6	502	-1428'	207.2	46
G 13671	143.6***	-11.5	-3.93**	-0.49	-49.1	794	-1765**	338.7**	53
G 2816	149.9***	145.1	-2.88	-1.40	66.3	1651'	-1955**	448.5***	54

Note - R^2 values all significantly greater than zero at P=0.001 in this and subsequent tables except where otherwise indicated.

*, **, *** - level of probability less than 0.05, 0.01 and 0.001, respectively.

Table 93. Regression coefficients of GCGs greater than (+), equal to (=) or smaller than (-) means of coefficients of environmental variables in AFBYAN II between 1988 and 1991.

	Environmental variables							
GCGs	STH	SR	PSR	RR	MT	DL	CDL	DI
1	-	=	-	-	=	-	=	=
2	-	=	=	=	=	-	-	=
3	-	=	=	=	-	=	-	-
4	=	=	=	=	=	=	=	+
5	=	=	=	-	+	=	=	+
6	=	=	=	-	+	=	=	=
7	=	=	+	+	=	-	=	-
8	=	=	=	=	+	+	=	=
9	=	=	+	=	-	=	+	=
10	=	+	=	=	+	=	+	+

Table 94. Coefficients from regression of environmental variables on canopy sizes (cm^2) of individual genotypes in AFBYAN II in 16 environments, 1988-1991.

Genotypes	Environmental variables							
		Rainfall periods						
	Soil rank	Pre-sowing	Vegetative	Reproductive	Mean temperature	Day length	Change in day length	R^2 (%)
INIA 10	33.8	0.10	-1.75*	-0.60	73.5	634	4636***	62
INIA 12	34.0	2.27	-1.50*	-1.72*	95.7	1937**	6350***	63
K 20	45.1	3.25*	-2.00**	-2.46**	120.8**	2299***	6377***	62
GLP 24	111.6*	1.35	-0.90	-1.69*	23.5	1783**	5629***	63
G 12470	71.7	1.21	-1.36	-0.93	103.7	1774*	6952***	66
HF 465-63-1	-24.8	2.66*	-2.37**	-1.23	182.1***	1898**	7626***	70
Kilyumukwe	39.0	2.93*	-1.08	-2.40**	63.4	1989**	6196***	61
Ubusosera 6	89.7*	2.80*	-1.11	-0.90	36.5	1880**	5203***	56
Red Wolaita	77.9*	-0.22	-1.49*	-0.13	7.0	331	2968**	55
Nain de Kyondo	10.5	3.73***	-3.08***	-1.32	163.7***	2216***	6288***	70
A 176	9.6	2.54	-1.61*	-1.34	127.2*	2157**	6842***	60
A 197	69.6	1.79	-1.64	-1.33	97.3	1651*	6166***	58
Ex Rico 23	-8.5	2.92*	-2.76**	-1.83*	201.9***	2239***	8050***	76
ZPv 292	98.1*	0.20	-1.19	-0.56	34.0	509	3590***	64
Calima	-1.5	2.67	-2.38**	-1.90*	141.5*	1729*	7020**	66
GLP 1004	38.2	1.92	-2.44**	-1.24	47.4	1476*	5762***	64
Carioca	44.4	2.41	-1.47	-1.62	69.7	1891**	6059***	58
A 370	89.8*	4.28***	-2.15**	-1.49	99.0*	2141**	5585***	64
A 410	64.2	2.64*	-1.59*	-1.35	88.5	1569*	5702***	66
XAN 76	40.6	3.59**	-2.41**	-1.61	171.6**	1915**	6778***	68
997 CH 173	104.9**	0.98	-1.83**	-1.08	29.8	1770**	5385***	67
GLPx 92	77.0	2.27*	-2.21**	-0.28	37.9	778	3871***	62
Ikinimba	54.7	3.26**	-1.71*	-0.85	46.1	1410*	4592***	53
G 13671	88.2*	1.43	-1.56*	-0.23	38.5	940	3720***	57
G 2816	109.4**	4.12***	-2.25***	-1.37	89.4	1657**	4867***	68

*, **, *** - level of probability less than 0.05, 0.01 and 0.001, respectively.

Table 95. Coefficients from regression of environmental variables on number of days to 50% flower of individual genotypes in AFBYAN II in 21 environments, 1988-91.

Genotypes	Environmental variables						
	Mean temperature	Day length	R^2 (%)	Mean temperature	Day length	Change in day length	R^2 (%)
INIA 10	-2.637***	2.89	60	-2.530***	0.16	13.45***	72
INIA 12	-2.671***	9.13***	55	-2.508***	4.97**	20.49***	77
K 20	-2.086***	2.88	63	-2.020***	1.21	8.24***	70
GLP 24	-2.750***	3.92	61	-2.644***	1.21	13.40***	72
G 12470	-2.062***	7.44***	54	-1.961***	4.86**	12.75***	68
HF 465-63-1	-2.705***	-0.66	56	-2.621***	-2.81	10.62***	62
Kilyumukwe	-2.071***	5.80*	40	-1.936***	2.33	17.08***	58
Ubusosera 6	-2.076***	1.95	52	-1.980***	-0.51	12.16***	65
Red Wolaita	-2.299***	1.23	57	-2.257***	0.15	5.34*	59
Nain de Kyondo	-2.812***	4.82	55	-2.691***	1.72	15.29***	67
A 176	-2.832***	0.92	67	-2.766***	-0.76	8.27**	71
A 197	-2.303***	6.35**	55	-2.178***	3.17	15.68***	73
Ex Rico 23	-2.380***	1.05	58	-2.315***	-0.61	8.17**	64
ZPv 292	-2.366***	1.46	65	-2.316***	0.16	6.41**	68
Calima	-2.242***	4.38*	57	-2.149***	1.99	11.77***	69
GLP 1004	-2.766***	4.34*	69	-2.676***	2.05	11.27***	78
Carioca	-3.342***	0.09	65	-3.270***	-1.74	9.06**	69
A 370	-2.582***	1.13	59	-2.513***	-0.63	8.64**	64
A 410	-2.406***	2.81	58	-2.318***	0.55	11.15***	67
XAN 76	-2.616***	-0.98	63	-2.598***	-1.46	2.36	64
997 CH 173	-2.235***	3.13	60	-2.160***	1.21	9.47***	68
GLPx 92	-2.811***	17.02***	47	-2.545***	10.21***	33.56***	81
Ikinimba	-2.420***	15.58***	40	-2.184***	9.55***	29.71***	71
G 13671	-3.067***	16.62***	55	-2.859***	11.31***	26.21***	78
G 2816	-3.004***	14.01***	46	-2.737***	7.20**	33.56***	80

Table 96. Coefficients from regression of environmental variables on number of days to maturity of individual genotypes in AFBYAN II in 21 environments, 1988-1991.

Genotypes	Environmental variables						
		Rainfall periods					
	Soil rank	Pre sowing	Repro-ductive	Mean temper-ature	Day length	Change in day length	R^2 (%)
INIA 10	1.088*	0.0156	-0.0388***	-2.559***	8.39*	-1.00	57
INIA 12	1.142	0.0260	-0.0357**	-2.788***	8.77	19.40***	55
K 20	1.057*	0.0248	-0.0305***	-2.469***	5.72	9.03*	53
GLP 24	1.287**	0.0198	-0.0207**	-3.123***	2.46	0.25	60
G 12470	1.325**	0.0272*	-0.0272***	-2.675***	11.55**	6.05	56
HF 465-63-1	0.563	0.0069	-0.0216*	-2.918***	-0.09	-2.98	54
Kilyumukwe	1.348*	0.0268*	-0.0306**	-2.193***	5.58	6.89	47
Ubusosera 6	1.009	0.0287*	-0.0235*	-2.573***	2.06	5.14	45
Red Wolaita	1.717***	-0.0157	-0.0122	-2.168***	3.15	1.14	47
Nain de Kyondo	0.753	0.0053	-0.0125	-2.830***	-0.49	5.97	52
A 176	0.913*	0.0290	-0.0225**	-3.291***	2.67	-0.05	62
A 197	1.194*	0.0222	-0.0330***	-2.398***	5.16	0.34	54
Ex Rico 23	0.506	0.0161	-0.0231**	-3.019***	-1.15	-0.88	58
ZPv 292	1.017	0.0254	-0.0350***	-2.822***	5.89	-3.70	51
Calima	0.705	0.0171	-0.0326***	-2.188***	1.85	2.20	53
GLP 1004	0.860	0.0102	-0.0356***	-2.463***	2.39	-0.45	59
Carioca	0.874*	0.0072	-0.0220**	-3.133***	8.46*	3.71	64
A 370	0.528	0.0179	-0.0188*	-2.653***	-0.59	-3.73	58
A 410	0.961	0.0242	-0.0271**	-3.222***	3.72	0.03	59
XAN 76	0.575	0.0148	-0.0201*	-3.233***	0.83	-3.86	55
997 CH 173	0.408	0.0078	-0.0184*	-2.587***	1.41	2.62	61
GLPx 92	2.738***	0.0427**	-0.0496***	-2.810***	34.69***	45.43***	85
Ikinimba	2.600***	0.0420**	-0.0528***	-2.284***	35.76***	46.24***	83
G 13671	1.087*	0.0347*	-0.0411***	-3.447***	30.83***	42.22***	85
G 2816	2.282***	0.0478**	-0.0581***	-3.277***	32.20***	44.48***	82

Table 97. Coefficients from regression of environmental variables on pods/m² of individual genotypes in AFBYAN II in 15 environments,1988-1991.

Genotypes	Environmental variables									
				Rainfall periods						
	Stands /m²	Soil rank	Pre sowing	Vegeta-tive	Repro-ductive	Mean temper-ature	Day length	Change in day length	Disease index	R² (%)
INIA 10	4.37***	-3.41	0.098	-0.158	-0.131	9.38**	139.2*	325.1**	-5.40	53
INIA 12	4.83**	-6.89	0.145	-0.154	-0.151	14.38*	185.5*	489.4***	-0.44	53
K 20	5.06***	-4.11	0.114	-0.104	-0.184*	9.11	169.0**	328.4**	5.48	54
GLP 24	5.01***	-1.19	0.049	-0.126	-0.029	4.85	64.5	157.9*	3.73	71
G 12470	4.83***	-6.96	0.054	-0.199	-0.031	7.96	191.6*	483.6***	-8.44	53
HF 465-63-1	4.18*	-12.08*	-0.114	-0.377*	0.194	14.05*	-17.1	461.0**	-9.79	64
Kilyumukwe	2.99***	-7.50**	0.019	-0.086	-0.020	8.92**	70.9*	400.3***	-15.19*	78
Ubusosera 6	5.17***	-1.04	-0.201	0.036	-0.060	-4.17	152.5*	340.7**	0.33	66
Red Wolaita	3.89***	-6.71*	-0.011	-0.247**	0.048	8.44*	35.3	336.3***	-15.37*	65
Nain de Kyondo	9.47***	6.39	-0.193	0.253	-0.326*	-0.82	382.4***	361.6*	41.70**	58
A 176	6.02***	-13.21***	0.038	-0.451***	0.082	20.39***	169.1**	828.3***	-22.25*	81
A 197	4.03***	-6.39*	0.035	-0.051	-0.140	5.57	225.6***	416.3***	8.67	66
Ex Rico 23	6.23**	-17.03**	-0.025	-0.546**	0.129	28.70***	161.7	719.9***	0.56	71
ZPv 292	3.54***	-6.11	0.012	-0.012	-0.107	10.73**	143.9**	401.2***	5.60	65
Calima	4.97***	-7.28**	0.087	-0.149	-0.090	11.97***	118.1**	379.5***	-2.96	77
GLP 1004	5.39***	-6.85*	0.145	-0.173	-0.177**	14.39***	191.8***	474.4***	0.88	77
Carioca	7.07***	-8.21	-0.122	-0.245	0.130	3.99	108.4	492.9***	-23.00*	74
A 370	5.79***	-8.42*	0.031	-0.351**	0.149	9.00	36.8	421.3***	-28.95***	71
A 410	4.15***	-15.46***	0.025	-0.615***	0.301***	22.54***	17.2	663.2***	-46.39***	82
XAN 76	7.03***	-8.76	0.192	-0.493*	0.029	30.69**	146.7	735.9***	-17.78	55
997 CH 173	7.73***	-7.04	0.081	-0.050	-0.255*	3.49	375.5***	625.9***	-5.47	66
GLPx 92	3.51***	-10.51***	-0.098	-0.279**	0.153*	3.62	114.5*	627.3***	-29.55***	83
Ikinimba	1.54	-12.72***	0.084	-0.366**	0.166*	11.47**	25.4	576.1***	-36.88***	67
G 13671	4.46**	-13.54***	-0.209*	-0.103	0.066	-0.56	77.7	382.3***	-7.93	71
G 2816	5.39***	-11.75**	0.199	-0.441***	0.013	26.46***	166.1**	675.3***	-13.87	79

Table 98. Coefficients from regression of environmental variables on seeds/100 pods of individual genotypes in AFBYAN II in 15 environments, 1988-1991.

Genotypes	Environmental variables									
			Rainfall periods							
	Stands/ m^2	Soil rank	Pre sowing	Vegeta-tive	Repro-ductive	Mean temper-ature	Day length	Change in day length	Disease index	R^2 (%)
INIA 10	-3.52	-4.26	-0.095	-0.013	0.102	5.21	-70.8	137.6	-2.80	10^{ns}
INIA 12	-2.76	-2.40	0.297	-0.602***	0.258*	10.79	-22.8	216.1	-36.85*	44**
K 20	-2.18	-2.92	0.637***	-0.755***	0.025	22.16**	96.5	271.7	-26.48	52
GLP 24	1.18	4.32	0.284	-0.616**	0.257	10.64	-38.2	7.1	-10.70	51
G 12470	-0.37	-10.35*	0.436**	-0.757***	0.208	15.17*	162.4	556.6***	-20.90	72
HF 465-63-1	2.41	-20.31*	0.116	-0.979***	0.685***	22.62*	-322.1**	223.0	-43.15*	58
Kilyumukwe	-2.11	-0.77	0.079	0.071	-0.116	0.79	192.6*	274.5	11.91	29^{ns}
Ubusosera 6	-0.22	3.57	0.293	-0.567*	0.347	7.35	62.6	73.0	-1.59	58
Red Wolaita	0.22	8.97	0.057	-0.261	0.165	2.04	-21.2	-238.6	28.51	38*
Nain de Kyondo	-2.12	-14.58*	0.343	-1.266***	-0.664***	28.22**	-166.7	255.8	-49.46**	69
A 176	10.43**	-16.03	-0.187	-0.346	0.155	10.05	-83.1	57.1	20.96	55
A 197	-1.26	10.12*	0.278	-0.279	-0.107	1.64	167.5*	58.9	4.57	58
Ex Rico 23	-1.54	5.28	0.293	-0.395	0.056	8.65	0.0	-161.6	-3.38	37*
ZPv 292	-0.60	5.60	0.248	-0.441*	0.116	11.05	91.1	273.1	-7.76	42*
Calima	-2.28	-0.97	0.192	-0.408**	0.143	6.81	77.2	321.3*	-9.27	58
GLP 1004	-0.52	5.03	0.345*	-0.669***	0.375**	17.38*	-40.2	-32.4	-7.02	70
Carioca	-1.39	-14.21	0.135	-0.442	0.294	18.81	-105.9	102.9	-22.59	19^{ns}
A 370	-1.75	-6.06	0.085	-0.554*	0.386*	8.13	105.8	351.0	-14.88	55
A 410	5.05*	2.39	0.117	-0.216	0.059	13.23	150.6	87.1	14.39	44**
XAN 76	3.34	-16.60*	0.231	-0.552*	0.154	22.31*	74.4	76.6	-18.07	53
997 CH 173	0.06	-3.52	0.509**	-0.685***	0.268	13.86	139.5	562.0**	-33.96*	57
GLPx 92	3.01	11.02	0.102	-0.031	-0.046	-1.67	198.3	-75.8	21.94	31^{ns}
Ikinimba	3.90*	11.46	0.274	0.012	-0.298*	0.62	373.7***	37.4	29.12	56
G 13671	-0.61	0.68	0.381	-0.349	0.036	15.18	150.7	176.5	-7.42	30^{ns}
G 2816	2.50	6.21	0.401*	-0.454*	0.056	17.80*	112.0	-32.4	9.66	56

Table 99. Coefficients from regression of environmental variables on seed weight (cg) of individual genotypes in AFBYAN II in 17 environments, 1988-1991.

Genotypes	Environmental variables								
			Rainfall periods						
	Stands/ m^2	Soil rank	Pre sowing	Vegeta-tive	Repro-ductive	Mean temper-ature	Day length	Change in day length	R^2 (%)
INIA 10	3.33	14.09*	-0.114	-0.231*	0.063	-17.27**	-13.4	-148.1	44
INIA 12	3.49	6.18	0.018	-0.136	-0.026	-12.56	68.8	55.4	30*
K 20	4.09*	3.24	-0.088	-0.119	-0.012	-7.37	88.2	185.0	34*
GLP 24	2.95	8.40	0.143	-0.033	-0.181	-10.10	95.7	151.5	34*
G 12470	3.68	-2.33	0.147	-0.025	-0.114	-12.28	6.9	108.3	33*
HF 465-63-1	0.97	13.55**	0.180	0.161	-0.393***	-14.64*	396.6***	272.9	57
Kilyumukwe	2.99	13.38*	-0.082	-0.575***	0.226	-20.32***	28.3	225.5	75
Ubusosera 6	0.75	6.35	0.018	-0.060	-0.068	-3.89	16.7	-103.7	16ns
Red Wolaita	0.33	4.49	-0.079	0.104	0.070	-9.65*	-53.5	-154.9	18ns
Nain de Kyondo	0.45	4.66	-0.049	0.256*	-0.081	-5.96	-44.5	9.7	21ns
A 176	-2.96*	7.69*	0.373***	-0.018	-0.281**	7.06	249.4***	39.3	62
A 197	6.81**	-4.24	-0.276	-0.081	0.119	-3.75	-57.2	360.0	44
Ex Rico 23	1.50	9.22**	0.103	-0.005	-0.138*	-1.17	88.9	49.9	29ns
ZPv 292	8.35*	6.30	0.095	0.049	-0.355**	-7.17	153.7	80.4	47
Calima	6.02**	19.54***	-0.183	0.137	-0.195	-19.49**	78.2	31.5	53
GLP 1004	3.46*	9.67	-0.002	-0.026	-0.294**	-11.22	117.6	217.6	52
Carioca	0.50	6.10	0.007	-0.007	0.001	-3.41	6.7	15.3	12ns
A 370	2.25	4.24	0.239	-0.139	-0.148	4.01	173.0*	265.3*	25ns
A 410	-1.06	12.64**	0.122	0.091	-0.156	-12.80*	55.7	-70.6	33*
XAN 76	-3.01	17.23*	-0.037	-0.001	-0.030	-20.73*	73.6	45.4	33*
997 CH 173	1.95	3.85	0.340*	0.014	-0.253**	2.45	245.9**	236.4	25ns
GLPx 92	4.50*	-3.67	0.096	-0.033	-0.161	3.05	156.8	173.2	21ns
Ikinimba	4.36*	8.48	-0.067	-0.010	0.025	-9.74	-7.9	-30.4	31*
G 13671	3.27	10.05	0.064	-0.057	-0.015	-3.18	8.0	78.9	25ns
G 2816	1.11	13.39**	0.047	0.223**	-0.104	-22.60***	76.5	-88.1	49

Table 100. Coefficients from regression of environmental variables on mean disease scores of most susceptible genotype in AFBYAN II in 21 environments, 1988-1991.

Diseases	Environmental variables						
	Soil rank	Rainfall periods			Mean temper-ature	Day length	R^2 (%)
		Pre sowing	Vegetative	Repro-ductive			
Anthracnose	0.097	-0.0003	-0.0011	0.0002	-0.313***	-1.05*	85
Angular leaf spot	0.249	0.0028	-0.0111**	0.0018	-0.070	-0.39*	71
Alternaria blight	0.048	0.0009	-0.0029	0.0007	-0.009	0.39	7ns
Ascochyta blight	-0.037	-0.0080	0.0035	0.0035	-0.554**	-2.93	56*
Floury leaf spot	0.134	0.0068	-0.0095*	-0.0001	0.342*	-1.58	58*
Rust	0.302	0.0062	-0.0024	-0.0020	-0.446***	-1.48	76
Scab	0.008	0.0016	-0.0004	-0.0009	0.024	0.02	20ns
Web blight	0.002	-0.0009	-0.0016	0.0095**	0.132	-1.18	53ns
White mould	-0.010	0.0010	-0.0013	-0.0008	0.009	-0.43	17ns
Common bacterial blight	0.231	-0.0037	-0.0084	0.0088	0.224	-1.08	41ns
Halo blight	0.134	-0.0047	0.0018	-0.0004	-0.212	1.20	34ns
Bean common mosaic virus	-0.135	0.0055	-0.0075	-0.0005	0.237	-0.62	26ns

*, **, *** - level of probability less than 0.05, 0.01 and 0.001, respectively.

Figure 1. Dendrogram of environment classification of seed yields for 28 environments and 25 genotypes in AFBYAN II.

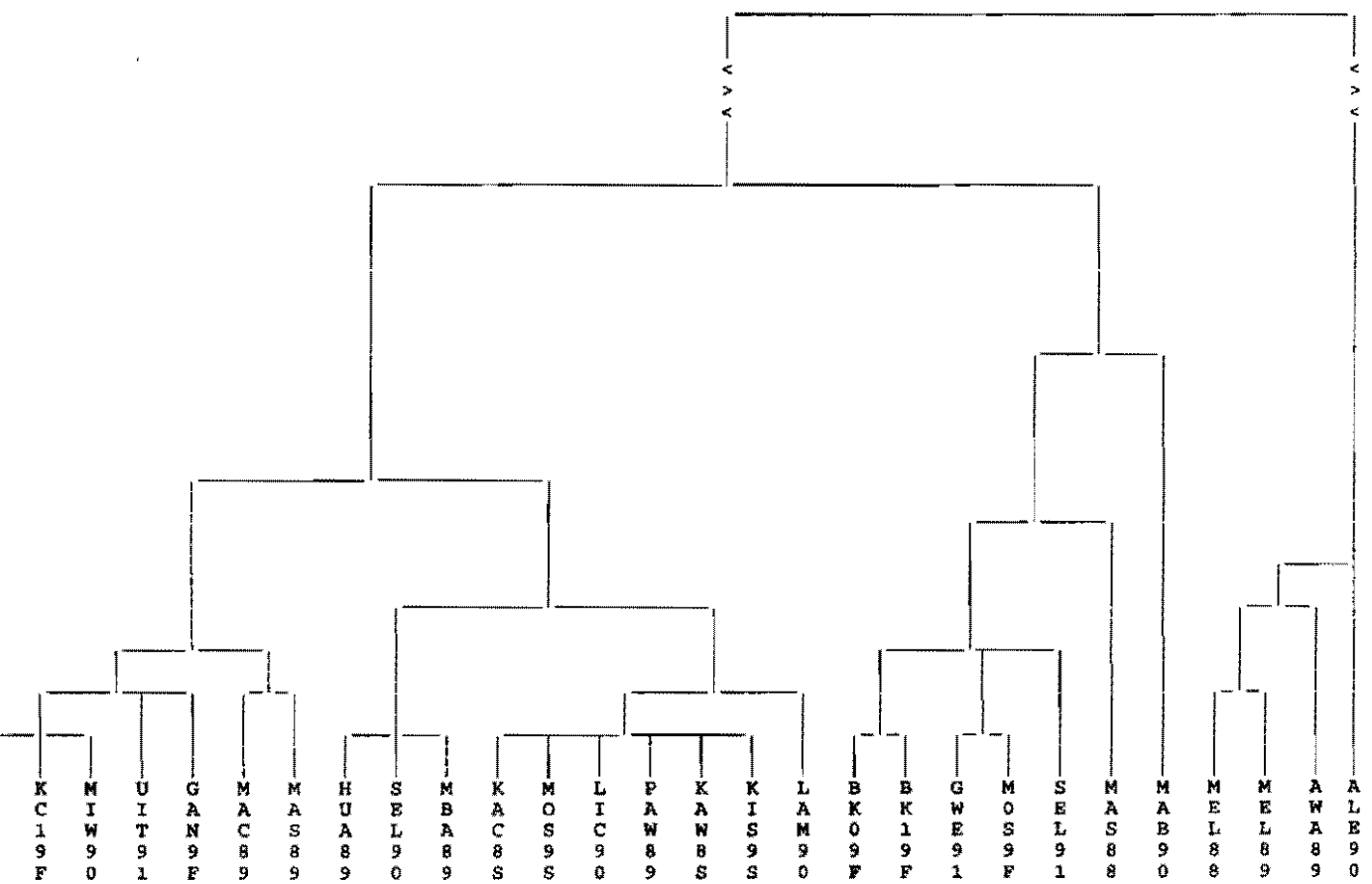

Figure 2. Dendrogram of genotype classification of seed yields for 25 genotypes and 28 environments in AFBYAN II.