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BREEDING SORGHUMS FOR THE GUINEA SAVANNA ZONE OF WEST AFRICA

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ICRISAT/SAFGRAD COOPERATIVE PROJECT
International Crops Research Institute for the Semi-Arid Tropics
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SUMMARY

A large number of diverse breeding lines, elite varieties, preliminary hybrids, male and female parents for hybrid production and sources of resistance to various stress factors were evaluated in observation nurseries planted at Farako-Bâ, Saria and Kamboinse research stations.

Twenty two elite varieties and thirty six preliminary hybrids were selected for regional/local advanced yield tests. Fifteen female parents and 64 male parents were also selected for use in hybrid production. The performance of hybrids relative to varieties was highly encouraging.

Two thousand seven hundred and eighty five germplasm accessions were evaluated at Farako-Bâ. Seventy nine accessions of diverse origin with good agronomic characters and high levels of resistance to leaf diseases, were identified for distribution to national programs.

Selected germplasm accessions, varieties and hybrids are under multiplication. A modest crossing program involving local adapted lines, promising exotic lines and sources of resistance to stress factors has been organised.

Two types of sorghums were suggested for cultivation in the Northern Guinea zone: 1) Sorghum varieties that can be planted in the first fortnight of June and harvested during the last week of October. These should possess moderate levels of resistance to midge, grain mold and head bugs. 2) Sorghum hybrids/varieties that can be planted in the second/third week of July and harvested during the last week of October. These could be relay planted into early planted maize, cotton, groundnut and pearl millet crops and should possess moderate levels of resistance to shootfly, stemborer, grain mold, midge and head bugs. In addition to white grain cultivars, red grain types (free from subcoat) should receive some attention.

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BREEDING SORGHUM FOR THE GUINEA SAVANNA ZONE OF WEST AFRICA

INTRODUCTION

The ICRISAT Sorghum Improvement Program in West Africa, hitherto, was primarily concerned with development of improved cultivars for the medium and low rainfall zones. However, the potential for increased yields through the use of high yielding cultivars, improved resource management, inputs and cropping systems is much higher in the assured moisture zone of West Africa (Guinea Savanna zone) where the mean annual rainfall varies between 900-1200 mm. The local land races of sorghum in the Guinea zone are extremely late maturing (140 to 180 days) and their grain yields (kg/ha) are much lower than would be expected from the assured moisture conditions. Identification and use of improved sorghum cultivars, particularly in those tracts where rainfall extends from May to October enabling relay cropping of legume/cereals, or where maize frequently succumbs to terminal drought, could enhance the productivity of the region. With the objective of identification/development of suitable sorghum cultivars that fit into existing/improved farming systems of the Guinea Savanna zone, ICRISAT initiated a sorghum breeding project funded by SAFGRAD/USAID during June 1985. Results of preliminary experiments and the follow up off-season activities carried out during the period June 1985 - January 1986 are reported here.

EVALUATION OF OBSERVATION NURSERIES

Seeds of a large number of diverse elite breeding lines, preliminary hybrids, male and female parents for hybrid production, sources of resistance to stress factors, improved varieties with insect resistance, several international nurseries and germplasm accessions were obtained from the ICRISAT Center Patancheru, India. These seeds were planted at the agricultural research station, Farako-Bâ (11.06°N latitude, 1066 mm average annual rainfall) during the last week of June and third week of July depending upon the arrival of seed shipments. Some of the advanced breeding material was also planted at the research station, Saria (12.16°N, 808.2 mm average annual rainfall). One set of B/A Line Observation Nursery (BON) - 1985 was planted at the research station, Kamboinse (12.2°N, 794 mm average annual rainfall). Appendix I summarises the details of diverse breeding material and germplasm accessions planted at the three locations. Plant/hill spacing of 80 x 40 cm with 3 plants per hill was adopted in the nurseries planted at Farako-Bâ. At Saria and Kamboinse a single plant per hill was maintained at 75 x 20 cm spacing. Basal dressing of land with fertilizer could not be carried out at Farako-Bâ well before planting because of continuous rains, delay in land preparation, and late arrival of seed shipments. The experimental plots were applied with cotton complex fertilizer (14:23:15) at the rate of 150 kg/ha one week after planting and top dressed with urea (100 kg/ha) five weeks after planting the crop. The germplasm accessions had to be given an additional dose of urea (50 kg/ha) since they suffered excessive water logging and denitrification at the seedling stage. They were also protected from pest attack at a later stage by applying Furadon granules (3 kg/ha) in the whorls. Nurseries planted at Saria received a basal dressing with cotton complex (100 kg/ha) and a top dress with urea (50 kg/ha). A similar dose of fertilizer was given for the nursery planted at Kamboinse.

A summary of the rainfall records of the 1985 crop season at Farako-Bâ, Saria and Kamboinse Stations is given in Table 1. At Farako-Bâ, the 1985 rainfall was 26.7% in excess of the long term average. Rainfall was nearly continuous during June, July and August while it was well spread over all the four weeks during September. However, rainfall was limited during October. At Saria and Kamboinse Stations, the rains arrived late and the total rainfall was lower than the long term annual averages by 25 and 28 percent respectively. However, it was fairly well distributed during the crop growth.

The weather at Farako-Bâ was very conducive for development of leaf diseases and grain molds and thus gave an opportunity for an effective screening of large number of breeding lines and germplasm accessions. The ICRISAT Pathologists stationed at Farako-Bâ and ICRISAT Center cooperated in evaluating all the material for various diseases.

Some of the plantings carried out during the third week of July failed due to excessive rains and soil erosion at the seedling stage. Poor and variable plant stands did not permit comparative evaluation of the entries. Important findings on breeding material that could be evaluated with reasonable confidence are summarised below.

Varieties:

A collection of 129 varieties of diverse origin was evaluated in single observation rows replicated twice. These varieties were bred at the ICRISAT Center and are of medium maturity (120-130 days). A set of the same varieties was also planted at Saria. No seedling emergence problems were observed at Farako-Bâ. However, heavy and continuous rains at Farako-Bâ through out the pre-flowering (GS_1) stage resulted in slow growth of plants, delayed flowering and increased disease incidence. It was also observed that dwarf and medium dwarf plant types with limited panicle exsertion could not produce sufficient number of panicles per plot under 3 plants/hill condition. Although incidence of grey leaf spot, sooty stripe, oval leaf spot and zonate leaf spot diseases was noticed, leaf anthracnose was the most common disease on introduced material. Grain anthracnose was the most serious disease on the grains, although incidence of Curvularia and Fusarium fungi was not uncommon. Stem tunnelling by borer was also frequently observed but it was not very damaging. Very late maturing entries including local checks (CV. Ouedezoure) were affected by midge and head bug attack.

Entries selected for 1986 Advanced Yield Tests are presented in Table 2. It might be mentioned that some of these varieties were evaluated in India during the same crop season (1985) and several ICSV Nos performed well across locations. At Saria, among others, ICSV 12 and ICSV 247 obtained very good visual scores. At Farako-Bâ, ICSV 2, ICSV 242 and M 64683 were nearly free from all leaf diseases. In addition M 24731, M 25822, M 25825, M 25854 and M 25875 were observed to be less susceptible to leaf diseases. The effects of grain weathering were reflected in reduced grain mass and enhanced floury endosperm texture, especially in the introduced varieties as compared to the Guinea local type, S-29 (Table 2). However, several of the introduced varieties were free from leaf diseases and gave much higher grain yields. The yield estimates were based on small observation plots and should, therefore, be interpreted with caution. It is encouraging to observe that several established varieties (ex: ICSV-2, SPV-386) bred in India have performed well and they deserve further testing. A few other entries exhibiting useful agronomic characteristics were selected for inclusion in the crossing block.

Breeding and Local Selections from Nigeria:

This nursery comprised breeding lines (originating from ICRISAT Center & All India Coordinated Sorghum Improvement Project - AICSIP) and Nigerian local races selected and advanced at Samaru by Dr. N.G.P. Rao, ICRISAT/SAFGRAD Sorghum Breeder during 1980-82. It was planted at Farako-Bâ and Saria in observation rows. At Farako-Bâ the Nigerian local races suffered heavily from leaf diseases and (because of late maturation) also from midge and head bug attack. At Saria they could not complete flowering due to absence of rains during October. However, the improved breeding lines were relatively free from diseases and provided some useful material for further use. Variety S-34 was selected for inclusion in the advanced yield tests while others will be used in the crossing program. At Saria S-34, S-36, S-13, S-17, and K4 deserved good scores. General observations made on these lines along with some notes taken on important Burkina Faso locals are given in Table 3.

Preliminary Hybrids:

Earlier reports from West Africa indicated that introduced hybrids succumbed to charcoal rot disease. The chances of identification of hybrids free from charcoal rot could possibly be high in a collection of hybrids of diverse origin. In order to diversi y the genetic base of commercial hybrids, several new A/B lines (female parents) were recently bred at the ICRISAT Center. One hundred and sixty three preliminary hybrids produced by using these new female parents and six male parents were evaluated at Farako-Bâ and Saria stations in observation rows. In general, the performance of hybrids compared to that of local and improved varieties was highly encouraging. The hybrids maintained better plant stands, vigourous growth, earlier flowering, better panicle exsertion, higher number of panicles per plot, higher grain yield per plot and higher grain mass than varieties. Due to lack of replication, accurate estimates of grain yields/ha could not be obtained. However, grain yield per hectare estimated on the basis of single plot yields recorded at Saria and Farako-Bâ are presented in Table 4 for selected entries. The average number of days to flower for the selected hybrids at Saria was 69 compared to 77 days at Farako-Bâ. This is in agreement with the much later flowering dates of varieties than hybrids planted at both these locations. Grain yields at Farako-Bâ were lower as was also the case with several other yield trials conducted at this location during the same crop season. However, the grain yield advantage of hybrids over varieties was apparent. At Saria the hybrids flowered during the second and third weeks of September after which the rainfall received was minimal. In spite of the moisture stess after flowering only 5% of the hybrids exhibited lodging. Several hybrids remained green for more than two weeks past maturity. At Farako-Bâ, anthracnose disease was particularly severe. However, approximately 20% of the entries were less susceptible to leaf diseases and several remained green well past maturity. The female parents ICSA-11, ICSA-38, ICSA-40, and M-20679 A produced hybrids with non-senescent plants free from leaf diseases.

Seeds of another set of 49 hybrids produced on the new A lines and the International Sorghum Hybrid Adaptation Trial (ISHAT) - 1985 arrived late and hence were planted during the third week of July at Farako-Bâ. The grain yield performance and other agronomic characters of selected entries from this set of material are presented in Table 5. Advanced hybrids included in ISHAT, like ICSH-153 (SPH-221), ICSH-102, ICSH-110 and ICSH-134 gave higher yields and deserved more advanced yield tests. It might be mentioned that in the International Sorghum Variety Adaptation Trial (ISVAT) - 1985 conducted at Farako-Bâ and Kamboinse, ICSH-153 hybrid check gave the highest yield (2910 kg/ha averaged over the two locations) and exhibited about 58% grain yield advantage over the trial mean. These preliminary observations on hybrids indicate their potential use for cultivation in the Guinea Savanna zone and call for further detailed investigations.

B/A Line Observation Nursery (BON):

The B/A Line Observation Nursery (BON) - 1985, comprising 45 new A/B lines developed at the ICRISAT Center and three checks (A/B Lines of 623, 296 and 2219) was planted at Farako-Bâ and Kamboinse stations in observation rows. This nursery was also planted during the same crop season by the national sorghum programs at Farako-Bâ (Burkina Faso), Sotuba (Mali) and Maradi (Niger). Visits to all these locations facilitated a thorough evaluation of the female parents for their adaptation to West African agroclimatic conditions. The A - lines were bagged soon after panicle emergence and % self fertility/seed set was carefully evaluated. With one or two exceptions at Maradi (subject to further confirmation) all the female parents maintained the sterility and didn't show any symptoms of sterility breakdown. Evaluation at four diverse locations provided an opportunity to evaluate the lines for their leaf disease resistance which is critical for introduced lines. Incidence of sooty stripe was very high at Sotuba and Kamboinse while it was moderate at Farako-Bâ. Long smut appeared in severe proportions on some entries at Kamboinse. Grey leaf spot, zonate leaf spot and anthracnose were important leaf diseases that affected the nursery at Farako-Bâ. Based on visual scores for general performance and disease incidence, 15 female parents were selected for further use in hybrid production. Average time to flower (d), plant height (cm) and disease scores recorded on the selected female parents are presented in Table 6. ICSA 1 (MA9), ICSA 2 (MA12), ICSA 26 and ICSA 34 were less susceptible for the various leaf diseases while ICSA 11 and ICSA 23 also exhibited good levels of resistance. The remaining parents were moderately resistant to all the diseases except sooty stripe. Some of the lines which exhibited low scores for sooty stirpe at Sotuba were affected severely at Farako-Bâ and vice versa. Further multilocational evaluation of the selected fifteen parents will reveal stable multiple disease resistant lines.

In addition to the BON, twenty A/B lines received from the ICRISAT Center were also observed at Farako-Bâ. Four lines, namely, SPL-117A, SPL-120A, SPL-151A and D1A were selected for more critical evaluation during 1986.

Restorer Lines:

Male and female parents exhibiting local adaptation to the test region are important for any hybrid breeding program. In order to select suitable male parents for future use, 251 restorer lines of diverse origin were obtained from the ICRISAT Center. In addition to these breeding lines, germplasm accessions (29) originating from Southern Africa and known to possess red grains with good malting quality were also observed. Past experience indicated that crosses with African locals x exotic dwarfs usually result in brown grain hybrids because of b_1-b_2 gene interaction. Three genetic stocks known to be homozygous recessive b_1b_2 and found to give white grain hybrids with African locals were also observed at Farako-Bâ. Finally out of the 283 male parents evaluated, 64 were selected for further use (Table 7) in hybrid production.

Evaluation of Germplasm Accessions:

Genetic improvement of any crop species depends upon the quantum of genetic resources available and the proportion of genetic variability exploited by breeding programs. Introductions of genetic stocks to an environment different from their origin frequently results in disappointment. Despite this general observation, a very low proportion of useful introductions could contribute significantly to the improvement of the crop. A survey of the sorghum genetic stocks in use by the national programs in West Africa indicated very limited variation. Moreover, sources of resistance to pests and diseases common to West Africa, are not well evaluated and documented. In the Guinea Savanna zone of West Africa, it might be useful to observe germplams types flowering between 85 to 100 days since a majority of local races of this zone exhibit a similar range of number of days to flowering. Therefore, seeds of germplasm accessions known to flower in 85 to 100 days and possessing white grain color were requested from the Genetic Resources Unit of the ICRISAT Center. The original objective was to evaluate all such lines in two dates of planting and document their individual performance for various economic characters. However, this was not possible due to late arrival of seed shipments and lack of sufficient land resources. Finally a total of 2795 germplasm accessions (Table 8) were planted in the third week of July at Farako-Bâ. Continuous heavy rains immediately after planting caused serious damage to the crop at the seedling stage and about 300 accessions didn't establish. Thirty percent of the accessions exhibited poor plant stand while the remainder performed normally. However, they were attacked by midge and head bugs after flowering resulting in serious grain losses. Therefore, only a visual evaluation of the accessions for their general adaptation and disease resistance was possible.

ICRISAT Pathologists cooperated in the evaluation of leaf diseases. The climate was highly favorable for development of leaf diseases as was evidenced by several cultivars exhibiting severe disease symptoms. Based on their agronomic performance and scores for five different leaf diseases 79 germplasm accessions were selected for further detailed investigations during 1986. A list of these accessions is provided in Table 9 along with their time to flower, plant height and disease scores.

It was ecouraging to find several accessions showing multiple disease resistance and good grain quality. These accessions originated from various countries and exhibited divergent panicle characteristics. Some of them deserved very high agronomic scroes. It is proposed to distribute these selected germplasm accessions to interested national programs in the region. Multilocational evaluation of these lines might enable us to identify stable sources of leaf disease resistance and additional sources of genetic variability for exploitation by national programs.

Other Nurseries:

Several other groups of material planted during July didn't establish properly because of continous rains during their seedling stage and excessive soil erosion at Farako-Bâ. There include preliminary and advanced varietal trials of ICRISAT Center, pest resistant breeding lines etc. In spite of good germination and field conditions, source lines for good seedling establishment exhibited very poor adaptation. The yellow endosperm selections from Karper's nursery failed to germinate.

Twelve F_2 populations of single crosses involving Nigerian local cultivars (Farafara and Kaura) and improved exotic dwarfs were grown in large plots. Although the F_2 segregants grew normally, no useful selections could be made. The recombinants didn't show any improved panicle characters. Moreover they were seriously damaged by midge and head bug due to late maturity. It is concluded that back-cross generations involving the improved dwarf parents might provide some interesting segregants. Such a back-cross program is underway.

OFF-SEASON ACTIVITIES

A summary of seed increase/crossing block planted during October-November, 1985 at Kamboinse under irrigation is appended (Appendix II.). An effort has been made to increase the seed of varieties selected for regional/local yield trials of 1986. Seeds of preliminary hybrids selected for yield trials have been requested from ICRISAT Center and a separate crossing plan was organised at the ICRISAT Center with assistance from Center staff. Similarly, all the selected germplasm accessions have been planted for seed increase and were included in a conventional crossing program organised at the Center. At Kamboinse, selected female parents (A/B lines) were maintained and multiplied.

In addition, several elite lines were selected from on going breeding programs in Mali, Niger and Burkina Faso and have been included in the crossing program. Sorghum cultivars originating from West Africa and elite lines of proven value in West African Regional trials were also included in the crossing block. Single crosses between divergent groups of material were attempted so as to provide seed for multiple crosses planned for 1986.

GENERAL DISCUSSION.

This breeding project has been conceived with the broad objective of selecting sorghum cultivars suitable for cultivation in the Guinea Savanna Zone. It is recognized that the project objectives could be further sharpened with increasing experience and availability of scientific data. Several sorghum based cropping systems involving different maturity groups of sorghum intended for specific sowing periods were proposed by past workers. Based on the current experience, it may be worthwhile to examine the prospects of different sorghum breeding approaches in conjunction with the agroclimatic and biotic factors prevailing in the Guinea Zone.

Zonal Limits: The guinea savanna zone is a large belt spread across West Africa and is dominated by tropical ferruginous soils and ferruginous crusts. In the Northern Guinea Zone the mean annual rainfall ranges from 900-1200 mm while in the Southern Guinea zone it may extend up to even 1450 mm. Although sorghum is grown in the Southern Guinea zone, it is not a very important crop there. Maize is the predominant cereal in this zone and it is well adapted and productive. In spite of the assured moisture conditions, adaptation problems of sorghum, particularly the medium and early maturing ones, in the Southern Guinea Zone are manifold. Maize is commonly grown in the Northern Guinea Zone but could suffer due to terminal drought and therefore is of marginal value. Sorghum is the staple cereal in this zone. Apparently, the success of improved sorghum cropping systems and cultivars in West Africa lies in the 900-1200 mm rainfall zone. Broadly speaking the 900-1200 mm zone of West Africa comprises the northern parts of Guinea, Ghana, Togo, Ivory Coast and Central African Republic, North Central parts of Nigeria, Southern parts of Chad and Mali, South Western region of Burkina Faso and the Central parts of Benin and Cameroon. In general, the soils planted with sorghum are shallow and have poor water holding capacity and low fertility (particularly deficient in Phosphate). Acidity of soils is also reported to pose problems, especially in those areas where continuous cropping is the practice.

Agroclimate: The Farako-Bâ Station of Burkina Faso represents a good example of the Northern Guinea Zone climate (Table 10). Although rains begin to fall during April, it is only during the first fortnight of June that they establish. July and August represent completely wet periods. Rainfall during September is reliable, however, it starts declining suddenly and sharply in the last week and is frequently less dependable in October (Fig. 1). November represents practically a dry period. However, in the Northern Guinea zone considerable residual soil moisture exists and sorghum crop can possibly be sustained till the middle of November subject to normal rainfall during October. Climatologists have indicated November 6 as the end of wet period (including residual moisture) in Bobo-Dioulasso which is very near Farako-Bâ (Cochemé and Franquin, 1967). An examination of the rainfall pattern and soil moisture holding capacities at other locations in the North Guinea zone leads to a similar general conclusion.

Traditional Sorghums: The traditional sorghums are plated anytime begining April 15 until June 15 - depending upon the incidence of rainfall and staggered planting is common. Plant populations do not exceed 60,000 per hectare. The cultivars are photoperiod sensitive and they flower during the third week of September. However, the brown sorghums are relatively early maturing and flower during the first week of September. All of them belong to the guineense group and possess long, drooping and open panicles. The white grain types have a highly corneous endosperm and are protected by involute glumes. The brown grain types are also protected by involute glumes but have a soft endosperm and are used mostly for brewing purposes. The area cultivated with white and brown grain types is approximately equal. The traditional sorghums are generally highly susceptible to leaf diseases like grey leaf spot. Grain yields of the best local races do not exceed 2500 kg/ha even under good management. Delayed plantings result in progressively less yield.

Diseases and Pests: Leaf diseases like grey leaf spot, anthracnose, zonate leaf spot, oval leaf spot and sooty stripe are common in the Northern Guinea zone. However, introductions suffer from anthracnose and sooty stripe more than any other disease. Fortunately durable resistance to leaf diseases is

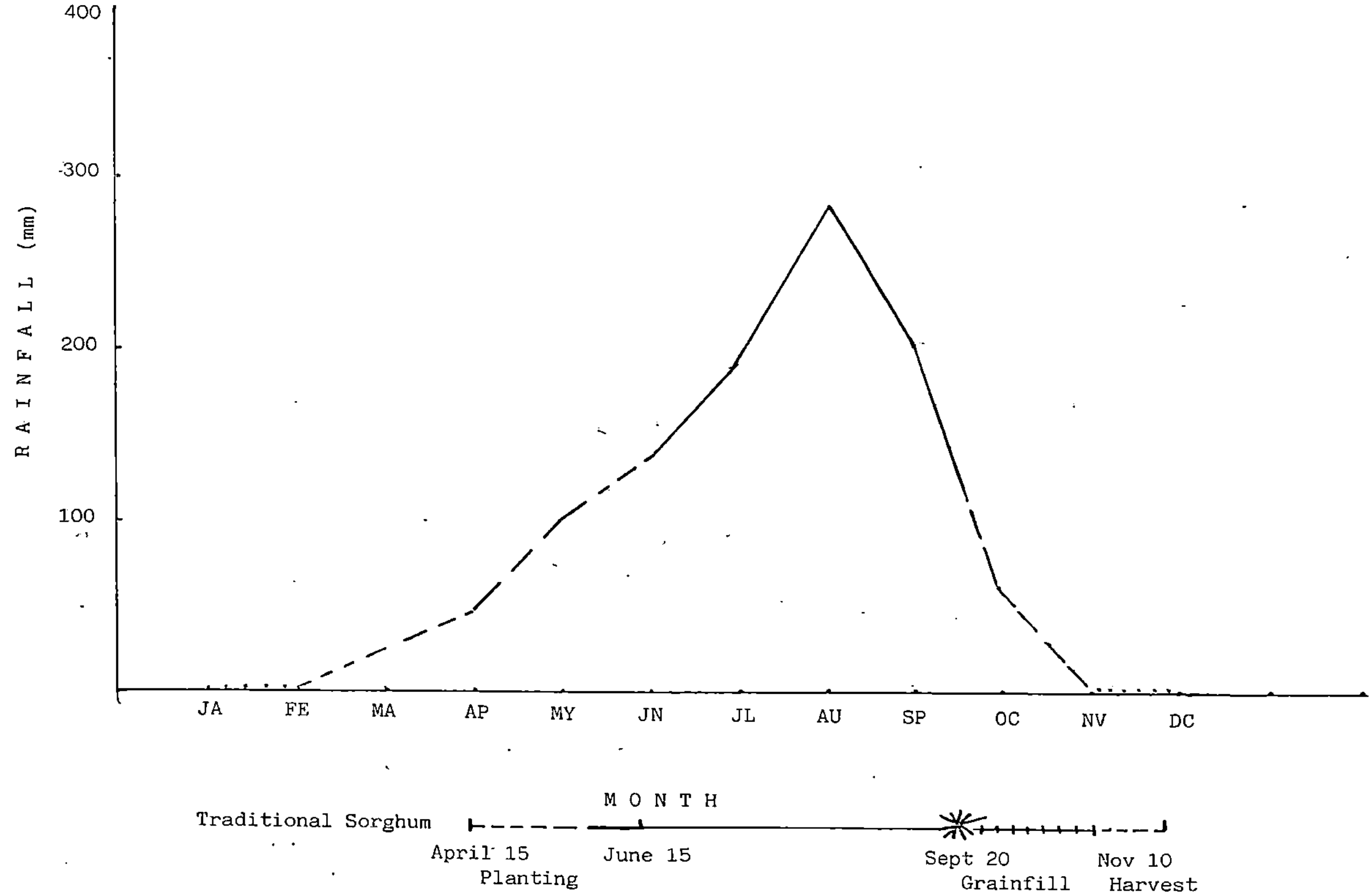

Fig. 1: Rainfall pattern at Farako-Bâ (11.06°N latitude). Computed on the basis of precipitation received during 1953 to 1984.

available. All the four major pests of sorghum, namely, shootfly, stem borer, midge and head bug (Eurystylys sp.) are important in this region. The staggered plantings of the local cultivars encourage a constant build up of pests and are highly vulnerable to all of them except the head bugs from which they are partially protected because of their guineense panicle with involute glumes. Shootfly populations increase to a damaging level after the second week of July. Similar is the case with stemborers, although they cause wide scale tunnelling (which is less damaging) throughout all plantings. Midge populations pose a danger to any crop flowering after the third week of September. Serious losses of grain caused by midge attack were reported from several districts of Burkina Faso by K.F. Nwanze (ICRISAT). Similarly head bugs cause severe grain damage to sorghum crop maturing after the second week of October. Resistance to midge and head bug are very important for sorghum varieties recommended for late plantings. At the moment sources of resistance to pests like head bug are not known while improved plant types with midge resistance are still under test. In any case, it is a very difficult task for sorghums relay planted during August to stand up the pest attack and slow growth due to water logging and yet produce economic yields. However, moderate levels of resistance to grain molds can be combined with white grain types that allow grains to mature during late September and early October. Apparently, the strategy of escaping pest attack by suitable adjustment of planting dates might provide some practical solutions for the immediate future. Search for durable resistance to pests must, however, continue. Thus a consideration of the pest population build up during the crop season indicates that with moderate levels of pest resistance, plantings can be staggered only up to July 3rd week.

Breeding Objectives: Some breeders have experimented with the objective of increasing yields by breeding photoperiod sensitive dwarf or medium height varieties that could be planted in the early rains and mature in the dry season. However, such varieties have rarely given satisfactory results. The ICRISAT regional trial 1985 comprising improved photoperiod sensitive material miserably failed at all the locations in the Guinea Zone. Obviously the approach of breeding improved dwarf varieties requiring 160-200 days to mature is not promising. The poor harvest index of tall and late maturing types is well recognized. Breeding partial or semi-photoeriod sensitive varieties was also suggested by some workers. Although photoperiod sensitivity contributes to the adaptation of cultivars intended for areas with uncertain length of rainy season, the very mechanism appears to reduce the magnitude of potential yield: Therefore significant increase in yield, stability of yield and photoperiod sensitivity may be difficult to combine. There doesn't seem to be any advantage for increased grain yield in plant types requiring more than 135 days to mature under West African conditions. Some such types may show certain advantages as individual plants during the years of satisfactory to good rainfall but they do suffer from the disadvantage of poor grain yield per plot/hectare .

One can conceive of two different types of sorghum maturity duration in the Noth Guinea Zone: i) A medium late maturing variety that can be planted in the first fortnight of June and harvested during the last week of October ii) An early maturing type that can be late planted during the second/third week of July and harvested during the last week of October. It is desirable that flowering period of all improved sorghums coincides and occurs before September third week irrespective of their planting date ie. preferably a few days earlier than the flowering of majority of the local white sorghum. This is necessary in view of the precarious pest and climatic situation prevailing after the third week of September. The early maturing sorghum could preferably be a hybrid and could be relay planted into early planted maize, cotton, groundnut and millet cropping systems. The advantages of hybrids with reference to seedling vigour, early maturity, exploitation of nutrients, and higher yield are well established. In West Africa, cash crops like cotton and groundnut are commonly fertilized and a hybrid sorghum component in such coopping systems can more effectively utilize the resources. However, an earlier maturing sorghum variety can also be an alternative component.

As mentioned earlier, midge, head bug, stemborer and shootfly are important pests in that order in the N.Guinea zone. The medium late (130 days) maturing sorghums as well as early maturing types (100 days) would require moderate levels of resistance to midge and head bug. The early maturing types would require resistance to the pests, shootfly and stember and good seedling vigour. Under late planting situations of sorghum, seedling viour and resistance to shoot pests assume great importance since late July is known to be an extremely wet period.

Significant attention should be paid to leaf disease resistance and grain quality. In the Guinea zone, sorghum grain molds affect grain quality with specific reference to grain mass and endosperm hardness. Stringent selection in favor of acceptable grain size and hardness is necessary. Although white grain types should be given the highest priority, the importance of brown grain types cannot be ignored. Traditionally sorghum beer is prepared from brown grains and their cultivation assumes commercial importance throughout the Guinea Zone. Brown grains are known to contain nutritionally harmful compounds called tannins. However, red grain types free from subcoat do not contain tannins and they exhibit superior brewing quality. Red grain types can also be used for food, provided their endosperm is hard. High levels of grain mold resistance has been identified at the ICRISAT Center in some red grain types. Therefore, breeding sorghum cultivars with red pericarp (free from subcoat) should be given adequate attention.

TRAVEL

The sorghum breeder travelled on short trips to Niger, Togo, Ghana, Mali and Ivory Coast with the objective of obtaining a first hand knowledge of the national sorghum programs in the region. The West African Regional Sorghum Workshop held at Bamako (October 21-24) was also attended.

ACKNOWLEDGEMENT

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Table 1. Rainfall pattern at Farako-Bâ, Saria and Kamboinse - 1985.

Month	Farako-Bâ		Saria		Kamboinse	
	Rainfall (mm)	No. Rainy days	Rainfall (mm)	No. Rainy days	Rainfall (mm)	No. Rainy days
January	0.0	0	0.0	0	0.0	0
February	0.0	0	0.0	0	0.0	0
March	40.0	1	0.0	0	4.8	1
April	6.7	2	3.5	1	3.4	2
May	111.8	6	10.8	3	17.1	3
June	290.0	13	63.0	10	75.3	7
July	271.5	15	213.2	11	209.9	10
August	428.6	17	169.4	13	133.2	12
September	154.9	13	141.2	11	129.2	11
October	57.3	5	4.1	3	0.6	1
November	0.0	0	0.0	0	0.0	0
December	0.0	0	0.0	0	0.0	0
	1360.8	72	605.2	52	573.5	47

Source: Direction de l'agrométéorologie - Ouagadougou.

Table 2. Performance of varieties - Farako-Bâ & Saria, 1985[1] (Plot size -4 m^2).

Entry	Farako-Bâ							Saria (visual score)
	Time to flower (d)	Plant height cm	No. of panicles/ plot	Grain yield kg/ha	Grain mass (g/100)	Endosperm texture[2] score	Leaf[3] Anthracnose	
M 24552 (ICSV 200)	80	185	35	1750	1.8	4		
M 24572 (ICSV 202)	80	142	31	1437	1.2	4	5	Good
M 24648 (ICSV 230	78	169	34	1937	1.3	5	5	
M 24667 (ICSV 234)	82	185	32	1437	1.4	4		
M 24723 (ICSV 242)	83	182	34	1937	1.8	4	2	
M 25534 (ICSV 126)	75	193	32	1312	1.9	3	5	V Good
M 24619 (ICSV 247)	78	199	28	2000	1.8	5	5	V Good
M 60256 (ICSV 2)	85	227	23	1092	1.7	5	2	Good
M 60272 (ICSV 111)	70	202	30	1967	2.3	4		Good
M 60375	89	218	25	1342	1.6	4	3	
M 60396	81	206	21	1342	2.2	5	3	Good
M 60310	88	212	29	1687	1.5	4	3	
M 60382	86	162	27	1312	2.7	4	5	Good
M 60388	90	189	24	1312	1.6	3		Good
M 60777	87	164	26	1000	1.9	4	4	
M 24525	85	187	22	1280	1.7	4	4	
M 24544	73	222	31	2062	2.3	3	3	
M 24581	84	198	21	1405	2.1	4	3	Good
M 24683	77	200	29	2125	2.1	3	2	
M 24727	75	179	31	1842	2.0	4	3	Good
M 24730	83	174	32	1187	2.0	4	3	V Good
M 24791	81	198	33	2280	1.8	4	5	Good
ICSV 1001 HV(Check)	79	195	19	938	2.7	5	3	
ICSV 1002 HV(")	79	207	24	1187	2.0	4	2	
S-29 (")	80	333	21	1000	2.3	2	4	

1. Based on observation nurseries planted at Farako-Bâ and Saria. Observations on time to flower, plant height, no. panicles, grain yield, grain mass and endosperm texture were averaged over two plots (single rows of 5 m planted 80 cm apart) grown at Farako-Bâ. Visual observations at Saria were based on single plots (two rows of 5 m).
2. Endosperm texture was scored on a scale of 1 to 5 where 1 = 80-100% of the endosperm corneous and 5 = 0-20% of the endosperm corneous. Observations on 10 randomly picked grains were averaged over the plot.
3. Leaf anthracnose was scored at Farako-Bâ on a scale of 1 to 5 where 1 = no disease 5 = more than 50% of the leaf area affected by the disease.

Table 3. Time to flower, plant height and disease scores of selected breeding lines and local cultivars. Farako-Bâ – 1985.

Cultivar/ Breeding line	Time to flower(d)	Plant height (cm)	Disease score[1]	
S-13	83	134	Anthracnose	5
S-17	85	129	Anthracnose	3
S-34 (M 601)	90	169	Sooty st.	3
S-36 (M 603)	98	134	2	
S-40	96	195	2	
S-46	103	180	2	
S-47	102	155	3	
K-4	96	152	3	
BES	105	175	3	
Fara Fara Sene-2	115	390	5	
729-2 (Kaura)	105	275	5	
735 (Nigerian Local)	111	420	5	
Boromo (Burkina land race)	86	375	4	
Gnofing "	90	365	4	
Ouedezouré "	104	430	4	
Tioadi "	96	335	4	

1. Diseases were scored on a scale of 1 to 5 where 1 = free from diseases and 5 = 50% leaf area affected by disease. S-13, S-17 and S-34 were scored only for the specific disease mentioned while the scores for other entries represent a general score.

Table 4. Performance of preliminary hybrids at Saria (S) and Farako-Bâ (F) - 1985. Plot size - 8 m^2 and 6 m^2 at Saria and Farako-Bâ respectively.

Hybrid	Time to flower(d)[1]	Plant height cm[1]	No. panicles per plot[2]		Grain yield kg/ha[2]		Grain mass g/100	Endosperm[3] texture	Disease score[4]
			S	F	S	F			
M 25467 A x MR841	75	185	36	61	3233	2313	2.0	3	-
ICSA 11 x MR 844	78	178	37	29	3399	1406	2.2	4	2.0
ICSA 11 x MR 862	73	195	39	51	2799	2156	2.3	4	2.0
M 25474 A x MR 862	73	188	34	60	3399	2219	2.2	4	-
ICSA 14 x MR 841	66	170	39	54	3666	1656	2.0	5	3.0
M 20679 A x MR 841	78	180	29	52	2933	1625	2.3	4	2.0
M 20679 A x MR 844	76	178	21	72	2099	2875	2.4	4	2.5
M 20679 A x A-4956	80	190	23	52	3433	1656	2.2	4	2.0
M 20679 A x R-653	73	165	12	62	3033	1656	2.5	4	3.0
ICSA-16 x MR 844	75	160	-	55	-	1656	2.0	4	3.0
ICSA-16 X MR 860	77	185	34	53	3499	1125	2.3	5	2.0
M 20769 x MR 860	78	170	37	53	2799	2281	2.9	4	2.0
M 20769 x R-656	79	173	36	54	2933	1563	2.3	4	2.0
ICSA 18 x R-654	71	163	24	59	2366	1594	2.6	4	2.0
ICSA 22 x MR 841	68	170	34	56	3233	812	1.9	5	4.0
ICSA 26 x MR 862	78	180	38	60	2033	1281	1.8	4	-
ICSA 27 x MR 841	64	165	45	53	3033	1250	2.5	4	-
ICSA 27 x MR 862	68	170	34	58	2699	2000	2.5	4	-
ICSA-28 x A 4956	74	149	39	40	3133	1219	2.4	4	2.0
ICSV-29 x MR 841	72	170	33	41	3799	813	1.9	4	-
ICSA 29 x MR 862	75	170	31	50	2633	1125	2.4	4	2.0
ICSA 30 x MR 841	75	170	43	47	3799	813	1.8	5	-
ICSA 30 x A-4956	75	180	40	49	3533	750	2.2	5	-
M 21019 x MR 841	73	198	39	71	3433	2000	1.8	5	3.0
M 21019 x A 4956	70	193	39	60	3866	1031	2.4	4	3.0
ICSA 38 x MR-841	86	160	-	27	-	844	1.9	4	2.0
ICSA 38 x MR 844	80	175	40	17	3466	563	2.1	4	2.0
ICSA 40 x MR 862	70	163	43	53	3666	2344	2.4	4	2.0
ICSV 1002	79	180	42	10	2816	344	2.5	5	2.5

1. Observations on time to flower(d), plant height (cm) and grain mass (g/100) were averaged over the two locations, Saria and Farako-Bâ.

2. Observations at Saria were based on single plots (two rows of 4 m). Observations at Farako-Bâ were also based on single plots (two rows of 5 m). Row spacing was 75 cm and 80 cm at Saria and Farako-Bâ respectively.

3. Endosperm texture scores were averaged over ten individual observations per plot on randomly picked grains and over the two locations.

4. Leaf diseases were scored at Farako-Bâ on a scale of 1 to 5 where 1 = no disease and 5 = 50% leaf area affected by disease.

Table 5. Performance of preliminary hybrids at Farako-Bâ, 1985. Plot size - 8 m^2.

Hybrid	Time to flower(d)	Plant height (cm)	No. panicles per plot	Grain yield kg/ha	Grain mass (g/100)	Endosperm[1] texture	Disease[2] score
ICSA 11 x MR 860	73	180	32	875	1.8	5	2.0
ICSA 16 x MR 860	70	180	61	1469	2.0	5	3.0
ICSA 19 x MR 844	73	170	26	938	1.5	5	3.0
ICSA 21 x MR 860	69	195	35	1219	1.8	5	2.5
ICSA 26 x MR 841	71	175	29	750	1.5	5	2.5
ICSA 26 x MR 860	68	195	60	2406	2.3	5	2.0
ICSA 27 x MR 841	61	175	55	2219	1.8	4	2.0
ICSA 27 x MR 860	66	190	44	1313	2.5	4	2.0
ICSA 28 x MR 860	65	180	52	2594	2.5	3	2.0
ICS 38 x MR 862	73	175	63	1531	1.8	5	2.0
ICSH 102	63	180	63	2281	2.1	4	2.0
ICSH 106	73	210	56	1531	1.9	5	2.3
ICSH 110	69	155	66	2343	2.1	5	2.0
ICSH 120	71	175	67	2281	1.6	5	2.0
ICSH 134	64	180	60	2781	2.3	5	2.0
ICSH 159	73	210	57	1562	1.8	5	2.3
ICSH 178	66	175	72	1625	1.7	5	2.0
ICSH 153	73	200	36	1312	1.6	5	2.0
ICSV 1001	72	205	35	1016	2.6	5	4.0
ICSV 1002	78	190	10	344	2.5	5	2.5

1. Endosperm texture observations were averaged over 10 random grains evaluated on a scale of 1 to 5 where 1 = highly corneous and 5 = highly floury.

2. Leaf diseases were scored on a scale of 1 to 5 where 5 = 50% leaf area affected and 1 = no disease.

Table 6. Time to flower, plant height (cm) and disease scores of selected A/B lines from B/A Line Observation Nursery (BON) - 1985.

A Line	Time to 50% flowering(d)[1]	Plant height (cm)[2]	Disease Score[3]			
			SS	GLS	ZLS	A
ICSA 1	81	109	2	2	2	0
ICSA 2	79	129	2	2	2	0
ICSA 11	75	118	3	2	2	0
ICSA 23	74	118	3	2	2	2
ICSA 25	73	143	4	2	2	0
ICSA 26	76	125	1	2	2	0
ICSA 34	81	90	3	2	2	2
ICSA 37	78	125	5	2	2	2
ICSA 38	81	122	5	2	2	2
ICSA 40	74	120	4	2	2	-
ICSA 41	80	127	5	2	-	3
ICSA 42	78	108	5	3	3	-
ICSA 43	76	127	4	2	2	0
ICSA 44	79	122	5	2	2	0
ICSA 45	74	123	4	-	-	-
Checks						
623 (TxA&M)	79	118	5	4	4	3
296 (AICSIP)	86	120	3	4	2	0
2219 (AICSIP)	70	112	2	2	-	4

1. Time to flowering (days) was averaged over observations made at Kamboinse and Farako-Bâ.

2. Plant height (cm) was measured at Farako-Bâ.

3. All diseases were scored on a scale of 1 to 5 where 1 = no disease 5 = more than 50% leaf area affected by disease - SS = Sooty Stripe, GLS = Grey Leaf Spot, ZLS = Zonate Leaf Spot, A = Anthracnose.
AICSIP = All India Coordinated Sorghum Improvement Project.
TxA&M = Texas A&M University.

Table 7. Time to flower and plant height of selected male parents (R lines) Farako-Bâ - 1985.

Origin	Plant height (cm)	Time to flower	No. panicles per/plot	Disease score
MR 801	140	84	21	
MR 803	155	90	12	2.0
MR 828	145	89	24	2.0
MR 829	145	87	27	
MR 832	155	90	16	3.0
MR 833	190	86	20	2.0
MR 834	160	89	16	2.5
MR 839	170	92	18	2.0
MR 841	130	90	20	
MR 847	150	105	7	
MR 848	115	88	28	
MR 849	155	99	14	3.0
MR 853	150	92	15	2.0
MR 854	145	92	15	2.0
MR 856	175	89	16	
MR 858	150	92	22	2.0
MR 860	140	87	24	
MR 861	145	90	21	
MR 862	110	89	23	
MR 864	130	87	22	
MR 870	190	88	22	
MR 871	160	87	18	
MR 874	155	92	24	
MR 875	135	89	22	2.0
MR 877	145	98	25	
MR 880	135	96	10	3.0
MR 882	120	94	25	2.3
MR 901	170	84	26	2.0
MR 904	145	100	7	
MR 906	125	86	16	
MR 910	125	88	17	2.0
MR 912	100	100	12	
MR 915	125	88	8	
MR 916	105	102	2	
MR 923	140	96	19	2.0
MR 927	115	98	5	
MR 930	135	88	26	2.3
MR 931	145	89	16	2.0
MR 933	150	93	23	2.0
MR 935	135	86	27	2.0
MR 943	155	88	31	2.0
MR 969	120	90	25	2.0
MR 979	145	96	22	2.0
MR 988	140	89	26	
MR 995	130	94	27	2.0
SPL 1R	135	94	19	2.0
SPL 2R	165	93	25	
SPL 4R	130	96	27	
SPL 12R	130	89	17	
SPL 15R	165	89	23	2.0
SPL 26R	160	94	16	
SPL 17R	165	84	28	
SPL 18R	170	87	26	2.0
SPL 23R	175	87	27	
SPL 27R	140	94	31	2.0
SPL 37R	120	84	18	2.0
A 2341	145	84	25	2.3
A 2342	145	90	22	2.3
A 2347	140	83	18	
A 2350	180	82	32	
A 2352	160	82	27	
IS 13922	149	82	26	
IS 22268	162	84	25	
M 24954	125	87	21	

Table 8. Sources of origin of Germplasm Accessions evaluated at Farako-Bâ - 1985.

Country	No. Accessions	Country	No. Accessions
Botswana	24	Senegal	39
Burkina Faso	24	Somalia	11
Cameroun	51	Sudan	224
China	4	S. Africa	5
Ethiopia	395	Srilanka	1
Gambia	2	Taiwan	1
Ghana	1	Tanzania	39
India	1375	Tchad	19
Japan	3	Thailand	1
Kenya	21	Uganda	20
Malawi	62	U.S.A.	56
Mali	2	Yemen AR	95
Mexico	6	Zimbabwe	8
Mozambique	5		
Nepal	1	Miscellaneous	62
Niger	72	Zera Zera group	92
Nigeria	74		
		TOTAL	2795

Table 9. Time to 50% flower (days), plant height (cm) and disease scores for selected germplasm accessions - 1985, Farako-Bâ.

Accession	Origin	Time to 50% flower (d)	Plant height (cm)	Disease score[1]				
				A	G	Z	O	S
IS 2327	Sudan	71	305	-	3	-	-	-
IS 2345	India	88	295	-	3	2	-	-
IS 2435	U.S.A.	78	305	2	2	-	-	-
IS 2508	U.S.A.	86	200	-	2	-	-	-
IS 2766	Uganda	84	255	-	2	2	-	-
IS 3443	Sudan	78	215	-	2	-	-	-
IS 3573	Sudan	83	150	-	2	-	-	-
IS 6109	India	94	225	-	3	-	-	-
IS 6928	Sudan	76	220	2	2	-	-	-
IS 6958	Sudan	69	175	-	3	-	-	-
IS 6991	Sudan	76	260	-	3	-	-	-
IS 9225	Uganda	69	250	-	2	-	-	-
IS 9672	Sudan	69	255	-	3	-	-	-
IS 9890	Sudan	72	175	-	3	-	-	-
IS 9928	Sudan	83	140	-	3	-	-	-
IS 10023	Ethiopia	72	195	3	-	-	-	-
IS 10036	Ethiopia	71	210	3	-	-	-	-
IS 10038	Ethiopia	73	180	3	-	-	-	-
IS 10281	Sudan	78	190	-	3	-	-	-
IS 10302	Thailand	80	275	-	2	-	-	-
IS 11436	Ethiopia	87	270	-	2	-	-	-
IS 11534	Ethiopia	73	210	2	2	-	-	-
IS 11540	Ethiopia	70	170	3	-	-	-	-
IS 11548	Ethiopia	78	270	-	4	(Long panicles)		
IS 11549	Ethiopia	76	235	-	4	("	")	
IS 11552	Ethiopia	76	250	-	4	("	")	
IS 12132	Ethiopia	85	260	-	2	-	-	-
IS 12200	Ethiopia	88	150	-	2	-	-	-
IS 12623	Ethiopia	83	290	-	3	-	-	-
IS 12661	Ethiopia	83	275	-	2	-	-	-
IS 14832	Cameroun	85	155	-	2	-	-	-
IS 18495	India	76	195	2	-	2	-	-
IS 19495	Sudan	87	230	3	3	-	-	-

IS 20130	Senegal	60	165	2	2	2	–	–
IS 20674	U.S.A.	85	250	2	2	–	–	–
IS 21609	Malawi	82	280	–	2	–	–	–
IS 21629	Malawi	80	280	–	2	–	–	–
IS 21658	Malawi	73	250	2	2	–	–	2
IS 23526	Ethiopia	92	155	–	2	–	–	–
IS 23538	Ethiopia	87	240	3	3	–	–	–
IS 23490	Ethiopia	78	245	3	3	–	–	–
IS 23493	Ethiopia	75	270	2	3	–	–	–
IS 23504	Ethiopia	85	310	2	2	–	–	–
IS 23526	Ethiopia	83	315	–	2	–	–	–
IS 23539	Ethiopia	85	270	–	2	–	–	–
IS 23538	Ethiopia	87	240	3	3	–	–	–
IS 23541	Ethiopia	85	315	–	2	–	–	–
IS 23542	Ethiopia	84	295	–	2	–	–	–
IS 23141	Tanzania	80	220	2	–	–	–	–
IS 20129	Senegal	58	255	–	–	–	–	–
IS 22473	Sudan	80	235	–	2	–	–	–
IS 3538	Sudan	78	185	–	3	–	–	–
IS 3555	Sudan	88	220	2	2	–	–	–
IS 6938	Sudan	86	205	–	3	–	–	–
IS 6962	Sudan	76	295	–	3	–	–	–
IS 9867	Sudan	80	230	–	3	–	–	–
IS 10951	Chad	76	230	–	3	–	–	–
IS 956	Chad	82	272	–	2	2	–	–
IS 2723	Uganda	89	242	2	2	–	–	–
IS 3533	Uganda	89	234	2	2	–	–	–
IS 3574	Uganda	96	154	–	2	2	–	–
IS 9699	Uganda	87	199	–	2	2	–	–
IS 9738	Uganda	80	242	–	2	2	–	–
IS 23512	Ethiopia	93	224	2	3	–	–	–
IS 23516	Ethiopia	87	184	2	2	–	–	–
IS 23570	Ethiopia	96	157	2	2	–	–	–
IS 23571	Ethiopia	104	225	2	2	–	–	–
IS 23588	Ethiopia	101	225	–	2	2	–	–
IS 23600	Ethiopia	94	214	2	2	–	–	–
IS 23604	Ethiopia	102	285	2	2	–	–	–

IS 23605	Ethiopia	108	250	3	2	-	-	-	
SL-1502	Ethiopia	101	190	2	2	-	-	-	
IS 12611	Ethiopia	102	230	2	2	2	-	-	
IS 22380	Sudan	87	209	3					(drought-tolerant)
IS 7285	Nigeria	64	255	-	5				less grain mold
IS 7286	Nigeria	64	175	-	5				less grain mold
IS 21479	Malawi	64	210	-	5	5			less grain mold
IS 9710	Sudan	89	114						(drought tolerant)
IS 22201	Ghana	74	174						(" ")
IS 13922		82	149						(Kafirs from South Africa)
IS 22268		84	162						(" " " ")

1. All diseases were scored on a scale of 1 to 5 where 1 = no disease
   5 = 50% of leaf area affected by disease.
   A = Anthracnose, G = Grey leaf spot, Z = Zonate leaf spot, O = Oval leaf spot,
   S = Sooty stripe.

Table 10. Some climatic parameters of Farako-Bâ Research Station[1].

Month	Mean rain-fall (mm)	Range of total rainfall (mm)	Mean No. of rainy days	Probability of being wet		Max Tempe-rature C°	Min tempe-rature C°	Mean % R.H.
January	1.0	0.0- 16.1	0.3	Week 1	0.00	33.1	15.0	36.7
				2	0.60			
				3	0.00			
				4	0.00			
February	3.5	0.0- 49.2	0.5	5	0.00	35.5	17.7	37.6
				6	0.00			
				7	0.60			
				8	0.00			
March	24.5	0.0- 86.1	2.4	9	0.60	36.5	21.0	49.6
				10	0.60			
				11	0.11			
				12	0.12			
				13	0.50			
April	45.9	11.2-176.6	4.3	14	0.17	35.9	23.2	65.4
				15	0.28			
				16	0.28			
				17	0.56			
May	106.9	30.9-279.9	8.5	18	0.67	34.2	23.2	74.1
				19	0.56			
				20	0.61			
				21	0.72			
June	136.3	49.1-210.7	10.7	22	0.72	31.6	21.5	81.1
				23	0.44			
				24	1.00			
				25	1.00			
				26	0.89			
July	192.5	39.8-389.6	13.2	27	0.89	29.6	21.1	86.4
				28	0.94			
				29	0.94			
				30	0.94			
August	280.4	175.3-476.5	17.3	31	0.94	29.3	20.9	89.3
				32	1.00			
				33	0.94			
				34	0.94			
September	201.1	112.2-331.3	15.3	35	0.94	30.3	20.5	86.5
				36	1.00			
				37	0.94			
				38	1.00			
				39	0.78			
October	63.8	2.2-170.0	6.5	40	0.44	32.6	20.4	78.8
				41	0.50			
				42	0.39			
				43	0.33			
November	10.3	0.0- 53.5	1.6	44	0.11	33.6	16.8	63.1
				45	0.22			
				46	0.11			
				47	0.17			
December	1.3	0.0- 24.1	0.3	48	0.06	33.2	14.2	49.2
				49	0.00			
				50	0.06			
				51	0.00			
				52	0.00			

1. Source: Direction de l'agrométéorologie - Ouagadougou. Mean rainfall figures were obtained from records pertaining to the years 1953-1984 while mean temperature and % relative humidity figures were calculated from data for the periods 1973-1984 and 1967-1984 respectively. Percent probabilities of weekly rainfall are quoted from Virmani, S.M., S.J. Reddy and M.N.S. Bose - 1980 ICRISAT Information Bulletin No.6.

APPENDIX I.

PLANTING SUMMARY - FARAKO-BA - 1985

Date of Planting: 29/06/85

Breeding Material	No. Entries x Rows
B/A Line observation nursery (BON) (including local checks)	110 x 1
Elite Varieties (DSM)	129 x 2
Preliminary hybrids on new A lines	163 x 2
B/A lines (BNV)	14 x 1
Restorer lines (DSM)	199 x 1
Restorer lines (BNV)	52 x 1
B/A lines (BVSR)	8 x 1
Striga resistant lines (MJV)	15 x 2
Breeding and local selections from Nigeria (NGPR)	55 x 2
Lines exhibiting good seedling establishment	8 x 2
Zera Zeras (KEPR)	93 x 2
DSM selections from Karper's nursery	48 x 2
Red grain kafir and other germplasm	29 x 2
Double recessive genetic stocks	3 x 2
Medium maturing varieties and hybrids	10 x 2
Agronomically good germplasm lines with drought tolerance (JMP)	18 x 2
Photosensitive B/A lines from Nigeria	6 x 2
Populations x E 35-1 derivatives (BNV)	5 x 2
Disease susceptible and resistant lines (RB)	24 x 2

Date of planting: 30/06/85

Nigerian Local Races x Improved Dwarf cultivars of exotic origin - F2 genration	12 x 40

Date of sowing: 15/07/85

Material	Entries x Rows
Pest resistant breeding lines	62 x 1
AICSIP Varieties	17 x 2
AICSIP Hybrids	7 x 2
Varieties and Hybrids (DSM)	17 x 2
AICSIP-PVT Entries	40 x 2
Preliminary Hybrids (DSM)	49 x 2
ISHAT Entries	25 x 2
Advanced Variety Trial (ICRISAT Center)	36 x 2
Preliminaty Variety Trial (ICRISAT Center)	144 x 1

Date of sowing: 17/07/85

Germplasm lines	320 x 1
(80-100 days to flowering and with white grains)	2365 x 1

PLANTING SUMMARY - SARIA - 1985

Date of sowing: 08/07/85

ISVAT	25 x 2
Elite Varieties (DSM)	129 x 2
Preliminary Hybrids	163 x 2
NGPR Selections from Nigeria	55 x 2

PLANTING SUMMARY - KAMBOINSE - 1985

Date of sowing: 29/06/85

B/A Line Observation Nursery (BON)	96 x 1

APPENDIX II.

SEED INCREASE/CROSSING BLOCK (NOVEMBER-85 - MARCH-86) - SUMMARY

Breeding lines from ICRISAT Center selected for yield trials.

M 24552	
M 24572	
M 24648	
M 24723	
M 25534	(SPV 615)
M 24619	
M 60256	(SPV 386)
M 60272	(SPV 472)
M 60388	
M 60777	
M 24544	
M 24581	
M 24727	
M 24730	
M 24731	
PM 11344	
SPH-221	(Hybrid check)

Breeding lines from ICRISAT Center selected for crossing block and preliminary trials.

ICSV 120	M 60310	
ICSV 189	M 60382	
ICSV 166	M 24525	
M 24667	M 24683	
M 60375	M 60264	(SPV 387)
M 60396	M 60297	(SPV 475)
	M 60253	(SPV 352)

Elite lines selected from ICRISAT West Africa Programs for yield trials.

S-34

Nagawhite

Mali Sor 84-7

ICSV 1001

ICSV 1002

ICSV 16-5

Elite lines selected from ICRISAT West Africa Program for crossing block.

ICSV 1001

ICSV 1002

ICSV 1032

S-13

S-36

S-34

Mali Sor-84-7

Mali Sor-84-2

83-SB-Pop Keninke 4-11-1

84-F4-104

84-F8-111

85-F4-13-1

85-F4-28

CMP 83 EP 5 # 14

CMP ICSV 8-2

CMP ICSV 95 HV

CMP ICSV 16 HV

CMP ICSV 23 HV

CMP ICSV 22 HV

CMP (Fada 123 x 38-3)-1-2

CMP |(Fada 69 x SPV 35) SPV 35|-6-1

CMP (Fada 69 x SPV 35)-11-2-1

CMP |(Sg 1666 x SPV 35) SPV 35|-5-2

CMP |(Fada 61 x VS 702) Fada 61|-10-2

CMP |(Fada 123 x 38-3) 38-3|-1-2

CMP |(Ng 2113 x 193-2-1) 193-2|-9-6

CMP |Ng 2113 x 193-2-) 193-2|-9-3

CMP |(Ng 2113 x 193-2) 193-2|-9-2

CMP |(Ng 2117 x 193-2) 193-2|-5-3

West African cultivars selected for crossing block.

Kamboinse Local
Boromo Local
L-30

CE 90
IRAT 202 (CE 145)
IRAT 204 (CE 151)
IRAT S-10
S-29
Koupela Brown
Poa Brown
Kokologho white
Gnofing
Ouedezoure
940-S
CSM 388
A4-D4-1-4-1
Gadiaba
Tarna-32
Terra
Babbadia Fara
Aje Bitchi
N' Gabirikimé
El Mota
Boutouri Houta

A/B lines from ICRISAT Center

ICSA/B Nos 1, 2, 11, 23, 25, 26, 34, 37, 38, 40, 41, 42, 43, 44, 45, SPL-117, 2219 (AICSIP), 296 (AICSIP).

Texas A&M Lines

TAM 2566, IS 7419 C

Germplasm Accessions

DV 6514, AF-28, IS 14384, IS 14332.

STAFF LIST

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1986

BREEDING SORGHUMS FOR THE GUINEA SAVANNA ZONE OF WEST AFRICA

AU-SAFGRAD

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