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(I C R I S A T)

PEARL MILLET IMPROVEMENT PROGRAM IN SENEGAL

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C O N T E N T S

PEARL MILLET IMPROVEMENT PROGRAM IN SENEGAL

INTRODUCTION :

Pearl millet is the most important cereal crop in terms of area as well as in production in Senegal. The year 1983 was a severe drought year anc! thc millet crop in most of the growing areas was affected. There was a shortfall of 350 000 tons of cereal grains (1/3 of the production) due to poor harvest.

The millet experiments werc planted at four locations - Nioro, Darou, Bambey and Louga during rniny season 1983. The season startcd earlier at Bnmbcy and / late at Louga. The experiments were plantcd on 21 June at Bambey, 1 and 2 July at Nioro and Darou and 23 August at Louga. The row length was 6.3 m long and 90 cm apart. Plant to nlant distance was 45 cm except for F_2 populations (90 x 90 cm). In all the replicated yield trials (reps 5 to 6), 6 rows were planted and central 4 rows leaving border plants were harvcstad. In hybrid tria1 nnc! fcrtility x spacing trial, 4 and 8 rows respectivcly were plantcd and central rows were harvcsted.

Total rainfall and its distribution is given in Table 1. Total rainfall was about 250 to 300 mm less at each location. The early maturing variutius suffered most at Nioro because of drought at flowering stage (drought between 10 August to 8 Sept). At Darou, the initial growth was poor because of drought at seedling stage. fit Bambey, there was drought for 50 days just after planting. Ninety five por cent plants were standing but the seedling growth was poor and the flowering was delayed by 15 to 20 days. At Louga, there was drought the whole month of September and Octobcr and the rainfall (146mm) was lowest in last 66 years. The poorest crop was at Louga and some experiments were poor at Nioro.

Because of drought and erratic rainfall, the soil heterogeneity created more variation in plots as normally expected. The coefficient of variations were high at Louga and Nioro. Almost all the breeding material was planted at 3 locations - Nioro, Bambey and Louga in single row plots. Cur selections art? based on mostly on visual scores, disease incidence and other morphological characters rather than yield data alone.

RESEARCH PROJECT OUTLINE

1. Project Number : M-1 (77) WAP (SG)
   Prcjcct Title : Diversification of genetic base.
   Project Location : Bsmbcy

Scientific Staff :

a) Team Leader : S.C. GUPTA (0.25 man-years)

b) Cooperating Scientist (s) : Dr. A.T. NDOYE, Millet Breeder I.S.R.A.

Durntion : Continuing.

Objectives :

- To breed high yielding varieties of 75 to 90 days to maturity.
  To transfer specific charscters in improved material.

Technique :

- The selected material from GAM corrected Indian project and thc introductions until 1980 were crossed in a diallel and topcross fashion. These crosses will be advanced to F_6 through pedigree selection. After F_4 progenies evaluation, selected progenies will be recombined to form synthetics.
- Thirty three best non-Senegalese materials were crossed with 62 Senegalese entries (mostly local germplasm) during the off-season 1981-82. Progenies will be advanced through pedigree selection.
- Fsw crosses for specific characters will be made every year and will be exploited throug! pproprate breeding methods.
- The progenies selected from above crosses will be utilized to form 75 days, 90 days, dwarf, and bristled synthetics. Some of thc progen ies will be evaluated for their restoration or maintaininy ability on male-sterile lines.

Achiev ents :

- Three hundred eight F_4 progenies derived from crosses among 48 selected entries were grown at Nioro, Bambey and Louga locations in single row plots. Based on multilocations, 18 progenies were selected as component of different synthetics (Table2). 62 diverse progenies were selected for various purposes - inbreds, sensible to diseases(resistant or susceptible), and dwarfs.

Two hundred forty F_2 populations derived from 1719 F_1 crosses (Senegalese x Non-Senegale) were grown at Nioro and Bambey during rainy season 1983. Three hundred forty six individual plants from 182 F_2 populations (Table 3) were selected for pedigree selection. These F_3 progenies are being advanced during this off-season. Six F_2 populations - F_2 SNS 27, 60, 90, 104, 121, and 145 the best performing one, will be advanced through sibbing. These 6 alongwith other 24 F_2 SNS will be re-evaluated during rainy season 1984 for individual plant selection.

- Eleven white grain lines were crossed withe 3 inbred lines during off-season 1982-83. The topcrosses alongwith parents were evaluated in 7 x 7 balanced lattice design at Bambey during rainy season 1983. The best general combining lines were - DWG 1130, Ghana 16157, DWG 1131, DUC 1125, and testers - IBMI 8108 and IBMI 8206. The crosses with high yield and high SCA effects were - Ghana 16157 x IBMI 8108, Ghana 16151 x IBMI 8206, DWG 1126 x IBMI 8206, DWG 1125 x IBMI 8108, DYG 1130 x IBMI 8207, DWG 1130 x IBMI 8206, and DWG 1131 x IBMI 8108, Fnrty crosses were grown in 2 row plots. Thrsc crosses - DWG 1131 x Souna III, DWG 1131 x IBV 8001, and Ghana 16152 x IBMI 8206 and 2 lines - Ghana 16152 (bold grain) and DWG 1134 were selected.

Existing Linkages :

National	: I.S.R.A., Senegal.
Regional	: ICRISAT, Regional program.
International	: ICRISAT Centre, University of Georgia.

Future Plans :

- Eighteen F_4 progenies Will be utilized to form four synthetics - IBMV 8401 to 8404 based on maturity, height, and bristleness. These progenies will be simultaneously evaluated for their combining ability effects. Fifty six diverse F_4 progenies will be advanced to F_6 (as inbreds). Twenty four progenies exhibiting different reaction to diseases in different locations will be passed on to I.S.R.A. pathology program for carrying out fundamental studies on race differentiation.
- From 346 F_3 SNS progenics grown during this off-season, progenies will be selected to form synthetics, and will be advanced to F_4

generation. These synthctics alongwith component lines, and crosses will be evaluated during coming rainy season.

- Seven selected crosses involving white grain lines will be advanced through pedigree selection.
- 3/4 HK-B78 (I) will be improved for 1000 seed weight by crossing with 2 white grain lines - Ghana 16 151 and Ghana 16152 and back crossing to 3/4 HK-B78 (I).

2. Project Number : M-2 (81) WAP (SG)

Project Title : Improvemcnt of synthetics of 90 days maturity adapted for rainfed conditions in Senegal.

Iro ject Location : Nioro, Bambey, and Louga.

Sciontific Staff :

Team Leader : S.C. GUPTA (0.1 man-years)

Cooperating Scientist (s) : Drs. D.F. MBAYE (Millet Pathologist) an:? A.T. NDOYE, I.S.R.A.

Durat ion : Continuing.

Objectives :

To improve synthetics for grain yield production and its stability, grain size, harvest index, head length and resistance to diseases.

Technique :

- Two synthetics - IBV 8004 and Souna III will be improved through recurrent selection fnr three cycles.
- These synthctics havc been improved thrcugh S_1 selection for one cycle during 1982. The second cycle was initiated during the off-season 1982-83 by producing half-sibs, which were evaluated during thc rainy season 1983. Thc selected progenies are being recombined during this off-season.
- The comparison between original and improved synthetics will be made in 1985.
- Two other varieties - IBV 8001 an3 3/4 HK-B78 (1) are being improved through gridded mass selection during the normal course of seed multiplication.

Achievements :

- Second cycle of recurrent selection was initiated during off-season 1982-83 by producing half-sibs from each of the two synthetics - Souna III (261) and IBV 8004 (400). These half-sib progenies were evaluated during rainy season 1983 at Nioro, Bambey, and Louga locations in single row plots and unreplicated trial. One replication was also planted in disease nursery at Bambey. Based on performance over 3 locations, 36 progenies from Souna III (Table 4) and 42 progenies from IBV 8004 (Table 5) were selected for recombination. The selected half-sibs (using S_1 seed from downy mildew free plants) are being recombined during the off-season 1983-84.
- The mean incidence of downy mildew was 5.7 % in IBV 8004 and 24.2 % in Souna III while in selected progenies it was 3.2 and 13.3 per cent respectively. Souna III is highly susceptible to downy mildew and the variability suggests that there is a scope to improve Souna III for downy mildew resistance.

Existing Linkages :

National : I.S.R.A., Senegal

Future Plans :

Two synthetics - Souna III and IBV 8004 Will be initially improved for three cycles. Further improvement will be, on how much useful variability then remains in the aynthetics. During 1984, new synthetics will bedeveloped in project 1 and one or two may be identified to improve under this project.

3. Project Number : M-3 (79) WAF (SG)

Project Title : National yield trials.

Project Location ; Nioro, Darou, Bambey and Louga.

Scientific Staff :

a) Team Leader : S.C. GUPTA (0.1 man-years)

b) Cooperating Scientist (s) : Dru A.T. NDOYE, D.F. MBAYE
I.S.R.A.

Duration : Continuing.

Objectives :

- To conduct yield trial on elite products, emerging out of our program, national, regional and international programs, to evaluate yield potential and to obtain agronomically useful information.

Technique :

- Replicated multilocational yield trials are conducted in 3-5 locations every year. New entries are first evaluated in initial yield trial (3locations).
- The selected material from ICRISAT and ISRA programs are jointly evaluated in advanced yield trial (ECON) at four locations.
- Some entries are tested in Gambia in collaboration with the department of agriculture for their usefulncss in Gambia.
- The entries selected from advanced trial arc rccommcndcd for pre-releasse testing and for regional trials.

Achievements :

a) Initial yicld trial : A replicated yicld trial of nine entrics was conductcd at three locations - Kioro, Bambey, and Louga in randomized block dcsign (5reps.) during rainy season 1983. Performance data 6.n grain yield in individual cvironment and thc mean data for seven characters are given in Table 6 and 7 resnectively. Based on three locations, the trial mean was 603 kg per ha. This is low as compared to previous years because of drought. The differences among entries for yield were non-significant at 5 % level of significancc. Two intervarietal hybrids - IBMI 8108 x Souna III and IBMI 8108 x 3/4 HK-B78 (I) are retained for furthor testing.

b) Advanced yield trial : This is the joint trial where the best material identified from different programs in Senegal is tested by millet scientists working in Senegal. This trial was initintcd in 1981 with 12 entries 6 replications. Three poor performing entries were dropped and a new entry was included in 1982. A trial of 10 entries - 4 progeny varictios front GAM, 3 synthctics and 1 experimental variety, from ICRISAT, and 2 checks - Souna III and farmers local - was conductcd at 4 locations (Nioro, Darou Bambey, and Louga) during rainy seasons 1982 and 1983. Thc

coefficient of variations were vory high at Nioro, Louga locations dur ing 1983 , and therefore excluded from analysis. Based cm mean over Bamboy and Darou locations, the trial mean was 1781 kg per ha (Table 8). Two entries IBV 8001 and local check were significantly superior to Sounn III in respect of grain yield production at Darou location. Based on mean over locations, the highest yielding cntry was IBV 8001 followed by H7 - 66, IBV 8004 and Scunn III. The dwarf entry 3/4 HK-B78 (I) produced 90 % grain 3s compared to Souna III but was apprec iat ed hy farmers. Same entries will continue in 1984, nnd there after all the entries will be replaced by hew ones.

c) Performance of selected entries in multilocational trials during last 4 years : Performance data for seven characters for each year (averaged over locations except grain yield) are presented in Table 9. Based on mean over locations and over years, the highest yielding entry was IBV 8001 (2.31t/ha, 20 % superior to Souna III) followed by IBV 8004 (18 % superior), H7 - 66 (10 % superior, nnd from national program) and 3/4 HK-B78 (3 % superior). hll the four entries had shorter plant height, earlier in flowering, higher seed weight, and better resistance to downy mildew as compared to Souna III nnd farmers local. Based on four years results, i-t. can be ccncludod that IBV 8001 and IBV 8004 are superior to Scunn III in respect of grain yield production and resistance to downy mildew. Thc other two entries are atleast equal to Souna III in terms of grain yield production but superior for downy mildew resistance.

d) CILSS trial : Two synthetics - IBV 8001 nnd IBV 8004 were also evaluated in CILSS trial during 1982 and 1983. During 1982, based on multilocational analysis (5 location3 in 3 countries), the two top entries were IBV 8004 (12 % superior to Souna III) and IBV 8001 (11 %). In Senegal based on 1982 and 1983 results, the highest yielding entry wns IBV 8004 followed by ITV 8001 and IBV 8001.

e) Pre - release demonstrations : During 1983 two synthetics - IBV 8001 and IBV 8004 were grown in 100 ha in three different regions of the country for seed multiplication. These varieties performed

well as compared to local material. We have supplied the the breeder seed (over 250 kg of each) to seed service for seed multiplication during 1984.

Existing Linkages :

National : I.S.R.A., SAFGRAAD, and SODEVA in Senegal. Depnrtement of Agriculture, Gambia.

Future Plans :

Two yield trials will continue. Efforts would be made to develop a cooperative net work to conduct trials in xfarmers fields in collaboration with national scientists, and extension agencies like SODEVA.

4. Project Number : M-4 (81) WAP (SG)

Project Title : Breeding for disease and pest resistance.

Project Location : Nioro and Bambey.

Scicntific Staff :

a) Team Leader : S.C. GUPTA (0.1 man-years)

b) Cooperating Scientists : Dr. D.F. MBAYE, I.S.R.A.
Dr. R.T. GAHUKAR Entomologist, CILSS, Millet Pathologists-ICRISAT Center.

Duration : Continuing.

Objectives :

- Ta incorporate the resistance to downy mildew and grain smut in elite breeding material.
- To conduct regional and international disease nurseries.
- To evaluate elite products against pests - car head Catterpillar and stem borer.

Technique :

a) Following materials are screened in srtificial disease nurscry at Bambey.

- Routine evaluation of all elite products - national yield trials.

- Evaluation of progenies derived from 2 synthetics under improvement through recurrent selection.
- To conduct regional and international disease nurseries.

b) Evaluation of elite products against pests : Only few entries which are in advanced stage are extensively screened against possible pests.

Achievements :

a) Disease resistant material : Four hundred ninety five disease resistant plants selected from various nurseries (rainy season 1982) were selfed. Eighty one S_2's derived from this material were grown during rainy season 1983 in 4 environments - Niero, Bambey, Louga and Bambey disease nursery. Based on performance data 12 lines were selected (Table 10) which will be utilized to form synthetics alongwith 10 F_4 progenies (Project 1). These 12 lines will also be crossed to male - sterile lines to find the potential parents for hybrids.

b) International pearl millet downy mildew nursery : A nursery of 50 entries including checks was conducted at Bambey (disease nursery) during rainy season 1983 by I.S.R.A. pathologist. The highest susceptible entry was 7042 (incidence 98 %) as every year and only 6 other entries had incidence more than 10 % (Table 11).

c) International Pearl Millet smut nursery : A nursery of 32 entries was conducted at Bambey (disease nursery) during rainy season 1983. The mean incidence of trial was 10.4 % (Table 12) and 22 entries had incidence less than 5 %.

In above 2 nurseries, most of the material was good as a source of resistance - but not agronomically desirable for our situation.

d) Pest nursery : This nursery was conducted by Dr. R.T. GAHUKAR, CILSS entomologist in Senegal during 1982 and 1983. This nursery consisted of 10 entries - five entries (IBV 8001, IBV 8004, ICMS 7819, ICMS 7838 and 3/4 HK-B78) contributed by ICRISAT, 3 from national program and 2 checks. These entries were evaluated for tolerance to stem borer and Raghuva. All the entries were simi to Souna III. Two synthetics - IBV 8001 and ICMS 7838 were the best for tolerance to Raghuva. H9 - 127 was the best for tole-

rance to stem borer.

Existing Linkages :

National	: I.S.R.A., CILSS
Regional	: ICRISAT regional program
International	: ICRISAT, Hyderabad, India.

Future Plans :

a) International disease nurseries will be conducted by Dr. D.F. MAYE, Millet Pathologist, I.S.R.A.

b) ICRISAT will continue.

- Routine evaluation of breeding products in disaase and pest nurseries.
- Continuëd search of new sources of resistanco.
- Improvement of resistance in synthetics within themselves.

5. Project Number : M-5 (81) WAP (SG)

Project Title : Development of male sterile lines nnd hybrids for local adaptability.

Projcct Location : Nioro; Dambey and Louga.

Scicntific Staff :

a) Team Leader :S.C. GUPTA (0.1 man-years)

b) Cooperating Scicntist (s) : Dr. K. ANAND KUMAR, ICRISAT, Niger.
Dr. B.S. TALUKDAR, ICRISAT, India .

Duration : Continuing.

Objectives :

- To develop suitable pollen parents from the material generated in project 1 and 4.
- To develop male-sterile lines in an adapted background.

Technique :

Parents will be chcsen for crosses from projects 1 and 4 with attributes considered desirable for hyhrid,

- Attempts would be made to identify maintainer lines on cxisting

male-sterile (111A, 81A, a derrivative from ♂ 1623 x 3/4 ED) to convert into male-sterile line.

- Restorer lines will be identified on new male-sterile lines.

Achievements :

- A trial of 28 hybrids (7 male steriles x 4 imbreds) plus 2 checks, replicated 5 times, was conducted at Dambey during rainy season 1983. The mean of trisl was 1140 kg/ha with high coefficient of variation (44.9 %). Eight entries yielded more than Souna III, however , none of the entry was significantlg superior to Souna III in respect of grain yield production (Table 13). All the hybrids were significantly less susceptible to downy mildew than Souna III but more susceptible to smut. All the hybrids were shorter in plant height and ear length as compared to Souna III. Twr: male-sterile lines (111 A and 81 A) and 2 tester-s - IBMI 8108 and IBMI 8206 werc the best general combiners in respect of grain yield production. Six hybrids (Table 13) werc retained for testing in rainy season 1984. All the hybrids werc fertile.
- Eightynine hybrids alongwith parents were evaluated in observation nursery at Dambey. Based on visual observations, 16 were selected for retesting. These are with 111 A x 3/4 HK-D78 (I), Souna III, F_3 141, F_3 206, IBV 8001, IBMI 8108 - 31-4, IBMI 8108 - 58-3 ; 1644 A x Souna III, IBV 8001, IBV 8004 ; 1055 A x IBMI 8108 - 30-1, 31-1 ; 1417 A x IBMI 8108 - 21-2, 31-2 ; 1423 A x IBMI 8108 - 21-2.
- Fourteen pairs of male-sterile lines were evaluated. Based on visual observations, only 3 pairs - 111 A/B, 81 A/B, and 1055 A/B were retained for further utilisation.

Existincj Linkages :

Regional	: ICRISAT Sahelien Centre, Niger.
International	: ICRISAT Centre, India.

Future Plans :

- This project will continue on a low priority until new m s lines developed.

- Selected 25 hybrids including local check will be tested in advanced hybrid trial during rainy season 1984.
- Selected 32 F_4 progenies from project 1 and 12 disease resistant lines from project 4 will be crossed on to 3 male-sterile lines and the crosses will bie evaluated during rainy season 1984.
- Search for maintainer lines adapted to our situation will continue.

6. Project Number : M-6 (78) WAP (SG)
Project Title : Regional trials and nurseries
Project Location : Nioro, Dambey and Louga.

Scientific Staff :

a) Team Leader : S.C. GUPTA (0.15 man-years)
b) Cooperating Scientist (s) : ICRISAT scientists in African program.

Duration : Continuing.

Objectives :

- To contribute elite material for utilisation in other programs through regional testing.
- To conduct regional trials and nurseries and to utilize the selected material in projects 1, 3 and 4.

Technique :

Regional trials and nurseries are multilocationally conducted in Senegal.

Achievements :

a) During 1983, two synthetics (IBMV 8301 and 8302) and 24 F_4 bulks (derived from GAM x Indian crosses) were contributed for regional testing.

b) Three regional trials - IMZAT, PMXN and Striga, were conducted in Senegal during rainy season 1983. The results are presented below :

- IMZAT : International millet zonal adaptation trial consisting of 16 entries including checks was conducted at three lacatinns - Nioro, Dambey and Louga. Performance data on grain yield in individual environment and the mean data for six characters averaged

over three environments are presented in Tables 14 and 15 respectively. Based on mean over three locations, the highest yielding entry was ITMV 8302 (735 kg/ha) followed by ITMV 8002 and ITMV 8001. All the entries except IEMP1, IEMP2 and Nigerian composite were statistically equivalent to Souna III in respect of grain yield production. Performance of Nigerian composite was poor because of very poor germination. Based on several years testing, it can be concluded that the material bred in Tarna performed well in Senegal and the material bred in Sudan is most unadapted to Senegalese agro-climatic conditions.

- PMXN : Pearl millet exchange nursery consisting of 50 entries was conducted at three locations - Nioro, Bambey and Louga during rainy season 1983. Performance data of top 10 entries are presented in Table 16. Best entries from each locations are listed in the same Table. None of the entry was superior to Souna III inrespect of grain yield production. However 6 lines F_4 B7, F_4 B5, ISMI 200, F_4 B20, F_4 B16, and F_4 B11 were selected for utilising in breeding program.
- Striga : A trial consisting of 11 entries and a check repeated 34 times was conducted at Louga during rainy season 1983. Performance data are presented in Table 17. There was no striga incidence at Louga during rainy season 1983. All the entries were poor and none of the entry was selected, even on the bases of other characters as ear length etc.

Existing Linkage : Cooperators in Africa.

Future Plans:

This project is very useful in terms of exchange of material and therefore should continue and strengthen in future.

7. Project Number : M-7 (77) WAI (SG)

Project Title : International tri.21 and nurseries.

Project Local : Bambey

Scientific Staff :

a) Team Leader : S.C. GUPTA (0.1 man-years).

b) Cooperating Scientist (s) : Scientists working in SAT.

Duration : Continuing.

Objectives :

- To conduct international trials and nurseries.
- To select the material for use in projects 1 and 3.

Technique :

International trials/nurseries and which may be useful to strengthen the national and international programs are being conducted in Senegal.

Achievements :

During 1983, five nurseries (Table 16) were planted at Bambey. Due to postal delay, the seed was received very late and therefore was planted on 9 August. The crop growth was very poor and suffered from drought. However, based on morphological characters - 4 pairs of male-steriles, 9 disease resistant lines, 5 inbred lines from source material inbred nursery and 6 populations from African Ressource nursery were selected for replanting in the rainy season 1984. The list of selected material is given in Table 16.

Existing Linkages : ICRISAT Center Hyderabad, India.

Future Plans :

- Should continue to conduct selected international trial and nurseries. This will provide a continuous flow of new breeding material into our program.
- Continue exchange of seed material with scientists working in SAT.

C. Project Number : M-i (82) WAP (SG)

Project Title : Development of agronomic practices for optimising yields of new varieties under rainfed conditions.

Scientific Staff :

a) Team Leader : S.C. GUPTA (0.1 man-years)

b) Cooperating Scientist (s) : Dr. L.K. FUSSELL, I.S.C. Niamey.
: Miss F. DIOI, Physiologist , I.S.R.A. Senegal.
Dr. L. CISSE Soil Chemist I.S.R.A. Senegal.
Dr, C. DANCETTE Agroclimatologist I.S.R.A. Senegal.

Duration : Continuing.

Objectives :

- To determine the apporpriate plant population for diffcrent types of millets.
- To determine the appropriate spacing and fert ilizer dose frr newly developed varieties of millet.
- To study the nerformance of nnw vnrieties under intercropping and double cropping situation

Technique :

a) Four varietiss - IBV 8004, IVS **5454,** H7 -66 and Souna III were tested at 23 . plant populations in a FAN design during 1982. IVS **5454** was replaced by 3/4 HK-B78 during **1983.**

b) Four varictics - IBV 8004, IVS **5454,** H7-66, and Souna III were tested in a replicated yield trial at 3 spacings (90 x 90, 90 x 60, 90 x **30** cm) with same plant population (37 020 plants per ha), and at 2 levels of fertilizer (61 N: **31.5** P2 05 : 31.5 K2 0, and **33** N : 21 P2 05 : 21 K2 0) during 1982. Based on resultr, the trial was modified in 2983 - IVS **5454** was replaced by a dwarf 3/4 HK-B78. Three levels of spacing were changed to 2 (90 x **90** and 90 x 45 cm) and zero fcrtilizer level was added.

c) Dr. C. DANCETTE is evaluating the performance of IBV 8004 and IVS **5454** under intercropping and double crop situations in collaboration with us.

Achievements :

a) Dtsnsity trial : Four varieties - Souna III, H7 - 66, IBV 8004 and 3/4 HK-B78 were planted at **23** diffcrent plant densities

(Plant population ranging from 3607 to 207, 925 plants per ha) at Bambey during rainy season 1983. It is difficult to conclude anything because of high coefficient of variations (Table19). Howover based on 2 years data, it can be concluded that tht optimum plant population for different varieties ranges from 10 000 to 30 000 plants per ha.

b) Spac ing and fertility trial : This trial consisting of 4 varieties at 2 spacings, and 3 doses of fertilizer was planted at 2 locations -Bambey and Lougn during rainy season 1983. at tho time of thinning, 2 plants per hill were maintained. Mean squares for five characters at twa locations are presented in Table 20. Thc differcnces among varictics, fertilizer levels and spacings were not significant for grain yield production at both the locations. Thc differences among varictics were highly significant for 1 000 seed weight, days to 50 % bloom, plant height and ear length at both the locations. At Lougn, with the increase in fertilizcr dose, There was significant reduction in days to 50 % bloom. Wider spacing significsntly increased plant height, ear lcngth and induced earliness at Bambey location. All thc interactions were non-significant except fertilizcr x spacing for plant height at Louga. Based on Y years results, increased plant population or hi3 ls dc not significantly increase the grain yield production.

b) Intercropping experiment, Cowpea with pearl millet (IBV 8004 and Souna III) and double cropping experiment (using IVS 5454) were conducted at Bambey and Louga respectively during rainy season 1983. In intercropping experiment, the distance between millet lines was 1.5 m and between 2 millet lines, 2 lines of cowpea 50 cm apart were intercropped. For millet plant to plant distanc e was 80 cm . Because of high coefficient of variation and poor grain yield production, no interpretation could be made. However, the association of cowpea varicty 58-57 and IBMI 8004 gave maximum revenue par ha. In double cropping experiment -

IVS 5454 was suffered from drought at the time of flowering. The crop was harvested in 86 days rather 70 and the planting of cowpea ndout was delayed. There was practically no harvest from cowpea, however IVS 5454 produced 387 kg grain yieldper ha. This technique could be more useful in south of Senegal.

Existing Linkages :

National	: I.S.R.A. Senegal
Regional	: I.S.C. Niamey, Niger.

Future Plans :

Experiment on varieties x fertilizer x spacing will continue for one more year. Based on results, the projet detail may be molified in 1985. Number and range of densities will be reduced in density trial in 1984. Experiments on intercropping and double cropping will be planned in collaboration with Dr. DANCETTE, Agroclimatologist, I.S.R.A. Perhapes 3/4 HK-B78 (1) will be included in some of the intercropping experiments.

SUMMARY

The objectives are to improve grain yield production and its stability, grain size, harvest index, resistance to diseases and insects, tillering ability and to maintain the head length. Eight projects are being developed to achieve above objectives and are summarized in following paragraphs.

Eighteen F_4 progenies and 12 disease resistant lines were selected to form 5 new synthetics. Three hundred forty six individual plants from 182 F_2 populations (Senegalese x Non-Senegalese) were selected for pedigree selection. Six best F_2 populations will be evaluated for their yield potentiallity during rainy season 1984.

Seven selected crosses involving white grain lines and bold seed will be advanced through pedigree selection. 3/4 HK-B78 (I) will be improved for its grain size.

Second cycle of recurrent selection was initiated during 1983 on two synthetics - Souna III and IBV 8004. The selected half-sib progenies are being recombined during this off-season.

Under the national yield trials project , two multilocational yield tri.313 were conducted during rniny season 1983. From initial trial, two :in? orvarietal hybrids - IBMI 8108 x Souna III and IBMI 8108 x 3/4 HK-B78 (1) are being retained for further testing. In advanced yield trial - IBV 8001 and local check were found to be significantly superior to Souna III in respect of grain yield production at Darou location. Based on mean over Darou and Bambey locat ions , the highest yielding entry was IBV 8001 followed by H7 - 66, IBV 8004 and Souna III.

Based on mean over locations and over four years, the highest yielding entry was IBV 8001 (2.31 t/ha, 20 % superior to Souna III) followed by IBV 8004 (18 %), H7 - 66 (10 %, and 3/4 HK-B78 (3 %). In CILSS trial, the first 3 entries were the top yielding in 1982. The foundation seed of IBV 8001 and IBV 8004 was multiplied by SODEVA in 100 ha during 1983.

Project on breeding for resistance to diseases and pests was initiated in collaboration with I.S.R.A. millet pathologist and CILSS entomologist. Disease nurseries - IPMDMN and IPMSN were evaluated in rainy season 1983 by Dr. Domba MBAYE I.S.R.A. millet pathologist. Most of the entries had low incidence to diseases but agronomically poor. Eighty one disease resistant lines selected from earlier trials in previous years evaluated in 4 environments and 12 were selected fo form synthetics.

One hundred seventeen hybrids based on different male-sterile lines were evaluated at Bambey. Twenty two hybrids were selected for further testing. Three male-sterile lines - 111 A, 81 A and 1055 A were retained for further crossing with selected lines from projects 1 and 4.

During 1983, one regional trial (IMZAT) and 2 exchange nurseries (PMXN and Striga) were conducted. None of the entry in IMZAT was significantly superior to Souna III in respect of grain yield production. Based on several years testing, it can be concluded that the material bred in Niger performed well in Senegal and the material bred in Sudan is most unadapted to Senegalese agro-climatological conditions. There was no Striga incidence during this years as well as last year. During rainy season 1981, almost all the fields were infected with Striga in northern region of the country.

Five nurseries from ICRISAT center, India, were planted at Bambey on 9 Agust 1983. Due to late planting, the crop growth was very poor and suffered from drought. Twenty four entries from various nurseries were selected for retesting.

A multidisciplinary project involving millet physiologists from ICRISAT Sahelian Center and I.S.R.A. and soil Chemist from I.S.R.A. was initiated during 1982 to determine the appropriate spacing, fertilizer dose and plant population for newly developed synthetics. Based on 2 years-analysis it can be said that the optimum plant population for different varieties ranges between 10 000 to 30 000 plants per ha. In another experiment on fertilizer and spacing, no differences among varieties, between fertilizer doses and between spacings were observed for grain yieldproduction at both the locations - Bambey as well as Louga. This may be because of high coefficient of variations. Experiment will be repeated in 1984 for confirming the results of 1982 and 1983. It looks that even the dwarf varieties are not responsive to higher plant population.

In conclusion, we have identified 2 medium tall synthetics and one dwarf experimental variety which are superior or equally good in yield as compared to the best released variety with better resistance to diseases. In future more efforts will be made on generating new synthetics from recently generated breeding material.

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Table 1. Total rainfall and its distribution overfour locations in Senegal during 1983.

NIORO			DARCU			Bambey			Louga		
Date		(mm)	Date		(mm)	Date		(mm)	Date		(mm)
13	Ju	L.2	20	Ju	4.0	20	Ju	75.0	19	ju	5.4
18	Ju	53.0	2	J1	15.t	5	J1	1.8	10	J1	2. 3
19	Ju	1.1	13	J1	35.0	9	J1	4.2	13	J1	1.1
20	Ju	3.9	19	J1	14.4	13	J1	1.5	11	Au	2.3
21	Ju	1.3	8	Au	43.7	1	AU		13	Au	16.8
26	Ju	0.2	9	Au	35.3	2	Au	4::	21	Au	17.8
27	Ju	2.9	10	AU	15.0	8	AU	6.5	23	AU	38.6
26	Ju	2.2	13	na	17.9	9	Au	27.C'	24	Au	19.1
1	J1	17.6	14	Au	0.7	13	Au	8.5	31	Au	30.8
2	J1	1.0	21	Au	lC.6	21	Au	26.9	10	Se	1.5
4	J1	c.5	22	Au	0.4	23	Au	1.2	11	Se	7.6
		6.5	23	Au	4.8	25	Au	5.5	21	Se	1.3
6	J1	10.6	24	Au	0.9	31	nu	34.0	9	Oc	0.5
7	J1	1.6	25	Au	12.4	10	SC	15.5	10	Oc	0.3
11	J1	12.6	29	Au	19.7	11	se	5.9	13	oc	0.3
13	J1	48.0	30	Au	5.6	12	Se	12.1			
19	J1	41.5	31	Au	6.2	21	se	24.3	Total		145.7
21	J1	C.l	8	Se	17.5	25	Se	2.3			
8	Au	7.8	10	Se	27.8	20	se	47.7			
9	Au	13.0	11	Se	3.9	29	Se	1.0			
10	Au	25.0	18	Se	6.5	30	Se	6.5			
13	Au	0.7	21	Se	5.8						
19	Au	5.0	25	Se	42.6	Total		315.9			
21	Au	2.5	20	Se	7.4						
23	AU	2.7	2	[illegible]	25.Q						
24	Au	4.2	12	Oc	10.7						
29	AU	5.9									
30	Au	3.1	Total		389.8						
8	se	75.0									
10	Se	5.8									
11	Se	3.6									
12	Se	0.9									
18	Se	1.5									
19	Se	3.5									
20	Se	0.2									
21	Se	0.4									
24	Se	12.c									
25	Se	4.1									
2t:	Se	2.9									
4	cc	6.0									
12	Oc	1.1									
15	cc	3.4									
17	Oc	0.1									
20	oc	lî.5									
Total		407.1									

Table 2. Performance of selected F4 (GAM X Indian) progenies averaged over Nioro and Bambey locations during rainy season 1983.

S.NO.	F4GI N°	Pedigree	Head weight g/6.275m2	Days to 50 % bloom *	Plant height (cm)	Ear length (cm)	Downy mildew (%)	Smut (%)	Remark
1	7	NELC 9109xSouna III	1440	58	182	38.2	0.0	7.5	75 days to
2	16	72 TM xSouna III	1630	56	204	33.0	11.6	7.5	maturity
3	64	SSC 9053 xIBV 8004	2070	57	182	31.6	0.0	22.5	"
4	122	GIN 615-1xGIN 525-1	945	52	161	46.0	3.6	17.5	"
5	198	7805l6xSC1 7034	2240	58	228	34.4	7.1	10.0	"
6	291	Togo short 23x Sirakorole 62	1660	58	206	31.4	0.0	15.0	"
7	26	NC 9092xIBV 8004	1220	64	200	40.5	13.3	12.5	90 days to
8	97	IVS-H78xIBV 8004	1950	61	206	43.4	10.7	20.0	maturity
9	116	GIN 615-1xGIN 525-1	1800	65	231	50.2	0.0	7.5	"
10	172	GIN 191-2xGIN 46	1150	64	223	42.0	0.0	12.5	"
11	183	GIN 191-2xD2 9043	1730	64	218	44.2	0.0	7.5	"
12	200	7806 51xIVS 5454	2540	62	224	37.6	3.4	15.0	"
13	269	LC 7053xGIN 35-8	1600	62	202	42.0	6.9	1.0	"
14	274	GIN 150-5xGIN 35-8	2080	64	190	43.0	1.8	5.0	"
15	293	Souna 12xTogo short 7	1970	64	199	38.4	18.4	1.0	"
16	307	Serere 24xIVS 8206	1040	62	214	41.4	0.0	42.5	"
17	140	GIN 615-1xGIN 234	900	68	133	28.0	7.1	0.0	Dwarf
18	68	SSC 9010xSouna III	1750	52	202	45.2	13.3	35.0	Bristled
19	100	ICMS 7045xIBV 8004	945	62	192	33.5	5.0	5.5	Thick head.

* Because of drought, the flowering was delayed by few days.

Table 3. Description of F2 populations (Senegalese X Non Senegalese) ndvanced to F3 during rainy Season 1983.

Non - Senegalese	SENEGALESE		
	F2 grown	F2 selectcd	F3
75 days to maturity			
EB 132-2	12	8	10*
IBS 5454-1-1	9	5	5
IVS 8206-7-1	8	8	12
WCFS 151-1-l	10	10	18*
GIN 615-5-2-1	7	6	9
World Composite	7	7	9
Inter varietal syn.	4	3	3
ICMS 7703	7	6	11
Serere Comp. 1	3	3	5
Ex Bornu	9	5	16
Nigericn lincs	8	6	14
CMM 100-3	9	7	12
J 1798 x (J $34-7 x 700544-7) -2-1-1	6	6	3%
90 days to maturity			
EB 218-1-5-2- 1	8	6	15
GIN 625-1-c-1	13	9	20*
NELC 9 146-1	5	4	12
Ex Bornu	8	6	10
WC 151	6	6	20 *
IBV 800 1	6	5	6
Malian lincs	9	6	14
18009 FS l-12	9	6	11
Niger lines	11	ii	17*
18096 FS 16-3	10	6	6
Dwarf lines			
72-7	9	5	5
GIN 615-1-2	10	9	11*
ICMS 7937-8-1	9	6	12*
3/4 ED - 19	1	1	3
3/4 EB - 33	6	3	6
G 73 K-77	5	4	7
Bristled lines			
SC 1-9114-1	9	6	9
Serere Comp. 2	5	4	10
SSC 125	7	4	5
Total	240	186	346

* Appears to be gond general combining lines.

Table 4. Performance of selected half-sib progenies from Souna III avéragçd over three locations (Nioro, Bambey and Louga) during rainy season 1983.

S.NO.	Entry	Head yield g/6.075m2	Downy mildew (%)[a]	Ear length (cm)	Plant height (cm)	Days to 50% bloom	Smut (%)	Agronomic score[b]
1	H1 - 1	1253	9.0	56.0	192	63.0	10.0	4.3
2	19	927	26.3	58.3	192	68.0	7.5	5.0
4	2(	727	19.0	57.3	205	64.5	10.5	4.3
	3C	693	3.0	54.7	188	67.3	22.5	5.3
5	3E	1020	17.3	51.3	223	59.3	13.0	5.3
6	5E	760	18.5	55-7	207	59.0	10.0	5.0
7	58	1373	15.1	59.7	217	63.0	12.5	3.0
8	73	993	31.1	48.7	177	61.5	12.5	6.0
9	79	720	2.3	48.0	205	61.0	10.5	5.7
10	105	730	20.2	51.3	195	63.0	18.0	5.0
11	112	1260	26.8	53.7	207	62.C	1C.0	4.7
12	Il.3	927	13.3	51.7	193	6C.7	2C.0	4.7
13	117	1640	7.4	54.7	195	62.3	17.5	4.7
14	118	59C	4.3	59.7	222	69.C	5.C	4.7
15	123	66C	18.1	56.3	195	66.C	1C.C	4.i
16	145	447	24.2	64.5	185	65.C	7:;	5.C
17	151	513	16.C	55.C	198	71.C	5.C	5.3
18	156	767	21.1	46.3	188	61.7	27.5	5.C
19	171	56C	2.3	47.7	183	8C.C	C.5	4.C
2C	179	453	C.C	57.C	198	61.7	7.5	5.3
21	185	553	24.1	53.3	2CC	64.C	5.C	5.C
22	19C	713	13.2	52.3	195	64.3	17.5	4.3
23	197	66C	24.2	56.7	195	66.C	18.C	4.7
24	2C5	253	7.9	5C.C	188	62.C	1C.C	5.7

Contd...

Table 4. Continued

25	HS - 207	340	6.7	54.0	185	65.0	3.0	5.0
26	219	720	2.3	49.7	205	56.7	5.0	4.7
27	222	1110	9.0	57.3	212	61.7	10.0	4.7
28	238	700	6.1	57.0	202	62.0	7.5	5.3
29	244	793	22.1	61.7	205	63.3	10.0	5.7
30	251	1020	11.3	56.0	200	65.5	10.0	6.0
31	252	573	16.4	57.0	200	63.0	10.0	5.3
32	256	640	5.0	49.3	182	64.0	7.5	3.7
33	267	620	13.8	45.7	187	67.3	25.0	5.0
34	280	900	0.7	50.3	212	68.0	25.0	4.7
35	282	940	7.0	55.0	188	59.7	17.5	4.7
36	289	1093	5.3	53.0	207	68.0	10.0	5.0
Mean (36)		796	13.3	54.1	198	64.2	11.6	4.9
Mean (261)		717	24.2	54.0	198	64.4	11.7	5.3

a/ Mean based on Nioro, Bambey and disease nursery at Bambey.

b/ Agronomic score 1-9, 1 Very good, 5 Average, 9 Very poor.

Table 5. Performance of selected half-sib progenics from IBV 8004 averaged over three locations (Nioro, Bambey nnd Louga) durig rainy season 1983.

S.NO.	Entry	Hend yield g/6.075m2	Downy nildew (%) [a]	Ear length (cm)	Plant height (cm)	Days to 50 % bloom	Smut (%)	Agronosic score [b]
1	HS - 6	714	10.5	35.0	162	70.7	15.0	4.3
3	15	1024	0.0	43.0	203	63.0	3.3	5.3
4	42	1572	9.0	33.7	200	59.7	22.t'	3.3
5		906	5.1	43.3	197	63.3	5.7	4.7
6	59	961	2.8	39.3	193	63.0	18.3	4.3
7		853		46.3	178	55.7	11.7	4.0
8	67	1865	6.0	38.3	197	61.0	6.7	4.7
	75		9	44.c	192	53.0	20.3	4.7
9	79	867	0.0	35.7	178	50.0	6.7	5.3
10	91	711	5.1	[illegible]	175	62.7	10.0	5.0
11	104	898	2.3	36.3	200	50.0	13.7	5.3
12	127	798	0.0	37.7	188	57.3	0.3	4.0
13	129	1002	0.0	40.3	182	61.3	5.0	4.3
14	136	825	5.5	43.7	183	59.7	16.7	4.3
15	147	598	0.0	40.3	185	54.7	20.0	4.3
16	169	637	0.0	44.3	178	56.7	5.3	4.7
17	182	450	3.'	45.c	186	61.C	16.7	5.7
18	191	960	6.7	47.r	191	61.3	16.7	4.7
19	194	533	0.0	37.0	178	60.0	10.0	5.3
20	213	713	2.7	39.3	173	61.7	11.7	5.3
21	224	1133	0.0	34.3	203	Gl.7	5.7	3.7
22	228	800	2.3	37.3	188	60.0	5.c	5.3
23	241	661	11.0	38.3	185	64.0	11.7	5.7
24	249	1380	0.0	37.0	189	56.5	15.0	4.5

Contd...

Table 5. Continued

25	HS - 257	733	3	46.7	107	62.3	"	5.0
26	276	1740	2.4	45.5	225	58.5	15.0	5.0
27	284	855	0.0	34.7	183	62.7	0.0	4.7
28	299	901	6.7	45.3	209	63.0	10.0	5.0
29	311	1776	2.3	46.3	220	61.0	6.7	3.3
30	317	1654	6.7	47.0	218	60.3	6.7	3.7
31	326	974	4.7	37.3	177	53.3	16.7	4.7
32	340	1071	0.0	39.7	185	62.7	20.0	5.0
33	347	1080	2.3	37.0	210	61.5	10.0	4.0
34	353	1282	0.0	32.0	174	60.5	10.0	5.3
35	362	882	5.4	41.0	187	61.0	10.0	4 "
36	368	760	2.3	36.3	196	64.0	16.7	5::
37	377	737	0.0	47.7	199	65.3	13.3	6.3
32	393	1680	5.3	34.0	235	61.0	20.0	5.0
39	400	985	9.3	35.3	122	64.0	10.0	5.0
40	405	1060	0.0	30.0	153	64.0	37.5	6.3
41	432	1520	2.3	46.0	224	59.5	35.0	5.5
42	437	422	0.0	34.7	225	62.5	6.7	5.0
	Mean (42)	978	3.2	39.9	192	61.0	22.9	4.0
	Mean (400)	723	5.7	37.Q	183	61.0	12.7	5.4

a/ Average based on Nioro, Bambey and disease nursery at Bambey.

b/ kgronomic score : l-9, 1 Very good, 5 Average , 9 Vory poor.

Table 6. Performance of initial yield trinl (1983) test entrics for grain yicld in individual environment.

S.NO.	Entry	NIORO		BAMBEY		LOUGA		MEAN	
		k g/ha	Rank	kg/ha	Rank	kg/ha	Rank	kg/ha	Rank
1	IBI 8108 x Souna III	560	2	1276	3	144	4	660	1
2	IBI 8108 x 3/4 HK-B78(I)	439	6	1331	1	112	9	628	3
3	Souna III	518	3	1142	6	187	3	616	4
4	Souna TII (S1) ci	704	1	947	9	121	6	594	7
5	IBV 8004	373	9	1016	8	23	1	543	9
6	IBV 8004 (S1) CI	484	4	1239	4	120	7	611	5
7	IBV 8004 (M) Cl	385	8	1319	2	201	2	635	2
8	IBV 8001	441	5	1170	5	118	8	577	4
9	IBV 8001 (M) C l	415	7	1132	7	136	5	560	8
	Mean	479	-	1174	-	154	-	603	
	SE+	96		144	-	22		54	-
	CD at 5 %	193	-	415	-	63	-	151	-
	CV %	31.2	-	27.5	-	31.9	-	34.4	-

Table 7. Performance of initial yield trial test entries for eight characters averaged over three environments (Nioro, Bambey and Louga) during rniny season 19C3.

S.NO.	Entry	Days to 5C % bloom	Plant height (cm)	Ear length (cm)	Downy mildew (%)		Smut (%)[a]	1CCC Seed weight (g)	Agro-nomic score[b]
					a	D/N			
1	IBV 9108xSouna III	59.4	19C	44.6	5.C	35.5	4.5	5.5	4.3
2	IBV 8 108x3/4 HK-B7C	6C.6	144	4t.4	6.4	3C.5	12. 5	6.1	5.3
3	Souna III	61.3	221	56.6	13.y	43.3	1C.5	6.2	5.2
4	Sounn III (S1) C1	65.1	216	57.3	11.4	27.3	5.5	6.C	4.7
5	IBV 3CC4	5C.7	2C3	42.2	3.2	9.4	13.C	6.5	5.2
6	IBV 3CC4 (S1) C1	5y.4	2CC	3f.5	3.9	41.2	2C.5	6.4	5.C
7	IBV 3C 04 (M) Cl	5C.9	2CC	44.6	3.f	3C.8	13.5	6.3	4.7
C	IBV 3CC1	6C.7	311	3C.f	5.4	17.5	14.C	6.3	5.3
9	IBV 3CC1 (M) Cl	CC.7	2C8	37.9	3.9	31.4	14.C	6.2	5.3
	Mean	6C.C	2C1	45.5	6.4	29.7	zu.7	6.2	5.C
	SE+	C.7	3	1.C	1.C	7.6	3.3	C.2	C.2
	CD at 5%	2.1	9	2.9	2.8	21.8	9.6	C.5	C.4
	CV %	5.4	5.9	f.4	4C.C;	57.1	C3.4	e.9	12.C

a/ Average based on Nicro and Bambey locations, D/N - Disease nursery at Bambey.

b/ Agronomic score 1-9, 1 Very good, 5 Average, 9 Very poor.

Table 8. Performance of advanced yield trial (1983) test entries for grain yield in two environments (Darou and Bambey) and for six characters averaged over two environments during rainy season 1983.

S.NO.	Entry	Grain yield (kg/ha)			Days to 50% bloom	Plant height (cm)	Ear length (cm)	Downy mildew (%)	Smut (%)	1000 seed weight (g)
		Darou	Bambey	Mean						
1	IBV 8001	1954	2101	2028	54.2	222	34.8	0.6	5.4	8.9
2	H7 - 66	1625	2100	1862	53.1	192	44.9	1.2	6.8	8.8
3	IBV 8004	1628	2086	1857	52.6	214	37.0	0.2	6.3	9.0
4	Souna III	1619	2057	1838	53.9	226	53.5	4.1	6.2	8.1
5	Local check	1919	1680	1800	55.8	228	53.1	4.6	7.7	7.1
6	PS 90	1789	1767	1778	53.2	134	34.3	2.1	10.1	8.1
7	ICMS 7819	1716	1750	1733	54.0	196	30.1	1.4	3.5	8.4
8	3/4 HK-B76	1484	1832	1658	57.1	146	50.5	1.0	5.6	7.5
9	H9 - 127	1615	1698	1656	55.6	153	45.3	0.6	8.7	7.9
10	H24 - 30	1405	1786	1596	49.6	189	39.7	2.2	7.9	7.9
	Mean	1676	1886	1781	53.7	190	42.3	1.0	6.8	8.2
	SE ±	116	232	161	0.6	3.7	1.1	0.6	1.1	0.2
	CD at 5%	234	469	279	1.0	10.0	3.2	1.7	3.2	0.4
	CV %	17.0	21.4	19.6	4.2	6.7	9.2	115	57.8	6.0

Note : This experiment was also conducted at Nioro and Louga but excluded from the analysis because of high CV's (over 45 %) and low yield values.-

Table 9. Performance of selected cntries in multilocational trials during last four years (1980 to 1983) in Senegal.

Entry	Year	Grain yield (t/ha)				%Superior Souna 3	Downy mildew (%)	Rust (%)	Days ta 50% bloom	Plant height (cm)	Ear length (cm)	1000 grain wt. (g)
		Nioro	Darou	Bambey	Louga	Mean								
~~IBV 8001~~	~~1980~~	~~2.85~~	~~---~~	~~2.28~~	~~1.70~~	~~2.27~~	131	2.4	8.4	50.2	20%	32.5	9.5
	1981	2.61	3.02	2.07	1.62	2.33	110	5.1	10.9	50.6	248	32.7	8.3
	1982	4.04	1.88	3.22	1.28	2.60	129	3.E	3.2	49.7	225	34.4	9.0
	1983	*	1.95	2.10	*	2.03	110	0.6	5.4	54.2	22%	34.8	8.9
	Mean	3.17	2.28	2.42	1.53	a.31	120	3.0	7.0	51.2	224	33.6	8.9
IBV 8004	1980	3.06	---	2.37	1.90	2.44	141	5.3	12.0	50.0	193	35.2	8.4
	1981	2.76	3.32	1.83	1.29	2.30	108	5.1	10.0	51.1	247	37.0	7.1
	1982	3.74	1.73	3.10	1.10	2.42	120	4.1	4.9	48.2	225	39.0	9.0
	1983	*	1.63	2.09	*	1.86	101	0.2	6.3	52.8	214	37.0	9.0
	Mean	3.19	2.23	2.35	1.43	2.26	118	3.7	8.3	50.5	220	37.0	8.5
H7 - 66	1981	2.50	2.76	1.24	1.32	2.26	106	3.3	11.2	49.4	228	44.4	8.1
	1982	3.93	1.68	3.30	1.05	2.49	123	2.2	6.3	48.2	214	47.7	9.4
	1983	*	1.62	2.10	*	1.86	101	1.2	6.8	53.1	192	44.9	8.8
	Mean	3.21	2.02	2.55	1.19	2.20	110	3.7	8.1	50.2	211	45.7	8.8
3/4HK-B78 (I)	1982	3.52	1.71	3.05	1.08	2.34	116	2.6	7.7	50.9	161	48.6	8.1
	1983	*	1.48	1.83	*	1.66	90	1.0	5.6	57.1	146	50.5	7.5
	Mean	3.52	1.60	2.44	1.08	2.00	103	1.8	6.6	54.0	154	49.6	7.8
Souna III	1980	2.12	----	1.67	1.41	1.73	100	16.0	7.2	55.6	216	47.5	7.4
	1981	2.51	2.61	2.37	0.99	2.12	100	16.1	4.8	55.1	274	53.4	7.4
	1982	3.91	1.11	2.00	1.06	2.02	100	11.6	2.2	55.6	235	53.0	8.0
	1983	*	1.62	2.06	*	1.84	100	4.1	6.2	53.9	226	53.5	8.1
	Mean	2.85	1.78	2.02	1.15	1.03	100	12.0	5.1	55.0	238	51.1	7.7
Local	1981	2.77	2.90	2.02	1.12	2.20	104	12.6	5.3	54.3	203	56.0	6.4
	1982	3.91	1.61	2.57	1.12	2.30	114	12.8	3.8	52.6	246	56.3	7.4
	1983	*	1.92	1.68	*	1.80	92	4.6	7.7	55.8	228	53.1	7.3.
	Mean	3.34	2.14	2.09	1.12	2.10	105	10.0	5.5	54.2	252	55.1	7.0

* Excluded from analysis because of high coefficient of variations(above 45%).

Table C. Performance of selected lines from disease resistant material for six characters during rainy season 1983.

S.NO.	Entry	Code N°	Head weight[a] g/.6165m2	Days to 50% bloom	Plant height[b] (cm)	Ear length[c] (cm)	Downy mildew[d] (%)	Smut (%) at Bambey	Remark
1	Souna III-1	19	63C	53.5	215	34.2	1.5	3 2	
2	ITV C.C2	3C	795	5C.C	23C	3C.5	3.C	3C	Resistant to Raghuva
3	Souna III-2	42	C5C	47.5	21C	32.5	5.C	15	
4	NELC-A 79	45	93C	51.C	22C	34.3	3.9	5	
5	SSC 9114	4C	14CC	4C.C	2CC	34.3	7.4	2C	Bristled
6	SRC-P 15C5	52	61C	62.C	2C2	44.3	27.7	1	Bristled, Res. To smut
7	Togo short 3	56	C3C	44.C	24C	33.C	17.9	45	Typical head
8	1C3C	61	1445	5C.5	16C	29.C	3.9	6C	
9	VCF4-C-5	64	14CC	57.5	23C	3C.2	1C.6	1C	
1C	EB 137xEB 117	7C	935	52.C	17C	31.2	C.C	1C	Res. to mildew
11	WCFS 14C-S-1DM1	74	1365	54.C	1CC	35.C	4.1	15	
12	IP 2253xEB237-3	67	1255	49.C	222	36.C	13.3	5	
	Mean (C1)		752	51.C	2C4	32.3	13.6	26	

a/ Average based over Nioro and Bambey locations.

b/ Based at Nioro only.

c/ Average based over Nioro, Bambey and Louga locations.

d/ Average based over Nioro, Bambey and disease nursery at Bambey.

Table 11. Performance of IPMDMN (1983) test entries for downy mildew and smut incidence in downy mildew disease nursery at Bambey during rainy season 1983.

S.NO	Pedigree	Downy mildew Inc.(%)	Downy mildew Severity (%)	Smut (%)
1	700 251	4.5	4.1	28.2
2	700 512	6.6	6.6	26.0
3	700 514	2.9	2.9	12.4
4	700 546	**0.0**	0.0	13.8
	700 651	**0.0**	0.0	17.8
6	P.7	**0.0**	0.0	23.4
7	P.105	6.8	5.4	14.2
8	P.310	2.3	2.3	25.9
9	P.472	**0.0**	0.0	37.2
10	P.473	**0.0**	0.0	5.9
11	P.513	10.5	5.5	23.0
12	P.524	0.0	0.0	19.5
13	P.1607	4.2	3.3	53.2
14	P.1610	5.0	2.0	53.8
15	P.2609	6.5	5.0	61.6
16	P.2671	0.0	0.0	20.1
17	P.2672	0.0	0.0	11.0
18	P.2894	8.9	8.9	12.5
19	P.2964	0.0	0.0	30.3
20	EB-83-2	**4.2**	4.2	23.7
21	EB-298-2-1-8	2.1	0.8	29.8
22	(B-282x3/4 EB-100)-1 1-9-2	53.6	47.4	21.6
23	(EB-132-2x700 481-34-5)x P.7	2.1	0.8	21.0
24	(P.7x(B-282xJ-804-1-1)-3-1	2.2	2.2	71.1
25	(F4 FC-1436-4-3-2xJ-104 ST)-1-1	13.1	7.4	21.9
26	NELC - H79 (Original)	4.3	3.0	18.5
27	NELC - H79 (Reconstituted)	2.2	0.9	46.8
22	IVC 8003 1	8.3	2.9	31.1
29	IVC 80082	2.2	0.4	8.7
30	IVC 80135	4.3	1.3	17.1
31	IVC 80191	24.0	20.3	31.9
32	IVC - P-78	0.0	0.0	14.0
33	IVC - P-8001	2.4	2.4	11.0
34	IVC - P-8004	8.7	8.7	13.8
35	MPP - 7147-2-I	0.0	0.0	20.6
36	7042	97.9	97.7	24.8
37	WC - P-800y	8.3	8.3	36.1
38	IP 1930	0.0	0.0	16.2
39	MC - P-8003	0.0	0.0	45.2
40	MC 80116	4.5	4.5	25.8
41	SDN 503	0.0	0.0	14.3
42	SDN 714	6.7	5.0	15.5
43	SC14(M) 160	11.8	6.1	35.4
44	SSC - BB78 (Reconstituted)	0.0	0.0	34.9
45	MAVOA	0.0	0.0	17.2
46	Souna III (5)	17.6	14.1	39.3
	Mean	-		

Table 12. Performance of IPMSN (1983) test entries for smut incidence at Bambey (disease nursery) during rainy season 1983.

S.NO.	Entry	Smut (%)	Remark
1	P10 Sl	5.8	
2	SSG FS 252 S4	2.3	
3	ICI 7517 S1	1.0	
4	EB 132-2-S-5-2-DM- 1	1.2	
5	P20-S-1	23.0	
6	P427 S1	19.4	
7	P489 S3	14.0	
8	P489 S1-11-2		Very late
9	P489 S2-2-1	3.2	
10	EBS 46- 1-2-S-2	1.2	
11	EBS 112-1-S1-1	1.0	
12	EB 117-4-3-S2-2-DM1		Very late
13	WCFS 151-S1-2-DM1-8	28. 1	
14	700 130-S l-DM-1	1.0	
15	IGMPS 101-i	1.0	
16	IGMPS 201-S5	1.0	
17	IGP'PS 400-4-3	1.0	
18	ICMPS 500-4-3		Very late
19	IGHPS 700-S4	1.0	
20	IGMPS 900-4-l	1.0	
21	IGMPS 902-l	1.3	
22	IGKPS 904-3	1.0	
23	ICMPS 1100-l-3	1.6	
24	ICMPS 1300-1-2	2.8	
25	ICMPS 1400-6-z	1.0	
26	ICMPS 1500-3-2	1.0	
27	ICMPS 1600-4	1.0	
28	ICMPS 1700 l-l	1.0	
29	IGMPS 1800-1-2	1.0	
30	ICMPS 2001-2	1.0	
31	3/4 ExB 220-S-1-DM1	43.5	
32	BJ 104	54.5	
33	Souna III	34.9	Resistant check
34	Souna III	71.0	Susceptible check
	Mean	10.4	

Table 13. Performance of single cross hybrids for seven characters at Bambcy during rainy season 19[illegible] 3.

S.NO.	Entry	Grain yield kg/ha	Days to 50 % bloom	Plant height (cm)	Ear length (cm)	Downy mildew (%)	Smut (%)	Agro-nomic score
1	III A x IBMI 8206	1327	79.6	166	43.6	4.3	60	5.4
2	x IBMI 8207	1338	79.2	149	39.4	0.4	45	4.8
3	x IBMI 8108	1562*	71.2	160	45.6	2.4	42	3.6
4	x PS 90-2	1577*	73.c	152	40.6	8.4	64	5.0
5	81 A x IBMI 8206	1439"	72.4	155	30.8	1.4	52	5.4
6	x IBMI 8207	1664*	74.2	159	31.7	1.9	84	4.8
7	x IBMI 8108	1865*	68.0	126	33.6	0.4	49	4.8
8	x PS 90-2	707	73.0	120	29.6	0.0	84	6.6
9	1100 A x IBMI 8206	1191	74.6	167	39.0	0.0	52	3.4
10	x IBMI 8207	878	7C.E	146	34.1	2.4	75	5.0
11	x IBMI 8108	1072	75.8	134	40.8	0.4	70	4.2
12	x PS 90-2	852	76.0	113	34.3	0.0	79	5.6
13	1369 1 x IBMI 8206	1135	76.2	171	38.2	0.0	35	4.2
14	x IBMI 8207	805	79.2	152	33.7	4.1	57	5.4
15	x IBMI 8106	1121	75.4	120	37.4	1.5	52	5.2
16	x PS 90-2	547	78.4	112	35.2	0.8	74	6.0
17	1399 A x IMBI 8206	1210	75.6	172	37.2	2.2	67	4.0
18	x IBMI 8207	1067	79.0	162	37.6	2.5	49	4.6
19	x IBMI 8107	1225	73.c	132	41.2	2.1	59	4.8
20	x PS 90-2	1205	77.8	124	39.1	4.c	83	5.2
21	1417 A x IBMI 8206	959	75.2	158	35.1	5.1	53	5.2
22	x IBMI 8207	1048	74.6	154	32.4	2.7	39	5.6
23	x IBMI 8105	997	75.6	119	40.8	2.1	87	5.4
24	x PS 90-2	1270	7c.4	126	41.9	6.4	79	4.6
25	1644 A x IBMI 8206	1303*	76.6	165	37.3	2.9	39	3.8
26	x IBMI 8207	1091	77.6	158	37.2	c.5	71	3.8
27	x IBMI 8108	883	79.6	119	40.9	c.4	88	4.3,
28	x PS 90-2	816	77.6	113	36.1	0.7	86	5.6
29	IDV 8004	1039	75.4	173	39.0	3.9	25	5 0
30	Souna III	1271	77.2	203	55.1:	14.0	27	5::
	Mean	1148	76.1	144	38.0	2.6	61	4.8
	SE ±	231	1.8	4.9	1.1	1.2	9	0.4
	CD at 5 %	640	5.1	13.6	3.1	3.3	26	1.2
	CV %	34.9	5.4	7.5	6.5	[illegible]3	34	19.7

* Entries selected for retesting in rainy season 19[illegible]4.

Table 14. Performance of IMZAT (1983) test entries for grain yield in individual environment.

S.No.	Entry	NICRC		BANBEY		LCUGA		MEAN	
		kg/ha	Rank	kg/ha	Rank	kg/ha	Rank	kg/ha	Rank
1	IKMV 8101	551	10	1111	10	157	5	606	10
2	IKMV 8201	411	13	1060	12	164	3	545	12
3	IBMV 8301	429	12	1139	9	135	10	568	11
4	IBMV 8302	699	2	1357	4	161	4	739	1
5	ITMV 8001	601	8	1381	3	165	2	716	3
6	ITMV 8002	604	7	1433	2	137	9	725	2
7	ITMV 8003	606	6	1082	11	117	14	602	9
8	INMV 13	606	5	1208	7	151	6	655	7
9	INMV 10	644	4	1144	8	132	12	540	8
10	INMV 20	490	11	1458	1	133	11	694	5
11	IEMP 1	283	15	742	15	110	15	378	16
12	IEMP 2	191	16	994	14	125	13	437	15
13	IEMP 3	300	14	1032	13	147	7	493	13
14	Nigerian Comp.	710	1	568	16	36	16	436	14
15	Souna III	582	9	1324	5	191	1	699	4
16	Local check	651	3	1281	6	141	8	691	6
	Mean	522	-	1145	-	138	-	602	-
	SE±	124	-	191	-	28	-	76	-
	CD at 5 %	350	-	540	-	79	-	216	-
	CV %	53.1	-	37.2	-	44.9	-	49.1	-

Table 15. Performance of IMZAT (1983) test entrics for üix characters averaged over three environments[a] during rainy scason 1983.

S.NC.	Entry	Days to 5C % bloom	Plant height (cm)	Ear length (cm)	Downy mildew[b] (%)	Smut (%)	Agronomic score
1	IKMV 8101	62.9	206	42.0	2.6	5.2	5.4
2	IKMV 8201	61.3	199	33.2	4.8	10.9	5.1
3	IBMV 8301	61.9	189	41.3	5.2	9.7	5.6
4	IBMV 8302	65.7	204	55.5	20.4	7.4	4.8
5	ITMV 8001	63.8	224	57.1	3.0	7.5	5.1
6	ITMV 8002	63.7	224	53.8	2.6	6.1	5.1
7	ITMV 8003	64.7	206	44.8	2.8	9.5	5.5
8	ITMV 12	61.8	200	39.2	2.1	4.9	5.9
9	INMV 1(	62.5	201	38.0	3.4	3.0	5.9
10	INMV 2(	61.9	201	39.5	1.6	3.9	5.0
11	IEMP 1	61.3	167	29.4	15.0	7.4	6.6
12	IEMP 2	59.3	182	33.8	7.0	6.7	6.4
13	IEMP 3	62.6	181	31.9	3.4	9.2	5.3
14	Nig. Comp.	66.5	208	38.6	2.8	3.5	6.2
15	Souna III	62.9	202	54.2	17.G	5.6	4.9
16	Local check	66.3	205	50.9	17.5	6.4	5.9
	Mean	63.0	200	42.7	7.0	6.7	5.6
	SE+	1.0	4	2.8	1.7	1.5	0.3
	CD at 5 %	2.8	11	7.8	4.8	4.3	0..
	CV %	5.0	73	13.3	75.9	88.1	15.6

a/ Environments - Nioro, Bambey and Louga.

b/ Average based on Nioro and Bambey locations.

Table 16. Performance of selected PMXN (1983) test entries for six characters averaged over three environments [a] during rainy season 1983.

S.NO	Entry	Origin	Grain yield kg/ha	Days to 50 % bloom	Plant height (cm)	Ear length (cm)	Downy mildew [b] (%)	Smut (%)
1	Souna III	Senegal	1225	64.7	198	51.8	20.6	2.3
2	F4 B7	Senegal	1015	63.7	197	38.5	5.0	8.7
3	ITV 9303	Niger	959	63.0	226	58.7	4.2	6.7
4	F4 B5	Senegal	896	61.0	202	50.4	13.4	2.3
5	ITV 8203	Niger	860	61.3	204	50.7	2.3	5.3
6	ISMI 200	Sudan	833	60.0	158	36.8	10.8	8.7
7	F4 B20	Senegal	806	62.0	194	40.4	3.4	2.3
8	F4 B16	Senegal	800	59.3	169	32.7	9.4	6.7
9	F4 b11	Senegal	782	60.3	192	40.5	0.0	1.0
10	ITV 8304	Niger	787	62.3	204	37.7	4.2	8.3
	Mean (50)		567	64.0	176	36.0	12.0	7.3

a/ Environments - Nioro, Bambey and Louga.

b/ Average based on Nioro and Bambey locations.

Top Entries at : Nioro, F4 B7, ISMI 192, F4 B10, ITV 8204 and F4 B13.
Bambey, Souna III, F4 B5, ITV 8303, ITV 02C.3 and ITV 8301.
Louga, F4 B13, F4 B22, F4 B10, Souna III and ISMI 190.

Table 17. Performance of STRICA (1983) test entrics for five characters at Louga during rainy season 1983.

S.NO.	Entry	Head yield g/12.15 m2	Days to 50 % bloom	Plant hcight (cm)	Ear length (cm)	Agronomic score [a]
1	P 2627-1-19 (x)	242	57.5	165	3 1.0	4.2
2	P 449-I-29 (x)	270	56.0	169	35.2	4.0
3	P 2661-3-5 (x)	229	58.8	155	32.5	4.2
4	I 5258-1-19 (x)	233	59.0	168	37.5	4.8
5	I 5258-1-10 (x)	100	62.8	150	28.0	5.5
6	1 5237-1-14 (x)	129	57.0	156	36.8	5.0
7	Serere 2A-9-2-27 (x)	61	59.0	148	33.5	5.8
8	P 2627-1-29 -x)	157	55.3	165	39.2	5.5
9	P 2627-2-18 (x)	224	59.8	159	36.1;	4.5
10	p 2627- 2-11 (x)	169	61.0	155	30.2	5.5
11	Souna III	214	57.0	158	kl.E	5.5
12	Ex Bornu (34)	212	62.0	165	35.5	5.0
	Mean	187	58.8	159	34.8	5.0

a/ Agronomic score 1-9, 1 Very good, 5 kverage, 9 Very poor.

Note : There was no STRIGA incidence during rainy season 1983.

Table 10. List of selected material from newly introductions grown during rainy season 1983.

S.NO.	Type of material	No. of introductions	Selections
1.	Male Steriles- Ms EC 6	17 pairs	467 x 468515x 516 545 x 546, 54x 548
2.	Disease Resistant Nursery	20	Mildew-700516, 700251 SDN 503; P7 Smut - P20-S-1 EBS 46-1-2-s-a EB 132-2-S-5-2-DM1 Ergot - ICMPES 27 Rust - 700481-7-s
3.	Source Material Inbred Nursery	35	2460, 2490 2491, 2512 2648
4.	African Ressource Nursery	20	80 x 86, 80 x 88 80 x 90, 80 x 92 80 x 93, 102 x 98
5.	Source Material Nursery ($F2'^{s}$)	8	NIL

Note :These introductions were planted on 9 August 1983 after second rain. Crop growth was poor and suffered from drought. Selections will be replanted in rainy season 1983.

Table 19. Performance data on grain yield (kg/ha) for four varieties at 23 different plant populations grown at Bambey during rainy season 1983.

NO.	Plants/ha	Souna III	H7 - 66	IBV 8004	3/4 HK-B78 (I)
1	3607	1492	578	940	1083
2	4337	1841	671	1165	1103
3	5215	1821	1143	1336	1020
4	6270	2398	1362	1193	1477
5	7539	2085	1193	1406	1763
6	9064	1966	1565	1488	1517
7	10898	2395	1494	1649	1612
8	13104	2426	1966	1008	2151
9	15755	1628	1912	1344	1870
10	18944	2176	2022	1041	2028
11	22777	1861	2102	1485	1702
12	27386	2102	2666	1318	2331
13	32928	1830	2240	1347	2252
14	39591	1772	2306	850	2101
15	47607	1996	2077	1523	1880
16	57236	1960	2674	1153	1347
17	68818	1881	1871	1248	2472
18	82744	1760	2595	1539	1750
19	99488	2230	2677	1303	2766
20	119620	2425	1756	1193	2473
21	143826	2290	2266	937	3687
22	172931	2970	1851	1917	3248
23	207925	2664	2792	1479	4007
Mean		2082	1938	1300	2071
SE±		427	550	270	473
CD at 5 %		1220	1571	770	1352
CV %		35.5	49.1	35.9	39.6

Table 20. Mean squares of Entry X Fertilizer X Spacing trial for five characters at two locations (Bambey and Louga) during rainy season 1983.

Source of Variation	d.f.	Grain yield (q/ha)		1000 seed weight		Days to 50% bloom		Plant height (cm)		Ear length (cm)	
		Bambey	Louga	Bambey	Louga	Bambey	Louga	Bambey	Louga	Bambey	Louga
Rep.	5	104.20	4.64	2.69	2.39	38.2	26.1	1901	346	151.8	97.0
Entry (E)	3	30.84	0.57	21.08**	6.62**	113.4**	174.6**	47605**	8625**	906.2**	1493.7**
Error a	15	31.98	0.52	2.14	1.10	41.5	18.6	351	183	15.5	29.5
Fertilizer (F)	2	0.24	1.18	0.86	8.06*	2.0	253.7**	158	135	0.2	33.8
E X F	6	1.89	0.66	0.25	3.90	18.4	21.7	82	199	7.3	35.3
Error b	40	16.19	0.53	1.17	1.65	20.2	10.9	180	134	8.6	28.3
Spacing (S)	1	5.94	0.16	0.42	1.61	28.4	5.8	2918**	1	258.7**	25.0
E X S	3	7.71	0.39	0.61	1.45	7.2	3.5	184	160	7.4	41.6
F X S	2	1.62	0.52	0.57	0.22	8.2	10.0	50	371**	6.0	45.8
E X F X S	6	0.69	0.23	0.19	1.75	1.3	6.4	15	45	8.0	4.4
Erroc c	60	4.28	0.26	0.47	0.96	6.5	4.4	120	67	7.4	32.3
CV % (a)	-	53.1	50.1	10.70	19.2	9.4	7.7	10.8	8.3	8.8	10.9
CV % (b)	-	37.8	51.4	13.82	23.5	6.6	5.9	7.7	7.1	6.5	10.7
CV % (c)	-	19.4	35.8	8.74	17.9	3.8	3.8	6.3	5.0	6.6	11.4

*,** Significant at 5 and 1 per cent level of significance respectively.