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INTERNATIONAL CROPS RESEARCH INSTITUTE FOR THE SEMI-ARID TROPICS
(ICRISAT)

HIGHLIGHTS OF 1975-76 RESULTS - CEREALS IMPROVEMENT (SORGHUM)

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CEREALS IMPROVEMENT
(SORGHUM)

Highlights of 1975-7 results

SORGHUM BREEDING

Two trials were sent to 14 locations each, and a third, of tropical material, to 9 locations within 10^{0} of the equator. Material showing up well in our trials included Kafinam x Simila, K x SB 65, K x Lulu dwarf, Dobbs, and some 5DX, 9DX and 2KX lines from the Serere (East Africa) programme: and CSV 1, 4, 5, SPV 9, 13, 35, CSH 1, 6 and SPH 6, 10, 24 from the All India programme. Pioneer hybrid 22E did well in Senegal.

Populations made good progress, and several lines derived from the Fast Lane populations out-yielded the local checks at both low and high fertility levels. S_1 testing was done on 1946 lines in all populations.

The grain-grass sorghum crosses segregated a wide range of very promising material some with good grain type, synchronous tillers, and grass like plant form. Others showed the non-senescent character and should therefore ratoon well.

The technique for screening for Striga resistance (low production of stimulant) at the seedling stage has been adopted, and screening of sorghum varieties is being started. Anatomical studies were made of types showing mechanical resistance.

The entomologist has supplied 89 shoot-fly resistant lines, 83 midge resistant lines, and 40 stem borer resistant lines. Some of these have reasonably good agronomic characters and were crossed to a range of parents, both for pedigree breeding and to develop population.

In the earliness and grain mould resistance project, 30 early germplasm lines were crossed to 28 lines having some mould resistance and to 26 high yielding lines from disease sources. 1721 single crosses and 341 double crosses were made. Three IS lines identified by the pathologists as probably resistant (unconfirmed) were crossed to many early and adapted parents and also to male-sterile sources and to 6 advanced populations. 286 single crosses, 26 double crosses, were made with 35 large glume types.

A new population for evident grain qualit was begun, using a wide range of segregates from our own material. Selection in the high lysine segregates from crosses with the Ethiopian hl gene showed promise. We believe we have obtained some 50 lines with plump seeds, high lysine, and acceptable agronomic characters.

Selection and intercrossing in the tetraploid material is resulting in yield improvement and much better grain quality. Successful crosses were made with S. halepense.

A departmental newsletter was issued for cereal workers

in the SAT, in order to improve our contacts, and co-operation.

GERMPLASM

11,114 sorghum lines were maintained and evaluated for important morphological characters. Some ten percent of the entries did not match their published descriptions. The germplasm collection was therefore obtained from Purdue, and grown in parallel with the collection here. This will enable some entries to be corrected, and will also supply some of those missing. We expect the number to be about 12,000 by the end of the 1976 season. Some 5,000 remain to be obtained from Puerto Rico or Fort Collins.

Some data on 300 lines were processed in Colorado, and data sheets for 10,050 classified lines are being prepared for documentation in the TAXIR system by Colorado Taximetric Laboratory.

9,777 seed samples were distributed to breeders and scientists in ICRISAT, in India, and overseas.

A collection of rabi sorghums was made in the Khammam, Kurnool, Nellore, and Prakasham districts of Andhra Pradesh.

PLANT PATHOLOGY

Fifteen organisms were isolated from mouldy sorghum grains and identified at species level. Moulds seriously reduced germination percentage, and this effect could not be diminished by using seed

dressings. Curvularia and Fusarium appeared to be the most damaging of the pathogens. A technique for inoculating sorghum heads was developed: the pathogens were multiplied on autoclaved sorghum grain, and after 7 days the cultures were suspended in water. The resultant inoculum was sprayed on sorghum heads 4-7 days after emergence from the boot. Four thousand germplasm lines with white or yellow grains were screened using this technique. Three were classed as very resistant, 99 as resistant. (Scores 1 and 3 on a 1-3-5-7-9 scale).

We have not yet succeeded in obtaining consistent high levels of sorghum downy mildew disease at Patancheru.

34 entries showing reduced susceptibility to leaf blight were identified.

Macrophomina phascoli and a Fusarium sp. were isolated from sorghum stalk rots.

PLANT PHYSIOLOGY

The range of variability available in the germplasm for important physiological characters was investigated. In growth stage 1 (GS1), mean leaf number varied from 8.3 to 10.2, and rate of leaf production from 3.0 to 4.6 days per leaf.

Duration of GS2 varied from 31 to 64 days, leaves produced from 2.2 to 10.8, and rate of leaf production from 4.6 to 14.3 days per leaf. The position of the largest leaf from the top varied from

2.0 to 5.8, and the node bearing the largest leaf was, on average, 2.6 nodes above the node which had a fully expanded leaf at the time of floral initiation. GS3 varied from 31 to 56 days, and grain filling rate from 24.0 to 54.6 g per 1,000 seeds. Seed number per head varied from 469 to 2,161, and seed size from 24.0 to 54.6 g per 1,000 seeds.

Nitrogen

Total nitrogen uptake per plant varied from 0.22 g to 1.14 g. NTE varied from 57.8% to 86.6%, and was strongly positively correlated with harvest index. Grain yield was strongly positively correlated with total plant nitrogen (r=51 ***), grain nitrogen content (r=58 ***) and nitrogen transfer efficiency (NTE) (r=0.33 *).

Large differences were found in root development, using brick chambers. In the comparison of the hybrids 22E and CSH-1, adventitious roots produced per plant upto 60 days were 37 and 27, but at 75 days were 41 and 72. Total length of main adventitious roots at 60 days were 794 and 545, but at 75 days were 1420 and 1934. Root/shoot ratio at all stages was greater in 22E.

Large differences were obtained in seedling vigour, and these appear to be heritable. Drought endurance trials using 73 genotypes are in progress.

SORGHUM ENTOMOLOGY

Most of the work in cereals entomology was focussed on pests of sorghum, as for a further year pest levels at Patancheru on millet were low.

Seventy five insects were identified as attacking the sorghum crop. Most of the identities of these have been checked with taxonomists and a working reference collection built up. The most important source of crop loss locally is Atherigona soccata, sorghum shoot-fly.

Detailed studies on this species were carried out. It was confirmed that some cultivars are non preferred for oviposition, that delay of sowing resulted in increased egg laying, and that usually one or two eggs were laid per plant. Experimentation showed that oviposition was heavier at higher plant densities, i.e. more eggs were laid per unit area. Percentage plants bearing eggs was highest at 20 cm between plant spacing within the row. These facts are of assistance in our screening programme. Studies of carry of shoot-fly indicated that 13 different grasses carried shoot-fly. Some 700 flies have been reared from alternative hosts, and most of them were A. soccata. The main grass species from which flies were collected was Digitaria ascendens.

Considerable progress was made on screening of sorghum germplasm shoot-fly resistance. Stark's technique was used and found satisfactory. Work on the attractant effect of fishmeal was initiated and valuable

information continues to be obtained. Attractant techniques will enable us to monitor fly populations throughout the dry season. Tolerance to shoot-fly was confirmed in several lines including IS 1054, 2269, 2312, 4664, 5604, 95656. Some crosses with West African selections were also tolerant. Breeders material was rated for shoot-fly levels.

Another important pest is Chilo. Work on the carryover of this pest as a torpid larva continued. It was observed that many larvae (11%) collected from stubble and cut stalks after harvesting of the head did not pupate in the period December/June. A high proportion of the larvae reared in the laboratory were parasitised (21-29%). Tachnids were the main parasites recorded.

Collaborative work with TPI on use of phermone for the trapping Chilo gave interesting preliminary results and is being continued. Little success was achieved in a study of viruses in Chilo conducted on conjunction with BTI.

Preliminary proposals for collaborative work with ICIPE, COPR, CIBC and local institutions have been formulated.

Information is being gathered on the sorghum and millet pest complexes in areas of cooperation, particularly in Africa.

SORGHUM MICROBIOLOGY

Large differences (ten fold) in nitrogen fixation associated with different sorghum varieties were observed. CSH-1 S. almum, and

S. verticilliflorium were among the most active of the lines so far examined.

SORGHUM BIOCHEMISTRY

The technology for rapid screening of small quantities of sorghum grains for protein and lysine content has been perfected. We use a "technicon" auto analyser for protein and UDY for lysine (Total basic amino-acids). Over 4,100 samples were screened, and the high lysine entries identified.