tannin content of some cultivars and advanced elite lines developed by IPA's Sorghum Breeding Program.

Sorghum seed samples were analyzed at IPA's laboratory in Recife, Pernambuco, following the methodology developed by Maxon and Rooney (1972). Out of the 212 cultivars that were analyzed, 64% belonged to the low tannin group; 21% average tannin; 9% high tannin; and 6% very high tannin groups (Table 1). The cultivar IPA 7301011 (Uganda) had an average tannin content of 0.11% and IPA 8602502 (India), 0.13% tannin. Both have been released for commercial sowing. The cultivar IPA 7300201 (USA) had the highest tannin content (1.35%).

Table 1. Classification of grain sorghum cultivars based on tannin content.

Tannin content (%)	Group	Number of cultivars
≤0.25	Low	136
0.26–0.50	Average	44
0.51–0.75	High	19
≥0.75	Very High	13

Reference

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Grain Mold Resistance in Guinea Sorghum Germplasm

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Snowden (1936) classified the guinea sorghums in the subseries Guineensia, which includes the cultivated species, *Sorghum conspicuum, S. guineense, S. margaritiferum*, and *S. roxburghii*. While Murty et al. (1967) divided these species into five work groups and 9 subgroups, Harlan and de Wet (1972) categorized them as subraces of guinea on the basis of selected spikelet characters. Sorghums belonging to guinea have grains that are flattened dorsoventrally, sublenticular in outline, twisting at maturity nearly 90° between gaping involute glumes that are longer or equal to the length of grain.

Guinea is basically a West African race, that is predominant in the savanna sorghum belt. A secondary center is found in Malawi and Tanzania. Since it is often grown in high-rainfall areas, it has undergone considerable selection for good weathering and storage qualities. Its seeds are often hard and corneous, and do not lose their color; they are moderately resistant to insect pest damage under primitive storage conditions. Its open pendulous panicles and gaping involute glumes probably help to reduce mold damage under wet conditions (Harlan and de Wet 1972).

Because of these characteristics of guinea sorghums, we studied them more closely for grain mold resistance, as an adequate degree of resistance could not be found in other germplasm for transferring into adapted cultivars. Around 4300 accessions belonging to the guinea race are present in the world germplasm collection maintained at ICRISAT Asia Center (IAC), Patancheru, India. They are predominantly from Benin, Gambia, Malawi, Mali, Mozambique, Senegal, Sierra Leone, Tanzania, and Togo. Some accessions have also been collected from the hilly areas of India (Prasada Rao and Mengesha 1988). Most of the guinea accessions are photoperiod-sensitive and do not flower in the long days of the rainy season at IAC. This has been a major handicap to screen guinea sorghums for grain mold resistance in field conditions.

As an alternative to overcome this hurdle sorghum pathologists at IAC developed an in vitro screening technique. This technique was used to test a representative part of guinea sorghums against three major grain mold fungi: *Fusarium moniliforme, F. pallidoroseum*, and *Curvularia lunata* (Singh and Prasada Rao 1993).

A representative sample of 51 guinea sorghum accessions belonging to the subraces *conspicuum* (12), *guineense* (10), *margaritiferum* (10), and *roxburghii* (19) were screened using the in vitro screening technique and evaluated using a 1–5 rating scale, where 1 = no mold visible on grain surface, and 5 = 50% molded grain. Fourteen accessions showed moderate to high mold resistance to the three pathogens in three successive tests.

Seedlings of these resistant genotypes were transplanted into pots. Twenty-one days after transplanting, the plants were maintained under 8 h daylight (by covering the pots with a thick black cloth from 1600 to 0800 h the following day) for 30 days to induce flowering. At the heading stage, the pots were moved to the grain mold nursery where high humidity was maintained by operating overhead sprinklers (Bandhyopadhyay and Mughogho 1988). At 50% anthesis, panicles of all entries were spray-inoculated with mixed spore suspension (1×10^6

spores mL-1). Observations taken 55 days after flowering showed that four entries [IS 7173 (Tanzania), IS 23773 (Malawi), IS 23783 (Malawi), and IS 34219 (Eastern Ghats, India)] did not develop grain mold. Six entries (IS 7326, IS 4963, IS 5726, IS 4011, IS 5292, and IS 27761) developed low to moderate grain mold infection (ratings of 2 to 3). The remaining four entries flowered very late and could not be screened successfully. This indicates that photoperiod-sensitive guinea germplasm is a source for grain mold resistance.

Of the four mold-resistant accessions, three belonged to *conspicuum*, and one to *roxburghii*. It would be useful to screen the remaining *conspicuum* accessions in the ICRISAT collection for grain mold resistance using the in vitro screening technique.

Despite the photoperiod-sensitivity of *conspicuum* accessions with grain mold resistance, a few are being used in the pedigree breeding program at IAC. These are not being converted to day-neutral background as large resources would be necessary to do this. Instead, a population breeding approach has been initiated to recombine the desirable grain mold resistance traits from *conspicuum* with photoperiod-insensitivity and agronomically desirable plant traits.

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Grain Mold Resistance in White Grain Sorghum

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Sorghum [*Sorghum bicolor* (L.) Moench] is attacked by more than a hundred diseases (Singh et al. 1993). Grain mold is one of the most widespread and devastating diseases of sorghum. Although about 40 fungal species have been found associated with this disease complex, only three—*Fusarium moniliforme*, *F. pallidoroseum*, and *Curvularia lunata*—are predominant.

In 1993, we reported grain mold resistance in white grain photoperiod-sensitive guinea sorghums (Singh and Prasada Rao 1993). Subsequently, we evaluated 347 lines derived through conversion of eight zera-zera accessions (IS 956, IS 2579, IS 3443, IS 6928, IS 6958, IS 18758, IS 24695, and IS 30469) to photoperiod-insensitivity. These accessions originated from Ethiopia (3) and Sudan (5) (Prasada Rao et al. 1989). All the 347 lines were first tested against the three fungi separately and in combination, using an in vitro screening technique (Singh and Prasada Rao 1993). One hundred and forty-three lines showed moderate to high grain mold resistance (1–5 ratings on a 1–9 scale, where 1 = mold-free, and 9 = 75% grain surface area covered by mold). These lines were evaluated during the 1993 rainy season in a field grain mold nursery (Bandyopadhyay and Mughogho 1988). Eighty-three single head selections were made from 17 lines that showed ratings of 1–5. These selections were again tested during the 1994 rainy season in the grain mold nursery, and almost all of them, including IS 18758C-618, IS 18758C-704, IS 18758C-710, and IS 18758C-496 showed extremely high levels of resistance (ratings of 1–3). Most of these selections mature between 29 and 45 days after anthesis. All the selections developed some infection by *Phoma* spp at later stages of maturity.

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Forage Quality of 18 Glossy Sorghum Genotypes under Rainfed Conditions in Nuevo León, Mexico

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In northeastern Mexico, forage production is very low due to drought. New sorghum cultivars resistant to drought and other abiotic and biotic stresses (Maiti and Bidinger 1979, Maiti et al. 1984, Maiti et al. 1994) are needed for this region. The association of glossy sorghum germplasm with resistance to multiple stresses is well-documented (Maiti et al. 1984). Glossy sorghum lines showed good productivity of forage under rainfed conditions in Mexico (Maiti et al. 1994). This study presents the evaluation of the forage quality of some glossy sorghum genotypes.

Eighteen glossy sorghum genotypes were grown in a replicated trial (3 replications) under rainfed conditions in spring, 1987, in semi-arid Nuevo León (annual rainfall of 466 mm, average maximum temperature 28°C, and minimum temperature 22°C). Ten plants (stem and

Table 1. Nutritive value (%) of 18 glossy sorghum genotypes (stover) under rainfed conditions.

Genotype	Ash	Protein	Fiber	Lipid	Carbohydrate
IS 862	6.6	4.7	27.5	1.4	59.7
IS 5067	6.4	5.1	27.3	2.3	58.8
IS 5622	8.0	4.5	27.5	3.0	56.9
IS 5476	6.5	8.0	25.0	1.2	59.2
IS 5484	5.3	6.7	28.5	0.8	58.7
IS 182	5.5	7.8	27.6	2.1	57.1
IS 5470	8.5	10.1	25.4	1.7	54.3
IS 5282	7.3	6.6	27.9	2.6	55.6
IS 5566	5.2	7.3	25.9	2.8	58.7
IS 1034	8.6	10.1	26.1	2.0	33.3
IS 4553	7.0	4.6	27.6	2.2	58.6
IS 2195	7.7	8.6	25.4	1.2	57.1
IS 2122	6.8	8.3	26.7	1.8	56.4
IS 2205	7.5	5.5	27.3	2.2	57.5
IS 4661	8.6	9.5	26.1	2.1	53.7
IS 4521	6.5	10.5	25.9	1.8	55.2
IS 1082	8.9	4.9	24.5	2.6	59.1
IS 4545	10.0	7.3	26.4	2.8	53.4
Average	10.0	7.2	26.6	2.0	57.1
SD	±1.2	±2.1	±1.2	±0.6	±2.0