probably offers resistance to shootfly oviposition and maggot movement on the slippery leaf surface which needs to be confirmed in future study. Genotypes IS 2205, IS 2312, 2396, IS 4776, IS 5282 and 5359 showed the same characteristics and were found to show high level of shootfly resistance (Sharma *et al.*, 1992). In this study IS 5282, IS 3962, IS 4576 and IS 2205 also showed high field resistance in oviposition nonpreference and deadhearts percentage.

Correlation studies between plant height and numbers of days to 50% flowering with shootfly resistance

Sorghum lines (525) varying in the intensity of leaf surface glossiness at the seedling stage have been used to study the relationship of plant height and days to flower with shootfly incidences. The data on shootfly resistance parameters viz. % plants with shootfly eggs (PE %) and % plants with deadhearts (PD %) and plant height (PH) and days to flowering (DF) were taken from Entomology and the Genetic Resources Unit, ICRISAT. The correlations among plant characters and shootfly resistance parameters are given in Tables 9.9 & 9.10).

Table 9.9 Correlations among morphological and shootfly resistance parameters in glossy lines.

Characters	DF	PH	PE %
PH	0.11O *		
PE %	-0.200 **	0.003	
PD %	-0.227 **	-0.067 *	0.885 **

[PH : Plant height; DF = Days to 50 % flowering; PE % = Percent of plants with shootfly eggs; PD % = Percent of plants with deadhearts. *, ** Significant at 5% and 1% level respectively]

Table 9.10 Correlations among morphological and shootfly resistance parameters in nonglossy lines.

Characters	DF	PH	PE %
PH	0.106		
PE %	- 0.278	0.062	
PD %	- 0.178	0.058	0.886**

[PH : Plant height; DF = Days to 50 % flowering; PE % = Percent of plants with shootfly eggs; PD % = Percent of plants with deadhearts. ** Significant at 1% level.]

Days to flowering had negative and significant association with percent plants with eggs and percent plants with deadhearts among glossy lines. Nonglossy lines showed a similar but nonsingnificant association. This indicates that high glossy intensity and late flowering are advantageous in decreasing shootfly susceptibility. The relationship between plant height and shootfly resistance parameters (PE % & PD %) were found negligible in both glossy and nonglossy groups.

Regression equations have been fitted among glossy and nonglossy genotypes in order to estimate the extent of the effects of plant height and days to flowering

shootfly incidence (Table 9.11). Days to flowering had significant effect on PE %, whereas plant height and days to flower and their interaction contributed substantially on shootfly damage among glossy genotypes. The relationship among these traits was negatively linear for nonglossy genotypes. Plant height played an important role both on egg nonpreference and shootfly damage. Days to flower and plant height showed a positive linear relation with percent damage. Plant height and days to flower were directly related to shootfly parameters among glossy genotypes.

Table 9.11 Response coefficients of plant height (PH) and days to flowering (DF) in different functions (* P=0.05, ** P=0.01).

Functions	PH	DF	(PH X DF)
Glossy lines			
PE % / (PH, DF)	0.010	-0.342 **	
PD % / (PH, DF, PH X DF)	-0.177	-0.868 **	0.002
PD% / (PH, DF)	-0.016	-0.360 **	
PD% / (PH, DF, (PH X DF)	-0.303 **	-1.169 **	0.004 **
Nonglossy lines			
PE% / (PH, DF)	0.025	-0.401	
PE% / (PH, DF, PH X DF)	0.809 *	1.630	-0.011 *
PD% / (PH, DF)	0.022	-0.273	
PD% / (PH, DF, PH X DF)	0.908 **	2.024 *	-0.001 **

Table 9.12 Test of independence between shootfly resistant levels, plant height and days to flowering among glossy lines (* P=0.05, ** P=0.01).

Comparision	df	X^2
Plant height vs % PE	4	4.59
Plant height vs %PD	4	9.74 *
Days to flower vs %PE	4	22.82 **
Days to flower vs % PD	4	30.18 **

An interdependence between shootfly resistance levels, plant height and days to flower among glossy lines has been tested using X^2 statistics (Table 9.12). Ovipositional preference (PE%) was independent of plant height, whereas shootfly damage was found significantly dependent on plant height. Similarly, PE% and PD % were highly dependent on days to flowering to shootfly resistance among glossy lines. These characters are further grouped into 3 plant height classes, i.e., dwarf (less than 150 cm), medium (150-250) and tall (more than 250 cm) and 3 flowering groups, early flowering (less than 70 days), intermediate (70-90 days) and late (more than 90 days). Is was confirmed that days to flowering played an important role on oviposition preference, but not plant height. Tall and late flowering genotypes seem favourable in reducing shootfly incidence.

Other insects and diseases

It has been recently reported that 50% of shootfly resistant lines having glossy trait are resistant to stem borer (Nwanze *et al.*, 1991). Scientist from the Centre for Overseas Pest Research, London while working at ICRISAT had some indications that glossy lines which were tolerant to shootfly were also tolerant to flea beetle (*Perigrinus* sp.) and shoot bug (*Perigrinus maidis*) (Susan Woodhead, COPR, U.K., personal communication). Tarumoto from Japan (personal communication, 1981) stated that the glossy lines were resistant to sorghum leaf blight caused by *Exserobilum turcicum*.

ABIOTIC STRESSES

Seedling drought resistance

Significant genotype differences among sorghum genotypes in response to drought were found. During the process of standardization of testing for seedling drought, it was noticed that most seedling drought resistant lines were glossy and recovered faster after the release of stress in field conditions (Maiti *et al.*, 1984).

Glossy and nonglossy lines were analyzed separately and analysis of variance revealed that glossy lines did not show much divergence in drought resistance. But significant differences were observed among nonglossy lines. The t-test between glossy and nonglossy lines also showed significant differences in various drought resistance parameters. Under stress, the growth rate was checked in nonglossy lines compared to glossy ones (Maiti, 1986). Nonglossy lines at early seedling stage were more vigorous than glossy lines. The glossy lines showed more resistance than nonglossy lines. Cluster analysis showed that about 87% of the resistant lines which fell in cluster 1 were glossy ones while all of the susceptible lines which formed cluster 4 were nonglossy (unpublished).

Glossy lines showed statistically significant differences from the nonglossy in several drought resistance parameters, e.g. visual score for wilting, recovery score, and percent survival of seedlings (unpublished).

Glossy lines showed higher water use efficiency in terms of water required to produce one gram of dry weight compared to the nonglossy lines in solution culture studies (Sullivan and Maiti, 1983, unpublished). In carbowax induced water stress, glossy lines were more tolerant to water stress compared to the nonglossy lines. The reduced transpiration and high water efficiency might be an adaptation of glossy lines for drought (Table 9.13). Glossy lines in general had higher water use efficiency (WUE, glossy - WUE = 12.65, Nonglossy - WUE = 9.66, avg.), but few glossy lines had low WUE and few nonglossy had also high WUE.

With respect to shoot/root ratio there was no clearcut distinction between glossy and nonglossy lines, some glossy lines had low values indicating higher root growth compared to shoot growth. This was also true in case of some nonglossy lines.

Experiments were conducted in a green house house at ICRISAT to study the comparative efficiency of glossy lines over nonglossy both under water stressed and unstressed situation (June-July 1992).

The mean values of some morphophysiological characters are shown in Table

14. Glossy lines showed superiority in growth (shoot, root and shoot + root dry weight) over nonglossy lines under water stress and control condition. F-ratio for glossy vs nonglossy indicate highly significant differences for root and shoot growth (dry weight) under water stress, but the differences were found significant only in case of shoot growth under control. The difference between glossy and nonglossy lines was higher under water stress compared to unstressed conditions.

Table 9.13 Water use efficiency (WUE) of glossy and nonglossy sorghums at Agronomy Faculty, University of Nebraska (Sullivan & Maiti- unpublished).

Genotypes	WUE $	Dry weight, g		Shoot/
		Shoot	Root	root
IS 2394 (G)	14.6	8.4	2.0	4.2
RS 671 (NG)	12.1	21.6	5.0	4.4
IS 2962 (G)	17.3	15.1	3.5	4.2
CSV5 (NG)	11.4	11.6	3.4	3.4
IS 4449 (NG)	9.9	11.4	3.5	3.3
IS 15701(NG)	10.0	11.6	4.6	2.5
IS 4405 (G)	9.0	16.4	4.4	3.7
IS 6205 (NG)	8.9	14.8	5.3	2.8
IS 9040 (NG)	6.4	11.1	7.0	1.7
IS 226 (NG)	9.0	18.9	7.6	2.5
IS 5567 (G)	13.9	14.6	4.8	3.1
IS 4621 (G)	9.7	20.7	7.3	2.8
IS 1096 (G)	11.4	15.1	5.3	3.0
IS 15701 (NG)	9.6	21.8	8.5	2.6

$ Plants were grown hydroponically in plastic cylinders (15.4 X 7.7 cm). The plants were harvested at 72 days after germination.

Table 9.14 Mean values of some morphophysiological characters of glossy and nonglossy groups of sorghums (SDW = Shoot dry weight, g; RDW = Root dry weight, g).

Variable	Mean values			
	Water		Stress	
	Glossy	Nonglossy	Glossy	Nonglossy
SDW	1.123	0.938	0.269	0.124
RDW	0.404	0.397	0.078	0.052
Total	1.527	1.335	0.347	0.177

The ratio of glossy to nonglossy again revealed the superiority of glossy over nonglossy under stress condition for root and shoot growth but under unstressed situation the values of the ratios were less compared to stress condition (Table 9.15).

Table 9.15 Water use efficiency (root growth - RT and shoot growth - SH) of glossy and non-glossy group under water stress and unstressed condition.

Group	Control (10^{-4}) RT	SH	R+S	Stress (10^{-4}) RT	SH	R+S
Glossy	10.03	27.90	37.93	1.40	4.75	6.15
Non-glossy	9.98	23.50	33.50	0.95	2.20	3.12
GL/NGL	1.01	1.19	1.13	1.47	2.14	1.97

Glossy genotypes showed superiority over over nonglossy ones for shoot, root and total dry weight under both water and unstressed condition (Table 9.16). F-ratios in the analysis of variance reveal that the genotypic variation among the glossy genotypes was highly significant for all characters under water and stress conditions. Although the variations among nonglossy lines were significant for these characters under water treatment, no variation was found under stress conditions. This means that under stress, glossy genotypes have advantage over nonglossy for genetic improvement of drought resistance. This was further confirmed from the heritability estimates for glossy genotypes under water and stress conditions (Table 9.17).

Table 9.16 Mean values (dry wt, g) and ANOVA of some morpho-physiological characters under water and stress condition.

SV	Water treatment F-values Shoot	Root	Total	Stress F-values Shoot	Root	Total
GL/NGL	16.20**	16.29**	4.17*	5.47*	0.53	3.25
GL	3.54**	6.71**	3.86**	3.48**	3.90**	3.72**
NGL	3.40**	2.17*	3.27*	0.54	0.12	0.32
Mean						
Glossy	2.51	0.50	3.02	0.22	0.056	0.28
Non-glossy	2.27	0.59	2.87	0.19	0.049	0.24

Effect of water stress on some physiological and biochemical components

García-Saucedo (1985) made a study of the effect of water stress on root growth, leaf area, transpiration and biochemical components like HCN, chlorophyll and carbohydrates of some glossy and nonglossy lines. HCN content in leaves increased considerably under drought stress with the decrease in optimum moi-

Table 9.17 Heritability of shoot, root and total dry weight under stress and no-stress situation (W = Water, S = Stress).

		Shoot dry weight	Root dry weight	Total
Glossy:	(W)	13	26	34
	(S)	36	95	79
N.Glossy:	(W)	12	6	27
	(S)	0	0	0

level. There existed variation in HCN content among glossy and nonglossy under water stress which is a character related to drought tolerance. Carbohydrate content increased from optimum to moderate water stress level in both types, but decreased at higher water stress. At the same time, chlorophyll content decreased thus affecting the photosynthetic activity. However, some lines showed significant decrease under water stress. The rate of transpiration decreased with increase in epicuticular wax content (Tables 9.18 and 9.19).

Table 9.18 Variability in HCN content, chlorophyll and carbohydrate at 3 levels of moisture.

Genotypes	HCN mg a1	a2	a3	Chlorophyll mg dry wt. a1	a2	a3	Carbohydrates mg dry wt. a1	a2	a3
IS 18390 (G)	17.0	17.5	34.5	1.6	0.96	-	1260	3213	2760
IS 183590 (G)	16.5	11.8	17.7	1.2	1.13	1.05	1101	3079	2888
LES-2R (NG)	18.0	12.2	17.7	1.0	0.55	-	1328	3214	2862
LES-10R (NG)	19.0	25.7	31.0	1.06	1.06	1.09	1188	2647	2832

Water levels: a1= each 7 days; a2= each 15 days; a3= each 30 days.

Table 9.19 Rate of transpiration (every 2 days) in glossy and nonglossy sorghum (g H_2O).

Genotypes	5 Dec.	7 Dec.	9 Dec.	12 Dec.	14 Dec.	%
IS 18390 (GL)	1.8	4.2	7.4	11.4	16.6	16.5
IS 18590 (GL)	3.1	7.7	13.7	23.5	36.4	30.9
LES-2R (NGL)	2.5	6.0	10.6	17.1	25.6	30.9
LES-10R (NGL)	2.3	5.6	10.1	16.7	24.8	25.1

Variability in intensity of glossiness and waxiness and its relation with water stress resistance

Ríos-Leal (1990) showed that the intensity in glossiness and waxy bloom contribute to higher water stress resistance compared to those having lower intensities. The epidermal cell, stomata and trichome number increased under water stress in all genotypes, although in some lines with higher intensity of glossiness and waxy bloom, epidermal cell and stomata number were more stable. Carbohydrate and HCN content increased under water stress, but the proportion was higher in genotypes having higher intensity of glossiness and waxy bloom compared to ones having lower intensity. The genotypes having higher glossiness showed higher epicuticular wax and also had less loss of water by transpiration (Figs. 9.12 - 9.15).

Mechanism of drought resistance in glossy lines

Glossy lines differ from nonglossy ones in the structure of their epicuticular wax. Under SEM, glossy leaves have smooth wax with large crystals, whereas nonglossy leaves show absence of smooth wax and presence of small needle shaped crystals. The glossy lines during seedling stage showed higher water use efficiency and less water loss by transpiration (Maiti, 1986). Besides some biochemical characters like chlorophyll, carbohydrate, wax and HCN content were reported to be associated with drought resistance (García-Saucedo, 1986; Ríos-Leal, 1990). Rodríguez-Cabrera (1987) showed that glossy lines had better growth under decreasing sprinkler irrigation compared to nonglossy lines.

The EW on sorghum leaf blades imparts drought resistance and therefore, the screening of sorghum genotypes for increased wax may have direct impact for

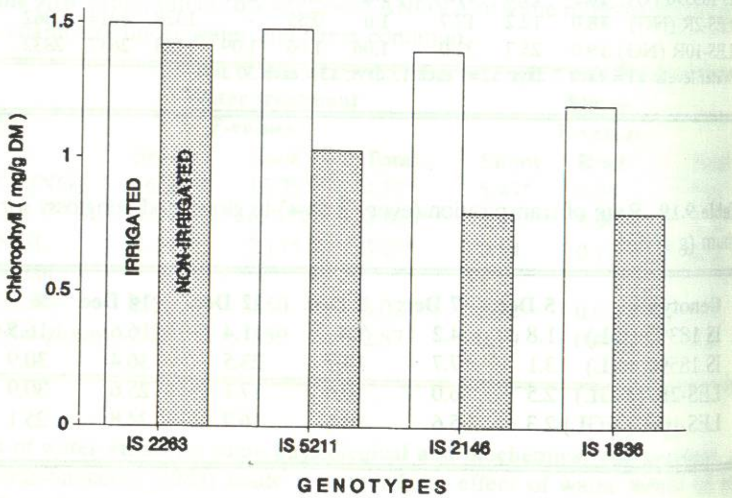

Figure 9.12 Total chlorophyll content (mg/g DM) in 4 glossy lines under irrigated and drought conditions in growth chamber.

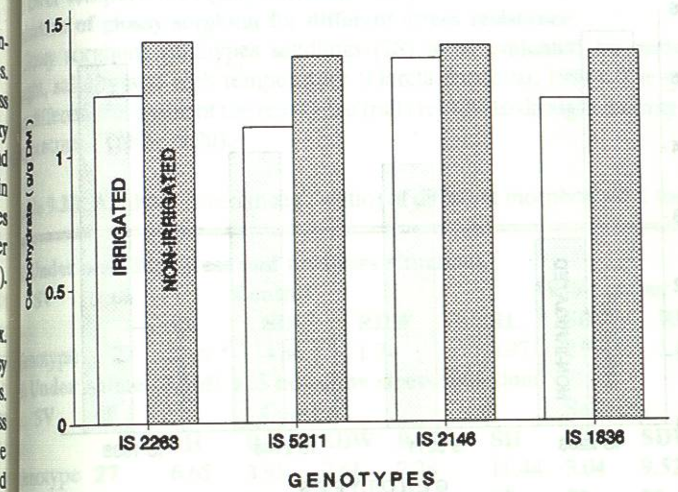

Figure 9.13 Carbohydrate content (g/g DM) in 4 glossy lines under irrigated and water stress situations.

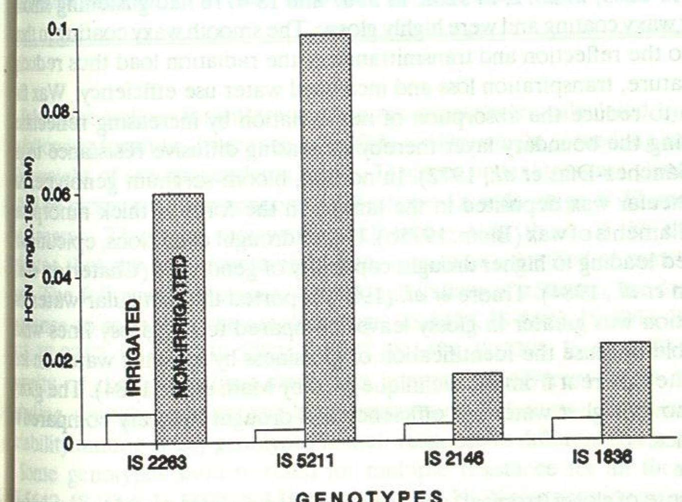

Figure 9.14 HCN content (mg/0.15 g DM) in four glossy lines under irrigated and water stress situation in growth chamber.

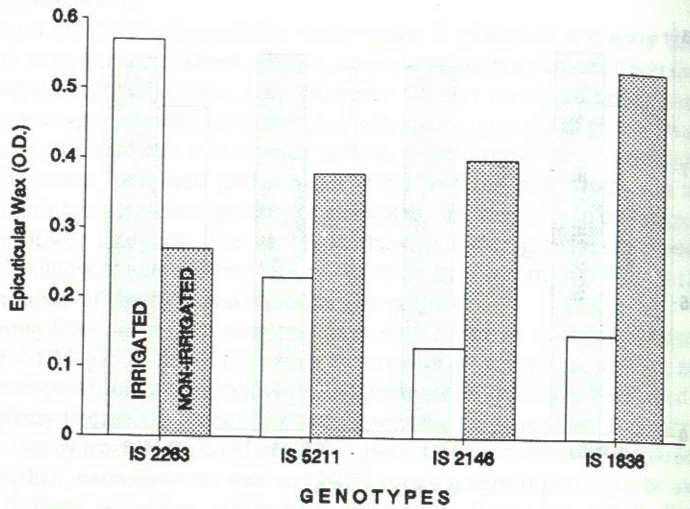

Figure 9.15 Epicuticular wax content and transpiration in 4 glossy lines under irrigated and water stress situations.

genetic improvement of drought resistance in sorghum (Blum, 1975b; Ebercon *et al.*, 1973; Jordan, 1983; Jordan *et al.*, 1984).

IS 1096, IS 2205, IS 2312, IS 5282, IS 5567 and IS 4776 had glistening smooth epicuticular waxy coating and were highly glossy. The smooth waxy coating in these lines leads to the reflection and transmittance of the radiation load thus reducing leaf temperature, transpiration loss and increased water use efficiency. Wax filaments seem to reduce the absorption of net radiation by increasing reflectance and thickening the boundary layer thereby increasing diffusive resistance to gas exchange (Sánchez-Días *et al.*, 1972). In normal, bloom sorghum genotypes has more epicuticular wax deposited in the lamina in the form of thick amorphous layers with filaments of wax (Blum, 1975b). Under drought conditions, epicuticular wax increased leading to higher drought capability of genotypes (Chaterton *et al.*, 1975; Jordan *et al.*, 1984). Traore *et al.* (1984) reported that cuticular water loss by transpiration was greater in glossy leaves compared to nonglossy lines which is questionable because the identification of glossiness by spraying water on leaf surface is quite different from the technique used by Maiti *et al.* (1984). The glossy lines have shown higher water use efficiency and drought recovery compared to nonglossy lines.

Temperature

The response of glossy (tropical) and nonglossy (temperate) to varying temperatures at the seedling stage was studied. Glossy sorghum showed higher levels of tolerance to higher temperatures compared to temperate ones (nonglossy) at the seedling stage, while the temperate sorghum showed tolerance to lower tempera

. Again, glossy sorghum showed a wide range of adaptability in both higher d lower temperatures (López-Irison, 1990).

luation of glossy sorghum for different stress resistance

Glossy sorghum genotypes seedlings (28) were evaluated for resistance to ught, salinity and high temperature (García-Sandoval, 1991). The genotypes e differenr for some of the resistance traits related to drought, salinity and high perature (Tables 9.20).

able 9.20 Analysis of variance (F-ratio) of different morphological variables.

) Under seedling stress and no-stress situation:

SV	df	Control			Water stress		
		RL	SDW	RDW	RL	SDW	RDW
enotype	27	2.16 *	4.86 **	1.74	0.97	2.97 **	1.64

) Under saline (0.2M) and no-saline stress situation:

SV	df	Control				Salinity			
		SH	RL	SDW	RDW	SH	RT	SDW	RDW
enotype	27	6.65	3.91	7.61	7.78	11.44	3.04	9.52	6.31
rror	56	**	**	**	**	**	**	**	**

) Under moderately high (35°C) and optimum (28°C) temperatures:

SV	df	Control				High Temperature			
		SH	RL	SDW	RDW	SH	RT	SDW	RDW
enotype	27	9.56	4.51	6.45	5.77	5.0	2.51	12.5	6.7
		**	**	**	**	**	**	**	**

L =Root length, cm; SDW= Shoot dry weight, g; RDW =Root dry weight; * P=0.05, ** P=0.01]

Tolerance indices for different stress resistances were calculated by adopting following formula: Tolerance index (TI) = {Dry weight of seedling under stress ry weight of seedling under control}. TI values under stress are given in Table 1. The glossy sorghum genotypes (28) showed a wide range of TI under differ- d stresses. TI of the root were much higher than those of the shoot. This dicates that the root maintained higher growth as a method of osmotic adjust- ent. The following genotypes showed high indices of tolerance for drought and istance to salinity at the seedling stage: IS 5359, IS 5692, IS 3962, IS 1034, IS 15, IS 2312, IS 4473, IS 5282, IS 8977, IS 5484, IS 2205, IS 4576, IS 5604. The ajority of the glossy lines were well adapted to different stress conditions, cluding drought, salinity and high temperature. Of course, there exists large riability among glossy genotypes in their response to different stress conditions. Some genotypes were selected for multiple resistance for all these stresses 5642, IS 1096, IS 5692, IS 5359 and IS 4545). HCN content showed an increase those genotypes subjected to multiple stress, except for IS 1096 which showed nstant levels (García-Sandoval, 1991). This could be related to a mechanism of ess resistance.

Table 9.21 Tolerance indices (TI) of 28 glossy sorghum genotypes under different stress conditions.

Genotypes	Water stress		Salinity		High temp.°C	
	TIS	**TIR**	**TIS**	**TIR**	**TIS**	**TIR**
IS 5359	2.25	5.27	1.14	1.56	2.89	3.56
IS 5692	1.67	0.88	0.64	1.38	2.44	3.77
IS 3962	1.32	0.40	0.94	1.81	2.73	4.02
IS 1034	1.56	2.44	0.77	1.21	2.62	6.19
IS 8315	1.16	0.96	1.04	1.57	3.39	6.05
IS 2312	1.09	0.86	0.94	0.88	2.42	4.76
IS 4473	1.07	1.49	0.90	0.89	2.25	5.02
IS 5282	1.06	1.17	0.85	1.18	2.92	5.46
IS 8977	0.98	1.33	0.86	1.04	2.78	6.12
IS 5484	0.93	1.11	0.80	1.13	2.54	6.97
IS 2205	0.90	1.57	0.89	1.18	2.72	6.82
IS 4576	0.89	1.10	1.00	1.57	2.01	3.88
IS 5604	0.89	1.36	1.00	1.47	2.84	7.37
IS 4545	0.88	0.66	0.64	1.06	4.58	10.28
IS 8311	0.86	0.74	0.93	1.32	2.05	2.86
IS 5642	0.85	1.11	1.28	1.37	2.62	5.20
IS 4776	0.80	1.32	0.96	1.16	2.46	6.08
IS 5622	0.79	0.84	1.01	1.51	2.97	6.35
IS 18390	0.77	0.71	0.99	1.11	2.50	6.08
IS 4661	0.77	0.89	0.93	1.38	2.01	4.95
IS 4663	0.75	0.78	0.71	0.86	3.23	5.53
IS 5587	0.75	1.06	0.91	1.25	2.23	4.26
IS 1054	0.72	1.00	0.93	1.11	2.07	4.40
IS 2396	0.70	0.65	1.10	1.72	2.10	3.66
IS 1096	0.69	0.96	0.79	1.13	3.52	7.92
IS 5567	0.65	0.86	0.85	1.17	2.18	5.46
IS 4405	0.64	0.90	1.05	1.29	2.23	3.85
IS 2146	0.58	0.93	0.92	1.22	2.07	4.03

NUTRIENT DEFICIENCY

Phosphorus uptake

Study on phosphorus uptake by glossy and nonglossy lines has shown that glossy lines were more efficient in phosphorus uptake under low phosphorus compared to nonglossy ones (Raju *et al.*, 1987.).

Uptake of minerals

A set of glossy lines have been evaluated for uptake of macro and micro elements under no stress and water stress situation at the seedlings stage (Table 9.22). The results show that the genotypes showed highly significant differences in the uptake of Fe, Zn, Na, Ca and Mg under irrigated condition, but for Fe and

under drought situation. Some genotypes were selected for efficient uptake minerals under both the situations.

Table 9.22 Analysis of variance for uptake of nutrients under irrigated and seedling drought conditions [** P=0.01].

A) Uptake of nutrients under irrigated conditions (F-ratios):						
SV	**df**	**Fe**	**Zn**	**Na**	**Ca**	**Mg**
Genotype	27	4.67	3.72	3.54	6.18	3.42
Error	56	**	**	**	**	**
B) Uptake of nutrients under seedling drought conditions (F-ratios):						
SV	**df**	**Fe**	**Zn**	**Na**	**Ca**	**Mg**
Genotype	20	3.33	1.43	0.93	4.96	1.08
Error	42	**			**	

Correlation studies were made among glossy sorghum genotypes in the uptake of mineral nutrients under irrigated and nonirrigated conditions (Tables 9.23 and 9.24). There was a highly significant correlation between uptake of different metals under irrigated conditions. Only a few of them showed significant correlation under water stress condition. Therefore, water stress interferes in the uptake of minerals.

Table 9.23 Correlations among assimilations of metals in glossy genotypes under irrigated conditios [** P=0.01].

	Fe	Zn	Na	Ca
Zn	0.661 **			
Na	0.662 **	0.497 **		
Ca	0.629 **	0.487 **	0.664 **	
Mg	0.689 **	0.672 **	0.830 **	0.784 **

Table 9.24 Correlations among assimilation of metals in glossy genotypes under seedling water stress situations. [* P=0.05, ** P=0.01].

	Fe	Zn	Na	Ca
Zn	0.430 *			
Na	0.170	0.194		
Ca	-0.076	0.136	0.077	
Mg	0.400 *	0.439 **	0.345 *	0.205

Determination of antinutritional elements in some glossy sorghum genotypes

Some glossy lines were evaluated for the presence of the antinutritional factor nitrate at 45 days under irrigated conditions (Table 9.25). It was revealed that there were variations in nitrate contents among glossy lines, and that IS 5484 showed the maximum level of nitrate while is 2312 and is 8977 did not show the presence of this element.

Table 9.33 Determination of nitrate content (mg/g dry wt) in 13 glossy genotypes.

Genotypes	Nitrate	Genotypes	Nitrate
IS 5484	5.36	IS 2205	0.94
IS 2146	4.42	IS 5567	0.85
IS 8315	3.83	IS 5642	0.51
IS 2396	3.74	IS 5567	0.34
IS 18390	3.74	IS 2312	0.00
IS 8311	2.72	IS 8977	0.00
IS 1096	2.38		

MULTIPLE RESISTANCE

The simple morphological trait 'glossy' appears to show resistance to both physical and biotic factors like drought, various insects and diseases. This should be utilized to develop resistant sorghum cultivars. Some glossy genotypes showed resistance to more than one stress factor. For example, IS 5604, IS 4664, IS 5359, IS 4712, IS 3676, IS 5622, IS 4661, IS 1054, IS 2314 and IS 2312 showed resistance to both shootfly and drought at the seedling stage. Lines with high yield potential and a high level of tolerance to shootfly have been developed (Agrawal and House, 1982). All these lines (200) have been tested for their resistance to drought at the seedling stage (unpublished). Many glossy lines tolerant to shootfly were found to show a higher level of resistance to drought at the seedling stage, although the degree of resistance depended on the intensity of glossiness.

CHARACTERISATION AND POTENTIAL USES OF GLOSSY GERMPLASM ACCESSIONS IN SORGHUM CROP IMPROVEMENT

Agronomic traits

Observations in India

Glossy lines showed much variation in days to flowering in both the rainy and postrainy seasons. During the rainy season at Patancheru, a large number of lines from West Africa and East Africa were found to be photoperiod sensitive.

During the rainy season: 126 lines were very late in flowering (95-160 days); some (103) were early in flowering (50-72 days); the maximum number of lines (221) were in the 73-94 days group. Although the maximum number of lines (422) were

tall (25.4-52 cm), a few (7) were in the dwarf group (75-16.4 cm) and a few ers had an intermediate height (16.5-25.3 cm).

ing the postrainy season: a few lines (14) were early (47-60 days) while a large ber of lines (375) were in the intermediate group (61-86 days). 83 lines were e dwarf group to medium height group (10.5-20 cm), while the maximum ber of lines were in the tall group (20-24.6 cm).

he glossy sorghum germplasm had a normal distribution with respect to days owering and plant height in both the rainy and postrainy season. In the rainy season, the occurrence of more early glossy lines were observed. The y lines showed much diversity in agronomic traits indicating the scope of ction for a desirable combination (Maiti *et al.*, 1984).

ervation in Mexico

orghum lines (495) were evaluated in Marín, Nuevo León, for different nomic traits like seedling vigor, glossy score, days to flowering, presence and nce of waxy bloom and its intensity, plant height, peduncle exertion, panicle , grain colour, glume covering and photosensitivity (unpublished). Glossy lines ed the variability in intensity of waxy bloom described by Chaterton *et al.* 5) (Table 9.26), indicating that very few of glossy lines had waxy bloom score d many of them fell in score 4. Many of the lines were also evaluated during 1983 and early 1984 and showed photosensitivity. In the early season, 132 tosensitive lines were found. In the late 1989 season, days to flowering ranged n 55 to 75. The genotypes showed much variability in seedling emergence, ling vigor, glossy score and plant height. The majority were late in flowering 0 days, 85.6%), intermediate (61-70 days, 13.8%) and 0.5% were early <60). Of the lines, 41% had maximum waxy bloom, while 88% had axillary buds, 22% did not have them. The majority of the lines had more than 150 cm 7%), 25% between 101-150 cm, and 2.3% were between 51 and 100 cm. Most he lines had the peduncle covered with an undesirable leaf sheath (58.6%), e lines, of course, showed good exertion.

able 9.26 Distribution of 106 glossy lines in the intensity of waxy bloom in lossy sorghum at Marin, N.L., Mexico. [1=highest - 5=minimum waxy]

Scores	Number of glossy lines
1	4
2	13
3	24
4	39
5	26

Most lines had small panicles (<15 cm, 59.7%), but some had good panicle s. Fiftysix percent of the genotypes were the white grained type. A large ber of glossy lines had waxy bloom scores varying from 3-5. A maximum ber of lines had waxy bloom scores of 4 at the seedling stage. Very few lines