Coleoptile Length and Emergence of Amigo 1AL.1RS Semidwarf Wheats

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ABSTRACT

This study compared growth chamber coleoptile length and field emergence of wheat backcross lines, that have the Amigo 1AL.1RS wheat-rye translocation, to those of their recurrent semidwarf cultivar parents. Field emergence from 4, 6 and 8 cm was determined in 1989, 1990 and 1991. Fourteen of 22 backcross lines had significantly longer coleoptiles than their recurrent parent, but those of only one were more than 10% longer. None had shorter coleoptiles. Differences in emergence among genotypes were substantial only in 1990, significant among planting depths in all experiments, but the genotype x planting depth interaction was not significant in all experiments. Differences in coleoptile lengths accounted for no more than 10% of the variation in emergence percentage across all treatments, but in 1990 variation in coleoptile length accounted for 36% of the variation in emergence percentage from the 8 cm depth, 81% of the variation in emergence among genotypes, and 98% of the variation among seed source emergence means. Although generally unrelated, seed weight in 1991 accounted for 64% of the variation in emergence of genotypes from the 8 cm depth. The Amigo 1RS rye segment had a small positive effect or no effect on coleoptile length and seedling emergence.

The coleoptiles of wheat (*Triticum aestivum* L.), as in other grasses, protect the plumule of the emerging seedling. Semidwarf cultivars generally have shorter coleoptiles than standard height cultivars (Allan et al., 1961). Nevertheless, semidwarfs of essentially the same height can differ substantially in coleoptile length (Peterson, 1989). Allan et al. (1962) found the emergence rate increase (ERI), a weighted average emergence that gives additional value to early emerging seedlings, was related positively to plant height and coleoptile length. However, they found coleoptile length only partially effective in predicting ERI of semidwarf wheats of comparable heights. Burleigh et al. (1965) found average coleoptile length positively correlated with ERI in all cases, but with emergence percentage only from the 4-inch (10.2 cm) and 5-inch (12.7 cm) planting depths. Allan et al. (1962) and Burleigh et al. (1965) also found coleoptile length negatively related to temperature, as did Sunderman (1964) who obtained significant correlations between emergence

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percentages and coleoptile lengths in field tests from all but 2-inch (5.1 cm) and 3-inch (7.6 cm) planting depths. He obtained the highest correlations from cultivars planted four inches (10.2 cm) deep. Sunderman (1964) and Sharma (1990) showed coleoptile length positively related to planting depth. Berg and Martin (1988) found large seed produced longer and heavier coleoptiles, heavier shoot weight and greater emergence percentage than small seed. They also found that shoot weight and emergence were positively related to thousand kernel weight, but coleoptile length and weight were unrelated to thousand kernel weight. They found that high protein content of the seed enhanced coleoptile length and weight, but shoot weight and emergence were unrelated to seed protein. Guedira (1993) found coleoptiles extremely sensitive to drought, that they became more sensitive as they elongated, and that advanced coleoptiles were unable to recover from very low water potentials.

Coleoptile length became a more critical consideration with widespread production of semidwarf cultivars. Nevertheless, by 1984, semidwarfs were grown on 59% of the wheat acreage of the United States (Dalrymple, 1988). Coleoptile length may be critical for emergence where it is necessary to plant deep to reach adequate moisture or when crusting or other soil conditions restrict emergence. Increasing the coleoptile length of semidwarf wheats is a desirable and feasible breeding objective.

The breeding material used in this study was chosen because it has been used extensively to provide resistance to greenbug biotypes B, C, and E, as well as other desirable characteristics.

The 1AL.1RS translocation in the germplasm line Amigo, Sebesta and Wood (1978), provided both insect and disease resistance as well as enhanced yield potential. Genes carried on the 1AL.1RS translocation in Amigo confer resistance to biotypes B and C of the greenbug, *Schizaphis graminum* (Rondani), powdery mildew, *Erysiphe graminis* DC. f. sp. *tritici* E. Marchal, stem rust, caused by *Puccinia graminis* Pers. f. sp. *tritici* Eriks. and E. Henn, and wheat curl mite, *Eriophyes tulipae*, vector of wheat streak mosaic virus. The coloeptiles of TAM 107 (TAM 105*4/Amigo), a greenbug biotype B and C resistant cultivar, were found to be 12% longer than those of TAM 105 (T.J. Martin, personal communication, 1987). Coleoptiles of TAM 105, 'Insave rye', the donor of the 1RS rye segment in Amigo, Amigo, and Largo, a greenbug biotype C and E resistant germplasm amphiploid of 'Langdon' (T. *turgidum* L. *durum* group 2n=28) and PI 268210, (T. *tauschii* (Coss.) Schmal (2n=14), Joppa et al. 1980, were found in replicated tests, to average 86, 91, 110, and 116 mm in length, respectively (K.B. Porter, unpublished data, 1988).

The purpose of this study was to determine the effect of the 1AL.1RS wheat-rye translocation from the germplasm line Amigo on coleoptile length and percent emergence of semidwarf backcross lines of different genetic gackgrounds and to determine the relationships among emergence, coleoptile length, and seed weight.

MATERIAL AND METHODS

Plant Material

Two groups of plant materials were used in this study. Group I included 22 entries. There were three backcross lines with the pedigree 'TAM W-101'*4/Amigo, seven lines with the pedigree 'TAM 108'*4/Amigo, eight lines, including the cultivar TAM 107, with the pedigree 'TAM 105'*4/Amigo, the three recurrent semidwarf cultivar parents (recurrent parents), and the tall check cultivar 'Scout 66'. The seed source of Group I was a rainfed breeding nursery at Chillicothe, TX. Group II included four seed sources of eight entries. The entries were TAM 107, one backcross line each with the pedigrees TAM W-101*4/Amigo*4//Largo, TAM 108*4/Amigo*4//Largo, and TAM 105*4/Amigo*4//Largo, the three recurrent parents, and Scout 66. The four seed sources of Group II were the 1988 irrigated and rainfed wheat breeding nurseries at Bushland, TX and rainfed nurseries at Stinnett and Dallas, TX. The presence of the 1AL.1RS translocation in backcross lines was verified cytologically or by the manifestation of homozygous resistance to biotype C greenbug or powdery mildew.

Coleoptile Measurements

Coleoptile lengths of entries in both Group I and Group II were determined on seedlings from Captan treated seed planted in growth pouches (Pfahler et al., 1991) and/or in screen bottom flats of water-moistened vermiculite (Livers, 1958). Polyethylene growth pouches measuring 16 x 17 cm, inserted with an absorbent unbleached paper wick with an upper trough for seed, were filled with 35 ml of either tap water or one half strength Hoagland's solution. The growth pouches were hung on 16 x 17 x 40 cm racks. The gross weight of sixteen seeds of a single entry was determined and the seeds were placed about 5 mm apart along the seed trough. Each pouch was a treatment.

The screen bottoms of wooden flats were covered with 3 cm of vermiculite. Twenty five seed of a single entry were weighed, spaced uniformly in a 30 cm row, and covered with six cm of vermiculite. There were eight rows per flat, a replication. Flats were then placed in shallow pans of water where the vermiculite and seeds imbibed water for 24 hours. The drained flats and racks of growth pouches were placed in a dark growth chamber where the temperature was maintained at 18°C and approximately 100% relative humidity. Growth periods ranged from 13 to 15 days. Coleoptiles were measured from the base of the embryo to the point of plumule emergence. Coleoptiles of seeds that germinated slowly or from which the plumule had not emerged were not measured. Nevertheless, coleoptiles were measured on more than 95% of seedlings from viable seed.

Coleoptile measurements of entries in Group I were made of seedlings grown in pouches of water and pouches of Hoagland's solution. The experimental design was a randomized split-plot replicated four times with growth mediums as whole-plots and genotypes as sub-plots. Seedlings from each seed source in Group II were grown in separate randomized block experiments in vermiculite flats and in a single split-plot water-pouch experiment in which seed sources were whole-plots and genotypes were sub-plots. Measurements were made of seedlings from the Bushland rainfed source in two vermiculite tests and the one growth pouch experiment, but seedlings of the other three seed sources were grown only once in each of the two types of experiments. Thus nine evaluations were made of the eight genotypes in Group II. Group II experiments were replicated three times.

Analyses of variance were made of coleoptile length and seed weight for each experiment, and a combined analysis was made of the means of the nine evaluations. Correlation coefficients were calculated between mean coleoptile length and seed weight of each treatment.

Emergence

Emergence was studied only of the genotypes in Group II, which were planted at three depths on a Pullman clay loam (fine, mixed, thermic Torrertic Paleustoll). The Dallas seed source was not included in the study. Experiments were conducted during 10 to 26 Apr 1989; 2 to 18 Apr 1990; and 19 Feb to 4 Mar 1991. Plots were planted with a 4-row nursery plot drill. The experimental design was a randomized split-split-plot with three replications. Depths of planting, 4, 6 and 8 cm, were whole plots, seed sources were sub-plots, and genotypes were sub-sub-plots. In 1989, each sub-sub-plot was a single 0.5 m row of 50 seeds. In 1990, each sub-sub-plot was 75 seeds planted in a 3-m row and, in 1991, sub-sub plots were four 1-m rows of 25 seeds each.

Percent germination of each genotype within seed sources was determined in unbleached paper towel rag dolls of 200 seed each in Jul 1989 and again in Jan 1991. Mean percent germination in Jul 1989 was 96%, ranging from 94 to 98% among seed sources and 89 to 96% among seed lots. Mean percent germination in Jan 1991 was 92%, ranging from 91 to 93% among sources and 82 to 96% among seed lots. Emerged plants were counted in each sub-sub-plot and mean percent emergence from viable seed was determined. Germination percentages determined in Jul 1989 were used to convert emergence counts to percent emergence from viable seed in the 1989 and 1990 trials while germination percentages determined in Jan 1991 were used for converting 1991 emergence data.

Analyses of variance were made of seed weight and percent emergence. Correlation coefficients were calculated between percent emergence and growth chamber mean coleoptile length, plot seed weight, and planting depth.

RESULTS AND DISCUSSION

Coleoptile Length

Mean coleoptile lengths of TAM W-101 and TAM 108 in Group I were essentially the same, but significantly ($P<0.01$) less than those of TAM 105 and TAM 107, while the mean coleoptile length of Scout 66, the tall cultivar check, was significantly ($P<0.01$) greater than that of all other genotypes (Table 1). Most backcross lines had longer coleoptiles than their recurrent parent, and ten of the 18 had significantly longer ($P<0.05$) coleoptiles than their recurrent parent. In addition, the mean coleoptile length of backcross lines with the pedigree TAM 108*4/Amigo was significantly greater ($P<0.01$) than the mean coleoptile length of the recurrent parent TAM 108 and the mean coleoptile length of lines with a TAM 105 genetic background was significantly greater ($P<0.05$) than the mean coleoptile length of TAM 105. Although the mean coleoptile length of some backcross lines in TAM 105 and TAM 108 genetic backgrounds were greater, none exceeded the mean coleoptile length of their recurrent parent by more than 9%. No backcross line had shorter coleoptiles than its recurrent parent.

The mean coleoptile length of seedlings grown in pouches of Hoagland's solution was not significantly greater than that of seedlings grown in pouches of water, but the genotype x growth medium interaction was significant ($P<0.01$). This significant interaction primarily was due to the result of three genotypes, TAM 105*4/Amigo

Table 1. Mean coleoptile length of wheat seedlings of the recurrent parents TAM W-101, TAM 105, TAM 108, their backcross lines to Amigo, and Scout 66 of Group I grown in growth pouches of water and growth pouches of one half strength Hoagland's solution.

		Mean Coleoptile Lengths			
		Growth Medium		Across Mediums	
Genotype	No. of lines	H_2O	Hoagland's	Range of Means	Mean
		-------------------------mm	---------------------------		
TAM W-101	†	66	66	66	66
TAM W-101*4/Amigo	3	68	69	67-70	68
TAM 105	†	75	79	77	77
TAM 105*4/Amigo	8	78	84‡	79-83	81*
TAM 108	†	62	66	64	64
TAM 108*4/Amigo	7	70	73‡	69-73	71**
SCOUT 66	†	96	105‡	100	100
Mean		73	77		75
LSD (0.05)				4.2	
C.V.%				5.2	

†Bulk seed from plots of certified seed.

‡Significantly (<0.01) greater than the corresponding H_20 mean.

*Significantly ($P<0.05$) greater than the mean coleoptile length of the recurrent parent.

**Significantly ($P<0.01$) greater than the mean coleoptile length of the recurrent parent.

lines, TAM 108*4/Amigo lines and Scout 66 having significantly longer coleoptiles when grown in Hoagland's solution than when grown in pouches of water. This differential response of genotypes to Hoagland's solution suggests the kind and quantity of nutrients in the seed affects coleoptile length, an hypothesis that is supported by results obtained by Berg and Martin (1988), who found coleoptile length was related positively to protein content of the seed.

The mean coleoptile length of Group II seedlings grown in vermiculite was 85 mm, and the mean of those grown in growth pouches of water was 79 mm. This difference was significant ($P<0.01$). Differences in mean coleoptile length among the eight genotypes were significant ($P<0.01$) in all tests, but the genotype x test interaction was not significant. The 36 correlation coefficients of mean genotype coleoptile lengths between any two of the nine evaluations, $N=8$, averaged 0.96, and ranged from 0.92 to 0.99. Thus only the nine-evaluation means for each of the eight genotypes are presented (Figure 1). All differences in coleoptile length among cultivars TAM W-101, TAM 105, TAM 108, and Scout 66 were significant ($P<0.01$). Coleoptiles of genotypes with the 1AL.1RS translocation were significantly longer ($P<0.05$) than those of their recurrent parent. Coleoptiles of progeny with TAM W-101 or TAM 105 as their recurrent parent were less than 10% longer than coleoptiles of the recurrent parent, but coleoptiles of the line with the translocation in a TAM 108 genetic background were 25% longer than those of

TAM 108.

No backcross line had more than three backcrosses. On the average, a line with three backcrosses will carry 6.25% of the genes of the non-recurrent parent that are not selected. These genes that are not selected of the non-recurrent parents may partially account for the small increase in coleoptile length of backcross lines over the recurrent parents in this study. Also, seed derived from the individual plants of cultivars used in the backcrosses were not available, and some differences might be attributed to differences between the individual parent plants and the bulk seed of the recurrent parent used in this study.

Overall the Amigo 1AL.1RS translocation had no effect, or a small positive effect, on coleoptile length; however, the increase in length attributable to the presence of the translocation was more than twice as great in TAM 108 backcross lines than in either TAM W-101 or TAM 105 backcross lines. This suggests genetic background may influence the effect of 1AL.1RS on coleoptile length.

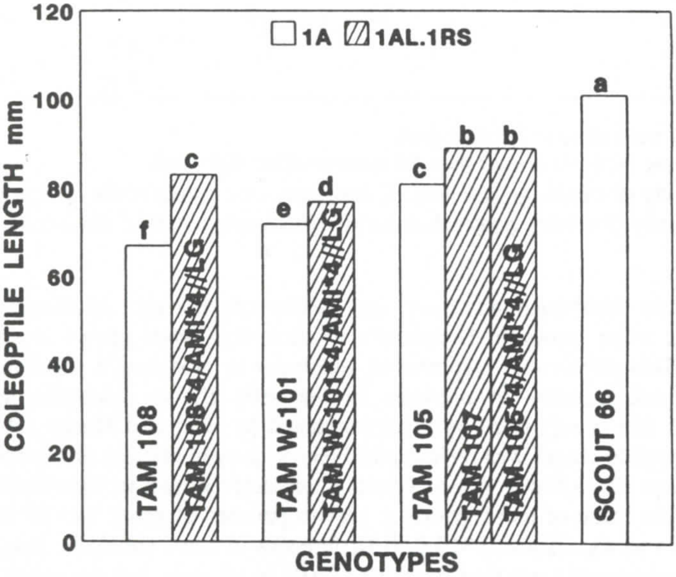


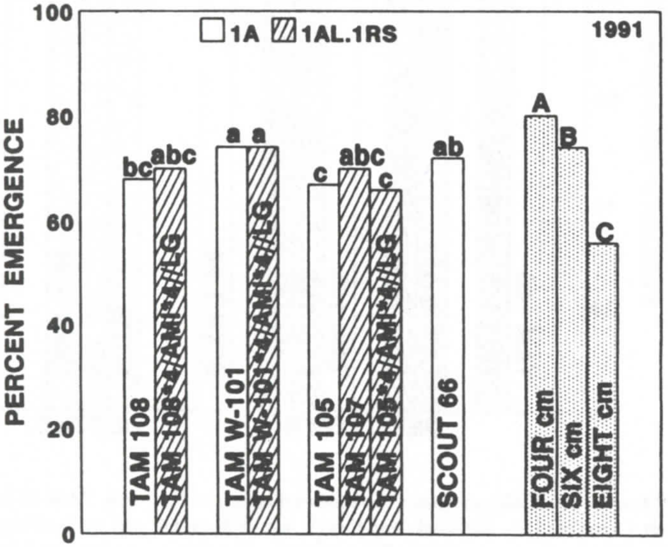
Figure 1. Nine-evaluation mean growth chamber coleoptile length of the standard height cultivar Scout 66; semidwarf recurrent parents, TAM 108, TAM W-101, and TAM 105, and their 1AL.1RS backcross line(s). The presence of either the 1A or 1AL.1RS translocation chromosome is indicated by the appropriate bar legend. Significant differences based on Duncan's Multiple Range Test at $P \leq 0.05$ are shown by different letters above the bars (SE=0.85).

Genotypes were ranked similarly for coleoptile length when grown in flats of vermiculite, pouches of water, or pouches of Hoagland's solution. Some genotypes, however, did respond positively to the Hoagland's solution. Different seed sources also had similar coleoptile length rankings of the genotypes tested.

Emergence

Mean emergence percentages in 1989, 1990, and 1991 were 89%, 63%, and 70%, respectively, differences among which were significant ($P<0.01$). Moist, mellow soil contributed to the high percent emergence in 1989. In 1990 and 1991, seed were germinated in moist soil but were covered with soil considered less favorable for emergence than in 1989. Differences in emergence among 3-year planting depth and 3-year genotype means were significant ($P<0.01$) as were the 3-year seed source means ($P<0.05$). All first order interactions among genotypes, seed sources, planting depths, and years were not significant except for year x planting depth and genotype x year ($P<0.01$). Mean emergence of the eight genotypes and of the three planting depths are presented for each year (Figure 2).

In 1989, differences in mean emergence among genotypes were small and not significant and differences among planting depths, although significant ($P<0.01$), were small. Neither the first order interactions nor the second order interaction among genotypes, planting depths, and seed sources were significant.



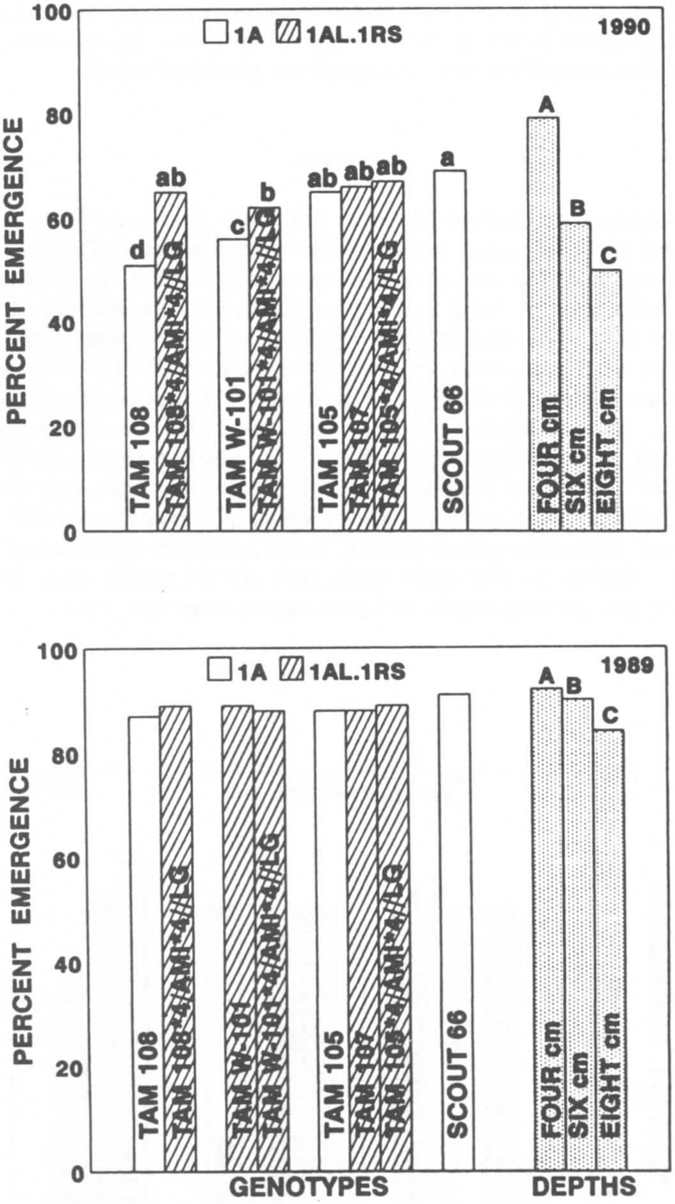


Figure 2. Mean percent field emergence of semidwarf cultivars TAM 108, TAM W-101, and TAM 105, of their respective 1AL.1RS backcross line(s), and of Scout 66; and mean emergence from 4-, 6-, and 8-cm planting depths, in 1989, 1990 and 1991. The presence of either the 1A or 1AL.1RS chromosome is indicated by the genotype bar legend. Significant differences based on Duncan's Multiple Range Test at $P \leq 0.05$ are shown by different letters above the bars: lower case letters for genotypes and capital letters for planting depths. SEs for genotypes=1.10, 1.63 and 1.62 and for planting depths=0.49, 1.78 and 1.87 in 1989, 1990 and 1991.

In 1990, differences in emergence among genotypes and among planting depths were significant ($P<0.01$), but as in 1989, neither the first order interactions nor the second order interaction among the three variables were significant. In 1990, mean emergence of the tall cultivar Scout 66, having substantially longer coleoptiles than the semidwarf genotypes, was significantly greater than that of three genotypes but substantially greater than that of only TAM W-101 and TAM 108. Emergence percentages for TAM W-101 and TAM 108 were only 39% and 37% for the 8-cm planting depth, compared to 59% for Scout 66. All backcross lines having the Amigo translocation exceeded the emergence of their recurrent parent but differences were significant ($P<0.01$) only for lines in which the 1RS segment was in either TAM W-101 or TAM 108 genetic background.

In 1991, the small emergence differences among genotypes were significant ($P<0.05$) as were the greater differences among planting depths ($P<0.01$). Mean emergence of backcross lines with the 1RS segment did not differ significantly from their recurrent parent. Unlike in previous years, differences among seed sources were significant ($P<0.01$) as was the genotype x seed source interaction ($P<0.01$). Planting depth x seed source, genotype x planting depth, and the second order interaction among these variables were not significant. Mean emergence of the Bushland irrigated, Bushland rainfed, and Stinnett rainfed seed sources was 74%, 64%, and 77%, respectively. The genotype x seed source interaction was primarily a result of genotypes TAM W-101 and TAM W-101*4/Amigo*4//Largo from Bushland irrigated and Stinnett sources exceeding the emergence of all other genotypes but being among the lower emerging genotypes from the Bushland rainfed source.

Relationships Among Percent Emergence, Growth Chamber Coleoptile Length, Seed Weight and Depth of Planting

Mean coleoptile lengths of the 22 genotypes of Group I plant material (Table 1) varied from 64 to 100 mm but mean coleoptile length of seedlings of individual pouches (data not given) ranged from 44 to 113 mm, reflecting sampling deviations and differences among genotypes, seed sources, replications and in response to growth mediums. Mean pouch seed weight was 56 mg but gross seed weight of individual pouches ranged from 34 to 75 mg. Differences in coleoptile length and pouch seed weight were substantial but the correlation coefficient between mean coleoptile length and gross seed weight across all pouches, $N=176$, was only 0.11 ($P<0.14$). Correlation coefficients between coleoptile length and seed weight, within growth mediums, $N=8$, were insignificant values of 0.14 and 0.06 and these values within each of the 22 genotypes, $N=88$, were significant for only two genotypes, one of which was a negative value. The same correlations calculated within groups of genotypes with the same genetic background were not significant, and the correlation coefficient between coleoptile length and seed weight among the means of 22 genotypes was only 0.14 ($P<0.53$). Coleoptile length and seed weight of Group I plant material were unrelated.

Correlation coefficients among coleoptile length, seed weight and seedling emergence for genotypes in Group II plant material are given in Table 2. Differences in mean coleoptile lengths among genotypes, shown in Figure 1, were substantial as were differences among genotypes in seed weight (data not shown). Nevertheless, only three of the r values given were significant ($P<0.05$) and all

Table 2. Correlation coefficients (r) between growth chamber coleoptile lengths and seed weights in nine coleoptile evaluations and correlation coefficients of growth chamber mean coleoptile length and plot seed weight with percentage emergence in 1990 and 1991 depth of planting experiments.

	Between growth chamber coleoptile length and seed weight		Correlation coefficient with seedling emergence				
				Coleoptile length		Plot seed weight	
				1990	1991	1990	1991
	N	r	N	r	r	r	r
ACROSS ALL PLOTS	216	0.04	216	0.34*	0.08	0.07	0.12
WITHIN GENOTYPES							
TAM 105	27	-0.16	27	0.27	0.35	-0.30	-0.11
TAM 107(TAM 105*4/AMIGO)	27	0.11	27	0.14	0.24	-0.03	0.06
TAM 105*4/AMIGO*4//LARGO	27	-0.09	27	0.30	0.17	-0.04	-0.04
TAM W-101	27	0.09	27	0.25	0.52**	0.10	0.22
TAM W-101*4/AMIGO*4//LARGO	27	0.22	27	0.13	0.49**	-0.03	0.13
TAM 108	27	-0.05*	27	0.07	0.26	0.05	-0.03
TAM 108*4/AMIGO*4//LARGO	27	-0.39*	27	-0.03	0.04	0.16	-0.21
SCOUT 66	27	0.15	27	-0.17	0.28	0.03	-0.07
AMONG GENOTYPE MEANS	8	0.07	8	0.90**	-0.02	0.23	0.69*
WITHIN SEED SOURCES							
BUSHLAND IRRIGATED	48	0.05	72	0.22	-0.08	0.01	0.24
BUSHLAND DRYLAND	72	0.09	72	0.39*			
STINNETT	48	0.12	72	0.36*	-0.09	0.12	0.14
DALLAS	48	0.18					
AMONG SEED SOURCE MEANS	4	-0.89*	3	0.99**	0.99**	-0.75	0.47
WITHIN PLANTING DEPTHS							
4 cm depth			72	0.45**	0.02	0.11	0.03
6 cm depth			72	0.47**	0.22	0.16	0.20
8 cm depth			72	0.61**	0.06	0.13	0.24
AMONG GENOTYPE MEANS WITHIN							
4 cm depth			8	0.87**	-0.29	0.17	0.04
6 cm depth			8	0.77**	0.22	0.25	0.65
8 cm depth			8	0.88**	-0.04	0.21	0.80**

*Significant at 0.05 level of probability.

**Significant at 0.01 level of probability.

were negative. Coleoptile length of Group II genotypes, as with Group I genotypes, was not meaningfully related to seed weight.

The lack of differences in emergence percentages among genotypes, seed sources, small differences among planting depths and insignificant first order interactions among these variables precluded the possibility of meaningful associations of emergence with seed weight or with coleoptile length in 1989.

The correlation coefficient between percent emergence and coleoptile length, across all plots, although significant ($P<0.05$), in 1990, indicated no more than 12% of the variation in percent emergence could be attributed to variation in coleoptile lengths. Variation in percent emergence within genotypes in 1990 was unrelated to variation in coleoptile lengths, but 81% of the variation in mean emergence among genotypes could be attributed to variation in mean coleoptile lengths. The positive relationship between emergence percentage and coleoptile length among genotypes was about the same magnitude among genotype means within each of the three depths of plantings. In 1991, 25% of the variation in emergence within two genotypes could be attributed to variation in coleoptile length but variation in mean emergence among genotypes was unrelated to variation in coleoptile lengths. In 1990, 16% of the variation in emergence within two seed sources could be attributed to variation in coleoptile lengths, but compelling is the fact that in both 1990 and 1991, 98% of the variation in seed source emergence means could be attributed to variation in coleoptile length. Nevertheless, the small number of seed sources used in this study precludes the conclusion that this relationship would be true among other seed sources. In 1990, coleoptile length had a significant effect on emergence percentages within all depths of plantings. It is notable that 36% of variation in emergence from the 8 cm depth could be attributed to variation in coleoptile length, but no more than 22% of the variation in emergence from either 4 or 6 cm could be attributed to variation in coleoptile lengths. Seed weight had no effect on seedling emergence in 1990, but in 1991 48% of the variation among genotype means could be attributed to variation in mean seed weights. Variation among genotype emergence means was not related to variation among seed weight means when seed was planted 4 cm deep, but when seed was planted 8 cm deep 64% of the variation among genotype emergence means could be positively related to variation in seed weight. Overall 50% of the variation in emergence was attributable to variation in depth of planting.

SUMMARY AND CONCLUSIONS

Coleoptiles of fourteen of 22 Amigo 1AL.1RS backcross lines, in Groups I and II, were significantly longer than coleoptiles of their recurrent parent, but those of only one were more than 10% longer. No translocation line had shorter coleoptiles than its recurrent parent. Coleoptile length rankings of genotypes grown in flats of vermiculite, pouches of water, or in pouches of Hoagland's solution, were comparable, but some genotypes responded positively to the exogenous source of nutrients. Coleoptile length differences among genotypes were unrelated to differences in seed weight.

Differences in field emergence among eight genotypes, which differed significantly in coleoptile length and seed weight, were negligible in 1989, significant ($P<0.01$) and large in 1990, and significant ($P<0.05$) but small in 1991.

Differences in emergence among 4-, 6- and 8-cm planting depths were significant ($P<0.01$) in all years and substantial in 1990 and 1991. In 1990, Scout 66, with the longest coleoptiles, exceeded significantly ($P<0.01$) the emergence of three of the seven semidwarf genotypes, including TAM W-101 and TAM 108 with the shortest coleoptiles. Though differences in emergence among planting depths were significant, the genotype x planting depth interaction was in no year significant. However, in 1990, the emergence percentages of TAM W-101 and TAM 108 from 8 cm were only 39% and 37%, compared to 59% for Scout 66. Emergence of 1AL.1RS lines were significantly greater ($P<0.01$) than that of the recurrent parent only in 1990 in lines in which the 1AL.1RS chromosome was in either a TAM W-101 or TAM 108 genetic background. Across all treatments, differences in coleoptile length in no year accounted for more than 10% of the variation in seedling emergence. However, in 1990, 34% of the variation in seedling emergence from the 8-cm planting depth could be attributed to differences in coleoptile length. In general, emergence and seed weight were unrelated, but in 1991, 64% of the variation in mean emergence among genotypes from the 8-cm planting depths was attributable to variations in seed weight. Overall, fifty percent of variation in emergence was related to differences in planting depth.

It is concluded that the presence or absence of the Amigo 1AL.1RS had little effect on emergence of the genotypes tested. However, no precipitation was received on the three depth-of-planting tests prior to emergence, and results of this study are not necessarily applicable to plantings made under different environments, particularly where precipitation after planting but prior to emergence could cause soil crusting or an increase in soil density.

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