

Chapter VIII

General Summary and Conclusions

Poor emergence of sorghum affects the stand and potential yields. Seed genetic characteristics, seed vigor, and environmental factors determine emergence. Finding a correlation among field emergence data and a laboratory seed vigor test could help growers anticipate problems. Experiments were conducted in 1995 and 1996, when field emergence was counted in three locations (Blacksburg, Orange, and Warsaw). Emergence data were compared with results from a modified standard germination test. Correlations were also sought with stress tests using polyethylene glycol 8000 (mw) and heat-shock. The conductivity of steep water of imbibing seed was also compared to field performance. Seeds of 23 hybrids from 1995 and 30 for 1996 were compared in these tests. Because of interactions, the Orange location was excluded from correlation analyses.

The results obtained show that:

- i- Field emergence of grain sorghum hybrids differed ($p > 0.05$) among genotypes, years, and locations.
- ii- Germination under optimal conditions (standard germination test) can differ among genotypes. Regression studies showed a weak association between laboratory germination and field emergence. Radicle length of seedlings grown under “optimal” conditions differed among genotypes but did not correlate with field emergence. The fresh weight of the seedlings also differed among genotypes for both years, and the association with field emergence was weakly correlated in 1996.
- iii- Germination under osmotic stress for 1996 data showed significant differences among genotypes, and the correlation with field emergence was significant in both years, although the r^2 values were no higher than for germination from the non-stress standard test. Genotypes also showed significant differences in radicle length, however, radicle length was not correlated with field emergence. Seedling fresh weight under osmotic stress differed among genotypes and in 1996 was weakly correlated with field emergence. The sensitivity of this test was evaluated by using the standard

germination test data as a reference. The hybrids showed significant differences for percent of reduction in radicle length and seedling fresh weight for both years. Radicles were shortened by more than 49% in both years. These data partially validate the use of osmotic stress to determine the sensitivity of sorghum hybrids. However, correlations with field emergence were not strong enough to be a good predictor of field performance.

- iv- Germination following heat-shock treatment differed among genotypes, and the correlation with field emergence was significant. Radicle length also showed significant differences among genotypes for 1995 but no correlation with field emergence. In 1996 this variable did not differ among genotypes, and the correlation with field emergence was weak. Heat shock reduced germination in 1995 when comparing with standard germination test data.
- v- The measurement of electrical conductivity in the seed steep water showed significant differences among genotypes. A weak association with field emergence was seen in 1996. Conductivity values per gram of seed revealed differences among genotypes, and the association with field emergence was higher than conductivity per cm^2 of seed or per seed.
- vi- From the results obtained, we can suggest no strong predictor of sorghum field emergence.
- vii- From the parameters studied, germination is better than radicle length or seedling fresh weight to be used in field emergence predictions.
- viii- Standard germination, osmotic stress, and heat-shock stress data provide some modestly good indicator of field performance; but under our conditions, we could not find a consistent, reliable laboratory test for predicting field performance of a wide variety of sorghum genotypes.