Several Tests to Predict the Performance of Cottonseed Evaluated

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Planting cottonseed in a greenhouse or placing seed in a constant temperature germinator may provide data to more accurately predict the field performance of cottonseed planted under adverse conditions. Many factors such as hardness of seed coat, depth of planting, texture and compaction of soil, residual heribicide, improper placement of fertilizer and insects and diseases affect seedling emergence. However, in properly aerated soil having adequate but not excessive moisture it is principally temperature that determines how soon germination and seedling emergence can occur.

Soil temperature conditions are often unfavorable when cottonseed is planted in the early spring. When this happens only the most vigorous seeds produce strong, healthy seedlings. Growers need information on each seed lot that will more accurately predict performance under adverse conditions.

The objective of this study was to compare the performance of cottonseed planted under adverse soil conditions with predicted performance based on the results of several tests. Acid-delinted, fungicide-treated seed of 24 representative varieties, provided by the Arizona Cotton Planting Seed Distributors and commercial concerns for 1967 Arizona on-farm variety tests, were used.

Data concerning field performance under adverse conditions were obtained by planting seed two inches deep in soil at the University of Arizona Casa Grande Overpass Experimental Farm at Tucson on March 15 and 16, 1967. A specially designed planting device was used to make 100 holes each 0.5 inch in diameter and two inches deep. A seed was placed in each hole and covered with moist soil. The planting pattern was a randomized block with six replications.

The soil temperature, Figure 1, and moisture content at the seed planting depth were recorded daily. Seedlings were counted as emerged when both cotyledonary leaves were above the soil surface and the hypocotyl straightened. Counts were made through May 20.

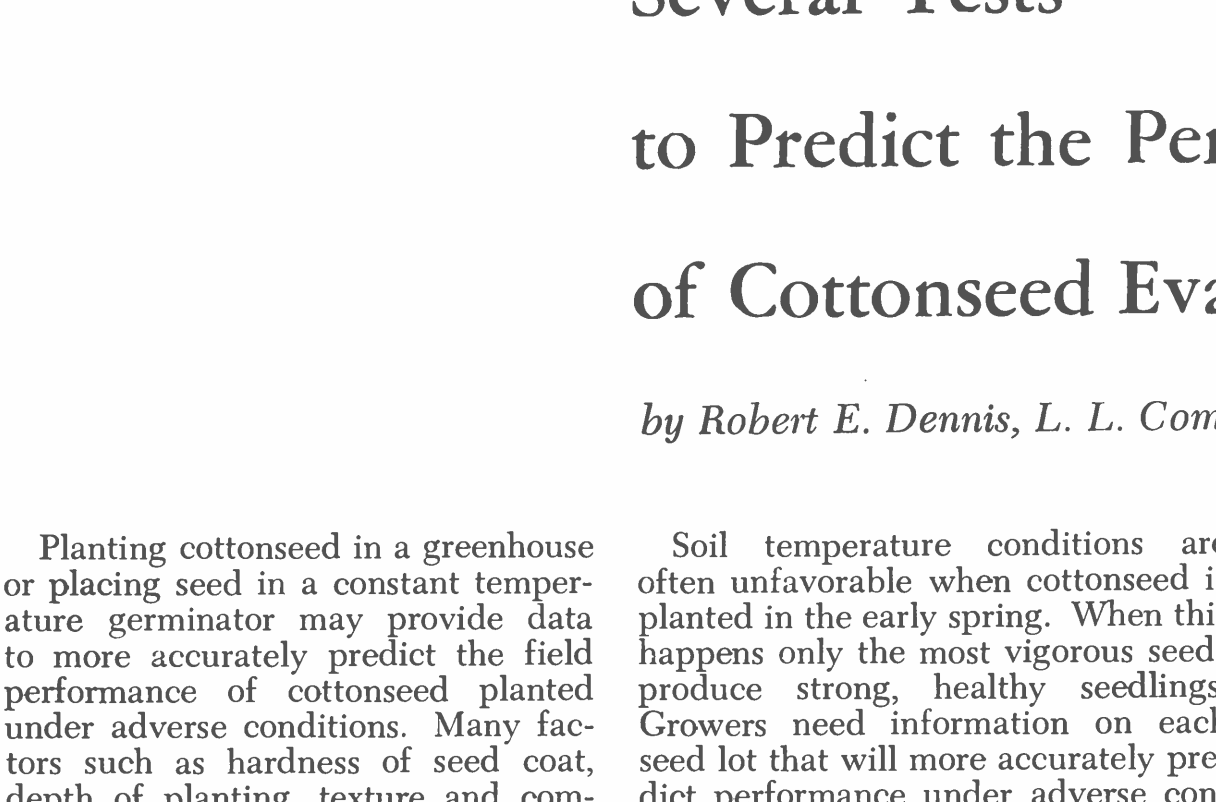

Figure 1. Graph showing daily maximum-minimum and 8 a.m. temperatures of soil at 2 inches in depth at the field testing plot, Tucson, 1967.

Several Tests to Predict Emergence Evaluated

Carbon dioxide concentrations of 300, 1200 and 2400 ppm were maintained in three different adjacent greenhouses. Air in the greenhouses was cooled by continuously moving it through water at 77° F. Surface soil from the area used for the field experiment was placed in benches in each greenhouse. Four replicates of

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Figure 2. Larry Comer, above, is observing cotton seedlings in the greenhouse in which the level of CO_2 in the atmosphere was maintained at 1,200 p.p.m. He did the work as part of his master's degree program.

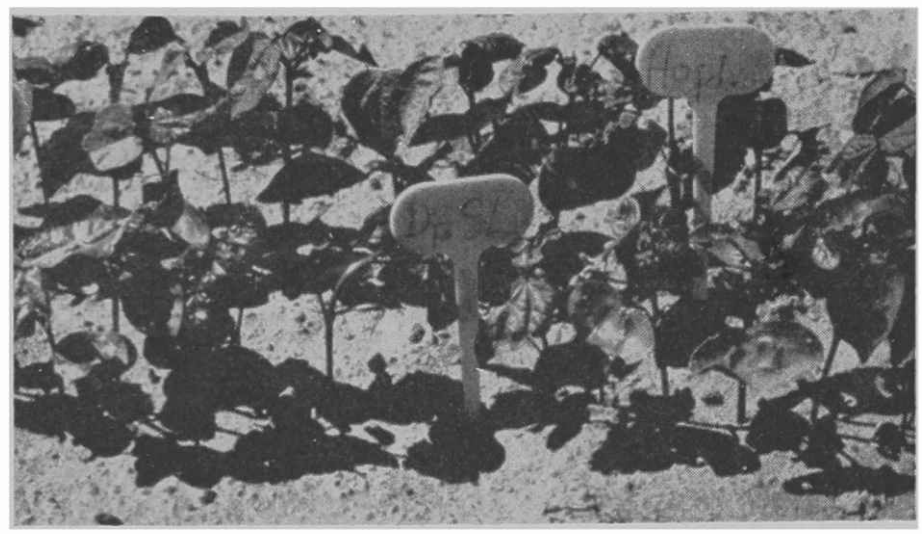

Figure 3. Cotton seedlings of Deltapine smoothleaf and Hopicala planted in border rows of field experiment. Note excellent stand obtained even though planting was made March 15 in relatively cool soil.

seed of each of the 24 entries were planted two inches deep in soil in each greenhouse. Seedling counts, using the same criteria as in the field experiment, were made 15 days after the initiation of the test.

Three germinators, each with a different constant temperature were used in another phase of the experiment. Temperatures were maintained inside the different germinators at 60, 65 or 70° F. Four replicates of 50 seeds each were placed in sterilized glass petri dishes on nontoxic filter paper. Petri dishes containing the seeds were placed in the germinators and radicles (young roots) were evaluated at 7 and again at 12 days. In these tests a seed was considered germinated when it had produced a radicle 0.5 cm long.

The standard tetrazolium quick test, with and without a Vitascope, was also used as a means of predicting seedling emergence in the field. For this test seeds were first placed in distilled water and then in a one per cent solution of tetrazolium chloride after the seed coat and membrane had been removed.

Results

The fluctuation of soil temperature that occurred in the field is shown in Figure 1. Soil moisture was at about 10 per cent when the experiment was initiated. Moisture content of the soil dropped slightly at different times, but in each instance rain, snow or application of irrigation water caused it to return to near 10 per cent. The temperature in the greenhouse ranged from 75.2 to 82° F during the course of the experiment.

The correlation coefficient for seedling emergence in the 1200 ppm CO_2 chamber and that obtained in the field was 0.72. The correlation coefficient for results obtained in the standard laboratory test and the field was only 0.41. Seed are held at 86° F for 8 hours and then at 68° for 16 hours for 12 days in the standard germination test for cotton.

It was of interest that the average dry weight of seedlings 15 days after planting was 2.64 g. for the 300 (normal atmospheric level), 4.20 g. for the 1200 and 3.45 g. for the 2400 ppm CO_2 chamber.

The correlation coefficient for results obtained in the field and those obtained in the 70° F constant germinator was 0.64, Table 1. This was a relatively simple and inexpensive test. The correlation coefficient for results obtained from the tetrazolium quick test and those obtained in the field was 0.72. The tetrazolium test is useful but the analyst using it must have had considerable training and experience in order to properly interpret results obtained.

Data reported in Table 2 summarizes results of some of the tests conducted in this study. Results of several of the predictive tests provided more reliable information concerning performance of cottonseed in the field than the laboratory test presently used. Data obtained from this preliminary research indicate that additional studies might provide a relatively simple test to more accurately predict field performance of cottonseed when planted in the field under adverse temperature conditions.

Table 1. Percent of seeds that produced a radicle 0.5 cm or longer after 12 days in constant temperature germinators.[1]

	Germinator Temperature - °F		
Variety	*60*	*65*	*70*
1517D	**17.0**	**87.0**	**91.0**
Hopicala	**21.0**	**90.5**	**93.0**
Stoneville 213	**21.6**	**72.0**	**89.5**
Deltapine 16	**48.6**	**86.5**	**93.5**
Pima S-4	**90.6**	**87.0**	**90.5**
Mean (24 varieties)	**34.7**	**72.9**	**88.5**
Correlation coefficient[2]	**0.26**	**0.59**	**0.64**

[1] *Varieties presently most important in Arizona are included in this table.*

[2] *This test and results under field conditions.*

Table 2. Field seedling emergence rank compared with rank as predicted using several different tests.[1]

Variety	*Field*	*Official Test*	*CO_2 1200 ppm*	*70 F Germinator*	*Tetrazolium*
1517D	**1**	**5**	**5.0**	**16.5**	**2.5**
Hopicala	**2.5**	**1**	**5.0**	**12.0**	**2.5**
Stoneville 213	**8.0**	**20**	**10.5**	**20.0**	**18.0**
Deltapine 16	**12.0**	**11**	**8.0**	**8.0**	**10.0**
Pima S-4	**17.0**	**3**	**15.0**	**18.5**	**2.5**
Correlation coefficient (24 varieties)		**0.41**	**0.72**	**0.64**	**0.72**

[1] *Varieties presently most important in Arizona are included in this table. Performance was the same when rank is indicated to be the same.*