DETERMINING COLD TOLERANCE OF COTTONSEED GERMINATION

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Abstract

The Texas High Plains is a major area of cotton production. If producers were able to plant earlier they could expect higher lint yields and better fiber quality. Historically, growers plant only after soil temperatures reach 65°F but cold fronts in the early spring often cause the soil temperatures to decline below this level. At a minimum, soil temperatures in the seed and root zone should exceed 60°F and the five day forecast for daytime maximum temperatures should exceed 80°F. Additionally, nighttime minimum temperatures should be forecast to be above 50°F for the following 5 days (Boman and Lemon 2005). If producers are capable of planting earlier that could take advantage of early season moisture. Cotton (*Gossypium hirsutum* L.) is sensitive to cold conditions during germination and establishment. Identifying cultivars with cold tolerance may provide growers with increased flexibility for sowing date options and allow for better establishment under cool conditions, reducing the costs associated with possible replanting (Tuck, et al., 2010). Identification of commercial cotton cultivars that could germinate at 60°F would greatly enhance cotton production in this region.

Objective

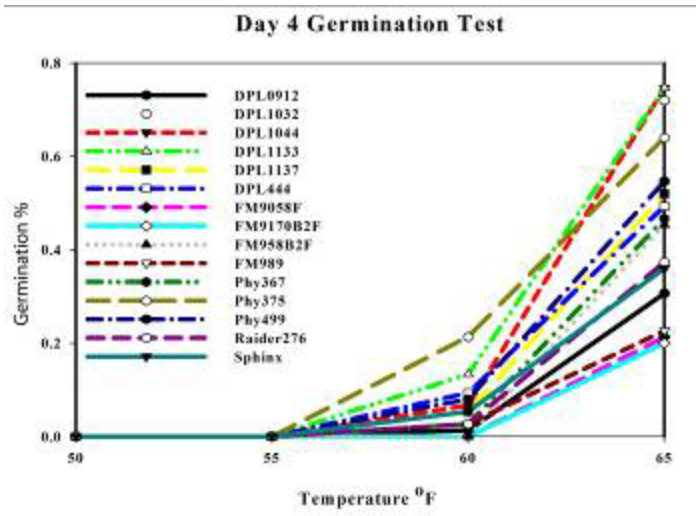
We conducted germination tests with 15 commercial cultivars of cotton at four temperatures (50°F, 55°F, 60°F, & 65°F) in standard germination chambers to attempt to determine if existing commercial upland cotton cultivars could germinate in cooler temperatures. Germination was determined at 4 and 12 days. Radicle length was measured at 12 days.

Materials and Methods

Seed of the 15 cultivars used in this germination trial were harvested at the Texas Tech Lubbock Research Farm in the fall of 2011 to reduce the potential impact of differential seed quality based on production site. Fuzzy cotton seed was then rolled in wet paper towels and placed in four germination chambers of the Water Curtain type, held at four temperatures (50°, 55°, 60°, 65° F). Fuzzy seed was used to avoid potential seed damage during acid delinting. Each cultivar was replicated three times with 25 seeds in each replication. Germination counts were taken on day four and day twelve. Radicle lengths were also measured on germinated seedlings at day twelve.

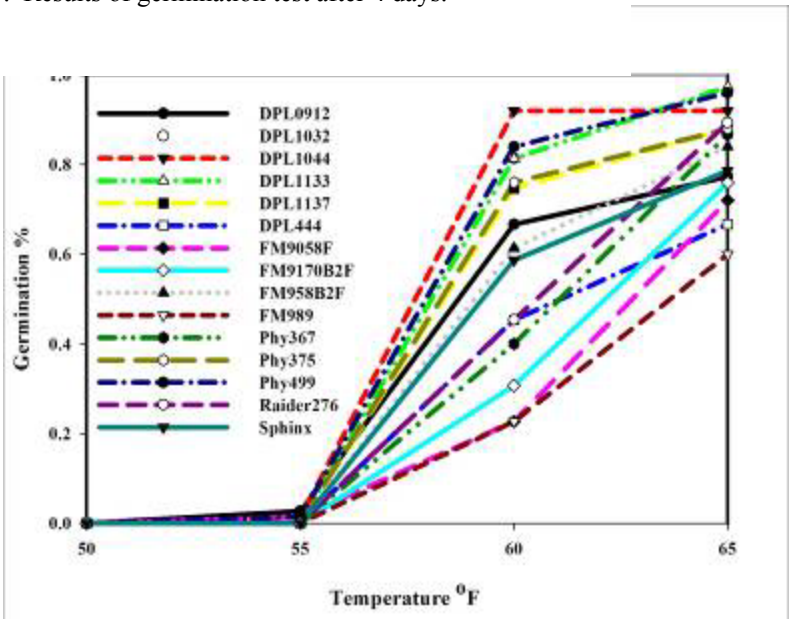
Results

None of the seed from the commercial cultivars germinated at 50°F or 55°F. Twelve cultivars had seed germination by day 4 at 60°F (Figure1). By day 12 at 60°F germination ranged from 92 to 23% (Figure 2). At 65°F, all of the cultivars had begun to germinate by day 4 with germination ranging from 20 to 75%. Final germination at day 12 at 65°F ranged from 60 to 97%. Statistically there was not a difference among radical length at the 50°F, 55°F, 60°F (Figure 3). There was a minimum significance at the 65°F, ranging from 39mm to 57mm in length.



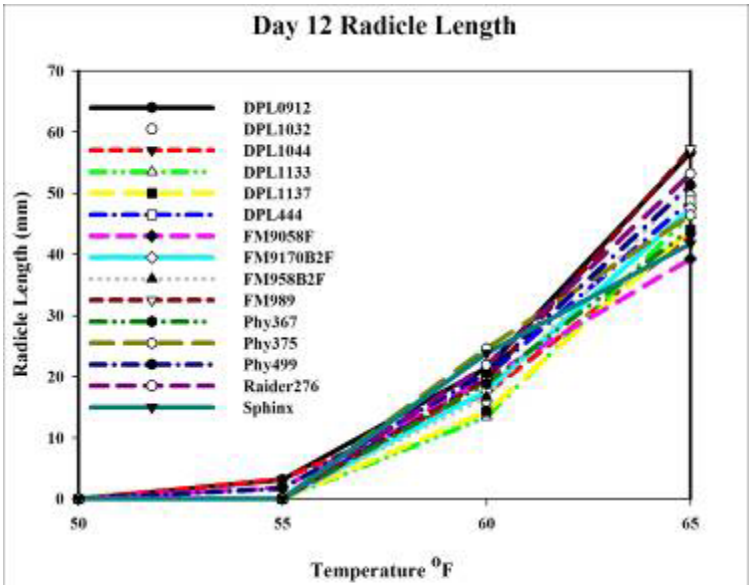
	50°	55°	60°	65°
LSD (0.05)	0	0	0.08	0.23
CV%	0	0	89.9	30.4
Significance	n.s.	n.s.	**	***

Figure 1. Results of germination test after 4 days.



	50°	55°	60°	65°
LSD (0.05)	0	0.02	0.25	0.19
CV%	0	250	25.6	14.1
Significance	n.s.	n.s.	***	*

Figure 2. Results of the germination test after 12 days.



	50°	55°	60°	65°
LSD (0.05)	0	3.6	10.2	9.8
CV%	0	275.7	32.1	12.3
Significance	n.s.	n.s.	n.s.	*

Figure 3. Radicle Length (mm) on Day 12

Conclusions

By definition, germination of a seed commences with the uptake of water and is completed with the appearance of the embryo, in most species radical first, through the surrounding structure(s) (Nonogaki, et al., 2010). None of the seed from the commercial cultivars germinated at 50°F or 55°F. Twelve cultivars had seed germination by day 4 at 60°F (Figure1). By day 12 at 60°F germination ranged from 92 to 23% (Figure 2). At 65°F, all of the cultivars had begun to germinate by day 4 with germination ranging from 20 to 75%. Final germination at day 12 at 65°F ranged from 60 to 97%. Statistically there was not a difference among radical length at the 50°F, 55°F, 60°F (Figure 3). There was a minimum significance at the 65°F, ranging from 39mm to 57mm in length. Based on this preliminary data it appears that cultivars and breeding lines should be evaluated at 60°F for the ability to emerge from cold soils. Future tests on these seed lots will include Cold Vigor Test and early spring seeding. Data from the combination of these tests will hopefully allow industry to select cultivars that germinate at cooler soil temperatures and require less frequent reseeding in this region.

References

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