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TESTS OF COTTON SEED TREATMENTS FOR EARLY EMERGENCE

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SUMMARY

A series of seed treatment trials was carried out in the laboratory and under field conditions in south-eastern Queensland in an endeavour to stimulate earlier emergence of seedlings under low soil temperatures. While gibberellic acid hastened emergence significantly, it had the undesirable effect of producing a spindly type of plant and reducing total emergence. The investigations confirmed the importance of seed dressing with mercurial fungicides such as Ceresan dust and liquid Panogen.

Introduction

Experiments to determine the place of cotton as a crop for the southern Darling Downs in Queensland were begun at the Hermitage Research Station, near Warwick, in 1958. The average frost-free period at this centre is only 191 days and early experience emphasized the importance of attempting to establish the crop as early as possible in the spring—that is, early in October—in order to lengthen the growing period.

The detrimental effect of low soil temperatures on cotton seedling emergence in October was illustrated in 1959 when most plantings failed under cold, wet ground conditions. Seedling emergence on heavy alluvial soils took up to 20 days instead of the normal 7 days under warmer soil conditions. The mean soil temperature at 2-in. depth, taken at 7.45 a.m., was 57, 57, 56 and 62°F for each of four consecutive weeks in October 1959. These and other records indicated that mean soil temperatures of less than 60°F could be expected at Hermitage during the first half of October. As 60°F is the accepted minimum for satisfactory germination (Tharp 1960), it was decided to examine various seed treatments with a view to accelerating germination and seedling emergence under low soil temperature conditions.

Preliminary experiments in 1960 enabled eight treatments to be selected for inclusion in detailed field and laboratory tests in 1961, the results of which form the basis of this paper.

Materials and Methods

Details of individual seed treatments are as follows:—

(*a*) Untreated (no fungicidal dust), mechanically delinted cotton seed, used as a check.

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(*b*) "Ceresan" (1·5% w/w organically combined mercury as a dust), used as a standard for dry pickling cotton seed.

(*c*) "Panogen" (1·5% w/v organically combined mercury as a liquid), used as a standard for the slurry method of seed dressing.

(*d*) Presoaking in water for 4 hr at 99–113°F to evaluate Indian practice in cool localities.

(*e*) Presoaking in water for 4 hr at room temperature (60-68°F), for comparison with treatment *d*.

(*f*) Hot water (185°F) seed immersion for 1 min to penetrate the seal between the chalazal cap and palisade layer in hard seed (Christiansen and Moore 1959). (The trial sample of cotton seed contained only 4% hard seeds as determined by soaking in water at 86°F for 48 hr.)

(*g*) Presoaking in gibberellic acid (25 p.p.m.) for 12 hr at room temperature (Dransfield 1961).

(*h*) Delinting with concentrated sulphuric acid, followed by neutralization with slaked lime solution. (This process increased the proportion of hard seeds to 10%.)

The seed used in treatments *d–h* inclusive was dusted with Ceresan (as in *b*) prior to planting. Presoaked seed was air-dried in the shade before dusting.

The 1961 experiment was designed as an 8 x 6 randomized block in a tiered layout with 3 times of planting over the main establishment period (September-October). Single-row plots comprised 150 seeds hand-planted at a uniform planting depth of 2 in. Preplanting irrigation was applied before the first and second plantings; the third planting was made after mid-October rains.

Seedling counts were taken at 2–3-day intervals for a minimum period of 20 days after each planting. The seedling was taken as having emerged when the hypocotyl first appeared above ground level.

The temperatures for the 7-day periods following field plantings were as follows:

Date Planted	Soil Temperature (°F) at 7.45 a.m.		Grass Minimum (°F)	Mean Hourly Screen Temperature (°F)
	2 in.	6 in.		
Sept. 27	60·5	60·4	36·0	59·6
Oct. 10	66·1	65·9	47·1	67·2
Oct. 27	67·0	66·8	41·1	65·8

Results and Discussion

Mean field emergence percentages are given in Table 1. The potential of each treatment is indicated by the laboratory germination tests (constant oven temperature 79–82°F), with six replications of 100 seeds being involved in each of the eight treatments.

TABLE 1

PERCENTAGE EMERGENCE (FIELD) AND GERMINATION (LABORATORY)

Treatment	Planted 27.ix.61				Planted 10.x.61				Planted 27.x.61				Laboratory Tests			
	7 Days		21 Days		6 Days		21 Days		6 Days		24 Days		2 Days		7 Days	
	Mean*	Equiv. %	Mean	Equiv. %	Mean	Equiv. %	Mean	Equiv. %	Mean	Equiv. %	Mean	Equiv. %	Mean	Equiv. %	Mean	Equiv. %
A. Untreated	21·7	13·6	53·6	64·7	24·4	17·1	53·1	63·9	44·3	48·8	56·7	69·8	43·0	46·6	70·1	88·5
B. Ceresan	27·4	21·2	56·1	68·8	31·9	28·0	59·7	74·5	51·7	61·5	65·3	82·6	47·2	53·8	74·7	93·0
C. Panogen	22·1	14·2	56·3	69·2	28·4	22·7	55·3	67·5	51·0	60·3	64·3	81·2	44·4	48·9	76·2	94·3
D. Presoaking in warm water	15·2	6·8	48·3	55·7	29·7	24·6	52·9	63·4	45·5	50·9	56·0	68·7	46·5	52·7	52·6	63·1
E. Presoaking at room temperature	14·9	6·6	50·5	59·6	26·5	20·0	53·1	64·0	40·3	41·9	55·0	67·1	54·4	66·1	64·5	81·4
F. Hot water immersion ..	11·6	4·0	44·9	49·9	24·9	17·7	52·0	62·0	40·4	42·1	58·1	72·0	61·9	77·8	70·9	89·3
G. Presoaking in gibberellic acid	33·5	30·4	46·7	53·0	30·1	25·2	43·3	47·0	37·3	36·7	47·2	53·8	57·8	71·6	66·3	83·9
H. Delinting with acid ..	14·3	6·1	43·4	47·2	17·9	9·5	53·3	64·3	33·1	29·9	51·5	61·3	42·5	45·6	55·2	67·4
Necessary differences for significance 5%	12·2		7·3		11·7		6·8		10·1		6·6		6·1		5·6	
Necessary differences for significance 1%	16·4		9·8		15·7		9·1		13·6		8·9		8·3		7·5	
	G≫DEFH B>DEFH		BC≫FH BC>DG A≫H : A>F		No. sig. diffs.		ABCDEH≫G F>G B>DF		BC≫GH BC>EF DA>H		BC≫EGH B≫D AF≫G B>AF C>AD DE>G		FG≫AB CDH E≫A,C,H F>E>BD		ABCEFG≫D ≫H BC≫EG C>A>E F>E	

* Inverse sine transformation used

Field conditions were unfavourable for germination and seedling emergence due to dry conditions after the first and last plantings and soil compaction as a result of heavy storm rains following the second planting in mid-October. Soil temperatures averaging 60·5 and 66·1°F at the 2-in. planting depth read at 7.45 a.m. for the 7 days following plantings on September 27 and October 10 were approximately 2 and 5° above normal respectively when compared with the mean soil temperatures recorded over the four seasons from 1958 to 1961.

However, significant differences were obtained. Gibberellic acid was the only treatment to promote earlier emergence under the low soil temperatures experienced following the first planting on September 27. Unfortunately, this plant hormone reduced total emergence under field conditions and produced a weak and spindly type of plant. For all practical purposes, no treatment proved superior to the standard mercurial fungicides, Ceresan and Panogen.

The time of planting effect was marked and improved emergence occurred under the warmer soil temperatures as the planting season progressed.

The solution to the problem of cotton establishment in marginal short-season areas appears to lie more in the development of suitable early-maturing varieties capable of producing high yields of good quality cotton when established from mid-October onwards at a time when soil temperature conditions are more favourable.

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