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RESEARCH ARTICLE

EFFECT OF PRE-SOWING TREATMENTS ON FIELD PERFORMANCE IN SUMMER AND WINTER COTTON GENOTYPE

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ABSTRACT

The present investigation was undertaken in order to know the effect of pre-sowing seed invigoration treatments on seed quality and seed yield in cotton genotype LRA 5166. The experiment was conducted in experimental farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University during summer and winter seasons of the year 2010-12. The different pre-sowing invigoration seed treatments showed differential response for all the seed quality attributes, growth and yield parameters. Among the treatments, seed treated with 500 ppm GA_3 (T_3) recorded significantly higher field emergence percentage (92.33%), lesser days to first flower (35.33) and maximum seed cotton yield (154.27) when compared to winter season. The season had significantly effect on all the seed quality parameters studied for cotton.

INTRODUCTION

Cotton (*Gossypium* spp.) called the 'white gold' enjoys a pre-dominant position amongst all cash crops in India. Cotton is one of the principal commercial crops playing a key role in economic, political and social affairs of the country. India has the largest cotton area in the world. The area under cotton is 12.18 million ha. The production and productivity is about 35.20 million bales and 491 kgs/ha respectively. It accounts for 1/4th of the global area (600 lakh/ha) in 2011-12. India contributes to 16% of the global cotton producer and emerged as the world's second largest cotton producer. In Tamil Nadu total cultivation area is 0.13 million ha, with a production and productivity of about 0.45 million bales and 575 kgs/ha respectively. Seed is one of the most vital and critical inputs for increasing agricultural production and productivity. The seeds of improved varieties have played a key role in agricultural transformation of India. Successful seed production depends upon the establishment of uniform, healthy and vigorous plants for which use of quality seed is very important. However, the availability of good quality cotton seed is often difficult because it is affected by numerous factors during seed production. Slow, asynchronous and unreliable germination and emergence arise due to low vigour seeds which leads to problems for successful field establishment crop growth. Seed invigoration treatments have, therefore, been developed to improve seed performance during germination and emergence. Most of these involves a period of controlled hydration of the seed to a point close to, but before, the emergence of the radicle after which the seeds are dried back to their initial moisture content before sowing (Khan, 1992, Basu, 1994). The purpose of these treatments is to shorten the time between planting and emergence and to protect seeds from biotic and abiotic factors during critical phase of seedling establishment which ensures synchronize emergence, uniform stand and improved yield.

Such treatments include osmoconditioning (Knypl and Khan, 1981), matriconditioning (Taylor *et al.,* 1988; Hardegree and Emmerich, 1992), humidification (Finnerty *et al.,* 1992; Van Pijlen *et al.,* 1996; Lee *et al.,* 1998) aerated hydration and hydro priming (Powell *et al.,* 2000; Soon *et al.,* 2000). Humidification is a pre-sowing hydration treatment in which seeds are equilibrated under conditions of high humidity (Finnerty *et al.,* 1992; Van Pijlen *et al.,* 1996; Suzuki and Khan, 2001). Humidification leads to controlled increased in seed moisture as by osmoconditioning (Finnerty *et al.,* 1992; Johnson-Flanagen *et al.,* 1994; Suzuki and Khan, 2001). It is also used for controlled hydration before sowing to avoid imbibitional injury under low temperature sowing (Thomas and Cristiansen, 1971; Ellis *et al.,* 1995) with this background, the present investigation was carried out to screen the suitable seed invigoration treatment in improving seed quality and seed yield parameter of cotton LRA 5166.

MATERIALS AND METHODS

The field experiments were conducted at Breeding Experimental Farm, Department of Genetics and Plant

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Table 1. Influence of pre-sowing seed treatment on seed quality characters in summer and winter season on cotton

Treatments	Germination percentage (%)			Speed of germination			Days to first flower			Plant height (cm)			Number of bolls per plant			Boll weight (gm)			Number of seeds per boll			Weight of seeds per boll (gm)			Seed cotton yield (gm)		
	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$	S_1	S_2	Mean $\bar{X}$
T_1	88.00	91.00	89.50	1.35	3.60	2.48	41.00	40.00	40.50	126.06	129.63	127.85	76.00	80.33	78.17	5.09	5.31	5.20	35.67	38.33	37.00	3.54	3.82	3.68	133.98	140.01	137.00
T_2	82.00	86.33	84.16	1.97	1.96	1.97	44.00	41.00	42.50	123.20	126.76	124.98	75.67	83.00	79.33	5.43	5.75	5.59	38.00	41.67	39.83	3.65	3.98	3.81	133.61	140.75	139.18
T_3	88.67	92.33	90.50	2.00	2.90	2.95	37.00	35.33	36.17	128.40	135.20	131.80	78.67	89.00	83.83	5.75	5.97	5.86	41.00	42.67	41.86	4.27	4.66	4.46	144.03	154.27	149.15
T_4	82.67	86.00	84.33	1.61	2.45	2.03	43.00	39.00	41.00	122.73	128.60	125.67	74.67	79.33	77.00	4.45	5.84	5.65	36.00	38.33	37.17	3.89	4.20	4.04	136.78	141.35	139.06
T_5	83.33	86.33	84.83	1.34	2.61	1.98	42.67	40.33	41.50	124.50	128.50	126.50	76.00	81.33	78.67	5.19	5.47	5.33	36.00	38.00	37.00	3.83	4.06	3.95	136.23	139.13	137.68
T_6	82.67	87.33	85.00	1.46	2.49	1.98	43.33	39.33	41.33	123.50	127.63	125.57	74.67	79.33	77.00	5.38	5.65	5.52	35.67	38.33	37.00	3.65	3.97	3.81	136.65	139.54	138.09
T_7	79.67	78.00	78.83	1.47	2.10	1.78	48.33	45.00	46.67	120.77	122.70	121.73	72.33	73.33	72.83	4.82	4.87	4.85	31.33	31.00	31.17	3.08	3.15	3.11	130.35	131.44	130.90
$\bar{X}$	83.86	86.76	85.30	1.60	2.73	2.17	42.76	40.00	41.38	124.16	128.43	126.30	75.42	80.81	78.12	5.30	5.55	5.43	36.24	38.33	37.29	3.70	3.98	3.84	136.52	140.93	138.72
	SEd	CD 0.5%		SEd	CD 0.5%		SEd	CD 0.5%		SEd	CD 0.5%		SEd	CD 0.5%		SEd	CD 0.5%		SEd	CD 0.5%		SEd	CD 0.5%		SEd	CD 0.5%	
S	0.40	0.82		0.17	0.35		0.35	0.73		0.30	0.62		0.29	0.59		0.03	0.06		0.46	0.95		0.03	0.07		0.42	0.88	
T	0.75	1.54		0.32	0.65		0.66	1.36		0.56	1.15		0.54	1.11		0.06	0.12		0.87	1.78		0.72	0.14		0.80	1.64	
ST	1.06	2.18		0.45	0.92		0.94	1.93		0.79	1.63		0.76	1.57		0.85	0.17		1.22	2.52		0.10	0.21		1.13	2.32	

S_1 – Winter season S_2 – Summer season

T_1 – KCl 2% T_2 – KH_2PO_4 0.5% T_3 – GA_3 (500 ppm) T_4 – Cycocel 100 ppm T_5 – Calotrophis leaf extract (2%) T_6 – Moringa leaf extract (2%) T_7 – Control

Breeding, Faculty of Agriculture, Annamalai University during winter (Aug-Sep) and Summer (Feb-Mar) season of the year 2010-12 to evaluate the influence of various pre-sowing seed invigoration treatment by using plant growth regulators, botanicals and chemical on seed quality and yield parameters. The seeds were subjected to the following treatments *viz.,* T_1 KCl_2 (2%), T_2 – KH_2PO_4 (0.5%), T_3 – GA_3 (500 ppm), T_4 - cycocel (100 ppm), T_5 – Calotropis leaf extract (2%), T_6 - Moringa leaf extract (2%) and T_7 – Control. The seeds were soaked in their respective solution for 6 hrs and dry under shade to bring back their original moisture content. Physical and genetically pure seed of LRA 5166 was used as a basic material for seed treatment. Treated seeds were raised in ridges and furrows with the spacing of 90 × 45 cm in three replications. Separate crops were raised for winter and summer seasons. Five plants from each replication in all treatment were selected randomly and tagged for recording various observations *viz.,* field emergence percentage, speed of germination, days to first flowering, plant height (cm), number of bolls per plant, boll weight (g), number of seeds per boll, weight of seeds per boll (g) and seed cotton yield (g). Observation were recorded separately for winter and summer season and subjected for statistical analysis.

RESULTS AND DISCUSSION

Pre sowing seed invigoration treatments with chemicals, growth regulators and plant products has been found effective in higher seed yield parameter under the summer season. Among the treatments, (T_3) Gibberellic acid promoted seed germination process more effectively in summer season cotton than in winter season cotton. Pre-sowing treatment with GA_3 recorded significantly improved early flowering (35.33) and effective improving plant height (135.20 cm) in summer season. The enhancement of germination percentage was more than 15% over this respective control in LRA 5166. This may be due to the action of GA_3 which promotes growth and elongation of cells. It stimulates the cells of germinating seeds to produce mRNA molecules that code for hydrolytic enzymes, induce mitotic division and increase seed germination rate. Summer season crop was much more efficiency. When compare to winter season crop which result in yield and yield components like number of bolls per plant (89.00), boll weight (5.97 g), number of seeds per boll (42.67), seed weight (4.66 g) and seed cotton yield (154.27 g). This may be due to the more photosynthetic activity during the summer season when compared to winter season, i.e. the utilization of photosynthates effectively and increase in source-sink relation in summer season cotton than winter season. The qualitative and quantitative character *viz.,* field emergence percentage (%), speed of germination, days to first flower, plant height (cm), number of bolls per plant, boll weight (g), number of seeds per boll, weight of seeds per boll (g) and seed cotton yield (g) were more in summer season when compared to the winter season. This may be due to the presence of long sunny period which leads to the production of more photosynthetes ultimately leads to the increasing the days to first flower, plant height (cm) number of bolls per plant, boll weight (g), number of seeds per boll, weight of seeds per boll (g) and seed cotton yield (g) similarly GA_3 treated seed showed increased in plant height, days to first flower, more number of boll/plant, boll weight (g) more number of seeds/boll, seed weight (g) and seed cotton yield (g). Gibberellins, or gibberellic acid, promote cell division and expansion (Taiz and Zeiger, 1998). This hormone is most closely related to vegetative growth. Among the treatments GA_3 promoted seed germination process more effectively in summer season cotton than in winter season cotton. The enhancement of germination percentage was more than 90% over its respective control. Promoting action of GA_3 on germination is in agreement to the earlier findings (Singh and Kumar, 1984). The role of gibberellins in seed dormancy and germination have been the focus of many studies.

Gibberellins promote seed germination (Kucera *et al.,* 2005). Exogenous application of gibberallic acid (GA_3) to intact, unstratified seeds in effective in breaking dormancy of seeds and effective in increasing the germination. These results are in agreement with the findings of (Hamilton and Carpenter, 1977; Bhatt *et al.,* 2000; Chien *et al.,* 2000) in seeds of *Myrica esculenta*. From the present study it was concluded that the summer season cotton treated with GA_3 performed well when compared to all other treatments and winter season. Hence to get high economic yield the LRA 5166 variety may be treated with GA_3 and raised in summer season.

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