Effect of growth regulators and chemicals on seed and seed cotton yield in *Gossypium hirsutum* L.

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ABSTRACT

An investigation was undertaken to improve the seed yield during seed production in rainfed condition through seed soaking with chemicals and foliar application of growth regulators. Maximum seed yield (632 kg/ha) was noticed in foliar application of 1% $MgSO_4$, followed by foliar application of 1% NAA (526 kg/ha). The highest seed index of 10.7 g was noticed in seed soaked with KH_2PO_4 coupled with boron spray, followed by seed soaked with succinic acid and IAA spray (10.0 g). More seeds per boll were observed in foliar spray of 1% $MgSO_4$ (29.4) followed by foliar application of boron (28.6). The maximum number of bolls per plant was observed in seed soaked with KH_2PO_4 and $MgSO_4$ spray (8.7). The highest boll weight observed in seed soaked with succinic acid plus IAA spray was 4.5 g, followed by seed soaked with succinic acid (4.4 g). It was found that foliar application of 1% $MgSO_4$ increased seed yield, seed cotton yield and boll number, which may be due to less leaf reddening, higher chlorophyll content. Foliar application of 1% $MgSO_4$ to cotton crop at 60 and 75 Days after sowing increased seed and seed cotton yield.

Introduction

Besides the cultivation of all four cultivated species (*G. hirsutum*, *G. barbadense, G. herbaceum* and *G. arboreum*), varieties and hybrids of these species are also commonly cultivated (Khadi and Kulkarni, 2001). Varieties occupy 40% of the area under cultivation (Anonymous, 2002). No doubt F_1 hybrids are superior to varieties but initial investment in terms of their seed cost is higher than for varieties, as seed cost per ha is US $25 as against US $5 for varieties. Additionally hybrids respond more to higher doses of fertilizers than varieties. The recommended fertilizer for hybrid is 150:75:75 NPK kg per ha as against 80:40:40 NPK kg/ha for varieties. As cost of cultivation of hybrids is more than varieties, small and marginal Indian farmers are unable to afford this and they are cultivating cotton varieties. Varieties belonging to *G. hirsutum* being early are also used in multiple and mixed cropping systems. Popular cropping systems include cotton followed by wheat in North India, cotton followed by maize or cotton - soybean, cotton - chili and cotton - groundnut in South India. This is an additional advantage available with varieties because varieties are early maturing and require narrow spacing. Research was diverted to develop scientific packages of hybrid seed production (Khadi *et al*., 1990; 1995) but this was not the case with varieties. So the present study was aimed to find suitable packages for seed production in cotton varieties.

Experimental procedure

The experimentation to develop a management package for seed production of Sahana cotton variety belonging to *G. hirsutum* was taken up at Agricultural Research Station, Dharwad Farm, Dharwad-580 007 during kharif 2001-02. Sahana cotton is bollworm-tolerant, high lint yielding and suitable for both irrigated and rainfed conditions. It is released for commercial cultivation in Karnataka, Andra Pradesh and Tamil Nadu states.

Chemicals like succinic acid, potassium dihydrogen phosphate, $MgSO_4$, boron in the form of boric acid, potassium nitrate and growth regulators like IAA, NAA and GA were used in addition to chemical fertilizers. Details of chemical treatments imposed and their concentration, duration and methods are mentioned in Table 1.

The experiment was laid out in a split-plot design and the recommended package of practices for the variety was followed. The observations on seed cotton yield (kg/ha), seed yield (kg/ha), seed index (g) and number of bolls per plant were recorded. Data was processed with the help of MSTAT, a computer software package.

Results and discussion

Enhancement of early growth with low cost technology like soaking the seeds with growth regulators like gibberellic acid, growth-inducing chemicals like succinic acid and KH_2PO_4 has been reported (Kairon, 1973). Enhancing early growth by increased germination and establishment of healthy seedlings helps to give good crops and higher yields. Similarly, auxins like NAA and IAA are known to prevent square and boll shedding (Bhatt *et al*., 1982) so that yield can be increased. Nutrients like boron and potassium are known to increase seed yield by increasing seed size. Magnesium sulphate prevents leaf reddening and induces good seed development and boll opening (Nageshwar Rao, 1977).

The data on effect of seed soaking with chemicals and growth regulators spray on seed cotton yield is presented in Table 2. The effect of chemicals and growth regulators did not have any significant effect. However, the interaction between seed soaking with chemicals and growth regulator spray gave significant effects. Highest seed cotton yield (1034 kg/ha) was recorded for foliar spray of $MgSO_4$ (1%) followed by NAA spray (856 kg/ha).

The maximum seed yield of 632 kg/ha was observed for foliar spray of 1% $MgSO_4$ followed by 10 ppm NAA spray (526 kg/ha) (Table 3). Significantly

higher numbers of bolls per plant were recorded when seed soaked with KH_2PO_4 as against without soaking (Table 4).

Seed index (100 seed weight) is the most important seed quality factor after seed cotton yield. The highest seed index (9.49 g) was noticed in succinic acid seed soaking treatment. The combination of seed soaking with KH_2PO_4 and foliar application of boron gave the highest seed index (10.06 g), followed by seed soaking with KH_2PO_4 (9.75 g).

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Table 1. *Details of chemicals and growth regulators and their concentrations.*

	Compound	Rate or concentration	Remarks
Chemicals	Succinic acid	0.2%	250 g of cotton seeds were soaked in 500 ml solution for 6 hours.
	KH_2PO_4	100 ppm	
	No soaking		
Growth regulators	IAA	10 ppm	Spray was given applied to the crop at 60 and 75 days after sowing.
	NAA	10 ppm	
	Boron (boric acid)	0.1%	
	$MgSO_4$	1%	
	KNO_3	1%	
	No spray	1%	

Table 2. *Effect of seed soaking with chemicals and foliar application of growth regulators on seed cotton yield (kg/ha).*

	Growth regulators (foliar application)						
Seed soaking chemicals	IAA	NAA	Boron	$MgSO_4$	KNO_3	No spray	Mean
GA	673	602	646	750	746	647	677
Succinic acid	717	658	694	577	769	678	682
KH_2PO_4	806	795	709	723	719	707	743
No soaking	729	856	797	1034	671	807	816
Mean	731	728	712	771	726	710	730
Interaction	SE	CD at 5%					
Chemicals (C)	57.7	NS*					
Growth regulators (G)	29.0	NS					
G at same level of C	57.9	170.9					
C at same level of G	230.9	315.1					
CV %	11.23						

* NS = not significant.

Table 3. *Effect of seed soaking with chemicals and foliar application of growth regulators on seed yield (kg/ha).*

	Growth regulators (foliar application)						
Seed soaking chemicals	IAA	NAA	Boron	$MgSO_4$	KNO_3	No spray	Mean
GA	416	371	397	453	462	399	416
Succinic acid	445	409	442	358	472	419	424
KH_2PO_4	493	500	451	451	448	440	464
No soaking	446	526	491	632	410	497	500
Mean	450	451	445	474	448	439	451
Interaction	SE	CD at 5%					
Chemicals (C)	33.6	NS*					
Growth regulators (G)	17.0	NS					
G at same level of C	34.0	100					
C at same level of G	45.7	135					
CV %	10.64						

* NS = not significant.

Table 4. *Effect of seed soaking with chemicals and foliar application of growth regulators on number of bolls per plant.*

Seed soaking	Foliar application						
	IAA	NAA	Boron	$MgSO_4$	KNO_3	No spray	Mean
GA	7.10	7.70	6.95	7.85	7.30	6.80	7.28
Succinic acid	7.05	7.15	5.95	6.90	7.30	7.95	7.05
KH_2PO_4	8.05	8.70	7.20	8.70	8.60	7.95	8.20
No soaking	6.50	8.00	6.35	7.30	7.60	7.30	7.17
Mean	7.17	7.88	6.61	7.68	7.70	7.50	7.42
Interaction	SE	CD at 5%					
Chemicals (C)	0.15	0.68					
Growth regulators (G)	0.30	NS*					
G at same level of C	0.60	NS					
C at same level of G	0.57	NS					
CV %	11.37						

* NS = not significant.