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Quality characteristics of two cotton cultivars as influenced by seed dressing with imidacloprid insecticide

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Abstract: Cotton yield, fibre quality and seed germination especially depend on cultivated variety, production technology and pest management techniques. Gaucho 70 WS is an imidachloprid seed dressing insecticide which has been extensively used in Bangladesh for management of cotton sucking pests. In this study seeds of CB3 and CB9 cotton cultivars were treated with different dosages of Gaucho 70 WS and investigations were done to know their effect on seed germination and quality of crops. Results indicated that Gaucho 70 WS as seed dresser did not affect germination over a period of four weeks for both CB3 and CB9 cultivars. On the contrary, seed treatments showed significant effect on ginning out tern, seed index, lint index, fibre length and micronaire value of these two cultivars. Gaucho 70 WS as seed dresser revealed quality crops with proper seed germination indicated that this insecticide was suitable for CB3 and CB9 cultivars.
Key words: Fiber, germination, ginning, lint index, micronaire value.

Introduction

Cotton is a highly valued cash crop which is a major input for the textile, agriculture, and food industries. The quality of cotton fibre is determined by the quality of ginning process, strength and length of fibre, length uniformity, maturity, fineness, trash content, colour, seedcoat fragment and stickiness. Cotton quality is affected by selecting the variety, seed, production technology, pest management tactics, harvesting and ginning. Therefore, proper variety selection, successful germination of seeds and protection of crops from pests and diseases are prerequisite for quality cotton production.

Imidacloprids are neonicotinoid insecticides in the chloronicotinyl nitroguanidine chemical family. These chemicals are most promising, low cost, selective and less polluting and have been used as seed treatment/dresser (Udikeri *et al*., 2007). Seed dressing and spray formulations of many insecticides in this group have come to be effective against pest abundance (Vastrad, 2003). The imidacloprids have appeared the best seed dressers in cotton (Dandale *et al.,* 2001; Patil *et al.,* 1999) and have been found to be promising against cotton sucking pests (Dhawan and Simwat, 2002; Patil *et al.,* 2004; Vadodaria *et al.,* 2001). These compounds found to keep cotton crop free from sucking pests for at least 45 days after sowing and also comparatively safe to natural enemies (Udikeri *et al*., 2007).

Cotton Development Board (CDB) of Bangladesh is a cotton research and extension organization and the CDB has released eleven varieties of which CB3 and CB9 are extensively cultivated varieties in the country. These cultivars are infested by a number of sucking pests and the major sucking pests are jassid, aphid, whitefly and thrips (Amin *et al*., 2008a). The farmers of Bangladesh are using imidacloprid insecticide as a seed dresser for controlling these sucking pests and producing significantly higher yield (Amin *et al*., 2008b). Hence, chemicals belonging to imidacloprids are effective against sucking pests of cotton and have become popular among farmers but there is no report on their impacts on germination of seeds and quality of crops. Problems during any step of production can cause irreversible damage to fibre quality and reduce profits for the producer. Therefore, in the present study imidacloprid insecticide, Gaucho 70 WS was used as seed dresser and investigation was done to know its effect on seed germination, ginning out tern, seed index, lint index, fiber length and micronaire value of the crops.

Materials and Methods

Seed treatment: The fuzzy seeds of CB3 and CB9 cultivars were separately soaked in water for half an hour and then put on sieves for drying. Gaucho 70 WS powder and cotton seeds were poured into different bowls following 1.5, 2.5, 3.5, 4.5 or 5.5 g/kg seed and stirred for 10-15 minutes for complete adherence of the chemical to the individual seed coat. Then the seeds were put on papers and dried in the sun for 30-45 minutes. Therefore, the seeds were stored in brown paper bags until germination test.

Germination test: CB3 and CB9 cotton seeds treated with different dosages of Gaucho 70 WS were used for germination test on 0, 7, 14, 21 or 28th day of treatment. Control observation for each cultivar was done with non-treated seeds. For germination test sands were sieved to discard particles bigger than 0.8 mm and smaller than 0.05 mm in diameter. Rectangular plastic boxes were used to put the sands and for every test new sands were used. Seeds were placed on a uniform layer of moist sands and then covered to a depth of 10 mm with sands. For each cultivar and treatment 100 seeds were placed in each plastic tray and replicated four times. The plastic trays with seeds were incubated at room temperature and irrigated at every odd day. After one week, germination percentage was recorded. The normal seedlings, abnormal seedlings and non-germinated seeds were classified according to the prescribed rules given by International Seed Testing Association (ISTA) and germination percentage was calculated using the following formula.

Germination (%) = [{(No. of seed produced normal seedlings) ÷ (No. of seed tested)} × 100].

Cultivation of crops: Cotton crops were cultivated in the Regional Cotton Research Station, Dinajpur, Bangladesh (25^{o}13'N, 88^{o}23'E) during August 2008 to March 2009. Crops were raised with CB3 and CB9 cotton seeds treated with different dosages of Gaucho 70WS. These varieties were also cultivated with non-treated seeds for control experiments. The experimental design was a randomized complete block with four replications. Plot size was one

row, 6 m long, spaced 1 m apart. Seeds were sown 45 cm apart within a row. Plots were maintained per Bangladesh Cotton Development Board recommendations.

Observation of crop qualities: A 50 boll sample of open bolls (seed cotton) in each plot was handpicked from four replications of each test to obtain boll sample data for observation of crop qualities. Therefore, bolls were ginned with a single roller electrical gin in the laboratory. Boll sample data included: (i) ginning out tern (GOT) = percentage of lint obtained from a sample of seed cotton; (ii) seed index = weight of 100 seeds (g); (iii) lint index = fibre weight on 100 seeds; (iv) fibre length (cm); and (v) micronaire value = fibre fineness and maturity. Fibre length was measured using fibre length measurement device KX730 (Dowell Science and Technology, HK Co. Ltd., Hong Kong) and micronaire value was tested using a cotton micronaire testing machine (Zhenjiang KDL Machinery Co. Ltd., Jiangsu, China).

Data analysis: One way ANOVA following Duncan's Multiple Range Test (DMRT) was employed using IBM SPSS 19 for analyzing the data.

Results and Discussion

Cotton seed germination and seedling development are highly sensitive to the environment and normally seedling emergence takes place 4 to 14 days after planting (CAES, 2010). In this study germination percentage was observed after one week of sowing. Table 1 showed that CB3 cotton seeds treated with different dosages of Gaucho 70 WS were planted for germination on 0, 7, 14, 21 or 28th day of treatment. Results indicated that 84.75 to 91.25% seeds produced normal seedlings and the dosages of Gaucho 70 WS and post treatment duration did not affect germination percentage to a significant level. The germination percentage of CB9 cotton variety showed that 84.00 to 88.00% seeds produced normal seedlings and there was no significant effect of the dosages of Gaucho 70 WS and post treatment duration on germination percentage (Table 2). Now-a-days, seed treatment is used as an economic and efficient pest control technique in many key crops because it possesses many high performance products which suppress pests and diseases to a significant level (Schemeer *et al*., 1990; Taylor *et al*., 2001; Nault *et al*., 2004). This study showed that the seed treating chemical Gaucho 70 WS acted as a protective coating around the seed grain against insect pests and did not harm seedling emergence.

Table 3 showed that the differences among the GOT of different treatments were statistically significant and observed GOT ranged from 34.87% to 38.37%. Percent GOT of the variety CB3 increased with increasing dosages of Gaucho 70 WS and the control treatment revealed the lowest GOT%. There was significant effect of the treatments on the GOT of the variety CB9 and observed GOT ranged from 37.13 to 40.75% (Table 4). Percent GOT of this variety also increased with increasing dosages of Gaucho 70 WS and the control treatment revealed the lowest GOT%. Amin *et al*. (2008a) cultivated CB3 and CB9 under economic threshold based insecticide sprayed condition and observed 39.0% and 35.83% GOT, respectively which showed agreement with our study. Zeybek *et al*. (2010) cultivated Nazilli 84-S variety with seed coating chemical and reported 42.29% to 45.45% GOT. They also reported that coating treatments might increase GOT.

Table1. Effect of Gaucho 70 WS on germination percentage of CB3 cotton cultivar

Dose (g/kg seed)	% Germination				
	0th DS	7th DS	14th DS	21th DS	28th DS
Control	90.50a	87.00 a	87.00 a	88.25a	88.25a
1.5	91.25a	88.00 a	84.75 a	85.25a	87.00a
2.5	89.50a	86.50 a	85.00 a	86.00a	85.00a
3.5	86.00a	87.75 a	85.00 a	86.00a	86.50a
4.5	87.25a	85.50 a	85.25 a	89.25a	85.50a
5.5	86.75a	86.25 a	85.00 a	88.75a	89.50a

Means within a column followed by same letter(s) are not differ significantly (DMRT, $p < 0.05$), DS = day of sowing.

Table 2. Effect of Gaucho 70 WS on germination percentage of CB9 cotton cultivar

Dose (g/kg seed)	% Germination				
	0th DS	7th DS	14th DS	21th DS	28th DS
Control	87.25 a	88.00a	87.75 a	87.25 a	86.50 a
1.5	87.50 a	86.00a	86.25 a	85.50 a	87.25 a
2.5	87.00 a	86.75a	84.50 a	85.00 a	86.00 a
3.5	87.00 a	84.00a	86.00 a	85.50 a	87.25 a
4.5	86.00 a	86.00a	84.75 a	86.00 a	86.50 a
5.5	86.50 a	85.75a	85.00 a	86.75 a	86.50 a

Means within a column followed by same letter(s) are not differ significantly (DMRT, $p < 0.05$), DS = day of sowing.

The average seed index, lint index, fibre length and micronaire value of the cotton varieties CB3 and CB9 across the seed coating treatments are presented in table 3 and table 4. Seed coating treatments showed significant effect on the seed index of CB3 and CB9 cultivars. Seed index of the variety CB3 ranged from 9.50 g to 10.88 g and the seeds treated with Gaucho 70 WS revealed significantly higher index. The variety CB9 showed seed index 8.75 to 10.98 g and seed coating treatments revealed significantly higher index. Lu et al (2011) studied 260

cotton cultivars and they reported seed index 9.60 to 13.10 g of 10 most influential cultivars.

Lint index refers the absolute weight of lint borne by a single seed, is a function of mean number of hairs per seed and mean hair weight (Ali *et al*. 2009). This study showed that lint index of CB3 cultivar varied from 5.96 to 6.72 and the results differed to a significant level. Lint index of CB9 cultivar varied from 5.99 to 6.95 and the results showed significant differences. Lint index of both the two cultivars increased with increasing dosages of the seed coating chemical. Lint index of ten cotton cultivars were reported by Lu *et al*. (2011) who observed lint index 6.3 to 7.5 which are comparatively higher than our cultivars.

Table 3. Effect of Gaucho on qualitative characteristics of CB3 cotton cultivar

Dose (g/kg seed)	GOT (%)	Seed index (g)	Lint index	Fiber length (cm)	Micronaire value
Control	34.87 c	9.50 b	5.96 d	1.00 b	3.93 c
1.5	36.12 b	10.75 a	5.96 d	1.03 ab	3.93 c
2.5	36.87 b	10.48 a	6.07 d	1.04 ab	4.01 c
3.5	37.00 b	10.47 a	6.22 c	1.05 ab	4.23 b
4.5	37.87 a	10.62 a	6.48 b	1.06 a	4.35 b
5.5	38.37 a	10.88 a	6.72 a	1.06 a	4.66 a

Means within a column followed by same letter(s) are not differ significantly (DMRT, $p < 0.05$).

Table 4. Effect of Gaucho on qualitative characteristics of CB9 cotton cultivar

Dose (g/kg seed)	GOT (%)	Seed index (g)	Lint index	Fiber length (cm)	Microneir value
Control	37.13 d	8.75 b	5.99 f	1.03 ab	3.69 ab
1.5	38.37 c	9.87 b	6.15 e	1.03 ab	3.95 ab
2.5	39.00 c	10.25 a	6.40 d	1.04 ab	4.30 ab
3.5	39.87 b	10.58 a	6.68 c	1.04 ab	4.57 a
4.5	40.25 b	10.92 a	6.85 b	1.05 a	4.64 a
5.5	40.75 a	10.98 a	6.95 a	1.06 a	4.70 a

Means within a column followed by same letter(s) are not differ significantly (DMRT, $p < 0.05$

There was significant effect of the seed coating treatments on the fibre length of the variety CB3 and observed length ranged from 1.00 to 1.06 cm. Fibre length of this variety increased with increasing dosages of Gaucho 70 WS and the control treatment revealed the lowest length. Seed coating treatments showed significant effect on the fibre length of CB9 variety and this variety produced longer fibre when the seeds were treated with Gaucho 70 WS. Our results showed harmony with Zeybek *et al*. (2010) who reported that seed coating treated crops produced the longer fibre. Coating treatments positively influenced on the micronaire values of CB3 and CB9 cultivars. Micronaire values of these two cultivars are 3.93 to 4.66 and 3.69 to 4.70, respectively. Our study varieties have comparatively lower micronaire value than Nazilli 84-S, Nazilli 143 and Nazilli M-503 varieties which were cultivated with coating treatments and revealed micronaire values of 5.15, 4.76 and 4.84, respectively (Zeybek *et. al*. 2010; Goktepe and Goktepe, 2000; Gulyasar *et al*., 2000).

This study cotton cultivars are morphologically differentiated; CB3 is a smooth and short height variety whereas CB9 is a bushy, hairy and long height variety. These two varieties also differ in their flowering time, number of sympodia, number of bolls per plant, pest infestation, yield, seed index and GOT characteristics (Amin *et al*. 2008a; Amin *et al*. 2011). The seed coating chemical Gaucho 70 WS had no negative influence on the germination of seeds of these two cultivars over a period of 28 days after treatment. On the contrary, seed treatment showed positive influence on GOT, seed index, lint index, fibre length and micronaire value of the two cultivars. Therefore, it is possible to say that cultivation of cotton seeds treated with imidacloprid insecticide is effective for technological qualities and this seed coating does not affect the agronomic characteristics of the crops.

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