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Studies on Physiological Response of FH-682 Cotton to Various Dosage of Dimecron 100SCW

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Abstract: Physiological response of cotton, *Gassypium hirsutum* L., to increasing rates of different doses of Dimecron was investigated. Dimecron was applied fortnightly and the seed cotton yield was found to be positively correlated to the physiological characters. Out of the total contribution to seed cotton yield, 85.08% was shared by number of opened bolls and weight of dry leaves which was significant compared with 13.29% contributed by other physiological characters. Although there was no clear difference in the influence of any single dose of Dimecron on all the characters yet it could be suggested that 200 ml acre^{-1} had comparatively more influence on the seed cotton yield compared with other doses tested.

Key words: Physiological characters, Cotton, Dimecron, IPM, *Bacillus thuringiensis*

Introduction

Cotton is ancient to Pakistan and being cultivated here since fifth millennium BC (Ahmed and Ali, 1993). Cotton has a vital role in the economy of Pakistan which rank fifth in cotton production and third as an exporter of raw in the world. It is a major foreign exchange earning and accounts for about 60% of its export and over 55% of domestic oil production. (Ahmed, 1991).

Insecticides from four different chemical classes (Organophosphates, Chlorinated hydrocarbons, Carbamates and Pyrethroids) are primarily used for insect control in cotton. However, some of the chemicals also have secondary effects on the treated plants. For example, Organophosphates induced changes in leaf morphology, increased the number of vegetative branches, delayed plant maturity and ultimately effects the yields of cotton (Lloyd and Krieg, 1987). While, Ali and Attique (1987) found that the application of Carbaryl, Monocrotophos, Permethrin and Cypermethrin at weekly intervals from six weeks after sowing did not effect seed cotton yield, bollworm infestation or number of matured bolls. However, Aldicarb application in furrow significantly enhance the number of bolls per plant and yield (Soares *et al*., 1996). The genotype, soil type, fertility and soil moisture are among the factors which can influence plant response to insecticides (Terry, 1992).

As most of the previous studies on effect of insecticide to cotton are mostly from other geographical regions of the world. Therefore there was a dire need to conduct such studies under local conditions using some of the Organophosphates like Dimecron 100SCW on cotton. Keeping in view the importance of the study the main aim of our experiment was to evaluate Dimecron (Organophosphate) effect on cotton physiology in the region and to confirm whether these changes are correlated to seed-cotton yield.

Materials and Methods

The material used were Dimercon (Phosphomedon) with different doses: 150 ml acre^{-1}; 200 ml acre^{-1}; 250 ml acre^{-1}; 300 ml acre^{-1} and 400 ml acre^{-1}. The cotton variety FH-682 were grown in a Randomized Complete Block design at "Ayub Agriculture Research Institute (AARI)", Raisalewala, Faisalabad in 1993 in collaboration with directorate of cotton. There were six treatments in all including a control.

The crop was sprayed with different doses of Dimecron two months after being sown, and the crop was sprayed with each dose of the test insecticide thrice at an interval of every fortnight. However the data on the physiological characters was collected from five randomly selected plants from each replication at the time of its maturity.

Statistical analysis: The data collected was analyzed by using PC based statistical package Micro-Stat. The seed-cotton yield was based on the nature of correlation of physiological characters. A regression analysis was done in order to calculate the correlation coefficient-R^2. The fitness of regression model was tested with the help of a X^2 value. The observed and estimated seed cotton yield was further confirmed by exposing it to Durban-Watson test (Theil, 1971) in order to find the auto-correlation in the characters.

Results and Discussion

There was significant change in mean values of all physiological characters studies except leaf area index and number of leaves (Table 1). While the mean seed cotton yield of control was significantly less compared with the Dirriecron treated treatments ($F = 22.33$; $p<0.01$;Table 1). However, individual comparison with different physiological characters showed that the number of opened bolls and weight of dry leaves had a significant influence ($F = 34.65$; $F = 32.27$ with $p<0.01$; $p<0.01$, respectively) on seed cotton yield. Therefore, the difference in yield between treated and untreated treatments is mostly likely to be the effect of Dimecron on physiology of plants, which is in agreement with the work of Sandras and Wilson (1998) who reported that the difference in growth and yield of cotton was mediated by the effect of Aldicarb. However, Lloyd and Krieg (1987) reported that insecticide treatments influenced growth and development of the plant although differences in treated and untreated plants were not significant.

As the seed cotton yield is the ultimate measure of the physiological performance of the plant. The correlation of the changes in the seed-cotton yield with those of physiological characters indicated two patterns of changes in the physiological influence of different doses of Dimecron on the

Table 1: Comparison of the mean values (plant^{-1}) of different physiological characters of FH-682 cotton treated with different doses of Dimecron 100SCW

	Doses					
Physiological Characters	Control	150	200	250	300	400
Seed cotton yield (gram plant^{-1})	20.4d	44.4a	46.7a	39.5bc	40.5b	36.93c
Plant height (cm plant^{-1})	89.97b	102.73a	100.4a	103.8a	100.5a	100.95a
Weight of fresh leaves (gram plant^{-1})	30.07d	45.0a	40.6b	35.96c	40.5b	41.2ab
Weight of dry leave (gram plant^{-1})	21.4d	37.0a	32.6bc	29.5c	33.7ab	32.5bc
Number of leaves (Plant^{-1})	66.7a	78.0a	75.4a	75.4a	79.8a	79.8a
Weight of dry stem (gram plant^{-1})	46.2c	62.1ab	66.8a	58.46	62.7ab	64.8ab
Number of flowers (plant^{-1})	4.79d	6.46a	6.22ab	6.08ab	5.2bc	5.2cd
Number of unopened bolls (plant^{-1})	10.62b	13.6a	14.8a	14.5a	14.1a	14.8a
Number of opened bolls (plant^{-1})	5.4d	9.18ab	9.68a	8.31 be	7.78c	7.4c
Leaf area index	1.62a	1.75a	1.68a	1.75a	1.8a	1.64a

Figures in the rows sharing common letters are not significantly different from each other

Table 2: A correlation matrix between seed cotton yield and different physiological characters treated with different doses of Dimecron 100SCW

Characters	1	2	3	4	5	6	7	8	9	10
Seed-cotton yield	1.000									
Plant height (cm)	0.6066**	1.0000								
Weight of fresh leaves (g)	0.7529**	0.3174**	1.0000							
Weight of dry leaves (g)	0.8120**	0.4228**	0.9182**	1.0000						
Number of leaves	0.4162**	0.0084	0.5465**	0.4851**	1.0000					
Weight of dry stem	0.7573**	0.4839**	0.6491**	0.6981**	0.2966	1.0000				
Number of flowers	0.7390**	0.4561**	0.4663**	0.5390**	0.1516	0.4204**	1.0000			
Number of unopened bolls	0.6772**	0.5803**	0.4605**	0.5183**	0.5437**	0.6150**	0.2424	1.0000		
Number of opened bolls	0.8200**	0.6525**	0.5360**	0.5654**	0.1919	0.6697**	0.7368**	0.6120**	1.0000	
Leaf area index	0.2483**	0.1858	0.2142	0.2467	0.1685	0.0283	0.1755	0.2064	0.3167**	1.0000

**Significant at 1% level; *Significant at 5% level

Table 3: The observed and estimated seed cotton yield of FH-682, cotton treated with different doses of Dimecron 100SCW

Treatments/[1] Doses	Seed-cotton yield[2]		X^2	P
	Observed	Estimated		
150	36.93	38.30	0.05	0.82
200	46.66	44.07	0.15	0.70
250	44.37	45.19	0.01	0.92
300	39.51	39.05	0.005	0.94
400	40.49	39.78	0.01	0.92
Control	20.44	21.45	0.06	0.80

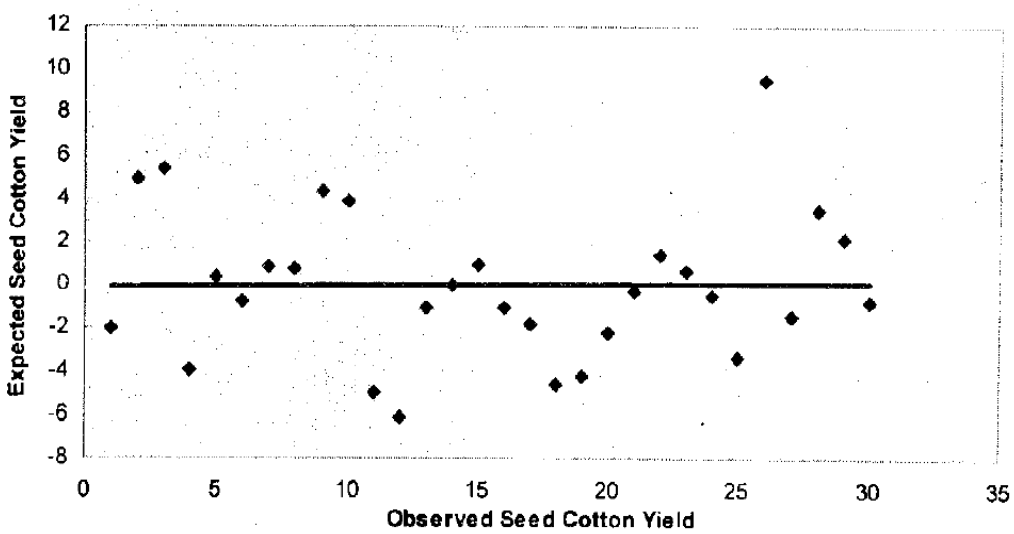

Fig. 1: Effect of different doses of Dimecron on Seed Cotton yield of FH-682 cotton

cotton (Fig. 1, Table 2). The change in plant height, weight of dry leaves, number of leaves, weight of dry stem, number of flowers, number of opened bolls and number of unopened bolls has positive correlation to seed cotton yield whereas the change in the leaf area index had not a significant correlation (Table 2). These results are in agreement with Iqbal (1993) where Tannaron and Baythroid had enhanced seed cotton yield which was positively correlated to plant height, weight of dry brackets, weight of dry stem and number of opened bolls. In contrast, Ahmed (1993) showed that the effect of Dimecron on physiological characters of S-12 cotton was not positively correlated to seed cotton yield.

As to the quantitative contribution of different physiological characters towards the seed cotton yield, a value of correlation coefficient R^2 (0.9537) reveals that 95.37% of the changes in the seed cotton yield came through the complex of physiological characters under studies. The individual partial correlation coefficient R^2 of number of opened bolls and weight of dry leaves were 0.6725 anti 0.1783, respectively suggesting that the contribution of these two characters towards seed cotton yield was 85.08% in the overall (95.37%) change in seee cotton yield whereas the rest 10.29% came through the contribution of number of unopened bolls, number of flowers, number of leaves, weight of fresh leaves. The characters responsible for 4.63% of change in the seed cotton yield could not, however be located suggesting a ample scope for further studies on influence of the insecticide on some others physiological characters like number of branches, crop maturity and vegetative growth on FH-682 cotton.

The non-significant variation in observed and estimated seed cotton yield ($X^2 = 5.96$; $p>0.05$; Table 3) and a regression line, drawn through confidence bands, was extremely current. A further analysis of observed and estimated seed cotton yield through the Durbin-Watson test (1.85) proves that there was no auto-correlation among the physiological characters. The absence of any auto-correlation among the physiological characters indicated that non of the characters overshadowed each other on its effect to seed cotton yield. Therefore the contribution of opened bolls as well as the weight of dry leaves was on real merit.

Conclusion: On the basis of present results, any recommended dose-rate should he encouraged in the field in order not only to control insect pests more effectively but also to improve its physiological status which is the fundamental requirement of the crop for its final performance. Although there was no clear difference in the influence of any single dose of Dimecron on all the characters yet 200 ml $acre^{-1}$ had comparatively more affect on seed cotton yield. However, use of insecticides has a number of side effects (i) These may reduce the number of beneficial arthropods early in the season, (ii) These interfere with the implementation of integrated pest management prograrnms. Therefore the best solution for these problems can be obtained by the use of a fully integrated multi-tactic integrated pest management (IPM) programme (Hoy, 1998). The use of bacterium pesticides, *Bacillus thuringiensis* based formulations within an IPM program was shown to be effective for controlling a variety of pests without having harmful effects on non-target organisms (Trumble *et al*., 1994; Meade and Hare, 1995).

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