Organic cotton production in Sindh, Pakistan

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ABSTRACT

An experiment was conducted at CCRI, Sakrand during 2001-02 cotton season to explore the possibilities of growing cotton in Sindh organically. One acre of CRIS-134 variety was treated with chemicals (fertilizer, insecticides etc.) and the other one-acre was left without application of chemicals (organic block). Six characters (first sympodial node number, number of sympodial branches, plant height, number of bolls per plant, seed cotton yield per plant and seed cotton yield (kg/ha) were studied in both organic and inorganic blocks. Mean squares from analysis of variance for all the characters studied were non significant, however, per hectare seed cotton yield difference between the two blocks was highly significant. The application of chemicals did not affect the earliness of the variety (1st sympodial node number), number of sympodial branches, plant height, number of bolls and seed cotton yield per plant. Cost benefit ratio revealed that in the inorganic block, total expenditure on application of chemicals was Rs. 6278/ha and the net income was Rs. 26382/ha, whereas in the organic block, the expenditure was Rs. 250/ha on farmyard manure and net income was Rs. 19710/ha. It was concluded that CRIS-134 could be grown without applying the chemicals thus reducing the additional cost of inputs with minimum compromization in the yield and avoiding serious problems of resurgence of secondary pests, insecticide resistance, ground water contamination and atmospheric degradation.

Introduction

At present, researchers and growers heavily depend on pesticide use to get the highest seed cotton yield and quality lint. There has been a tremendous increase in pesticide application in the world during the last decade, especially in Pakistan where the economy largely depends on cotton. At the same time, insecticides have brought many problems such as resistance, resurgence and the emergence of new pests as well as environmental contamination.

Organic production requires the elimination of conventional synthetic pesticides and fertilizers. Pests are such a serious to cotton production that economic yields are almost impossible to achieve without monitoring pests and adopting chemical controls. Organic cotton production is a system of growing cotton without synthetic chemical fertilizers, herbicides, conventional synthetic insecticides, growth regulators and defoliants. It is a system that contributes towards healthy environment.

Reasons for growing organic cotton

- Fertilizers and all pre-emergence herbicides are applied to the soil, but the cotton plant does not take up all the chemicals. Some elements are released in to the environment while others leach into the soil and also pollute underground water.
- The insecticides are sprayed with back mounted sprayers. Spray-men do not use protective equipment thus creating a danger of insecticide inhalation. In tractor-mounted sprays, wind drift can lead to inhalation. There are many incidences reported in Sindh almost every day that spray-man died due to inhalation, or the dejected men or women including children made suicide by drinking insecticide.
- Chemical control of insects, particularly when insecticides were introduced, was the cheapest and most efficient way. However, "cheapest" and "efficient" do not seem true characteristics any more because of increases in the number of sprays required, insect resistance, under dosing, adulteration etc.
- Indiscriminate use of insecticides changed the behavior of the insect complex. Some minor insects became major and certain new insects were introduced. Consequently there was an increase in the consumption of insecticides that ultimately lead to the price hike of the chemicals.
- It is also assumed that organic products will fetch premium prices therefore will enhance the farmer's income.
- Agrochemicals pollute the environment including the soil, water and air. Organic cotton is environmentally safe to produce.
- The cost of products permitted for application on an organic crop is usually lower than synthetic insecticides and fertilizers.

Experimental procedure

CRIS-134 variety was planted on 23 May 2001 in two acres area in a experimental field at CCRI Sakrand. The field was under cotton-fallow-cotton rotation, with one years of organic cultivation prior to the experiment. One acre was kept as organic production (without fertilizers and insecticides) and other acre was treated conventionally for exploring whether organic cotton could successfully be produced in Sakrand and its surroundings or not. Each one acre block was devided in four small blocks to make four replications. In one acre block of organic cotton, approximately 37 kg farmyard manure was applied well before the sowing, and 5 kg poultry manure per acre was applied each at first, second and third irrigations. One irrigation was done on 21 July 2001 to suppress the population of thrips in both organic and inorganic blocks, whereas in the inorganic block chemical fertilizer and

four insecticidal sprays (two against sucking pests and two against bollworm complex) were applied as well as other agronomic practices when needed. Weekly pest populations was also recorded in both blocks to establish the trend of pest attack between the two blocks. In total, 40 plants were selected (10 from each replication) from both the blocks (organic and inorganic) to study various characters, *viz*. first sympodial node number, number of sympodial branches, plant height, number of bolls per plant, seed cotton yield per plant and to see whether these characters were influenced by the application of chemical fertilizers or not. Statistical analysis of these characters was also carried out after Steel and Torrie (1980).

Results and Discussion

Statistical analysis of the data (Table 1) showed that there were no any significant differences among organic and inorganic cotton blocks of CRIS-134 variety for five characters (first sympodial node number, number of sympodial branches, plant height, number of bolls per plant and seed cotton yield per plant). However, a highly significant difference was observed between the two blocks in respect of seed cotton yield per hectare. Average performance of CRIS-134 in respect of all the characters studied in both the blocks (organic and inorganic) is presented in Table 2. In the organic block, the first sympodial branch appeared on 6.7 main stem node number, 18.6 bolls were formed on 18.5 sympodial branches from which 26.0 g seed cotton yield/plant was obtained. While in the inorganic block, the first sympodial branch appeared on 7.0 main stem node number, 17.1 bolls were formed on 19.9 sympodial branches from which 27.7 g seed cotton yield per plant was achieved.

It was observed from Tables 1 and 2 that the vegetative as well as reproductive growth of CRIS-134 was similar in both the blocks (organic and inorganic) and no significant differences were observed in growth, flowering, fruit setting and seed cotton yield per plant, which means that application of poultry manure maintained the nitrogen requirement of the plant to some extent in the organic block of CRIS-134 where no chemicals were applied. However, there existed a highly significant difference between the two blocks when the yield was considered on a per hectare basis. Numerically, from the organic block, 998 kg/ha seed cotton was harvested whereas from the inorganic block 1633 kg/ha was obtained (Table 2). This difference in yield might be due to the heterogeneity of soil in the organic block and difference of plant population between the two blocks which was 51604 plants/ha in the organic block and 56131 plants/ha in the inorganic block and also the higher population of live larvae in the organic block.

The weekly pest population was also recorded in the two blocks starting from 3rd week of July to the 1st week of October (Table 3). The data revealed that the thrips population remained on higher in the organic block where compared to the inorganic block with the maximum population during 3rd and 4th week of July after which it was suppressed and remained below the economic injury level in both blocks. This might be due to the reduction in temperatures during August, September and October as compared to June and July.

It was also observed from the data that spraying against sucking pests in the 4th week of July did not affect the population in the inorganic block. With regard to the jassid population, a similar trend was observed in both blocks, the population remained below threshold level. Although spraying against sucking pests was done in the inorganic block, the jassid population was similar in both sprayed and unsprayed blocks, which proved that spraying against thrips and jassids was ineffective. Interesting results were observed regarding whitefly population; the sprayed block had higher population compared to the unsprayed (organic) block. This suggested that spraying against sucking pests further aggravated the situation and that the whitefly population flared up, which could be attributed to the population of natural enemies which might be safe and on higher side in unsprayed block as compared to the sprayed (inorganic) block where, due to application of insecticides, the population of natural enemies might had reduced to the considerable level.

Regarding bollworm damage and living larvae percentage, the bollworm damage percent was recorded higher in the inorganic block up to the 4th week of August compared to organic one. After that the population was suppressed by spraying against bollworms in the 4th week of August in the inorganic block. This might be also due to the presence of natural enemies. However, the living larvae remained active and on the higher side in the organic block in the whole month of September, which might had reduced the per hectare seed cotton yield significantly. But then the population was suppressed by spray against bollworm in the 4th week of August. Mohyuddin and Qureshi (1999) have also reported that if no control measures against bollworm are taken, yield is reduced by almost 50%.

The cost benefit ratio of the organic and inorganic block was also calculated (Table 4) to see the effect of expenditure on application of chemicals in the inorganic block and on farmyard and poultry manure in the organic block and also to see whether this expenditure compensated the yield reduction in the organic block or not. Accordingly, in the inorganic block, the total expenditure on application of chemicals (fertilizers and insecticides) incurred was Rs. 6278/ha, whereas return from seed cotton yield sold at Rs. 20/kg was Rs. 32660, in this way net income was Rs. 26382/ha (no premium was paid for the organic crop). The expenditure on farmyard manure including its application was only Rs 250/ha and on poultry manure it was negligible.

When the net income received from the inorganic block was compared with that of organic block, it was Rs. 6672/ha more, which in terms of cash is attractive but if seen from an environmental pollution view point, it is very dangerous because the indiscriminative use of chemicals (fertilizers and insecticides) has created serious problems of resurgence of secondary pests, insecticide resistance, ground water contamination and atmospheric degradation. Death tolls have been increased due to inhalation of insecticides when sprayed or mishandled. Especially in Sindh, almost every day numerous reports publish in the newspapers that some one conducted suicide by drinking an insecticide. Organic cotton production has however, has an edge over the inorganic production because it is free from all kinds of chemicals and if a reasonable premium is given to the farmers then the days are not far away to save our environment from degradation to a greater extent. CRIS-134 variety has proved itself to be grown organically in Sindh province.

References

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Table 1. *Mean squares for six characters studied in the organic and inorganic blocks.*

Source of variation	d. f	1st sympodial node number	Sympodial branches	No. of bolls	Plant height	Seed cotton yield per plant	Seed cotton yield per hectare
Replication	3	0.17	1.59	17.07	36.19	2.76	23.3
Treatment	1	0.24	3.51	4.65	380.88	6.02	132098**
Error	3	0.20	7.22	9.10	46.59	13.75	34

** = Significant at 1% level of probability

Table 2. *Average performance of CRIS-134 for six characters studied in organic and inorganic blocks.*

Treatment	1st sympodial node number	Sympodial branches	No. of bolls per plant	Plant height (cm)	Seed cotton yield/plant (g)	Seed cotton yield (kg/ha)
Organic cotton	6.7	18.5	18.6	117.6	26.0	998
Inorganic cotton	7.0	19.9	17.1	131.4	27.8	1633

Table 3. *Population trend of sucking pests and bollworm damage in organic and inorganic blocks at CCRI, Sakrand during 2001-02.*

	Organic block					Inorganic block				
Months/ Weeks	Thrips	Jassid	W. Fly	Boll worm damage %	Live larvae %	Thrips	Jassid	W. Fly	Boll worm damage %	Live larvae %
July										
3rd week	12.86	0.33	1.80	1.92	0	13.25	0.39	1.89	2.00	0
4th week	31.77	0.57	0.73	5.0	2.0	24.93	0.5	0.7	6.0	2.0
August										
1st week	8.5	1.47	0.6	7.0	3.0	4.4	2.0	0.5	6.0	1.0
2nd week	1.37	1.83	0.97	6.0	3.0	1.07	0.93	0.93	8.0	5.0
3rd week	1.4	0.83	0.5	6.71	2.23	0.33	0.33	4.6	6.53	1.96
4th week	0.5	0.33	0.93	6.58	3.29	0.33	0.4	2.63	8.8	4.0
September										
1st week	0.6	0.53	1.97	10.52	3.95	0.43	0.33	2.26	8.44	2.60
2nd week	0.27	0.3	1.5	10.0	3.33	0.3	0.23	3.0	10.25	2.56
3rd week	0.4	0.33	2.13	8.45	2.11	0.27	0.23	3.33	7.14	1.43
4th week	0.53	0.3	1.73	9.16	2.29	0.33	0.3	3.8	6.77	1.5
October										
1st week	0.46	0.17	2.4	7.40	1.48	0.33	0.16	4.16	5.62	1.25

Table 4. *Cost benefit ratio of organic and inorganic blocks at CCRI, Sakrand during 2001-02.*

Particulars of inorganic block	(Rs. /ha)	Particulars of organic block	(Rs. /ha)
DAP fertilizer and its application	1780	Farmyard manure its application	250
Urea fertilizer and its application	2027	Poultry manure its application	Negligible
Thiodan and its application	544	Total expenditure	250
Tamaron and its application	605	Return from seed cotton yield	19960
Cypermethrine & its application	494	Net income	19710
Karate and its application	828		
Total expenditure on chemicals	6278		
Return from seed cotton yield	32660		
Net income	26382		