Economic Evaluation of IPM Technology for Cotton in Yavatmal District of Maharashtra

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ABSTRACT

Cotton is one of the most important commercial crop. In India the area under cotton crop is 9.53 Million ha. with productivity of 553.0 kg/ha, however, Maharashtra state, occupies an area of 31.90 lakh ha. with productivity of 60.00 kg/ha. IPM is accepted as the only relevant means of reducing dependence on chemical input. The judicious and timely use of IPM practices is of prime importance to minimize the use of pesticides and control of insect. It is therefore necessary to find out the existing level of knowledge and extent of adoption of IPM practices for pest management for cotton and also to identify the constraints faced by farmer in adoption of IPM technology. The present study was carried out in Yavatmal district of Vidarbha in Maharashtra. Nine villages of three tahsils were selected and from each village 10 farmers were selected randomly thus total 90 farmers were selected as sample. The study concluded that average size of holding for overall farms was observed 4.33 ha. Extent of adoption of IPM technology was found higher in Pest resistant and tolerant variety i.e. 82.22 per cent followed by soil manuring i.e. 80.00 per cent. Most of the farmers i.e. 71.11 per cent were in group of medium level of adoption. The cost of cultivation at cost 'C" was found low in high adoption group i.e. ₹ 22995.12 followed by medium adoption group and low adoption group and it was ₹ 23526.48 and ₹ 23751.74. The Input-Output ratio at cost "C" was 1.4, 1.48 and 1.66 in case of low, medium and high adoption groups respectively. Thus, the production of cotton crop was observed profitable at all technology level. Lack of technical guidance, unaware of critical component of IPM technology, lack of capital, lack of irrigation facilities were found major constraints faced by cotton growers.

Keywords: *IPM technology, Cotton*

INTRODUCTION

Cotton is one of the most important commercial crop playing a key role in economic, political and social affairs of the world. The organized sector of Indian textile industry constitutes the largest single industrial segment in the country in terms of annual value of output and labour employed both direct and indirect. In India the area under cotton crop is 9.53 Million ha. with productivity of 553.0 kg/ha, however, Maharashtra state, occupies an area of 31.90 lakh ha. with productivity of 60.00 kg/ha. Cotton crop is grown on 13.60 lakhs ha in Vidarbha region with productivity of 282.00 lint kg/ha Hence, cotton productivity of state is less as compared to national average (Anonymous, 2008). In 1967, Food and Agriculture Organization panel of expert define "Integrated Pest Management as a pest management system that in the context of the associate environment and population dynamics of the pest species utilizes all suitable techniques and the method as compatible manner as possible and maintain pest population at level below those causing economic injury". The aim was to keep the pest below the Economic Injury Level (ETL) and manage them without decrease in yield. IPM is accepted as the only relevant means of reducing dependence on chemical input. It is environmentally safe, ecologically sound and sustainable alternative, which sheet to minimize the use of pesticide by placing greater relevance on biological control. The judicious and timely use of IPM practices is of prime importance to minimize the use of pesticides and control of insect. It is therefore necessary to find out the existing level of knowledge and extent of adoption of IPM practices for pest management for cotton and also to identify the constraints faced by farmer in adoption of IPM technology. The study was therefore planned and undertaken with following specific objectives.

OBJECTIVES

(i) To examine the level of adoption of IPM technology

(ii) To study the economics of IPM technology adopted cotton

METHODOLOGY

The present study was carried out in Yavatmal district of Vidarbha in Maharashtra was purposively selected for the study since integrated pest management technology proposed by Dr. PDKV, Akola Maharashtra was demonstrated to farmer in larger area. The district lies between 19^0 26' and 20^0 42' north latitudes and 77^0 18' and 79^0 9' east longitudes. It has an average elevation of 434 meters above mean sea level. The climate of the district is in general hot and dry with moderately cold winter. The year may be divided in to four seasons. The hot season begins in March and extends up to first week of June. This is followed by south west monsoon season which last up till end of September, October and November constitute the post monsoon season which is followed by cold season which last up till February. From the district of Yavatmal, Yavatmal, Ner and Ralegaon tahsils were selected for this study. From these tahsils nine villages viz., Bhishni, Waghapur, Jamwadi, Son Wadona, Uttar Wadona, Yarad, Ralegaon Kalab, Watkhed, Watkhed Bk., were selected for final sample as the IPM demonstration were operated in these villages. Form these 9 villages 90 respondents were selected by random sampling method.

RESULTS AND DISCUSSION

Extent of adoption of IPM technology by selected farmers

At overall level the extent of adoption of Pest resistant and tolerant variety was observed highest 82.22 per cent followed by soil manuring i.e. 80 per cent , crop rotation was 77.77 per cent, whereas, the extent of adoption of deep ploughing/tillage and clean cultivation were 75.55 per cent and 68.88 percent respectively. Extent of adoption of Crop residue and destruction under cotton cultivation was observed 63.33 per cent at overall level fallowed by use of Spraying of Neem seed extract i.e. 62.22 per cent. Whereas two practices namely Seed treatment of *Trichoderma viridae* and Releasing Predator and Parasite are not followed by farmers

Distribution of farmer on the basis of level of adoption

Extent of adoption of IPM technology by selected farmers. Out of 90 farmers 7 farmers belongs to low group having adoption index of 30.52 per cent, large no of farmer observed in medium adoption i.e. 64 farmer belongs to medium group having adoption index of 51.78 percent . Extent of adoption of IPM technology by 19 farmers belong to high adoption group having adoption index of 67.11 per cent. The contribution of farmers in low, medium and high adoption IPM group was 7.77 per cent, 71.11 per cent and 21.11 per cent respectively. More number of farmers were concentrated in medium adoption of IPM technology as confirmed with the findings of Bansod (2002).

Table 1 : The extent of adoption of IPM technology by selected farmers n=90

Sr. No.	IPM component	Small	Medium	Large	Overall
1	Crop rotation	83.78	71.87	76.19	77.77
2	Trap crop	27.02	40.62	33.33	33.33
3	Removal of alternate host	37.83	43.75	38.09	40.00
4	Clean cultivation	72.79	65.62	66.66	68.88
5	Deep ploughing / Tillage	70.27	81.25	76.19	75.55
6	Crop residue and destruction	56.75	65.62	71.42	63.33
7	Soil manuring	72.79	81.25	90.47	80.00
8	Judicious use of Fertilizer	43.24	46.87	52.38	46.66
9	Pest resistant and tolerant variety	75.67	84.37	90.47	82.22
10	Hand picking and destruction of larvae	37.83	40.62	23.80	35.55
11	Collection and destruction of affected fruit and plant parts	45.94	40.62	28.57	40.00
12	Clipping affected terminal shoots for controlling spotted bollworm	37.83	32.43	19.04	33.33
13	Seed treatment of Trichoderma viridae	-	-	-	-
14	Spraying HaNPV/ Bt.	13.51	21.87	33.33	21.11
15	Use of pheromone trap and Perchar for bird	32.43	46.87	47.61	41.11
16	Spraying of Neem seed extract	54.05	62.50	76.19	62.22
17	Releasing Predator and Parasite	-	-	-	-
18	Insecticides	40.54	43.75	52.38	44.44

Resource utilization

The pattern of utilization of resources by farmers indicates the degree of management of resource, their choice and decision making. Besides this, it indicate the level of technology adopted by the farmers. Human labour, bullock labour, seed, manures and fertilizers for cotton crop were the basic type of resources used, being considered in the present study. Levels of key inputs utilization per hectare in the different adoption groups for cotton crop.

(a) Human labour

An attempt has been made to measure the degree of labour uses, according to farm operations. It helps to formulate the labour calendar. Labour utilization for a crop depends on the intensity of preparatory and cultural operations done for raising crop. Total human labour employed per hectare for cotton crop as seen from Table 10 were 22.1 man days, 25.1 man days and 25.89 man days for low, medium and high adoption groups respectively and at overall level, it was worked out to 24.36 days. Whereas, for female it was 46.76 42.2 and 47.8 for low, medium and high adoption groups respectively and at overall level, it was worked out to 45.58 days.

(b) Bullock labour

Total bullock labour employed per hectare worked out to 9.12 pair days, 9.2 pair days, 8.02 pair days in low, medium and high adoption groups respectively and at overall level, it was worked out to 8.78 pair days.

(c) Machine charges

Total machine hours incurred per hectare worked out to 4.13, 4.95 and 4.4 hours for low, medium and high group respectively and at overall level, it was worked out to 4.49 hr.

(d) Manure and fertilizer

In respect of manures as against the recommended dose of 48-60 quintal per hectare, the actual use is 33.53 quintals in low, 35.51 quintals in medium and 35.83 quintals in high adoption groups respectively, overall average worked out to 34.95 quintals. In case of chemical fertilizer, use of nitrogen, phosphorus and potassium, It was observed that 49.26:27.33:11.22 kg, 51.7:22.06:13.18 kg and 42:17.79:11.44 kg of N: P: K was used respectively in low, medium and high adopter groups.

From above result it is concluded that utilization of fertilizer is low as compared to recommended dose.

(e) Seed

Seed is an important input in crop production and considering the recommended seed rate per hectare for hybrid cotton which is mostly used in this area i.e. 3-4 kg/ ha. It was observed that, its utilization near to recommended level in low, medium and high adopter groups i.e. 3.6 kg, 3.4 kg and 3.21 kg respectively, From these results it could be concluded that the cotton growers used low levels of key inputs as compared to recommended levels except seed hence obtained less yield as compared to recommended yield. The use of nitrogen and phosphorus was mostly through complex fertilizers, hence there was imbalance in their application.

Cost of cultivation

Cost of cultivation of cotton crop has been estimated on the basis of cost A, cost B and cost C. The purpose of estimating these costs is to work out profitability of different crops on the basis of direct costs and imputed costs. Information on item wise cost of cultivation per hectare of cotton at different cost concepts in respect of groups having different adoption level

It is revealed Table that at overall level, per hectare total cost of cultivation (Cost 'C') for cotton was ₹ 23424.44. Main items of cost were rental value of land and hired female and male labour accounting for 24.81 percent, 9.73 percent and 6.86 per cent of the total cost respectively, whereas, share of bullock labour and machinery labour were 6.37 per cent and 5.75 per cent at overall level. Expenditure on FYM, seed, fertilizer, plant protection chemicals accounted for 8.95 per cent, 10.69 per cent, 5.46 per cent and 2.24 per cent respectively of total cost at overall level. Among IPM technology adopted groups also, rental value of land and hired human labour emerged to be important items of cost. As regards rental value of land, its share in total cost in low, medium and high adoption group was 23.03 per cent 24.21 per cent and 27.19 per cent respectively. Whereas the hired female labour was 9.84 per cent, 8.96 per cent and 10.39 per cent in low, medium and high adoption groups respectively and male labour was 5.25 per cent, 7.46 per cent and 7.88 per cent in low, medium and high adoption groups respectively.

Table 2: Per hectare cost of cultivation of cotton by different IPM adoption groups (₹/ha.)

Sr. No.	Items	IPM adoption group			Overall
		Low	Medium	High	
1	Hired labour				
	Male	1247.27 (5.25)	1757.21 (7.46)	1812.9 (7.88)	1605.79 (6.86)
	Female	2338.11 (9.84)	2110.15 (8.96)	2390 (10.39)	2279.42 (9.73)
2	Bullock labour	1551.18 (6.53)	1564.9 (6.65)	1364.28 (5.93)	1493.45 (6.37)
3	Machine charges	1240.52 (5.22)	1486.85 (6.31)	1320.52 (5.74)	1349.33 (5.75)
4	Seed	2570.56 (10.82)	2550.9 (10.84)	2400.27 (10.43)	2567.24 (10.69)
5	FYM	2012.08 (8.47)	2130.79 (9.05)	2150 (9.34)	2097.62 (8.95)
6	Fertilizer	1343.38 (5.65)	1334.48 (5.67)	1164.8 (5.06)	1280.88 (5.46)
7	Irrigation	125.23 (0.52)	212.62 (0.90)	210.26 (0.91)	182.70 (0.77)
8	Plant protection	750.25 (3.15)	523 (2.22)	311.23 (1.35)	528.16 (2.24)
9	Incidental charges	148.56 (0.62)	176.8 (0.75)	105.93 (0.46)	143.76 (0.61)
10	Repairing charges	227.11 (0.96)	222.19 (0.94)	197.27 (0.85)	215.23 (0.91)
11	Interest on working capital@ 6%	813.25 (3.42)	844.19 (3.58)	805.64 (3.50)	821.02 (3.5)
12	Land revenue	103.18 (0.43)	115.12 (0.48)	127.18 (0.55)	115.16 0.48)
13	Depreciation	1620.09 (6.82)	1482.17 (6.3)	1148.39 (4.99)	1416.88 (6.03)
14	Cost A	16090.77 (67.74)	16511.37 (70.18)	15508.67 (67.44)	16036.93 (68.45)
15	Rental value of land	5470.15 (23.03)	5697.51 (24.21)	6252.82 (27.19)	5806.82 (24.81)
16	Interest on fixed capital @ 10%	538.42 (2.26)	469.85 (1.99)	517.21 (2.24)	508.49 (2.16)
17	Cost B	22099.34 (93.04)	22678.73 (96.39)	22278.7 (96.88)	22463.36 (95.43)
18	Family labour				
	Male	723.28 (3.04)	522.63 (2.22)	511.33 (2.22)	585.74 (2.49)
	Female	929.12 (3.91)	325.12 (1.38)	205.09 (0.89)	486.44 (2.06)
19	Cost C	23751.74 (100)	23526.48 (100)	22995.12 (100)	23424.44 (100)

(Figures in parentheses show the percentage to the total)

The other important items of cost in terms of there share in the total cost were bullock labour and machine labour. The share of interest on working capital was worked out to 3.5 per cent at overall level of IPM technology groups. The per hectare total cost of cultivation in low, medium and high adoption groups was Rs.23751.74, Rs. 23526.48 and Rs. 22995.12 respectively. Where as it was observed to Rs. 23424.44 at overall level.

Economics of production of cotton by different IPM adoption groups

Table 3: Economics of production of cotton by different IPM adoption groups

Sr. No.	Particular	IPM adoption groups			Overall
		Low	Medium	High	
1	Yield (Qtl)	12.16	12.5	13.2	12.62
2	Rate/Qtl.	2750	2790	2900	2815.53
3	Per hectare				
	Cost A	16090.77	16511.37	15508.67	16036.93
	Cost B	22099.34	22678.73	22278.7	22352.25
	Cost C	23751.74	23526.48	22995.12	23491.11
4	Gross return	33440	34875.78	38280.27	35532.01
5	Net returns at				
	Cost A	17349.23	18364.41	22771.6	19495.08
	Cost B	11340.66	12197.05	16001.57	13179.76
	Cost C	9688.26	11349.3	15285.15	12107.57

It is revealed from this Table 3 that per hectare production of cotton is observed to 12.16 qtl., 12.5 qtl. and 13.2 qtl in low, medium and high adoption groups respectively. The net returns at cost "A" was observed to ₹ 17349.23, ₹ 18364.41 and ₹ 22771.6 in low, medium and high adoption groups respectively. Gross return observed the highest in high level of adoption of IPM technology i.e. ₹ 38280.27 followed by medium and low level of adoption i.e. ₹ 34875.78 and Rs. 33440 respectively. Net returns was obtained the highest in high level of adoption group i.e. ₹ 15285.15 followed by medium level of adoption group i.e. ₹ 11349.3 and low adoption of IPM technology group i.e. ₹ 9688.26 The study thus revealed that per hectare output of cotton and consequently the gross and net return increased with the level of adoption of technology as confirmed with the findings of Sudhakar *et al.* (1997).

Input-output ratio

It is observed that, the Input-output ratio at overall level at cost "A" worked out to 2.21. at cost "B" and cost "C" the ratio at overall level was 1.59 and 1.51 respectively. Among groups the highest ratio at all the cost were observed in high adoption group i.e. 2.46, 1.71 and 1.66 at cost A, cost B and cost C respectively. Input-output ratio was observed greater than unity in all the adoption groups indicated that cotton cultivation was profitable at all the levels of technology of adoption. It showed increasing trend with increased level of IPM technology of adoption as confirmed with the findings of Vishweshwar and Naik (2000) which indicated higher returns realized per rupee invested in case of IPM farmer than that of conventional farmer.

Table 4 : Input-output ratio for different IPM adoption group of farmers

Sr. No	Benefit-Cost ratio	IPM adoption Group			
		Low	Medium	High	Overall
1	at Cost A	2.07	2.11	2.46	2.21
2	at Cost B	1.51	1.53	1.71	1.59
3	at Cost C	1.40	1.48	1.66	1.51

The discussion thus revealed that cotton production is a profitable proposition in the study area. The production and return from the cotton cultivation, in general increased with the increase in adoption of recommended technologies. Thus, the farmer should adopt IPM technologies to the fullest extent to exploit all the production potential of this crop.

CONCLUSION

Average size of holding for overall farms was observed 4.33 ha. Extent of adoption of IPM technology was found higher in Pest resistant and tolerant variety i.e. 82.22 per cent followed by soil manuring i.e. 80.00 per cent. Most of the farmers i.e. 71.11 per cent were in group of medium level of adoption. The cost of cultivation at cost 'C" was found low in high adoption group i.e. ₹ 22995.12 followed by medium adoption group and low adoption group and it was ₹ 23526.48 and ₹ 23751.74. The Input-Output ratio at cost "C" was 1.4, 1.48 and 1.66 in case of low, medium and high adoption groups respectively. Thus, the production of cotton crop was observed profitable at all technology level. Lack of technical guidance, unaware of critical component of IPM technology, lack of capital, lack of irrigation facilities were found major constraints faced by cotton growers.

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