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Effect of integrated pest management technology on production of cotton in Western Maharashtra

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ABSTRACT
The Integrated Pest Management (IPM) Technology was introduced and demonstrated in one of the villages in Dhule district of Western Maharashtra during 2002-03. The present investigation is an attempt to assess the economic efficiency of IPM in cotton during 2004-05. The results of the study based on the data collected from 30 adopters and 30 non-adopters of IPM indicated that the factors like education, farm size and income of the cotton growers have significant influence on the adoption of IPM. The yield of cotton was increased by 11 per cent. Whereas, 20 and 39 per cent higher gross and net returns were obtained due to adoption of IPM over non-IPM situation. IPM emerges as a cost reducing strategy and has an economic potential to substitute predominantly chemical pest control strategy.

Key words: IPM, Cotton, Cost and returns, Awareness, Adoption.

INTRODUCTION

In recent years the use of pesticides in agriculture have come under severe criticisms because of their technological failure of pest resistance, resurgence and secondary outbreak, and potential hazards to ecology and human health. The resultant effects on farm economy have been escalation in the cost of production, increase in crop losses and reduction in farm profitability. The reduction in pesticide use without effective technological alternatives may results in decline in crop yields and output prices. To address these concerns, the focus of plant protection research is gradually shifting towards development of environmentally safe and economically feasible alternatives to chemical pesticides using biotechnological approaches. Cotton is an important cash crop grown in the State of Maharashtra with on an average area of 28.4 lakh hectares. Dhule is one of the major districts has shared 3.52 per cent of the area under cotton in the State. The crop has occupied an important place in the cropping pattern of the district. Cotton crop also consumes heavy chemical pesticides. In order to reduce the heavy use of chemical pesticides the scientists from the Entomology Section, College of Agriculture, Dhule one of the constituent colleges of Mahatma Phule Krishi Vidyapeeth, Rahuri had introduced and demonstrated the Integrated Pest Management technology for cotton in two villages in the district one viz., Budaki, Tahsil Shirpur in the year 2001-02 and another viz., Henkalwadi, Tahsil Dhule in the year 2002-03. The present investigation is an attempt to examine the effect of IPM technology on production of cotton in the district.

MATERIALS AND METHODS

Sampling and farm characteristics :

The study was undertaken by selecting the second village viz., Henkalwadi tahsil and district Dhule purposively where the IPM technology was introduced and demonstrated in the year 2002-03. The total sample of 60 cotton growers comprised of 30 adopters and 30 non-adopters of IPM technology were selected randomly. The average size of holding of adopters was 2.30 and of non-adopters 2.68 hectares. The proportion of net cultivated area (92.60 per cent) and the irrigated area (13.91 per cent) was relatively higher on IPM adopter farms than non-adopter farms. The average per farm gross cropped area was 2.63 hectares in the case of adopter farms and 2.98 hectares on non-adopter farms. The proportion of area under cotton in the gross cropped area was higher (45.25 per cent) in the case of adopter farms as compared to non-adopter farms (39.26 per cent). The area under food grain crops was by and large the same on both the categories of farms. All the cotton growers use the seed of Nanded-44 variety. The cropping intensity in both the cases of adopter and non-adopter farms was more or less the same.

Analytical approach :

The data on the aspects on awareness, level of adoption and costs and returns of IPM adopters and non-adopters of cotton were collected from the selected cotton growers with the help of specially designed schedules. The data were collected by survey method for the year 2004-2005. For analysis of data partial budget approach was adopted to assess the economic efficiency of IPM. Only variable inputs have been considered for estimating the costs and returns, per quintal cost of production as well as the expenditure on pesticide inputs and total expenditure on plant protection measures for making comparison between both IPM and non-IPM situations on cotton farms. The analysis was further extended to examine the influence of the various factors on adoption of the IPM technology. The results of the study are summarized as under.

RESULTS AND DISCUSSION

Awareness and adoption of IPM technology :

Table 1 represents the information on extended awareness and adoption of IPM technologies on the sample farms.

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Table 1 : Awareness and adoption about ipm technology on sample farms.

(N=No. of farmers)

Technology modules	Non-adopters N=30		Adopters N=30	
	Awareness	Adoption	Awareness	Adoption
Seed treatment	22 (73.33)	10 (33.33)	30 (100.00)	30 (100.00)
Border rows of maize and cow pea alternatively	10 (33.33)	-	28 (93.33)	23 (76.66)
Sataria after every 10 rows of cotton	-	-	27 (90.02)	25 (83.33)
Pheromone traps: 5/ha. (Replacement of lures thrice)	-	-	20 (66.66)	18 (60.00)
NSK (limboli pend extract): 12 kg/ha per spraying: 3 spraying	12 (40.00)	3 (10.00)	28 (93.33)	26 (86.66)
Tricho cards 5/ ha (3 times)	13 (43.33)	3 (10.00)	25 (83.33)	23 (76.66)
Mechanical control: collection of infested larvae, field sanitation etc.	-	-	26 (86.660	19 (63.33)
Chemical control	30 (100.00)	15 (50.00)	28 (93.33)	26 (86.66)

Figures in the parenthesis are the percentages to the total number of selected farms

It is revealed from the table 1 that the awareness regarding the various technology components of IPM was more than 80 per cent in the case of adopters except the use of pheromone traps (66.66 %). The adoption of IPM component for seed treatment was cent percent in case of adopters. While the other components are partially adopted by the adopters. The level of adoption was ranged between 60 to 87per cent by the adopters. It was interesting to note that the non-adopter were also aware of the some of the components of IPM technology. The awareness of seed treatment was 73 per cent and its adoption was only 33 per cent on non-adopter farms. Awareness of some of the components viz., NSK spraying, Trichocards was also observed to some extent in the same category of farms. However, the level of adoption of the same was only to the extent of 10 per cent. The non-adopters mostly rely on chemical control measures had extended its adoption towards 50.00 per cent only.

Factors influencing adoption of IPM

The correlation between adoption and the factors like age, education, farm size and income level of the adopters are expected to influence the adoption of IPM technology of cotton. The results shown in Table 2 indicated that income, education and farm size showed significant correlation with the adoption of IPM technology. The factor viz., age was non-significant indicating that it has least influence on adoption of IPM.

Costs and returns

The average per hectare cost (variable cost) on account of variable inputs on IPM adopter farms was estimated to be Rs. 9821/-, which is marginally higher, as compared to IPM non-adopter farms (Table 3). Input specific cost, however, differed between IPM adopter and non-adopter situations. The expenditure on plant protection inputs was 8 per cent less on IPM adopter farms of cotton showed the significant reduction in the expenditure on pesticides. The maximum saving in the expenditures on the use of chemical pesticides was 82 per cent in the IPM adopters over non-adopters of IPM technology. The difference was highly significant. The per hectare expenditure on account of fertilizers was 18 per cent more on IPM adopter farms than the non-adopter farms. This was followed by 13 per cent in the use of manure and 4 per cent in human labour. Whereas, the expenditure on seed and bullock labour was less by 11.66 and 8.46 per cent respectively. The marginal and non-significant difference in the average total variable cost between the two situations indicated that the IPM technology for cotton does not demand for any additional funds. The second part of the

Table 2 : Correlation with factors of adoption of IPM

Particulars	Correlation
Age	0.0394^{NS}
Education	0.2684^{**}
Farm size	0.2947^{*}
Income	0.3165^{***}

(*, **, *** = significant at 10%, 5%, and 1% level of significance, respectively)

Table 3 : Differentials in costs and returns under adopter and non-adopter situations.

Particulars	Adopters	Non-adopters	% change over non-adopters	t-statistics
Cost				
A) Pest control inputs cost				
1) Chemical pesticides	432.61 (41.8)	2389.04 (845.2)	(-) 81.89	12.66**
2) NPV	285.44 (65.2)			
3) Trichocards	694.65 (144.8)			
4) Nimboli Pend / Extract	705.58 (90.6)			
5) Inter crop seed	68.27 (18.2)			
Total	2186.55 (319.2)	2389.04 (860.0)	(-) 8.47	1.20*
B) Other inputs cost				
1) Human labour	3926.55 (803.2)	3777.21 (619.7)	(+) 3.95	0.80*
2) Bullock labour	377.42 (79.3)	412.33 (92.7)	(-) 8.46	1.56*
3) Manures	407.81 (426.4)	360.15 (527.5)	(+) 13.23	0.38 NS
4) Fertilizers	1167.20 (312.4)	988.18 (287.9)	(+) 18.11	2.30**
5) Seed	1755.56 (41.3)	1987.26 (441.1)	(-) 11.66	2.86**
Total	7634.54 (312.3)	7525.13 (822.4)	(+) 1.45	0.68 NS
Total variable cost	9821.09 (1,232.8)	9914.17 (1,982.7)	(+) 0.94	0.21 NS
Returns				
1) Cotton yield (Qtl/ha)	11.54 (3.54)	10.43 (1.19)	10.64	1.73*
2) Gross returns	23529.82 (4,799.2)	19764.85 (3,309.8)	19.05	3.40**
3) Net returns	13708.73 (4801.5)	9850.68 (3,776.3)	39.16	3.45**

Figures in parentheses are standard deviations.
** and * indicate significance level at 1 and 5 per cent respectively.

Table 2 indicates the returns from both the situations. The yield of cotton on IPM adopter farms was 11.54 qtl/ ha which was more by 10.64 per cent than the IPM non-adopter farms. The mean value of output on IPM adopter farms was Rs. 25,350/ha, which was 19 per cent higher than the non-adopter farms of IPM and is statistically significant. Highly significant difference in net returns i.e. 39 per cent more on IPM adopter farms was also realized.

Unit cost of production

The economic efficiency of a particular technology can be judged by the per unit cost of output. Table 4 presents

Table 4 : Cost of production under adopters and non-adopters of IPM

Inputs	Adopters	Non-adopters	% change over non-adopters	t-test
Total variable cost	851.05 (337.27)	950.54 (285.51)	-10.46	1.44*
Cost of plant protection inputs	189.48 (70.09)	229.05 (107.97)	-17.28	1.95*
Total cost of plant protection	252.56 (107.38)	302.07 (131.25)	-16.39	1.85*

Figures in parentheses are standard deviations.
** and * indicate significance level at 1 and 5 per cent respectively.

the per quintal cost of production of cotton with IPM adopter and non-adopter situations. On consideration of total variable cost the per quintal cost of production of cotton was Rs. 851/- on adopter farms which was significantly less by 10 per cent over the non-adopter farms. The cost of plant protection inputs per quintal of output on adopter farms was 17 per cent less than the non-adopter farms. The per unit total cost of plant protection (includes cost of inputs, application and labour cost and cost on account of hand picking of insect larvae etc.) on adopter farms was 16 per cent less than the non-adopter farms. Therefore, IPM technology can substitute the existing chemical pest control since it has proved to be a cost reducing strategy.

CONCLUSIONS

The study concluded that the IPM appears to be an effective alternative to chemical pest control. The awareness and adoption of IPM technology was observed to be more than 80 per cent for the adopters. The factors like education farm size and income of the cotton growers have significant influence on the adopters of IPM technology. The IPM could reduce the pesticide use without having any adverse effect on crop yield. The per hectare yield was higher by 11 per cent on IPM farms. The use of some inputs was higher on IPM adopter farms but this did not make any significant difference in the average cost of cultivation between IPM adopter and non-adopter farms. The gross return on IPM adopter farms were 19 per cent higher even the IPM practice is a labour intensive one. There was a gain in net income by 39 per cent due to adoption of IPM. The per quintal cost of production of cotton was less by 10 per cent on IPM adopter farms. IPM emerges as a cost reducing strategy and has economic potential to substitute predominantly chemical pest control strategy.

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