The Andhra Agric. J 55(3):393-396, 2008

Economic Analysis of Cotton Production Using Integrated Pest Management Technologies in Andhra Pradesh

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ABSTRACT

This study has been undertaken to make cotton production in the state of Andhra Pradesh globally competitive by reducing the cost of production at farmer's level through adoption of new pest management technologies, namely Integrated Pest Management (IPM). A sample of ten experimental and ten control plots has been taken for each technology in three villages every year consecutively for 5 years period. Every year the farmers were changed from the same village. The study has revealed that the adopters of IPM could get higher yield as compared to non-adopters. These technologies have been found cost-effective due to reduced cost of per quintal production by Rs 129. These technologies have been found to generate more income as the adopters could earn Rs 4072/ha when compared to the non-adopters. The IPM technologies have reduced the cost of plant protection by 27 per cent. Total number of sprays reduced considerably by 3.3 sprays with adoption of IPM. This was apparent from the results that saving in plant protection by adoption of IPM is 1401/- The cost-benefit analysis has shown these technologies to be economically viable. These technologies will reduce the chemicals-consumption and enhance the productivity of cotton on sustainable basis with lower cost of production, which in turn would protect the environmental health and economic condition of the debt ridden cotton growers on a long-term basis.

key words : Cotton production, Integrated Pest Management Technologies.

Cotton popularly known as 'white gold' is the most important commercial crop of Andhra Pradesh with an acreage of 9-10 lakh ha accounting to 10-15% of total cropped area under rainfed situation. The average yield of cotton worked out to be 552 kg/ha, which is about two-thirds of the potential average yield of the important cotton varieties grown in the state. The major factor responsible for low productivity and quality deterioration of cotton in the state as well as in the country is the severe attack of insects/pests on this crop, from sowing to harvesting. These insects/ pests, which include bollworms and sucking pests, cause about 50 per cent loss in cotton (Dhaliwal and Arora, 1996). To check this loss in cotton, farmers use huge amount of pesticides on this crop. About 54 per cent of the total pesticides are used only on cotton, leading to higher cost of its production and deterioration in its quality (GoI, 1997). The yield of the cotton crop witnessed a significant decline year-after-year during 1990s. The intertwining of increased cost of production with low yields has resulted in sharp decline in the net earning of the cotton growers in the state. This phenomenon has pushed these farmers into debt-trap forcing some of them to commit suicides (Singh and Toor, 2005).

For sustainable cotton production in the state, the Acharya N G Ranga Agricultural University (ANGRAU) is the first in India to come out with multi-component Integrated Pest Management (IPM) strategy but spread is not satisfactory (Rao and Rao, 2006). Under the Technology Mission on Cotton (TMC), set up by the Government of India in 2001, efforts were made to bring the pesticide-use down to 20 per cent (Mayee, 2003) by developing new technologies for cotton production, the most important being Integrated Pest Management (IPM) The IPM is a decision-support system for the selection and use of pest-control tactics, singly or harmoniously coordinated into a management strategy based on cost-benefit analysis that takes into account the interests of and impacts on producer, society and environment. Keeping in view the importance of these technologies in controlling indiscriminate use of pesticides for sustaining cotton productivity, an attempt has been made to evaluate the impact of IPM technologies on selected farmers' cotton fields in the state of Andhra Pradesh. More specifically, the present investigation was focused on evaluating the impact of these technologies on cotton productivity, cost of production, plant protection expenditure, net returns, economic viability in the cotton belt of Andhra Pradesh state.

MATERIAL AND METHODS

The study was undertaken during 2002-07 for five consecutive years as part of the TMC MM 5.1 project entitled "Evaluation of cotton production technologies for fiber quality, yield and economic viability". The economic viability of IPM technologies was examined in the project villages of Andhra Pradesh following with & without technology. IPM trials were conducted in three villages Jonnalagadda, Anathavarappadu and Pedapalakaluru in Guntur district of Andhra Pradesh. Experiments were conducted on 10 farms using IPM technology and on 10 farms without IPM technology from the same village each year coming to 50 farms in 5 years period. Each year 10 new farmers were selected to conduct the trials from the same village. To eliminate the impact of farm-size and variety, these variables were kept constant on the sample farms. Each demonstration was conducted on one acre plots and the non-adoption sample data was also generated from one acre. For working out gross returns, the actual price of cotton received by the farmers in the market was used. The variable costs included expenditure on seeds, fertilizers, insecticides/ pesticides, human/machine /bullock labour and irrigation along with 12 per cent interest on working capital.

Details of IPM Technology adopted: Integrated Pest Management developed at Regional Agricultural Res. Station, Lam, Guntur district has paved the way for the successful cultivation of the cotton crop. The following are the salient features of IPM.

* Growing cotton in a rotation crop to restore polyculture in the system.
* Growing intercrops/strip crops (cowpea, groundnut, green gram, soybean, cluster bean) were found better in increasing the population of natural enemies.
* Growing fodder jowar or maize as barrier crop around cotton and castor and marigold as trap crops was found more advantageous.
* Replacement of sprayable insecticides in the initial stages of crop growth by seed treatment with insecticides like Carbosulfan 25 DS @ 40 g/kg or Imidacloprid 70 WS @ 5 g/kg of seed or Thiomethoxin @5g/kg followed by stem application of Monocrotophos @ 1 ml/4 ml of water or Imidacloprid 200 SL @ 1 ml/20 ml of water. This would help in preserving the populations of natural enemies of cotton pests.
* Monitoring of pests by using pheromone (10 traps/ha) and light traps.
* Release of Trichogramma egg parasites @ 1, 50, 000/ ha coinciding with the first brood of bollworms.
* Topping of cotton plants at 14-16 sympodial stage (around 100 days) to avoid egg laying of *Heliothis* on tender leaves.
* Erection of bird perches @ 10 Nos./ac to promote the bird predation of grown up larvae
* Hand collection of grown up larvae
* Application of HaNPV @ 500 LE/ha mixed with 1.25 kg/ha of jaggery and 200 ml teepol or Bt formulation or neem seed kernel extract (5%).
* Spraying of certain insecticides like Endosulfan or Chlorypyriphos with synergists like sesame oil. Mixing of sesame oil with Endosulfan in 1:2 ratio or with Chlorpyriphos in 1:4 ratio is desirable.
* Need based application of recommended insecticides – Triazophos/ Endosulfan/ Profenophos/ Neemoil against whitefly, Endosulfan/ Qnuinalphos/ Acephate/ Triazophos/ Indaxocarb/ Spinosad against *Helicoverpa*.
* Removal of cotton stubbles after last picking without opting for ratoon crop to break the cycles of problem pests.

RESULTS AND DISCUSSION

Cotton productivity:

The very objective of any technological intervention is improved productivity. Five years average productivity of cotton with the intervention of Integrated Pest Management technologies was averaged and presented in Table. A close look at the Table reveals that IPM technologies had a positive impact on cotton productivity as 3.7 per cent higher yields were obtained on experimental plots than control plots. Though the per cent increase in productivity is at minimal level the other important factors like environmental pollution and consequent health problems taken into consideration the technology would be a viable alternative.

Pesticide use:

The indiscriminate use of pesticides in cotton cultivation has caused several negative externalities in the farm and non-farm sectors (Painuly et al., 1998). Although, the main objective of IPM technologies in cotton was to obtain sustainable cotton production by reducing the use of pesticides, these continue to be a major component of IPM owing to several constraints such as the use of cultural practices, non-availability of resistant cultivars, effective parasitoids and microbes, etc. On the basis of the experiments,

experts recommend the selection of a pesticide along with strict adherence to its dosage, time, and method of application, etc. to control the pest complex of cotton eco-system during vegetative (jassid and white fly) and flowering (bollworms and white fly) phases (Singh and Singh 2007).

The judicious use of pesticides with the adoption of IPM was observed from results presented in the table. Twenty seven per cent reductions in cost of plant protection was observed with the adoption of IPM technologies. Total number of sprays reduced considerably by 3.3 sprays with adoption of IPM. This was apparent from the results that saving in plant protection by adoption of IPM is 1401/ - . This might be due to expert guidance received by the project farmers leading to need based use of pesticides by following economic threshold level (ETL) in contrast to non IPM farmers who would have used pesticides indiscriminately with the advice of dealers/traders and/or fellow farmers.

Cost and returns structure:

The economic viability of the intervention is the major factor to be considered for adoption of a practice. Hence, cost of cultivation and net returns were worked out in detail. The net returns were worked out after deducting the fixed as well as variable expenditure from the gross returns. The analysis revealed that per hectare cost of cultivation was reduced by Rs 2408 with the adoption of IPM practices. This could be seen by reduction in the unit cost of production of kapas i.e., Rs 1282 per quintal with the IPM adoption where as in farmers practices the cost for production of 100kg kapas is Rs 1440, resulting 9.1 per cent reduction in unit cost of production.

The ultimate measure for the farmers in judging the worth of the technology is net income from the adoption. It could be observed from the table1 that the incremental increase in net income is Rs 4072/-. The increment in income is highly apparent that the increase is about 65 per cent more compared to control. Though the net income with the adoption of IPM practices Rs 10299/- and with farmers practices Rs 6227/-. This is the net income after deducting the fixed costs also. If only variable expenditure is considered the increase in gross income is about 25 per cent higher over control.

Economic viability:

The economic viability of IPM technologies was examined by computing benefit-cost ratios (BCR), i.e. the ratio of gross margins to the total expenditure which includes variable expenditure and fixed costs incurred in growing cotton and the results obtained are given in Table. The BCR is higher for the cotton grown on the plots using cotton pest management technologies (1.56) compared to non adopter (1.42) implies that the returns were more through IPM technologies. This shows that these technologies are cost effective and economically viable.

Constraints identified in adoption of the IPM technology:

- § Availability of IPM components like Ha NPV, NSKE in sufficient quantities in the open market.
- § Non availability of Bio agents in the open market.
- § IPM demonstrations conducted at individual holdings were found ineffective and unconvincing.

Conclusions:

Insects/ pests pose serious problems, from sowing to harvesting stages, in the cultivation of cotton crop. For the sustainable production of cotton and judicious use of pesticides, new cotton pest management technologies, namely IPM was developed. The study has revealed that the adoption of the Integrated Pest Management technology reduced about 7 per cent cost of cultivation and achieved 25 percent more net returns when compared to Non IPM farmers. They realized higher input-output ratio (1:1.56) than non adopted farmers (1:1.42). These technologies are cost-effective (decrease production cost) and more remunerative (increase the net income of the farmer). All the parameters used for the evaluation have conferred that these technologies are economically viable at the farmer's field. The study has suggested that the state, researchers and extension workers should launch a mass campaign to educate the farmers about these technologies. It would improve the economic condition of cotton-growers and check the environmental deterioration due to excessive use of insecticides. Above all, it would sustain and enhance the productivity of cotton in the state on a long-term basis.

Acknowledgement:

The data for this paper have been taken from the research project "Evaluationof Cotton Production Technologies for Yield, Fiber Quality and Economic Viability, funded by ICAR, New Delhi under Technology Mission on Cotton Mini Mission1 (TMC MM1). The authors thank the farmers for adopting the recommended technology and providing data as and when required.

Table 1. Economics of Integrated Pest Management (IPM) technologies in Cotton Production (2002-07)

				N = 50
S.No	Operational differences in expenditure	IPM technology	Farmers practice	Addition / Reduction over farmers practice
A.	**Fixed Cost**			
1	Land Revenue	338	338	0
2	Interest on fixed capital	193	193	0
3	Rental Value	9300	9300	0
4	Total Fixed Cost	9831	9831	0
B.	**Variable Cost**			
1	Ploughing Cost	3265	3178	87
2	Seed & Sowing Expenditure	1875	2785	-910
3	Intercultural Operation	3163	2976	187
4	Fertilizer & Application	3154	3455	-301
5	Total no.of sprays	8.1	11.4	-3.3
6	Plant protection cost with application cost	6987	8388	-1401
7	Picking cost	5566	5400	166
8	Marketing charges	1345	1197	148
9	Interest on working capital	476	856	-380
10	Total Operational Cost	25839	28246	-2408
11	Total cost of cultivation (A+B)	35669	38077	-2408
12	Yield(q ha^{-1})	28	27	1
13	Price realized (Rs. qt^{-1})	2005	2005	0
14	Gross Return (Rs. ha^{-1})	55799	54135	1664
15	Cost of Production(Rs. qt^{-1})	1282	1410	-129
16	Net Return(Rs. ha^{-1})	10299	6227	4072
17	Benefit Cost Ratio	1.56	1.42	0.14

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(Received on 1.02.2008 and revised on 05.06.2008)