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Economics of INM Technologies for Sustainable Cotton Production and Fiber Quality: A Five Year Study 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 Integrated Nutrient Management (INM). A sample of ten experimental and ten control plots has been taken for each technology in two 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 INM could get higher yield as compared to that by non-adopters. These technologies have been found cost-effective due to reduced cost per quintal production by Rs. 114. These technologies have been found to generate more income as the adopters could earn Rs.4105 ha^{-1} as compared to that by the non-adopters. This was apparent from the results that saving in fertilizer cost by Rs. 94 and reduction in plant protection is 1004/- with reduced sprays by 1.4 times. The INM technologies do not have any negative impact on the quality parameters of cotton. These technologies will reduce the chemical fertilizer-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 prodiction, Fiber quality, I N M Technologies.

Normally farmers are applying the chemical fertilizers as basal. The cotton plants are more responsive to chemical fertilizers only when sufficient moisture is available in the soils. Cotton is a heavy feeder of major nutrients**.** It responds well to higher doses of fertilizers particularly nitrogen. So the farmers are applying higher doses of inorganic fertilizers resulting in more pest and disease attack. The supplement of nutrients supplied through organic manures not only improves crop yields but also sustains the soil health and productivity. Sustainable higher yields could be achieved through Integrated Nutrient Management (INM). The farmers of the present project area are applying double the dose of Nitrogen in inorganic form against the recommended dose of 120 kg N ha^{-1}. This leads to improper ratio of applied Phosphorous and Potash nutrients. The Scientists suggests the farmers to apply recommended dose of 120:60:60 kg NPK ha^{-1} in inorganic form and add 10 t. FYM ha^{-1} or any other organic manure to the field before land preparation. This will also help in increasing the water holding capacity of the soil as the cotton is being grown in rainfed areas. The most efficient and economic crop production system in the long run consists of a combination of organic manures and chemical fertilizers combining the best aspects of both the types of nutrient supply (FFTC 1991). Hence the present study was under taken to know the impact of Integrated Nutrient Management (INM) practices on economics and fiber quality parameters of cotton.

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 INM technologies was examined in the project villages of Andhra Pradesh following with & without technology. INM trials were conducted in Jangamguntlapalem and Pedapalakaluru villages in Guntur district of Andhra Pradesh. Experiments were conducted on 10 farms using INM technology and on 10 farms without INM technology from the same village each year making a total of 50 farms in 5 years period. Every year the farmers were changed 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 and for the non-adoption sample data was generated from one acre. For working out gross returns, the actual price of cotton received by the farmers in the

Table 1. Economics of Integrated Nutrient Management (INM) technologies in Cotton (2002-07)

N = 50

S.No	Operational differences in expenditure	INM Intervention	Farmers Practice	Addition / Reduction over farmers practice
A.	**Fixed Cost**			
1	Land Revenue	338	338	0
2	Interest on fixed capital	199	199	0
3	Rental Value	9591	9591	0
4	Total Fixed Cost	10127	10127	0
B.	**Variable Cost**			
1	Ploughing Cost	3080	3350	-270
2	a)Seed &Sowing Expenditure	1890	2375	-485
	b)Seed Cost			0
	c)Sowing expenditure			0
3	Intercultural Operation	3289	3150	139
4	Fertilizer & Application	3556	3650	-94
5	Total no.of sprays	8.6	10	-1.4
6	Plant protection cost with application cost	7950	8954	-1004
7	Picking cost	5740	5450	290
8	Marketing charges	1478	1227	251
9	Interest on working capital	506	528	-22
10	Total Operational Cost	27498	28694	
11	Total cost of cultivation(A+B)	37624	38821	-1197
12	Yield(q ha^{-1})	28.5	27.3	1.4
13	Price realized (Rs. qt^{-1})	2005	2005	0
14	Gross Return (Rs. ha^{-1})	57544	54636	2907
15	Cost of Production(Rs. qt^{-1})	1311	1425	-114
16	Net Return(Rs. ha^{-1})	9793	5688	4105
17	Benefit Cost Ratio	1.53	1.41	0.12

Table 2. Quality parameters of cotton fiber with INM technologies 2002-07

N = 50

S. No.	Quality parameters	Farmers practice	Intervention
1	GOT	37.17	36.74
2	Staple Length	29.36	31.03
3	Micronaire Value (Fineness)	3.94	4.03
4	Bundle Strength	21.12	21.80
5	U R	41.48	43.98
6	FMR	0.83	0.82

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 Integrated Nutrient Management (INM) Technology

INM means supply of crop nutrients through all available sources namely chemical fertilizers, organic manures, bio-fertilizers etc. Conjunctive use of inorganic and organic fertilizers in 2/3 and 1/3 ratio is recommended. Sow green manure/legume crop before sowing of cotton. Use of organic manures at 10 t/ha as FYM, compost, vermi compost or any organic residue. Apply before sowing and incorporate in the soil.

Benefits:

Use of organic + inorganic is important

1) To save fertilizer
2) To improve fertilizer use efficiency
3) Organics provides micronutrients and check their deficiency
4) Improves soil physical properties, (in clay soils it brings better aeration and root penetration)
5) Organics promotes microbial activity and makes native nutrients available

Such practice maintains soil fertility and helps in realizing sustainable yields

Results and Discussion

Cotton productivity:

The very objective of any technological intervention is improved productivity. The mean values of productivity of cotton during the project period with the intervention of Integrated Nutrient Management technologies were presented in Table 1. A close look at the table 1 reveals that INM technologies had a positive impact on cotton productivity as 4.4 per cent higher yields were obtained on experimental than control plots. Though the per cent increase in productivity is at minimal level the other important factors like soil pollution and degradation and consequent problems in sustaining production taken into consideration the technology would be a viable alternative.

Although, the main objective of INM technologies in cotton was to obtain sustainable cotton production by reducing the use of chemical fertilizers, these continue to be a major component of INM owing to several constraints such as the non-availability of organic manures like FYM, bio-fertilizers, etc. On the basis of the experiments, experts recommend the combination of inorganic and organic fertilizers in 2/3 and 1/3 ratio for better crop growth and higher yields with better returns and ultimately reduced dependency on external inputs.

The integrated use of organic and inorganic manures with the adoption of INM was observed from results presented in Table 1. This was apparent from the results that saving in fertilizer cost by mere Rs 94/-, but reduction in plant protection by adoption of INM is 1004/- . This might be due to low incidence of pests and diseases because of proper use of manures and fertilizers which arrest luxuriant vegetative growth. This trend was reflected through the total number of sprays, which are reduced considerably by 1.4 sprays with adoption of INM.

Cost of production and returns:

The economic viability of the intervention is another 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 incurred in growing cotton from the gross returns received by the farmers.

The analysis revealed that per hectare cost of cultivation was reduced by Rs. 1197/- with the adoption of INM practices. This could be seen as reduction in the unit cost of production of kapas i.e., Rs 1311/- per quintal with the INM adoption where as in farmers practices the cost for production of 100 kg kapas is Rs 1425/-, leading to 8 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. 4105/-. The increment in income is highly apparent i.e. about 72 per cent more compared to control. Though the net income with the adoption of IPM practices Rs. 9795/- and with farmers practices Rs. 5688/-. This is the net income after deducting the fixed costs also. If only variable expenditure is considered the increase in gross income is about 26 per cent higher over control.

The economic viability of INM technologies was examined by computing benefit-cost ratios (BCR), i.e. the ratio of gross margins to the total expenditure which includes input expenditure and fixed costs incurred in growing cotton and the results obtained are given in Table 1. The BCR is higher for the cotton grown on the plots using cotton pest

management technologies (1.53) compared to non adopter (1.41) implies that the returns were more than the expenditure. This shows that these technologies are cost effective and economically viable.

Fiber quality parameters:

Quality of lint was analyzed with the help High Volume Instrument (HVI) at Central Institute for Research on Cotton Technology (CIRCOT) centre established at Lam, Guntur district of AP. From the figures presented in the Table 2, it was revealed that the intervention of IPM do not have bearing on the analyzed fiber quality parameters like Grow Out Test (GOT), Staple length, Micronnaire value, Uniformity Ratio (UR) and Fiber Maturity Ratio (FMR).

Conclusions

For the best practices, sustainable production of cotton and integrated use of organic and inorganic sources of nutrients IPM was developed. The present study revealed that the adoption of the Integrated Nutrient Management technology reduced about 7 percent less on cost of cultivation and achieved 26 percent more gross returns when compared to Non IPM farmers if variable costs are considered. They realized higher input-output ratio (1:1.53) than non adopted farmers (1:1.41). These technologies are cost-effective (decrease production cost) and more remunerative (increase the net income of the farmer). Adopted farmers realized 5.05 % increase in yield than non adopted farmers. The gross returns and net returns of adopted farmers were Rs1211/-ha and Rs.4118 /-ha, respectively more when compared to non-adopted farmers. So proved economically viable at the farmer's field. The other farmers are ready to adopt INM in cotton as it results in more economic returns than non-adopted farmers and it was considered as one of the most important component of sustainable agriculture. 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 fertilizers and insecticides. Above all, it would sustain and enhance the productivity of cotton in the state on a long-term basis.

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