Impact assessment of adoption of production technology on productivity of cotton in Dhule district of Maharashtra

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ABSTRACT

The study of three years data (2017-18 to 2019-20) on impact assessment of technology adoption on cotton production in Dhule district indicated that the adoption of package of practices had increased the average per hectare production of cotton by 57.72 per cent while cost of production was decreased by 7.69 per cent with B-C ratio of 2.70 over 1.58 in farmers' practice. This indicated the importance in use of recommended package of practices in enhancing productivity of cotton and thereby the income of farmers from cotton cultivation. It is therefore recommended that the farmers from Dhule district be motivated for the use of recommended package of practices for cotton cultivation.

Keywords: Cotton; technology; adoption; impact assessment

INTRODUCTION

The main cotton growing belts in north Maharashtra are Jalgaon, Dhule, Nandurbar and Nashik districts with Jalgaon and Dhule contributing 80 per cent of the total acreage and production (Pawar 2019). The area under organic cotton production in Dhule district is large as compared to other districts in Maharashtra and it is increasing day by day (Khandikar et al 2010).

Cotton is a crop that underwent continuous technology and policy shifts over period of time and thus is a test case through which one can examine the changes in the growth and associated instability. The major technology and policy changes cotton cultivation saw include the commercial hybrids' introduction in late 1960s, diffusion in 1970s and 1980s supported by favourable public policy, emergence of new constraints in cotton cultivation in technological and institutional fronts in 1990s and introduction of genetically modified cotton during early years of the last decade (Suresh et al 2013). Besides low prices of cotton nationally and internationally due to non-adoption of recommended technologies of cotton production is also a limiting factor in cotton production (Mahmood et al 2017).

Technological change holds the potential to increase crop output as well as incomes of farmers and the communities in which they live (Gupta et al 2018).

Agricultural development system represents a complex organization including research, education, extension, training and clientele groups (Wasnik et al 2003). The Indian textile industry occupies a pivotal place in the country's economy. With over 1,500 mill units, about 40 lakhs handlooms, 17 lakhs power loom units, the textile industry is the single largest industry of the country. It accounts for 20 per cent of industrial production and 7.5 per cent of GDP. The different sectors of the industry provide employment to about 27 million people. Besides a large population, engaged in cotton growing and ginning, manufacture of man-made fibres, chemicals, trade, transport, banking, insurance etc derives its livelihood from the indirect employment generated by the textile industry. Thus technology transfer in cotton production for sustainable cotton development becomes imperative since there are considerable gaps in research and development activities to cotton and also it becomes more cost intensive and complex.

The present study was conducted to assess the impact of adoption of production technology on productivity of cotton in Dhule district of Maharashtra.

METHODOLOGY

The Tavkheda village in Shindkheda Tehsil of Dhule district, Maharashtra was selected purposively for the study. In all total 100 farmers were randomly selected of which 33 per cent were small and very small landholders. The objectives of the study were to assess the impact of technology adoption on productivity of cotton and to find out the changes in income of the cotton growers due to adoption of technology. The sampling design adopted was both purposive and simple randomization. The National Agricultural Development Programme 'Farmers First' was implemented by ICAR- KVK, Dhule, Maharashtra at Tawkheda village under which the production technology of cotton was studied. For studying the impact of technology adopted on productivity of cotton, the data of 100 farmers of the same programme during the period of three years viz 2017-18, 2018-19 and 2019-20 were collected. The collected data were analyzed by using the simple statistical tools such as averages, percentage change and paired t-test.

RESULTS and DISCUSSION

The integrated crop management production technology developed by Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, Maharashtra for cotton production and its usage on farmers' fields is given in Table 1.

Cotton was sown during 26 May to 21 June and the technology as per Table 1 was implemented on 100 farmers' fields and the change in the production was worked out. Further, per hectare production, cost of cultivation, income and benefit-cost ratio were worked out and are presented in Table 2.

The per hectare production of cotton was increased due to adoption of technology over all the three years (2017-18 to 2019-20). The market prices received were more in 2018-19 compared to 2017-18 and 2019-20. The cost of cultivation in farmers' practice and technology adoption was decreased over the period 2017-18 to 2019-20 whereas it was highest ie Rs 46,784 and 43,624 respectively in the year 2017-18. The B-C ratio in case of farmers' practice and technology adoption was highest ie 1.88 and 3.10 respectively in the year 2018-19.

The increase in per hectare production was the result of adoption of package of practices of cotton cultivation in all the 3 years viz 67.63, 51.38 and 51.69 per cent for the year 2017-18, 2018-19 and 2019-20 respectively with an average of 57.72 per cent. The cost of cultivation was reduced from 6.75 to 8.25 per cent whereas the total income increased from 51.38 to 67.60 per cent.

Table 1. Integrated crop management technology package for cotton developed by MPKV

Input	Required/used
Soil health card	Yes
Seed (kg/ha)	2.5
Compost (FYM) (tonnes/ha)	10
Biofertilizers	
Azotobactor (g/ha)	625
Phosphorus solublizing bacteria (g/ha)	625
Trichoderma (kg/ha)	2.5
Chemical fertilizers (kg/ha)	125:65:65 (N:P:K)
Micronutrients	
Zink sulphate (kg/ha)	12.5
Ferrous sulphate (kg/ha)	12.5
Crop protection	
Vertisilium (kg/ha)	2.5
Neem oil (ml/ha)	1250
Dimethoate (ml/ha)	1250
Copper oxychloride (g/ha)	1250
Streptocycline (g/ha)	60
Yellow sticky track (number)	50

Table 2. Production cost, income and B-C ratio of cotton cultivation

Component	Year			
	2017-18	2018-19	2019-20	Average
Production (q/ha)				
Farmers' practice	15.85	13.72	11.22	13.60
Technology adoption	26.57	20.77	17.02	21.45
Per cent change	67.63	51.38	51.69	57.72
Market price (Rs/q)	4,733.33	5,639.5	4,700	5,024.28
Income (Rs/ha)				
Farmers' practice	75,083	77,373	52,734	68,397
Technology adoption	1,25,840	1,17,128	80,008	1,07,659
% Change	67.60	51.38	51.72	57.40
Cost of cultivation (Rs/ha)				
Farmers' practice	46,784	41,196	41,571	43,184
Technology adoption	43,624	37,798	38,173	39,865
% Change	-6.75	-8.25	-8.18	-7.69
B-C ratio				
Farmers' practice	1.60	1.88	1.27	1.58
Technology adoption	2.88	3.1	2.09	2.70

The significance of difference between productivity of cotton, cost of cultivation and income with farmers' practice and using package of practices given by the Mahatma Phule Krishi Vidyapeeth, was tested by using paired t-test and results are presented in Table 3

It was found that the difference between cost of cultivation, productivity and income of cotton cultivation with farmers' practice and using package of practices given by University was statistically significant at 1 per cent level of significance for all the years viz 2017-18, 2018-19 and 2019-20.

Problems faced by the cotton growers in adoption of technology package

The information on problems faced by the cotton growers was collected from the farmers (Table 4).

The major problems faced by the cotton growers were lack of technical information like knowledge regarding plant spacing, identification of pests and diseases, insecticides and corresponding sprays.

Singh and Singh (2017) found that the adopters of integrated pest management (IPM) and insecticides resistant management (IRM) technologies in cotton belt of Punjab could get significantly higher yield as compared to that by non-adopters. These technologies were found cost-effective due to higher production and could reduce the per quintal production cost by Rs 253 and Rs 175 respectively. These technologies were found to generate more income and employment as the adopters could earn Rs 6,840 and 5,901/ha more income as compared to that by the non-adopters. The gain in human employment due to adoption of these technologies was of 11 and 12 human days/ha respectively. The IPM and IRM technologies have reduced the pesticides consumption by 67 and 54 per cent respectively. The cost-benefit analysis showed these technologies to be economically viable.

Cotton is a crop that underwent continuous technology and policy shifts over period of time and thus is a test case through which one can examine the changes in the growth and associated instability. The major technology and policy changes cotton cultivation saw include the commercial hybrids' introduction in late 1960s, diffusion in 1970s and 80s supported by favourable public policy, emergence of new constraints in cotton cultivation in technological and institutional fronts in 1990s and introduction of genetically modified cotton during early years of the last decade. This study revealed that shifts in technology and policy were associated with distinct changes in major agricultural parameters like growth and instability of area, production and yield. National cotton production stagnated during pre-hybrid phase, exhibited significant and positive growth during the early hybrid phase ushered in by public sector and showed stagnation again during the late hybrid phase. This was followed by significant positive growth during the *Bt* phase. This

Table 3. Differences in cost of cultivation, productivity and income from cotton cultivation

Year	Farmers' practice	Technology adoption	Calculated t-value of paired t-test	Table t-value of paired t-test
Cost of cultivation (Rs/ha)				
2017-18	46,784	43,624	79.52***	1.99
2018-19	41,196	37,798	53.27***	1.98
2019-20	41,571	38,173	53.28***	1.98
Average	43,184	39,865	95.18***	1.96
Productivity (q/ha)				
2017-18	15.85	26.57	38.53***	1.99
2018-19	13.72	20.77	18.97***	1.98
2019-20	11.22	17.02	15.60***	1.98
Average	13.60	21.45	31.99***	1.96
Income (Rs/ha)				
2017-18	75,083	1,25,840	38.25***	1.99
2018-19	77,373	1,17,128	18.93***	1.98
2019-20	52,734	80,008	15.60***	1.98
Average	68,397	1,07,659	31.97***	1.96

Table 4. Problems faced by cotton growers before adoption of package of practices developed by the MPKV

Problem	Respondents (%)
Lack of technical information	91
Lack of knowledge regarding plant spacing and seed rate	46
Identification of pests and diseases	87
Pest related insecticides and number of sprays	72
Lack of information about soil testing	89

trend was in tandem with the trends in yield as well. The pattern of growth in area, production and yield was closely associated with instability also– generally low during the pre-hybrid phase, increased substantially during the early hybrid phase, but fell during the late hybrid phase and exacerbated during the *Bt* phase.

Suresh et al (2013) opined that shifts in technology and policy are associated with distinct changes in major agricultural parameters like growth and instability of area, production and yield.

Mahmood et al (2017) assessed the awareness and adoption of recommended cotton production technologies at Faisalabad, Pakistan and found that awareness level of some production technologies like tillage, selection of varieties, time of sowing, seed rate, seed treatment, thinning and weed control was high as compared to other technologies like fertilizer application, irrigations, insect pest management and picking. The high level of awareness led to higher adoption of that particular production practice. It was suggested that modern methods of communication like internet, mobile and videos should be effectively used for dissemination of agricultural technologies to increase cotton production.

Gupta et al (2018) carried out a local economy-wide impact evaluation of productivity enhancing technological change amongst small-scale cotton producers in Tanzania's lake zone and observed that demand constraints shifted benefits from farmers to downstream processors while limiting positive spillovers within local economies. Excess cotton gin capacity did the opposite. They were of the view that interventions to ensure markets for increased output should complement strategies to raise productivity if a project's goal is to improve welfare in farm households and the communities in which they live.

Shabbir and Yaqoob (2019) explored that overall improvement in farm inputs had a more stable impact on the productivity of cotton in Pakistan whereas HYV seeds, mechanization and area were the real reason for the growth in India.

CONCLUSION

The average per hectare production and income of cotton cultivation was increased by 57.72 and 57.40 per cent respectively due to adoption of technology package. Whereas the average per hectare cost of production was declined by 7.69 per cent which improved the B-C ratio to 2.70 from 1.58 (in farmers' practice). The results of the paired t-test depicted that the difference between cost of cultivation, productivity and income of cotton with farmers' practice and using package of practices given by University was statistically significant. Lack of technical information on cotton cultivation was the major problem faced by the cotton growers.

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