

**Chapter VII**  
**RESULTS AND INTERPRETATIONS - II**  
**Package of practices & Cost of cultivation of**  
**cotton**

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## **CHAPTER VII**

### **RESULTS AND INTERPRETATIONS - II** **PACKAGE OF PRACTICES AND** **COST OF CULTIVATION OF COTTON**

#### **7.1. Climate**

Cotton is a tropical crop. For proper growth of the crop, a temperature of 21 to 27° c is suitable while slightly higher temperature of 27 to 31° c is appropriate during the stage of bolls formation. The crop is generally rainfed in the state of Maharashtra as only less than 3 per cent of the total area under the crop is irrigated (Appendix - 15). Rainfall of about 500 to 750 m.m. is necessary for good growth. During the stages of flowering and bolls formation, excess rain or dry season is not suitable. Similarly, the crop is sensitive to extreme cold climate. Excess humidity and cloudy climate is also harmful as the crop is more prone to diseases and pest infestations in this climate.

#### **7.2. Soil and land preparation**

Medium to heavy black soil is ideal for the crop. In the study area, the soils in which the crop is grown are black cotton soil, which has good water holding capacity. For rainfed crop, ploughing the field at 20 to 25 cm depth once in 3 years is recommended while for irrigated crop ploughing the field after harvest of the previous crop and formation of rows for sowing is recommended, depending on the soil type. The sample farmers were following the practice of harrowing the field 3 or 4 times with the blade harrow before sowing.

#### **7.3. Seed**

Seed production and distribution in the country is controlled by the Seeds Act (1966) and the Seeds (Control) Order (1984). The seeds used by the

farmers belong to the categories of certified seed, truthfully labeled seed, market seed, neighbour's seed or self-grown seed. However, majority of the cotton seeds used generally falls into the last three categories. In the sample, while only 5 per cent of the farmers were using self grown seed in Amaravati, rest 95 per cent of farmers in Amaravati and 100 per cent farmers in Nagpur were using hybrid seeds purchased from the market<sup>1</sup>.

For rainfed indigenous varieties of cotton, a seed rate of 12 to 15 kg. per hectare is recommended while for irrigated hybrid varieties it is 2.5 to 3 kg. per hectare. The sample farmers were following the recommendation of seed rate for irrigated hybrid crop although the crop was not generally irrigated. The cottonseed for sowing should be free from fibre. For this, the farmers were soaking the seeds in water for 4 to 5 hours and keeping them in wet cloth for 4 to 5 hours before planting. Seed treatment with Azatobactor bacterial culture and fungicide treatment with a mixture of one gram Vitavax and 3 grams of Thiram is recommended per kg. of seeds. However, the seeds purchased by the farmers from the market were pre-treated. The recommended varieties of cottonseed by the Department of agriculture, Maharashtra are the following.

Rainfed crop	
A) Improved varieties	B) Hybrid varieties
1. Y -1	1. NHH 44
2. JLH - 168	2. Sankar - 4
3. LRA - 5166	3. PKV Hybrid - 2
4. Eknath	4. AKH - 81
5. Rohini	
6. Namdev	

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<sup>1</sup> Both private and public sectors produce seed. The private sector concentrates on hybrid seed that is usually sold as truthfully labeled seed. The private sector handles more than 90 per cent of the truthfully labeled seed.

7. Purnima

8. Renuka

Irrigated crop

A) Improved varieties

1. LRA 5166

2. JLH 168

3. PKV Rajat

4. Savata

B) Hybrid varieties

1. NHH 44

2. Sankar – 4

3. Sankar – 6

4. Sankar – 8

5. Sankar – 10

#### **7.4. Planting**

The farmers sow the seeds for rainfed crop during 2nd fortnight of June and for irrigated crop during 2nd fortnight of May. The distance between plants is kept followed as per the following recommendation.

Rainfed crop	1) Indigenous varieties	40 x 22.5 cm.
	2) American varieties	60 x 30 cm.
	3) Hybrid varieties	60 x 60 cm.
	Or	
		75 x 75 cm.
		or
		90 x 90 cm.
Irrigated crop	1) Hybrid varieties	100 x 90 cm.
	2) Other varieties	90 x 60 cm.

#### **7.5. Manures and Fertilisers**

The cotton soils are generally sufficient in phosphate (P) and potash (K) and deficient in nitrogen (N) and organic matter. Therefore, farmyard ma-

nure is applied at the rate of 12 to 15 tonnes per hectare. The usual dose of fertilisers recommended for the study area is as follows.

#### Rainfed crop

- 1) Indigenous variety 50 : 50 : 35 kilograms of NPK per ha.
- 2) Hybrid variety 80 : 40 : 40 kilograms of NPK per ha.

#### Irrigated crop

- 3) 100: 50: 50 kilograms of NPK per ha.

In case of irrigated cotton,  $1/3^{\text{rd}}$  N and full dose of P&K should be given at the time of planting.  $1/3^{\text{rd}}$  Nitrogen after one month and remaining  $1/3^{\text{rd}}$  N after 2 months of planting or at the time of flowering should be given. In case of rainfed cotton,  $1/2$  N and full P&K should be given at the time of planting and the remaining N should be given after 30-35 days of planting.

Majority of the sample farmers in both the districts were applying fertilisers to the cotton crop, 72 farmers (60 per cent) in Amaravati and 59 farmers (49.2 per cent) in Nagpur had not applied organic manure for the crop. The average quantity of organic manure applied varied from 8.1 tonnes per hectare in Amaravati to 6 tonnes per hectare in Nagpur. Urea, 18:18:0 mixture and Di-Ammonium phosphate were the chemical fertilisers used by the farmers in both the districts. Majority of the sample farmers were applying Nitrogen and phosphorus mixed fertilisers to the cotton crop in two doses, but the farmers applying potash fertilizers were less.

#### **7.6. Irrigation and water Management**

Rainfed cotton requires more water supplies at the time of flowering and boll formation. During this period, if there is a problem of water supply, then 2 irrigations at 10-12 days interval could increase the production. Among the sample farmers, 47 farmers (39 per cent) in Amaravati district

and 58 farmers (48.3 per cent) in Nagpur district had given two irrigations to the cotton crop. For irrigated crop one irrigation should be given before seeding. If germination is less, then another light irrigation should be given after 8 – 10 days of seeding. Care should be taken that there is no water deficiency during flowering and boll formation. Once the bolls mature and they burst, then irrigation should not be given. Among the sample farmers, the maximum number of irrigations given to the crop was 3 in Amaravati and 4 in Nagpur.

### **7.7. Control of Weeds**

Control of weeds for 65-70 days is quite helpful in case of cotton. For that, weeding should be done as per requirement. Among the sample farmers 111 farmers (92.5 per cent) in Amaravati and 112 farmers (93.3 per cent) in Nagpur had done at least one weeding to the cotton crop. The maximum number of weeding was 3 in Amaravati and 4 in Nagpur.

### **7.8. Plant protection**

Cotton is a crop susceptible to a number of pest and disease attack. Some of the common pest and diseases affecting cotton in Maharashtra and the recommended control measures are discussed below.

#### **7.8.1. Pests of cotton**

##### **7.8.1.1. Bollworm**

Bollworm is the most important pest of the cotton crop often making serious crop losses. There are different types of bollworms that attack cotton among which pink bollworm affects the bolls more prominently. The infestation cannot be seen from outside easily. But due to the infestation, the bolls don't mature and burst out and therefore the yield reduces. The caterpillar of another type, called the spotted bollworm, feeds on the delicate

branches making them dry. Due to this attack leaves, flowers, buds and bolls wilt and fall out. The caterpillars of the green coloured bollworm damage the leaves and buds. The bigger ones make hole in the bolls and make the boll empty. These holes are irregular, round and big. The caterpillar feeds on the bolls with head inside the boll and rest of the body outside.

For the control of bollworm attack, 17 millilitre of Endosulphan 35% or 16 millilitre of Quinalphos 25% or Monocrotophos 36% mixed in 10 litres water has to be sprayed in 1 hectare. Among the sample farmers, 69 per cent in Amaravati and 96 per cent in Nagpur reported spraying for bollworm attack.

#### **7.8.1.2. Leaf hopper**

Leaf hopper sucks the juice from below the leaf, which leads to leaves turning yellow and subsequently dark brown colour. If the infestation is more, all the leaves will become reddish-brown (copper colour) and the leaves wilt inside. Due to this, the growth of plant gets stunted.

#### **7.8.1.3. Aphid**

These pests suck the juice of the leaves and the leaves turn yellow. The larvae excretes a sticky substance on which black fungus grows, the plant becomes sticky and blackish.

#### **7.8.1.4. Thrips**

Thrips suck the juice from the leaves and bolls. Due to the attack, white or brownish colour spots are developed on the leaves.

### **8.1.5. Mite**

They suck the juice of the leaves and the leaves turn red or copper coloured and wilt.

### **7.8.1.6. Whitefly**

These insects suck the juice due to which leaves wilt. If the infestation is heavy, then the leaves turn reddish and dry out and ultimately fall.

For the control of the above pests, 10 ml of Di-Methoate 30% Solution or 2.5 ml of Phosphomedon 85% solution or 8 ml of Methyl demeton 25% has to be mixed in 10 litres of water for spraying 1 hectare. Among the sample farmers, 96 per cent in Amaravati and 100 per cent in Nagpur reported spraying for aphid/thrips attack during the reference year.

### **7.8.2. Diseases of cotton**

#### **7.8.2.1. Fusarium wilt**

This disease spread through seed. Due to the disease, small plants wilt before bolls are formed. To prevent the attack, cotton seed is to be treated with a mixture of 1 gram Vitavax and 3 grams of Thiram for one kilogram of seed.

#### **7.8.2.2. Blight**

It leads to black dots on the leaves. Even the branches turn black and the leaves wilt and drop down. On the bolls, black oily spots are also developed. This disease also spreads through seed.

Over-dependence on chemical control of cotton pests has led to many adverse effects, notably, pesticide resistance of cotton pests. Problems of pyrethroid resistance are reported in cotton areas in Punjab, Tamilnadu and Andhra Pradesh. The average number of spray applications to cotton crop was 5 to 6 but in some parts of Tamilnadu and Andhra Pradesh cotton farmers are reported to be spraying upto 20-25 times. A contributing factor to this has been unregulated distribution of registered pesticide products, which resulted in excessive and indiscriminate use of pyrethroids. Although, all pesticides are supposedly to be registered, there is no control on the quality of the product reaching the farmers. Among the sample cotton farmers of the study, few farmers reported that they started using pesticides based on substances like neem and tobacco on cotton and found to be effective.

### **7.9. Harvesting**

The crop generally takes 5-6 months for harvesting. While harvesting, mature bolls are plucked from the plants individually. Since all the bolls may not reach maturity at the same time, cotton harvesting is done in 5 to 6 plucking. The average number of plucking by the sample farmers in Amaravati was 6 and in Nagpur 5.

### **7.10. Adoption of recommended package of practices**

Agricultural technology in India witnessed rapid changes since the days of green revolution by way of introduction of High Yielding Varieties of Seeds, new inputs like fertilisers and pesticides alongwith expansion of irrigation facilities. Continuous

improvements in agricultural technology and their diffusion into the farmers' fields are ensured through well-aid agricultural research and extension systems. The existing level of new technology is being documented and disseminated in the form of recommended package of practices for the major crops in each State, together by the respective State Agricultural Universities and the Department of Agriculture of the respective State Governments. Adoption of recommended package of practices is very low in India for most of the crops and cotton is no exception.

Various factors affect the adoption of recommended package of practices by the farmers widely and speedily. These factors can be grouped into economic attributes of the practices/technology itself (cost, returns, etc.) technical characteristics of the practices/technology recommended (simplicity, divisibility, etc.) and characteristics of the farmers adopting the practices/technology. In this study, the focus being the human capital-productivity relationship, adoption of recommended package of practices for cotton cultivation in terms of seed, fertiliser application, pesticide sprays etc. were examined with respect to the characteristics of the farmers.

Generally a farmer is likely to adopt the recommendations more rapidly if the farm is large, the higher his income and socio-economics status and the more educated he is. Also, older farmers tend to adopt new practices more slowly.

Cotton farmers in the study were facing many problems associated with cultivation

of cotton like non-reliability of the quality of seeds purchased, poor understanding of pesticides usage and the principles of good crop management. As farmers received little or no information on scientific aspects of growing cotton, poor agricultural practices were found common. These include continuous mon-cropping of large cotton areas, extension of cotton beyond its season, cotton plant litter left in the field, poor pesticide spraying equipment which gives improper treatment of the foliage, insecticide treatment with sub-lethal doses, excessive use of nitrogenous fertilisers, poor plant spacing, etc. Many of the problems and inefficiencies were associated with the spraying equipment and practices. The sprayers were dirty and neglected, mostly old and leaked from multiple points.

There was considerable variation in the amounts of fertilisers applied among the farmers as also compared to the recommended package of practices. There was no much variation in the variety of seeds used, as mentioned earlier that 95 per cent of the sample farmers in Amaravati and 100 per cent of the sample farmers in Nagpur were using hybrid seeds purchased from the market. The use of five other major inputs by the sample farmers such as use of organic manure, quantities of N, P and K and spray for control of bollworm, were compared with recommended package of practices and sample farmers were classified as adopters and non-adopters. The results are given in Table 7.1.

**Table 7.1. Number of adopters and non-adopters of recommended package of practices for cotton**

Recommendation	Amaravati		Nagpur	
	Adopters	Non-adopters	Adopters	Non-adopters
1. Organic manure	48 (40.0)	72	61 (50.8)	59
2. Nitrogen	74 (61.7)	46	88 (73.3)	32
3. Phosphorus	35 (29.2)	85	51 (42.5)	69
4. Potash	30 (25.0)	90	42 (35.0)	78
5. Spray for bollworm	20 (16.7)	100	54 (45.0)	66

*Figures in brackets are percentage of adopters to the total number of sample farmers in each district.*

The use of organic manure for the cotton crop was widely prevalent in both the study districts. Almost all the sample farmers had applied fertilisers but in majority cases, either quantity was lower than the recommended dose or the application was highly imbalanced in terms of nutrients. The sample farmers who had adopted 3 out of these 5 recommendations were classified as adopters and accordingly, 35 sample farmers in Amaravati and 54 sample farmers in Nagpur were identified as adopters for the logit regression analysis.

The source of technical information received by the farmers who are identified as adopters in the two districts are indicated in Table 7.2.

**Table – 7.2. Source of information used by adopters**

Source	Amaravati		Nagpur	
	Total Farmers	Adopters	Total Farmers	Adopters
<b>One-way channel or passive source</b>				
News daily	83	27 (32.5)	59	20 (33.8)
Farm journal	42	12 (28.6)	59	20 (33.8)
Radio	76	26 (34.2)	57	22 (38.6)
Television	99	24 (24.2)	84	36 (42.9)
<b>Two-way channel or active source</b>				
Farmer training	13	2 (15.4)	9	1 (11.1)
Visit by extension officer	62	30 (48.4)	47	40 (85.1)
Visit to extension office	39	15 (38.5)	30	12 (40.0)
Progressive farmer	67	24 (35.8)	29	13 (44.8)
Neighbour farmer	58	20 (34.5)	29	13 (44.8)
Proximity to office of the farm university	51	15 (29.4)	25	6 (24.0)
Proximity to office of the department of agriculture	28	8 (28.6)	46	25 (54.3)
Proximity to office of cotton development	31	8 (25.8)	17	1 (5.9)
Members of farm household employed in agriculturally related service	18	3 (16.7)	17	1 (5.9)
Minikit trial	15	5 (33.3)	26	9 (34.6)

*Figures in brackets are percentage of adopters to total farmers who have received information from that particular source.*

It could be seen from the table that, although large number of farmers receive technical information from one way channels like news daily, farm journals, radio and television, the percentage of adopters are less. The number of farmers receiving information from two-way channels like extension visit, discussions with progressive farmers, etc. are comparatively less but the percentage of adopters are more in these groups. Visit by extension officer was the major source of technical information indicated by majority of the adopters in both the districts. As high as 85 per cent of the sample farmers in Nagpur district and 48 per cent in Amaravati district who have visited by extension officer were adopters.

### **7.11. Cost of cultivation of cotton**

Various cost concepts, as explained in study design and methodology chapter, have been used for calculation of cost of cultivation of cotton in the study. The average cost of cultivation per hectare of cotton cultivation in Amaravati and Nagpur districts using these different cost concepts are indicated in Table 7.3. However, only Cost C2 has been used for calculation of net income from cultivation of cotton.

**Table 7.3. Average cost of cultivation of cotton in the study districts.**

Description	<i>(Rupees per hectare)</i>	
	Amaravati	Nagpur
Cost A1	8065.00	8830.00
Cost A2	8065.00	8830.00
Cost A2 + Family labour	8865.25	9490.00
Cost B1	8594.55	9425.40
Cost B2	11015.35	12187.00
Cost C1	9394.80	10085.40
Cost C2	11815.60	12847.00
Cost C2*	11815.60	12847.00
Cost C3	12997.20	14131.70

Cost A1 which is nothing but all expenses in cash and kind incurred in cultivation of 1 hectare of cotton worked to Rs.8, 065 in Amaravati district and Rs.8, 830 in Nagpur district. The cost used for calculation of net income from cultivation of cotton, i.e. Cost C2 worked out to Rs. 11, 815 per hectare in Amaravati and Rs.12, 847 in Nagpur.

Among the various components of cost of cultivation of cotton, operational cost comprising mainly the input costs constitute 73 per cent in Amaravati and 69 per cent in Nagpur. Cost of human labour (26.0 per cent), cost of fertilisers and manures (14.6 per cent), cost of seeds (10.3 per cent), cost of pesticides (8.5 per cent) and cost of animal/machine labour (11.7 per cent) were the major components of operational cost of cultivation of cotton in Amaravati district. The shares of these components in Nagpur district were 22.3 per cent, 13.9 per cent, 11.2 per cent, 9.0 per cent and 10.5 per cent, respectively, in Nagpur district. Majority of the sample farmers in both the districts reported that the increase in labour charge and human labour cost in the cost of cultivation as one of the factors that has declined the profitability of cotton cultivation. Besides, lured by the prospect of getting a bumper crop, the farmers use hybrid seeds purchased from the market, the quality of which sometimes proves to be bad and yields less than local varieties. The cost of seed alone in the cost of cultivation works out to 10 per cent. The break-up of Cost C2 into various components are indicated in Table 7.4.

**Table 7.4. Break-up of cost of cultivation**

Item	Amaravati	Nagpur
<b>Operational Cost</b>	<b>8653.40</b>	<b>8897.00</b>
Human Labour	3080.00	2860.00
- Family	800.25	660.00
- Hired	2279.75	2200.00
Bullock labour	648.40	486.00
- Own	389.00	-
- Hired	259.40	486.00
Machine Labour	729.50	866.50
- Own	291.80	519.60
- Hired	437.70	346.90
Seed	1227.50	1432.50
Fertilisers & Manures	1727.50	1785.00
- Fertilisers	880.00	1075.00
- Manures	847.50	710.00
Insecticide	1005.50	1157.00
Irrigation charge	73.00	105.00
Interest on working capital	162.00	205.00
<b>Fixed Cost</b>	<b>3162.20</b>	<b>3950.00</b>
Rental Value of own land	2420.80	3000.00
Rent paid for leased-in land	0	0
Land revenue, cesses & tax	20.00	50.00
Depreciation on implements and buildings	240.00	300.00
Interest on fixed capital	529.55	600.00
<b>Total cost</b>	<b>11815.60</b>	<b>12847.00</b>