

EVALUATION OF THE IMPLEMENTATION OF THE  
CENTRAL SECTOR SCHEME ON PROMOTION OF  
AGRICULTURAL MECHANIZATION IN MAHARASHTRA

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## ACKNOWLEDGEMENTS

The present study entitled 'Impact Evaluation of Central Sector Scheme on Promotion of Agriculture Mechanization Through Small Tractors' was undertaken at the initiative of the Ministry of Agriculture, Government of India.

We are grateful to Professor D.C. Wadhwa, Director of our Institute for his constant encouragement right from the beginning of this study. We are thankful to Dr. K.S. Deshpande, for his help at each and every stage of our study.

Mr. M.P. Khare had formulated the design of the study and collected the initial information needed for the work. He also supervised the field work of the study. We are thankful to Mr. M.P. Khare for all the initial work he did while formulating the study.

We are also thankful to Shri J.D. Talhande, Joint Director of Agriculture, Shri Chavan and Shri Karandikar, Agricultural Development Officers respectively in Nashik and Sangli districts for providing the necessary information at different stages of the study. We would like to thank our field staff Shri E.D. Khodaskar, Shri S.S. Dete, Shri S. B. Kate and Shri V.B. Lokare for data collection and processing the data.

We owe a deep debt of gratitude to all our sample beneficiaries for providing necessary information which we sought from them. Without their kind cooperation, the study would not have been possible to this stage.

(ii)

We must mention the painstaking work of typing done by Shri S.K. Athale, Shri V.N. Inamdar, Shri A.V. Moghe and Smt. M.S. Marathe. We are grateful to all of them.

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January 1995

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## CHAPTER I

### INTRODUCTION

#### 1.1 Introduction

New Agriculture Technology (NAT) in Indian agriculture has not only increased the use of the yield enhancing inputs like HYVs seed, fertilizers and pesticides but also introduced the use of machineries. The number of tractors has increased from 6.09 lakhs in 1950-51 to 15.50 lakhs in 1991-92. However, the spread of tractors varies across regions. Many studies corroborated that tractor owning farmers are mostly rich and with larger size of land holding.

Nevertheless, owing to intensive commercialization of agriculture and sharp rise in wage rate of both human and bullock labours, many small and medium farmers are also willing to use tractors. But, their meagre resource base does not permit them to buy tractor, since it involves higher investment. In order to avoid this, Central Government has recently (in the Eighth Plan) introduced a scheme, namely, "Promotion of Agriculture Mechanization Through Small Tractors". This scheme is introduced mainly to promote the use of small tractors among the small and medium farmers.

Before getting into the details of the Central Scheme of mechanization and its impact on agricultural production and economic condition of farmers at micro-level, it would be better to analyse the overall development of tractorization, factors responsible for tractor use and its impact on agriculture particularly on employment and productivity in India.



## 1.2 Factors Determining Tractor Use :

Use of tractor in agriculture is determined by many factors<sup>1</sup> like type and quality of irrigation, pattern of cultivation (commercialization or subsistence), size of land holdings, intensity of cultivation, availability of human labour, comparative cost of human or bullock labour, crop pattern, type of soil, availability of tractor, road facility to bring the tractor into land, policy of the government, farmer's perception etc. Studies proved, among others, that development of quality of irrigation is foremost reason for intensive use of tractor.<sup>2</sup> In tank irrigation based agriculture system, cultivation intensity will be normally low and hence demand for agriculture labour will be lower. However, this will vary in the case of perennially irrigated area (groundwater and assured canal based system), where pattern of agriculture will be more intensive. Cultivation work can commonly be seen round the year. This causes the scarcity for labour and increase use of tractor. Punjab, Haryana and Western U.P., come under this category.

It is widely confirmed in the literature that farm size is significantly higher among the tractor using households than the others. When size of holding of the farmer is higher, all farming operations cannot be done using manual or bullock labourers. Moreover, supervision of these manual labourers is more laborious. Hence large farmers prefer to use tractors.

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1. Reddy V.Ratna, R.S.Deshpande & S.B.Kate (1991), "Determinants of Farm Mechanization in India", Asian Economic Review, Vol. XXIII, No.3, Pp.429-454.

2. Jose A.V. (1984), "Farm Mechanisation in Asian Countries, Some Perspective", Economic and Political Weekly, June, A97-A103.

Importantly, when other auxiliary employment opportunity increase scarcity for agriculture labour is felt intensively. This leads to two impacts. First, it increases the wage rate of labour. Second, this reduces willingness to work in agriculture, since agriculture is onerous job compared to other non-agriculture work. However, one cannot strictly define the factors which are responsible for tractor use. This will vary according to situational characteristics. For instance, the factors which are responsible for tractor use in Punjab may not be same in Tamil Nadu.

### 1.3 Development of Tractor Use :

Tractor use has been continuously increasing since 1951 however, the rate of use of tractor is much faster after the introduction of the Green Revolution or NAT, in 1965. It is calculated, for instance, that rate of increase of tractor was only 3000 per annum between 1951 and 1966, while the same is 57000 per annum between 1966 and 1991.

Development of tractor is relatively slow when compared to other modern machineries like oil engines and electric pumpsets. The number of oil engines per lakh hectares has increased from 295 in 1966 to 2707 in 1991, while electric pumpsets have increased from 330 to 5028 during the same period (Table 1.1). But tractor has increased only from 7 lakhs to 811 lakhs during the same period. It is mainly because of three reasons. First, for pumpset, land size is not a very important criterion, whereas size of land is an essential

determinant for tractor use particularly for land preparation works. Secondly, total cost as well as the maintenance costs are less in pumpset when compared to tractor. Thirdly, the criteria followed by the banks to sanction loans for tractors are more complicated compared to pumpsets.

Table 1.1 : Mechanization in Indian Agriculture

Year	GCA (ml. ha.)	Tractors		Oil Engine		Electric Pumpsets		Consumption of power (KWH) p.a.'000 hec.
		Lakh	Per lakh ha.	Lakh No.	Per lakh ha.	Lakh No.	Per lakh ha.	
1951	132	0.09	7	0.66	50	0.21	16	1.5
1961	153	0.31	20	2.30	151	2.00	131	5.5
1966	155	0.54	34	4.65	295	5.13	330	12.4
1971	166	1.43	86	15.57	942	19.00	1150	30.3
1981	173	5.20	301	28.10	1623	43.24	2505	84.5
1991	181	14.68	811	49.00	2707	91.00	5028	322.6

GCA = Gross Cropped Area

Source : Centre For Monitoring India's Economy (CMIE, 1993), Basic Statistics Relating to Indian Economy, August, Bombay.

There is no uniform pattern in development of tractor across the country. States like Punjab, Haryana and U.P., together accounted for about 54 per cent of tractor in 1990-91. These states, however, have only about 20 per cent of the gross cropped area (GCA) of the country in 1991 (Table 1.2). This

implies that the number of tractors per 1000 hectares is much higher in these States. On the other hand, States like Rajasthan, Madhya Pradesh and Maharashtra accounted for about 35 per cent of the GCA but share only 20.8 per cent of the tractor population. This is mainly because of the lower irrigation intensity (II). Ratio of Gross Irrigated Area (GIA) to GCA is higher in Haryana, Punjab and U.P., and hence their share in total tractor population is more.

For instance, the ratio of GIA is 94 per cent in Punjab and 71 per cent in Haryana in 1990-91. Both cropping intensity and irrigation are significantly higher in the States like Punjab, Haryana and U.P. (Table 1.3). Hence the evidence seems to direct to the fact that tractor use is higher wherever irrigation is available on large scale.

#### 1.4 Impact of Tractor Use on Employment and Yield

Impact of the use of tractors is different than the impact of the other yield increasing inputs like fertilizers and pesticides. Inputs like fertilizers directly increase the yield of crop, whereas, it is not so in the case of tractor. There is an on-going debate among the researchers regarding the massive introduction of tractor and its impact on employment. There are mainly three arguments available in this regard. There is an argument that tractor use displaces the human labour and does not contribute towards increasing yield.<sup>2</sup> It is also believed that tractor use is not needed in the countries like India where, abundant of surplus human labour is available. Second argument is about the introduction of tractor in culti-

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For Footnote No.2, please refer to page No.

**Table 1.2 : Statewise share of Gross Cropped Area (GCA), Gross Irrigated Area (GIA), Number of Tractors in India : 199**

State	GCA	GIA	Tractor	Live-stock population*	Working cattle and Buffaloes@
1. Andhra Pradesh	7.11 (5)	8.69 (3)	2.77 (10)	8.7	8.07
2. Bihar	5.65 (7)	6.79 (7)	5.12 (8)	N.A.	10.8
3. Gujarat	5.58 (8)	4.70 (8)	7.51 (6)	4.1	3.99
4. Haryana	3.19 (12)	6.86 (6)	9.03 (3)	2.1	1.07
5. Karnataka	6.33 (6)	4.21 (10)	3.38 (9)	6.0	5.48
6. Madhya Pradesh	12.87 (2)	7.17 (4)	7.63 (5)	11.7	14.4
7. Maharashtra	11.78 (3)	4.02 (11)	5.16 (7)	8.8	8.3
8. Punjab	4.04 (10)	11.48 (2)	23.45 (1)	2.5	2.05
9. Rajasthan	10.45 (4)	7.53 (5)	6.03 (4)	10.6	4.85
10. Tamil Nadu	3.58 (11)	4.68 (9)	0.87 (12)	6.5	5.17
11. Uttar Pradesh	13.74 (1)	23.80 (1)	21.60 (2)	15.8	16.66
12. West Bengal	4.67 (9)	3.09 (12)	1.82 (11)	8.2	7.29
India	100.0	100.0	100.0	100.0	100.0

\* 1987, @ 1982.

Figures in brackets indicate respective rank of the State in India.

Source : Computed from CMIE (1994).

Table 1.3 : Relationship between Irrigation and Tractor in 1991

	GIA GCA	Rank	No. of Trac- tors	Rank	Tractor per 1000 ha. of MSA	CI	II
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	40.7	5	34183	10	3.10	104.3	124.7
Bihar	40.0	6	63091	8	8.19	136.1	125.2
Gujarat	28.0	7	92541	6	9.96	111.5	116.5
Haryana	71.6	2	111390	3	31.16	165.6	163.0
Karnataka	22.1	10	41640	9	2.58	113.3	122.9
Madhya Pradesh	18.6	11	94025	5	4.81	122.1	102.7
Maharashtra	11.4	12	63668	7	3.55	121.9	122.7
Punjab	94.0	1	289064	1	68.53	177.9	180.4
Rajasthan	24.0	8	98965	4	6.04	118.3	119.2
Tamil Nadu	43.6	4	10707	12	1.92	118.9	121.9
Uttar Pradesh	58.0	3	266339	2	15.40	147.3	140.1
West Bengal	22.1	9	22429	11	4.20	162.4	100.0

Note : CI = Cropping intensity; II = Irrigation intensity;  
MSA = Net Sown Area, GCA = Gross Cropped Area  
GIA = Gross Irrigated Area

Source : Computed from CMIE (1994), Basic Statistics ; States, September.

vation and the resultant increase in the total employment days. This happens in two ways<sup>3</sup> (i), Once tractor is introduced, the cultivation work can be finished in time resulting in higher cropping intensity and total employment will simultaneously increase in agriculture, and (ii) when demand for tractor increases it will increase the employment opportunity in the tractor manufacturing industry and its allied centres. Third group argues that tractor neither increases the crop's yield nor reduces employment opportunity, but it helps to reduce the unnecessary time delay in each operation.

However, it is very difficult to arrive at similar conclusion across regions and crops regarding the impact of tractor use. It depends on many factors viz., intensity of tractor use, type of crop, time of use (lean or scarcity period), how much of tractor time used, type of operation etc. Moreover, impact may not be similar for all crops.<sup>4</sup> For instance, tractor can be

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- 2 (i) Shamel Roy and Melvin G. Blase (1978), "Farm Tractorisation on Productivity and Labour Employment : A Case Study of Indian Punjab", Journal of Development Studies, Vol.14, No.2, January, pp. 193-209.
  - (ii) Agarwal, Bina (1983), Mechanisation in Indian Agriculture : An Analytical Study Based on the Punjab, Allied Publishers, New Delhi.
  - (iii) Bhatia, Bhim Sen (1990), Adoption of Farm Mechanization in a Developing Economy, Daya Publishing House, Delhi.
3. Binswanger P. Hans (1978), The Economics of Tractors in South Asia : An Analytical Review, ADC and ICRISAT, Hyderabad, India.
  4. Narayanaoorthy A. (1992), Impact of Tractors and Weedicides on Yield and Employment in Sugarcane Cultivation. Journal of Rural Development, Vol.11(3), May, pp.351-362.

used right from ploughing operation to harvesting and thrashing for paddy, whereas, the same is not possible in crop like sugarcane with the present technology. Likewise, if tractor is used for transportation purposes the reduction of employment will be less, while the reduction will be more for paddy and wheat if it is used for harvesting operation. It is also because of the fact that harvesting operations both in paddy and wheat needs more employment days. However, in any crop, the adverse impacts will increase with the hours of tractor use.

It is easier to analyse the total employment in a particular region or area after the introduction of the tractor. Further, it is obvious that when the tractor is used, one can avoid unnecessary delays in cultivation. This further allows farmers to go for one more crop. Hence, cropping intensity and employment days for rural labour will go up. However, this is not possible for all the crops particularly for annual crops like sugarcane, plantations, grapes, etc. Impact on employment days would be more, if tractor is intensively used in all the operations in these crops.

Second important argument, among the researchers is about the yield increasing impact of tractors. One cannot easily separate the benefits of tractor use in the yield of a crop. Needless to say, yield of a crop is determined by many factors other than tractor use alone. The studies available in this line come out with mixed kind of conclusions.<sup>5</sup> Some studies

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5. See : Binswanger (1978) for more details in this regard.



found a positive relationship between yield and tractor use, while others found no significant relationship between tractor farm and non-tractor farms. However, tractor farmers used more yield increasing inputs like fertilizers and pesticides. Some researchers argued that deep tilling by tractor reduces the weed problem and increases the moisture availability period which ultimately helps in increasing the crop yields. This is not possible with bullock plough, since the bullock drawn plough can only reach limited depths.

Sometimes, tractor may indirectly help to increase the crop yield. Modern varieties need correct quantity of inputs at right time. The important advantage of tractor is timeliness of the operations. On farm Development (OFD) works, sowing and applying inputs, can be done in right time by using tractors. These would sometimes help in increasing the yield of crops. In addition to these, one cannot avoid the use of machineries in any competitive agriculture. Use of tractor is essential for some crops, since the biological sources of energy like bullocks could not cope with current requirements.<sup>6</sup> Foodgrains production has to be increased in all possible ways to feed the ever increasing population. Commercialization of agriculture is only possible with machineries like tractors where, cost minimization is possible when hours of tractor use increase.<sup>7</sup>

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6. Singh, Rajinder and Karam Singh (1993), "Demand for Tractors in Punjab" Agricultural Situation in India, October, 549-555.

7. Binswanger P. Hans (1978), *ibid.*

It is clear that tractors became a necessary input for intensive commercialization of agriculture. The tractors which are available in the market are big size (above 25 H.P.) and not suitable for small and medium farmers. To help the small and medium farmers, Central Government has introduced a scheme for the promotion of agricultural mechanization through small tractors (18 H.P. PTO) in the Eighth Five Year Plan on a pilot basis.

#### 1.5. Overview of the Scheme

A steady rate of growth in farm mechanization became an essential point in agricultural policy formulation especially after the green revolution. The necessity of such policy was felt mainly due to five factors, viz., (i) ease of operations, (ii) time constraint, (iii) stress on labour supply, (iv) higher cost of cattle maintenance, <sup>and</sup> (v) multiplicity of the operations. It was noted above that tractorization is a capital intensive activity and therefore it may restrict the access of small farmers to mechanization. As the problems relating draught power, labour shortage and time productivity become acute for the small farmers, their need for mechanization increases. Keeping in view the need for mechanization among the group of small and marginal farmers a scheme on promotion of agricultural mechanization was taken up under the Central Sector schemes during the year 1992-93. The scheme involved supply of small tractors below 18 Power Take Off (PTO) Horse Power to the farmers with a subsidy of 30 per cent or to a maximum limit of

Rs. 30,000. Initially, the scheme was sanctioned on a pilot basis for the year 1992-93 and was extended for one more year. The major considerations for participating in the scheme were as follows:

1. Farmers applying for the scheme should have land holding in the minimum and maximum ranges indicated below by type of land.

Sr. No.	Type of land	Minimum size of holding	Maximum size of holding
1.	Perennially irrigated land with possibility of double cropping in the year	6 acres	8 acres
2.	Irrigation available only for one crop - not perennially irrigated	9 acres	12 acres
3.	Seasonal irrigation available through the public sources of irrigation	12 acres	16 acres
4.	Land under paddy cultivation successively for the last three years	12 acres	16 acres
5.	Rainfed land	18 acres	24 acres

Source : Guidelines for the Scheme. Government of Maharashtra, Department of Agriculture, Pune.

2. A farmer owning a tractor earlier either on his/her name or in the name of any of the members of his/her family shall not be eligible to avail the benefits of the scheme.

8. This part is based on the Scheme Guidelines circulated by the Government of India and the Government of Maharashtra.

3. Preference would be given to the farmers belonging to the Scheduled Castes and Scheduled Tribes. As far as possible 22 per cent of the total allocation should go to these group of farmers.
4. Maharashtra Agro-Industries Development Corporation (MAIDC) shall undertake to supply the tractor, trailer, other implements, fertilizers, etc., to the farmers under the scheme. MAIDC shall also be responsible for after-sales service and training the farmers.
5. The beneficiary shall undertake to repay the loan amount to the bank in the stipulated period and will not sell the tractor to any other person.

Apart from these, some operational guidelines are also given by the Department of Agriculture, Government of Maharashtra. These included : (i) the loan application of the farmers should be evaluated by the banks on a case to case basis, (ii) the subsidy would be transferred to the loan account and in no way, it will reach the farmer directly, (iii) subsidy can be availed by a group of farmers, (iv) down payment or margin money would be 15 per cent of the total cost, (v) the loan repayment period is uniformly fixed as 12 years.

With these guidelines the scheme was implemented during 1992-93 on a pilot basis. It was continued in the subsequent years. During the first year of the implementation of the

scheme, the Government of Maharashtra could distribute tractors to 230 beneficiaries. The spread over the districts was quite skewed and bears a direct relationship with the demands put forward by respective district authorities. Nashik and Kolhapur divisions received the highest share during the first year of the implementation of the programme. In the following year Pune division recorded the highest achievement, followed by Nashik, Kolhapur and Amravati Divisions. During the year 1993-94 the State Government had put forth the target of 514 tractors, of which 371 tractors could be distributed. The increase was about 55 per cent over the earlier year.

#### 1.6 Objectives of the Study and Methodology

Keeping in view the main focus of the scheme and its implementation in the State of Maharashtra, the present study on impact evaluation of the scheme was taken up with the following objectives :

1. To assess the extent to which the objectives of the scheme have been achieved.
2. To evaluate the benefits accruing to small, marginal farmers belonging to Scheduled Castes and Scheduled Tribes.
3. To assess the contribution of this scheme in increasing agricultural production.
4. To assess the impact of this switch over to tractor on employment generation.

5. To find out the economic viability of the investment under this scheme.

With the above objectives of the impact evaluation study of the scheme, it was decided that two districts would be selected for the purpose of the study based on the maximum number of tractors distributed during 1992-93<sup>9</sup>. This has helped towards better analysis of the impact evaluation in three ways. Firstly, since the tractor is given during the year 1992-93, there is a sufficient time gap to realize the benefits of the tractor scheme. Secondly, the initial adjustment problems are over and the tractor use has stabilized in the farm households. Thirdly, the process of such stabilization has given the beneficiaries experience to use the tractor and thus reduced the wastages. Nashik and Sangli are the districts which received largest number of tractors through the scheme during the year 1992-93. Out of the total 230 tractors allotted during the year 1992-93, Nashik district alone claimed 67 tractors as against 30 tractors distributed in Sangli district. Thus out of the 97 tractors given under the scheme in the two districts we selected 37 beneficiaries. Twenty-one beneficiaries were selected from Nashik district and 16 beneficiaries were from Sangli. Thus the sample formed about 38 per cent of the total beneficiaries from the two districts.

Any impact study can be approached from two different methodological viewpoints. Firstly, one can compare the

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9. The objectives and methodology of the study are the same as those agreed in the co-ordination meeting and circulated by AERC, Allahabad.

benefits derived by the beneficiaries of the scheme as compared to the similar parameters among the non-beneficiaries. This approach is referred to as 'with and without' approach. Second method of ascertaining the impact is to enlist the changes in the cultivation practices of the beneficiaries after the participation in the scheme. This approach is usually called as 'before and after' approach, signifying the changes after participating in the scheme. We have chosen here to compare the before project situation (before the tractorization) with the situation after tractorization. This gives a distinctive advantage in four ways. Firstly, the decision-making process of the individual farmer undergoes a change after participating in the programme and therefore the comparison with non-beneficiaries may not indicate a correct picture. Secondly, it becomes very difficult to find a non-beneficiary household almost exactly with the similar characteristics as that of the beneficiary (without the changes, that have taken place due to the scheme). Thirdly, the pattern of investment, resource allocation, employment, etc., undergo a total change and these changes can either be in the form of an increment in the parameters or a decrement. Thus these do not offer an easy comparability with the non-beneficiaries. Lastly, the beneficiary group acts as a complete system of decision process and thus it helps to analyse the changes within the system.

### 1.7 Evaluation of the Scheme Objectives

As already indicated the Government of India fixed

certain criteria to sanction the loan for farmers under this scheme. The basic objective of the scheme is to promote mechanisation among small farmers and since the very small as well as marginal farmers cannot invest economically in the scheme the land holding size was increased to fit the NABARD definition of small farmers. Thus the guidelines issued by Government of India indicated the eligible beneficiaries as those who have 6 to 8 acres of perennially irrigated land. Government of Maharashtra in its guidelines regarding the scheme incorporated flexibility regarding eligibility criteria by giving different land holding categories as indicated earlier. The flexibility in the eligibility criteria helped to extend the benefits to more eligible farmers but it also made it difficult to check the eligibility under the criterion given by the Government of India. Table 1.4 shows the distribution of the beneficiaries in the two districts.

According to the size of holding/<sup>the</sup> beneficiaries are almost equally spread across the three size classes of land holding. As mentioned above the criteria for eligibility was modified by the Government of Maharashtra to cover seasonally irrigated land as well as land irrigated from the government sources and rainfed areas. Therefore, it was difficult to check the eligibility of the beneficiaries to participate in the scheme. However, we tried to ascertain the total size of land under perennial irrigation in the household. It was noted that out of the total beneficiaries there were 26 households reporting less than 3.20 hectares of irrigated area under perennial source of irrigation.



Table 1.4 : Distribution of Beneficiaries According to Size of Land Holding

S. No.	Land size in hectares	Number of beneficiaries		Percentage to total beneficiaries		
		Nashik	Sangli	Nashik	Sangli	Total
1.	Upto 3.20	8	5	38.09	31.25	35.14
2.	3.21 to 5.00	6	5	28.57	31.25	29.73
3.	Above 5.00	7	6	33.33	37.50	35.13
	Total	21	16	100.00	100.00	100.00

The remaining 11 households had reported more than 3.2 hectares of perennially irrigated area. Therefore, about 30 per cent of the beneficiaries were found ineligible but still derived the benefits from the scheme. This is possible because the restrictive criteria about the size of holding provokes the farmers to transfer the land by resorting to fragmentation. Thus one member of the household, who applies for the benefits of the scheme has the size of holding within the requisite limit, whereas, the total holding size of the household is much larger. At the time of interview it was difficult to separate such holdings as the cultivation of the land is taken jointly in the household. In view of this difficulty it would be better to reduce the amount of subsidy and allow the benefits of the scheme for all the farmers or with a ceiling limit on size of holding of the household.

Another important norm suggested by the Government of India was that those availing the benefits should be the first time buyers of the tractor and in no case should have owned a tractor now or earlier in his name or in the name of his family.<sup>10</sup> Though, most of the farmers did not report having any other tractor other than the one supplied under the scheme, there were two cases from Nashik district who had a tractor before. Our enquiries revealed that many such cases may be there but the respondents concealed the information at the time of interview. Further, the process of implementation of this criteria, involves an undertaking from the beneficiary to the effect that he does not own a tractor earlier and a certificate to that effect from the Block Development Officer. It is necessary to change this process or allow all the applicants to avail the subsidy based on the limits on the size of holding. The alternative change can be in terms of docket sheet prepared by the officers of the agricultural department, which would help in plugging the pilferage.

Among the major objectives of the scheme, both the central as well as the state governments have indicated that a sizeable portion of the outlay should be used to benefit the farmers belonging to the group of Scheduled Castes or Scheduled Tribes. It was indicated in the guidelines prepared by the department of agriculture Government of Maharashtra that 22 per cent of the total outlay should reach the beneficiaries belonging to the Scheduled Castes and Scheduled Tribes. From the list of

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10. Guidelines given by the Government of India for Implementation of the Central Sector Scheme for Promotion of Agricultural Mechanisation, Annexure I, item 8.3, p.3.

beneficiaries we noted that only one beneficiary from Sangli district belonged to the Scheduled Tribe category. It must be however, noted that the two eligibility criteria namely 6-8 acres of perennially irrigated land and 15 per cent down payment, will not allow any of the Scheduled Caste or Scheduled Tribe farmers to avail the benefit of the scheme. Most of the cultivators belonging to these group of castes do not have large irrigated holdings and the financial resources required as seed money for such investment are also not available with them. Therefore, it is not surprising that there is hardly any beneficiary belonging to the Scheduled Castes and Scheduled Tribes. Thus it is necessary to modify the criteria for the group of Scheduled Castes and Scheduled Tribes if it is desired that the farmers belonging to these groups should be benefited under the scheme.

### 1.8 Scope of the Study and Limitations

The present study is spread over five chapters. In the present chapter we discussed the process of mechanization and its impact as understood from various studies. The objectives were set forth for the purpose of analysis. We have analysed the features of the scheme and its design in the light of the objectives. The second chapter includes the impact of the scheme on variables relating production. The important components considered here are cost of production, cropping pattern and change in productivity due to the scheme. This chapter is followed by the analysis of the impact on employment both for

human as well as bullock labour. Viability of the investment through the financial viability analysis is done in the fourth chapter. The last chapter includes a summary and conclusion of the study.

Among the limitations of the study, we felt four prominent limitations at the time of analysis. Firstly, the study is taken up almost within the first two years from the starting of the scheme. Therefore, the flow of benefits and the cost might not have stabilised during such a short period. This may lead to improper estimation of the viability of scheme as well as its impact. Secondly, the results of the study pertain to a tractor with 18 HP, and hence in no case these results can be generalised for other types of tractors. The 18 HP tractor has a good flexibility in operations but has its own limitations. Thirdly, the sample farmers form a very low percentage of the total number of tractor users in the sample region, though their proportion to the total number of beneficiaries is quite large. This does not allow us to generalise the results for tractor users. Lastly, the sample area has grapes as the dominant crop along with sugarcane. The share of other crops is quite low and hence, the results of the study are applicable more in the similar crop zones.

## CHAPTER II

### IMPACT OF TRACTORIZATION ON PRODUCTION

#### 2.1 Introduction

Farm mechanisation in general and tractorization in particular have an important place in modernisation of Indian agriculture. With the introduction of the Green Revolution, there appears to be a steady increase in the demand for tractors and accessories. The improved farm technology has induced farmers to adopt intensive agriculture which necessitates the use of tractors, power tillers and power threshers for timely and efficient completion of farm operations. This is particularly true in respect of large holdings with a high proportion of irrigation. With the expansion of assured irrigation and introduction of short duration high yielding crops, tractors have been found to be more effective than animal power in bringing about desirable changes in cropping pattern and cropping intensity. Further, tractors can be used for several activities like transportation, land reclamation, harvesting, threshing, etc. These advantages partly explain the rapid pace of tractorization in regions which have witnessed expansion of irrigation and adoption of high yielding varieties and remunerative commercial crops.

In view of the above, the present chapter seeks to present information related to input cost on different crops, total expenditure and total income. This chapter also includes some information regarding the impact of tractorization on the small size of holding comparing the situations before and after the tractorization.

## 2.2 Operational Holding

Size of holding helps us in categorization of farmers for the purpose of analysis. The distribution of farmers according to their size of holding is presented in table 2.1. The distribution of land size shows that the majority of the farmers have land holding less than 5 hectares and they constitute about 62 per cent of the total sample. Even in the group of farmers having holding below 5 hectares those with less than 3.2 hectares are in majority. They constitute about 38 per cent of the total sample. The average size of holding was 5.95 and 5.86 hectares in Nashik and Sangli district. It was observed that none of the farmers purchased land after the introduction of the tractor. The distribution of land is almost equal across the three size classes but the larger size class of holding do not have high proportion of perennially irrigated land.

## 2.3 Livestock Assets

Bullocks are the main source of draught power available for agricultural operations in India. The stock of the animals of different types would indicate the economic status of the farmer. Table 2.2 gives the average number of animals and their value per household in Nashik and Sangli districts. The total number of animals maintained by the households was observed to be the same in both the districts. On an average, a household maintained nearly 7 animals. Out of the total herd strength, 44 per cent were bullocks,

Table 2.1 : Land Holding Distribution of Sample Farmers

Cate- gory	Size of holding (ha)	Number of Opera- tional holding	Percen- tage of number of holding	Opera- tional area(ha)	Percen- tage of area of opera- tional holding	Average size of holding (ha)
<u>Sample from Nashik district</u>						
I	Below 3.20	8	38.10	24.40	19.52	3.05
II	3.20 - 5.00	5	23.80	20.80	15.64	4.16
III	5.00 and above	8	38.10	79.80	63.84	9.98
		21	100.00	125.00	100.00	5.95
<u>Sample from Sangli district</u>						
I	Below 3.20	5	31.25	14.04	14.98	2.81
II	3.20 - 5.00	5	31.25	19.80	21.12	3.96
III	5.00 and above	6	37.50	59.90	63.90	9.98
		16	100.00	93.74	100.00	5.86

37 per cent cows and remaining 19 per cent buffaloes in Nashik district. The corresponding figures for Sangli district were 33 per cent, 19 per cent and 48 per cent, respectively. The number of draught animals maintained by the household was less in Sangli district as compared to Nashik district. This could be due to the early adoption of farm mechanization in the study area.

Table 2.2 : Details of Livestock of Sample Farmers in Nashik and Sangli districts

(Average per household)

Livestock	Sample from Nashik district		Sample from Sangli district	
	Number	Value(Rs.)	Number	Value(Rs.)
Bullock	3.00 (43.80)	19095.25 ( 45.46)	2.19 (33.03)	13625.00 ( 32.86)
Cows	2.52 (36.79)	9476.19 ( 32.39)	1.25 (18.86)	8312.50 ( 21.25)
Buffaloes	1.33 (19.41)	6233.10 ( 21.65)	3.19 (48.11)	19031.25 ( 45.89)
Total	6.85 (100.00)	28309.53 (100.00)	6.63 (100.00)	41468.75 (100.00)

Note: Figures in parentheses are percentages to the total.

The total investment of the sample farmers on different types of animals was substantially higher in Sangli district (Rs. 41469) compared to Nashik district (Rs. 28310). The farmers of Sangli district have invested about 44 per cent more on the livestock. The major investment was observed to be on draught animals (about 45 per cent) in Nashik district and on buffaloes (about 46 per cent) in Sangli district. Thus it can be observed that in Sangli district the farmers have diversified their investment in the animal power. We do not find any difference in the stock of the household animals before and after the introduction of tractorization.



## 2.4 Mechanized Implements

Mechanization of farming is quite common in both the districts, but these two do not represent the highly mechanized districts of the state. Table 2.3 presents the number of machines per household for Sangli and Nashik districts. The major mechanized implements with the farmers were oil engines, electric pump sets, threshing machine and fodder cutting machine. Among these electric pump-sets are more frequent in both the district. Thus, the highest investment is in the electric pumpsets and it is 93 and 79 percent in Nashik and Sangli districts.

Table 2.3 : Per Household Mechanized Implements on Sample Farm in Nashik and Sangli Districts

Implements	Sample from Nashik District		Sample from Sangli District	
	Number	Investment(Rs.)	Number	Investment(Rs.)
Oil Engines	0.05 (2.18)	428.57 (2.01)	-	-
Electric Pump Sets	2.24 (97.82)	20330.95 (97.99)	2.75 (89.58)	26958.75 (73.17)
Threshing Machine	-	-	0.19 (6.19)	9375.00 (25.44)
Fodder Cutting Machine	-	-	0.13 (4.23)	512.50 (1.39)
Total	2.29 (100.0)	21309.52 (100.00)	3.07 (100.00)	36846.25 (100.00)

Figures in parentheses are percentages to the total.

Most of the sample farmers owned 2 electric pump sets in Nashik district and 3 in Sangli district. The per household investment in mechanized implements was Rs. 21,310 in Nashik and Rs. 36,846 in Sangli district. The share of investment on other implements is relatively less except about 25 per cent on threshers in Sangli district. Thus it is clear that in both the districts the farmers spent major amount of money on irrigation related assets namely irrigation pump sets. Here also we have noticed no difference in the stock of agricultural implements after the introduction of tractor.

#### 2.5 Area Under Major Crops

Theoretically it is argued that tractorization induces change in the cropping pattern. But many a times the strong factors are local conditions and factor as well as the product market behaviour that dictate the allocation of area under different crops. Area under major crops before the tractorization and the changes occurred due to tractorization are presented in table 2.4. The table reveals that except for increase in area under grapes in Nashik district and Jowar in Sangli district, no major changes occurred in other crops due to tractorization. Area under most of the crops declined after tractorization in both Nashik and Sangli districts. Although there was an increase of 18.31 per cent area under grapes, yet the decline was as high as 34.25 per cent for sugarcane, 26.51 per cent for jowar, 12.12 per cent for wheat and less than 10 per cent for the other crops. The change

was more prominent from subsistence low value crops to high value commercial crops. However, in Sangli district, there was no significant change in area under grapes and sugarcane.

The changes in cropping pattern indicates a shift, though slight, towards commercial crops in terms of allocation of area. Though the area shift is not substantial, it is quite possible that the commercial crops may be claiming the large share of the total resources. Even the changes may also occur in terms of productivity and intensity of cropping. As the increase in the area is only for grapes in Nashik and for Jowar in Sangli district and for other crops there is a decline, it seems the tractor farmers have shifted some area under other crops to the commercial crops like grapes and Jowar. Further, as the total cropped area is also declined in both the districts, the tractor farmers have either left some area fallow for next season or they have sold out a portion of their land.

Further, as far as total cropped area is concerned, it is almost the same for Nashik and Sangli districts before tractorization, being 7.02 hectares in Nashik and 7.01 hectares in Sangli district. Out of total cropped area, area under grapes is as high as 30.34 per cent before tractorization and 37.23 per cent after the tractorization in Nashik district. In Sangli district, the area under grapes is almost same (around 31 per cent) before and after the implementation of the scheme.

Table 2.4 : Area Under Major Crops in Nashik and Sangli Districts

(in hectares/household)

Crops	Sample from Nashik district		Percentage increase(+) or decrease(-)	Sample from Sangli district		Percentage increase(+) or decrease(-)
	BT	AT		BT	AT	
Grapes	2.13 ( 30.34)	2.52 ( 37.23)	(+) 18.31	2.13 ( 31.10)	2.13 ( 31.37)	0.00
Sugarcane	0.73 ( 10.40)	0.43 ( 7.10)	(-) 34.25	1.16 ( 16.55)	1.16 ( 16.69)	0.00
Jowar	0.83 ( 11.32)	0.61	(-) 26.51	0.70 ( 9.99)	0.83 ( 12.66)	(+) 25.71
Bajra	0.45 ( 6.41)	0.42 ( 6.21)	(-) 6.67	-	-	-
Soyabean	-	-	-	1.07 ( 15.26)	0.97 ( 13.96)	(-) 9.35
Wheat	0.66 ( 9.40)	0.58 ( 8.58)	(-) 12.12	0.23 ( 3.28)	0.18 ( 2.59)	(-) 21.74
Other Crops	2.22 ( 31.63)	2.15 ( 31.81)	(-) 3.15	1.67 ( 23.82)	1.58 ( 22.73)	(-) 5.39
Total	7.02 (100.00)	6.76 (100.00)	(-) 3.70	7.01 (100.00)	6.95 (100.00)	(-) 0.86

Notes: 1. Figures in parentheses are percentages to the total

2. BT - Before Tractorization; AT - After Tractorization

## 2.6 Cropping Pattern

The area under major crops above indicated on broad trends in area allocation. An analysis of area shares under different crops especially under irrigated and rainfed conditions helps us to understand the changes in better perspective.

Generally the cropping pattern of the irrigated area would be different and is usually dominated by high value commercial crops as compared to the low density subsistence crops grown under rainfed conditions.

2.5

It may be observed from the table that grapes occupied 41.12 per cent area under irrigated conditions in Nashik district before tractorization. This has increased to 50.7 per cent after the tractorization. Similarly, in Sangli district the area under grapes has gone up by about 2 per cent points. Vegetables occupied second highest share of area followed by sugarcane, wheat and pulses in Nashik district. There is almost a uniform reduction in the area share under these crops after tractorization. The decline was quite sharp in the case of sugarcane. The share of other crops in the gross cropped area was very less. In Sangli district, after grapes, the maximum area was under sugarcane (22.48 per cent) followed by pulse crops (7.17 per cent), fodder crops (6.20 per cent), Jowar (4.65 per cent) and wheat (4.46 per cent) under irrigated conditions before farm mechanization. After tractorization, the order was sugarcane (23.29 per cent), pulse crops (6.43 per cent), fodder crops (6.02 per cent), Jowar (5.02 per cent) and Soyabean (4.42 per cent).

Under unirrigated conditions, Jowar occupied maximum area (44.56 per cent) on the farms followed by groundnut (25.00 per cent), Bajra (24.46 per cent) and Rice (5.44 per cent) before tractorization in Nashik district. There was no.

Table 2.5 : Cropping Pattern on the Sample Farms

(in hectares/household)

Crops	Sample from Nashik District			
	BT		AT	
	I*	UI*	I*	UI*
Grapes	2.13 (41.12)	-	2.52 (50.70)	-
Sugarcane	0.73 (14.09)	-	0.48 (9.60)	-
Jowar	-	0.82 (44.56)	-	0.61 (34.08)
B Bajra	-	0.45 (24.46)	-	0.42 (23.46)
Soyabean	-	-	-	-
Wheat	0.66 (12.74)	-	0.58 (11.67)	-
Rice	-	0.10 (5.44)	-	0.16 (8.94)
Maize	-	0.01 (0.54)	-	0.13 (7.26)
Fulses	0.48 (9.27)	-	0.21 (4.23)	-
Groundnut	-	0.46 (25.00)	-	0.47 (26.26)
Vegetable	0.81 (15.64)	-	0.73 (14.69)	-
Spices	0.10 (1.93)	-	0.19 (3.82)	-
Other fruits	0.11 (2.12)	-	0.07 (1.41)	-
Flower	0.12 (2.32)	-	0.15 (3.02)	-
Fodder	0.04 (0.77)	-	0.04 (0.80)	-
TOTAL	5.18 (100.00)	1.34 (100.00)	4.97 (100.00)	1.79 (100.00)

Contd...

Table 2.5 :Contd..

Groups	Sample from Sangli District			
	BT		AT	
	I*	UI*	I*	UI*
Grapes	2.18 (42.25)	-	2.18 (43.78)	-
Sugarcane	1.16 (22.48)	-	1.16 (23.29)	-
Jowar	0.24 (4.65)	0.46 (24.36)	0.25 (5.02)	0.63 (31.98)
Bajra	-	-	-	-
Soyabean	0.22 (4.26)	0.35 (45.95)	0.22 (4.42)	0.75 (33.07)
Wheat	0.23 (4.46)	-	0.13 (3.51)	-
Rice	-	-	-	-
Maize	-	-	-	-
Pulses	0.37 (7.17)	-	0.32 (6.43)	-
Groundnut	-	0.54 (29.19)	-	0.59 (29.95)
Vegetable	-	-	-	-
Spices	0.34 (6.59)	-	0.27 (5.42)	-
Other fruits	0.10 (1.94)	-	0.10 (2.01)	-
Flower	-	-	-	-
Fodder	0.32 (6.20)	-	0.30 (6.02)	-
TOTAL	5.16 (100.00)	1.85 (100.00)	4.98 (100.00)	1.97 (100.00)

Notes : 1 Figures in parentheses are percentages to the total  
2 BT = Before Tractorization, AT = After Tractorization  
3 I\* = Irrigated, UI\* = Unirrigated

change found in the unirrigated crop pattern after the tractorization. In Sangli district, Soyabean occupied maximum area in both before and after the scheme. It was observed that Soyabean and Jowar were grown both under irrigated and unirrigated conditions in Sangli district. The total gross cropped area was observed to decline after tractorization under both irrigated and unirrigated conditions in Nashik district. However, in Sangli district it increased from 1.85 hectares to 1.97 hectares under unirrigated conditions.

The foregoing analysis reveals that grape was the main crop under irrigated conditions in both the districts and Jowar was the main crop under unirrigated conditions in Nashik district and Soyabean in Sangli district. Further it reveals, farmers were allotted more area under crops after tractorization and reduced area under some less remunerative crops in Nashik. However, area under grapes and sugarcane was same in Sangli district before and after tractorization. The shift in area after tractorization was observed only for Jowar under both irrigated and unirrigated conditions in Sangli district.

## 2.7 Intensity of Cropping

The change in the intensity of cropping was noticed by many studies on tractorization. But as indicated earlier in the analysis of area allocation to various crops, the cropping intensity is a function of many other variables other than tractorization. Moreover, the presence of annual crops in the cropping pattern also make it difficult to compare the



change in the cropping intensity. It can be seen from table 2.6 that the average gross cropped area has declined in both the districts and as a result there is a slight decline in the intensity of cropping. The intensity of cropping was worked out as 118 per cent and 114 per cent, before and after tractorization in Nashik district respectively. This indicated a decline of about 3 per cent points. The decline in Sangli district is however, quite marginal. We are aware that, it is difficult to base the conclusions about the change in cropping intensity especially based on one years' data. Moreover, this factor takes time for stabilisation after the introduction of the scheme.

Table 2.6 : Cropping Intensity on Sample Farms

District	Average size of holding (ha)	Average Gross Cropped Area (ha)		Cropping Intensity	
		BT	AT	BT	AT
Sample from					
1 Nashik	5.95	7.02	6.76	118	114
2 Sangli	5.86	7.01	6.95	120	119
Average	5.91	7.02	6.84	119	116

Note : BT - Before Tractorization    AT - after Tractorization

## 2.8 Cost of Cultivation

Changes in the method of cultivation brings in substantial changes in the cost of cultivation. Tractorization induces larger expenditure on the cost of materials and reduces

the same on labour input. The reduction in production cost can be used by efficient allocation of factors of production. Analysis of the cost of cultivation of different crops before and after the tractorization indicates the changes in factor allocations. These are presented in tables 2.7 and 2.8 for Nashik and Sangli districts respectively.

### 2.8.1 Cost of Cultivation in Nashik District

It is indicated earlier that due to the changes in mechanization and ease of operations the cultivator will vary the nature and duration of the crop. In Nashik district, we have both short as well as long duration crops and both commercial as well as subsistence crops. Table 2.7 shows the average per hectare expenditure incurred on various items of the cost of cultivation. It can be observed from the table that the per hectare expenditure has reduced on all the crops except for jowar. After the introduction of tractor. The reduction in the cost of cultivation is larger in the commercial crops and not so significant in the seasonal crops. It is already mentioned that tractor is used more for the annual commercial crops and hence the result is obvious. Intensive use of tractor is seen in the grape cultivation and this has caused a substantial reduction in the cost. It is used for spraying pesticides and replaced a major cost of labour. The quantity of pesticide used as well as labour input was saved in the process.

Similarly, the cost of cultivation for sugarcane has also reduced significantly after the introduction of tractor. The use of tractor for sugarcane cultivation is mainly for the land preparation and transportation. The tractor use under sugarcane was quite prevalent even before the scheme, but after the introduction of the scheme, there is some rationalisation in its use. In Nashik district the reduction in the cost was noticed specifically in the grapes and sugarcane and incidentally there was an increase in the cost of cultivation of a few crops.

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**Table 2.7 : Inputwise Cost Details for Different Crops for the Sample from Nashik District**

(in rupees/hectare)

Crops		Seed	Mannure	Fertilizer	Pesticides
Grapes	BT	-	7957.59 (11.04)	6836.50 (9.49)	18287.39 (25.38)
	AT	310.34 (0.48)	5114.94 (7.93)	8037.64 (12.46)	15568.68 (25.68)
Sugarcane	BT	5132.18 (22.83)	3000.00 (13.33)	3114.94 (13.89)	195.40 (0.87)
	AT	576.92 (3.47)	1750.00 (10.52)	3442.30 (20.69)	-
Jowar	BT	170.40 (2.46)	1460.23 (21.10)	721.59 (10.42)	-
	AT	171.19 (2.23)	2220.34 (28.87)	661.02 (8.60)	-
Bajra	BT	159.13 (2.96)	1543.08 (28.34)	490.38 (9.14)	-
	AT	156.12 (2.43)	1423.27 (22.21)	627.55 (9.76)	-
Wheat	BT	702.74 (7.16)	1034.25 (10.53)	1842.47 (18.76)	134.93 (1.88)
	AT	832.95 (10.70)	954.55 (12.26)	1412.88 (18.14)	-
Other Crops	BT	833.37 (6.57)	2202.04 (17.35)	1968.57 (15.51)	1436.94 (11.32)
	AT	980.81 (6.43)	2452.85 (16.08)	2447.37 (16.04)	1556.47 (10.20)
Total	BT	943.10 (3.17)	3723.87 (10.88)	3261.61 (10.97)	5824.35 (19.60)
	AT	569.97 (1.84)	3096.82 (10.02)	4166.43 (13.48)	6314.84 (20.44)

Contd..

Table 2.7 : Contd...

Crops		Mannual Labour		
		Hired	Family	Total
Grapes	BT	23857.59 (33.11)	1747.10 (2.42)	25604.69 (35.53)
	AT	22455.33 (34.80)	1122.41 (1.74)	23577.74 (36.54)
Sugarcane	BT	6247.93 (27.86)	876.72 (3.91)	7124.65 (31.77)
	AT	8147.43 (48.98)	706.09 (4.24)	8853.52 (53.22)
Jowar	BT	1689.49 (24.41)	796.02 (11.50)	2405.51 (34.75)
	AT	1764.83 (22.95)	910.17 (11.83)	2475.00 (32.18)
Bajra	BT	1440.96 (26.84)	537.02 (10.00)	1977.98 (36.85)
	AT	1388.78 (21.59)	667.35 (10.38)	2056.13 (31.97)
Wheat	BT	2479.79 (25.25)	1330.82 (13.55)	3810.61 (38.80)
	AT	1567.80 (20.13)	1437.12 (18.45)	3004.92 (38.59)
Other Crops	BT	2976.02 (23.45)	1087.96 (8.57)	4285.88 (33.77)
	AT	3272.04 (21.45)	1461.95 (9.58)	4733.99 (31.03)
Total	BT	9195.61 (30.94)	1208.45 (4.07)	10404.06 (35.00)
	AT	10145.77 (32.83)	1164.10 (3.77)	11309.87 (36.60)

Contd...

Table 2.7 : Contd....

Crops		Bullock Labour	Tractor	Other Expenditure	Total Expenditure
Grapes	BT	575.23 (0.80)	1113.39 (1.55)	11683.37 (15.21)	72053.15 (100.00)
	AT	411.83 (0.64)	1712.64 (2.65)	8784.29 (13.62)	64518.16 (100.00)
Sugarcane	BT	794.25 (3.54)	2028.15 (9.04)	1039.33 (4.63)	22423.63 (100.00)
	AT	314.10 (1.39)	352.56 (2.12)	1344.37 (8.03)	16534.29 (100.00)
Jowar	BT	1023.40 (14.86)	555.68 (8.03)	5500.00 (7.22)	6921.82 (100.00)
	AT	805.08 (10.47)	759.49 (9.88)	393.31 (5.13)	7690.42 (100.00)
Bajra	BT	676.92 (12.61)	394.23 (7.34)	121.15 (2.26)	5357.33 (100.00)
	AT	1132.65 (17.61)	293.57 (4.56)	737.24 (11.46)	6431.84 (100.00)
Wheat	BT	1087.67 (11.08)	620.55 (6.32)	537.67 (5.47)	9820.89 (100.00)
	AT	1098.49 (14.11)	354.85 (4.56)	123.79 (1.65)	7787.42 (100.00)
Other Crops	BT	844.08 (6.65)	633.47 (4.99)	709.39 (5.59)	12691.84 (100.00)
	AT	1030.92 (6.76)	827.79 (5.43)	1224.12 (8.02)	15254.32 (100.00)
Total	BT	793.05 (2.67)	904.75 (3.04)	3863.23 (13.00)	29723.02 (100.00)
	AT	732.13 (2.37)	1006.55 (3.26)	3704.22 (11.99)	30900.89 (100.00)

Table 2.3 : Inputwise Cost Details for Different Crops for the Sample from Sangli District

(in rupees/hectare)

Crops	Seed	Mannure	Fertilizers	Pesticides
Grapes BT	-	4423.16 (6.69)	6591.95 (9.97)	25258.62 (38.18)
AT	-	4729.89 (7.29)	7813.22 (12.04)	23706.90 (36.54)
Sugarcane BT	747.31 (5.76)	795.69 (6.13)	3677.42 (23.32)	-
AT	580.69 (4.23)	1107.53 (8.07)	3333.33 (24.30)	-
Jowar BT	109.19 (2.14)	562.50 (11.00)	708.03 (13.85)	-
AT	105.53 (2.33)	875.89 (19.77)	643.94 (14.65)	-
Soyabean BT	843.60 (13.59)	636.62 (10.26)	977.91 (15.75)	40.69 (0.66)
AT	985.26 (14.81)	717.95 (10.79)	1224.36 (18.40)	38.46 (0.58)
Wheat BT	743.61 (12.37)	203.33 (3.44)	2115.23 (34.94)	-
AT	1016.07 (12.56)	446.43 (5.52)	2053.57 (25.38)	-
Other Crops BT	1238.47 (13.58)	917.91 (13.77)	692.16 (10.39)	37.31 (0.56)
AT	934.65 (13.29)	1330.61 (19.01)	975.78 (13.33)	35.43 (0.50)

Contd..

Table 2.8 : Contd....

Crops		Manual Labour		
		Hired	Family	Total
Grapes	BT	15123.56 (22.36)	1131.39 (1.71)	16255.45 (24.57)
	AT	11718.39 (18.06)	1309.48 (2.02)	13027.87 (20.08)
Sugarcane	BT	5355.91 (41.25)	956.99 (7.37)	6312.90 (48.62)
	AT	5292.20 (38.57)	1012.63 (7.38)	6304.83 (45.95)
Jowar	BT	1800.89 (35.22)	373.66 (7.31)	2174.55 (42.53)
	AT	1206.73 (27.24)	373.40 (8.43)	1580.13 (35.67)
Soyabean	BT	1842.15 (29.67)	276.16 (4.45)	2118.31 (34.12)
	AT	1513.78 (22.76)	362.18 (5.44)	1875.96 (23.20)
Wheat	BT	1422.22 (23.49)	293.33 (4.85)	1715.55 (23.34)
	AT	1708.93 (21.12)	419.64 (5.19)	2128.57 (26.31)
Other Crops	BT	1423.49 (21.40)	753.96 (11.39)	2185.45 (32.79)
	AT	1555.31 (23.54)	494.48 (7.03)	2149.79 (30.57)

Contd...



Table 2.8 : Contd....

Crops		Bullock Labour	Tractor	Other Expenditure	Total Expenditure
Grapes	BT	573.27 (0.87)	390.80 (0.59)	12656.58 (19.13)	66154.83 (100.00)
	AT	204.02 (0.32)	816.19 (1.26)	14573.79 (22.47)	64871.88 (100.00)
Sugarcane	BT	752.50 (5.80)	209.68 (1.61)	483.09 (3.76)	12983.59 (100.00)
	AT	591.21 (4.31)	1240.67 (9.04)	562.31 (4.10)	13720.57 (100.00)
Jowar	BT	848.21 (16.59)	221.88 (4.34)	483.09 (9.55)	5112.45 (100.00)
	AT	361.68 (8.17)	295.09 (6.66)	562.31 (12.70)	4429.57 (100.00)
Soyabean	BT	833.71 (13.43)	268.78 (4.33)	483.09 (7.86)	6207.71 (100.00)
	AT	673.08 (10.12)	575.64 (8.65)	562.31 (8.45)	6653.02 (100.00)
Wheat	BT	654.44 (11.47)	83.59 (1.38)	483.09 (8.06)	6053.89 (100.00)
	AT	1035.72 (12.80)	848.21 (10.48)	562.31 (6.95)	8090.88 (100.00)
Other Crops	BT	917.01 (13.76)	183.42 (2.83)	483.09 (7.32)	6664.82 (100.00)
	AT	710.83 (10.11)	326.77 (4.65)	562.31 (7.99)	7032.17 (100.00)

Notes: 1 Figures in parentheses are percentages to the total.  
2 BT - Before Tractorization; AT - After Tractorization

### 2.8.2 Cost of Cultivation in Sangli District

Inputwise expenditure on various items in Sangli district is presented in table 2.8. It is clear from the table that the result of Sangli district are entirely different from those obtained for Nashik district. In Nashik, almost in all the crops the cost of cultivation has reduced, but similar trend is not observed in Sangli district. Here the reduction in the cost of cultivation was observed only for grapes. Moreover, the absolute value of reduction is also smaller in Sangli as compared to Nashik district.

The proportion of expenditure on manual labour even in the case of jowar has reduced considerably. The cost of cultivation has increased for most of the crops. Even for the other minor crops the total expenditure on cost of cultivation has increased by about 1/5th of the cost before tractorization. The major increase came from the higher use of material inputs. In other words the scheme of mechanization helped in better adoption of technology and induced towards a shift in input use.

### 2.9 Pattern of Tractor Use

One of the major changes in the cost of cultivation is the use of tractor for different operations. In both the districts together the farmers have used about 2735 hours of tractor in 260 hectares before the introduction of the scheme. This has increased to 7622 hours after the purchase of own tractor thereby indicating, more than double increase in the

tractor use. On an average, each tractor was used for about 206 hours in the two seasons and about 30 hrs. per hectare after the introduction of the scheme.

The rate of use of tractor hours widely varied across crops. For instance, in grapes, it increased from 13 hrs. per hectare to 65 hrs/ha. between before and after the scheme. In Soyabean it increased from 5 hrs/ha. to nearly 12 hrs./ha. But, this has reduced in crops like Jowar and Bajra. The reason for the intensive use of tractor in grape is that the farmers find this small tractor is very useful for spraying pesticides in Grapes. Among the various operations of grapes, pesticides spraying is the main and important operation hence tractor use is substantially higher in Grapes.

The use of tractor also varies with districts. Use of tractor is significantly more in Nashik district compared to Sangli district. The average use of tractor for all crops is only 19 hrs/ha. in Sangli district, whereas the same is about 38 hrs/ha. in Nashik district. Nashik's pattern of agriculture is comparatively more intensive hence the tractor use intensity is more. Among the various operations, tractor is mainly used for spraying of pesticides in grapes, transportation, inter-culture for grapes, dry ploughing for sugarcane, soyabean, bajra, jowar etc. in both districts.

Thus, it is clear that tractor use is relatively more in Nashik district than Sangli. Among the crops, use of tractor is substantially higher in grapes in both districts and in both before and after introduction of scheme.

Table 2.9 : Pattern of Tractor Use Across Crops

	(Average Hours per hectare)					
	Hired Tractor		Own Tractor		Total	
	Before	After	Before	After	Before	After
Sample from Sangli District						
1 Grapes	0.43	2.01	9.48	32.76	9.91	34.77
2 Sugarcane	4.41	15.22	2.15	6.45	6.56	21.67
3 Jowar	0.36	0.00	7.52	7.52	7.68	7.5
4 Soyabean	2.85	4.68	2.33	6.86	5.17	11.54
5 wheat	0.00	0.00	2.78	25.71	2.78	25.71
6 Others	1.53	1.34	3.23	5.00	4.81	6.34
Total	1.70	4.13	5.26	15.02	6.96	19.16
Sample from Nashik District						
1 Grapes	0.00	0.00	16.29	84.72	16.29	84.72
2 Sugarcane	0.00	0.00	31.17	12.00	31.17	12.00
3 Jowar	0.00	0.00	12.41	7.42	12.41	7.42
4 Bajra	0.00	0.00	14.36	3.98	14.36	3.98
5 Wheat	0.00	0.00	7.61	7.05	7.61	7.05
6 Others	0.00	0.00	6.18	14.71	6.18	14.71
Total	0.00	0.00	13.26	38.68	13.26	38.68
.Combine for Districts						
1 Grapes	0.19	0.80	13.32	64.12	13.51	64.92
2 Sugarcane	2.41	9.90	15.29	8.39	17.71	18.29
3 Jowar	0.14	0.00	10.42	7.47	10.56	7.47
4 Bajra	0.00	0.00	14.36	3.98	14.36	3.98
5 Soyabean	2.85	4.68	2.33	6.86	5.17	11.54
6 wheat	0.00	0.00	6.61	10.53	6.61	10.53
7 Others	0.56	0.43	5.12	11.21	5.68	11.69
Total	0.74	1.32	9.80	28.28	10.54	30.10

Note : 1 Before - Before the Scheme  
2 After - After the Scheme

## 2.10 Changes in Productivity of Crops

Tractor in itself is not directly a yield increasing input, but it helps in energy conservation as well as the optimum use of manpower and other energy inputs. The proper timing of operations, deep ploughing and the ease of operations indirectly help in improvement of yield due to tractors. Productivities of different crops in the sample region of Nashik and Sangli are presented in table 2.10.

It is clear from the table that the productivity has increased for majority of the <sup>principal</sup> crops in both the districts. Among the different crops a substantial increase was mainly observed in the 'other crop' group. Wheat also recorded a substantial increase in the productivity <sup>in Sangli</sup>. Sugarcane has shown a slight decline in productivity in Nashik district and an increase in Sangli. The productivity of grapes has increased in both the districts. The increase in productivity can be attributed to <sup>four</sup> factors. Firstly, there is an increased use of purchased inputs and wherever, these inputs are used in optimum quantity, the productivity has changed upwards. Secondly, the tractorization has helped in cutting short the time of operation and thus the timely application of inputs helps in increasing the productivity. Thirdly, the access to information also increases and this helps in obtaining the optimum use of resources. Lastly, the small tractor has an added advantage, most of the farmers have expressed that spraying pesticides in right time, by using this small tractor, is the main reason for the yield increase despite a reduction in the cost of cultivation.

Table 2.10 : Productively for Different Crops for Nashik and Sangli District

(in Quintals/hectare)

	Sample from NASHIK DISTRICT						Sample from SANGLI DISTRICT					
	Main Product		Percent- age Increase (+) Decrease (-)	By Product		Percent- age Increase (+) Decrease (-)	Main Product		Percent- age Increase (+) Decrease (-)	By Product		Percent- age Increase (+) Decrease (-)
	BT	AT		BT	AT		BT	AT		BT	AT	
Grapes	169.64	191.80	(+)11.56	-	-	-	226.10	283.10	(+) 8.27	-	-	-
Sugar- cane	98.56	89.42	(-) 9.27	713.39	448.71	(-)37.54	956.90	970.90	(+) 1.46	16.31	16.94	(+) 5.02
Jowar	22.95	21.19	(-)(7.67)	1090.91	1415.25	(+) 22.92	18.30	13.97	(-)23.66	21.12	15.25	(-)24.95
Bajra	19.80	19.28	(-)(2.63)	1259.61	1163.27	(-) 7.65	-	-	-	-	-	-
Soyabean	-	-	-	-	-	-	18.30	18.39	(+) 0.44	-	-	-
wheat	23.42	18.03	(-)(23.01)	-	0.45	(+)100.00	18.89	30.36	(+) 6.22	-	-	-
Other Crops	14.30	20.77	(+)5.74)	0.43	0.58	(+) 93.55	147.16	154.21	(+) 4.79	-	-	-

Note: BT - Before Tractorization, AT - After Tractorization

Interestingly, the productivity of by-product has also increased when there is an improvement in the yield of crop. This may be true, since along with the better growth of crop that will not only increase to help productivity but also by-product. For instance, if growth of paddy crop is good, that will increase both yield and straw value.

It is clear from the above analysis that the yield of majority of the crops have increased after the implementation of tractorization scheme despite a reduction in cost of cultivation. Hence, it may be concluded that tractorisation had a positive impact on productivity of most of the crops in these two districts.

#### 2.11 Gross Value of Production

The gross value of production includes the value of crop production and by-product. The value of production of each of the crop is computed by multiplying the yield of the crop by the selling price. Wherever, the produce was not sold, the prices reported by the other selected farmers in the village were taken for calculation. The value of by-product was computed at the prevailing market prices.

It is obvious that the total value of product varies with quality of produces and variety. Mere increase in production does not necessarily means higher gross value of production, since it is mostly determined by the market condition. It is evident from the table 2.11 that the gross

Table 2.11 : Gross value of output of Main Product and By-product in Nashik and Sangli District

(In rupees/hectare)

Crop	Sample from Nashik District					
	Main Product		Percent- age Increase (+) Decrease (-)	By Product		Percent- age Increase (+) Decrease (-)
	BT	AT		BT	AT	
Grapes	211205.35	209713.74	(-)10.71	-	-	-
Sugarcane	72471.26	73076.92	(+) 0.83	713.39	448.71	(-)37.5
Jowar	6036.93	6550.85	(+) 7.35	1204.54	1470.34	(+)18.0
Bajra	6350.96	6357.14	(-) 7.21	1221.15	1163.27	(-)(4.7
Soyabean	-	-	-	-	-	-
Wheat	10989.75	10511.36	(-) 4.35	13.70	45.45	(+)30.1
Other Crops	35528.57	33232.46	(+) 7.07	51.02	19.74	(-)(33

Contd....



Table 2.11 (Contd.)

Crop	Sample from Sangli District					
	Main Product		Percentage Increase (+) Decrease (-)	By Product		Percentage Increase (+) Decrease (-)
	BT	AT		BT	AT	
Grapes	220438.60	257313.22	(+) 6.70	-	-	-
Sugarcane	59112.90	72102.15	(+) 21.97	322.58	338.68	(+) 4.99
Jowar	6585.71	4401.06	(-) 32.66	1857.15	1507.10	(-) 18.85
Bajra	-	-	-	-	-	-
Soyabean	17220.93	20310.89	(+) 17.94	-	-	-
Wheat	8388.89	12500.00	(+) 49.01	-	-	-
Other Crops	14998.13	18838.58	(+) 25.61	-	-	-

Note : BT - Before Tractorization

AT - After Tractorization

Table 2.11 : Gross value of output of Main Product and By-product in Nashik and Sangli District

(In rupees/hectare)

Crop	Sample from Nashik District					
	Main Product		Percent- age Increase (+) Decrease (-)	By Product		Percent- age Increase (+) Decrease (-)
	BT	AT		BT	AT	
Grapes	211205.35	209713.74	(-)10.71	-	-	-
Sugarcane	72471.26	73076.92	(+) 0.83	713.39	448.71	(-)37.54
Jowar	6036.93	6550.85	(+) 7.85	1204.54	1470.34	(+)18.08
Bajra	6350.96	6357.14	(-) 7.21	1221.15	1163.27	(-)(4.74
Soyabean	-	-	-	-	-	-
Wheat	10989.75	10511.36	(-) 4.35	13.70	45.45	(+)30.14
Other Crops	35528.57	33232.46	(+) 7.07	51.02	19.74	(-)(38.6

Contd....

Table 2.11 (Contd.)

Crop	Sample from Sangli District					
	Main Product		Percent- age Increase (+) Decrease (-)	By Product		Percent- age Increase (+) Decrease (-)
	BT	AT		BT	AT	
Grapes	220438.60	257313.22	(+) 6.70	-	-	-
Sugarcane	59112.90	72102.15	(+)21.97	322.58	338.68	(+) 4.99
Jowar	6585.71	4401.06	(-)32.66	1857.15	1507.10	(-)18.85
Bajra	-	-	-	-	-	-
Soyabean	17220.93	20310.89	(+)17.94	-	-	-
Wheat	8388.89	12500.00	(+)49.01	-	-	-
Other Crops	14998.13	18838.58	(+)25.61	-	-	-

Note : BT - Before Tractorization

AT - After Tractorization

value of output has increased in majority of the crops after the implementation of tractorization scheme. The increase was found maximum in jowar (7.85 per cent) followed by sugarcane (0.83 per cent) and other crops (7.07 per cent) in Nashik district. Interestingly, whenever yield rate increases the gross value of crops also increases except for the other crops in Nashik. The reduction in the gross value of production despite higher production, might be due to the reduction of output prices in the market. This indicates that gross value of a crop produced is not determined only by yield but condition of the market. There is no significant change observed in the gross value of output of grapes before and after the scheme.

In Sangli district, the value of output of most of the crops has increased after the implementation of the scheme, except for jowar. The yield of jowar has reduced after the scheme and hence the gross value has also reduced. While comparing yield rate with gross value of crops in Sangli district, particularly in grapes, the increasing rate of yield was only 8 per cent but the gross value per hectare has increased nearly by 7 per cent. This could be because of the better market condition for that crop. Thus, it is clear from the above analysis that the gross income of the majority of the crops in both districts has increased after the scheme.

### 2.12 Net Income from Agriculture

The scheme of mechanization was introduced mainly to enhance the economic viability of the small farmers by

increasing their net returns from agriculture. The analysis of the cost of cultivation and the changes in the gross value of output indicated mixed trends across crops. The clear picture, therefore, can only be obtained from the analysis of the net income per hectare from the scheme as compared to the same before the implementation of the scheme. Here we have analysed the net income from agriculture including the by-products.

### 2.12.1 Net Income of Different Crops in Nashik

The details of per hectare total expenditure, total income and net income of each crop before and after the implementation of tractor scheme are presented in Table 2.12. It can be observed from table that except for other crops, the net per hectare income has increased in all crops. In terms of percentages, the increase was found marginal in jowar (3.36 per cent) and bajra (declined). The rate of increase of net income is relatively less in grapes and sugarcane. However, in absolute money value, it increased about Rs. 6800/ha. in grapes and Rs. 6000/ha. in sugarcane. The increase in net income has occurred because of reduction of cost of cultivation on one hand, increase in yield rate on the other. These two factors helped to increase the net income of each crop.

It is interesting to note that although there was a decline in total expenditure as well as the total income of wheat after the scheme, the increase in net income of this crop was maximum (43 per cent). On the whole, <sup>change in</sup> the per hectare net income of all principal crops grown in Nashik district has shown a positive sign after the tractorization scheme.

Table 12 : Income and Expenditure Patterns of Different Crops in Nashik District

(In Rupees/hectare)

Crops	Total Expenditure			Total Income			Net Income		Percentage Incr- ease(+) Decr- ease(-)
	Bef.	Now	Percentage Incr- ease(+) Decr- ease(-)	Bef.	Now	Percentage Incr- ease(+) Decr- ease(-)	Bef.	Now	
Grapes	72058.15	64518.16	-10.46	211205.36	209713.74	-0.70	139147.21	145899.08	+4.69
Sugarcane	22428.68	16634.29	-25.83	73189.66	73525.64	+0.46	50760.98	56891.35	+10.78
Jowar	6921.92	7690.42	+10.00	7241.48	8021.19	+9.27	319.56	330.76	+3.36
Bajra	5367.88	6431.84	+16.54	8072.11	7520.41	-6.83	2704.23	1088.57	-59.74
Wheat	9820.89	7787.42	-20.71	11003.42	10556.82	-4.06	1182.53	2769.39	+42.70
Other crops	12691.84	15254.32	+16.80	32579.59	38252.19	+14.83	19887.76	22997.87	+13.52
<b>Total</b>	<b>29657.99</b>	<b>30900.80</b>	<b>+4.02</b>	<b>82600.46</b>	<b>95735.49</b>	<b>+13.72</b>	<b>52942.46</b>	<b>64834.60</b>	<b>+18.34</b>

Note : Bef. - Before Tractorization; Now - After Tractorization.

### 2.12.2 Net Income of Different Crops in Sangli District

Table 2.13 presents per hectare total expenditure, gross income and net income before and after the tractorization for Sangli district. It is clear from the table that the net income of each crop has increased after the scheme in Sangli district except for jowar. Among other crops the increase was noted in wheat followed by other crops. The increase in the per hectare net income for wheat was as high as 89 per cent. There are changes which can be observed in the pattern of net income across different crops and between the districts. For instance, the increase in net income is substantial in jowar and bajra in Nashik district. The increase in net income is only 5 per cent even in important crops like grapes. But in Sangli district the net income of wheat and other crops has increased substantially. Importantly, the increase in income from grapes is more than five times of that from Nashik district. However, the use of tractor is not that high in Sangli district.

Although the net income per hectare for crops like wheat, bajra, sugarcane, etc., has increased substantially in terms of percentages the absolute value is much higher for grapes in both the districts. Additional income generated through the other minor crops is relatively less compared to the additional income generated through grape cultivation.

### 2.13 Impact of the Scheme on Small Farmers

The focus of the scheme was to introduce mechanization in agriculture and at the same time provide opportunities to small and marginal farmers and weaker sections of the society.

**Table 2.13 : Income and Expenditure Pattern of Different Crops in Sangli District**

(In rupees/hectare)

Crops	Total Expenditure		Percentage Incr- ease(+) Decr- ease(-)	Total Income		Percentage Incr- ease(+) Decr- ease(-)	Net Income		Percentage Incr- ease(+) Decr- ease(-)
	Bef.	Now		Bef.	Now		Bef.	Now	
Grapes	66154.83	64871.83	-1.94	220488.50	257313.22	+16.70	154333.67	192441.34	+24.69
Sugarcane	12983.59	13720.57	+5.68	59435.48	72440.86	+21.88	46451.89	58720.29	+26.41
Jowar	5112.45	4429.57	-13.36	8392.86	5908.16	-29.60	3280.41	1478.59	-54.93
Mooyabean	6207.71	6653.02	+7.17	17220.93	20310.89	+17.94	11013.22	13657.87	+24.01
Wheat	6053.89	8090.88	+33.65	8388.89	12500.00	+49.01	2335.00	4409.12	+88.83
Other crops	6664.82	7032.17	+5.51	14998.13	18838.58	+25.61	8333.31	11806.41	+41.68
<b>Total</b>	<b>25924.04</b>	<b>25832.06</b>	<b>-0.35</b>	<b>85569.07</b>	<b>100768.69</b>	<b>+15.08</b>	<b>59645.02</b>	<b>74936.63</b>	<b>+20.41</b>

**Note :** Bef. - Before Tractorization; Now - After Tractorization.



Among the directives for the scheme implementation issued, by the Government of India and also followed by the Government of Maharashtra, it was indicated that about 22 per cent of the scheme allocation should go to the weaker sections. We have seen earlier that the design of the scheme did not clearly allowed the access of the weaker sections of the cultivating class. But among the beneficiaries there were more than one-third cultivators with holding size less than 3.2 hectares. (The maximum land holding permitted under the scheme with perennial irrigation.) The focus of enquiry here is to ascertain the benefits accrued to the farmers belonging to this group.

Table 2.14 gives the gross value of the total production of all the crops, expenditure incurred and net income for the two sample regions across the size classes of holding. The size-productivity relationship is positive in Sangli district. But the incremental income generated in the lowest size class of holding is highest as compared with the other size classes. The increase in the net income has come mainly out of the increment in production, though the cost has reduced slightly. The smallest size class has the increment of about Rs.14000 per hectare as compared to Rs.18000 per hectare in the largest size class. The results of Nashik district are not exactly the same. In fact in Nashik district the net income of the lowest size class has reduced by about 5 per cent. The middle size class has the highest increment of about 50 per cent over the base line.

Among the two districts, the per hectare net income/profit is relatively more in Sangli compared to Nashik in

**Table 2.14 : Size-wise Income and Expenditure Pattern for Sangli and Nashik Districts (Rs./ha)**

Size Category	Sample from Sangli			Sample from Nashik			
	Total Production	Total Expenditure	Net Income	Total Production	Total Expenditure	Net Income	
below 3.20 ha.	BT	68129.31 (22.79)	37959.91 (2.49)	30269.40 (48.18)	110693.10 (1.89)	35317.24 (16.63)	74875.86 (-5.17)
	AT	83655.17	38801.90	44853.28	112780.20	41775.37	71004.83
3.20-5.00 ha.	BT	153995.87 (21.19)	44131.49 (-2.06)	109814.38 (30.56)	103500.00 (22.70)	46248.44 (-11.66)	57251.55 (50.47)
	AT	186642.56	43269.42	143373.14	127000.00	40855.22	86144.78
Above 5.00 ha.	BT	84872.29 (12.68)	23375.81 (-1.59)	61496.48 (18.10)	68713.92 (18.95)	23208.74 (6.21)	45505.18 (25.46)
	AT	95632.80	23003.11	72629.70	81737.80	24649.06	57083.75
All	BT	100322.36 (16.82)	30392.66 (-1.15)	69929.70 (24.63)	82600.46 (16.69)	29540.96 (5.31)	53059.49 (23.02)
	AT	117194.93	30042.93	87152.01	96385.87	31110.82	65275.05

- Notes :**
1. BT - Before Tractorization; AT - After Tractorization.
  2. Figures in brackets indicate per cent-increase over the base observation.
  3. Income and expenditure arrived here is arrived by taking net cropped area as the denominator.

both the situations. The per hectare net profit is about Rs.21,800 higher in Sangli compared to Nashik. This is due to two reasons: first, Sangli farmers have concentration of high value crops. They have larger share of area under grapes. Secondly, the quality of grapes is also better in Sangli district. But the difference in the differential accruals of incremental income across size classes can be attributed mainly to the level of commercialization of agriculture in Nashik as against that in Sangli.

To sum up, it is unambiguously confirmed by the above analysis that introduction of small tractor has increased the productivity and net income of the majority of the crops in both the sample districts. This has also reduced the cost of cultivation substantially in crops like grape. The introduction of tractor has helped farmers in many unaccountable and indirect ways - timeliness, to overcome labour scarcity problem, for quick work, etc. If we could value these benefits, the total benefits of the tractor would be more always.

## CHAPTER III

### IMPACT OF TRACTORIZATION ON EMPLOYMENT

This chapter includes the analysis of the impact of the use of tractors on employment in agriculture. The changes in employment before and after the introduction of the scheme, for both manual and bullock labourers for different crops are analysed here. As in the earlier chapter, the analysis here has been attempted separately for Nashik and Sangli districts as well as combined for both the districts. Impact on family labour and hired labour is separately studied to understand the impact of tractor use in these two separate groups. Similarly, the analysis has also been undertaken for bullock labour input.

#### 3.1 Aggregate Changes in Employment

It is already indicated that impact of tractor use on employment cannot be the same for all the crops and in all the regions. Needless to say that many situational factors play an important role in this respect. It is necessary to look into the over all distribution of the total employment days across the crops before the componentwise analysis. Table 3.1 presents the distribution of employment days across different crops. It is clear from the table that about 65 to 70 per cent of the manual labour days were spent on grape cultivation in both the districts before the introduction of this special scheme. The area share of grapes is in the range of 30-35 per cent and it accounts for about 70 per cent share of the total employment. Thus grape is an important crop in providing employment opportunity in these two districts. There is a variation in



(Table 3.1 contd.)

(In percentage)

Crops	BULLOCK PAIRS DAYS					
	Own Bullock		Hired Bullock		Total	
	BT	AT	BT	AT	BT	AT
<u>SANGLI DISTRICT</u>						
1. Grapes	23.22	9.42	24.68	17.24	23.47	11.73
2. Sugarcane	13.55	17.15	27.93	24.71	16.02	19.39
3. Jowar	11.95	11.59	3.89	6.32	10.57	10.03
4. Soyabean	14.36	15.22	27.27	25.28	16.58	18.19
5. Wheat	3.35	6.04	-	2.30	2.78	4.93
6. Others	33.56	40.58	16.24	24.13	30.59	35.71
7. Total	100.00	100.00	100.00	100.00	100.00	100.00
<u>WASHIK DISTRICT</u>						
1. Grapes	11.62	8.21	-	-	11.62	8.21
2. Sugarcane	11.73	12.94	-	-	11.73	12.94
3. Jowar	4.19	6.34	-	-	4.19	6.34
4. Bajra	0.84	1.16	-	-	0.84	1.16
5. Wheat	6.86	9.25	-	-	6.86	9.25
6. Others	57.86	57.72	-	-	57.86	57.22
7. Total	100.00	100.00	-	-	100.00	100.00

Note: - indicates nil, BT - Before Tractorisation,

AT - After Tractorisation

the distribution of employment days before and after the scheme. This implies that the tractor use has altered the structure of employment and this can be attributed to the scheme.

The use of family labour for grape cultivation in Sangli district has not changed significantly after the introduction of the scheme whereas, the proportion of hired labour for grape cultivation has come down by about 6 points. This implies that tractor has reduced the hired labour days. However, this pattern is slightly different in the case of Nashik district, where employment days for grape cultivation have increased in the case of family labour, while reduced in hired labour by about 3 points after starting the use of tractors.

In the case of bullock labour use, the picture is quite different for two reasons. Firstly, there are crops like grapes and sugarcane which do not require intensive bullock use. Further, the bullock labour is used mainly for land preparations. Secondly, bullock labour is directly substituted by tractor use both under the farm operations as well as for transportation. But for the crops like pulses, oilseeds and low value cereals, the use of bullock labour is still prevalent. It is interesting to note that the practice of the hiring of the bullock labour is not prevalent in Nashik district, possibly due to the higher level of commercialisation. Most of the farmers either own the tractor and still maintain sufficiently large livestock. Moreover, the proportion of area allocated to grapes is higher in Nashik as compared to Sangli district.

The distribution of employment days combined for both the districts is given in Table 3.2. These results are almost similar to those observed in Table 3.1. This indicates no specific variation in the pattern of employment between districts. It is clear that larger employment is created in grape cultivation as compared to the other crops.

### 3.2 Changes in Family and Hired Labour

To understand the real impact of tractor use on per hectare employment days, we have analysed the changes in family and hired labourers for both the districts. This is mainly done to understand how the impact of tractor use varies between districts.

Wages paid vary across the districts, villages and even among farmers. The variations are also there in the type of payments (kind, cash, contract, etc.). The average wage rate paid to male labourer works out to be Rs. 30 per day whereas, the same for female labour is Rs. 20-25 per day. However, the wage rate for both male and female used go up by about Rs. 3 to 5 when there is a demand particularly during the initial season of the crop and harvesting period. Sometimes, farmers used to bring labourers from the nearby villages to meet the labour demand during scarcity period.

Table 3.3 shows the details of employment per hectare for Sangli district for the important crops. It is clear from the table that per hectare employment days, is significantly higher for grapes than any other crops. There are mainly two reasons for this : First, grape is a perennial crop hence naturally



**Table 3.2** Distribution of employment days for different crops : Total both Nashik and Sangli districts

(In percentage)

Crop	Area		Manual Labour Days					
			Family Labour		Hired Labour		Total	
	BT	AT	BT	AT	BT	AT	BT	AT
1. Grapes	30.66	34.66	42.34	49.96	71.74	68.00	69.12	65.
2. Sugarcane	13.09	11.29	13.72	12.78	9.05	8.95	9.47	9.
3. Jowar	11.02	10.62	6.35	5.09	2.05	2.40	2.43	2.
4. Bajra	3.62	3.47	2.31	1.62	0.46	0.46	0.63	0.
5. Soyabean	6.63	6.16	3.13	2.37	1.36	1.23	1.52	1.
6. Wheat	6.70	5.92	3.78	2.96	1.46	1.73	1.67	1.
7. Others	25.27	27.86	28.36	25.21	13.88	17.20	15.17	18.
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Crop	Bullock Pairs Days					
	Own Bullock		Hired Bullock		Total	
	BT	AT	BT	AT	BT	AT
1. Grapes	14.18	8.47	24.68	17.24	14.64	9.18
2. Sugarcane	12.13	13.83	27.92	24.71	12.83	14.71
3. Jowar	5.90	7.45	3.89	6.32	5.82	7.36
4. Bajra	0.65	0.92	-	-	0.62	0.84
5. Soyabean	3.18	3.21	27.27	25.29	4.23	5.01
6. Wheat	6.08	8.57	-	2.29	5.82	8.06
7. Others	57.86	57.22	16.23	24.14	56.05	54.83
Total	100.00	100.00	100.00	100.00	100.00	100.00

Note : BT - Before tractorisation, AT - After tractorisation

the total employment days per hectare would be more. Secondly, it is a labour intensive crop in this area, which needs utmost care to deal with pests and diseases. This further increases the labour days used. However, it would be helpful to compare the employment days of annual crops to get more meaningful information.

In our study, grape and sugarcane are the two important annual crops. It was noted that hired labour use for grapes was about 483 days higher than sugarcane before the scheme, this difference came down to only 353 days after the purchase of the tractor implying a loss of about 130 days per hectare for grapes alone in Sangli region. However, the reduction is very negligible in sugarcane during this period.

On the whole, the reduction of employment days after the scheme is about 32 days per hectare and it widely varies across crops as seen from the results obtained in Sangli district. Importantly, reduction is quite prominent in grape cultivation where, it declined by about 127 days per hectare. Though, sugarcane is also a yearly crop like grapes, the employment days under this crop has increased by 13 days per hectare. The results would be more interesting, if we make comparisons between family and hired labour. In almost all the crops, per hectare employment days for various crops under family labour has increased. But this pattern does not hold for the changes observed in hired labour. For instance, after the scheme, family labour days have increased by nearly 6 days per hectare in

Table 3.3 : Employment days of manual labour,  
Sangli district : Per hectare

	Family Labour		Hired Labour		Total	
	Before	After	Before	After	Before	After
1. Grapes	40 (15.0)	46	675 (-19.70)	542	715.37 (-17.85)	587.70
2. Sugarcane	26 (61.50)	42	192 (1.56)	189	218.12 (5.99)	231.18
3. Jowar	13 (23.08)	16	67 (-22.39)	52	80.63 (-16.09)	67.66
4. Soyabean	16 (-6.25)	15	70 (21.43)	55	85.41 (-17.89)	70.13
5. Wheat	16 (18.75)	19	66 (39.39)	92	81.39 (36.02)	110.71
6. Others	32 (-3.13)	31	76 (44.74)	110	107.54 (31.90)	141.85
All	29 (13.79)	33	279 (-12.90)	243	307.48 (-31.53)	275.95

Note: Figures in brackets indicate percentage change between Before and After

grapes, whereas about 123 days of hired labour use has declined for the same crop. This is mainly because of the intensive tractor use in grapes. In grapes, labourers are mainly used for spraying pesticides, inter-culture, etc. Majority of the farmers find the small tractor more useful for these two operations hence they intensively use the tractor resulting in the reduction in hired labour use. Although tractor use is prevalent in sugarcane and grapes, the adverse impact on employment particularly

for hired labour in sugarcane is not felt as intensively as that in the case of grapes.

Table 3.4 shows the family and hired labour used for different crops in Nashik district. The employment structure in Nashik district is slightly different than that of Sangli district. Total reduction in family and hired labour days for all the crops is only about 31 per hectare in Sangli, whereas the same is about 77 days per hectare in Nashik district. This is mainly because of the intensive use of tractor in Nashik. For instance the average use of tractor is 19 hours per hectare in Sangli, whereas, the same is nearly 39 hours per hectare in Nashik district.

Table 3.4 : Family and hired employment days : Nashik  
Per hectare

Crops	Family Labour		Hired Labour		Total	
	Before	After	Before	After	Before	After
1. Grapes	50.22	63.20	887.94	540.84	938.17	604.06
	(25.85)		(-39.09)		(-35.61)	
2. Sugarcane	45.15	48.00	286.36	274.00	331.82	322.00
	(6.31)		(-4.32)		(-2.96)	
3. Jowar	22.98	21.87	60.34	74.21	83.33	96.09
	(-4.83)		(22.99)		(15.31)	
4. Bajra	21.27	18.18	43.61	36.36	64.89	54.55
	(-14.52)		(16.62)		(-15.93)	
5. Wheat	19.56	19.67	76.08	77.86	95.65	97.54
	(0.56)		(2.34)		(1.98)	
6. Others	36.48	37.65	197.68	204.03	234.16	241.68
	(3.21)		(6.04)		(3.21)	
All	36.77	43.75	386.06	301.78	422.84	345.52
	(18.98)		(-1.39)		(-18.29)	

Note : Figures in brackets indicate percentage change between before and after

Among the crops, there is about 35 per cent reduction in employment in grape cultivation followed by bajra. However, reduction in the employment days in bajra cultivation may not be solely due to use of tractor. A comparison between family and hired labourers between the districts indicated a steep reduction of hired labour in Nashik district compared to Sangli district. For instance, the reduction is about 39 per cent in Nashik against only 19 per cent in Sangli district. However, the increase in the amount of family labour (in terms of percentage) is much higher than the reduction in hired labour in Nashik district compared to Sangli district. The main reason for the reduction of hired labour in Nashik is because of the intensive use of tractor as indicated earlier.

After knowing the structure of employment in the two districts separately, we have the combined results of both the districts to understand the net reduction of employment days per hectare. We have already seen that among the various crops, the reduction is substantial in grapes compared to the other crops. The combined results of human labour days for both the districts are given in Table 3.5. It is clear that except wheat, the employment days have reduced for all the major crops. The change in days of employment is conspicuous for grapes and soyabean. In these crops the use of tractor is much higher than the other crops and hence the reduction in employment days is higher. For instance, the per hectare use of tractor hours has increased from 13 hours to 65 hours in grapes, while 5 hours to 12 hours in soyabean.

Table 3.5 : Human labour days for both districts,  
Combined : per hectare

	Family Days		Hired Days		Total	
	Before	After	Before	After	Before	After
1. Grapes	45.93 (22.64)	56.33	794.84 (-31.91)	541.24	840.77 (-28.93)	597.57
2. Sugarcane	34.55 (26.92)	44.23	234.76 (-6.84)	218.71	269.62 (-2.48)	262.94
3. Jowar	19.20 (-2.39)	18.74	63.08 (-1.00)	62.45	82.27 (-1.31)	81.19
4. Bajra	21.28 (-14.57)	18.18	43.62 (-15.96)	36.36	64.89 (-15.93)	54.55
5. Soyabean	15.70 (-4.08)	15.06	69.71 (-21.02)	55.06	85.41 (-17.89)	70.13
6. Wheat	18.74 (4.22)	19.53	73.97 (8.79)	80.47	92.70 (7.87)	100.0
7. Others	33.37 (6.02)	35.38	166.74 (2.17)	170.36	200.11 (2.81)	205.74
8. All	33.26 (17.53)	39.09	339.71 (-18.79)	275.86	372.98 (-15.56)	314.95

Note : Figure in brackets indicate percentage change between Before and After the scheme

A comparison of changes in family labour with those in the hired labour shows the increase in the family labour days, in terms of percentages, is almost same as that of the hired labour. However, this trend is not similar and varies across crops. In the case of grapes, family labour days have increased by about 22 per cent, while it reduced by 31 per cent in hired labour. Likewise, in sugarcane, family labour days have increased

by 26 per cent, but reduction is only about 6 per cent in the hired labour input. But in terms of man days, the reduction is substantial in hired labour days, when compared to family labour days.

On the whole, it is clear, that hired labour days have reduced by about 63 man days per hectare, while about 5 days per hectare increase was noted in the family labour input. Hence, in aggregate the net loss of manual labour days is about 58 labour days per hectare.

### 3.3 Changes in Bullock Labour Days

In many farm operations tractors substitute the bullock labour input but the impact may not be exactly similar to that observed in the manual labour input. This is mainly due to the specific crop operations and their differences across crops. The use of bullock labour is usually more for the crops like paddy and sugarcane.

In aggregate the crops other than grapes absorb about 50 per cent of bullock labour days. There are mainly three reasons for the higher proportion of bullock labour days in the cultivation of the other crops. Firstly, area under other crops is relatively more in both the districts. Secondly, the use of tractor in other crop is relatively less compared to grapes or sugarcane in both districts, and thirdly, other crops offer ease of operation as well as time for the bullock labour operations.

### 3.3.1 Bullock Pairs Per Hectare in Sangli District

To understand the per hectare use of bullock pairs among different crops, we have computed averages by using total employment days of each crop with their respective area as in the manual labour days. The bullock pairs are computed separately for family (own) bullock and hired bullock.

Table 3.6 gives average per hectare use of bullock pairs for each crop for the sample in Sangli district. As indicated earlier the use of bullock pair is relatively less in grapes compared to the other crops. The per hectare use of bullock pairs is lower for grapes compared to all other crops and even lower than the all crop average. For instance, before the scheme, all crops average use of bullock pairs was 8 per hectare whereas, the same was only 6 bullock pairs for grapes.

There is a wide difference in the pattern of changes in bullock and manual employment days. As we have seen earlier, the reduction was mostly noted in the hired human labour input, but in the case of bullock labour this case is different and the decrease was noted in the own bullock labour input. This is because of the use of tractor in majority of the crops. However, use of bullock days has increased particularly in cultivation of other crops and wheat. This increase was noted both under hired as well as own components.

The average use of bullock labour per hectare is given in Table 3.7 for Nashik district. This is completely different



Table 3.6 : Bullock days in Sangli district : Per hectare

Crop	Own Bullock		Hired Bullock		Total	
	Before	After	Before	After	Before	After
1. Grapes	4.97	1.12 (-77.46)	1.09	0.85 (-21.01)	6.06	1.98 (-67.33)
2. Sugarcane	5.43	3.82 (-29.52)	2.31	2.31 (0)	7.74	6.13 (-20.80)
3. Jowar	7.95	3.40 (-57.23)	0.54	0.78 (44.44)	8.49	4.18 (-50.71)
4. Soyabean	6.22	4.04 (-35.05)	2.44	2.82 (15.57)	8.66	6.86 (-20.79)
5. Wheat	6.94	8.93 (28.67)	0.0	1.43	6.94	10.36 (49.28)
6. Others	9.33	6.61 (29.15)	0.93	1.65 (77.42)	10.26	8.27 (-19.40)
7. All	6.64	3.72 (-43.98)	1.37	1.56 (13.37)	8.01	5.28 (-24.08)

Note: Figures in brackets indicate percentage change between Before and After

from Sangli district. In Nashik district farmers use only own bullock and hired bullock input is completely absent for all the crops, whereas the same is not true in the case of Sangli district. However, we could understand that some of the farmers (mostly among relatives), exchange their bullock pairs for work when there is a demand, however, it has not been reported as a hired bullock when the survey was conducted.

In <sup>the</sup> cropwise use of bullock pairs, the reduction is more

in grapes compared to the other crops. This could be because of the use of tractor in the grapes cultivation. For instance, the use of tractor hour per hectare has increased from 16 to 85 (net increase is 68 hrs.) in Nashik district, while the increase is only 24 hours in Sangli district in grapes cultivation.

Combined results of both Nashik and Sangli would give the aggregate net loss/gain of bullock labour days per hectare. The results are given in Table 3.8. These results show that bullock pairs have reduced by about 37 per cent after the introduction of the small tractor. Among the crops the reduction is more due to grapes, though the actual of bullock labour is less for this crop. As between the own and hired bullock days, the reduction

Table 3.7 : Bullock Labour Days in Nashik district :  
Par hectare

Crop	Own Bullock		Hired Bullock		Total	
	Before	After	Before	After	Before	After
1. Grapes	6.81	2.40	-	-	6.81	2.40
	(-64.75)				(-64.75)	
2. Sugarcane	20.00	20.00	-	-	20.00	20.00
	(0)				(0)	
3. Jowar	6.32	7.66	-	-	6.32	7.66
	(21.20)				(21.20)	
4. Bajra	2.34	2.08	-	-	2.34	2.05
	(-12.39)				(-21.39)	
5. Wheat	13.04	11.72	-	-	13.04	11.72
	(-10.12)				(-10.12)	
6. Others	20.60	21.26	-	-	20.60	21.26
	(3.20)				(3.20)	
7. All	17.81	10.89			17.81	10.89
	(-38.85)				(-38.85)	

Note: Figures in brackets indicate percentage change between Before and After

**Table 3.8** : Bullock labour days for both Nashik and Sangli districts : Combined : Per hectare

Crop	Own Bullock		Hired Bullock		Total	
	Before	After	Before	After	Before	After
1. Grapes	6.01 (-68.55)	1.89	0.48 (-29.17)	0.34	6.48 (-65.59)	2.23
2. Sugarcane	12.03 (-21.19)	9.43	1.26 ( 9.05)	1.50	13.29 (-17.38)	10.98
3. Jowar	6.96 (-21.98)	3.43	0.21 (95.24)	0.41	7.17 (-18.55)	5.84
4. Bajra	2.34 (-12.39)	2.05	-	-	2.34 (-12.39)	2.05
5. Soyabean	6.22 (-35.05)	4.04	2.44 (15.57)	2.82	8.66 (-2.79)	6.86
6. Wheat	11.78 (-4.92)	11.20	-	0.27	11.78 (-2.63)	11.97
7. Others	26.57 (-39.82)	15.99	0.34 (76.47)	0.60	26.91 (-38.39)	16.58
All	12.98 (-40.36)	7.74	0.59 (16.75)	0.69	13.57 (-37.88)	8.43

**Note:** Figures in bracket indicate percentage change between Before and After

is substantially higher in own bullock labour input as compared with the increase in the hired bullock input. The reduction in own bullock labour input is about 40 per cent while the hired bullock labour use increased by 16 per cent. The above phenomenon is not the same across crops. For instance, in grapes own bullock labour input has reduced by about 68 per cent, while the reduction is only about 29 per cent in the hired bullock use.

The reduction in the own bullock labour input in soyabean is about 35 per cent but the use of hired bullock labour has increased by 15 per cent for the same crop.

Cropwise net loss/gain in human labour input as well as the bullock labour input are presented in Table 3.9. The decrease in employment days for human as well as bullock labour occurred almost in all the crops. However, the intensity of impact of tractor use on employment varies across crops. The reduction of human employment days in the grape cultivation is about 20 per cent but the reduction is about 65 per cent in the bullock labour input. The impact in terms of labour substitution is more in bullock labour days compared to the human labour. This is because of the fact that bullock is mainly used for ploughing operation, but after the introduction of tractor, majority of the farmers are using tractors for ploughing wherever possible which, reduced the bullock days substantially. However, this is not the case in the human labour input since it is needed right from the farm development works/<sup>to</sup> till harvesting and transportation including marketing. Per hectare net reduction, for all crops, is 58 days in human labour input and about 5 bullock pairs days in the animal labour input. From this it is clear that the impact of tractor use differs across crops and the type of operations.

After analysing the absolute loss or gain of labour days both in human and bullock labour, we turn to make a direct comparison between hours of tractor use and employment in each crop.

Table 3.9: Manual and bullock days : Total : Per hectare

Crops	Manual Labour*		Net Loss/ Gain	Bullock Labour*		Net Loss/ Gain
	Before	After		Before	After	
1. Grapes	640.77 (-20.93)	597.57	-245.2	6.48 (-65.59)	2.23	-4.25
2. Sugarcane	269.62 (-2.48)	262.94	-5.68	13.29 (-17.38)	10.98	-2.31
3. Jowar	82.27 (-1.31)	81.19	-1.08	7.17 (-18.55)	5.84	-1.33
4. Bajra	54.89 (-15.93)	54.55	-10.34	2.34 (-12.39)	2.05	-0.29
5. Soyabean	85.41 (-17.89)	70.13	-15.01	8.66 (-20.79)	6.86	-1.80
6. Wheat	92.70 (7.87)	100.0	7.30	11.78 (-2.63)	11.47	-0.31
7. Others	200.11 (2.85)	205.74	5.63	26.91 (-38.39)	16.58	-10.33
All	372.98 (-15.56)	314.95	-58.03	13.57 (-37.88)	8.43	-5.14

\* includes both family and hired.

This attempt is to understand the direct association between hours of tractor use and labour days. The results are given in Table 3.10.

A number of studies have corroborated that the impact of tractor use on employment days would depend upon the intensity of tractor use. Thus, when use of tractor hours increases, the number of working days both for human and bullock labour decline. Our results also confirm this unique fact. It can be noted from

Table 3.10 : Tractor use and Labour use : Comparison : Per hectare

Crop	Tractor*		L/G	Manual Labour		L/G	Bullock Labour		L/G
	Before	After		Before	After		Before	After	
1. Grapes	13.51 (380.53)	64.92	51.41	840.77 (-20.93)	597.57	-243.2	5.48 (-65.59)	2.33	-4.25
2. Sugarcane	17.71 (3.27)	18.29	0.58	259.62 (-2.48)	262.94	-6.68	13.29 (-17.38)	10.38	-2.31
3. Jowar	10.56 (-29.26)	7.47	-3.09	82.27 (-1.31)	81.19	-1.08	7.17 (-18.55)	5.84	1.33
4. Bajra	14.36 (-72.28)	3.98	-10.38	64.89 (-15.93)	54.55	-10.34	2.34 (-12.39)	2.05	-0.29
5. Soyabean	5.17 (123.21)	11.54	6.37	85.41 (-17.89)	70.13	-15.01	8.66 (-20.79)	6.86	-1.80
6. Wheat	6.61 (59.30)	10.53	3.92	92.70 (7.87)	100.0	7.30	11.78 (-2.63)	11.47	-0.31
7. Others	5.68 (105.81)	11.69	6.01	200.11 (2.85)	205.74	5.63	26.31 (-32.39)	16.58	-10.33
All	10.54 (135.59)	30.10	19.56	372.98 (-15.56)	314.95	-58.03	13.57 (-37.88)	8.43	-5.14

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Note: Figures in brackets are percentaze change between  
Before and After the scheme.

L/G - Loss/Gain \* - per hectare use in hours

Table 3.11 : Net Loss/Gain of Labour Input per hectare

Crop	Manual Labour Days			Bullock Labour Days		
	Family	Hired	Total	Family	Hired	Total
1. Grapes	10.4	-253.60	-243.2	-4.12	-0.14	-4.25
2. Sugarcane	9.38	-16.05	-6.68	-2.55	-0.24	-2.21
3. Jowar	-0.46	-0.63	-1.09	-1.53	-0.21	-1.33
4. Bajra	-3.1	-7.26	-10.34	-0.29	-	-0.29
5. Soyabean	-0.64	-14.35	-15.01	-2.13	0.34	-1.80
6. Wheat	0.79	6.50	7.30	-0.53	0.27	-0.31
7. Others	2.01	3.62	5.63	-10.58	-0.26	-10.33
All	5.83	-63.65	-58.03	-5.24	-0.10	-5.14

Table 3.10 that wherever, hours of tractor use are more the reduction of employment days, in both manual and bullock labour is also higher. For instance, the use of tractor has increased by about 51 hours per hectare in grapes after the introduction of the scheme. This has caused a reduction of about 243 man days and 4 bullock pair days per hectare in the same crop.

#### 3.4 Loss/Gain in Employment Days Per Hectare

As mentioned earlier, per hectare loss of employment days may not be the same for all the crops. The impact will change between family and hired labour days. The net loss/gain of labour days for each crop and by type of labour input are presented in Table 3.11. It is clear from the table that loss of human labour days varies from 243 days in grapes to about a day in jowar per hectare in manual labour. These changes in the hired labour input as well as the family labour input are quite different. The aggregate change for all the crops indicates that the net reduction of human labour is about 58 days. However, the loss of human days per hectare is about 243 man days per hectare in grapes alone. The changes in bullock labour input is almost similar like manual labour. The pattern in the changes of employment in own bullock labour input and hired bullock labour days is quite different. Unlike in manual labour, tractor use has mainly reduced the own bullock input rather than the hired bullock days.



### 3.4 Summary

To sum up, the loss of human labour days after the introduction of the tractor was quite conspicuous in the region. The quantum of reduction is very high in the hired labour input, while there is a slight increase in the family labour input. Among the various crops, the reduction in employment is quite significant in grape followed by soyabean and sugarcane. There is a clear negative association between hours of tractor use and human labour input almost in all the crops and particularly in grapes.

However, it is only one side of the picture. We do not know the other employment opportunities which created through the tractor use (especially in manufacturing and allied sectors). If the increase in the employment days is large enough to compensate this loss, then one can consider that the scheme as a whole may not have adverse impact on employment situation.

## CHAPTER IV

### ECONOMIC VIABILITY OF TRACTORIZATION

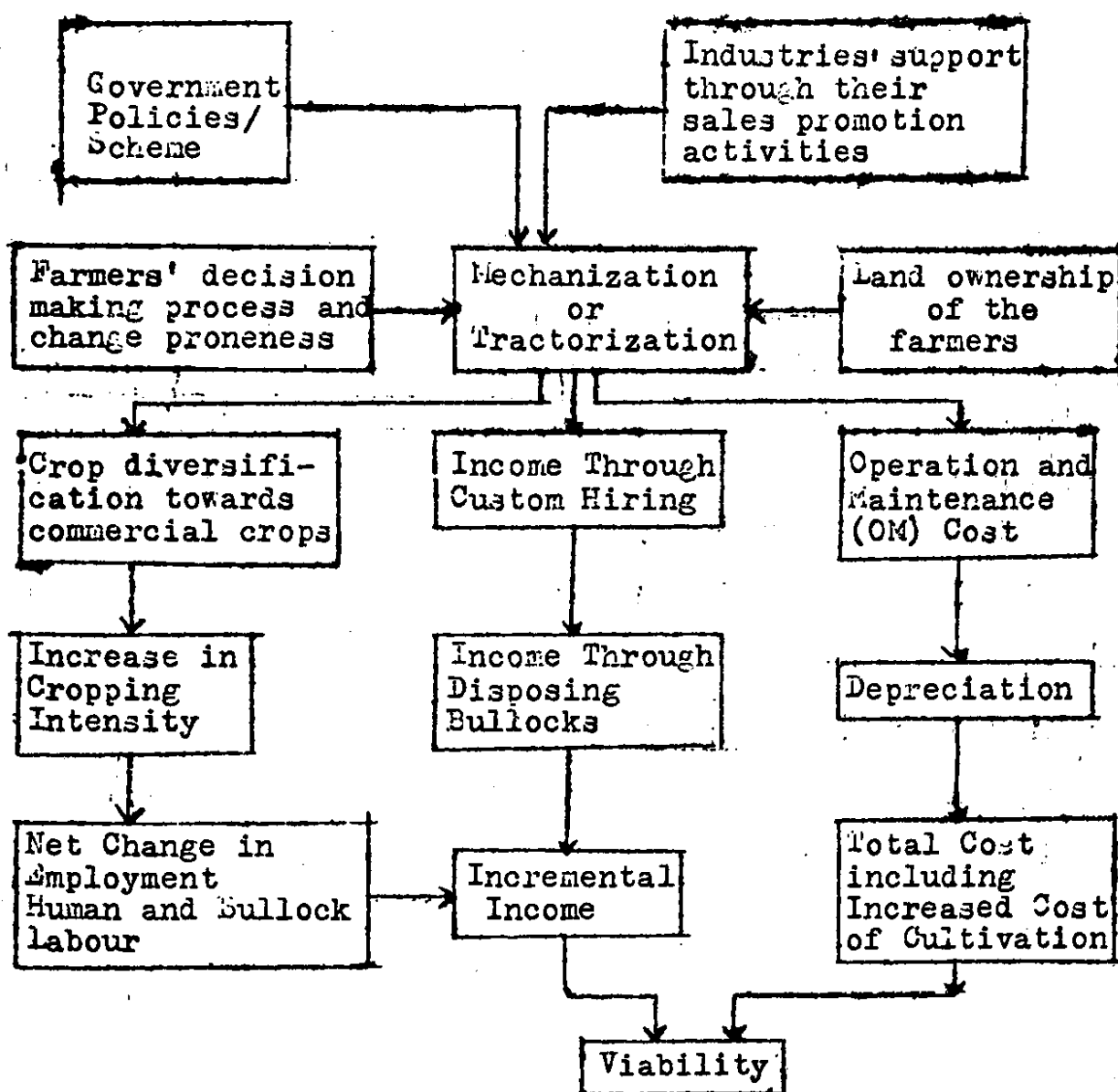
#### 4.1 Introduction

The rapid changes in the agricultural policies during the post-green revolution period encouraged farmers in the use of agricultural machineries such as tractors, power tillers, diesel engines and electric motors. In addition to this the expansion of cultivable tract coupled with increase in the intensity of cropping necessitated the support of agricultural machineries. Apart from this, the changing attitude of the farmers towards more leisure and less drudgery work also required the use of machine power in agriculture particularly tractors which relieves both animal power and manual labour from agriculture. Less dependence on the animal power reduces the drudgery in two ways, viz., labour needed in tending the animals and also in extracting the energy input from the animal.

However, tractorization is still not in easy reach for many since it incurs heavy initial investment relative to their affordability. But the Central Sector scheme on the promotion of agricultural mechanization has ensured the access of farmers for tractorization. This helped the cultivators to graduate from bullock farmers to tractor owners. In addition to relieving from drudgery, the tractors also generate income to the owners through custom hiring. But the income generated through increasing productivity and custom hiring in relation to the

cost involved can indicate the viability of the investment. Hence, an attempt on the viability of tractors can throw some light on this aspect. To see the viability of the tractors, the inter-linkages of the whole process have to be established. The inter-linkages of the process of mechanization and its viability are presented in Figure 4.1.

Figure 4.1 : Economics of Mechanization and Viability



The Figure explicates that the tractorization rests on four components viz., Government scheme, industrial sales promotion efforts, farmers' change-proneness, and land ownership of farmers. While the Government policies like the Central Sector schemes for mechanization encouraged the farmers to purchase tractors on subsidy-linked-credit, the industries through sales promotion programmes conscientise the farmers about the use of the tractors with various implements on different agricultural activities and demonstrate the operation of machines to attract the farmers. These two factors influence the use of machines. Apart from this, ultimately what decides the process of mechanization is the attitude of the farmers towards change coupled with economic conditions. The change proneness of the farmers is essential for adapting to the modern techniques because sometimes farmers with viable size of landholding do not opt for mechanization. Hence, the adaptive behaviour of farmers is perforce important to break the static traditional methods of cultivation. The combined effects of all these factors decide the mechanization or tractorization in agriculture.

The outcome of mechanization can be felt in the crop diversification towards commercial crops and intensity of cropping. The tractorization or in turn availability of more energy input makes the farmers to take decisions in favour of lucrative commercial crops. Moreover, this causes the spill over effects on the use of labour and simultaneously on the other inputs to retain their engineering relationship. This results also in enhancing the productivity and intensity of cropping. In the

ultimate count, it exhibits a better incremental income. Similarly, the tractors are sometimes hired-out for both agricultural use and transportation. In addition to this, tractorization also makes the existing bullocks redundant or their marginal productivity reaches closer to zero. Incidentally, the additional income is accrued through selling the redundant bullocks. On the whole, the income from cropping and the income through custom-hiring boost up the incremental income pertaining to tractorization.

Another side of tractorization is the increase in the cost of operation. The cost of operation forms the major chunk of the cost involved in the initial years or during the economic life of tractors. But after that, the share of the maintenance cost and salvage value increases in the cost of operation. The relative positions of the incremental income due to tractor and the total cost of operation can explain the viability of the scheme of tractorization.

#### 4.2 Viability of Tractorization

The comparison of the discounted flow of the private benefits and cost explains the viability of tractors in agriculture. The benefits of the scheme are computed by using the budgeting method of benefit-cost analysis. The additional net output can be considered as the benefits due to the tractorization. Similarly as Binswanger assumed, the increase in output due to other capital items like pumpsets or fertilizers is equivalent to the cost of the inputs<sup>1</sup> and therefore, their

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1 Hans Binswanger (1978); op.cit., pp. 62-63.

contribution is not accrued separately. Thus the analysis of viability of the investment would need a careful mapping of the benefits and costs.

The viability can be both economic viability and financial viability. In the economic viability all the benefits of the programme like tangible, secondary and non-tangible benefits have to be quantified in a comparable form to the cost involved in the programme. The tangible benefits of the programmes include increase in net production, increase in net income, quantitative improvement in production, cost reduction and time savings. Increase in production coupled with qualitative improvement enhances the market value of the products and in turn the net incremental income of the farmers. In addition to this, mechanization also reduces the cost of cultivation and the time needed for different operations. These direct benefits combinedly contribute to higher net incremental income due to tractorization.

The secondary benefits pertaining to introduction of tractors are noticed in the increase in the area under cultivable tract particularly marginal lands, effectiveness of deep ploughing and power spraying and multiplier effect of these factors. The graduation of farmers from bullock owners to tractor owners equips them adequately to cultivate the lands which are inaccessible to bullock plough. The deep ploughing and power spraying with the help of tractorization helps in extracting the optimum use of inputs. In addition to this, the availability of excess energy capacity causes multiplier effect in the income generation of the beneficiaries. These secondary benefits of tractorization

indirectly improve the productivity of land by strengthening the interrelationship of inputs. The ultimate quantum of these benefits are noticed in the incremental income due to tractorization.

Unlike the tangible and secondary benefits, the intangible benefits are difficult to be identified and quantified. But as Price Gittinger (1982) puts it,<sup>2</sup> they are also like the real benefits and reflect true values but they do not lend themselves easily to exact valuation. In tractorization, the intangible benefits come in the form of less drudgery in the work, more leisure to people, more non-agricultural employment, better educational level and better quality of life. The introduction of tractors in agriculture relieves major portion of manual labour and bullock labour from drudgery of cultivation. As a result, the cultivators get more leisure and time to concentrate on other family affairs, and bringing up their children with good education. The redundant agricultural labourers get drafted in the industrial or service sectors with relatively better remuneration. It brings in additional remittances to the rural economy. Thus, the rural economy is geared up to development through the intangible benefits of the tractorization.

#### 4.3 The Assumptions

The estimation of economic viability demands the whole gamut of the process of development and some of the benefits can be noticed only after certain point of time. Therefore, in

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<sup>2</sup> Gittinger, J. Price (1982), *Economic Analysis of Agricultural Projects*, Second Edition, EDI Series in Economic Development, World Bank, Johns Hopkins University Press, Baltimore, pp. 61-62.

such situation the suitability of economic viability is difficult immediately within two years of the investment. Hence, the financial viability is estimated with certain assumptions to see the viability of tractors in the rural household.

I. The economic life of the tractor is assumed as 12 years keeping in view the consideration given to the beneficiaries to clear-off the loan. Since twelve years time is given to clear the loan in easy instalments, it is presumed that economic life of the tractor comes up to that period. NABARD studies assume the economic life of tractor ranging between 10 and 12 years.<sup>3</sup> After 12 years, 10 per cent of the total cost is assumed as salvage cost.

II. With the introduction of the tractors, farmers are also assumed to sell off at least 50 per cent of their redundant bullocks. The price of these bullocks is considered as income in the first year.

III. The increase in output due to other capital inputs like fertilizers, pesticides and pumpsets are assumed to be equivalent to the cost of the respective inputs (as indicated in the study by Binswanger<sup>4</sup>).

IV. The cost of the tractor is assumed to be the total cost of the tractor and the expenditure incurred to get the loan as well as bring the tractor home minus the subsidy.

V. Since the tractors procured through loan are only 18 power take off horse power (18(PTO) HP), the possibility of

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3 National Bank for Agriculture and Rural Development, Evaluation Study Series.

4. Binswanger (1978), op.cit., p. 63.



hiring-out is restricted. Hence, it is presumed that the income through custom hiring services is negligible. This was also observed in the field. None of the beneficiaries indicated any hiring out.

VI. The favourable impact of the application of tractor power for cultivation has been noticed on cropping intensity, productivity and increase in the area under commercial crops. This has led to higher net incremental income to the beneficiaries of the scheme.

VII. Salary of the driver is imputed at the opportunity cost of a driver in the area.

#### 4.4. Net Incremental Income

As the effectiveness of the scheme on cropping pattern, intensity of cropping and productivity is positive (discussed in the second chapter) and significant, the net incremental income for most of the commercial crops exhibits a similar trend. It is not surprising that the food crops showed a slight decline in the productivity, for farmers are enticed by the lucrative commercial crops and they cultivate food crops only for their own consumption. Since the gross income from agriculture and the gross cost involved in the production process have been discussed earlier, only the net gain from agriculture and under various crops has been presented in this part.

The net gains before and after tractorization in agriculture for both Sangli and Nashik districts have been presented in Table 4.1. It explicates that grapes alone account for 91 per cent of the total net incremental income in Sangli

Table 4.1 : Net Incremental Income Per Household Before and After the Scheme

Crops	Sample Region from					
	Jangli District			Nashik District		
	Net gain Before	Net gain After	Net Incremental Income	Net gain Before	Net gain After	Net Incremental Income
1. Grapes	335675.69	418560.13	82884.44	325911.19	415970.90	90059.71
2. Sugar-cane	53999.63	68253.06	14263.44	43342.86	35786.10	-7556.76
3. Jowar	2256.00	1306.50	-949.50	1531.00	2501.76	970.76
4. Soyabean	11846.44	13316.44	1470.00	-	-	-
5. Wheat	525.38	771.53	246.25	6077.67	5972.86	-104.81
6. Other crops	13956.63	19060.19	5102.56	31362.95	37470.38	6107.43
Total	418260.75	521277.94	103017.19	409293.29	497852.71	89559.42

district. Interestingly the same crop contributes income large enough to compensate the loss in net incremental income from other crops in Nashik district. This seems to mean that the power sprayers used with the help of tractor power and to some extent intercultivation through tractors have contributed effectively to the net income from grapes. In the case of other crops, while Jangli maintains a positive change for all the crops except jowar, Nashik registers a decline in productivity of most of the crops except jowar and other crops. Quite surprisingly, sugarcane which is one of the major commercial crops in both the districts

showed a decline in net income in Nashik district. This is possibly due to the relative neglect of the crop in the presence of the importance given to grapes. Similarly while soyabean is one of the major crops next to sugarcane in Sangli district, it is not at all grown in Nashik district. While there is a consistent increase in the incremental income for all the commercial crops in the Sangli district, Nashik exhibited a mixed picture with highly significant improvement in income from grapes and decline in sugarcane. Unlike commercial crops, food crops present a mixed picture.

The cropwise incremental income has shown differential impact of tractorization. It is certain that all these changes could not be ascribed to the introduction of tractor alone, but under the assumptions indicated above, these can be attributed to the scheme. In strict sense the segregation of the benefits of tractors alone are not amenable for quantitative measurement.

#### 4.5 Cost of Investment and Operation

Analysis of the cost involved in maintaining and operating a tractor has only been considered here since the cost of cultivation and other costs related to agriculture are analysed in the earlier chapter. Since, these tractors are small in size and only 18 (PTO) HP capacity, the use is restricted mostly to the own farm. Hence, the depreciation cost takes over all other costs.

The various costs incurred in operating and maintaining a tractor in Sangli and Nashik districts are presented in Table 4.2. It shows that the expenditure incurred in Sangli district is higher than that in Nashik district. This is probably due to

Table 4.2 : Expenditure Incurred on the Tractor Purchased Under the Scheme

Particulars of Expenditure	Sample Region from	
	Jangli District	Nashik District
1) Total Cost of the Tractor (including Subsidy)	172012.13	161090.48
2) Incidental Expenditure (from dealer to village)	492.19	557.24
3) Repair and servicing	1651.56	1643.33
4) Diesel	4987.75	3971.48
5) Driver's Salary	6000.00	6000.00
6) Other Expenditures (Extra fittings and other instruments)	667.38	880.24
7) Depreciation Cost (at the rate of 8.33%)	14334.34	13424.21
<b>Total</b>	<b>200145.36</b>	<b>187566.98</b>

difference in the cost at the time of purchase. Depreciation is calculated with the assumption of economic life of the tractor as 12 years. The repair and servicing cost is relatively less because it is a new vehicle and use is also limited to own farm only. These vehicles are operated mostly by the member of the household only. This also reduces the maintenance cost. Hence, the salary of the driver is imputed by taking the opportunity cost of the driver. Probably, the difference in the investment cost and other operation and maintenance costs is due to the proximity to the place of production and the time of operations. While the information availability about the price and capacity of tractors

is better in Nashik, it is not so in Sangli due to the distance and remoteness of the villages.

#### 4.6 Benefit-Cost Analysis

Benefits due to the introduction of tractor and additional cost involved per hectare have been analysed for both Sangli and Nashik districts. This will throw some light on the increase in benefits and costs after the introduction of tractors in the area. The incremental benefits per hectare and cost are presented in Table 4.3. It explicates that while income from own farm is higher in Nashik, income through selling redundant bullocks is marginally higher in Sangli. In the cost side, the major cost is the depreciation, for the initial year maintenance cost will be negligible. On the whole it shows that the cost per hectare is higher in Sangli than Nashik. But it is otherwise in the case of income. This implies that the pay off is higher for the same inputs in Nashik than in Sangli district.

Financial benefit-cost ratio is used to find out the viability of the project at the household level and viable size of holding to maintain a tractor. The incremental benefits and costs are discounted to get the net present worth at 15 per cent discount rate<sup>5</sup> by giving weightage to the changes in price level and borrowing rate of capital. In addition to this, by taking all the assumptions into account, the benefit-cost ratios are calculated for both Sangli and Nashik districts separately.

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<sup>5</sup> The choice of the discount rate was mainly guided by the studies conducted by NABARD. This represents the opportunity cost of the capital.

Table 4.3 : The Benefit and Cost Per Hectare in Sangli and Nashik Districts

Item	Sample Region from	
	Sangli District	Nashik District
<b>I. Income (Per Hectare) :</b>		
a) Net Incremental Income from Own Farm	15291.60	15636.86
b) Income from Selling Bullocks	974.34	968.65
<b>Total Benefits</b>	<b>16265.94</b>	<b>16605.51</b>
<b>II. Expenditure (Per Hectare):</b>		
a) Depreciation	2472.77	2383.16
b) Cost on Maintenance	404.12	455.77
c) Cost of Diesel	717.02	587.54
d) Salary to Driver	862.53	887.64
<b>Total Cost</b>	<b>4456.44</b>	<b>4314.11</b>

Benefit-cost ratio with 15 per cent discounted value for Nashik district is presented in Table 4.4. The gross benefits subsume income from selling bullocks and salvage value of the investment in the first and final year of the economic life of the tractor respectively. Nevertheless, the major contribution is from own farm and particularly from grapes. The benefit-cost ratio is 3.069 and it implies that the tractor scheme is highly viable and advantageous to the average beneficiary household

**Table 4.4 : Benefit-Cost Ratio Per Tractor in Nashik and Sangli Districts**

Years	Nashik District		Discount factor at the rate of 15%	Sangli District	
	Gross cost present worth	Gross benefits present worth		Gross cost present worth	Gross benefits present worth
1	125404	83613	0.870	135556	95552
2	9815	57706	0.756	10432	77881
3	8588	53930	0.658	9080	67785
4	7466	51228	0.572	7893	58926
5	6487	44511	0.497	6858	51199
6-11	24551	168460	1.881	25956	193775
12	2441	92571	0.187	2580	22481
	184752	567019		198355	567599
	B.C. Ratio 3.069			B.C. Ratio 2.862	
	N.P.V. 382267			N.P.V. 369244	
	Viable size of holding 2.20 hectares (5.43 acres)			Viable size of holding 2.73 hectares (6.73 acres)	

owning 6.760 hectares of perennially irrigated land. The viable size of holding to own and operate a 18 (PTO) HP tractor is 2.20 hectares or 5.43 acres of perennially irrigated land with maximum land under grapes. It may be noted here that the viable size of holding for such investment will have to be computed under an assumed crop combination and which may rarely represent the actual situation.

Similarly the benefit-cost ratio for Sangli region also depicts a comfortably high value of 2.862. The net present worth

of the benefits and costs are also illustrated in Table 4.4. This explicates that in Sangli region owning and maintaining a tractor is highly viable for the average beneficiary household with 6.975 hectares of perennially irrigated land. The viable size of holding to operate a tractor is 2.73 hectares or 6.73 acres of land with the presumption that grape occupies the major share of the cultivable land.

#### 4.7 Beneficiary responses relating to the scheme

The beneficiary responses about awareness of the scheme, reasons for purchasing tractors and the difficulties in purchasing tractors are presented in Table 4.5, along with the other benefits like subsidy and training to drive tractors. Majority of the farmers both from Sangli and Nashik districts came to know about the scheme through Panchayat Samitis or agricultural officers. The rest of the farmers got the information through newspapers or neighbouring farmers. In the case of reasons for availing the scheme benefits, the shortage of human labour and difficulties in maintaining bullock power were the major reasons cited. This has pushed the farmers to look for a viable alternative. Some of the beneficiaries were interested in purchasing a tractor even without the subsidy and prior to the scheme but their economic conditions did not permit them to do so. In all these aspects both the districts show homogeneous characteristics of the beneficiaries. In addition to this, though subsidy element in the scheme enticed some of the beneficiaries, majority of the beneficiaries were prepared to avail this scheme even without subsidy. Apart from all these, the company has made provision to train the



**Table 4.5 : Beneficiaries Perception About the Different Components of the Scheme**

Particulars	Sample Region from	
	Sangli District	Nashik District
<b>1. Information about Tractor Scheme:</b>		
a) Panchayat Jamities and Agriculture Officer	62.50	76.19
b) Newspapers	31.25	23.81
c) Neighbouring Farmers	31.25	
<b>2. Reasons for Purchasing Tractor:</b>		
a) Shortage of labour	100.00	100.00
b) Substitute to bullocks	31.25	100.00
c) Subsidy is attractive	31.25	66.67
d) Problems in rearing bullocks	62.50	
<b>3. Difficulties in Tractor Purchasing and Application :</b>		
a) Economic problem	75.00	28.57
b) Small holdings	25.00	9.52
c) Unknown about tractor use	18.75	
d) Other problems	18.75	61.91
<b>4. Subsidy element in Purchasing:</b>		
a) Without subsidy purchasing	68.75	71.43
b) Because of subsidy	31.25	28.57
<b>5.- Training to Drive Tractors</b>		
a) Company	81.25	42.86
b) Government and Company	12.50	-
c) Neighbour farmers	6.25	9.52
d) Own	-	47.62

**Note:** Indicated figures are percentages to total sample households.

beneficiaries in operating the tractors. While majority of the beneficiaries got themselves prepared to drive tractors with the help of the company in Sangli district. Only about half of them got the training from the company and the others learnt it on their own in Nashik. On the whole, this scheme gave an opportunity to the farmers<sup>to</sup> step up mechanization in their farming operations.

#### 4.8 Summary

The major incremental income due to the introduction of tractor is own farm income. Even in farm income, income from grapes formed the larger share in both districts. If income from grapes is taken out, then Nashik records a negative incremental income. Tractorization also brought in the crop diversification and a decisive shift towards commercial crops. On the cost side, depreciation cost takes a larger share, for in the initial years the maintenance cost will not be so high as in the later part of its economic life. Since these tractors are small in size, the custom hiring service are almost negligible. Hence, the operation cost or diesel and oil cost is also low. Per hectare benefit-cost flow explicates that Nashik district is getting better pay off from lower tractor operational cost.

Unlike the per hectare benefit-cost relationship, the benefit-cost ratio exhibits a higher value for Nashik than Sangli. The viable size of land holding is higher where the B-C ratio is low. It shows a higher land holding as viable land size in Sangli as compared to Nashik. On the whole, it seems to explain that the 18 (PTO) HP tractors are viable

alternative to bullock labour and manual labour for those who have more than 5 acres of perennially irrigated land. It also implies that there is a positive relationship between the size of holding and benefit-cost ratio for the tractor owners. It also gives an impression that without grapes, the viable size of holding will be much higher than the estimated one. In addition, it replaces the bullock labour from agriculture and makes the own manual labour to graduate to skilled labour or tractor operator. It also reduces the drudgery in agriculture by replacing manual and bullock labour. Further it makes the other inputs more effective through power sprayers and deep ploughing. Ultimately, it enhances the overall productivity of land and in turn the income of the farming community.

## CHAPTER V

### SUMMARY AND CONCLUSION

#### 5.1 Introduction

It has been well documented by many studies that mechanization increases the efficiency of each operation and reduces the per unit cost of cultivation. This enhances the per hectare net income/profit of the crop enterprise. Since the introduction of the new agriculture technology (NAT), the use of modern machineries like tractors, pumpsets, sprayers, threshers, etc., has increased many-fold in Indian agriculture. Unlike the other technological inputs such as fertilizers and pesticides, mechanization is concentrated only in some parts of the country, especially where intensity of irrigation is high. It is also corroborated by studies that the farmers who use machineries mostly belong to the group of large farmers. However, owing to the non-availability of draught animals and the recent price rise along with the problems in availability of manual labour, many small and medium farmers are willing to use tractors. But, its capital intensive nature coupled with their poor resource base restricts their access to the tractorization. Moreover, the tractors are generally of big size and costlier therefore totally unfit for small and medium farmers.

To overcome these problems and to help the small and medium size farmers, the Government of India has introduced a scheme called 'promotion of agricultural mechanization through

small tractors' in the year 1992-93. This has been introduced in the Eighth Five Year Plan on a pilot basis with an intention to extend it in future based on the level of response of the farmers. This scheme provides 30 per cent or maximum of Rs.30,000 of loan as subsidy. The bank loan is sanctioned for the selected farmers satisfying the criteria as indicated in the guidelines of the scheme. This is an impact evaluation study of this scheme conducted in two districts of Maharashtra.

### 5.3 Objectives and Methodology

This study is taken up with the following objectives:

- 1) To assess the extent to which the objectives of the scheme have been achieved.
- 2) To evaluate the benefits accruing to small, marginal farmers belonging to the scheduled Castes and scheduled Tribes.
- 3) To assess the contribution of this scheme in increasing agricultural production.
- 4) To assess the impact of this switch over to tractor on employment.
- 5) To find out the economic viability of the investment under this scheme.

The present study was conducted in Maharashtra in two districts where maximum number of tractors were distributed during the year 1992-93. The two selected districts were Nashik and Sangli. Out of the 97 tractors distributed in the two districts, Nashik and Sangli districts accounted for 67 and 30 respectively. We have selected twenty-one beneficiaries

from Nashik and sixteen beneficiaries from Sangli districts. Keeping in view the spread of the sample over the talukas of the district, we selected about 38 per cent of the beneficiaries. The impact of tractor use was assessed by making comparison on the practices of crop cultivation of beneficiaries before and after the introduction of tractor. The year 1992-93 was the reference year for assessing the parameters before tractorization and 1993-94 was the reference year for the post-tractorization changes.

### 5.3 The Design of the Scheme

The basic objective of the scheme was to promote farm mechanization among the small farmers. The scheme drafted by the Government of India indicated the minimum and maximum size of holding under perennial irrigation. The Government of Maharashtra gave a distribution of land by categories indicating the requirement of the holding size for the scheme. This attempt has introduced some flexibility but there was an inherent compromise on clear identification. Among the sample farmers we have noted about 30 per cent of the beneficiaries having more than 3.2 hectares of land under perennial irrigation.

Another important norm suggested by the Government of India was that the beneficiary should be a first time buyer of this tractor and in no case should have owned a tractor earlier in his name or in the name of any other member of the family. We came across two farmers in Nashik district who had owned a tractor before this scheme. The scheme requires an undertaking from the farmer as well as certificate from the Block Development Officer, specifying basic requirements. Therefore, it becomes

necessary to monitor the scheme more strictly.

The guidelines of the scheme indicated that about 22 per cent of the outlay should go to the beneficiaries belonging to the Scheduled Castes and Scheduled Tribes. But out of the 97 beneficiaries only one beneficiary belonged to this group and therefore, it is clear that the scheme did not reach this group. But this happens due to the two conditions of the scheme, namely, the size of holding between 6 and 8 hectares of perennially irrigated land and 15 per cent of the total cost as down payment. It was told to our team that these two conditions are very difficult to satisfy for the farmers belonging to the group of the Scheduled Castes and Scheduled Tribes. Thus, it becomes necessary to have a fresh look at these three conditions.

#### 5.4 Impact Evaluation on Crop Production

Grapes and sugarcane are the two important commercial crops dominating the cropping pattern both before and after the tractorization. It was noted that except for increase in area under grapes in Nashik district and jowar in Sangli district, no major changes occurred in the area allocations under the other crops due to tractorization.

The distribution of land size shows that majority of the farmers have land holding less than 5 hectares and they constitute about 62 per cent of the total sample. The average size of holding was 5.95 and 5.86 hectares in Nashik and Sangli districts respectively. None of the sample farmers in both districts purchased land after the introduction of tractor. This indicated no change in the asset holding. Similar results

were obtained in the analysis of livestock. The stock of animals maintained by the beneficiaries was almost the same and no change was observed. Bullocks and buffaloes are important household animals in the two districts. We do not find any difference in the stock of animals before and after the introduction of tractorization. Electric pumpsets, oil engines, threshing machine and fodder cutting machines were the other important mechanized implements with the farmers. Among these, electric pumpsets are more frequent in both the districts. There was no change in the stock of mechanized implements before and after the tractorization.

There was a slight reduction in the intensity of cropping in both the districts after the introduction of tractorization. The intensity of cropping was 118 per cent and 114 per cent, before and after tractorization respectively in Nashik district, while the same was 120 per cent and 119 per cent in Sangli district. It is difficult to assert that tractorization has reduced intensity of cropping, since one cannot make any conclusion by using one year data.

In Nashik district the per hectare cost of cultivation has reduced for all the crops except jowar. The reduction is higher in commercial crops and particularly in grapes. It was noted that reduction in the cost was positively related to the hours of tractor use. Among different inputs, the cost reduction was mainly observed in the hired labour, pesticides and bullock labour for most of the crops.

The pattern of change in the cost of cultivation in Sangli district was entirely different than Nashik district.



The reduction in the cost of cultivation was noticed only for grapes. In absolute terms the reduction of cost was lower in Sangli district, even in grapes, when compared with Nashik district.

The use of tractor for different crops has increased from 2735 hours to 7622 hours after the introduction of scheme. On an average, each tractor was used for about 206 hours in the two seasons and about 30 hours per hectare after the introduction of the scheme. The use of tractor was relatively more in grapes compared to any other crops. It increased from 13 hours per hectare to 65 hours/hectare. Tractor use was meagre in crops like jowar and bajra. The per hectare use of tractor was substantially high in Nashik district compared to Sangli district. Tractors were mainly used for spraying pesticides, transportation, inter-culture for grapes, dry ploughing for sugarcane, soyabean, etc.

Productivity has increased for majority of the crops in both the districts. Among different crops a substantial increase was observed in the 'other crops' group. Sugarcane has shown a slight decline in the productivity in Nashik district and increase in Sangli district. The productivity of grapes has increased in both the districts. It was also found that the productivity of by-product increased whenever there was an improvement in the yield of crop.

Gross value of production has increased in majority of the crops after the tractorization scheme. The increase was found maximum in jowar (47.4 per cent) followed by sugarcane in Nashik district. In Sangli district the value of output of

most of the crops has increased, but the yield of jowar has reduced. The increase in the gross value of output came mainly out of grapes and due to yield effect rather than price effect.

The per hectare net income of each crop has increased after the implementation of the scheme in both the districts. In terms of percentage the increase was found substantial in Nashik district for jowar and bajra. However, in absolute money value, the amount of increase was quite high in grapes and sugarcane.

As in the case of Nashik, the increase in net income was noted in almost in all the crops in Sangli district. Among the different crops, the per cent increase was higher in wheat followed by 'other crops' group. The increase in income from grapes was more than double than that of Nashik district. Altogether, additional income generated through the other minor crops was relatively less compared to the additional income generated through grape cultivation.

### 5.5 Impact of the Scheme on Small Farmers and Employment

The size productivity relationship is positive in Sangli district. But the per cent of incremental income generated in the lowest size class of holding is highest as compared to the other size classes. The incremental income of the below 3.20 ha. farmers was Rs. 14000 per hectare as compared to Rs. 18000 per hectare in the largest size class (above 5 ha. group). The results of Nashik district are not exactly the same as that of Sangli district. The net income in the lowest size class of Nashik has reduced by about 5 per cent. The middle size (3.20 to 5.00 ha.) has the highest incremental income of about 50

per cent. This shows that there is no uniform pattern in the relationship of size and net income generated.

Among the different crops, grape cultivation accounts for major changes in manual employment days in both before and after the introduction of tractor. Grape cultivation alone absorbs 65-70 per cent of total employment days. In the case of bullock labour input, 'other crops' absorb larger bullock labour compared to grapes or sugarcane.

The per hectare use of manual labour was found significantly higher in grape cultivation compared to any other crop. Introduction of tractor reduced the manual employment significantly particularly in the grape cultivation. The reduction was mostly noted in the hired labour component. The changes in the manual labour days was not same in both the districts. The percentage of reduction was relatively higher in Nashik district as compared to Janoli. After the introduction of tractorization, family labour days have increased, while hired labour employment days have declined.

As in the manual labour, there was a reduction in the per hectare use of bullock labour almost in all the crops. The reduction was not similar between districts. Unlike in the manual days, here most of the reduction was found in own bullock input. The reduction was relatively more in grape cultivation compared to the other crops. Altogether, the reduction was 40 per cent in own bullock input and about 16 per cent increase in hired bullock input. In terms of days, the reduction was nearly 5 days per hectare for all crops.

There was a positive relationship between hours of tractor use and reduction of employment days. It was found that when tractor use increases, it is accompanied by reduction in employment. For instance, use of tractor hours has increased by about 51 hours in grape cultivation which reduced by about 243 mandays and by 4 bullock pairs of animal input.

On the whole, in terms of employment days, the reduction was more in hired labour which was about 63 days per hectare for all the crops while the same was very meagre in bullock labour days.

#### 5.6 Economic Viability of Tractorization

Income from grapes formed the large share of the incremental income in both the districts. If income from grapes is taken out, then Nashik records a negative incremental income. The custom-hiring services are almost negligible, since these are small tractors. The operational cost of diesel and oil cost is also low. Per hectare benefit-cost flow explicates that Nashik district is getting better pay off from lower tractor operating cost.

The benefit-cost ratio exhibits a higher value for Nashik than Sangli. The viable size of holding is higher where the B-C ratio is low. It shows a higher land holding as viable land size in Sangli as compared to Nashik. On the whole, it seems to explain that the 18 (PTO) HP tractor is viable alternative to bullock labour and manual labour for those who have more than 5 acres of perennially irrigated land. It also implies that there is a positive relationship between the size of holding

and benefit-cost ratio for the tractor owners. It also gives an impression that without grapes, the viable size of holding will be much higher than the estimated one.

It was found from this study that this small tractor scheme had increased their farm income to certain level despite there are changes across crops. This has not only helped them to reduce the cost of cultivation and increase per hectare net also helped in many qualitative ways. Majority of the income/profit, but/farmers feel that this small tractor is very useful for spraying pesticides, dry land ploughing, interculture, etc. Moreover, easy handling nature of this tractor does not need any specialized driver to operate this tractor. Though, there is a large reduction of employment days in some crops, this will increase their total employment opportunity through increasing cropping intensity in future. One may not get immediate positive effect in the introduction stage of any technological input. Input adoption is a process which takes time to create new positive impact.

### 5.7 Policy Implications

1) The size of land holding is uniformly fixed for all the types of farmers in this scheme. The condition of minimum 6 acres of perennially irrigated land holding makes it difficult to identify the beneficiaries belonging to the Scheduled Castes and Scheduled Tribes to avail the benefits of the scheme. If it is intended to reach the cultivators belonging to this group, then it would be necessary to relax the condition of the minimum size of holding specially for those belonging to this group.

2) Similarly the down payment is also uniformly fixed for all types of farmers. Since the majority of the farmers belonging to the group of scheduled Castes and Scheduled Tribes cannot afford this the government can either reduce the margin money or completely abolish the down payment for this group of beneficiaries.

3) The amount of subsidy is uniformly fixed for all categories of farmers. This can be altered in two ways. Firstly, government may increase the amount of subsidy to the farmers belonging to the socially backward communities. Secondly, the amount of subsidy can be inversely graded with the size of land holding of the family.

4) Instead of sanctioning and distributing the amount of subsidy in the initial period of the scheme, government may sanction the subsidy amount in the last year of their instalment or after some stipulated period. This will help to reduce the default payment.

5) Farmers feel that the spare parts of this tractor are costlier and not available in time. Government can give assurance to the farmers for providing spare parts for at least 10 years through Agro-Industries Development Corporation or by some arrangement with the reputed tractor companies.

6) Government can arrange training programme once in a year regarding operation and maintenance of the tractor with the help of the tractor producers, since new problems may occur when tractor use increases.

7) Government authorities or bank officials may keep all records of the beneficiaries including their original documents.

of the tractors till they complete their full loan instalments. This would reduce the number of defaulters and sale of tractors bought on subsidy.

8) To understand the real impact of this scheme on the farmers' cultivation pattern and economic conditions, it would be better to conduct a study at least after five years from the introduction of the scheme. Generally, the process of adoption period will always be more for machineries like tractors compared to technological inputs like fertilizers and pesticides.

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