UTILIZATION PATTERN OF FARM TRACTORS IN DISTRICT AHMEDNAGAR (MAHARASHTRA)

By

DILIP ANANDRAO DHOBALE

B.Tech. (Agril. Engg.)

A Thesis Submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH, RAHURI – 413 722,

DIST. AHMEDNAGAR, MAHARASHTRA, INDIA

In partial fulfillment of the requirements for the degree

of

MASTER OF TECHNOLOGY

(Agricultural Engineering)

in

Farm Machinery and Power

Approved by

Prof. L.V. Gharte
Chairman and Research Guide

Dr. S.B. Ghadge
Committee Member

Prof. A.B. Lende
Committee Member

Prof. A.P. Jaiswal
Committee Member

Prof. V.M. Kadu
Committee Member

DEPARTMENT OF FARM MACHINERY AND POWER
FACULTY OF AGRICULTURAL ENGINEERING
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI-413 722, DIST. AHMEDNAGAR
MAHARASHTRA, INDIA.

2003

UTILIZATION PATTERN OF FARM TRACTORS IN DISTRICT AHMEDNAGAR (MAHARASHTRA)

By

DILIP ANANDRAO DHOBALE

B.Tech. (Agril. Engg.)

A Thesis Submitted to the

MAHATMA PHULE KRISHI VIDYAPEETH, RAHURI – 413 722,

DIST. AHMEDNAGAR, MAHARASHTRA, INDIA

In partial fulfillment of the requirements for the degree

of

MASTER OF TECHNOLOGY

(Agricultural Engineering)

in

Farm Machinery and Power

Approved by

Prof. L.V. Gharte
Chairman and Research Guide

Dr. S.B. Ghadge
Committee Member

Prof. A.B. Lende
Committee Member

Prof. A.P. Jaiswal
Committee Member

Prof. V.M. Kadu
Committee Member

DEPARTMENT OF FARM MACHINERY AND POWER
FACULTY OF AGRICULTURAL ENGINEERING
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI-413 722, DIST. AHMEDNAGAR
MAHARASHTRA, INDIA.

2003

CANDIDATE'S DECLARATION

I hereby declare that the experimental work and its interpretation of the thesis entitled, "Utilization Pattern of Farm Tractors in District Ahmednagar (Maharashtra)" or part thereof has not been submitted for any other degree or diploma of any university nor the data have been derived from any thesis publication of any university or scientific organization. The sources of materials used and all assistance received during the course of investigation have been duly acknowledged.

Place : MPKV, Rahuri
Date : 18/9/2013

(Dilip A. Dhobale)
Reg No - 0101.

CERTIFICATE

This is to certify that the thesis entitled, **"Utilization Pattern of Farm Tractors in District Ahmednagar (Maharashtra)"**, submitted to the Faculty of Agricultural Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra, India, in partial fulfilment of the requirement for the degree of **MASTER OF TECHNOLOGY (Agricultural Engineering)** in **FARM MACHINERY AND POWER** embodies the results of a bonafide research work carried out by Shri Dilip Anandrao Dhobale under my guidance and supervision and that no part of the thesis has been submitted to any other University or Institute for any Degree or Diploma.

The assistance and help received during the course of this investigation have been duly acknowledged.

Place : MPKV, Rahuri
Date : 18/9/2003

Gharte

Prof. L.V. Gharte
Research Guide & Head
Department of Farm Machinery and Power
Faculty of Agricultural Engineering
Mahatma Phule Krishi Vidyapeeth
Rahuri-413 722, Dist. Ahmednagar

CERTIFICATE

This is to certify that, the thesis entitled, **"Utilization Pattern of Farm Tractors in District Ahmednagar (Maharashtra)"**, submitted to the Faculty of Agricultural Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra, India, in partial fulfilment of the requirements for the degree of **MASTER OF TECHNOLOGY (Agricultural Engineering)** in **FARM MACHINERY AND POWER,** embodies the results of a piece of *bona fide* research work carried out by **Shri Dilip Anandrao Dhobale** under the guidance and supervision of Prof. L.V. Gharte, Head, Department of Farm Machinery and Power, Faculty of Agricultural Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra and that no part of this dissertation has been submitted for any other degree or diploma.

Place : MPKV, Rahuri
Date : 18 / 9 / 2003

Dr. H.G. More
Dean
Faculty of Agricultural Engineering
Mahatma Phule Krishi Vidyapeeth
Rahuri-413 722, Dist. Ahmednagar

ACKNOWLEDGEMENTS

I deem it to be my proud priviledge to express my sincere, humble and deep sense of gratitude to Prof. L.V. Gharte for invaluable guidance, constructive criticism and helpful suggestions. I am especially indebted to the RTO, Ahmednagar for kind assistance during the research work.

I express my deep sense of gratitude to Dr. H.G. More, Associate Dean, Dr. A.S. College of Agricultural Engineering, M.P.K.V., Rahuri for his suggestions behind this project.

I am thankful to Dr. S.B. Ghadge, Prof. A.B. Lende, Prof. A.P. Jaiswal, Prof. V.M. Kadu for their advice and encouragement. I am also thankful to Dr. Subhashchandra Shinde, Prof. of Extension Education, for their kind assistance.

I am also thankful to my all friends who directly or indirectly helped me. I am also thankful to Mr. Nanasaheb Kale and staff members of Farm Machinery and Power Department.

Last but never the least, I have no words to express gratitude towards my family members for their patience and moral support during the course of investigation.

Place : MPKV, Rahuri
Date : 18/9/2003

(Dilip A. Dhobale)
Reg No 0401

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Agril.Engg.	:	Agricultural Engineering
ASAE	:	American Society of Automotive Engineers
B.Tech.	:	Bachelor of Technology
Dist.	:	District
Fig.	:	Figure
ha	:	Hectare
HP, hp	:	Horsepower
hr.	:	Hour
ISAE	:	Indian Society of Agricultural Engineers
Jr.	:	Journal
Ltd.	:	Limited
M.B.	:	Mould board
mm	:	Millimeter
MPKV	:	Mahatma Phule Krishi Vidyapeeth
RTO	:	Regional Transport Officer
SAE	:	Society of Automotive Engineers
Sq.km.	:	Square kilometer
Sr.No.	:	Serial Number
UK	:	United Kingdom
USA	:	United States of America
&	:	And
%	:	Per cent

ABSTRACT

UTILIZATION PATTERN OF FARM TRACTORS IN DISTRICT AHMEDNAGAR (MAHARASHTRA)

By

DILIP ANANDRAO DHOBALE

(Reg. No. 0101)

MASTER OF TECHNOLOGY
(Agricultural Engineering)

FACULTY OF AGRICULTURAL ENGINEERING
MAHATMA PHULE KRISHI VIDYAPEETH,
RAHURI-413 722, DIST. AHMEDNAGAR

Research Guide	:	Prof. L.V. Gharte
Department	:	Farm Machinery and Power

Ahmednagar is a developed district from agricultural and agrobased industries point of view. The development has been achieved by full use of available irrigation facilities, following scientific farm practices and using improved farm implements, machines and tractors.

The study was conducted in Ahmednagar district of Maharashtra to ascertain the utilization pattern of farm tractors. The district was divided into three groups (two consisting of 5 tahsils and one consisting of 4 tahsils) and one village from each block was selected randomly. Thus total 14 villages were chosen for the study.

Twenty respondents were surveyed in each of the groups selected for study. Results of the study revealed that tractors with 35-50 hp

were very popular and were owned by 76.66 % of farmers. The consideration of "timeliness in farm operations" dominated the farmers decision while purchasing the new tractors, as 56.6% of them assigned first priority to it. M.B. plough and trailer were found to be most popular and important implement owned by all tractor owners. Average annual use of tractor was found to be 830 hours; out of which it was used for 535 hours for custom hiring work and 295 hours for self work. Maximum use of tractors was recorded in tillage operations (39.75%) followed by transportation operation (30.72%). High cost of tractor and high cost of diesel, oil and spare parts were the major constraints reported by the tractor owners.

Introduction

1. INTRODUCTION

Agriculture is the backbone of Indian economy and a source of income for more than 60 per cent of the population. But its agricultural production per hectare and per head is perhaps the lowest in the world. The application of improved agricultural technology will help to increase the per head agricultural production.

Modern agriculture is mostly dependent on high yielding varieties, increased use of fertilizers, chemicals, pesticides and better irrigation and farm mechanization in India. The introduction of farm machinery has played a significant role in increasing agricultural production due to timely performance of critical farm operations. Rapid rise in the cost of inputs such as seed, fertilizers, insecticides, etc has necessitated precision in placement and application of these inputs. The use of appropriate farm machinery has helped in achieving these objectives. Substitution of mechanical power in lieu of manual and animal labour became essential in view of the fast rising wages of the human labour and escalation in the maintenance cost of the animals. Drudgery of human labour and upkeep of animals are also been important considerations in mechanization. Tractor is the basic unit of farm mechanization in India and is a good indicator of the level of farm mechanization of that region.

Tractors were introduced on government farms and a few sugarcane / tea plantation farms during thirties. First tractor manufacturing plant was established at Faridabad in Haryana during 1960-61. Now there are about twenty licenced tractor manufacturing units in the organized sector with licensed capacity of around 0.2 million

tractors per annum. About 40 different models of tractors are presently being used in the country. The performance of new tractors produced is regularly monitored at Central Farm Machinery Training and Testing Institute, Budni, Madhya Pradesh. However, little information is available on the performance of the tractors being used on the farms.

Today, the mechanization of Indian agriculture is in its primary stage. Human power predominates even though it can be substituted by animal power and/or mechanical power. The availability of adequate power for agricultural operation is now recognised as an important factor to achieve higher production per unit area. A worldwide survey has revealed that the optimum power input for obtaining good yield is 1 hp per hectare. As against this, the current power availability on our farms is barely 0.4 hp per hectare (Shete, G.S. and Saoji, A.B., 1992).

A response to mechanization is now increasing. Upto 1960, the demand for tractors was fulfilled entirely through imports. From 1961 to 1975 the tractor requirement was fulfilled through imports and indigenous production. From 1976, the entire requirement of tractors is fulfilled through indigenous production. Today, India ranks 1st in production and also exports tractors.

In agriculture, the tractor has changed the tasks as well as the daily routine of the farmers. The machine has changed the pattern of their work, work days, and their interaction with co-workers during working and leisure times (Easterby, R., 1975). Hence, the adoption of tractors, apart from economics considerations depends on many others factors too : social and cultural factors like availability of hired or family labour for field operations, farmer's traditions and skill in animal cultivation, prestige attached to tractor ownership, their attitude towards

hiring or lending the tractors when not in use on their own farms, mechanical skills; political factors such as land tenure system, credit, tractor hiring scheme, rural employment, agricultural policies, cultural identity, foreign exchange rates, availability of second hand tractors, and marketing and training facilities (Cattermole, 1978).

The choice of tractor mainly depends upon various factors like size of farm, nature of work required of tractor, crop and soil type, engine and transmission of tractor, ground drive (2 or 4 wheel drive), design factor like tractor vibration, noise, micro-climate inside the tractor cab and other facilities available regarding the health, comfort and safety of the operator (Matthews, 1982).

Also the use of tractor mainly depends upon its practical usefulness (Matthews, 1982; Sjoflot, 1982), the availability of the service from the dealer (Sjoflot, 1982), and maintenance and repair cost associated with a particular tractor.

Small and medium farmers form core of the farming community in India. They could not modernize their farms with their limited resources. They are not fully benefited by the opportunities thrown up by the Green Revolution . In order to enable this section of farming community to purchase tractors and other agricultural machinery, agro-industries corporation has organized programme for distribution of the same. Nationalized banks and other credit institutions are advancing loans to the farmers for purchase of tractors and other agricultural machinery. To provide technical services and machinery hiring facilities, another scheme has been formulated by the ministry of agriculture. Under this scheme 'Agro-Service Centres' are being set up and financed

through nationalized banks and other credit institutions. The loans are to be repaid in installments spread over a period of five to seven years.

This research project was undertaken to study the utilization pattern of farm tractors in Ahmednagar district of Maharashtra. This study was conducted with a view of obtaining useful information for knowing the tractor utilization in the study area and constraints in adoption of tractors and farm machinery. The study area, Ahmednagar district, is situated in the western part of Maharashtra state. The 70 per cent of the land holding are less than 2 ha in size Agriculture is still in a semi-mechanized state in the district and tractor is the main agricultural machinery used for various purposes like primary tillage, secondary tillage, seeding, cultivating, threshing and transporting of agricultural products, fertilizers, farm yard mannures and people.

In view of this, the present research work was undertaken at the College of Agricultural Engineering, Mahatma Phule Krishi Vidyapeeth, Rahuri, with the following objectives.

1. To study the utilization pattern of farm tractors and their annual use for various agricultural operations.
2. To study the constraints in adoption of farm tractors and machinaries.

Importance of the study

The study on utilization pattern of farm tractor has been done only for some small part of India. Hence this study is significant. The investigation is planned mainly to assess knowledge and utilization pattern of farm tractors and to study the constraints in adoption of farm tractors and machinaries.

The study will be useful to the planners and manufacturers to decide the strategy of utilization pattern. It will be also helpful to the manufacturers and dealers to concentrate upon a particular group of farmers to increase their sale thereby to increase the level of farm mechanization.

Review of Literature

2. REVIEW OF LITERATURE

This chapter deals with a brief review of relevant literature cited for present research work. In this chapter there are four sections. The first section gives the brief idea about development of tractors. Second section gives list of tractor manufacturers, their collaborators and year of commencement of production. Third section gives the yearwise production, sale, import, export of the tractors. Fourth section gives the direct reviews related to utilization pattern of tractors & constraints in adoption of tractors & machinaries.

2.1 Development of Tractors

1858	Steam plowing engine by J.W. Fawkes drew eight plows at 4.8 km/h in virgin sod.
1873	The Parvins steamers was probably the first U.S. attempt at a tracklaying device, although the U.S. Patent Office recorded crawler tractor developments in the early 1850s.
1876	Otto patents were issued for an internal-combustion engine.
1889	At least one company built a tractor with an internal combustion engine
1908	The first winnipeg tractor trials were held.
1910-1914	1. The first tractor demonstration was held in the United states at Omaha, Nebraska, in 1911.
	2. Smaller, light weight tractors were introduced.
	3. The frameless-type tractor was introduced
1915-1919	1. The power take off was introduced
	2. The Nebraska tractor test law was passed.
1920-1924	A highly successful all-purpose farm tractor was developed.

1925-1929 The power take off was gradually adopted.

1930-1937
1. The diesel engine was applied to larger tractors.
2. Pneumatic tires and higher speds were introduced.
3. Full electric equipment was adopted.
4. Interest in high compression engines increased.
5. The all purpose tractor was generally acceped.

1937-1941
1. Standardized ASAE and SAE power takeoff and hitch locations were generally accepted.
2. Pressurized cooling systems were introduced.
3. Liquid fill was widely used in tires to add ballast for traction.
4. Three point implement hitch and linkage were introduced.
5. Automatic hydraulic draft control was introduced.

1941-1949
1. Live power take off was introduced.
2. Hydraulic controls for drawn implements were adopted.
3. Tractors for burning liquefied petroleum gases were introduced.
4. Number of lawn and garden tractors expanded rapidly.

1950-1960
1. Power of tractors increased rapidly.
2. Percentage of diesel tractors increased.
3. Refinements such as power steering, automatic transmissions and transmissions with greater speed selections became widely available.

1961-1970
1. Power of tractors continued to increase.
2. Except for the smallest tractors in the United States, all tractors now have diesel engines.
3. Much more emphasis was given on operator comfort and safety.

4. Full power shift transmissions became available.
5. Radial-ply tractor tires became available.
6. The number of power tillers started to expand in Japan.

1970-1978
1. Turbocharger and intercoolers were added to diesel engines.
2. Rollover protective structures (ROPS) became available.
3. Most large tractors were equipped with cabs.
4. Nebraska tractor tests included sound level measurements.
5. Four wheel drive increased in popularity.

1979-1985
1. Tractors equipped with electronic sensing an control systems became popular.
2. Tractor size and power have appeared to reach upper limits.

2.2 List of Tractor Manufacturers, their Collaborators and Year of Commencement of Production.

Table 2.1 List of Tractor Manufacturers, their Collaborators and Year of Commencement of Production.

Manufacturer	Collaborator	Year
Eicher Tractors Ltd.	Gebr, Eicher Tractorenfabrik, West Germany	1961
Gujarat Tractors Ltd. / Tractors and Bulldozers Ltd.	Motokov-Praha, Czechoslovakia	1963
Tractor and Farm Equipment Ltd.,	Messey Ferguson, UK	1961
Escorts Ltd.	Moloimport Warazawa Zaklady Mechaniczne Ursus, Poland	1964

Contd . .

Contd.....

Mahindra and Mahindra Ltd. / International Tractor Co. of India Ltd.	International Harvesters, UK	1965
+Escorts Tractor Ltd. / Escorts Ltd. (Farmtrack Division)	Ford UK	1971
Hindustan Machine Tools Ltd. (Central Sector PSU)	Motokov-Praha, Czechoslovakia	1971
*Kirloskar Tractors Ltd.	Klochner-Humboldt Deutz, Germany	1974
Punjab Tractors Ltd. (State Sector)	CMERI, India	1974
*Pittie Tractors Ltd.	Own know-how	1974
*Harsha Tractors Ltd.	Motoimport, Russia	1975
*Auto Tractors Ltd.	British Leyland, UK	1981
**Haryana Tractors Ltd, / Pratap Steel Rolling Mills Ltd.	Own know-how	1983
VST Tillers and Tractors Ltd.	Mitsubishi, Japan	1983
*United Auto Tractors Ltd.	Uzina Tractorul, Romania	1986
*Asian Tractors Ltd.	Own know-how	1989
Bajaj Tempo Ltd.	Onw know-how	1997
International Tractors (Sonalika) Ltd.	Own know-how	1998
New Holland Tractor (India) Ltd.	New Holland Tractors, Italy	2000
Larsen and Tubro Ltd.	John Deere, USA	2000
Greaves Ltd.	Same Deutz-Fahr, Italy	2000

* Currently not in production
** Have been producing small quantities on "On & Off" basis
+ Now producing Farmtrac as well as powertrac tractors

2.3 Yearwise Production, Sale, Import, Export and Population of Tractors in India.

Table 2.2 Yearwise production, sale, import, export and population of tractors in India.

Year	Production	Import	Export	Sale	Population*
Upto 1946	0	4500	0	4500	4500
1947-51	0	4000	0	4000	8500
1952-56	0	12500	0	12500	21000
1957-60	0	16000	0	16000	37000
1961	880	2998	0	3877	39000
1362	1414	2616	0	4030	41000
1963	1983	2346	0	4329	43000
1964	4323	2323	0	6646	47000
1965	5673	1989	0	7662	52000
1966	8816	2591	0	11407	62000
1967	11394	4038	0	15432	76000
1968	15466	4726	0	20192	93000
1969	18093	10478	0	28571	118000
1970	20099	13300	0	33399	146000
1971	18100	19739	0	37839	176000

Table contd...

Table contd...

1972	20802	1000	0	21802	210000
1973	24425	793	0	25425	228000
1974	31088	1100	0	31881	256000
1975	33252	2920	0	34352	287000
1976	33146	0	0	36066	319000
1977	40946	0	0	40946	356000
1978	54322	0	0	54322	406000
1979	62275	0	0	62275	464000
1980	71024	0	0	72012	526000
1981	84137	0	0	79467	594000
1982	63155	0	0	65776	644000
1983	75872	0	0	76545	701000
1984	84876	0	0	82390	754000
1985	75550	0	0	76817	798000
1986	80369	0	0	80670	841000
1987	92092	0	0	92092	911000
1988	109987	0	0	109987	996000
1989	121624	0	0	121624	1085000
1990	139831	0	458	139373	1190000

Table contd...

Table contd...

1991	150556	0	583	149973	1304000
1992	144350	0	1174	143601	1407000
1993	138770	0	1498	138057	1491000
1994	164841	0	3038	164309	1593000
1995	191329	0	3454	191196	1712000
1996	221689	0	3719	220941	1853000
1997	255327	0	7000	250378	2038000
1998	260815	0	6536	254279	2292279
1999	269251	0	6900	262351	2554630
2000	180300	0	7119	173181	2727811

*Based on estimated life of 15 years

Source : Statistical abstract of India 2001.

2.4 Utilization Pattern of Farm Tractors and Constraints in Adoption of Tractors and Farm Machineries

Easterby (1975) reported that in agriculture, the tractors has changed the tasks as well as the daily routine of the farmers. The machine has changed the pattern of their work, work days and their interaction with co-workers during working and leisure times.

Kaholon, A.S. (1976) studied the impact of mechanization of Punjab agriculture with special reference to tractorization. He reported that tractorization has helped to increase the mechanization.

Cattermole (1978) found that the adoption of tractors, apart from economic considerations, depends on many other factors too : social and cultural factors like availability of hired or family labour for field operations, farmers traditions and skill in animal cultivation, prestige attached to tractor ownership, their attitude towards hiring or lending the tractors when not in use in their own farms, mechanical skills; political factors such as land tenure system, credit, tractor hiring scheme, rural employment, agricultural policies, cultural identity, foreign exchange rates, availability of second hand tractors, marketing and training facilities.

Matthews, J. (1983) studied the criteria to be employed by the farmers in selecting tractors including power level, torque characteristics, fuel efficiency, type of ground drive, appropriate use of implement's combinations and effective maintenance. All served to improve the economics of tractor operation. Also he found that the choice of tractor mainly depends upon various factors like size of the farm, nature of work required from the tractor, crop and soil type, engine and transmission of tractor, ground drive, design factors like tractor vibration, noise, micro-climate inside the tractor cab and other facilities available regarding the health, comfort and safety of the operator

Singh Bhawan and Singh K.N. (1991) studied the utilization of different models of tractors on large mechanized farms in Punjab.

Shukla, L.N., Jain, M.K. (1991) conducted a survey for establishing the recent trends in tractor sales and the factors influencing the decisions of the farmers who purchased new tractors in Ludhiana district of Punjab. Twenty one villages in three blocks of the district were

covered. The analysis of the data showed 35 hp tractor as most popular tractor and two third of the purchase was found to be replacement sale.

Singh, S., *et al.* (1992) carried out a study to assess the availability and utilization pattern of farm machinery and tractors in selected villages of Punjab state. The average annual use of tractor in crop production was found to be 165 hr. which was less than he expected use. The annual use of TD cultivator, disc harrow and seed drill was 38, 170 and 23 hr, respectively.

Saoji, A.G. and G.S. Shete (1992) studied the level of mechanization and factors affecting mechanization in Digras village of Rahuri taluka of Ahmednagar district. They tested two hypothesis. The first hypothesis that personal, social and economical characteristics of farmers do not affect mechanization disproved whereas second hypothesis stating that perception of characteristics of farm machinery affected adoption was proved.

Shaym, M. (1992) collected data from 49 tractor owning farmers in Bhopal and Raisen districts of Madhya Pradesh. The data indicated that the most farmers possessed a tractor of 18 to 30 pto-hp, a trailor, a cultivator, a seed drill, a crop thresher and electric pump-sets. Use of tractors for operation other than tillage, sowing and transporttion was found very limited. Almost all the farmers have taken bank loan for purchasing a new tractor. About one third of farmers used their tractor for custom hiring jobs. Average annual use was reported to be around 1000 hr. Very limited repair facilities were found available in rural areas. Most farmes did not avail services of the authorised dealers for repair of their tractor. Farmers, in general, were found satisfied with their tractor.

Singh, J. (1993) studied 203 farms having 218 tractors, selected from ten districts of Punjab and reported that though most of the farmers were cultivating with their own tractors and own operational holdings of 4-14 ha, yet 18.23 per cent of the sample farmers operated less than 6.0 ha of land. The average annual use of the tractor was reported to be 396.8 hr which is much less than the possible extent of 1000 hr.

Joginder Singh and Dhawan, K.C. (1994) conducted a survey to study an economic analysis of tractorization of Indian agriculture. They conducted survey in Punjab state. The study based on sample of 113 tractor owner showed that on average, power availability per hectare was 3.61 hp on the sample farms. The cropwise use of tractor showed that paddy and wheat were the main crops in the crop-mix farming which accounted for 33.96 per cent and 39.60 per cent of the total use on tractors owing farms, respectively. Seed bed preparation, sowing of seed, marketing of products, threshing and puddling were the important farm operations for which tractors were being used.

Ram, R.B. (1996) conducted study to observe trends of farm mechanization in South Bihar alluvial plain zone. It was observed that the maximum number of tractors (44) were operated for 800-1100 hr per year. The common implements used were field cultivator, mould board plough, leveller, crop thresher and the trolley. The tractors were used for about 32 per cent time for the custom hire work.

Patil, V.Y., M.R. Sawant and K.P. Thorat (1998) studied the tractorization in Ahmednagar district. The study was conduted in 13 tahsils of the district. The information collected from 130 respondents revealed that they showed interest in Mahindra and Mahindra and Swaraj

make tractors during the year 1993-97. The constraints in adoption of tractor were high cost of tractor and related working assets and high cost of repair and maintenance.

Balasankari, P.K. and Salokehe, V.M. (1999) studied tractor utilization by farmers in Coimbatore district of Tamilnadu state, India. They interviewed 88 farmers. They found that only about 12.5 per cent of the farmers surveyed had proper training for use and maintenance of tractor and about 45 per cent of them had a license to drive the tractor. Inconveniences involved in maintaining animals (75 per cent), reduced labour availability during peak seasons (67 per cent) and timeliness of operations (64 per cent) were the main reasons given by the farmers for buying a tractor.

Yadav, S., Bahl, V.P. and Bhall, D. (1999) conducted a study in Mohindergarh district of Haryana to ascertain the utilization pattern of farm tractors. They selected three blocks of the district and four villages were randomly chosen in each block. Twenty respondents were surveyed in each of the blocks selected for the study. Results of the survey revealed that tractors with 35-40 hp were very popular and were owned by 61.66 per cent of farmers. The consideration of "timeliness in farm operations" dominated the farmers decision while purchasing the new tractors, as 78.33 per cent of them assigned first priority to it. Tractor drawn cultivator was found to be the most popular and important implement owned by 86.66 per cent of tractor owners. Average annual use of the tractor was found to be 448.091 hours only; out of which it was used for 238.60 hours for custom hiring work and 210.31 hours for self work. Maximum use of the tractors was recorded in tillage operations (29.19 per cent) followed by threshing operations (19.40 per cent). Crop

threshers provided the maximum custom hiring work (13.88 per cent), where as tillage operations engaged the tractors for a maximum period of 16.33per cent on self land.

Sandeep Yadav and Aggrwal S. (2000) studied economic analysis of utilization of farm tractors in selected districts of Haryana state to ascertain the trends in tractor sales and economic analysis of utilization of farm tractors. They selected the districts according to the three different cropping patterns. All blocks from these districts were taken into consideration and from each block one village was selected purposely which was having maximum number of tractors. Total numbers of new tractors owning farmers surveyed in the above selected villages were two hundred. Results of the survey revealed that the average annual use of farm tractor in these districts was 594.32 hours, out of which 58.46 per cent of time, was used for custom work and only 41.54 per cent for own works. Maximum annual use of farm tractor in the state was found in tillage operation i.e. 20.92 per cent for own work and 13.49 per cent for custom work.. The operating costs for tractors less than 25 hp, 30-35 hp and more than 35 hp were found as Rs.147.30, 157.51 and 169.08 per hour, respectively.

Methodology

3. METHODOLOGY

This chapter deals with discussion in brief on "Where" and "How" the research work is carried out. The methodology has been explained as under:

3.1 Location of the Research Site

Ahmednagar district of Maharashtra state was selected for this study as it has easy access and ease of collection of the data Secondly, the district is in semimechanized state. The region has highest number of sugar factories (13) and high percentage of irrigated land in Maharashtra. The north side of district is surrounded by Nasik and Aurangabad districts. While the east and south-east sides are surrounded by Beed and Osmanabad districts respectively. The boundaries of Solapur and Pune districts are located on south and west side of the district respectively. This district comprises of 14 tahasils (blocks). Pune-Nasik national highway passes through western side of the district. Daund-Manmad railway track passes through the district. The district map is shown in fig. 3.1.

3.2 Information of Research Site

3.2.1 Area and population

Ahmednagar district occupies an area of 17,048 sq. km out of which 13,160 sq. km land is cultivable. The main sources of irrigation are canals and wells.

The total population of this district is 33.62 lakhs as per 1990-91 census. Out of this 28.30 lakhs population is rural (84.18 per

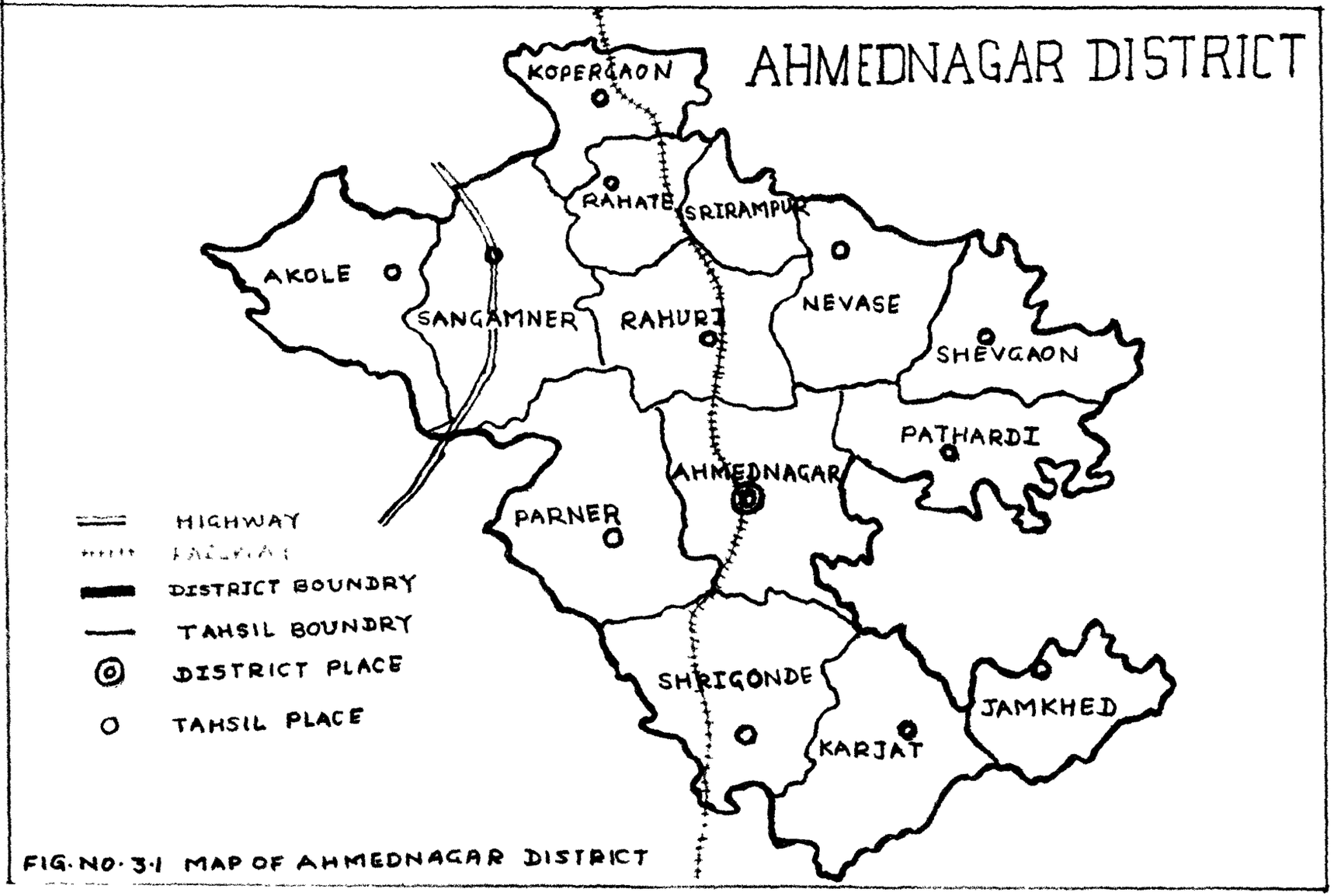

FIG. NO. 3.1 MAP OF AHMEDNAGAR DISTRICT

cent) whereas 5.33 lakh population is urban (15.82 per cent) . The literacy percentage of males and females is 62.23 per cent and 37.83 per cent respectively, while the average literacy is 50.32 per cent.

3.2.2 Soil and climate

The Ahmednagar district crest is made from volcanic lava called. "Deccan Trap". Three types of soils are commonly found in the region riz.

1. Deep alluvial soils,
2. Shallow, light to medium, sandy clay,
3. Light, silt loam, sandy loam, clay loam with calcium.

The average rainfall is 592 mm. There is relatively more precipitation in the north and north-west sides of the region. While the precipitation decreases towards south and east sides of the district. The average minimum and maximum temperatures are 20 degree celcius and 42 degree celcius respectively. Summer is hot and dry, rainy season is warm and hot and winter season is cool and dry.

3.2.3 Land utilization statistics

Table 3.1 shows the land use pattern of Ahmednagar district.The gross cropped area is 77.19 per cent to the total geographical area. The total barren land is 9.43 per cent to the total geographical area.

Table 3.1 The land use pattern of Ahmednagar district

Sr. No.	Land utilization	Area '00' ha
1	Total geographical area	17048
2	Area under forest	1756
3	Area not available for cultivation	1607
4	Other uncultivated land including fallow land a. Cultivable waste b. Permanent pastures	 294 498
5	Net sown area	11604
6	Area sown more than once	805
7	Gross cropped area	13160

3.2.4 Industrial Development

Ahmednagar district is known for its agro-industrial development. Co-operative sugar factories, milk processing units, oil industries and drip and sprinkler industries are established in this district.

3.3 Grouping of the Blocks (Tahasils)

The study was carried out in the district Ahmednagar, which is located in western part of Maharashtra state.

There are fourteen blocks in Ahmednagar district. These fourteen blocks were grouped into three groups (two consisting of five blocks and one consisting of four blocks) according to agroclimatic conditions. One village from each block was selected randomly for the study (The village having maximum number of tractors was selected). Thus a total of 14 villages were surveyed for the study which was

conducted in the year 2002-03. In each group, 20 respondents were selected, thus making the total number of respondents as 60. Table 3.2 shows the name of the group and villages of Ahmednagar district selected for the survey.

Table 3.2 Name of the groups and villages of Ahmednagar district selected for survey

Sr. No.	Name of group	Name of the villages
1	Kopargaon	Takali, Ghargaon, Belapur, Rajur, Loni
2	Rahuri	Digras, Kukane, Supe, Chichondi Patil, Bodhegaon
3	Pathardi	Tisgaon, Visapur, Rashin, Kharda

Kopergaon group consists of Kopergaon, Sangamner, Shrirampur, Akole, Rahata tahsils. Rahuri group consists of Rahuri, Newasa, Parner, Ahmednagar, Shevgaon tahsils. Pathardi group consists of pathardi, Shrigonda, Karjat and Jamkhed tahsils.

3.4 Collection of the data

The data regarding the sale of tractors in Ahmednagar district was collected from the RTO office of Ahmednagar.

The survey was carried out during 2002-03 by collecting information through personal contact with the farmers. One questionnaire was prepared for conducting the study. The first part of questionnaire included general information about name of the farmers, age, address, farmer's land holding, area under different crops, details of tractor owned (i.e. make, model, hp), date of purchase, cost, implements owned, custom hiring details, annual use for various operations and details of

maintenance and service of tractors, source of irrigation, importance given to different factors while purchasing tractors.

Second part of questionnaire included the information on constraints in adoption of farm tractors and machineries and suggestions of the farmers.

A good rapport was established with tractor owners. The respondents were contacted during the leisure time. The objectives and importance of study was explained to them for getting accurate information. They were assured that their information would be used only for the purpose of study without disclosing their identity. The data were collected personally by interviewing the respondents on an average half an hour was required for interview. The data collection work was completed in 30 days in April May 2003.

3.5 Parameters Studied

A. Size of land holding

It is the total area possessed by the respondents. As per size of land holding the respondents were grouped into 5 categories.

1. Marginal ..... less than 1 ha
2. Small ..... 1-2 ha
3. Semi medium ..... 2-4 ha
4. Medium ..... 4-10 ha
5. Large ..... 10 ha and above

B. Tractor ownership

The hp range of the various tractors were categorised into three categories.

1. Upto 35 hp
2. 35 to 50 hp
3. More than 50 hp

Also the make / model of the tractor was taken into consideration. Above three categories of hp were divided according to the operational land holding of the respondents.

C. Implements ownership

The following implements were taken into consideration.

1. M.B. Plough
2. Trailer / trolley
3. Cultivator
4. Seed drill
5. Disc harrow
6. Rotavator
7. Leveller
8. Ridger
9. Pumpset

D. Various factors considered while purchasing tractor

Following factors were considered while purchasing tractor

1. Timeliness in operation
2. Custom service
3. Fuel efficiency
4. H.P. required
5. Resale value
6. Repair and maintenance cost
7. Purchase price

8. Spare parts and repair facilities
9. Special technical features

E. Operationwise utilization of tractors

Following operations were considered while studying the annual use of tractors for own and custom hire work.

1. Tillage
2. Sowing
3. Leveling
4. Threshing
5. Transportation
6. Irrigation
7. Miscellaneous use

3.6 Analysis of Information

The information collected through interview and questionnaire was transferred to the primary tables and then to secondary tables. The data were processed and tabulated by using simple frequencies the percentages were worked out where needed.

3.6 Constraints in Adoption of Farm Tractors and Machineries

The information regarding constraints experienced by the farmers in adoption of tractor were also ascertained. The constraints were tabulated.

3.7 Suggestions of Farmers about use of Tractors and Machineries

Suggestions were invited from the farmers about tractors and improved farm implements. The suggestions were tabulated.

Results and Discussion

4. RESULTS AND DISCUSSION

This chapter deals with the presentation of the results of investigation and critical discussion of the results presented. The data collected from 60 respondents from 14 tahsils of Ahmednagar district were first compiled into primary tables. They were then transferred into secondary tables in view of achieving the objectives of the study. The data is presented by working out the frequencies and percentages. The results of the investigation are presented and discussed under various heads as follows.

4.1 General Information

The average age of the subjects was 42 years (ranging from 20 to 49 years). On average, they had about 21 years of experience in farming i.e. they had taken up the responsibility of tractor driving at the age of 22 years. Table 4.1 shows the ownership of the land by the farmers who owned tractors. The table shows that most of the marginal and small farmers were out of reach for buying tractor.

Table 4.1 Size of the land holding owned by the farmers

Sr. No.	Land holding size	No. of farmers	Percentage
1	Marginal (< 1 ha)	2	3.33
2	Small (1-2 ha)	6	10.00
3	Semi-medium (2-4 ha)	10	16.67
4	Medium (4-10 ha)	32	53.33
5	Large (> 10 ha)	10	16.67
	Total	60	100

Nearly 94 per cent of farmers had ground water as source of irrigation (wells and borewells). Only about 6 per cent of the farmers had purely rainfed land. Table 4.2 shows the availability of water for farming availability of water meant better production and hence a better economic return. So only those who could expect significant return could do multiple cropping and also invest in a tractor.

Table 4.2 Number of seasons of availability of water to the farmers

Sr. No.	No. of seasons of availability of water	No. of farmers	Percentage of farmers
1	One	7	11.67
2	Two	15	25.00
3	Three	38	63.33
	Total	60	100

4.2 Effect of Operational Land Holding on Tractor Ownership

The effect of land holding on the purchase of tractors is given in Table 4.3. It was found that tractors of 35 to 50 hp were very popular in the district and owned by 76.66 per cent of the farmers which were surveyed. These were more popular amongst the farmers having land holding of 4 to 10 ha. The tractors with more than 50 hp were less popular and were owned by 20 per cent of the farmers. A close perusal of Table 4.3 revealed that 30 per cent of the farmers having 2 to 4 ha land holding own tractors of more than 50 hp. In fact, this category of the farmers take tractors not only for their own work but for custom hiring service too for supplementing their incomes. Similar trend was observed for the farmers of 4 to 10 ha. land holding. However, for the farmers falling in the category of 4-10 ha operational land holding, 81.25 per cent of the farmers going for tractors of 35 to 50 hp. However, it was

interesting to know that 70 per cent of the farmers with more than 10 ha of land holding possessed tractors of 35-50 hp. Probably, this category of the farmers were not very much interested in outside work and hence preferred tractors of 35 to 50 hp which were quite effective for their work.

Table 4.3 Effect of land holding on purchase of tractors

Sr. No.	Land holding (ha)	Number of tractors in the hp range			Total	
		Upto 35	35-50	More than 50	Number	Percentage
1	<2	2 (25.00)	6 (75.00)	-	8	13.33
2	2-4	-	7 (70.00)	3 (30.00)	10	16.67
3	4-10	-	26 (81.25)	6 (18.75)	32	53.33
4	10 and more	-	7 (70.00)	3 (30.00)	10	16.67
Total per cent		2 (3.33)	46 (76.66)	12 (20.00)	60	100

*Figures in parenthesis indicated percentage.

4.3 Effect of Operational Land Holding on Implements Ownership

The trend in implements ownership is given in Table 4.4 which revealed that M.B. Plough, trailer, cultivator, seed drill, disc harrow, rotavator, leveller, ridge maker are the most popular implements owned by the farmers of the district. Tractor drawn M.B. plough and trailer were most popular and owned by almost all (100 per cent) of the farmers. Contrary to common belief, cultivator was owned by 75 per cent

of the farmers. However, land leveller, considered to be quite important, was found to be owned by only 66.67 per cent farmers only. Implements ownership was found to be maximum for the farmers of 4 to 10 ha operational land holding and minimum for the farmers of less than 2 ha land holding category. Per cent of tractor drawn cultivator and leveller possessed by the farmers of 4-10 ha land holdings were 90.62 per cent and 15 per cent, respectively. It indicated that for custom service work, these were the most popular implements. Trailer was possessed by almost all (100 per cent) farmers mainly for transportation work.

Table 4.4 Effect of land holding on implements ownership

Sr. No.	Name of implement	No. of farmers according to land holding (ha)				Total	
		<2	2-4	4-10	10 and above	No.	Per cent
1	M.B. Plough	8	10	32	10	60	100
2	Trailer / Trolley	8	10	32	10	60	100
3	Cultivator	-	8	29	8	45	75
4	Seed drill	-	-	-	2	2	3.33
5	Disc harrow	-	1	-	5	6	10
6	Rotavator	-	-	-	3	3	5
7	Leveller	3	7	24	6	40	66.67
8	Ridger	-	1	-	-	1	1.66
9	Pumpset	8	10	32	10	60	100

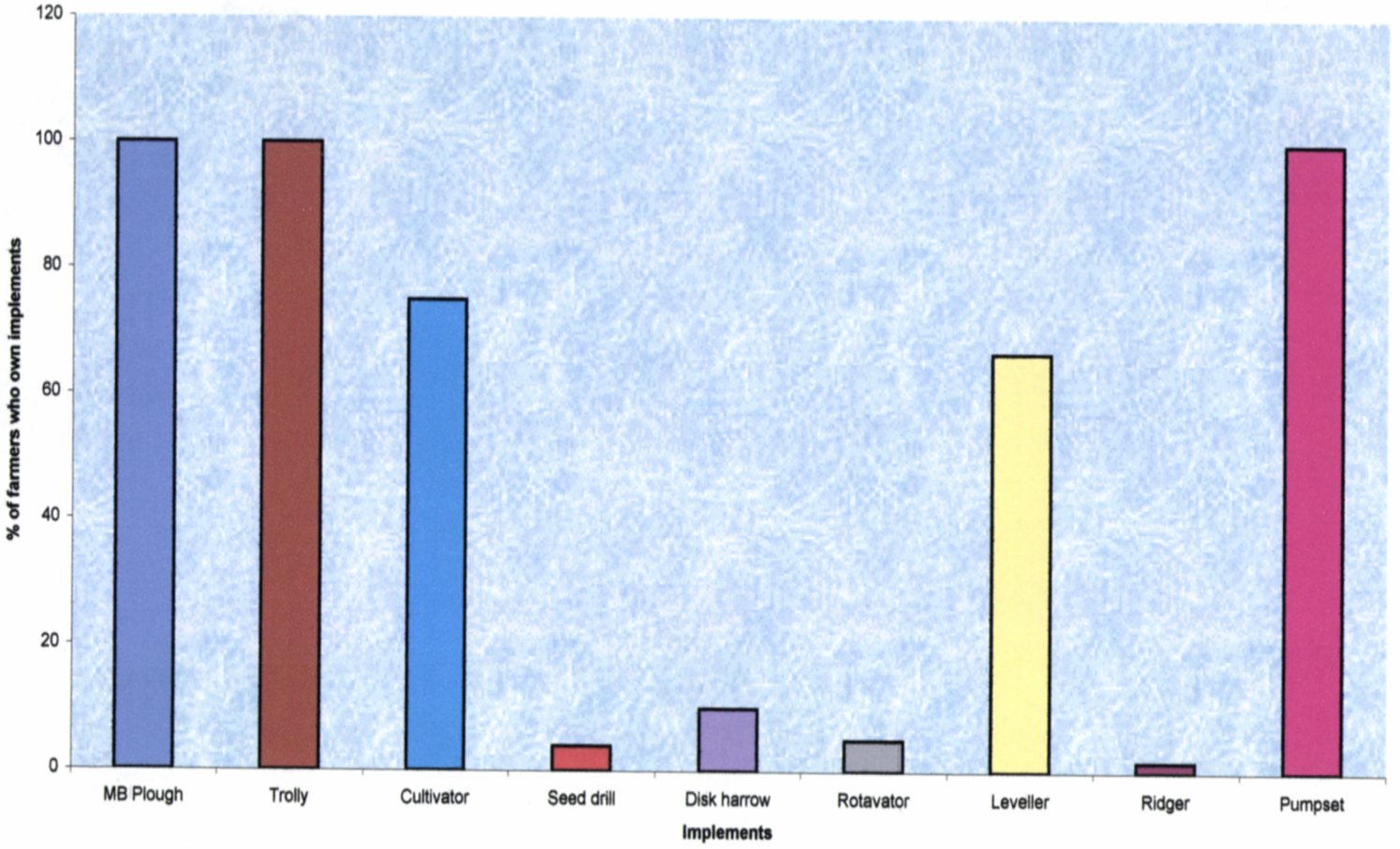

Fig 4.1 Implements owned by farmes in the study area

4.4 Ownership Pattern of Various HP Tractors

It was found (Table 4.5) that a maximum 76.66 per cent of the farmers owned tractors ranging 35-50 hp. Thus 30-35 hp tractor was the most popular tractor. The percentage of tractor owners possessing below 35 hp tractors was 3.33. This was due to limited use of such tractors for operations in horticultural plantations. A common belief amongst the planners is that with the fragmentations and division of agricultural land, small hp tractor is the need of the time. The phenomenon is reversed due to the latest increasing trend in custom hiring service of the tractors. 20 per cent of the farmers owned tractors of more than 50 hp.

Table 4.5 Ownership pattern of various HP tractors in Ahmednagar district

Sr. No.	HP of the tractor purchased	No. of the farmers				Per cent share
		Sangamner group	Rahuri group	Pathardi group	Total	
1	Upto 35	Nil	Nil	2 (3.33)	2	3.33
2	35-50	17 (85.00)	14 (70.00)	15 (75.00)	46	76.66
3	50 and above	3 (15.00)	6 (30.00)	3 (15.00)	12	20.00
Total		20 (100)	20 (100)	20 (100)	60	100

*Figures in parenthesis indicated percentage.

4.5 Preferences on Make of Tractors

Table 4.6. Fig. 4.3 shows the preferences of the farmers on the make and model of the tractor. The Mahindra and Mahindra tractor

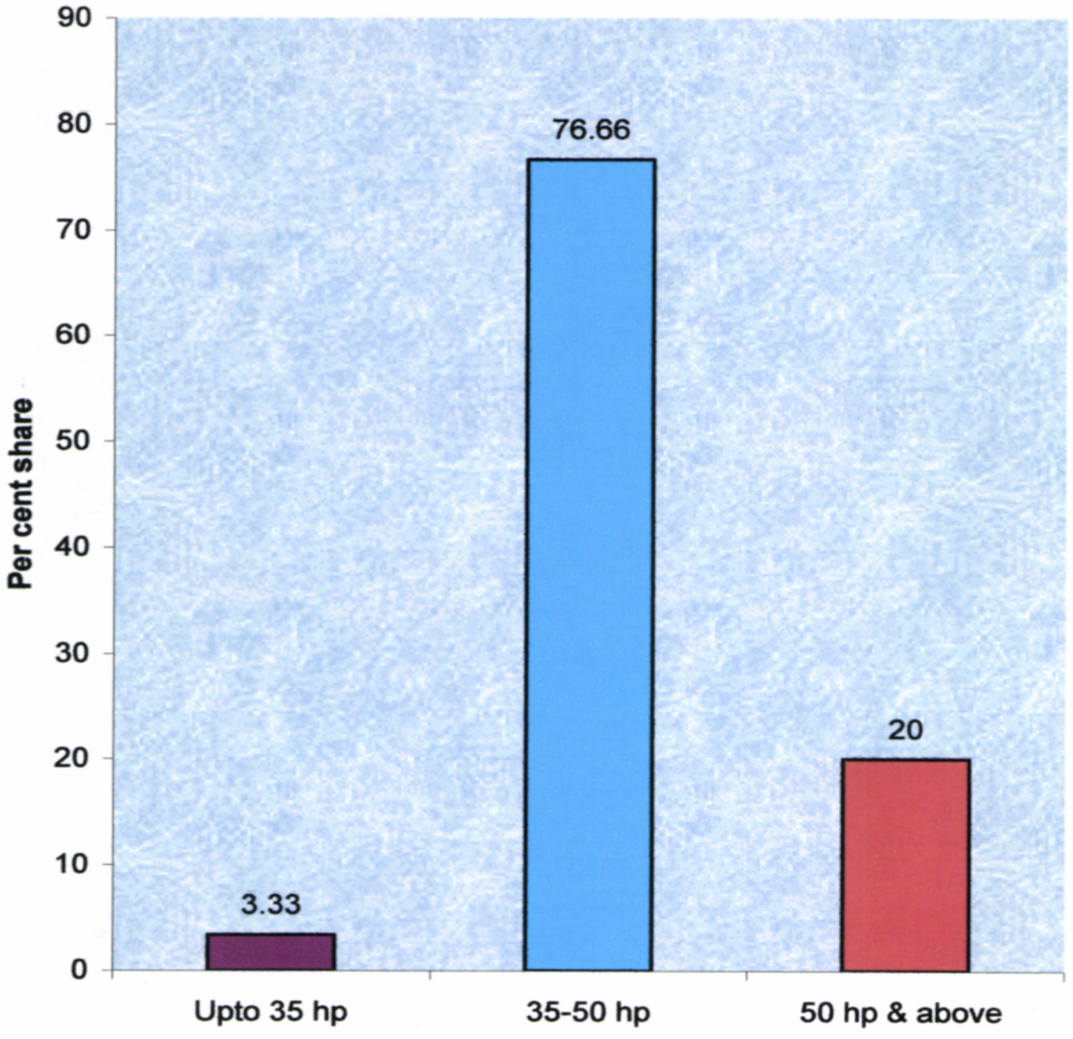

Fig. 4.2 Ownership pattern of various HP tractors

was preferred by the farmers (40 per cent) because it was considered to be suitable for the field work and other rough work and also due to easy availability of spare parts. The second preference was given to Swaraj tractor (23.33 per cent), as it has low price. Escort was preferred for its compact configuration. TAFE tractor was preferred by only 11.67 per cent of the farmers.

Table 4.6 Preferences on the make and model of the tractor

Sr. No.	Make and model of tractor	No. of farmers	Per cent preferred
1	Mahindra and Mahindra	24	40.00
2	Swaraj	14	23.33
3	Escorts	11	18.33
4	TAFE	7	11.67
5	Others	4	6.67
	Total	60	100.00

4.6 Factors Affecting Farmers Decisions for Tractor Purchase

Importance given to various factors by the farmers on priority basis while purchasing new tractor is given in Table 4.7. Among all the factors, "Timeliness in farm operations" was considered to be the most important factor and 81.67 per cent of the farmers gave it first priority. Next important factor was "Custom service" and 18.33 per cent of the farmers gave first priority to it while purchasing new tractors. More than half i.e. 51.67 per cent of the farmers gave second priority to the factor "hp required" while 31.67 per cent of the farmers assigned third priority to the factor "fuel efficiency" while purchasing new tractor. It was interesting to know that "Cost of tractor i.e. purchase price" ranked

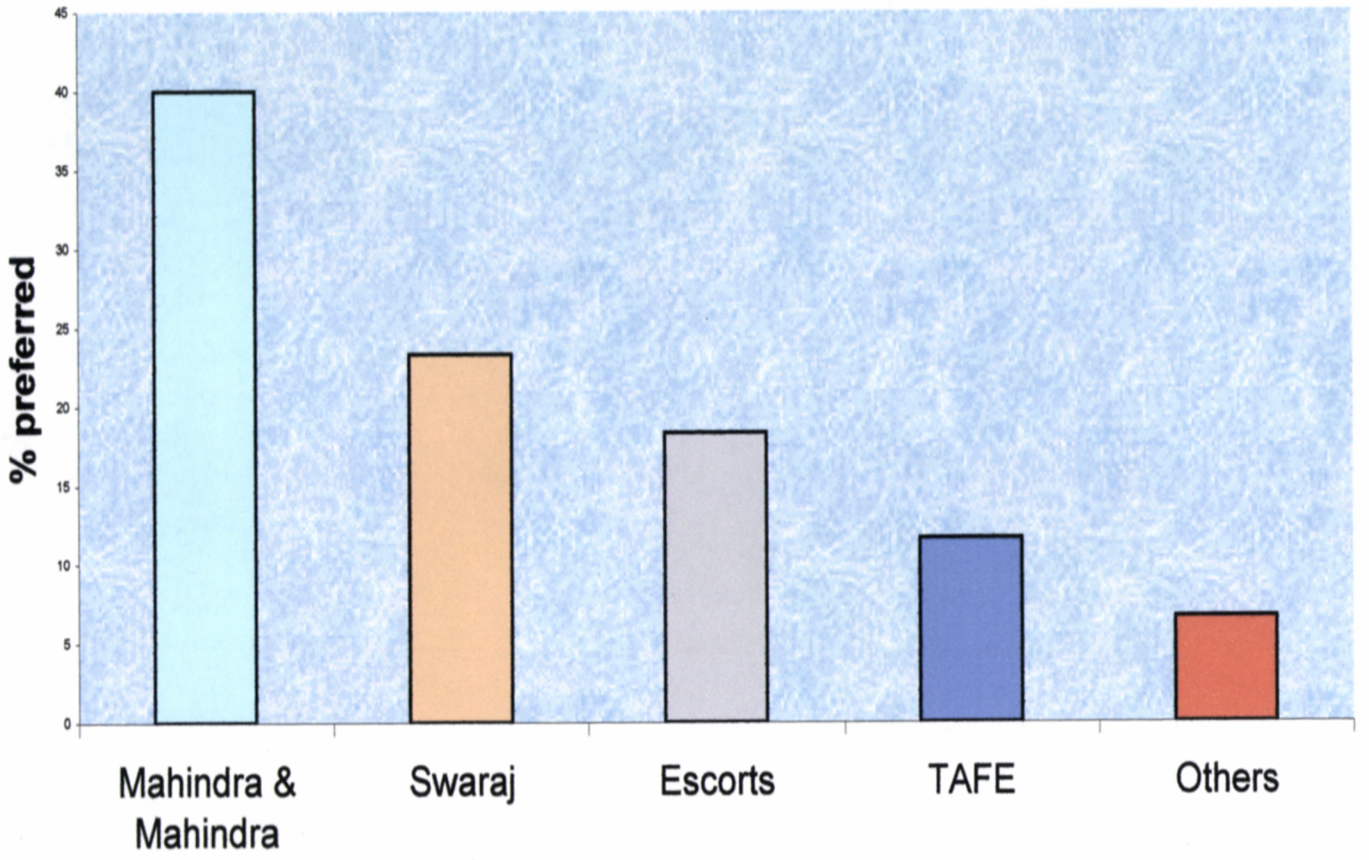

Fig. 4.3 Preferences on the make and model of the tractor

Table 4.7 Importance given to different factors while purchasing tractors

Priority given	Timeliness in operation	Custom service	Fuel efficiency	H.P. required	Resale value	Repair and maintenance cost	Purchase price	Special technical features	Spare parts and repair facilities
First	49 (81.67)	11 (18.33)	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Second	7 (11.67)	13 (21.67)	3 (5.00)	31 (51.67)	Nil	Nil	3 (5.00)	3 (5.00)	Nil
Third	Nil	5 (8.33)	19 (31.67)	18 (30.00)	1 (1.66)	Nil	6 (10.00)	10 (16.67)	1 (1.66)
Fourth	2 (3.33)	7 (11.67)	8 (13.33)	9 (15.00)	6 (10.00)	2 (3.33)	13 (21.67)	11 (18.33)	2 (3.33)
Fifth	1 (1.67)	4 (6.66)	Nil	2 (3.33)	17 (28.33)	9 (15.00)	11 (18.33)	7 (11.66)	9 (15.00)

* Figures in parenthesis indicated percentage

quite low in the priority list of the farmers. No respondents assigned first priority to it, while the 2nd, 3rd, 4th and 5th priority was assigned to it by 5.00 per cent, 10 per cent, 21.67 per cent and 18.33 per cent, respectively of the farmers, who were surveyed.

Priority Index was calculated (Table 4.8, Fig. 4.4) by assigning the credit points as 5,4,3,2 and 1, respectively to first, second, third, fourth and fifth priority and determining their weighted average. It was found that the preferences of the farmers were (on decreasing order) timeliness in operation, hp required, custom service, fuel efficiency, special technical features, purchase price, resale value, spare parts and repair facilities, repair and maintenance cost.

Table 4.8 Priority index for various factors

Priority No.	Factor / Parameter	Priority Index
1	Timeliness in operation	55.6
2	H.P. required	39.6
3	Custom service	28.0
4	Fuel efficiency	17.0
5	Special technical features	14.2
6	Purchase price	13.4
7	Resale value	6.4
8	Spare parts and repair facilities	32
9	Repair and maintenance cost	2.6

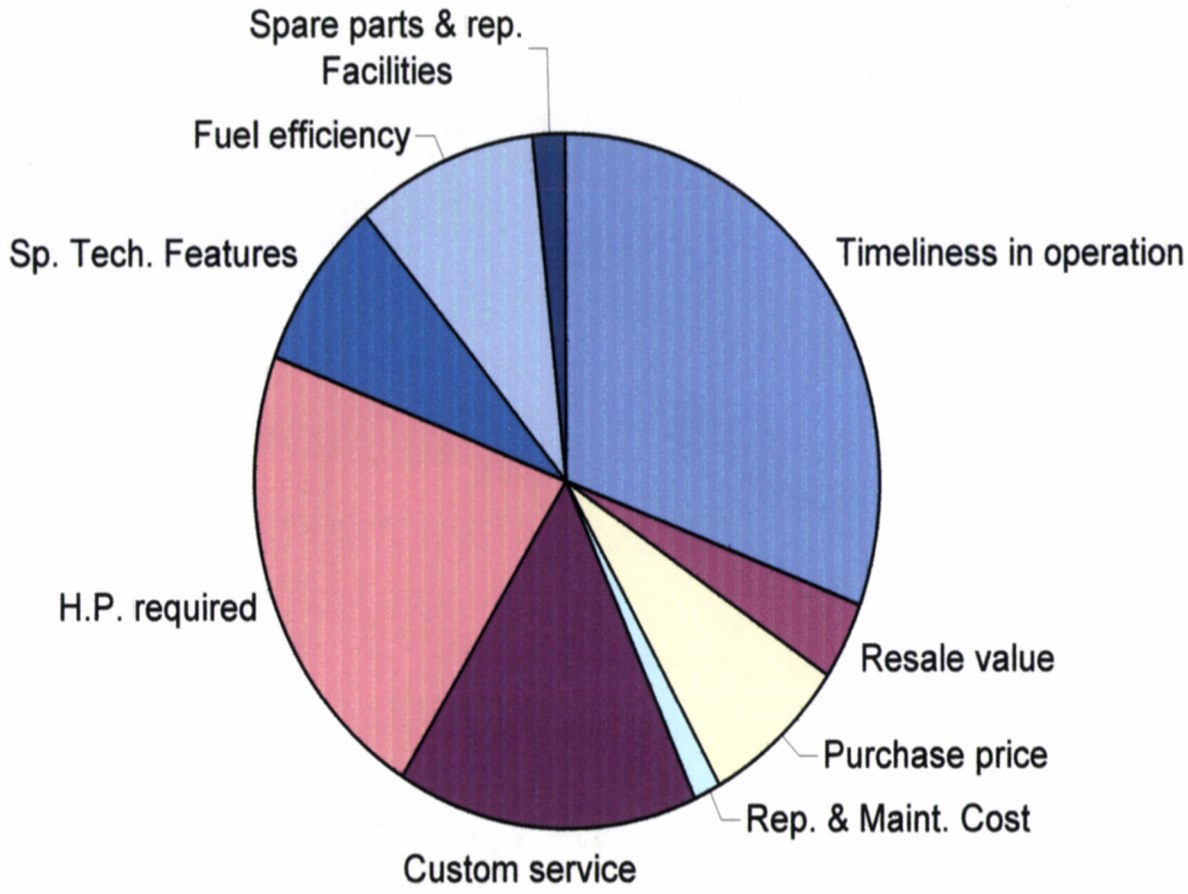

Fig. 4.4 Prioriy index for factors affecting decisions for purchase of tractors

4.7 Utilization pattern of farm tractors in different agricultural operations

Table 4.9, Fig.4.5 shows the utilization pattern of farm tractors in different agricultural operations for own land and for custom service.

Table shows that tractors were used about 35.54 per cent of time performing farm operations on the own field. About 64.46 per cent of tractor utilization was for custom hire service. The table shows that average annual use of the tractors was 830 hrs only in the district. Maximum use of the tractor for 330 hr (39.75 per cent) was seen in tillage operation, followed by transportation operation 255 hr (30.72 per cent) and levelling operations 135 hr (16.26 per cent). In the own work and custom hire work the maximum use of the tractor was found in tillage operations (14.45 per cent and 25.3 per cent).

Table 4.9 Operationwise utilization of tractors on sample farms, Ahmednagar

Sr. No.	Operation	Average annual use of tractor for own land (hr)	Average annual use of tractor for custom service (hr)	Average annual use of tractor (hr)	Percentage of total use
1	Tillage	120 (14.25)	210 (25.30)	330	39.75
2	Sowing	10 (1.2)	Nil	10	1.20
3	Levelling	25 (3.00)	110 (13.25)	135	16.26

Table contd..

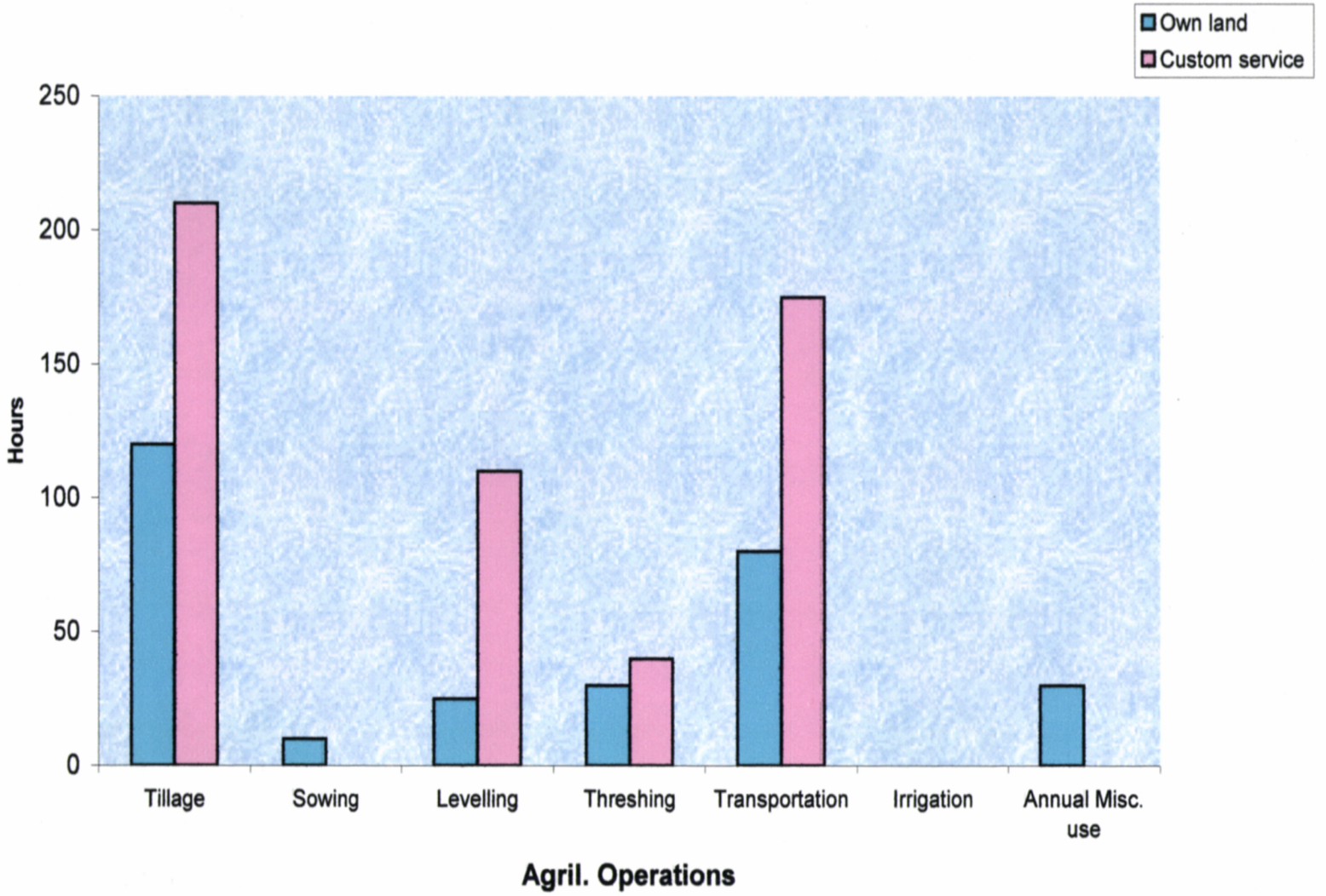

Fig. 4.5 Average annual use of tractors for own and custom work

Table contd..

4	Threshing	30 (3.61)	40 (4.81)	70	8.43
5	Transport-ation	80 (9.63)	175 (21.08)	255	30.72
6	Irrigation	Nil	Nil	0	0
7	Annual miscellaneous use	30 (3.61)	Nil	30	3.61
	Total	295 (35.54)	535 (64.46)	830	100
	Total annual average use = 830 hrs				

* Figures in parenthesis indicated percentage.

4.8 Repair and Maintenance of Tractors

Very limited wheel repair facilities such as tyre puncture, tyre inflation, etc. were available in the villages. There are tractor repair workshops in the area of about 10-15 in Ahmednagar and dealers are there at all taluka places. Tractors were normally taken to the nearest town for minor repair and Ahmednagar for major repairs. It was observed that farmers had to travel with an average of 24.3 km for the major works. Many such trips could be availed if tractor manufacturers make available a kit of fast wearing spare parts to the farmers at reasonable price and make arrangements for giving preliminary training in replacement of these parts.

4.9 Constraints in Adoption of Tractors and Implements

The various types of constraints in adoption of farm tractors and implements as perceived by various respondents are presented in Table 4.10.

Table 4.10 Constraints in adoption of tractors and implements

Sr. No.	Constraints	No. of farmers	Per cent
1	High cost of diesel	54	90
2	High cost of diesel, oil and spare parts	53	88.3
3	High cost of repair and maintenance	33	55
4	Marginal profit over working cost	39	65
5	Hiring charges does't get in time	25	41.66

90 per cent of the respondents considered high cost of tractor as major constraint. High cost of diesel, oil and spare parts was considered as a constraint by 88.3 per cent tractor owners. 55 per cent of farmers considered high cost of repair and maintenance as a constraint.

4.10 Suggestions of the Farmers

Tractor owners made important suggestions regarding tractor utilization.

1. Training facilities should be made available by company at taluka level.
2. The bank interest on loans should be less.
3. The prices of tractor should be feasible.
4. There should be subsidy scheme for tractor.
5. There should be 90 per cent loan facility for tractor.

Summary and Conclusions

5. SUMMARY AND CONCLUSIONS

5.1 Summary

The use of tractor and farm implements, helps in performing farm operations efficiently relieving the farmers from the drudgery of physical work. It also helps in expedius performance of farm operations during peak periods. With proper use of farm implements, farmers can produce more with minimum labour and cost.

The review of literature shows the need of study in the area of use of tractor and related implements by the farmers. Considering this aspect, the present study was undertaken. The main purpose of the study was to know the utilization pattern of farm tractors in Ahmednagar district and to study the constraints in adoption of tractors and implements. The present investigation entitled, "Utilization pattern of farm tractors in district Ahmednagar (Maharashtra)" was carried out with the said objectives.

5.1.1 General information

The average age of the respondents was 42 years. Near about 53.33 per cent farmers have operational land holding of 4-10 ha.

5.1.2 Effect of operational land holding on tractor ownership

It was found that the 35-50 hp tractor was more popular (81.25per cent) in the respondents with 4-10 ha operational land holding. 30 per cent of the farmers having operational land holding of more than 10 ha, own tractors of more than 50 hp.

5.1.3 Effect of operational land holding on implements ownership

The study showed that M.B. Plough and trailer was possessed by all the farmers. But cultivator and leveller was possessed by almost all the farmers having operation land holding of 4-10 ha.

5.1.4 Ownership pattern of various H.P. Tractors

The study showed that 76.66 per cent of the farmers owned tractors ranging 35-50 hp. Thus 35-50 hp tractors were most popular.

5.1.5 Preferences on make of the tractors

40 per cent of the farmers preferred Mahindra and Mahindra tractor. Second preference was given to Swaraj tractor (23.33 per cent). Escorts was preferred by 18.33 per cent of the farmers whereas TAFE was preferred by only 11.67 per cent farmers.

5.1.6 Factors affecting farmers decision for tractor purchase

The factor "Timeliness in operation" was considered the most important factor and 81.67 per cent farmers gave first priority to it. 18.33 per cent farmers gave first priority to "custom service" 51.67 per cent of the farmers gave second priority to the factor "hp required" while 31.67 per cent of the farmers gave third priority to the factor "fuel efficiency".

5.1.7 Utilization pattern of farm tractors in different agricultural operations.

Tractors were used about 55.54 per cent of time performing farm operations on the own land. About 64.46 per cent of tractor utilization was for custom hire service. The annual use of tractor was 830 hrs only.

Maximum use of tractor was in tillage operation (330 hrs) followed by transportation operation (255 hrs) and levelling operations (135 hr).

5.1.8 Constraints in adoption of tractors and implements

The important constraints and problems those inhabited the use of tractor pointed out by respondents were largely of economic concerned. Mostly those were high cost of tractor (90 per cent), high cost of working assets (88.3 per cent), marginal returns over the working cost (65 per cent), high cost of repair and maintenance (55 per cent).

5.1.9 Suggestions of farmers about tractor and farm implements.

The farmers had made number of suggestions to overcome the problems faced by them to enhance the use of tractor and improved farm implements. Most of the farmers have suggested to reduce the sale prices of the tractor and implements to reduce repairing and maintenance prices with respect to tractor, to reduce prices of oil, diseases and spare parts and subsidy on tractor and agricultural implements.

5.2 Conclusions

1. Farmers with an operational land holding size of 4-10 ha area preferred tractors of 35-50 hp.
2. Most of the popular hp tractor was 35-50 hp as about half of the tractors purchased by the farmers surveyed were of this size.
3. The tractors of Mahindra and Mahindra were most popular and were owned by about 40 per cent of the respondents.
4. The consideration of "timeliness in operations" has higher preference in the farmers gave their second priority to the hp required.

5. M.B. plough and trailer were possessed by almost all the farmers owing tractor. Cultivator was owned by about 75 per cent of the tractor owner while leveller was possessed by about 67 per cent of the tractor owners.
6. Maximum use of tractor was recorded to be in tillage operation (39.75 per cent), followed by transportation (30.72) and levelling (16.26 per cent).
7. The average annul use of farm tractors was 830 hrs. For 64.46 per cent of time, the tractors were used for custom higher work and 35.54 per cent of time for their own work.
8. Important constraints in adoption of tractor and implements were high cost of tractor and related working assets, marginal returns over working cost and high cost of repair and maintenance.

5.3 Suggestions for Future Work

1. Utilization pattern of tractors for other districts should be studied.
2. Cost of operation for various operations should be calculated.
3. The knowledge of maintenance schedule and its adoption should also be considered.

Literature Cited

6. LITERATURE CITED

Balasankari, P.K. and Salokhe, V.M. 1999. A case study of tractor utilization by farmers, Coimbatore district,Tamilnadu, India. AMA 30 (3) : 14-18.

Cattermole, C.G. 1978. Economic, political and social aspects governing the success of small tractors. The Agricultural Engineer. 33 (2) : 32-34.

Easterby, R. 1975. Psychological aspects of agricultural ergonomics. The Agricultural Engineer, 30 (4) : 112-114.

Kaholon, A.S. 1976. Impact of mechanization of Punjab Agriculture with special reference to tractorization. Indian Journal of Agril. Economics. 31 (4) : 54-77.

Matthews, J. 1982. Effective choice and use of agricultural tractors. The Agricultural Engineer, 37 (3) : 96-100.

Matthews, J. 1983. Effective choice and use of agricultural tractors. World Agricultural Economics and Rural Sociology. Abstracts, 35 (310).

Patil, V.Y., Sawant, M.R. and Thorat, K.P. 1998. Tranctorization in Ahmednagar district. Unpublished B.Tech. (Agril. Engg.) Thesis, MPKV, Rahuri, Maharashtra.

Ram, R.B. 1996. Trends of farm mechanization in south Bihar alluvial plain zone. Paper presented in XXXII annual convention of ISAE held at PAU Ludhiana, April. 16-17, 1997.

Shete, G.S. and Saoji, A.B. 1992. Analytical study of level of mechanization and factors affecting mechanization in Digras village of Rahuri tahsil of Ahmednagar district. Unpublished B.Tech.(Agril.Engg.)Thesis, M.P.K.V., Rahuri, Maharashtra.

Shyam, M. 1992. Farm tractor utilization in selected districts of Madhya Pradesh. Indian Journal of Agricultural Engineering; 2(1) : 12-16.

Singh Bhawan and Singh K.N. 1991. Utilization of different models of tractors on large mechanized farms. Proceedings of annual convention of Indian Society of Agricultural Engineers held at IARI, New Delhi, India, 9-11 October.

Shukla, L.N., Jain, M.K. 1991. Trends in tractor sales in Ludhiana district of Punjab. Jr. of Agril. Engg. Today; 15-16 : 39-46.

Singh, J. and Dhawan, K.C. 1994. An economic analysis of tractorization of Indian agriculture : A case study in Punjab state. AMA 25 (4) : 61-64.

Singh, J. 1993. Project report on tractorization of Punjab Agriculture Socio Economic Considerations. P.A.U. Ludhiana.

Singh, S., *et al.* 1992. Farm power availability and utilization in selected village to Punjab. Jr. of Research, P.A.U. Ludhiana; 29 : 378-386.

Yadav, Sandeep, Bahl, V.P. and Bhalla, Deepak. 1999. Utilization pattern of farm tractors in district Mohindargarh (Haryana). Agricultural Engineering Today; 23 (1-2) : 65-76.

Yadav, Sadeep and Aggarwal, S. 2000. Economical analysis of utilization of farm tractors in selected districts of Haryana. Agricultural Engineering Today; 24 (1) : 14-21.

Literature Cited

APPENDIX-I

Model, power range and inductive price of tractors in 1997.

Model	Engine		Max. PTO power (kW)	SFC at max. power (g/kWh)	Weight / PTO power (kg/kW)	*Price (Sep.30, 98) (Rs.)
	No. of cylinders	Capacity (cm^3)				
Mahindra 225 DI	2	1261	12.0	271	142.92	176950
Mahindra 265 DI	3	1788	22.8	249	76.10	200395
Mahindra B-275 DI	3	1892	23.3	256	74.68	215383
Mahindra 365 DI	3	1810	21.9	255	78.54	208797
Mahindra 475 DI	4	2384	29	238	61.38	235730
Mahindra 575 DI	4	2523	31.2	233	59.94	264308
Swaraj 724 FE	2	1728	16.0	259	107.81	170500
Swaraj 735 FE	3	2592	25.1	250	73.11	211000
Swaraj 855	3	3308	33.9	257	57.27	263000
Escorts 325 M	2	1795	16.6	288	100	174700
Escorts 335 M	2	1960	20.9	250	83.97	200500
Escorts 340 M	3	3120	33.2	339	54.97	228000
Escorts 355 M	3	2727	29.6	245	62.67	247000
Farmtrac 50	3	2868	31.0	297	59.35	269000
Farmtrac 60	3	3147	31.3	253	59.31	298000
TAFE 25 DI	2	1670	17.7	269	90.41	176340
TAFE 30 DI	3	1788	25.1	258	65.74	213273
TAFE 1035 DI	3	2365	24.9	243	65.66	218738
MF 245	3	2500	30.5	256	58.20	256475
Eicher 241 NC	1	1557	15.1	262	190.93	162075
Eicher 242 NC	1	1558	14.1	267	114.54	165620
Eicher 312	2	1790	20.3	259	85.47	184745

Contd. .

Contd .

Eicher 364 NC	2	1963	22.9	272	76.20	204035
HMT 2522 Edi	2	1560	16.1	266	102.48	180950
HMT 3511	3	2340	22.5	254	84.43	211214
HMT 4511	3	2698	30.5	274	69.67	249381
HMT 5911	4	3456	37.5	264	63.71	212391
Hindustan G 312	2	1798	18.7	271	91.18	133184
Hindustan G 453 DI	3	2697	32.3	290	61.61	242903
Hindustan Super G 614	4	4160	39.2	285	68.88	277902
Hindustan G 614	4	4667	48.9	277	55.52	307066

APPENDIX-II

UTILIZATION PATTERN OF FARM TRACTORS IN DISTRICT AHMEDNAGAR (MAHARASHTRA)

Questionnaire

A-I Name of farmer :
Address :

A-II General information :

1) Land holding (Avg. total) ..... acre
   i) Irrigated area ..... acre
   ii) Unirrigated area ..... acre
   iii) Rainfed area ..... acre

2) No. of seasons of availability of water
   i) One Yes / No
   ii) Two Yes / No
   iii) Three Yes / No

A-III 1) Tractor company : .....
2) Make / Model / H.P. : .....
3) Purchasing price (Rs.) : .....
4) Source of capital : .....
5) Loan : .....
6) Payment : .....
7) Date of purchasing : .....

A-IV Data about farm implements possessed by the farmer

Sr. No.	Implement	Do you use		Purchasing price
		Own	Hire	
1	M.B. Plough			
2	Trailer / Trolly			
3	Cultivator			
4	Seed drill			
5	Disc harrow			
6	Rotavator			
7	Leveller			
8	Ridger			
9	Pumpset			

A-V Importance given to different factors while purchasing price.

Sr. No.	Factor	Priority given
1	Timeliness in operation	
2	Custom service	
3	Fuel efficiency	
4	H.P. required	
5	Resale value	
6	Repair and maintenance cost	
7	Purchase price	
8	Special technical features	
9	Spare parts and repair facilities	

A-VIII Operationwise utilization of tractors on sample farms.

Sr. No.	Operation	Hrs / day	Day / season	Hrs / year
1	Tillage			
2	Sowing			
3	Levelling			
4	Threshing			
5	Transportation			
6	Irrigation			
7	Annual miscellaneous use			

A-VIII. Repair and maintenance of tractors

A) Knowledge about servicing

1) Place of servicing .....

2) Distance of servicing .....

3) The place of repairing ....

4) Do you get original spare parts ....

5) Annual servicing charge .....

B) About tractor use

1) Parts to be repaired from time to tome .....

2) No. of months for which tractor is not in use and its reason.

3) Does tractor use is beneficial ? What is your opinion ?

Questionnaire-B

A. Constraints in adoption of tractors and machinaries

1) . . . . . .

2) . . . . . .

3) . . . .

4) . . . . . .

B. Feedback / suggestions from the farmers

1) ....

2) . . . . . .

3) . . . . . .

4) . . . . . .

Farmer's sign / Thumb mark

Vita

7. VITA

DILIP ANANDRAO DHOBALE
A candidate for the degree
of
Master of Technology
in
AGRICULTURAL ENGINEERING
2003

Title of thesis	:	"Utilization pattern of Farm Tractors in District Ahmednagar (Maharashtra)"
Major field	:	Farm Machinery and Power

Biographical information

Personal	:	Born at Bhawadi, Tal. Ambegaon, Dist. Pune (MS) on July 5, 1979. Son of Shri Anandrao Maruti Dhobale and Sou. Changunabai Anandrao Dhobale.
Educational	:	Completed primary and secondary education at Dhamani, Tal. Ambegaon, Dist. Pune from Shri Shivaji Vidyalaya and Jr. College, Dhamani and received the degree of Bachelor of Technology (Agril. Engg.) from College of Agricultural Engineering and Technology, Dr. P.D.K.V., Akola (MS)
Awards	:	Received Gold Medal for standing 1st in B.Tech. (Agril. Engg.).
Scholarship	:	University Merit Scholarship during M.Tech. (Agril. Engg.)
Other activities	:	Member of ISAE during 2000-2001. Completed MS-CIT course
Address	:	A/P - Nirgudsar, Tal. Ambegaon, Dist. Pune.