LABOUR INPUT BEHAVIOUR IN SELECTED CROPS

THESIS

Submitted to
Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
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DECLARATION OF STUDENT

I hereby declare that the experimental work and its interpretation of the thesis entitled **"LABOUR INPUT BEHAVIOUR IN SELECTED CROPS"** or part thereof has neither 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 material used and all assistance received during the course of investigation have been duly acknowledged.

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CERTIFICATE

This is to certify that the thesis entitled **"LABOUR INPUT BEHAVIOUR IN SELECTED CROPS"** submitted in partial fulfilment of the requirement for the degree of **"Master of Science in Agriculture (Agricultural Economics)"** of Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola is a record of bonafide research work carried out by **Monalisha Gurung** under my guidance and supervision.

The subject of thesis has been approved by the Student's Advisory Committee.

Place : Akola
Date : 29/05/2014

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(D) Abbreviations

%	- Per cent
°C	- Degree centigrade (Celsius)
/	- Per
@	- At the rate
Agril.	- Agricultural
Avg.	- Average
ch.	- Channel
Dist.	- District
Dr. PDKV	- Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola
e.g.	- Exampli gratia (For example)
et al.	- Et alia (and others)
etc.	- Et cetra
Fig.	- Figure
G	- Gram
Ha	- Hectar
i.e.	- That is
Kg.	- Kilogram
Kh.	- Kharif
M.S.	- Maharashtra State
Mha	- Million hectare
No.	- Number (s)
q/ha	- Quintals per hectare
qtl.	- Quintal
Qty.	- Quantity
resp.	- Respectively
Rs./`	- Rupees
Sr. No.	- Serial number
vis-à-vis	- In relation to
Viz.,	- Videlicet (namely)
w.r.t.	- With respect to

F) THESIS ABSTRACT

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b) Full name of student	: **MONALISHA GURUNG**
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ABSTRACT

The present study of labour input behaviour in selected crops was carried out during the year 2012-2013. With the objective 1. To study the growth of labour input in selected crop. 2. To study the share of labour changes in output price.3. To study the wage behaviour. 4. To assess the changes in labour input. Five districts of Amaravati division was selected for the present study namely Akola including Washim, Amaravati, Yavatmal, Buldhana. Two Crops namely Soybean and Cotton was selected for the study. The present study based on the time series data from the period 1990-91 to 2009-2010 on the basis of labour input, percentage

share of labour charges in cost A and cost C for the year 2010 and wage rate. The data was collected from Agricultural price and cost scheme which held under the Department of Economics and Statistics Dr. P.D.K.V.Akola.

In India it is well known that labour are the backbones of rural economy. Labour is one of the primary factors of production. It is considered to be important not only because it is productive but also because it activates other factors and makes them useful for production purposes.

In Amravati Division observed that in case of cotton and soybean the highest growth rate of labour utilization was found in harvesting and sowing whereas the lowest growth rate of labour utilization was found in irrigation and raising, plant protection operation.

The percentage share of labour charges in cost A and cost C for 2010 observed that in case of cotton and soybean the highest share in cost A and cost C was used for manuring, harvesting, threshing whereas the lowest percentage share of labour charges in cost A and cost C was used for raising, interculturing, plant protection.

In the growth rate of labour wages observed that in case of cotton and soybean the highest growth rate of labour wages was found in harvesting and sowing whereas the lowest growth rate of labour wages was found in irrigation and raising and plant protection operation.

CHAPTER I

INTRODUCTION

1.1 Background Information

Agriculture in India is the vertical backbone of the country and is regarded as the largest sector of the country's economic activity. It is the major sector of the State economy, in which the majority of people earn their livelihood. Though the share of agriculture in the aggregate economy has declined rapidly during the planned development of the country, it assumes a pivotal role in the rural economy. The contributory share of agriculture in GDP has declined from 55.4 per cent in 1950-51 to 18.5 per cent in 2006-07. Agriculture at present provides livelihood to 60 per cent of the total population. The sector provides employment to 58.4 per cent of country's workforce and is the single largest private enterprise. Agriculture also plays a very important role in industrial development of our nation as it is the source of raw materials for many industries. India's foreign trade is deeply associated with agriculture. Agriculture accounts for about 14.7 per cent of the total export earnings. Agriculture and its related goods contribute 38 per cent in the total exports of the country (Anon., 2007). Expanding agricultural production increases the demand for other sectors notably fertilizers, pesticides, machineries, transportation and communication varying with the level of technology. Indian agriculture continues to be a gamble on the monsoon.

1.2 Agriculture labour in India

In India it is well known that labour are the backbones of rural economy. They are always dominant and a decisive factor in walks of the life. They play a major role in settlement of the economic condition of the family. Besides maintaining the home, labour extends their hand in managing family farms. Labour has to play the role as an active participant in socio potential and psychological environment. The labour in agricultural field is mainly located in the rural area a private farms with a meagre possibility of continuous employment and assured wages. They are mostly employed and seasonal basis and paid at the mercy of land owner.

Labour is one of the primary factors of production. It is considered to be important not only because it is productive but also because it activates other factors and makes them useful for production purposes. The size of labour force in a country is determined by the number of people in the age group of 15-59 years as generally children below 15 years and old people above 59 years do not participate in production activity. India's labour force consists of 459.1 million workers (2004-05), growing at the rate of 2 per cent annually. Out of this 268.1 million workers are employed in agriculture as cultivators and labourers (Nagaraj, 2007).

Landless agricultural labourers are those having a homestead and earning 50 percent of more income from agricultural wages. The lot of the landless agricultural labours are extremely miserable in the country. Their appalling condition is too well known. The lack of sustained employment, frequently suffer from social handicaps and are a source of serious weakens. These workers still live mostly on a semi starvation level eking out a living which hardly permits even hand to mouth existence. The real wages in almost all the districts of Maharashtra have declined during the sixties and the seventies but increased marginally during the eighties. As wages and income increases, participation of labour decreases but at diminishing rate. The increasing proportion of machinery to total energy used in agriculture decreases labour work participation rate.

Work participation rate and composition of workers in India has undergone change over the years. The work participation rate in the rural area has increased by 4 percent points from 23 percent in 1981 to over 27 percent in 1991 with wide regional variations over decade (1981-1991).

1.3 Agricultural Labour – Definition

Unlike industrial labour, agricultural labour is difficult to define. The reason is that unless capitalism develops fully in agriculture, a separate class of workers depending wholly on wages does not come up. The First Agricultural Labour Enquiry Committee (ALEC) 1950-55 defined Agricultural Labour as "Those people who are engaged in raising crops on payment of wages" (based on occupation).That is if half or more of a

household have wage employment in agriculture then those households can be termed as agricultural labour households. The Second ALEC 1956-57 enlarged the definition to include- "Those who are engaged in agriculture and other agricultural occupations like dairy farming, horticulture, rising of livestock, bee keeping, poultry etc."(based on income).According to this definition if 50 per cent or more of its income is derived as wages for work rendered in agriculture and allied activities, then it could be classed to agricultural labour household. According to National Commission on Labour "An Agricultural labourer is one who is basically unskilled and unorganised and has little for his livelihood, other than personal labour"(Srivastava,1993).

1.4 Classification of Agricultural Labourers

The agricultural labourers can be classified into mainly two categories.

1. Landless agricultural labourers
   i) Permanent Labourers Attached to Cultivating Households,
   ii) Casual Labourers.

2. Very small cultivators whose main source of earnings due to their small and sub marginal holdings is wage employment. Permanent or attached labourers work on annual or seasonal basis and they work on some sort of contract. Their wages are determined by custom or tradition. Temporary or casual labourers are engaged only during peak period of work. They are paid at the market rate. Under the second group come small farmers who possess very little land and therefore, have to devote most of their time working on the lands of others as labourers.

1.5 Characteristics of Agricultural Labourers

Agricultural labour in India is being widely scattered over 6.38 lakh villages of which half have population of less than 500 each and therefore, any question of building an effective organization, like that of industrial workers, poses insurmountable difficulties. Agricultural labourers, especially in smaller villages away from towns and cities, are generally unskilled workers carrying on agricultural operation in the centuries old traditional wages. Most agricultural workers belong to the depressed

classes, which have been neglected for ages. The low caste and depressed classes have been socially handicapped and they never had the courage to assert themselves. In some parts of India, agricultural labourers are migratory, moving in search of jobs at the time of harvesting. The number of agricultural labourers being very large and skills they possess being meager, there is generally more than abundant supply of agricultural labourers in relation to demand for them. It is only during the sowing and harvesting seasons that there appears to be near full employment in the case of agricultural labourers. But, once the harvesting season is over, majority of agricultural workers will be jobless especially in areas, where there is single cropping pattern. Due to all the above mentioned factors, the bargaining power and position of agricultural labourers in India is very weak. In fact, quite a large number of them are in the grip of village money lenders, landlords and commission agents, often the same person functioning in all the three capacities.

1.6 Nature of Agricultural Labour Market

The agricultural labour market in India is highly segmented. The labour absorption and wage rate depends on

1. Adoption of new technology,
2. Population and migration,
3. Marketing & other institutional support like credit etc.
4. The terms of trade and the extent of the market,
5. The profitability.

Demand -supply and the quality of life of the labour in the various markets also differ widely. The hilly region with shifting cultivation and forestry provide job opportunities to the agricultural labour at a lower level compared to the region which have adopted new agricultural strategies .These regions vary with regard to wage levels also. Also the inter-zonal movement of agricultural labour is rigid. The demand for agricultural labour and wage levels in Punjab, Haryana and other areas of green revolution are higher than those in the remote areas of Orissa or Assam where no agrarian reform or agricultural strategy has been adopted. Some studies have reported the increasing casualisation of labour,

increasing feminization of labour due to male migration, decline in the customary and dependency relationship, increasing integration of labour market due to increased mobility of labour because of development in the means of communication and road infrastructure (Sharma and Kumar, 2003).

1.7 Socio-economic impact of labour input

Labour is an important input in the agricultural sector. In India, the labour force was of 520 million people during 2009-10, which is likely to increase to 574 million by 2014-15 (GoI, 2010). Two-thirds of present workforce is employed in agriculture and rural industries, and one-third of rural households are agricultural labour households, subsisting on wage employment. Till the 1990s, Indian agriculture was considered as a labour-intensive agriculture due to high labour-capital (L/K) use. The employment elasticity in agriculture was 0.50 during 1987-88 to 1993-94 and it declined to 0.02 during 1993-94 to 1999-00, whereas, during the same period the employment elasticity in industries increased from 0.25 to 0.28 and in construction industry from -1.10 to 1.00 (Papola, 2006). It implies that employment generation was high in other sectors vis-à-vis agriculture, resulting in labour-pull from agriculture. The increased labour-pull caused strain in farm labour availability as well as raised wages in agriculture (Gupta and Sidhartha, 2011). It affected the performance of timely farm operations and thereby growth of the sector.

The labour in agriculture engages in farming operation either as cultivators or as an agricultural labourer. The labour has been considered best for sowing, transplanting, harvesting, threshing, cleaning, storing and so on because they work hard with full dedication.

1.8 Need and Importance of study

Agricultural labourers constitute the vital input in the agricultural production. Here this study is attempt to define labour input in terms of economic decision characterizing a process of resource allocation. The concept of labour input is measurable in real time units.

In India the labour force is largely masculine, with only one out of every four workers — as agriculture labour, as farmers or co-farmers, as family labour or as managers of farms and farm entrepreneur.

Five districts of Amravati division selected for this study namely Akola including Washim, Amravati, Buldana, Yavatmal. There are many problems which are associated with proper use of labour in proper way or proper time.

From the economic point of view the labour input in proper way for crop cultivation is one of the important-source of farm income; it gives employment, high yield and production.

1.3 Objectives

1. To study the growth of labour input in selected crop.
2. To study the share of labour changes in output price.
3. To study the wage behaviour.
4. To assess the changes in labour input.

1.4 Hypothesis

On the basis of review and available literature following hypothesis were set for the present study.

1. Labour input positively increased in certain activities over study period.
2. Wage rates increased over study period (excluding money inflation).

1.5 Scope of the study

The present study basically aims in founding out the labour input behaviour of selected crops in Amravati division. The major focus of this research was to find out whether the labour input has positive or negative impact on the crop production. This study gives the idea about labour utilization, wage behaviour, performance of labour input over a period of time. It also aims at finding out the various motivating factors responsible for the labour input. This study will try to help the planners, policy makers and government to plan for the development of the labourers. It will also guide many producers to get the more yield through the proper use of labour in crop cultivation.

1.6 Limitation of the study

The present study is restricted to Amravati division due to limited time and facilities at the disposal of the researcher. As the study was limited to time series data from 1990-91 to 2009-2010 on the basis of labour input. Therefore limited data may be limitation of the study. Being a student scholar, this study had the limitation of time, resources and other facilities. Besides these limitations of this study also suffered from lack of reviews due to the fact that research on this area especially labour input with respect to Amravati division is very limited.

CHAPTER II

REVIEW OF LITERATURE

Research is a continuous process. The review of literature is an important aspect in the research studies. Review of the work done provide necessary guideline and motivates the researches to proceed in a desirable direction. Some of the studies which have bearing on the objectives of the present investigation are presented in this chapter. These studies have been mainly reviewed under the following three groups.

1) Growth of labour input in selected crop.
2) Share of labour changes in output price.
3) The wage behaviour.
4) Changes in labour input.

2.1 Growth of labour input in selected crops

Rembeza (1989) studied the labour input and work costs at various levels of mechanization in the production of potatoes. In this study the impact of mechanization on labour input and work costs in potato farming was analysed, drawing on studies conducted in 1983 and 1984 in Polish private farms. Labour inputs in potato production in least mechanized operations, where horses were the main tractive force, was 387 man-hours per ha. In the most highly mechanized farms this figure was 137 man-hours per ha. M echanization led to changes in labour cost structure, whereas cost levels varied to a lesser extent. Costs fell primarily for work which could be carried out with relatively inexpensive tools and machinery, or with machines which could be used for a variety of purposes on the farm. Use of potato planters gave reductions in work costs on areas over 3.5 ha, and for harvesters savings were made on plots over 7 ha.

Zivkovic et al. (1992) using data from 29 crop enterprises in the state farm sector of Vojvodina, Serbia, the relationship between labour input and production of wheat, maize, sugarbeet, sunflowers, soyabeans and rape over a 6 year period is investigated. Results indicate that the efficiency with which labour is used varies between enterprise. Greater rationalization of labour use for all crops is required if returns are to be improved.

Huiban et al. (1997) studied the determinant of the innovation propensity of the firm is analyzed. A direct measurement of innovation is used; the role of labour factor quality as a major determinant of innovation is emphasized. A definition is built of labour factor quality, based on a double dimension: individual skill level and functional distribution of jobs inside the firm. Each job category can be involved in the innovation process at different stages: conception, decision, and implementation. Reference is made to the French agricultural and food sectors.

Errington (1998) studied the increasing flexibility of machinery and labour inputs to UK farming. This article reviews the evidence that labour and machinery inputs to UK farming are becoming increasingly flexible with the growth of agricultural contracting and machinery rings. The increased opportunity for farmers to make marginal adjustments to labour and machinery inputs tends to erode some of the economies of size with important implications for economically optimum farm structures. The article first describes and explains the increasing flexibility of the inputs before going on to examine the evidence for systematic variation in labour and machinery costs by enterprise size. The analysis suggests that economies of size persist, particularly among the beef and sheep enterprises. The strongest evidence of the erosion of economies of size is found on the cereals and other cropping enterprises. It is concluded that smaller farms and smaller farm enterprises will continue to face the fundamental problem of higher unit costs for the foreseeable future. The problem is likely to be greatest on those farms (small farms involved in beef and sheep production) and in those areas (LFAs, Objective 1, Objective 5b) where farming appears to display its most beneficial externalities in social and environmental terms.

Hunter et al. (2000) studied the effect of 8 different canopy management treatments on yield, labour input, and growth compensation of a vertically trellised Vitis vinifera cv. Sauvignon blanc/110 Richter vineyard in the western Cape was investigated. Spurs were spaced 15 cm apart. Supplementary micro-irrigation was applied. Combinations of shoot positioning-suckering-topping and shoot positioning-suckering-topping-leaf removal resulted in the highest yields; substituting leaf removal by lateral

removal noticeably decreased yields. Doing nothing to manage the canopy resulted in the lowest yields. Considering yield as well as labour input, lateral shoot removal cannot be considered an economically viable practice. Significant compensatory growth was brought about by the removal of lateral shoots. That would have impacted on the distribution of carbohydrates and probably counterbalanced positive effects of improved microclimate. In the efficiency of the canopy and the feeding of the bunches. Ratios of main shoot leaf area to lateral shoot leaf area as well as practical canopy composition criteria are presented. The results provide new perspectives on existing canopy composition criteria and clearly indicate the beneficial effects of correct canopy management.

Sorensen, C.G. (2000) studied the handling and application of manure makes considerable demands on the capacity of technical systems, as significant quantities of manure will have to be applied within a short time frame in order to achieve the maximum utilization of the nutrients. Consequently, from an operational machine planning point of view, it is essential to understand the consequences in terms of labour input and system capacity from using various technologies, which might imply different degrees of utilization of manure nutrients as well as different expected environmental influences. As part of a project creating basic knowledge on design elements for slurry application techniques, operational technical studies are being conducted on a number of private farms in Denmark using different methods of slurry transport and different application techniques. Specific studies were made into transportation systems involving traditional slurry tankers, separate transport to buffer tanks in the field and systems for pumping the slurry to the field by way of pipelines. With regards to application techniques, the attention was focused on band spreading by means of trailing hoses and shallow injection on grassland or fallow soil. The studies also included a detalied measurement of the time and labour requirement, the machinery capacity, the slurry characteristics, etc. A significant increase in the capacity of the shallow injectors was observed, as compared with earlier deep slit types. The developed calculations and models based on the operation technical studies provide operational and technical evaluations for a given manure

handling system. Results clearly indicate the significant difference in labour input and machinery capacity for the various application methods. An advantage of the models would be their flexibility to cope with numerous different farm and application scenarios.

Belokopytov (2004) studied the growth or productivity of agrian labour. Factors influencing the productivity of labour in the Russian agricultural sector are considered, based on an analysis of the situation in Smolenskaya Oblast'. The level of productivity of labour on agricultural enterprises in Smolenskaya Oblast' showed a marked decline between 1990 and 1996, did not increase between 1996 and 1998, but grew on average by 10.7%/year between 1999 and 2002. However the level of productivity of labour in Russian agriculture remains low. Ways in which productivity can be improved are considered; these include changes to working hours, selecting crop varieties that involve less labour intensive production methods, introducing modern technologies, increasing levels of automation, and developing social infrastructure for workers. Analysis of the situation in Smolenskaya Oblast' shows that there are significant variations in the extent to which agricultural enterprises are equipped with basic resources. Grouping enterprises by their level of resource provision shows that, in general, the efficiency of utilization of agricultural labour increases as resource provision increases. However this is not always accompanied by corresponding growth in the floating capital needed for purchases of feeds, seeds, fuel, fertilizers and other production inputs. The rate of technical re-equipping of agriculture is determined by levels of investment activity. The effectiveness of investment is largely dependent on its size and structure. The development of cooperation and the formation of large integrated agro industrial structures are one way of increasing investment attractiveness and, through modernization and technical re-equipping, increasing the productivity of labour significantly.

Reddy et al. (2011) an analysis was carried out to study the input utilization and factor productivity of inputs used in the production of cotton. Productivity of individual input as well as total factor productivity was estimated to know the sustainability of cotton production. The Tornqvist-Theil indexing procedure was used to workout total factor productivity

indices. Human, machine labour and fertilizers showed a positive growth while animal labour, manures, seeds and plant protection chemicals showed a negative growth during the period of analysis. Productivity of land, human labour, animal labour, manures and seed showed a positive growth while productivity growth of machine labour was negative. The growth of total factor productivity was positive and significant indicating the sustainability of cotton production in the state. In significant growth of total input index indicates that there are serious bottlenecks in input usage which needs to be corrected to achieve higher output growth

Tyagi (2011) his paper estimates the labour input in rice production by farm size, gender and age group in Echigotsumari region, a rural area in Niigata prefecture. It also explores the future possibility of farmland conservation in a severely aging situation. Random coefficient regression analysis using Agricultural Census data by rural community unit clarified considerable labour input by small and elderly farmers. Under certain assumptions, about 71% of rice field area held by elderly farmers can be conserved by the expansion of young farm management entities. The spatial distribution of young and elder management entities is not particularly polarized.

Rudenska et al. (2013) presents the results of studies conducted in 2009 on utilization of the resources and inputs of human labour in selected 53 family farms. Obtained results were compared with the labour inputs provided for 2015 year in the projects of technological modernization for investigated objects. Within the years 2009-2012 the studies included farms of the acreage ranging from 8 to 150 ha AL. In 2009 the average farm acreage amounted to 44.23 ha, while in 2015 it will reach 49.49 ha AL, increasing by 11.9%. In order to determine the relationship between farm acreage and labour inputs, the objects tested were divided into 11 area groups; the groups from I to IX consisted of the 5 farms, groups X and XI included 4 farms each. Together with raising AL area of the farm, increase the employment and labour inputs in farm; however, these indices decrease as accounted per the AL area. Average employment in surveyed objects in 2009 amounted to 2.87 workers per farm, or 6.50 workers per 100 ha AL. Inputs of the labour, own and hired, reached jointly on average

5751 work-hrs per farm and 130.1 work-hrs per ha AL. In 2015 average inputs of labour (own and hired) will reach 5340 work-hrs per farm, and 107.8 work-hrs per ha, thus being lower by 7.2% per farm, and by 17.1% per ha, on average. Indices of human labour technical equipment with the tractor power amounted, and will amount (on average) to 28.0 and 29.0 tractor-hrs per 100 work-hrs; these indices will range within 13.7 tractor-hrs per 100 work-hrs (II group) and 47.7tractor-hrs per 100 workhrs of productive labour of the farmers (group XI).

2.2 Share of labour changes in output price

Niedziolka, (2001) analysed the labour and energy inputs, and the cost of maize grain production on a family farm in Poland. Labour inputs averaged 35.4 manhour/ha, electric and mechanical energy inputs were 172.7 kWh/t, and the input of cumulated energy was -5.7 Gj/t. Direct production cost of maize of maize grain amounted to ~390 PLN/t. The analysis of technology applied to maize cultivation for grain, with respect to energy consumption and economics, showed the possibility of achieving advantageous production results.

Dobek (2002) studied the labour and energy and production costs of winter rape. This study was conducted to determine the inputs of labour, energy and costs of production of winter rape in two selected farmsteads (farmstead A and B) in West Pomeranian province, Poland. The utilization of aggregates of high productivity in farmstead B resulted to a shorter labour time and lower labour input. Technology applied in farmstead B had greater energy consumption during cultivation of rape by using a tractor with greater power. Application of higher doses of mineral fertilizers resulted to higher crop yield, an increase in production costs by over 44%, and higher profit.

Brzozowski et al. (2011) studied the own and hired labour inputs on farms with production of strawberries for processing. The aim of this research was to evaluate the levels of hired labour inputs on farms with production of strawberries for processing and to quantify the strength of the relationship between the share of hired labour and the other variables such as profitability and volume of production. To complete the latter, a

regression analysis was used. The research was conducted on 28 farms producing strawberries for processing. The production on farms with a higher level of the hired labour turned out to be more profitable than on the farms with a lower share of hired labour. The relationship between the share of the hired labour and the volume of production as well as the market output turned out to be highly significant for strawberries production.

Terrones Cordero et al.(2012) studied in order to analyze the agricultural production in Mexico, a dual approach using a trans log cost function was performed to derive an inputs demand system of eight equations (labor, tractors, threshers, commercial bank credit, credit development banks, nitrogen fertilizers, phosphate fertilizers and potassic fertilizers). Time series data were used for the period 1970-2006, for prices and quantities of inputs and, the actual agricultural GDP as the product. In order to characterize the complementarily relations or substitution that the inputs store between them, the Allen-Uzawa elasticity of substitution between pairs of inputs was used finding that, the demand for the studied inputs is inelastic on its price. From the set of analyzed inputs, the costs of wages constitute the largest share (58.62%). In order to meet the demand for an agricultural output growth in 2010, commercial and development banks should increase the loans in 2.28 and 0.72% respectively. The demand for inputs: labor and tractors, development credit bank and fertilizers resulted to behave as complementary; while the demand for inputs: labor and phosphate fertilizers, tractors and threshers, development credit banks and commercial credit banks behaved as substitutes.

Chongela et al. (2013) studied Estimation of constant elasticity of substitution (CES) production function with capital and labour inputs of agri-food firms in Tanzania. This paper focused on estimation of the impact of capital and labour inputs to the gross output of agrifood products using constant elasticity of substitution (CES) production function in Tanzanian context. The CES production functional form was estimated by maximum likelihood estimator (MLE). The empirical results revealed that capital and labour inputs have impacted the gross output of the agri-food products by 97, 96, 94, 78 and 61%, for bakery, grain mill, fruits and vegetables, oil seeds and fats, meat and dairy products, respectively. However,

interventions in terms of economic policy instruments such as capital goods and skilled labour are highly encouraged for the worthwhile economies of the agri-food firms' in the country.

2.3 The wage behaviour

Bhalla (1993) in her paper has examined the wage determination and labour absorption in Indian agriculture. The study reveals that the labour absorptive capacity of Indian agriculture as a whole has declined. The real wages of agricultural labourers has shown a upward climb. The study concludes that there is plenty of scope for expansion of employment within agriculture in certain regions and in the production of particular crops like paddy, jowar and cotton.

Sunil Kanwar (1998) Wage labour in developing agriculture: This book was motivated by the fact that the overwhelming burden of previous empirical research into the issues of farmers' off-farm labour allocation, their hiring-in behaviour, the process of rural wage determination and related matters, has ignored the presence of risk as a variable of potential importance. This study models the farm household's decision making process within the framework of a farm household model under production risk. The farm household model is used as the framework to analyze the demand for labour and hired labour, the hiring-out behaviour of rural households, and wage functions. The partial analyses of the demand and supply of wage labour are supplemented by a simultaneous equations analysis of the rural labour market. The empirical estimation uses ICRISAT's farm household data from three villages situated in diverse agro climatic zones of India, which was collected over the ten-year period.

Chawla (1999) has attempted to examine the changes in educational and employment status of female labour in rural areas of Amritsar district of Punjab at two points of time *i.e.*, 1990-91 and 1997-98. The data was collected from 200 female workers based on three stage random sampling procedure. The employment of female labour in the primary sector declined from 60 per cent to 53.5 per cent, but it showed upward shifts in secondary and tertiary sectors. The number of illiterate female workers declined from 44 per cent to 39 per cent between 1990-91

and 1997-98 with a proportionate increase in the number of literate female workers. Their share in the family income from primary, secondary and tertiary activities showed increase from 12, 15 and 18 per cent in 1990-91 to 15, 17 and 20 per cent in 1997-98.

Anjugam *et al.* (2000) in their paper have analyzed the performance of agricultural labour market in Madurai district of Tamil Nadu with the objective of studying the demand for and supply of agricultural labourers in wet and garden land areas of the district. The results showed that woman labour use was higher in garden lands than in wet lands. Regression analysis showed that in wet lands one rupee increase in the net income per farm was found to increase the demand for hired casual labourers by 0.0040 manday/hectare, increase in the net cropped area was found to increase the demand by 358.44 man days. In garden lands an increase in cropping intensity by one per cent was found to increase the demand by 0.97 man-day, an increase in net cropped area by one hectare was found to increase the demand by 110.95 man-days and one rupee increase in net return per farm was found to increase the demand by 0.0066 manday. The study suggests that to improve the demand for hired labour, irrigation facilities and better prices for farm products essential. Also the wage rates should be increased and to facilitate this labour cooperatives are to be formed.

Ghanekar (2000) has made an attempt in her paper to examine the characteristics of agricultural labour market and the economic status of the labourers. After the starting of lift irrigation scheme in 1980s, the village exhibited a trend towards increased commercialization and monetisation, structural changes such as increased numbers of female workers as agricultural labourers and increased casualization of the labour force along with increased individual bargaining capacity of the labourers.

Jain and Singh (2000) have conducted a study on the trends in tenancy and labour use pattern in Punjab Agriculture. The study revealed that human labour employed on per cultivated hectare showed a decline in all the size-classes except the marginal farms and so was the case of casual hired labour. Female and child labour employment on the farm for crop production also showed a decline and its employment for crop

production declined with the increase in farm size. Major share of women and child labour used in the farm was supplied by family itself since the migratory labour mostly consists of male labour.

Ray and Haque (2000) in their paper have examined the employment per acre, operation wise labour use and wage differential between migrated contract labour and local hired labour employed. The study revealed that in Hoogly district of West Bengal contract male and child labourers migrated to the study area and were employed predominantly in sowing and harvesting seasons of boro and aman paddy. No female contract labour migrated to the study area. Poverty was the main reason for migration. Besides, lower wages and low employment opportunities also caused migration.

Singh and Singh (2000) have made a comparative study of contractual and casual labour arrangements in agriculture in the Tarai region of Uttar Pradesh based on data collected from 75 labour households. The study revealed that both males and females worked as casual labourers in various activities. The group labour that consists of 5 to 8 male and female workers of a village and the family engaged themselves under the contractual arrangements. They were found to be engaged in inter-culture, earthing and harvesting of sugarcane, transplanting, harvesting and threshing of paddy crop and harvesting and threshing of wheat crop. For the harvesting and threshing of wheat, kind payment is made on the basis of produce while in sugarcane and other crops cash payment is made on per acre basis. The study shows that wages earned through contractual arrangements are higher (40 and 38%) in the case of male and female workers as compared to casual employment on farm.

Singh *et al.* (2000) have conducted a study in 12 sample villages in Gwalior district with a view to examine the employment behaviour of rural labour and its effect on rural labour market. The study revealed that, as a consequence of farm mechanization and rural development programmes more male labour started moving from agricultural to non agricultural occupations obtaining higher wage rate / earnings per annum and more employment. The scarcity of male labour thus resulted in higher demand

for female labour at an attractive wage rate thus causing a gradual feminization in agriculture.

Tomer *et al.* (2000) conducted a study to examine the family and hired labour employment in various crops and regions of Haryana state. The study was conducted in irrigated and semi-irrigated zones of Haryana. The study revealed that per hectare labour use was higher in the irrigated area. Hired labour (casual and contract) use was higher than family labour use in the irrigated zone. Hired labourers were mostly migrants from labour surplus states. The migrant labour caused a reduction in the wage rate in the rural labour markets of the state.

Tuteja (2000) has conducted a study on the effect of contractual labour arrangements in agriculture on women workers in rural Haryana. The practice of employing contract labour, adversely affected casual as well as self employed women agricultural workers. They got low paid jobs due to competition from migrant male labour. The study highlights the urgent need for assessing and modifying labour policy and rectifying the neglect of analysis of women worker's position after the prevalence of contractual labour arrangement.

Solanki and Sharma (2001) in their study 'Impact of Economic Reforms on Rural Employment-A case study of Jhakam Irrigation Project, Rajasthan' revealed that there is a significant impact of economic reforms on rural employment through irrigation. The 'with and without approach' of impact analysis was used. A sample of 100 farmers was selected for the study from two villages, 50 each from irrigated command area and unirrigated command area. The study revealed that the total labour use in crop production activity in the command area was higher compared to non command area. The use of family labour, attached labour and casual labour were also higher in the command area. The share of female workers in total labour absorption in crop production was found to be 42.45 per cent per farm in the command area compared to non command area. The labour in the non command area which was left out of irrigation suffered diversification from crop production and diverted to other activities in search of gainful employment.

Singh *et al.* (2005) have conducted a study on labour wage discrimination in agriculture. The study was conducted in six states using stratified random sampling technique. The results of the study showed that women worked less hours per day compared to men. The allocation of time by women in the six states varied from 7.3 hours per day in Ranchi (Jharkand) to 9.5 hours per day in Adilabad (A.P). The work performed by women are weeding, spraying (assisting to men), irrigation, harvesting, threshing, drying up of pods grains *etc.* Wage disparities were found to be higher among men and women in agriculture. Labour wages of male over female in agriculture were found to be higher (47%) in Ranchi (Jharkand) and lower (31%) in Coimbatore (Tamil Nadu). The CV of labour wages of male over female in agriculture was 42.1075 while in others (non-farm) it was 32.875.

Kumar (2007) had conducted a study on the trends and determinants of female employment in agriculture. The study was based on data taken from population census of Registrar General of India for the year 1981, 1991 and 2001, the proportion of female workers increased by 4.76 per cent points. The number of women agricultural labourers increased by 3.46 per cent points during the same period. The economic factors such as presence of male agricultural workers in the area, cropping intensity, agricultural output as indicative of income level and index of modernization all together determine 46.5 per cent of variation in RFWPR as agricultural workers.

Vithob *et al.* (2008) in their study examined the wage differences between male and female agriculture labourers and their migration. The study has been done in Shorapur taluka of Gulbarga district in Karnataka. The study revealed that some jobs are reserved to female labourers in agriculture *viz.* chilli, cotton, groundnut picking, transplanting and weeding. The slack season wage rate was Rs.15 to 20 per day and the peak season wage rate was Rs.25 per day for female labourers. The study suggests that provision of irrigation and adoption of labour intensive cropping patterns may help to improve the conditions of female labourers. Also there is a need for comprehensive policy and minimum wage to promote welfare of the rural female labour class in the study region

2.4 Changes in labour input

Wang JingXin (1997) studied the relationship between intensive farming systems and labour inputs, the increased production in agriculture in recent years and changes in investment in agriculture are discussed with reference to China. Changes in agricultural production conditions lead to increased labour inputs and also require economy of capital and its replacement. The links between production and management and links with the processing industry and marketing need to be improved to make full use of the benefits of intensification. Various parts of the agricultural system such as water conservancy also need to be improved.

Fousekis et al. (1998) studied the empirically analyses the determinants of labour productivity growth in Greek agriculture during the last 20 years. A recently proposed approach and duality results are utilized to decompose labour productivity growth into: (a) the effect of changes in labor force; (b) the effect of changes in the input mix; (c) the effect of changes in public infrastructure; and (d) the effect of technological improvements. The empirical results suggest that labour productivity rose at an average rate of 2.51% per annum during the period 1975-95. The increase in the materials to labour ratio appears to be the most important determinant of labour productivity growth, followed by the decrease in the labour force, and general technological progress. The positive impact of the fall in labour force in Greek agriculture is more pronounced in the last decade. The relative importance of changes in the private capital to labour ratio appears to be small, especially in the period 1985-95.

Kozlowski et al. (1999) studied the labour input in family farms. In this paper presents the labour input per hectare of agricultural land and per unit of gross final production in 77 family farms grouped according to their mechanization potential and area. The farms surveyed were located in 37 provinces across Poland and the data gathered for 1992-1993. The results indicate that, when evaluating labour use per grain unit of gross final production, 3 labour hours can be considered as a model for farms of 30 hectares and over, and 4-6 labour hours for smaller farms. Labour input

exceeding these numbers seems to indicate lower efficiency of labour use and organization.

Rabe (1999) studies to reduce labour input and production time in the nursery. The trials were carried out to investigate the effects of bench-rooting, media removal and methods to inhibit lateral bud sprouting on the growth of the following graft combinations: M arisol and Nules clementines on citrange rootstocks, M ihowase satsuma on citrange rootstocks, Eureka lemons on rough lemon rootstock and M idknight Valencia on citrange rootstocks. Evaluation of various degrees of root curling of rootstocks (bench-rooting) indicated no consistent differences in initial post-establishment growth. Removal of different amounts (50 or 100%) of the nursery potting mix from potted plants at planting in the field also did not result in significant initial growth differences. An attempt to enhance vegetative growth due to application of gibberellic acid (0-100 mg/litre) resulted in a linear positive relationship in growth in Midknight Valencia but a very erratic response in Nules clementine. Inhibition of lateral sprouting (number of sprouts and degree) was quite successful following application of NAA (12.5-25 ml/litre) but not with Butralin (B5-0969). Additional research was required to render the NAA treatment commercially viable.

Malaga Tobala (2000) studied the proportion in the inputs of human labour and mechanized work in the processes of cereal crop harvesting and production. The relationships among the changes in the level of human labour and mechanized work inputs at harvesting of cereals and their effect on the total input of human labour, mechanized work and on the cost of mechanization throughout the whole production process are discussed. Surveys were conducted of 50 family farms in 1989 and 1999. Significant qualitative and quantitative relationships were determined with the use of statistical computer software.

Schupp et al. (2008) studied the Mechanical thinning of peach and apple trees reduces labour input and increases the fruit size. They studied Hand thinning is a necessary but costly management practice in peach (Prunus persica) production. Organic apple (Malus x domestica) production also may require hand thinning to adjust crop load. Mechanical

devices to aid in thinning have been developed, but none has proven highly efficient and capable of completely replacing hand thinning. Narrow canopy training systems and novel peach tree growth habits offer new opportunities to examine mechanical methods for thinning peach and apple trees. In 2005 and 2006, a U.S Department of Agriculture-designed spiked-drum shaker was used to thin pillar (columnar) peach trees at 52 to 55 days after full bloom. The drum shaker, driven at two different speeds in the orchard, reduced crop load an average of 58% and follow-up hand thinning time by 50%, and increased fruit size by 9% at harvest compared with conventional hand-thinned or nonthinned control trees in 2005. In 2006, the shaker was driven at one speed but operated at two different frequencies. At 260 cycles/minute, the drum shaker removed more fruit and reduced crop load to a greater extent than when operated at 180 cycles/minute, however, fruit size at harvest did not differ between the two operating frequencies. The drum shaker reduced follow-up hand thinning time between 54% and 81%. Horticultural and economic evaluations of the drum shaker and/or a German-designed blossom string thinner were conducted in 2007 in four commercial peach orchards trained to a perpendicular V or quad V system and an organic apple block trained to a narrow vertical axis system. Mechanical thinners reduced peach crop load by an average of 36%, decreased follow-up hand thinning time by 20% to 42%, and increased fruit in higher market value size categories by 35%. The net economic impact of mechanical thinning versus hand thinning alone ranged from $175/ha to $1966/ha. Mechanical thinning at 20% full bloom resulted in more fruit in the large size categories (2.75 inches in diameter and larger) than thinning at 80% full bloom. The string thinner effectively thinned dwarf apple trees trained to a vertical axis system in a certified organic orchard, resulting in a reduction in hand thinning time and an increase in fruit size. Based on our tests, mechanical thinning appears to be a promising technique for supplementing hand thinning in apple and peach trees.

Warmund et al.(2012) studied the time required to harvest and field sort chinese chestnuts (Castanea mollissima) with two types of paddock vacuums and with a manual nut-harvesting tool was compared.

Pickup time for harvesting chinese chestnuts was faster with a small paddock vacuum (Paddock Vac) than with a manual nutharvesting tool (Nut Wizard), but field sorting plant material and soil, as well as movement of the small vacuum, was time-consuming. With minor equipment modifications to facilitate sorting, harvest time for a larger paddock vacuum (M axi Vac) was 2 seconds faster per nut than that for the manual nut-harvesting tool. Economic analyses revealed that the larger modified vacuum also reduced labor costs by $237 when the wage rate was low ($8 per hour) and with total production at 1000 kg. However, with the lower equipment cost, the manual nut-harvesting tool was more economical to use than the modified paddock vacuum, with $8 per hour labor costs and <6370 kg of harvested chestnuts. As labor costs and nut production increased, it was more economically efficient to use the modified paddock vacuum as compared with a manual nut-harvesting tool. At $10, $12, and $15 per hour labor, the modified pasture vacuum was the lowest cost method of harvesting chestnuts at yields 4555, 3466, and 2510 kg, respectively. Thus, the modified pasture vacuum may provide a relatively inexpensive method for new, small producers to mechanize chestnut harvest.

CHAPTER III

METHODOLOGY

In any scientific study, it is necessary for investigator to get well acquainted with the method of conducting research. He should also follow appropriate steps in carrying out research to get desired results. In the field of research in agricultural economics, the steps involved are selection of research topic, formulation of objectives, nature and source of data to be collected, deciding methods of collection of data and analysis of data. The methodology adopted for the present study is discussed in this chapter.

3.1 Selection of area

Amravati division of Vidarbha region was selected for the present study. Amravati division includes five districts namely Amravati, Yavatmal, Buldana, Akola including Washim which were selected for present research. For analysis purpose the Washim district was included in Akola due to non availability of separate data for Washim district because Washim district was bifurcated from Akola in the year 1999-2000.

3.2 Selection of crop

The crops namely Soybean and Cotton were selected for the study. Soybean and Cotton is the major crop of this division. Larger percentage of area is covered under the Cotton and Soybean crop.

3.3 Collection of data

The present study was based on the time series data from the period 1990-91 to 2010-11 on the basis of labour input, output price and wage rate. The data was collected from the Agricultural price and cost scheme which held under the Department of Economics and Statistics Dr.P.D.K.V. Akola.

3.4 Method of analysis

The study of labour input behaviour as proposed was carried out by compound growth rate. Operation wise growth rate of labour input, wage rate was calculated, percentage share of labour charges on the basis of cost A and cost C of the year 2010 was also calculated. The data thus

calculated was analysed for simple Arithmatic averages, Standard deviation, Coefficient of variation.

Analysis of data

Analysis of compound growth rate of operation wise labour input and wage rate of selected crops namely Cotton and Soybean was estimated by usisng the exponential growth function.

$$Y = ab^t$$

Where,

Y = labour input year wise 1, 2, 3.....

a = intercept.

b = regression coefficient.

t = time period

The above equation was reduces to the following linear equation by taking logarithm of both sides.

$$\text{Log } Y = \log a + (\log b) \times t$$

The compound growth rate (CGR%) was estimated as

$$CGR = [\text{analog } (\log b) - 1] \times 100$$

3.5 Analysis of share of labour charges

Operation wise percentage share of labour charges was worked out on the basis of cost A and cost C for 2010 by the simple tabulated form.

3.6 Analysis of Coefficient of Variation

Coefficient of variation of operation wise labour input of selected crops was calculated by using the following formula

$$C.V\ (\%) = \frac{SD}{A.M} \times 100$$

Where,

C.V = Coefficient of variation

SD = standard deviation

AM = Arithmetic mean

CHAPTER IV

SOCIO-ECONOMIC STATUS OF AMRAVATI DIVISION

1. Location of Amravati Division

Amravati Division falls under Vidarbha region of Maharashtra. It comprises of five districts namely Amravati, Yavatmal, Buldana, Akola including Washim. Amravati district lies between 20°32' and 21°46' North latitude and 76°-37' and 78°-27' East longitude. There is the boundary of the Wardha district on east, south Yavatmal district. Akola district is on west side and Baitul district of Madhya Pradesh on north side of Amravati district. The Buldhana district lies between 19^0,51' to 21^0,17' north latitudes and 76^0,38' to 76^0,40' East longitudes the district is surrounded by the spatula ranges in east side. The Yavatmal district lies between 19^0, 26" and 28^0. 42" of North Latitude while 77^0, 18" and 79^0, 18" of Eastern Longitude. It covers area of 13584 sq. km. accounting for 4.41 per cent of the total area of Maharashtra. The Akola District lies between 20° 17' and 21° 18' North latitudes and 76° 17' and 77° 14' East longitudes. It covers area of 5417 sq. km. accounting for 1.76 per cent of the total area of Maharashtra. Akola district is surrounded by Amravati district in North, part of Amravati and Yavatmal district in East, Washim and Yavatmal district to the South and Buldhana district towards the West.

2. Administrative set up

Maharashtra State has six revenue divisions viz., Mumbai, Pune, Nasik, Aurangabad, Amravati and Nagpur. Vidarbha area includes Amravati and Nagpur revenue divisions comprising eleven districts viz., Buldhana, Akola, Washim, Amravati, Yavatmal, Wardha, Nagpur, Bhandara, Gondia, Chandrapur, and Gadhchiroli. Washim and Gondia are newly formed districts bifurcating Akola and Bhandara districts respectively. The present study is confined to Amravati Division of Vidarbha.

3. Agro-climatic conditions

3.1 Topography and soil

Amravati district is widely cultivated tract possessing rich deep black soil generally called as 'Black Cotton Soil'. The pH of soil is 7.5 to 8.5 on the side of Wardha River and Purna River, the tract is fertile. Near the hills on the Southern border, there is shallow and inferior soil.

The eastern part of Buldhana district lies in Purna valley, which itself is a part of Tapi river. The Purna which is the chief tributary of the river Tapi has formed fertile soil. The eastern Part of the district has medium type soil. The district has 363 meters above mean sea level. The soils of district are suite fertile. Rich black cotton soil is found in Eastern part of district. The central part has also good soils on the plateau. In the north, the soils are shallow with murum substratum, medium black soil is found in the rivers valleys.

South-West part of Yavatmal district is a hilly region. The hills of Ajanta and Pusad are situated here. Pusad, Umarkhed and Mahagaon talukas and some parts of Digras and Arni occupies this region. The Northen part of Yavatmal district is a plateau. It covers Darwha, Ner and Yavatmal taluka and some parts of Arni and Digras taluka. The soils are severely eroded & shallow. . The soils of the district are 50% light (7.5 – 25 cm i.e. Entisol), 30% medium (26-50 cm i.e Inceptisol) and 20% black cotton soils (91 – 100 cm i.e. Vertisol).

The northern part of the Akola district lies in Purna valley which itself is a part of Tapi river basin. River Purna has formed fertile basin in Akola, Balapur and Murtizapur tahsils of Akola. The soil of the district is basically derived from volcanic trap rock and it is quite fertile. It is classified into categories as coarse soil found in south, medium black soil found in the plain and deep black soil found in river valley.

3.2 Climate and rainfall

Amravati Division comprises of five districts namely Amravati, Yavatmal, Buldana, Akola including Washim. So its climate and temperature is different in different district.

The climate of the Amravati District remains very hot in summer and cold in winter. The temperature in the month of May is generally high, average maximum and minimum temperature in 2011 on Amravati division was 40.1°c and 12.4°c respectively. Amravati division falls in medium and assured rainfall zone of Maharashtra state having an average annual rainfall 918.08mm during 2011. The rainfall is comparatively more in northern part than the south. The rainy season spreads over June to September. There has not been regularity in rainfall during last few years.

The climate of the Buldhana district is hot and humid. In some parts of the district i.e. khamhgaon, Jalgaon (Jamod) and Shegaon Tahsils the climate is severe i.e. very hot in summer which reaches upto 44^0c in the months of May and much cold in the winter, during the month of December which comes down to 8-10^0c.

Buldhana district falls in western zone of Vidarbha region having an average rainfall between 750-800 mm.

The climate of the Yavatmal district during winter is too cool, while in summer it is too hot. The average minimum and maximum temperature extremities observed throughout the year were 10^0C and 45.5^0C, respectively. The district Yavatmal falls under Agro-climatic Zone No. 8 i.e. Moderate Rainfall Zone. Only small western part of Darwaha & Ner Tahsils falls under assured rainfall zone No. 7. The Average rainfall received in this Zone usually exceeds 900 m. m. The climate is hot and dry. More than 75% rainfall in this zone is received in Kharif season, hence Kharif cropping system Predominates in the zone.

The climate of the Akola district during winter is too cool, while in summer it is too hot. The average minimum and maximum temperature

extremities observed throughout the year were 10°C and 46.5°C, respectively. Akola district falls in assured rainfall zone of Maharashtra state having average rainfall between 750 to 1000 mm.

4. Demographic features

4.1 Population

The important demographic features of the district as per official census 2011. The Akola district population was 18,18,617 which constitute about 1.62 per cent of state population. Out of the total population 51.48 per cent were males and 48.52 per cent were females. The sex ratio was 942 females for every 1000 males. The density of the population for the district was 321 persons per sq.km. The population growth was recorded at 11.60 per cent when compared to 2001 census which was 20.58 per cent.

The Yavatmal district population was 2,772,348 which constitute about 2.47 per cent of state population. Out of the total population 1,419,965 (51.21%) were males and 1,352,383 (48.78 %) were females. The sex ratio was 952 females for every 1000 males. The density of the population for the district was 204 persons per sq.km. The population growth was recorded at 12.78 per cent when compared to 2001 census which was 18.35 per cent.

Table 4.1. Demographic particulars of Amravati Division

District	Population lakhs			Density (person/km)	Sex Ratio No of female/1000 male			Literacy (%)			Population growth since 2001-2011
	Rural	Urban	Total		Rural	Urban	Total	Rural	Urban	Total	
Akola	10.96 (60.31)	7.21 (39.69)	18.17 (100)	321	931	951	942	85.22	91.07	87.55	11.60
Amravati	18.51 (64.10)	10.36 (35.90)	28.87 (100)	237	945	952	947	88.22	85.89	92.37	10.71
Buldhana	20.38 (18.55)	5.49 (21.23)	25.87 (100)	268	926	938	928	80.36	88.37	82.09	15.92
Yavatmal	21.76 (18.41)	5.99	27.75	204	944	954	947	77.96	96.71	80.70	12.90

(Source: Directorate of census operations in Maharashtra,2011

5. Land Holding

The details of land holding of Amravati Division are presented in district wise in Table 4.4.

Table 4.2 Land holding of Amravati Division

Sr. No.	Land holding (ha)	Land holders (%)	Area (%)
	Akola		
1.	0-2	52.93	24.12
2.	2-5	32.68	33.61
3.	5-10	11.28	27.23
4.	10-20	2.02	12.98
5.	20-50	1.09	2.06
6.	Total holding	100	100
	Amravati		
1.	0-2	34.56	37.80
2.	2-5	27.21	24.58
3.	5-10	22.74	21.76
4.	10-20	13.28	14.01
5.	20-50	2.21	1.85
6.	Total holding	100	100
	Buldhana		
1.	0-2	26.92	7.73
2.	2-5	36.32	23.80
3.	5-10	24.02	29.58
4.	10-20	11.40	30.01
5.	20-50	1.34	8.88
6.	Total holding	100	100
	Yavatmal		
1.	0-2	4.15	0.87
2.	2-5	35.60	15.78
3.	5-10	34.35	28.22
4.	10-20	22.32	39.35
5.	20-50	3.58	15.78
6.	Total holding	100	100

(Source: District Socio-economic Review, 2008-09)

6. Land Utilization Pattern

The geographical area of the Akola district was 5,40,481 ha. During the year 2009-10 the cultivable land (i.e., net area sown, current fallows and other fallow lands) was 4,47,331 ha and it is accounted for 82.76 per cent of the total geographical area of the district.

The information in respect of land utilization pattern in Amravati district is the total geographical area 12217 ha During the year 2009-10.

The information in respect of land utilization pattern in Buldana district is the total geographical area (967100 ha) 69.11 per cent area is under cultivation.

The geographical area of the district was 13,51,900 ha. During the year 2009-10 the cultivable land (i.e., net area sown, current fallows and other fallow lands) was 1186500 ha and it is accounted for 87.76 per cent of the total geographical area of the district.

The details of land use pattern of Amravati Division is presented in Table 4.3

Table 4.3 Land utilization pattern of Amravati Division

Sr. No.	Particular	Akola		Amravati		Buldhana		Yavatmal	
		Area (ha)	% to total area	Area (ha)	% to total area	Area (ha)	% to total area	Area (ha)	% to total area
1.	Total geographical area	540481	100	12217	100	967100	100	1351900	100
2.	Area under forest	36414	6.73	3101	25.38	883	9.13	25430	1.88
3.	Barren and uncultivable land	18280	3.38	195	1.59	483	4.99	39400	2.91
4.	Permanent pastures and other grazing land	5292	0.97	531	4.35	13391	138.46	60800	4.49
5.	Land under miscellaneous tree crops	8098	1.49	70	0.57	10	0.10	60800	4.49
6.	Cultivable waste land	5958	1.10	93	0.76	263	2.72	25400	1.87
7.	Land put under non-agricultural use	5801	1.07	435	3.56	511	5.28	41600	3.07
8.	Current fallow	7911	1.46	136	1.12	174	1.80	299900	22.18
9.	Other Fallow	5262	0.97	143	1.18	272	2.81	28700	2.12
10.	Net sown area	447331	82.76	7513	61.49	6684	69.11	857900	63.45
11.	Area sown more than once	37086	6.86	2776	22.72	1695	17.53	79000	5.84
12.	Gross cropped area	484417	89.62	10289	84.21	8379	86.64	936900	69.30
13.	Cropping intensity (%)	108.29	-				125.36	101.06	-

(Source : District Socio-economic Review, 2009-10)

7. Cropping Pattern

Cotton, *Kharif* sorghum, soyabean and mung etc crops were grown in the Amravati Division followed by tur, gram, wheat, udid, sunflower, maize, bajra and sugarcane. The area under different crops grown in different district was furnished in the table 4.6.

Table 4.4.Cropping pattern of Amravati Division

Sr. No.	Crop	Area (ha)	Percentage to total
A.	**Akola**		
1.	Wheat	18871	3.89
2.	Kharif jowar	84922	17.53
3.	Bajra	1210	0.24
4.	Maize	2451	0.50
5.	Other cereals.	21	0.004
	Total cereals.	107367	22.16
6.	Gram	20087	4.14
7.	Tur	25634	5.29
8.	Mung	43334	8.94
9.	Udid	14082	2.90
10.	Other Pulses	1038	0.21
	Total Pulses	**104308**	**21.53**
	Total food grains	**211675**	**43.69**
11.	Sugarcane	335	0.06
12.	Cotton	192994	39.84
	Total Fibre crops	194166	40.08
13.	Soyabean	40613	8.38
14.	Sunflower	3550	0.73
15.	Groundnut	1332	0.27
16.	Other oilseeds	8497	1.75
	Total oilseeds	55877	11.53
17.	Total fruits and Vegetables	6924	1.42
18.	Other crops	15598	3.22
	Gross cropped area	**484417**	**100.00**
B.	**Amravati**		
1.	Paddy	103	1.00
2.	Wheat	1318	12.80
3.	Jowar	245	2.39
4.	Other cereals	306	2.99
	Total cereals	1972	19.18
I.	Pulses		
1.	Gram	562	5.46
2.	Tur	1087	10.56
3.	Other pulses	986	9.58
	Total pulses	**2635**	**25.60**
II.	**Total Food Grain**	**4607**	**44.78**
B.	**Non Food Grain**		
1.	Groundnut	167	1.62
2.	Safflower	163	1.58
3.	Sunflower	148	1.44
4.	Soybean	1664	16.17
5.	Total Oilseeds	2142	20.81
6.	Cotton	3488	33.76
7.	Sugarcane	52	0.51

III.	Total Non Food Grain	5682	55.22
C.	**Gross cropped Area**	**10289**	**100.00**
C. Buldhana			
1	Rice	368	4.39
2	Wheat	214	2.55
3	Jowar (kharif+Rabi)	151	1.80
4	Bajara	641	7.65
5	Maize	145	1.73
6	Other millet	472	5.63
	Total cereals	**1991**	**23.76**
7	Gram	131	1.56
8	Tur	382	4.56
9	Mung	765	9.12
10	Udid	704	8.40
12	Other pulses	43	2.49
	Total pulses	**2025**	**24.16**
	Total food grain	**4016**	**47.92**
13	Sugarcane	374	4.46
14	Chilli	60	0.72
15	Other spices	192	2.29
	Total spices	**626**	**7.47**
16	Fruits	61	0.73
17	Vegetables	37	0.44
18	Cotton	162	1.93
19	Other fiber crop	30	0.35
	Total fiber crop	**288**	**3.46**
20	Groundnut	126	1.50
21	Sesamum	34	0.41
22	Sunflower	38	0.45
22	Other oilseed crop	201	2.39
	Total oilseed crop	399	4.76
	Total non-food crops	3050	36.40
23	Gross cropped area (GCA)	8379	100
D. Yavtmal			
1.	Wheat	19037	2.03
2.	Kharifjowar	68775	7.3
3.	Maize	401	0.042
4.	Other cereals.	47	0.005
	Total cereals.	**88485**	**9.44**
5.	Gram	31228	3.33
6.	Tur	97031	10.35
7.	Mung	10931	1.16
8.	Udid	7364	0.78
9.	Other Pulses	1050	0.11
	Total Pulses	**146574**	**15.64**
	Total food grains	**235059**	**25.08**
10.	Sugercane	5950	0.63
11.	Cotton	457357	50.95
12.	Soybean	228928	24.43
13.	Groundnut	18	0.001
14.	Other oilseeds	1560	0.16
	Total oilseeds	229059	24.44
15.	Total fruits and Vegetables	7253	0.77
16.	Gross cropped area	9,36,900	100.00

8. Crop Season and Crop Rotation

There are two important crop seasons i.e. *kharif* and *Rabi* where as in summer season land generally remains fallow and preparatory tillage operations are carried out.The manner in which crop rotations are commonly followed is presented in Table 4.7.

Table 4.5. Crop season and crop rotation of Amravati Division

Sr. No.	Kharif	Rabi
1.	Cotton	-
2.	Cotton + Tur + Jowar	-
3.	Jowar	Gram
4.	Cotton + Mung + Udid	Wheat
5.	Cotton + Tur + Mung	Gram
6.	Jowar	Safflower / wheat
7.	Cotton + Tur	Safflower
8.	Cotton + Tur + Jowar + Mung	Sunflower
9.	Mung	Safflower
10.	Cotton + Mung	-
11.	Cotton + Soybean	Gram
12.	Soybean + Tur	Wheat / Gram
13.	Cotton + Jowar	-

(Source: District Socio-economic Review, 2008-09)

9. Input Supply

Agricultural inputs like seed, manure, fertilizers, insecticides, pesticides etc. required to the farmers are made available to them through number of agricultural service centers established at district level and block levels.

Maharashtra State Seed Corporation and other private seed companies supply quality seeds to the farmers. The farm input are made available to the farmers by co-operative societies functioning at block level, Panchayat Samiti also provides inputs to the farmers. Co-operative society supply input against the loan sanctioned by DCCB to individual cultivator.

Fig.1. Map of Amravati Division

10. Credit Supply

The credit supply in Amravati division is done by Primary Agriculture Co-operative Credit Society, Non-agricultural credit Society, Panan Sanstha, Production Society and Social Service Society.

11. Markets

For the marketing of agricultural produce, agricultural market committees are functioning in the district. All the districts of Amravati Division having facilities of regulated markets. These sub-markets are connected with roads and having facilities of banking, electricity etc.

CHAPTER V

RESULTS AND DISCUSSION

The present study on Labour Input Behaviour of Selected Crops was conducted in Amravati Division of Vidarbha region. The statistical comparisons of operation wise labour input, wage rates were studied with the help of compound growth rate. Arithmetic mean, coefficient of variation of labour input was calculated. The results were presented in this chapter.

5.1 To study the growth of labour input in selected crop.

Operation wise compound growth rate of labour input in Amravati Division for Cotton and Soybean cultivation has been presented in the table 5.1.1 to 5.1.8.

Operation wise growth rate of labour input for Cotton cultivation

Results of the operation wise compound growth rate of labour input in Amravati Division for Cotton cultivation has been presented in the table 5.1.1 to 5.1.4.

Table 5.1.1. Growth rate of labour input for Cotton in Akola District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1. Primary Tillage	2.7*	0.76***	2.07*
2. Manuring	1.9*	1.5	1.6*
3. Fertilizer application	2.6*	0.4	1.2
4. Sowing	3.4*	1.76	2.73*
5. Raising	-0.5	0.3*	-0.1
6. Interculturing	1.5	-0.8NS	0.5
7. Plant Protection	1.2	2.7*	2.4***
8. Irrigation	0.2*	-0.1NS	0.2*
9. Harvesting	5.2***	4.1*	4.3*

*, **, ***, Significant at 1%, 5% and 10% level of significance;

The table 5.1.1 revealed that in Akola including Washim District during the overall period the highest growth rate of labour utilization was found in harvesting operation i.e; 4.3 percent increase per annum followed by sowing 2.73 percent, plant protection 2.4 percent, primary tillage 2.07 percent, manuring 1.6 percent increase per annum whereas in case of irrigation operation lowest growth rate of labour utilization 0.2 percent

increase per annum and other operation like fertilizer application, raising, interculturing operation were non significant was observed.

During the Period I was observed that in case of harvesting 5.2 percent, sowing 3.4 percent, primary tillage 2.7 percent, fertilizer application 2.6 percent, manuring 1.9 percent, increase per annum whereas raising, interculturing and plant protection were shows non significant.

During the Period II was observed that in case of harvesting 4.1 percent, plant protection 2.7percent, primary tillage 0.76 percent, raising 0.3 percent increase per annum was whereas manuring, fertilizer application, sowing, interculturing, irrigation operation were shows non significant.

Table 5.1.2 Growth rate of labour input for Cotton in Amravati District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1. Primary Tillage	3.27***	2.7*	3.64*
2. Manuring	1.7	1.5	1.1
3. Fertilizer Application	2.4***	0.4	1.2
4. Sowing	4.36*	3.05*	4.03*
5. Raising	1.2**	-0.5	0.3*
6. Interculturing	1.6*	0.3*	0.6
7. Plant Protection	0.2	1.3*	0.8***
8. Irrigation	2.2***	-0.1	2.4***
9. Harvesting	5.4***	2.2***	3.6*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.1.2 revealed that in Amravati District during the overall period the highest growth rate of labour utilization was found in sowing operation i.e, 4.03 percent increase per annum followed by primary tillage growth 3.64 percent, harvesting 3.6 percent, irrigation 2.4percent, plant protection 0.8 percent increase per annum whereas in case of raising operation the lowest growth rate of labour utilization 0.3 percent increase per annum and other operation like manuring, fertilizer application, interculturing shows non significant was observed.

During the Period I was observed that in case of harvesting 5.2 percent, sowing 4.36 percent, primary tillage 3.27 percent, fertilizer

application 2.4 percent, irrigation 2.2 percent, interculturing 1.6 percent, plant protection 0.8 percent increase per annum whereas manuring and plant protection shows non significant.

During the Period II was observed that in case of sowing 3.05 percent, primary tillage 2.7 percent, harvesting 2.2 percent and interculturing 0.3 percent increase per annum whereas others like manuring, fertilizer application, raising and irrigation were shows non significant.

Table 5.1.3 Growth rate of labour input for Cotton in Buldhana District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1. Primary Tillage	3.41***	2.11	2.82*
2. Manuring	2.66	1.3	2.1
3. Fertilizer Application	3.17*	1.83	2.42***
4. Sowing	4.24*	3.16*	3.73*
5. Raising	2.14***	1.3	1.72
6. Interculturing	1.8*	0.6*	0.8*
7. Plant Protection	2.03	1.4	1.71
8. Irrigation	1.7	1.3*	1.1
9. Harvesting	5.61***	3.27**	4.16*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.1.3 revealed that in Buldhana District during the overall period observed that the highest growth rate of labour utilization was found in harvesting operation i.e, 4.16 percent increase per annum followed by sowing 3.73 percent, primary tillage growth 2.82 percent, fertilizer application 2.42 percent, increase per annum whereas in case of interculturing operation lowest growth rate of labour utilization 0.8 percent increase per annum and other operation like manuring, raising, plant protection, irrigation shows non significant.

During the Period I was observed that in case of harvesting 5.61 percent, sowing 4.24 percent, fertilizer application 3.17 percent, primary tillage 3.14 percent, raising 2.14 percent and interculturing 1.8 percent increase per annum whereas manuring, plant protection and irrigation were shows non significant.

During the Period II was observed that in case of harvesting 3.27 percent, sowing 3.16 percent, irrigation 1.3 percent and interculturing 0.6 percent increase per annum whereas primary tillage, manuring, fertilizer application, raising and plant protection were shows non significant.

Table 5.1.4. Growth rate of labour input for Cotton in Yavatmal District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1. Primary Tillage	3.78*	2.48	3.32*
2. Manuring	2.24***	1.56	1.84*
3. Fertilizer Application	2.69	1.76	2.17
4. Sowing	4.94	3.49***	**3.76***
5. Raising	1.82*	0.6	1.12
6. Interculturing	1.6*	0.3*	**0.5***
7. Plant Protection	1.82*	1.13	1.41
8. Irrigation	2.2***	-0.1	2.4***
9. Harvesting	5.43***	3.21*	3.64*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.1.4 revealed that in Yavatmal District during the overall period observed that the highest growth rate of labour utilization was found in sowing operation i.e, 3.76 percent increase per annum followed by harvesting 3.64 percent, primary tillage 3.32 percent, irrigation 2.4 percent manuring 1.84 percent increase per annum whereas in case of interculturing operation lowest growth rate of labour utilization 0.5 percent increase per annum and other operation like fertilizer application, raising, plant protection were shows non significant was observed.

During the Period I was observed that in case of harvesting 5.43 percent, primary tillage 3.78 percent, manuring 2.24 percent, irrigation 2.2 percent, raising 1.82 percent, plant protection 1.82peercent and interculturing 1.6 percent increase per annum whereas fertilizer application, sowing were shows non significant.

During the Period II was observed that in case of sowing 3.49 percent, harvesting 3.21 percent, interculturing 0.3 percent whereas manuring, fertilizer application, raising ,plant protection and irrigation were shows non significant.

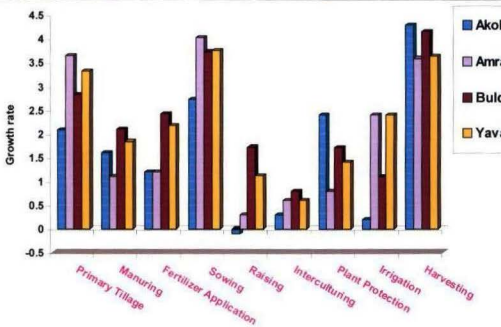

Fig.2. Operationwise growth rate of labour input for cotton cultivation

Operation wise growth rate of labour input for Soybean cultivation

Results of the operation wise compound growth rate of labour input in Amravati Division for Soybean cultivation has been presented in the table 5.1.5 to 5.1.8.

Table 5.1.5. Growth rate of labour input for Soybean in Akola District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	4.21*	1.7*	4.01*
2.Manuring	3.05***	2.51***	2.77*
3.Fertilizer Application	3.64*	2.11	3.41*
4.Sowing	6.1**	4.64	5.23*
5.Raising	2.3***	0.3	1.01*
6.Interculturing	2.3***	-0.1	1.7*
7.Plant Protection	1.5	0.8***	1.2*
8.Irrigation	2.17	1.3	1.9
9. Threshing	5.23***	4.24*	4.36*
10. Harvesting	7.13**	5.23***	5.82***

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.1.5 revealed that in Akola including Washim District during the overall period observed that the highest growth rate of labour utilization was found in harvesting operation i.e, 5.82 percent increase per annum followed by sowing 5.23 percent, threshing 4.36 percent, primary tillage growth 4.01 percent, fertilizer application 3.41 percent, manuring 2.77 percent, interculturing 1.7 percent and plant protection 1.2 percent increase per annum whereas in case of raising operation lowest growth rate of labour utilization 1.01 percent increase per annum was observed and irrigation shows non significant.

During the Period I was observed that in case of harvesting 7.13 percent, sowing 6.1 percent, threshing 5.23 percent, primary tillage 4.21percent, fertilizer application 3.64 percent, manuring 3.05 percent, raising 2.3 percent interculturing 2.3 percent increase per annum whereas plant protection and irrigation were shows non significant.

During the Period II was observed that in case of harvesting 5.23 percent, threshing 4.24 percent, manuring 2.51 percent, primary tillage 1.7 percent, plant protection 0.8 percent increase per annum whereas

increase per annum whereas fertilizer application, sowing, raising, interculturing and irrigation were shows non significant.

Table 5.1.6. Growth rate of labour input for Soybean in Amravati District

Particulars	Period I (1991-2000)	Period Ii (2001-2010)	Overall (1991-2010)
1.Primary Tillage	5.23***	4.14	4.26*
2.Manuring	3.17***	2.23***	2.8*
3.Fertilizer Application	3.62***	1.73*	2.81*
4.Sowing	5.87***	4.76	5.11***
5.Raising	3.01***	2.23*	2.64*
6.Interculturing	2.71*	1.82*	2.23*
7.Plant Protection	2.1	1.2*	1.7*
8.Irrigation	1.8*	0.6	1.2
9. Threshing	6.12**	4.84	5.63***
10. Harvesting	7.48**	5.21***	6.82*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.1.6 revealed that in Amravati District during the overall period observed that the highest growth rate of labour utilization was found in harvesting operation i.e, 6.82 percent increase per annum followed by threshing 5.63percent, sowing 5.11percent, primary tillage growth 4.26percent, fertilizer application 2.81percent, manuring 2.8percent, raising 2.64percent, interculturing 2.23percent increase per annum whereas in case of plant protection lowest growth rate of labour utilization 1.7percent increase per annum and irrigation shows non significant.

During the Period I was observed that in case of harvesting 7.48 percent, threshing 6.12percent, sowing 5.87percent, primary tillage 5.23percent, fertilizer application 3.62percent, manuring 3.17percent, raising 3.01percent, interculturing 2.71percent and irrigation 1.8percent, increase per annum whereas plant protection shows non significant.

During the Period II was observed that in case of harvesting 5.21 percent, manuring 2.23percent, raising 2.23percent, fertilizer application 1.73percent, interculturing 1.82percent increase per annum whereas primary tillage, sowing, irrigation and threshing were shows non significant.

Table 5.1.7. Growth rate of labour input for Soybean in Buldhana District

Particulars	Period I (1991-2000)	Period Ii (2001-2010)	Overall (1991-2010)
1.Primary Tillage	6.42	3.27*	4.81
2.Manuring	3.17*	2.23***	2.8*
3.Fertilizer Application	4.21	3.13*	3.84*
4.Sowing	6.28**	4.57	5.31***
5.Raising	3.43*	1.81*	2.74*
6.Interculturing	-0.7	0.9***	-0.2
7.Plant Protection	1.8*	-0.7	**0.4***
8.Irrigation	2.01	0.8***	1.41
9. Threshing	6.12**	4.84	5.63***
10. Harvesting	7.63**	5.46***	**6.93***

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.1.7 revealed that in Buldhana District during the overall period observed that the highest growth rate of labour utilization was found in harvesting operation i.e, 6.93 percent increase per annum followed by threshing 5.63 percent, sowing 5.31percent, fertilizer application 3.84percent, manuring 2.8percent, raising 2.74percent increase per annum whereas in case of plant protection lowest growth rate of labour utilization 0.4percent increase per annum and other operation like interculturing and irrigation were shows non significant.

During the Period I was observed that in case of harvesting 7.63percent, sowing 6.28percent, threshing 6.12percent, fertilizer application 4.21percent, raising 3.43percent, manuring 3.17percent and plant protection 1.8percent increase per annum whereas fertilizer application, interculturing and irrigation were shows non significant.

During the Period II was observed that in case of harvesting 5.46percent, primary tillage 3.27percent, fertilizer application 3.13percent, manuring 2.23percent, interculturing 0.9percent, raising 1.81percent, , irrigation 0.8percent increase per annum whereas sowing, plant protection and threshing were shows non significant.

Table 5.1.8. Growth rate of labour input for Soybean in Yavatmal District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	6.82*	3.48*	5.12***
2.Manuring	3.24	2.36***	2.92
3.Fertilizer Application	4.51	3.56*	3.94*
4.Sowing	6.77	4.83	5.61
5.Raising	3.43*	1.81*	2.74*
6.Interculturing	1.2	0.8***	1.01*
7.Plant Protection	1.8*	-0.3	0.2*
8.Irrigation	1.87*	0.6	1.24
9. Threshing	5.89***	3.63	4.57
10. Harvesting	7.13	5.64***	6.37*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.1.8 revealed that in Buldhana District during the overall period observed that the highest growth rate of labour utilization was found in harvesting operation i.e, 6.37 percent increase per annum followed by primary tillage 5.12 percent, fertilizer application 3.94percent, raising 2.74 percent, interculturing 1.01percent increase per annum whereas in case of plant protection lowest growth rate of labour utilization 0.2percent increase per annum and other operation like manuring, sowing, irrigation, threshing were shows non significant .

During the Period I observed that in case of primary tillage 6.82percent, threshing 5.89percent, raising 3.43percent, plant protection 1.8percent increase per annum whereas manuring, fertilizer application, sowing, interculturing, harvesting were shows non significant.

During the Period II observed that in case of harvesting 5.64percent, fertilizer application 3.56percent, primary tillage 3.48percent, manuring 2.36percent, raising 1.81percent, interculturing 0.8percent increase per annum whereas sowing, plant protection, irrigation, threshing were shows non significant.

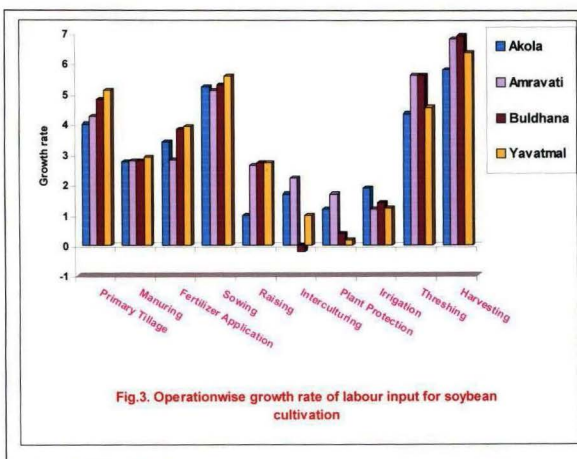

Fig.3. Operationwise growth rate of labour input for soybean cultivation

5.2 To study the share of labour changes in output price.

Here, results of the operation wise work percentage share of labour charges in cost A and cost C for the cultivation of Cotton and Soybean separately of year 2010 in Amravati division has been presented in the table 5.2.1 to 5.2.8.

Operation wise Percentage share of labour charges in cost A and cost C for Cotton cultivation

Results of the operation wise compound growth rate of labour input in Amravati Division for Cotton cultivation has been presented in the table 5.1.1 to 5.1.4.

Table 5.2.1 Percentage share of labour charges in cost A and cost C for Cotton in Akola District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1.Primary Tillage	0.9	0.3
2. Manuring	4.5	3.1
3. Fertilizer Application	0.09	1.7
4. Sowing	0.31	0.04
5. Raising	2.1	1.4
6. Interculturing	2.6	1.8
7. Plant Protection	1.5	0.3
8. Irrigation	0.04	0.2
9. Harvesting	1.6	1.3
Value of cost A & cost C	Cost A= 20852.74	Cost C= 30679.69

The table 5.2.1 revealed that the percentage share of labour charges in cost A and cost C for Cotton cultivation. In case of cost A observed that the highest percentage share of labour charges was used for manuring operation i.e, 4.5 percent followed by interculturing operation 2.6 percent, raising 2.1 percent, harvesting 1.6 percent used whereas the lowest percentage share of labour charges 0.04percent was used for the irrigation. In case of cost C observed that the highest percentage share of labour charge was used for manuring operation i.e, 3.1 percent followed by intrculturing operation 1.8 percent, raising 1.4percent, harvesting 1.3 percent used whereas the lowest percentage of labour charge 1.04percent was used for the sowing.

Table 5.2.2. Percentage share of labour charges in cost A and cost C for Cotton in Amravati District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1. Primary Tillage	3.04	2.1
2. Manuring	2.7	3.1
3. Fertilizer Application	0.9	0.6
4. Sowing	4.4	2.9
5. Raising	0.5	0.3
6. Interculturing	1.2	0.2
7. Plant Protection	0.4	1.6
8. Irrigation	1.4	0.3
9. Harvesting	5.4	3.8
Value of cost A & cost C	Cost A= 22411.55	Cost C= 31836.97

The table 5.2.2 revealed that the percentage share of labour charges in cost A and cost C for Cotton cultivation. In case of cost A observed that the highest percentage share of labour charge was used for harvesting operation i.e, 5.4percent followed by sowing 4.4 percent, primary tillage 3.04 percent and manuring 2.7 percent was used whereas the lowest percentage share of labour charge 0.4percent was used for the plant protection. In case of cost C observed that the highest percentage of labour charge 3.8percent was used for harvesting followed by manuring 3.1 percent, sowing 2.9 percent and primary tillage 2.1percent was used whereas the lowest percentage share of labour charge 0.2percent was used for the raising.

Table 5.2.3 Percentage share of labour charges in cost A and cost C for Cotton in Buldhana District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1. Primary Tillage	4.8	3.1
2. Manuring	0.6	0.4
3. Fertilizer Application	0.1	0.7
4. Sowing	2.3	1.4
5. Raising	1.5	0.9
6. Interculturing	0.3	0.2
7. Plant Protection	0.7	0.4
8. Irrigation	0.4	0.3
9. harvesting	5.8	3.6
Value of cost A & cost C	Cost A= 17323.79	Cost C= 27632.14

The table 5.2.3 revealed that the percentage share of labour charges in cost A and cost C for Cotton cultivation. In case of cost A observed that the highest percentage share of labour charge was used for harvesting operation i.e, 5.8percent followed by primary tillage 4.8 percent, sowing 2.3percent was used whereas the lowest percentage share of labour charge 0.1percent was used for the fertilizer application. In case of cost C the highest percentage of labour charge 3.6percent was used for harvesting followed by primary tillage 3.1 percent, sowing 1.4 percent was used whereas the lowest percentage of labour charge 0.2percent was used for the interculturing operation.

Table 5.2.4. Percentage share of labour charges in cost A and cost C for Cotton in Yavatmal District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1. Primary Tillage	3.9	3.05
2. Manuring	0.5	0.4
3. Fertilizer Application	0.9	0.7
4. Sowing	1.9	1.4
5. Raising	1.2	0.2
6. Interculturing	0.2	0.9
7. Plant Protection	0.5	0.4
8. Irrigation	0.4	0.3
9. Harvesting	4.8	3.7
Value of cost A & cost C	Cost A= 20928.44	Cost C= 27293.28

The table 5.2.4 revealed that the percentage share of labour charges in cost A and cost C for Cotton cultivation. In case of cost A observed that the highest percentage share of labour charge was used for harvesting operation i.e, 4.8percent was used followed by primary tillage 3.9 percent, sowing 1.9 percent was used whereas the lowest percentage share of labour charge 0.2percent was used for the plant protection. In case of cost C the highest percentage share of labour charge 3.7percent was used for harvesting followed by primary tillage 3.05 percent, sowing 1.4 percent whereas the lowest percentage share of labour charge 0.2percent was used for the raising operation.

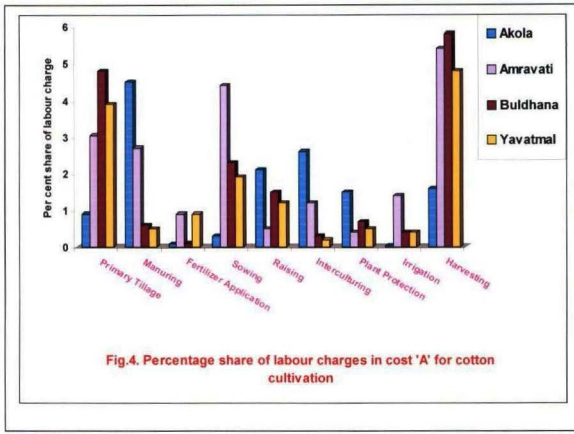

Fig.4. Percentage share of labour charges in cost 'A' for cotton cultivation

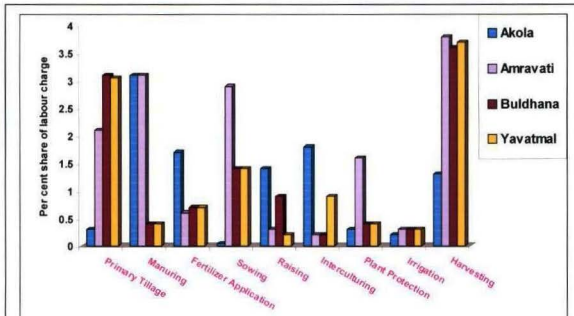

Fig.5.Percentage share of labour charges in cost 'C' for cotton cultivation

Operation wise Percentage share of labour charges in cost A and cost C for Soybean cultivation

Results of the operation wise compound growth rate of labour input in Amravati Division for Cotton cultivation has been presented in the table 5.1.5 to 5.1.8.

Table 5.2.5. Percentage share of labour charges in cost A and cost C for Soybean in Akola District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1. Primary Tillage	3.4	2.4
2. Manuring	1.4	1.1
3. Fertilizer Application	2.1	1.7
4. Sowing	2.8	1.9
5. Raising	1.5	2.1
6. Interculturing	1.8	1.2
7. Plant Protection	0.01	1.3
8. Irrigation	1.7	1.2
9. Treshing	1.6	1.4
10. harvesting	2.6	1.8
Value of cost A & cost C	Cost A= 29984.90	Cost C= 42134.58

The table 5.2.2 revealed that the percentage share of labour charges in cost A and cost C for Cotton cultivation. In case of cost A observed that the highest percentage share of labour charge was used for primary tillage operation i.e 3.4percent was used followed by sowing 2.8 percent, harvesting 2.6 percent, fertilizer application 2.1 percent whereas the lowest percentage share of labour charge 0.01percent was used for the plant protection. In case of cost C observed that the highest percentage share of labour charge 2.4percent was used for primary tillage followed by raising 2.1 percent, sowing 1.9 percent,harvesting 1.8percent whereas the lowest percentage share of labour charge 1.1percent was used for the manuring operation.

Table 5.2.6. Percentage share of labour charges in cost A and cost C for Soybean in Amravati District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1. Primary Tillage	4.2	3.1
2. Manuring	3.7	3.8
3. Fertilizer Application	3.5	2.5
4. Sowing	3.1	2.3
5. Raising	2.8	1.8
6. Interculturing	4.9	3.6
7. Plant Protection	3.5	2.6
8. Irrigation	2.7	2.5
9. Treshing	5.2	2.1
10. harvesting	4.6	4.2
Value of cost A & cost C	Cost A= 15803.80	Cost C= 21374.65

The table 5.2.6 revealed that the percentage share of labour charges in cost A and cost C for Soybean cultivation. In case of cost A observed that the highest percentage share of labour charge was used for threshing operation i.e, 5.2percent followed by interculturing 4.9 percent, harvesting 4.6 percent, primary tillage 4.2 percent whereas the lowest percentage share of labour charge 2.7percent was used for the irrigation. In case of cost C the highest percentage share of labour charge 4.2percent was used for harvesting followed by manuring 3.8 percent, primary tillage 3.1 percent whereas the lowest percentage share of labour charge 1.8percent was used for the raising operation.

Table 5.2.7. Percentage share of labour charges in cost A and cost C for Soybean in Buldhana District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1. Primary Tillage	3.6	2.4
2. Manuring	1.4	1.1
3. Fertilizer Application	2.8	3.7
4. Sowing	3.4	2.6
5. Raising	1.5	1.1
6. Interculturing	2.4	2.1
7. Plant Protection	0.01	1.3
8. Irrigation	1.7	1.2
9. Treshing	1.6	2.4
10. harvesting	2.6	2.7
Value of cost A & cost C	Cost A= 14720.16	Cost C= 21050.80

The table 5.2.7 revealed that the percentage share of labour charges in cost A and cost C for Soybean cultivation. In case of cost A observed that the highest percentage share of labour charge was used for harvesting operation i.e 3.6 percent followed by sowing 3.4 percent, fertilizer application 2.8 percent, harvesting 2.6 percent whereas the lowest percentage share of labour charge 1.4percent was used for the manuring. In case of cost C observed that the highest percentage share of labour charge 3.7 percent was used for fertilizer application followed by harvesting 2.7 percent, sowing 2.6 percent, primary tillage 2.4 percent whereas the lowest percentage share of labour charge 1.1percent was used for the raising operation.

Table 5.2.8. Percentage share of labour charges in cost A and cost C for Soybean in Yavatmal District

Particulars	% share of labour charges in cost A	% share of labour charges in cost C
1. Primary Tillage	3.1	2.4
2. Manuring	2.8	1.3
3. Fertilizer Application	0.07	2.4
4. Sowing	3.7	2.6
5. Raising	3.3	2.5
6. Interculturing	2.6	0.02
7. Plant Protection	3.4	2.4
8. Irrigation	3.1	1.8
9. Treshing	1.7	2.8
10. harvesting	2.6	3.1
Value of cost A & cost C	Cost A= 14476.05	Cost C= 18732.64

The table 5.2.2 revealed that the percentage share of labour charges in cost A and cost C for Soybean cultivation. In case of cost A observed that the highest percentage share of labour charge was used for sowing operation i. 3.7percent followed by plant protection 3.4 percent, raising 3.3 percent, primary tillage 3.1 percent whereas the lowest percentage share of labour charge 0.07percent was used for the fertilizer application. In case of cost C observed that the highest percentage of labour charge 3.1percent was used for harvesting followed by threshing 2.8 percent, sowing 2.6 percent, raising 2.5 percent whereas the lowest

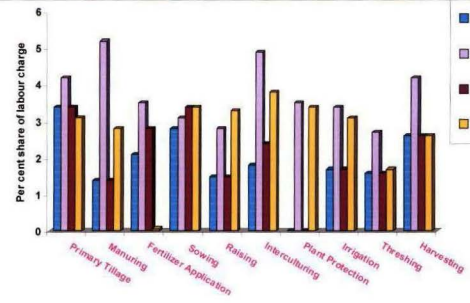

Fig.6.Percentage share of labour charges in cost 'A' for soybean cultivation

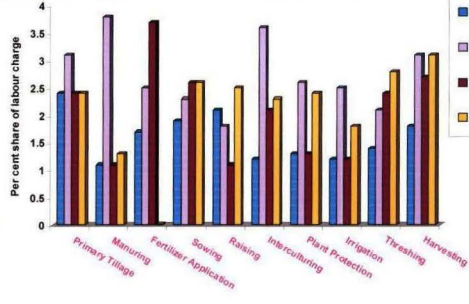

Fig.7.Percentage share of labour charges in cost 'C' for soybean cultivation

percentage share of labour charge 0.02percent was used for the interculturing operation.

5.3 To study the wage behaviour.

Results of the operation wise compound growth rate of labour wage rates in Amravati Division for Cotton and Soybean cultivation has been presented in the table 5.3.1 to 5.3.8

Operation wise growth rate of labour input for Cotton cultivation

Results of the operation wise compound growth rate of labour wage rates in Amravati Division for Cotton cultivation has been presented in the table 5.3.1 to 5.3.4.

Table 5.3.1. Growth rate of labour wage rates for cotton in Akola District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	5.31***	3.86	4.26
2.Manuring	3.46***	2.41***	2.87*
3.Fertilizer Application	3.52*	2.64	3.1*
4.Sowing	6.78	5.29***	5.74***
5.Raising	3.1*	1.23	2.13
6.Interculturing	2.77*	1.3	1.87*
7.Plant Protection	3.73	2.34***	2.86
8.Irrigation	2.82*	0.82***	1.6*
9.Harvesting	8.50	6.53*	6.87*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.1 revealed that in Akola including Washim District during the overall period observed that the highest growth rate of labour wages was found in harvesting operation i.e, 6.87 percent increase per annum followed by sowing 5.74percent, fertilizer application 3.1percent, manuring 2.87percent, interculturing 1.87percent increase per annum whereas in case of irrigation lowest growth rate of labour wages 1.6percent increase per annum and other operation like primary tillage, raising, plant protection were shows non significant.

During the Period I observed that in case of harvesting 6.53percent, primary tillage 5.31percent, sowing 5.29percent, fertilizer application 3.52percent, manuring 3.46percent, raising 3.1percent,

irrigation 2.82percent and interculturing 2.77percent increase per annum whereas sowing, plant protection and harvesting were shows non significant.

During the Period II observed that in case of harvesting 6.53percent, sowing 5.29 percent, manuring 2.41percent, plant protection 2.34percent, irrigation 0.82percent increase per annum whereas primary tillage, fertilizer application, raising, interculturing were shows non significant.

Table 5.3.2. Growth rate of labour wage rates for cotton in Amravati District

Particulars	Period I	Period II	Overall
1.Primary Tillage	5.81***	4.12	4.76
2.Manuring	3.31***	2.62*	2.91*
3.Fertilizer Application	3.54*	2.56	3.11***
4.Sowing	6.61	5.36***	5.78***
5.Raising	2.74*	1.78*	2.21***
6.Interculturing	2.86*	1.2*	1.91*
7.Plant Protection	3.63	2.54*	3.12***
8.Irrigation	2.41***	0.6*	1.4*
9.Harvesting	8.77	6.71	7.62

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.2 revealed that in Amravati District during the overall period observed that the highest growth rate of labour wages was found in sowing operation i.e, 5.78percent increase per annum followed by plant protection 3.12 percent, fertilizer application 3.11 percent, manuring 2.91 percent, raising 2.21 percent, interculturing 1.91 percent increase per annum whereas in case of irrigation lowest growth rate of labour wages 1.4percent increase per annum and other operation like primary tillage, harvesting were shows non significant.

During the Period I observed that in case of primary tillage 5.81 percent, fertilizer application 3.54percent, manuring 3.31percent, interculturing 2.86percent, raising 2.74percent, irrigation 2.41percent increase per annum whereas sowing, plant protection ,harvesting were shows non significant.

During the Period II observed that in case of sowing 5.36percent, manuring 2.62percent, plant protection 2.54percent, raising

1.78percent, interculturing 1.2percent, irrigation 0.6percent increase per annum whereas primary tillage, fertilizer application and harvesting were shows non significant.

Table 5.3.3. Growth rate of labour wage rates for cotton in Buldhana District

Particulars	Period I	Period II	Overall
1.Primary Tillage	5.46***	3.87*	4.46*
2.Manuring	3.11***	2.42***	2.74**
3.Fertilizer Application	3.32***	2.21	2.73*
4.Sowing	6.13**	5.24***	5.61*
5.Raising	2.4***	1.4	1.87
6.Interculturing	2.1	0.8*	1.6*
7.Plant Protection	2.84*	1.7	2.1
8.Irrigation	2.21	0.6*	1.2*
9.Harvesting	7.81**	6.5	7.31**

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.3 revealed that in Buldhana District during the overall period observed that the highest growth rate of labour wages was found in harvesting operation i.e 7.31percent increase per annum followed by sowing 5.61 percent, primary tillage 4.46 percent, manuring 2.74 percent, fertilizer application 2.73 percent interculturing 1.6 percent increase per annum whereas in case of irrigation lowest growth rate of labour wages 1.2 percent increase per annum and other operation like raising, and plant protection were shows non significant.

During the Period I observed that in case of harvesting 7.81 percent, sowing 6.13 percent, primary tillage 5.46percent, fertilizer application 3.32 percent, manuring 3.11 percent, raising 2.4 percent increase per annum whereas interculturing and irrigation were shows non significant.

During the Period II observed that in case of sowing 5.24 percent, primary tillage 3.74 percent, manuring 2.42percent, interculturing 0.8 percent, irrigation 0.6 percent increase per annum whereas fertilizer application, raising, plant protection and harvesting were shows non signinifant.

Table 5.3.4. Growth rate of labour wage rates for cotton in Yavatmal District

Particulars	Period I	Period II	Overall
1.Primary Tillage	5.76***	3.92	4.84
2.Manuring	3.36***	2.63	2.87*
3.Fertilizer Application	3.42***	2.34***	2.93*
4.Sowing	6.49	5.13***	5.76***
5.Raising	2.46***	0.8*	1.6*
6.Interculturing	2.61	1.86*	2.13
7.Plant Protection	2.96*	1.82*	2.36***
8.Irrigation	2.34***	1.4*	1.77*
9.Harvesting	7.69***	6.37	7.26**

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.4 revealed that in Yavatmal District during the overall period observed that the highest growth rate of labour wages was found in harvesting operation i.e 7.26 percent increase per annum followed by sowing 5.76 percent, fertilizer application 2.93percent, manuring 2.87 percent, plant protection 2.36 percent, irrigation 1.77 percent increase per annum whereas in case of raising lowest growth rate of labour wages 1.6percent increase per annum and other operation like primary tillage, and interculturing were shows non significant.

During the Period I observed that in case of harvesting 7.69percent, primary tillage 5.76percent, fertilizer application 3.42percent manuring 3.36percent, plant protection 2.96percent, raising 2.46percent, irrigation 2.34percent increase per annum whereas sowing and interculturing were shows non significant.

During the Period II in case of sowing 5.13percent, fertilizer application 2.34percent, interculturing 1.86percent, plant protection 1.82percent, irrigation 1.4percent, raising 0.8percent increase per annum whereas primary tillage, manuring and harvesting were shows non significant.

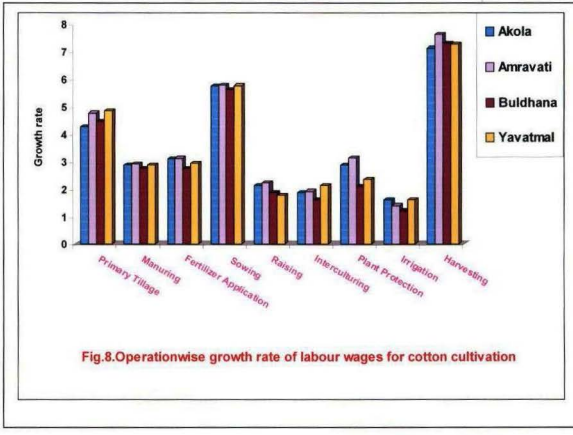

Fig.8.Operationwise growth rate of labour wages for cotton cultivation

Operation wise growth rate of labour wage rates for Soybean cultivation

Results of the operation wise compound growth rate of labour input in Amravati Division for Soybean cultivation has been presented in the table 5.1.5 to 5.1.8.

Table 5.3.5. Growth rate of labour wages for Soybean in Akola District

Particulars	Period I	Period II	Overall
1.Primary Tillage	6.43**	4.71	5.31***
2.Manuring	4.27	3.34***	3.86
3.Fertilizer Application	4.41	3.52***	4.11
4.Sowing	7.36	5.61***	6.23*
5.Raising	3.76	1.84*	2.24***
6.Interculturing	3.28***	1.62	1.92*
7.Plant Protection	2.81*	1.77*	1.83*
8.Irrigation	2.76*	1.2	1.52*
9.Threshing	6.67	4.72	5.36
10.Harvesting	9.69	6.46**	7.34**

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.5 revealed that in Akola including Washim District during the overall period observed that the highest growth rate of labour wages was found in harvesting operation i.e 7.34percent increase per annum followed by sowing 6.23 percent, prmary tillage 5.31 percent, raising 2.24 percent, interculturing 1.92 percent and plant protection 1.83 percent increase per annum whereas in case of irrigation lowest growth rate of labour wages 1.52 percent increase per annum and other operation like manuring, fertilizer application and threshing were shows non significant.

During the Period I observed that in case of primary tillage 6.43 percent, interculturing 3.28 percent, irrigation 2.82percent, plant protection 2.81percent increase per annum whereas manuring, fertilizer application, sowing, raising, threshing and harvesting were shows non significant.

During the Period II observed that in case of manuring 3.34%, fertilizer application 3.52%, sowing 5.61%, raising 1.84%, plant protection 1.77% and harvesting 6.46% increase per annum was observed whereas others were non significant.

Table 5.3.6.Growth rate of labour wages for Soybean in Amravati District

Particulars	Period I	Period II	Overall
1.Primary Tillage	6.61**	4.76	5.63*
2.Manuring	4.36	3.24***	3.79
3.Fertilizer Application	4.50	3.46	4.12
4.Sowing	7.42**	5.73***	6.57**
5.Raising	3.61*	1.74	2.62
6.Interculturing	3.24*	1.3	1.92*
7.Plant Protection	2.76*	1.64	1.81*
8.Irrigation	2.36***	1.2	1.4*
9.Threshing	6.73	4.83**	5.54
10.Harvesting	10.21	7.63**	8.31**

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.6 revealed that in Amravati District during the overall period observed that the highest growth rate of labour wages was found in harvesting operation i.e 8.31percent increase per annum followed by sowing 6.57percent, primary tillage 5.63percent, interculturing 1.92percent, plant protection 1.81percent increase per annum whereas in case of irrigation lowest growth rate of labour wages 1.4percent increase per annum and other operation like manuring ,fertilizer application, raising and threshing shows non significant.

During the Period I observed that in case of sowing 7.42percent, primary tillage 6.61percent, raising 3.61percent, interculturing 3.24percent, plant protection 2.76percent and irrigation 2.36percent increase per annum whereas manuring, fertilizer application,threshing and harvesting were shows non significant.

During the Period II observed that in case of harvesting 7.63 percent, sowing 5.73percent, threshing 4.83percent, manuring 3.24percent increase per annum whereas primary tillage, fertilizer application, raising, interculturing, plant protection and irrigation were shows non significant.

Table 5.3.7. Growth rate of labour wages for Soybean in Buldhana District

Particulars	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	6.50**	4.64	5.57***
2.Manuring	4.24	2.87*	3.54***
3.Fertilizer Application	4.36	3.42	3.92
4.Sowing	7.27**	5.62***	6.48**
5.Raising	3.5***	1.81*	2.31***
6.Interculturing	3.18***	1.16	1.64*
7.Plant Protection	2.82*	1.50*	2.11*
8.Irrigation	2.18***	1.32	1.56*
9. Threshing	6.64	4.82	5.61
10. Harvesting	9.73	7.82**	8.12*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.7 revealed that in Buldhana District during the overall period observed that the highest growth rate of labour wages was found in harvesting operation i.e 8.12percent increase per annum followed by sowing 6.48percent, primary tillage 5.57percent, manuring 3.54percent, plant protection 2.11percent, interculturing 1.64percent increase per annum whereas in case of irrigation lowest growth rate of labour wages 1.56percent increase per annum and other operation like fertilizer application and threshing were shows non significant.

During the Period I observed that in case of sowing 7.27 percent, primary tillage 6.50percent, raising 3.5percent, interculturing 3.18 percent, plant protection 2.82percent, irrigation 2.18percent increase per annum whereas manuring, fertilizer application, threshing, harvesting were shows the non significant

During the Period II observed that in case of harvesting 7.82percent, sowing 5.62percent, manuring 2.87percent, raising 1.81percent, plant protection 1.50percent whereas primary tillage, fertilizer application, interculturing, irrigation and threshing were shows non significant.

Table 5.3.8. Growth rate of wages for Soybean in Yavatmal District

Particulars	Period I	Period II	Overall
1.Primary Tillage	6.76	4.73	5.64***
2.Manuring	4.41	2.82*	3.61
3.Fertilizer Application	4.69	3.46***	4.12
4.Sowing	7.48**	5.69	6.64**
5.Raising	3.61*	1.93*	2.52*
6.Interculturing	3.28***	1.32	1.87*
7.Plant Protection	2.86*	1.61	2.21*
8.Irrigation	2.24	1.18	1.64
9.Threshing	6.64**	4.82	5.61***
10.Harvesting	10.24	7.96**	8.51*

*, **, ***, Significant at 1%, 5% and 10% level of significance

The table 5.3.8 revealed that Yavatmal District during the overall period observed that the highest growth rate of labour wages was found in harvesting operation i.e 8.51 percent increase per annum followed by sowing 6.64percent,primary tillage 5.64 percent, threshing 5.61 percent, raising 2.52 percent, plant protection 2.21 percent increase per annum whereas in case of intercultural operation lowest growth rate of labour wages 1.87percent increase per annum and other operation like manuring, fertilizer application and irrigation were shows non significant.

During the Period I observed that in case of sowing 7.48 percent, threshing 6.64 percent, raising 3.61 percent, interculturing 3.28 percent, plant protection 2.86 percent, increase per annum whereas primary tillage, manuring, fertilizer application, irrigation and harvesting were shows the non significant

During the Period II observed that in case of harvesting 7.96percent, fertilizer application 3.46 percent, manuring 2.82 percent, raising 1.93percent whereas primary tillage, sowing, interculturing, plant protection, irrigation and threshing were shows non significant.

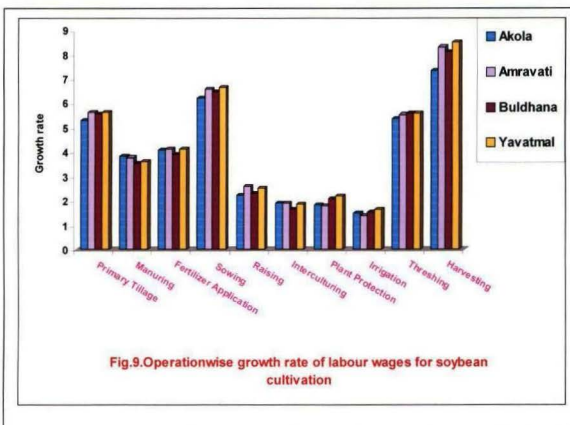

Fig.9.Operationwise growth rate of labour wages for soybean cultivation

5.4 To assess the changes in labour input

The results of the compound growth rate of changes in labour input of Cotton and Soybean cultivation in Amravati Division has been presented in the table 5.4.1 to 5.4.8. In this case randomly identified 3-4 operation of labour utilization and study the performance of labour input over time.

Table 5.4.1. Operation wise growth rate of changes in labour input in Akola District

Particulars For Cotton	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	2.7*	0.76***	2.07*
2.Manuring	1.9*	1.5	1.6
3.Sowing	3.4*	1.76	2.73*
4.Harvesting	5.2***	4.1*	4.3*
Particulars For Soybean	**Period I**	**Period II**	**Overall**
1.Primary Tillage	4.21*	1.7	4.01*
2.Manuring	3.05**	2.51	2.77
3.Sowing	6.1***	4.64	5.23*
4.Threshing	5.23***	4.24*	4.36*
5.Harvesting	7.13*	5.23***	5.82***

The table 5.4.1 revealed that in Akola including Washim District the growth rate of changes in labour input for Cotton and Soybean. During the overall period the highest growth rate of labour utilization was found in harvesting operation i.e; 4.3 percent in case of Cotton and in case of Soybean 5.82 percent increase per annum followed by sowing primary tillage and other operation.

During the Period I was observed that in case of Cotton harvesting 5.2 percent, sowing 3.4 percent increase per annum whereas in case of Soybean harvesting 7.13percent, sowing 6.1percent increase per annum .

During the Period II was observed that in case of Cotton harvesting 4.1 percent increase per annum whereas in case of Soybean harvesting 5.23percent increase per annum.

Table 5.4.2. Operation wise growth rate of changes in labour input in Amravati District

Particulars For Cotton	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	3.27***	2.7*	3.64*
2.Manuring	1.7	1.5	1.1
3.Sowing	4.36*	3.05*	**4.03***
4.Harvesting	5.4***	2.2***	3.6*
Particulars For Soybean	**Period I (1991-2000)**	**Period II (2001-2010)**	**Overall (1991-2010)**
1.Primary Tillage	5.23***	4.14	4.26*
2.Manuring	3.17***	2.23***	2.8*
3.Sowing	5.87***	4.76	5.11***
4.Threshing	6.12**	4.84	5.63***
5.Harvesting	7.48**	5.21***	**6.82***

The table 5.4.2 revealed that in Amravati District the growth rate of changes in labour input for Cotton and Soybean. During the overall period the highest growth rate of labour utilization was found in sowing operation i.e; 4.03 percent in case of Cotton and in case of Soybean harvesting operation 6.82 percent increase per annum followed by primary tillage, primary tillage and other operation.

During the Period I was observed that in case of Cotton harvesting 5.4 percent, sowing 4.36 percent increase per annum whereas in case of Soybean harvesting 7.48percent, threshing 6.12percen increase per annum .

During the Period II was observed that in case of Cotton sowing 3.05percent, harvesting 2.2 percent increase per annum whereas in case of Soybean harvesting 5.21percent increase per annum.

Table 5.4.3. Operation wise growth rate of changes in labour input in Buldhana District

Particulars For Cotton	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	3.41***	2.11	2.82*
2.Manuring	2.66	1.3	2.1
3.Sowing	4.24*	3.16*	3.73*
4.Harvesting	5.61***	3.27**	**4.16***
Particulars For Soybean	**Period I (1991-2000)**	**Period II (2001-2010)**	**Overall (1991-2010)**
1.Primary Tillage	6.42	3.27*	4.81
2.Manuring	3.17*	2.23***	2.8*
3.Sowing	6.28**	4.57	5.31***
4.Threshing	6.12**	4.84	5.63***
5.Harvesting	7.63**	5.46**	**6.93***

The table 5.4.3 revealed that in Buldhana District the growth rate of changes in labour input for Cotton and Soybean. During the overall period the highest growth rate of labour utilization was found in harvesting operation i.e; 4.16 percent in case of Cotton and in case of Soybean harvesting operation 6.93 percent increase per annum followed by sowing and other operation.

During the Period I was observed that in case of Cotton harvesting 5.61 percent, sowing 4.24 percent increase per annum whereas in case of Soybean harvesting 7.63percent, threshing 6.12percen increase per annum .

During the Period II was observed that in case of Cotton harvesting 3.27 percent sowing 3.16percent increase per annum whereas in case of Soybean harvesting 5.46percent increase per annum.

Table 5.4.4. Operation wise growth rate of changes in labour input in Yavatmal District

Particulars For Cotton	Period I (1991-2000)	Period II (2001-2010)	Overall (1991-2010)
1.Primary Tillage	3.78*	2.48	3.32*
2.Manuring	2.24***	1.56	1.84*
3.Sowing	4.84	3.49***	**3.76***
4.Harvesting	5.43***	3.21*	3.64*
Particulars For Soybean	**Period I (1991-2000)**	**Period II (2001-2010)**	**Overall (1991-2010)**
1.Primary Tillage	6.82*	3.48*	5.12***
2.Manuring	3.24*	2.36***	2.92
3.Sowing	6.77	4.83	5.61
4.Threshing	5.89***	3.63	4.57
5.Harvesting	7.13	5.64***	**6.37***

The table 5.4.3 revealed that in Yavatmal District the growth rate of changes in labour input for Cotton and Soybean. During the overall period the highest growth rate of labour utilization was found in sowing operation i.e; 3.76 percent in case of Cotton and in case of Soybean harvesting operation 6.37 percent increase per annum followed by primary tillage and other operation.

During the Period I was observed that in case of Cotton harvesting 5.43 percent, primary tillage 3.78percent increase per annum whereas in case of Soybean primary tillage 6.82percent, threshing 5.89percent increase per annum .

During the Period II was observed that in case of Cotton sowing 3.49 percent harvesting 3.21percent increase per annum whereas in case of Soybean harvesting 5.64percent, primary tillage 3.48 percent increase per annum.

5.5 Coefficient of variation

Coefficient of variation indicated the variation of particular operation over a period of time. The table 5.5.1and 5.5.2 revealed that coefficient of variation in cotton and Soybean cultivation for the period 1991-2010 presented below

Table 5.5.1. Operation wise coefficient of variation for cotton cultivation

Operation	Akola		Amravati		Buldhana		Yavatmal	
	Mean	Cv	mean	cv	Mean	cv	mean	Cv
1.Primary Tillage	942.61	39.67	947.24	42.93	998.26	52.92	943.73	40.71
2.Manuring	422.72	49.82	322.47	33.67	273.66	37.05	344.98	44.60
3.Fertilizer Application	341.12	44.11	382.26	39.46	346.43	40.11	326.04	30.26
4.Sowing	517.85	50.89	744.76	40.76	930.18	20.79	676.97	39.76
5.Raising	521.89	32.06	388.31	43.19	396.08	50.08	436.72	79.38
6.Interculturing	435.83	81.06	142.4	28.71	135.82	34.63	161.12	38.81
7.Plant Protection	220.16	43.18	257.81	30.50	249.72	40.95	272.71	48.44
8.Irrigation	230.75	41.64	221.96	40.42	221.79	44.22	229.28	46.28
10.Harvesting	1300.7	39.28	1293.3	36.26	1183.7	44.49	1150.6	46.41

As seen from Table that the operation wise coefficient of variation of cotton cultivation for overall period in Akola district highest Coefficient of variation 81.06percent has been observed in intercultural operation followed by sowing 50.89percent, manuring 49.82percent whereas lowest Coefficient of variation 39.28 percent in case of harvesting was observed.

In Amravati district highest coefficient of variation 43.19percent has been observed for raising followed by primary tillage 42.93percent, sowing 40.76percent whereas lowest Coefficient of variation 28.71percent in case of interculturing was observed.

In Buldhana district the highest coefficient of variation 52.92percent has been observed in primary tillage operation followed by raising 50.08percent, plant protection 40.95percent whereas lowest Coefficient of variation 20.79percent in case of sowing was observed.

In Yavatmal district the highest coefficient of variation 79.38percent has been observed in raising operation followed by plant protection 48.44percent, irrigation 46.28percent whereas lowest Coefficient of variation 30.26percent in case of fertilizer application was observed.

Table 5.5.2.Operation wise coefficient of variation for Soybean cultivation

Operation	Akola		Amravati		Buldhana		Yavatmal	
	Mean	Cv	Mean	cv	Mean	Cv	mean	Cv
1.Primary Tillage	149.27	62.68	237.45	27.67	149.27	62.68	182.70	85.01
2.Manuring	143.16	62.12	229.28	46.28	143.16	62.12	135.01	26.73
3.Fertilizer Application	137.70	60.91	126.81	35.66	151.56	59.42	154.01	27.97
4.Sowing	167.17	63.37	139.93	36.31	120.08	61.07	129.89	71.34
5.Raising	140.32	61.44	137.53	36.47	143.16	62.12	132.26	66.01
6.Interculturing	120.08	61.07	224.87	45.63	137.70	60.91	135.82	34.63
7.Plant Protection	125.39	65.06	138.39	37.07	125.39	65.06	129.89	71.34
8.Irrigation	132.26	66.00	204.88	41.70	149.27	62.68	159.05	33.04
9.Threshing	139.75	62.38	136.13	36.33	183.89	83.75	145.29	39.68
10.Harvesting	166.67	63.45	219.37	36.19	229.28	46.28	180.50	22.07

As seen from Table that the operation wise coefficient of variation of cotton cultivation for overall period in Akola district highest

Coefficient of variation 66.00percent has been observed in irrigation operation followed by plant protection 65.06percent, harvesting 63.45percent whereas lowest Coefficient of variation 60.91percent in case of fertilizer application was observed .

In Amravati district highest coefficient of variation 46.28percent has been observed for manuring followed by interculturing 45.63percent, irrigation 41.70percent whereas lowest Coefficient of variation 27.67percent in case of primary tillage was observed.

In Buldhana district the highest coefficient of variation 83.75percent has been observed in threshing operation followed by plant protection 65.06percent, irrigation 62.68percent whereas lowest Coefficient of variation 46.28percent in case of harvesting was observed.

In Yavatmal district the highest coefficient of variation 85.01percent has been observed in primary tillage operation followed by sowing 71.34percent, plant protection 71.34percent whereas lowest Coefficient of variation 22.07percent in case of harvesting was observed .

CHAPTER VI

SUMMARY AND CONCLUSIONS

Agriculture being the important sector of economy, in India it is well known that labour is the backbones of rural economy. The labour in agricultural field is mainly located in the rural area a private farms with a meagre possibility of continuous employment and assured wages. They are mostly employed and seasonal basis and paid at the mercy of land owner. Labour is one of the primary factors of production. It is considered to be important not only because it is productive but also because it activates other factors and makes them useful for production purposes. Agricultural labourers constitute the vital input in the agricultural production. Here this study is attempt to define labour input in terms of economic decision characterizing a process of resource allocation. The concept of labour input is measurable in real time units.

The study based on the secondary data collected from the Agricultural price and cost scheme which is held under the Department of Economics and Statistics Dr.P.D.K.V. Akola. The data pertain to the operation wise labour input, wage rates of the selected crops of 20 years for the period from 1990-91 to 2009-2010 were collected for five districts of Amravati division namely Amravati, Buldhana, Yavatmal, Akola including Washim.

The study entitled "Labour Input Behaviour of Selected Crops" was undertaken with the following objectives,

1) To study the growth of labour input in selected crop.
2) To study the share of labour changes in output price.
3) To study the wage behaviour.
4) To assess the changes in labour input.

The crops selected for the study were cotton, soybean. The data for 20 years i.e, from 1990-91 to 2009-2010 of these two crops were analysed to obtain compound growth rates of operation wise labour input , wage rates of selected crops namely Cotton and Soybean.

In order to study the growth of labour input in selected crops analyzed the compound growth rate of operation wise labour input by fitting

the exponential function. The compound growth rates were estimated in 1990-91 to 2009-2010 on the basis of period. In order to study the share of labour changes in output price has been worked out by the 2010 cost A and Cost C data. In this case calculated the percentage share of labour charges obtain for the cost A and cost C of all the operation on the year 2010. In order to study the wage behaviour analyzed the compound growth rate of operation wise labour wages by fitting the exponential function. The compound growth rates were estimated in 1990-91 to 2009-2010 on the basis of period. In order to study the changes in labour input randomly selected 3-4 operation of labour input and study performance through growth rate as like as 1st objective.

6.1 To study the growth of labour input in selected crop.

The growth analysis revealed that in Amravati Division during 1990-91 to 2009-10. In Amravati Division district wise studied the growth of labour input in sleeted crops. The study reveal that in Akola District during the overall period observed that in case of cotton the highest growth rate of labour utilization was in harvesting i.e, 4.3percent whereas the lowest growth rate of labour utilization was 0.2percent for irrigation increase per annum. In case of Soybean the highest growth rate of labour utilization was in harvesting i.e, 5.82percent whereas the lowest growth rate of labour utilization was 1.01percent for raising increase per annum.

In Amravati District during the overall period observed that in case of cotton the highest growth rate of labour utilization was in sowing i.e, 4.03percent whereas the lowest growth rate of labour utilization was 0.3percent for raising increase per annum. In case of Soybean the highest growth rate of labour utilization was in harvesting i.e, 6.82percent whereas the lowest growth rate of labour utilization was 1.7percent for plant protection increase per annum.

In Buldhana district during the overall period observed that in case of cotton the highest growth rate of labour utilization was in harvesting i.e, 4.16percent whereas the lowest growth rate of labour utilization was 0.8percent for interculturing increase per annum. In case of Soybean the highest growth rate of labour utilization was in harvesting i.e, 6.93percent

whereas the lowest growth rate of labour utilization was 0.4percent for plant protection increase per annum.

In Yavatmal district during the overall period observed that in case of cotton the highest growth rate of labour utilization was in sowing i.e, 3.76percent whereas the lowest growth rate of labour utilization was 0.5percent for raising increase per annum. In case of Soybean the highest growth rate of labour utilization was in harvesting i.e, 6.37percent whereas the lowest growth rate of labour utilization was 0.2percent for plant protection increase per annum.

6.2 To study the share of labour changes in output price.

Here, study the work percentage share of labour charges in cost A and cost C of year 2010 in Amravati division operation wise for the cultivation of Cotton and Soybean separately. The study reveal that in Akola District in case of Cotton the highest percentage share of labour charges in cost A was 4.5percent for manuring, cost C was 3.1percent for manuring was used and in case of soybean the highest percentage share of labour charges in cost A was 3.4percent for primary tillage, cost C was 2.4percent was used for primary tillage has been observed.

In Amravati District in case of Cotton the highest percentage share of labour charges in cost A was 5.4percent for harvesting, cost C was 3.8percent for harvesting was used and in case of Soybean the highest percentage share of labour charges in cost A was 5.2percent for primary tillage, cost C was 4.2percentwas used for harvesting has been observed.

In Buldhana District in case of Cotton the highest percentage share of labour charges in cost A was 5.8percent for harvesting, cost C was 3.6percent was used for harvesting and in case of Soybean the highest percentage share of labour charges in cost A was 3.4percent for primary tillage, cost C was 3.7percent was used for fertilizer application has been observed.

In Yavatmal District in case of Cotton the highest percentage share of labour charges in cost A was 4.8percent for harvesting, cost C was 3.7percent was used for harvesting and in case of Soybean the highest percentage share of labour charges in cost A was 3.8percent for

interculturing, cost C was 3.1percent was used for harvesting has been observed.

6.3 To study the wage behaviour.

The growth analysis revealed that in Amravati Division during 1990-91 to 2009-10. In Amravati Division district wise studied the growth of labour wages in sleeted crops. In Akola including Washim District during the overall period observed that in case of cotton the highest growth rate of labour wages was in harvesting i.e, 6.87percent whereas the lowest growth rate of labour wages was 1.6percent for irrigation increase per annum. In case of Soybean the highest growth rate of labour wages was in harvesting i.e, 7.34percent whereas the lowest growth rate of labour wages was 1.52percent for irrigation increase per annum.

In Amravati District during the overall period observed that in case of cotton the highest growth rate of labour wages was in sowing i.e, 5.78percent whereas the lowest growth rate of labour wages was 1.4percent for irrigation increase per annum. In case of Soybean the highest growth rate of labour wages was in harvesting i.e, 8.31percent whereas the lowest growth rate of labour wages was 1.4percent for irrigation increase per annum.

In Buldhana District during the overall period observed that in case of cotton the highest growth rate of labour wages was in harvesting i.e, 7.31percent whereas the lowest growth rate of labour wages was 1.2percent for threshing increase per annum. In case of Soybean the highest growth rate of labour wages was in harvesting i.e, 8.12percent whereas the lowest growth rate of labour wages was 1.56percent for irrigation increase per annum.

In Yavatmal District during the overall period observed that in case of cotton the highest growth rate of labour wages was in harvesting i.e, 7.26percent whereas the lowest growth rate of labour wages was 1.6percent for raising increase per annum. In case of Soybean the highest growth rate of labour wages was in harvesting i.e, 8.51percent whereas the lowest growth rate of labour wages was 1.87percent for irrigation increase per annum.

6.4 To assess the changes in labour input.

The growth analysis revealed that in Amravati Division during 1990-91 to 2009-10. In Amravati Division district wise studied the growth of labour input in sleeted crops. Here, In order to study the changes in labour input randomly selected 3-4 operation of labour input and study performance through growth rate as like as 1st objective.

Conclusions

From the present study following conclusions are drawn,

1. In Amravati Division observed that in case of cotton and soybean the highest growth rate of labour utilization was found in harvesting and sowing whereas the lowest growth rate of labour utilization was found in irrigation and raising operation.
2. The percentage share of labour charges in cost A and cost C for 2010 observed that in case of cotton and soybean the highest share in cost A and cost C was used for manuring, harvesting, threshing whereas the lowest percentage share of labour charges in cost A and cost C was used for raising, interculturing, plant protection.
3. In the growth rate of labour wages observed that in case of cotton and soybean the highest growth rate of labour wages was found in harvesting and sowing whereas the lowest growth rate of labour wages was found in irrigation and raising and plant protection operation.

Policy Implications

1. In agriculture, labourers need training to improve skill, knowledge about perfect way of labour input for crop cultivation. It helps to increase the production of crop which ultimately helps to develop the society.
2. Labourers need to get the proper market knowledge about wages which helps to get the proper idea about the wage of the work for earning proper wage rates of the work. So government should be build-up rate which helps to get proper wages.
3. The labourers are found to be involved in only specific crops and specific activities in agriculture. They are not involved in any mechanical operations due to their lack of skill and as a result they are not getting work for more number of days. So efforts should be made to impart training for labourers to handle agricultural implement and machineries. For this there is a need to organise the agricultural labourers and form a labour pool or labour bank at the village level. The farmers in the area the local authorities and the labourers together should work for this. Thus they can get higher wages and they will feel a status for their work.

CHAPTER VII

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