STUDY NO. 102

IMPACT STUDY OF SOIL TESTING ANALYSIS IN THE STATE OF MADHYA PRADESH

AGRO- ECONOMIC RESEARCH CENTRE FOR MADHYA PRADESH AND CHHATTISGARH
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.)

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PROJECT TEAM

Data collection

Dr. A. Shrivastava

Mr. N.P. Sharma

Dr. N. Khan

Mr. C.K. Mishra

Mr. S.K. Upadhye

Tabulation & Compilation of Data

Mr. Ravi Singh Chouhan

Mr. Hemant Kumar Niranjan

Interpretation and Report Writing

Dr. Hari Om Sharma

AGRO- ECONOMIC RESEARCH CENTRE FOR MADHYA PRADESH AND CHHATTISGARH

Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.)

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PREFACE

*The present study entitled "**IMPACT STUDY OF SOIL TESTING ANALYSIS IN THE STATE OF MADHYA PRADESH"** was conducted for 2 soil testing laboratories of Madhya Pradesh, The 100 farmers of Sagar and Dhar districts (50 in each districts) randomly selected for the investigation. It was observed from the study that the infrastructure available for soil testing in the state was found very poor. On an average one laboratory serves 66000 farmers and 51000 hectares of cultivated area. Out of the total respondents only 71 received their soil testing report, out of which only 49 (69%) adopted recommendations provided by Soil Testing laboratory. Although per hectare expenditure on seed, fertilizer and plant protection measures of adopted farmers increased for all crops after adopting soil testing analysis recommendation. Per hectare expenditure on labour was also found increased in all crops except in soybean. The cost of cultivation and cost of production of all the crops reduced drastically, while cost benefit ratio were found increased after adaption of recommendation of soil testing. The lack of knowledge about soil testing technology (70%), non-availability of soil testing report (62%), less co operation from officers of agriculture department (46%) and complicated method of testing soil sample (30%) were found the main constraints in adoption of soil testing recommendations. Thus, there is an ample scope for improvement the analyzing capacity as well as dissemination ability of the soil testing laboratories. If this, coupled with professional management through proper linkages, can bring radical changes in the soil testing service in the state to extent the farmers' satisfaction.*

I extend my heartfelt thanks to the technical (Dr. A. Shrivastava, Mr. N.P. Sharma and Dr. N. Khan,) supporting staff (Mr. C.K.. Mishra, Mr. S.K. Upaydhe, Hemant Kumar and Ravi Singh Chouhan) of AER- Centre, Jabalpur for collection, tabulation, analysis of data and drafting of report.

On behalf of the Centre, I express my deep sense of gratitude to Dr. V. S. Tomar , Hon'ble Vice-Chancellor, Dr. S.S. Tomar, Director Research Services and Dean, Faculty of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur for providing all facilities and help during various stages in successful completion of this study of high importance.

I express my sincere thanks to the Asstt. Soil testing Officer of Sagar & Dhar, and their field staff for providing not only secondary data but also extending help in collection of field data from the selected respondents .

All the Scientists and supporting staff members of Department of Agricultural Economics and Farm Management, JNKVV, Jabalpur deserved to be complemented for their untiring efforts in bringing this innovative study to its perfect shape.

I hope the findings and suggestions made in the study would be useful to policy makers of the states and Govt. of India.

Date : 10 /10 /2012

Place: Jabalpur

(N.K. Raghuwanshi)

Prof & Head

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CHAPTER-I

INTRODUCTION

An efficient use of fertilizers is a major factor in any programme designed to bring about an economic increase in agricultural production. The farmers involved in such a programme will have to use balance quantities of fertilizers to achieve the desired yield levels. However, the amounts and kinds of fertilizers required for the same crop vary from soil to soil, even field to field on the same soil. The use of fertilizers without first testing the soil is like taking medicine without first consulting a physician to find out what is needed. It is no doubts that the fertilizers increase yield and the farmers are aware of this. But are they applying right quantities of the right kind of fertilizers at the right time at the right place to ensure optimum profit? Without a proper fertilizer recommendation based upon a soil test, a farmer may be applying too much of a little needed plant food element and too little of another element which is actually the principal factor limiting plant growth. This not only means an uneconomical use of fertilizers, but in some cases crop yields actually may be reduced because of use of the wrong kinds or amounts, or improper use of fertilizers.

Soil testing is a chemical process by virtue of which requirement of nutrients for plant can be analyzed so as to sustain the soil fertility. The farmers find it extremely difficult to know the proper dose and type of fertilizer, which is suitable for his soil. While, using a fertilizer one must take into account the requirement of his crops and the characteristics of the soil.

The basic objective of the soil testing programme is to provide a service to farmers to better and more economic use of fertilizers and better soil management practices for increasing agricultural production in their farm. Higher production from high yielding varieties cannot be obtained without applying proper dose of fertilizers to overcome existing deficiencies of soils. Efficient use of fertilizers is a major factor in any programme designed to bring about an economical increase in agricultural production.

A fertilizers recommendation from a soil testing laboratories based on carefully conducted soil analysis and the results of up-to-date agronomic research on the crop, and it therefore is most scientific information available about fertilizing that is needed for a crop in a particular field. Each recommendation based on a soil test takes into account the values obtained by these accurate analysis, the research work so far conducted on the crop in the particular soil areas, and the management practices of the concerned farmer. The soil test with the resulting fertilizer recommendation is therefore the actual connecting link between agronomic research and its practical application to the farmers' fields. However, soil testing is not an end in itself. It is a means to an end. A farmer who follows only the soil test recommendations is not assured of a good crop. Good crop yields are the result of the application of fertilizer and good management skills, such as proper tillage, efficient water management, good quality seed, adequate, plant protection measures etc. Soil testing is essential and is the first step in obtaining high yields and maximum returns from the money invested in fertilizers.

Soil testing till today has been used mainly to formulate precise recommendations for the major nutrients i.e. Nitrogen, Phosphorus and Potassium fertilization of crops in different soils and to recommend appropriate doses of amendments for salt-affected and acidic soils. Micronutrients, comprising Zinc, Copper, Iron, Manganese, Boron and Chlorine, though required by plants in much smaller amounts, yet are as essential for them as the major nutrients. Despite that, little attention has been paid to employ the soil testing for assessing the micronutrient status of soils and determining soils requirement for micronutrient fertilizers for growing crops. With an objective to extent the advisory service to the farmers of the state regarding the nutrient problems of soils and crops and suggest appropriate remedial measures for efficient correction of the same. Jawaharlal Nehru Agriculture University Jabalpur and the Department of Agriculture Madhya Pradesh Bhopal have established soil testing laboratories for nutrient. Some private laboratories are also available in the state. Farmers are advised to make the best use of this service rendered by these laboratories.

Box 1.1 Basic Objectives of Soil Testing
1. *Classification of soils.* 2. *Evaluate and monitor soil fertility.* 3. *Identify salinity, alkalinity, acidity, etc., problems.* 4. *Assess the relative nutrient supplying power of soil.* 5. *Predict profitable responsiveness of soil to added fertilizers, lime, Gypsum and other amendments for optimum and economical crop production.*

There are more than 514 soil testing laboratories in India with a capacity of about 6.5 million samples per annum. In order to provide soil-testing facilities to all 106 million farm holdings in a reasonable period of time, the existing analyzing capacity of the soil testing program needs to be augmented almost 15-20 times. Madhya Pradesh is having presently 70 Soil Testing Laboratories and 4 Mobil laboratories to analyze approximately more then 4 lac sample per annum. The main objective of soil testing laboratory is to maintain the soil health by analyzing nutrient status of the soils and to give suggestions on the quantities of major nutrients like Nitrogen, Phosphorus, and Potassium to be applied to the soils. Micro Nutrient analysis is also important to know the status of Manganese, Boron, Zinc, and Iron etc., present in the soil and accordingly suggest supplemental application for better plant growth.

Success or failure of soil testing programmes largely depends on rapidity providing correct information to farmers, ability of the programme to provide service to a large group of farmers in a particular area, proper analysis and interpretation of results and recommendations that when followed are profitable for the farmer. Then only will this service be effectively utilized to improve local agricultural production Time and quality consciousness in the service is a real challenge for the analysts in the new millennium. This compels laboratory to adopt rapid, reliable, time saving procedures and methods to meet future requirements. The farmer's confidence in the programme can be established only by demonstrating that it actually provides a means of improving his profit. Looking to the importance of the soil testing in farmers' field this study had been conducted as the review of various studies reported that the recommendations of soil testing laboratories are useful for farmers for increasing their levels of output but the majority of the farmers has not been interested in this, due to lack of knowledge about soil testing facilities, testing of soils is incredible, laboratories are situated far away, and non availability of soil testing report etc.

1.2 Objectives

The present study was planed to focus the impact assessment of soil testing analysis in Sagar and Dhar districts of Madhya Pradesh with the following specific objectives:-

- To assess the soil testing infrastructure available across different agro-climatic regions / districts of Madhya Pradesh.
- To determine the growth of sample target, and achieved by soil testing laboratory.

- To identify the gaps in sample target, and achieved by Sagar and Dhar soil testing laboratories and recommendation adopted by the farmers.
- To evaluate the cost effectiveness of the soil testing analysis.
- To identify constraints in adoption soil testing technology by the farmers.
- To suggest ways and means for proper utilization of these soil testing laboratories.

1.3 Scope of the study

The study will be beneficial to farmer as study provided information to them that how the soil testing analysis will be benefited to them and how they got benefit from the analysis of soil. The study will also be beneficial to extension worker that it suggests how the constraint is adoption of soil testing technology will be remove and as it provide feed back to them that if they carefully tested the soil samples of the farmers. The report of these will help in increasing the yield of crops and ultimately the agriculture production will be enhanced manifold. The finding of the study will also provide feed back to scientists and policy makers as it suggested that how the analysis of soil samples will provide benefits to farmers and provide list of feed back to them for future planning.

1.4 Research Methodology

In Madhya Pradesh total numbers of laboratories are 70, out of which Soil Testing laboratory of Sagar & Dhar (M.P.) has been selected purposively for the study. The soil testing laboratory of Sagar district covers farmers of Sagar and Damoh districts and Soil testing laboratory situated at Dhar covers Dhar district.

These laboratories not only analyzing macro nutrient (N, P, K) and PH but also analyzes the micro nutrient {Fe, Cu, Mo, Zn, etc} and provides recommendation to the balance use of fertilizer to cultivators. The laboratory working under the direct control of the Joint Director Soil Testing, Department of Agriculture Madhya Pradesh, and Sub Divisional Agriculture Office, Senior Agriculture Development Officer, the Rural Agriculture Extension Officer (R.A.E.O.) helps in the collection of soil sample at field level and sent these samples to soil testing laboratory. He also provided soil testing report of the recipient farmers. The R.A.E.O.'s thought cultivators about the importance of soil testing and help them for assessed the soil fertility for financial loss can be avoided and to maintain the soil health. They also provide technical knowledge that how.

Both primary and secondary data collected for the study. The primary data were recorded on general information of farmers who tested there soil and adopted the recommendation of soil testing report, land use and cropping pattern, incremental cost and return obtained before and after adopting recommendation of soil testing, constraints in adoption of soil testing recommendation.

The secondary data were collected on infrastructure facility available in different agro climatic region in Madhya Pradesh, sample collected, analyzed and reported during the year 2001-02to 2010-2011 by the soil testing laboratory. Year 2001-02 and 2010-2011 were treated as base and current year respectively for analyzing of secondary data. The survey method was used for collection of the relevant data from selected cultivators by using pre-tested interview schedule. The investigator was briefly explained about the objectives of the study to each respondent and assured them that the supplied information is confidential and will be used only for research purpose.

The secondary data were also collected by personal visit in the office of Director of Agriculture and Joint Director of Agriculture, Soil Testing, Vindhyachal Bhavan, Bhopal and also from the published and unpublished record of Soil Testing laboratories of Dhar and Sagar districts.

A list of all the farmers who tested their soil sample in the year 2008- 09 has been collected from the respective soil testing laboratory and 50 farmers in each laboratory has been selected for the study. Thus, the total number of respondents were 100, (50 each from Sagar and Dhar districts) of Madhya Pradesh. Before and After technique has been followed to asses the impact of soil testing analysis. The year 2008- 09 was treated as before and 2009-10 as treated as after year respectively. The collected primary data are pertains the agriculture year 2010-11. While, the required secondary data are pertain to year from 2001-02 to 2010-11.

The analysis of the collected data was done on the basis of stated objectives. The impact analyses were done through before and after techniques. Year 2009-10 and 2010-11 were treated as the before and the after year respectively. While, the growth of sample targeted and achieved and absolute change analyzed with the help of secondary data. In this triennium average ending year 2003-04 was treated as base and triennium average ending 2010-11 was treated as Current year. The data were classified with two groups, i.e. before and after adoption of soil testing technology by the respondents. Tabulation of the data was done in simple two way table. The analysis of the data was done by using the mean and percentage.

The following are the concepts and term that used in the analysis of the data and to full fill the result in the study.

Arithmetic mean

The average was worked out by using the arithmetic mean of selected crop for their area, production and productivity during the study period.

$$\textbf{Mean } (\bar{X}) = \frac{\sum X}{N}$$

Where;

$\bar{X}$ = Average of different factors

$\sum X$ = Summation of different factors

N = Number of observation

Absolute change

Absolute change in soil samples target and achieve through triennium average of base and current year are workout by the formula given below

$$\textbf{Absolute change} = y_n - y_0$$

Where;

y =Variate; soil samples achieved average of the last three years 2005-06 to 2007-08.

o=Average of the beginning (Base) three years 1993-94 to 1995-96 of concerned variable.

Relative change

Relative change method was used for estimating the percentage change.

$$\textbf{Relative change} = \frac{y_n - y_o}{y_o} \times 100$$

y_n and y_o refer to same as expressed in absolute change.

Simple growth

To reveal the behavior of selected variables (target and achievement of soil sample) in the District over time, regression analysis was carried out. The following form of linear production function was fitted by least square technique to estimate the trend and growth rate of the selected variables for the study period (2001-02- 2010-11).

Linear equation y = a+bx

Where;

Y= dependent variable

a= constant

b= regression coefficient (Rate of change)

x= independent variable (years)

$$\textbf{Simple growth rate (SGR)} = \frac{b}{\bar{y}} \times 100$$

Gross income

Gross income is the total value of main product and by product from the yield.

Cost benefit ratio

It is the ratio of gross income and total cost on the cultivation

$$\textbf{Cost benefit ratio} = \frac{\textbf{Gross income}}{\textbf{Total cost}}$$

Cost of cultivation

Both operational and fixed cost was worked out to estimate the cost of cultivation.

Cost of production

It is the ratio of total cost incurred on production and physical output obtained on sample farms.

$$\textbf{Cost of production} = \frac{\textbf{Total cost – value of by product}}{\textbf{Main product}}$$

Variable cost

These cost are related is the out lays on variable input that are used up during the production process. Since these costs are the function of output on labour, inputs, interest on working capital and depreciation.

Labour cost

It is the total cost of human labour, bullock labour and machine labour used in cultivation.

Human labour

It is the casual hired labour evaluated by the actual amount paid in cash or kind. Family labour it evaluated on the basis of prevailing wage rate in the villages in the reference year.

Bullock labour

It is the hired bullock labour evaluated by the actual amount paid in cash or kind .In the case of owned bullock labour , the valuation is done on the basis of prevailing wage in the reference year.

Machine labour

The hired machine labour evaluated according to actual amount paid in cash or kind. In the case of owned machine labour the valuation is done on the basis of prevailing wage in the reference year.

Input

Input is the most important variable in the production of crops. These are the main inputs found in the study who used by the cultivators**.**

Value of seed

It is evaluated on the basis of market price for owned seed and actual value for the purchased seed as cost of seed.

Value of farm yard manure and fertilizer

Fertilizer and FYM have been valued according to market price. The farm produced FYM are evaluated on the basis of prevailing price in the village in the reference year.

Value of insecticides and pesticides

It is evaluated at village market price in the reference year.

Interest on working capital

It is evaluated at 10 per cent for on working capital for crop season only.

Depreciation

The reduction in value of an asset through wear and tear, and calculated 3.33 per cent for on total assets for a single crop assuming 10% per annum for whole farm.

Fixed cost

These cost refer to the value of services from fixed response and as such are over fixed costs since they are not the function of output. They are the same at all level of production, rent, interest depreciation constitute fix cost.

Interest on fixed capital

It is worked out @ 10 per cent per annum on the value of fixed assets (excluding land), viz. implements, machine farm buildings, irrigation structure and drought animals etc. it is calculated in proportion to the area under the crop.

Rental value of owned land

It is calculated at 15 per cent of gross income of the crop on owned land.

Land revenue

Cess and other taxes are calculated at the rate a dually paid, on the basis of proportion to the area under the crop.

1.5 Review of Literature

Resuming of research study is very essential for any research. The main objective of the resuming of literature is to determine what work {both theoretically and practically} have been done in the past, which could assist in delineation of problematic areas, provide a basis for conceptual frame work method and procedure used and suggest operational definitions for major concept to help in interpretation of finding. The resume of research study provides guidelines to an investigator, making his work more precise through the use of review of literature. A very little work had been done in the past related to this study. Hence, some of the important available literatures related to the present study are reviewed in the following section.

Anonymous (2000) discusses the current use of soil tests to predict the probability of crop response to application of fertilizers, and considers their possible use to determine if application of fertilizers and/or waste material will result in the pollution of surface and groundwater. It is suggested that using soil testing to identify the potential for an environmental impact may have value, but only if a comprehensive approach is taken.

Biswas (2002) observed that the soil testing is proven scientific tools to evaluate soil fertility for recommending balanced nutrition to crops. However, the soil testing programme in India has failed to create the desirable impact on the farming community due to extremely poor coverage and delay in timely dissemination of fertilizers recommendation to farmers. While creation of required infrastructural facilities involves huge burden on Government exchequer, application of space age technology has given ample scope to improve the analyzing capacity as well as dissemination ability of the soil testing laboratories. This, coupled with professional management through proper linkages can bring radical changes in the soil testing service in the country to the extent of consumer satisfaction.

Sharma, *et. al* (2005) reported that only 13 % of soybean growers were tested their soil for application of balance dose of fertilizer. Majority of them were not tested there soil due to lake of knowledge (70.20%), soil testing was incredible (27.34%), soil testing laboratories situated far away (12.24%), non availability of soil testing report (11.02%) and complicated method of taking soil samples(8.97%).

Reid (2006) observed that soil testing plays an important role in crop production and nutrient management. On farms that use commercial fertilizer as the main nutrient source, it is the best way to plan for profitable fertilizer applications. On livestock farms, knowing how much nutrient is present in the soil to start with is critical. Only then can a nutrient management plan be developed to properly manage both the nutrients that have been generated on-farm and any nutrients that are being imported to the property as bio solids or commercial fertilizer. Soil testing is really a three-step process, the collection of a representative sample from each field or section, proper analysis of that sample to determine the levels of available nutrients, and use of the results to determine optimum fertilizer rates. Keeping records is an integral part of the soil-testing process; they will help determine if soil test levels are increasing, decreasing or being maintained over time.

Hence, it is clear from above reviews that vary little work done in this particular aspect however these laboratories were found to be work from a long time period of time. Soil testing is a proven scientific tool to evaluate soil fertility and plays an important role in crop production and nutrient management. (Reid, 2006). However, the soil testing programme in India has failed to create the desirable impact on the farming community due to extremely poor coverage and delay in timely dissemination of fertilizers recommendation to farmers (Biswas, 2002). Only 13 % of soybean growers were tested their soil for application of balance dose of fertilizer (Sharma et.al 2005).

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CHAPTER-II

BACK GROUND OF THE STUDY AREA

This chapter deals with the background of the selected area for the study. Sagar and Dhar districts were selected to investigate the problem. Brief description of these districts is given in this chapter.

2.1 Sagar

The origin of the name comes from the Hindi word SAGAR meaning lake or sea, apparently because of the large and once beautiful lake around which the town of Sagar has been built. Sagar was founded by Udan Singh in 1660 and was constituted a municipality in 1867. A major road and agricultural trade centre, it has industries such as oil and flour milling, saw-milling, ghee processing, handloom cotton weaving, bidi manufacture and railway and engineering works. It is known in all over India due to its University named as Dr. Harising Gaur University and Army cantonment and recently. It has come into lime due to “Bhagyodyay Tirth” a charitable hospital named after a jain sant Shri Vidya Sagarji Maharaj. It is known for Police Training College in Madhya Pradesh. Head quarter of Forensic Science Lab is also in Sagar.

The history of the town of Sagar dates back 1680.A.D. When Udan Shah, a descendant of Nihal shah, built a small fort on the site of the present one, and founded a village close to it called Parkota which is now part of town. The present fort and a settlement under its walls was founded by Govind Rao Pandit, an officer of the Peshwa who held charge of Sagar and the surrounding territory after 1735 A.D. when it came under the Peshwas’s possession.

In 1818 A.D., the greater part of the district was ceded by the Peswa Baji Rao II to the British Government, while different parts of the rest of the present district of Sagar came in the possession of the British at different times between 1818 and 1860. The Dhamoni pargana of Banda tahsil was ceded in 1818 A.D. by Appai Bhonsla. The Bhera pargana of Banda tahsil was acquired by transfer from the Bundelkhand States in 1818 A.D. The parganas, Rahatgarh in Sagar tahsil and Garhakota, Deori, Gourjhamer and Naharmow in Rehli tahsil collectly known as Punch Mahal were originally made over to British by Sindhiya at different dates from 1820 to 1825 for management. The Shahgarh pargana of Banda tahsil was confiscated in 1857 in consequence of the rebellion of the chief. The Kanjia pargana of Khurai tahsil was acquired from Sindhia by a treaty in 1860 A.D. A small area in the north-east corner of the tahsil around the village of Hirapur was similarly transferred to the British from the Charkhari State to Bundelkhand and added to the district after the uprising of 1857.

2.1.1 Location

Sagar is situated between 23º 10′ and 24º 37′ north latitude and 78º 04′ and 79º 21′ East latitude. It is surrounded by district of Narsinghpur, Raisen, Vidisa, Tikamgarh, Chhatarpur, Damoh and part of U.P. (Fig.1) it is about 551 ft. above the main sea level. It has geographical area of 10.23 lakhs. The habited villages are 1894. Forest villages 16, un-habited villages are 195. The district has 9 tehsils, 11 blocks, 6 revenue sub division 760 Gram Panchayats. (Table 2.1) The total area of the district is 10,252 sq.Km. which contains the 2.35% of the State's area.

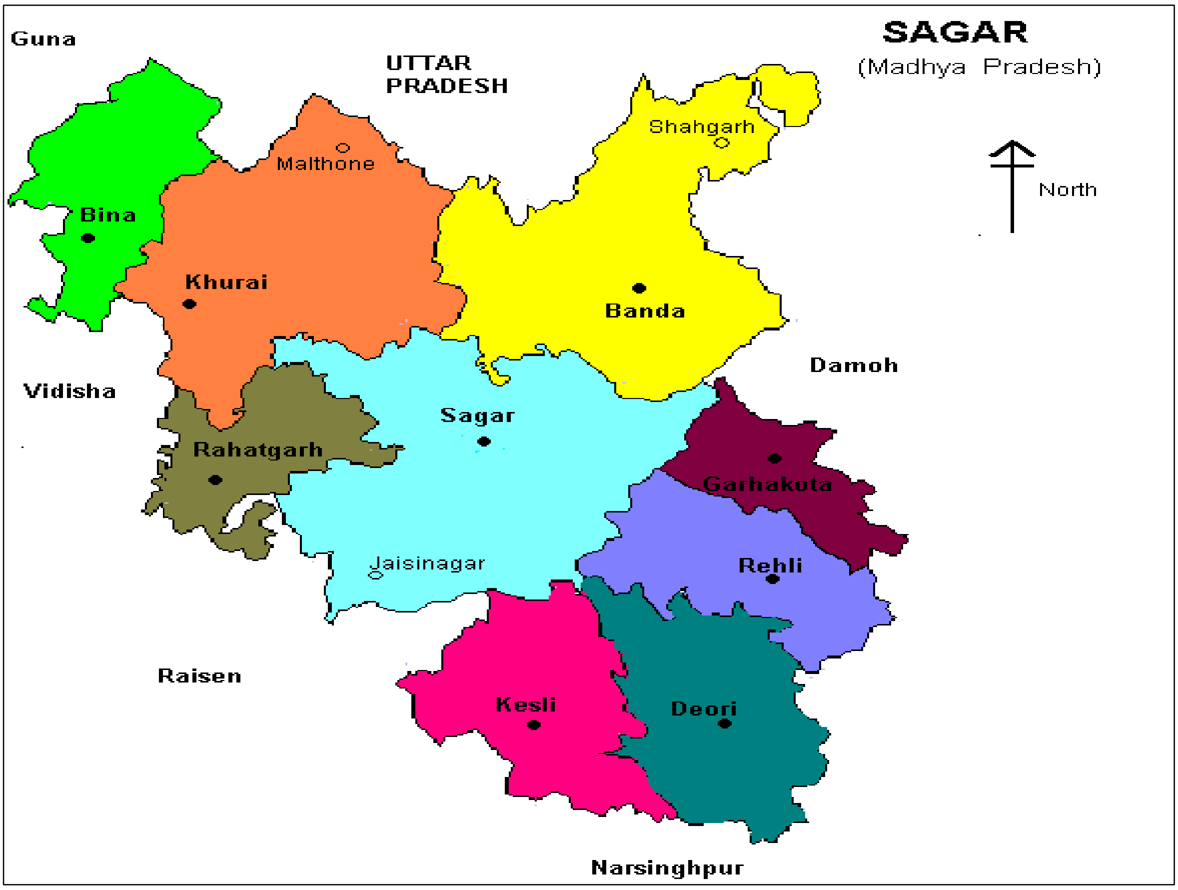

Fig. 2.1: Sagar District of Madhya Pradesh

2.1.2 Administrative Setup

The division and district head quarter of Sagar is Sagar. This district has been divided into nine tehsil namely Sagar, Rahatgadh, Khurai, Bina, Rahli, Gadhakota, Devri, Kesli and Banda. It has eleven blocks viz., Sagar, Jaisinaar, Rahatgarh, Devri, Kesli Shahgarh and Banda. The administrative Setup of Sagar district is given in table 2.1. From state capital Bhopal, this district has direct road and rail connections. Its distance from Bhopal, by road is 140 km.

Table 2.1: Administrative Setup of Sagar.

S.No.	Particulars	Numbers
1	District HQ	Sagar
2	Division	Sagar
3	Tahsil	9
4	Blocks	11
5	Zila Pandhyat	1
6	Nagar Nigam	1
7	Nagar Palika	5
8	Nagar Panchyat	4
9	Gram Panchayat	760
10	Area (in Sq.Km.)	1025
11	Revenue Villages	2089

Source: District Website, Sagar

2.1.3 Population

In the present case, according to 2011 census, Sagar district has a total population of 2,378,295 out of which 1,254,251 are male and remaining 1,124,044 female. A brief detail of population in the district given below. (Table 2.2)

Table 2.2: Population Profile of Sagar.

S. No.	Particulars	Population	Percentage
1	Total Population	2,378,295	100
	Male	1,254,251	52.74
	Female	1,124,044	47.26
2	Urban Population	708,949	29.81
3	Rural Population	1,669,346	70.19
4	Total Household	376,379	15.83
5	Working Population	819763	34.47
6	Male Female Ratio	896	--

Source: District Website, Sagar

The highest area in Sagar district is under Kesli block followed by Rehli, Khurai, Shahgarh (Table 2.3) and maximum number of revenue villages also present in Kesli block followed by Deori, Banda and Jaisinghnagar. The table also reveled that in the total 760 Gram Panchayat of Sagar district maximum number of Gram Panchayat present in Rehli block (91) followed by Sagar (86), Rahatgarh (81) and Banda (78).

Table 2.3: Demographic detail of different Blocks.

Block	No. of Revenue Village	Area (Ha.)	No. of Gram Panchayat
Sagar	188	91358	86
Jaisinagar	194	83981	62
Rahatgarh	177	67620	81
Bina	127	82076	64
Khurai	179	101849	63
Malthon	149	84644	62
Banda	211	94469	78
Shahgarh	170	96576	47
Rehli	179	111693	91
Deori	247	86713	70
Kesli	254	121780	56
Total	**2075**	**1022759**	**760**

Source: District Profile, District Planning and Statistics Department, Sagar.

2.1.4 Literacy

The district literacy is presently 68.08%, which is above the state literacy rate of 64.11%. The district has recorded a good growth in literacy level. The district has also achieved a commendable growth in the literacy level of both male and female population. A summary of the literacy status of the district is given in the table below.

Table 2.4: Literacy Rate of Sagar.

	Literacy rate 2001			Literacy rate 2011			% Change Increased		
	National	**M.P.**	**Sagar**	**National**	**M.P.**	**Sagar**	**National**	**M.P.**	**Sagar**
Male	65.38	76.8	79.96	82.00	80.00	86.27	16.62	3.2	6.31
Female	54.16	50.28	54.50	65.5	60.00	67.71	11.34	9.72	13.21
Total	**65.38**	**64.11**	**68.08**	**74.00**	**70.60**	**77.52**	**8.62**	**6.49**	**9.44**

Source: District Profile, District Planning and Statistics Department, Sagar

2.1.5 Soils

The dominant soils capes of the area represented by gently to very gently sloping, shallow and moderately deep, ustorthents and ustochrepts, respectively grading to nearly level, deep chromusterts. The soil of the district fall in dry sub-humid region, the dominant soils capes of the area are represented by gentle to very gentle slope, shallow and moderately deep with the moisture index ranging from (-) 03 to (-) 22. Nutrient availability and their retention lead to better response to fertilization. The surface of the soil crack during dry period and the subsurface shows shining pressure faces of the pads indicating moderate to high shrink swell potential. The clay content ranges between 63 to 65% abruptly decreasing to 54% in the sub soil region. These are highly saturated soils and the exchange complex is dominantly saturated by divalent while the montmorillonite constitute the dominate clay material in the exchange complex. Different type of soils found in different parts of the district, light black soils, light Red and thick red soils with core sand are the predominant soil types available in the district.

2.1.6 Agro-Climate

The agro-climate of the sub region is characterized by hot dry sub humid with dry summers and mild winters. The mean annual temperature varies from minimum 24-25ºC to a maximum of 42ºC in the hottest month of May. The mean winter (December-January- February) temperature ranges from 18-19ºC dropping to a minimum 6 to 8ºC in the coldest month of January. The sub region receives a mean annual rainfall of 1000 to 1500 mm which covers more than 72% of the mean annual PET demand ranging between 1400 to 1600 mm. The average rainfall of the region is 1327.5 mm. The peak period of rainfall intensity occurs in July, August and September months.

Table 2.5: Blocks under different Agro-Climatic Situations.

Agro-climatic zone	Blocks Covered	Area in '000 ha.	% of Geo-Graphical area	Soil type
Vindhya Plateau	Malthan, Banda, Sagar	267906	26.19	Medium black soil, dark brown to yellowish
	Sagar, Rahatgarh, Jaisingnagar	275689	26.96	Medium black deep soil, dark grayish th clay loam.
	Bina, Khurai	158978	15.54	Deep black soil, clay & clay loam, Dark yellowish.
	Rehli, Kesli, Deori	320186	31.31	Medium black, very deep to shallow dark grayish brown

The rainfall ceases in October whereas moisture availability continues till November. As such, the LGP of the region varies from 150-180 days starting from middle of June and ending in 3rd week of November. Sometimes rainfall is delayed till the last week of June or first week of July and unseasonal rains in January facilitating good crop harvest on residual moisture. The moisture index varies from -3 to -2 suggesting the prevalence of dry sub humid condition of the area. The MAST greater than 22ºC and the difference between MSST and MWST exceeding 5ºC suggest the hypothermic soil temperature regime in the area. The district is divided into two Agro Climatic Zone. The maximum area of the district covers under Vindhya Plateau zone (Table 2.5). There is uncertainty in the rainfall and vary year to year. Data in table 2.6

shows the variation of rainfall (800 mm to 1400 mm) in the different block of district in last 04 years.

Table 2.6: Rainfall Data of different Blocks (m.m.)

Block	2006-07	2007-08	2008-09	2009
Sagar	1089.9	606	1163.8	885.5
Rahatgarh	1180.4	658	1183.4	805
Bina	932.8	734.4	1287	565.2
Khurai	1024.0	905	1303.2	671.2
Malthon	921.4	703.7	1230.5	668.4
Banda	586.6	484	1215.5	587
Shahgarh	923.0	571	1670	540
Jaisinagar	651.5	789	1072.3	888.8
Rehli	823.0	684.3	1118	1056.2
Deori	1514.0	986	846.5	753.5
Kesli	1065.2	852.2	727.6	672.8

Source : District statistical data

2.1.7 Agriculture

Agriculture is the main occupation of people in the district. About 439950 (52%) of the working populations are engaged in crop growing activities. Agricultural activities are carried out in two seasons namely rainy season (Kharif) and winter seasons (Rabi). soybean, urd, paddy, maize pigeon pea, and are the major crops in Kharif while, wheat and chick pea are the major crops in Rabi in the district.

2.1.8 Land Utilization

Out of 1022759 ha of land, the net sown area is around 52%, forest 29%, fallow 2.23% and 8% land under other uses.

Table 2.7: Land Use Pattern of Sagar (ha.)

Particulars	Sagar		Madhya Pradesh
	Area	(%)	(%)
Total	1022759	100	100
Forest	298,010	29.14	27.93
Net Sown Area	537,423	52.55	49.01
Fallow	22,808	2.23	3.85
Area not suitable for cultivation	81,413	7.96	10.23
Pasture Land	0	0	0
Others Lands	83,105	8.13	4.42

Source: PLP, NABARD, 2009-10

The percentage area of net sown to the total cultivable area is 95.53% which is much higher than state average. Khurai, Rehli, Rahatgarh and Sagar have maximum net sown area. Deori, Shagarh and Banda have maximum forest area compared to other blocks. Table 2.7 provides the information about comparison with the state figure of land use. Its shows that Sagar is richer in land use pattern of forest and net sown area.

2.1.9 Cropping pattern

Sagar is known as Soybean district where the crop was grown to on an area of 202.91 thousand hectares.

Table 2.8: Cropping Pattern in Sagar District

S.N.	Crops	Area (000 hac)	% to GCA
1.	Paddy	8.37	1.14
2.	Jowar	3.70	0.50
3.	Maize	3.81	0.52
4.	Arhar	3.24	0.44
5.	Soybean	202.91	27.56
6.	Wheat	163.69	22.23
7.	Gram	198.65	26.98
8.	Total cereals	182.20	24.75
9	Total pulses	304.82	41.40
10.	Total foodgrain	487.02	66.14
11.	Total oilseed	212.55	28.87
12	Total gross cropped area (GCA)	736.31	100

In Rabi season wheat was the most important crop which covered 163.69 thousand hectares area. The gram crop was also one of the important Rabi season crop covered 198.65 thousand hectares area in the district (Table 2.8).

2.2 Dhar

Dhar District has occupied an important place thought it's epoch-ancient, mediaeval and morden. Dhar, known as Dhar Nagari in ancient period and Piran Dhar in mediaeval period, has had the privilege of being of the capital city, both in the ancient and in the early mediaeval periods.

The Paramaras ruled over a vast territory around Malwa for 400 years from the 9th to the 13th centuries. Vakpati Munja and Bhojadeva were the most famous rurlers of this dynasty. Munja was a great general, a poet of repute and a great patron of art and literature. His court was adorned by poets like Dhananjaya, Halayudha, Dhanika, Padma gupta, the author of Navasahasankacharita, Amitagati, etc. He excavated the Munja Sagar at Dhar and Mandu and built beautiful temples at a number of places.

Bhojadeva, the most illustrious of the Parmaras, was one of the greatest kings of ancient India. His name became a household word in India not only as a soldier but also as a builder, a scholar and a writer. Authorship of a large number of books on a variety of subjects like grammar, astronomy, poetics, architecture and asceticism is ascribed to him. He shifted his capital from Ujjain to Dhar, where the established a university for Sanskrit studies. It is known as the Bhoja Shala in which was enshrined the image of Goddes Saraswati. He rebuilt temples, including the magnificent temple at Bhojapur. Bhoja also created a large lake near Bhojapur.

2.2.1 Location

Dhar is located in the Malwa region of western Madhya Pradesh state in central India situated between 74º28′ to 75º42′ east latitude and 22º 36′to 23º 10′ North latitude. It is the administrative headquarters of Dhar District. The town is located 33 miles (53 km) west of Mhow, 908 ft (277 m) above sea level. It is picturesquely situated among lakes and trees surrounded by barren hills, and possesses, besides its old ramparts, many interesting buildings, both Hindu and Muslim, some of them containing records of cultural and historical importance.

2.2.2 Population

In 2011, Dhar had population of 2,184,672 of which male and female were 1,114,267 and 1,070,405 respectively. In 2001 census, Dhar had a population of 1,740,329 of which males were 890,416 and remaining 849,913 were females. There was change of 20.33 percent in the population compared to population as per 2001.

Table 2.9: Population Profile of Dhar.

S. No.	Particulars	Population
1	Total Population	2,184,672
	Male	1,114,267
	Female	1,070,405
2	Urban Population	413,115
3	Rural Population	1,771,557
4	Total Household	515,712
5	Male Female Ratio	961

2.2.3 Administrative Setup

The district head quarter of Dhar is Dhar and division is Indore. (Fig.2) Dhar district has 5 tahsils including Dhar itself, namely Badnawar, Sardarpur, Dhar, Dharampuri and Manawar. This district has been divided into thirteen blocks namely Dhar, Tirla, Nalcha, Badnavar, Sardarpur, Manavar, Umarban, Dharampuri, Nisarpur, Kuksi, Bagh, Dahi, Gandhwani. The administrative Setup of Dhar district is given in table 2.10.

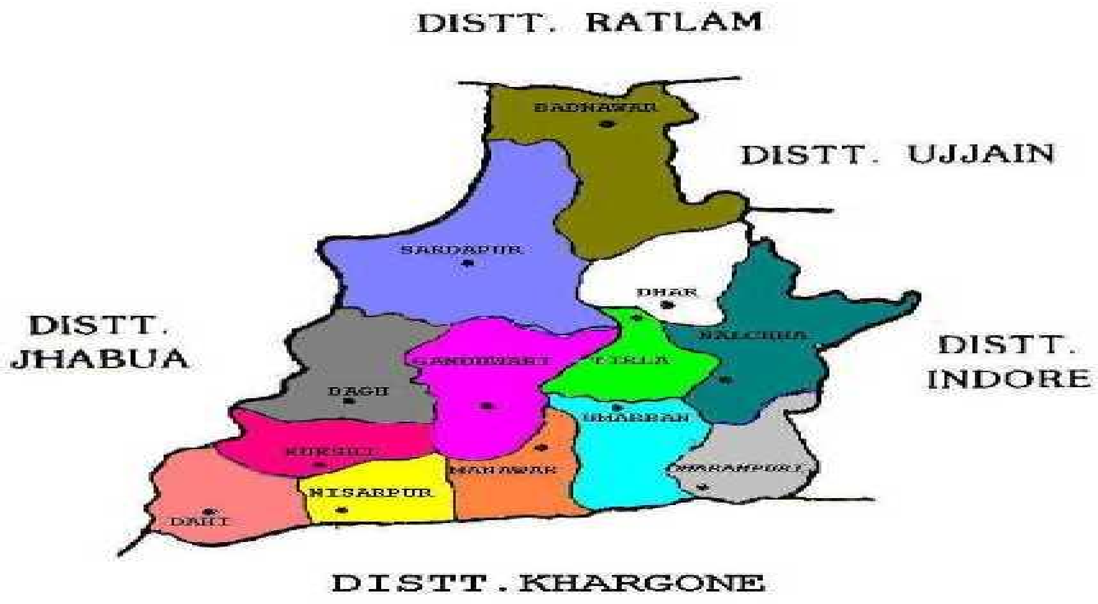

Fig. 2.2: Dhar District of Madhya Pradesh

Table 2.10: Administrative Setup of Dhar.

S.No.	Particulars	Numbers
1	District HQ	Dhar
2	Division	Indore
3	Tahsil	7
4	Blocks	13
5	Zila Pandhyat	1
6	Nagar Nigam	0
7	Nagar Palika	3
8	Nagar Panchyat	13
9	Gram Panchayat	678
10	Area (in Sq.Km.)	8153
11	Revenue Villages	1579

Table 2.11: Demographic detail of different Blocks.

Blocks	No. of Revenue Village	Area (Ha.)	No. of Gram Panchayat
Dhar	99	579	52
Tirla	140	534	52
Nalcha	180	784	67
Badnavar	165	1038	89
Kuksi	47	343	37
Bagh	89	521	48
Nisarpur	60	353	34
Dahi	62	482	46
Manavar	99	555	64
Umarban	99	479	61
Gandhwani	144	736	66
Sardarpur	190	1280	95
Dharampuri	100	429	51
Total	**1474**	**8153**	**762**

Source: District Profile, District Planning and Statistics Department, Dhar.

2.2.4 Literacy

Average literacy rate of Dhar in 2011 were 60.57 compared to 52.45 of 2001. If things are looked out at gender wise, male and female literacy were 71.12 and 49.69 respectively. For 2001 census, same figures stood at 65.75 and 38.57 in Dhar District. Total literate in Dhar District were 1,111,637 of which male and female were 662,619 and 449,018 respectively.

Table 2.12: Literacy Rate of Dhar.

	Literacy rate 2001			Literacy rate 2011			% Change Increased		
	National	M.P.	Dhar	National	M.P.	Dhar	National	M.P.	Dhar
Male	65.38	76.8	65.75	82.00	80.00	71.01	16.62	3.2	5.26
Female	54.16	50.28	38.57	65.57	60.00	49.07	11.41	9.72	10.5
Total	65.38	64.11	52.45	74.00	70.60	60.66	8.62	6.49	8.21

Source: District Profile, District Planning and Statistics Department, Dhar.

2.2.5 Soils

The nature & characteristics of soils is dependent primarily on relief of the area which influences the variation in soil formation. The soils of Dhar districts are classified on deep and medium black soils under the broad classification of soil of India & are fertile soils. There are alluvial deposits constituting gravel sand; silt or clay sized unconsolidated alluvium found along the narrow strips of rivers. Most of the areas are covered with black cotton soil of varying thickness, mostly adapted for cultivation.

2.2.6 Agro-Climate

Dhar district has been classified as transitional ecosystem of moist semi-arid and dry sub humid climate. It receives an average rainfall of 833.1 mm. The mean annual rainfall covers 60% of total Potential Evapotranspiration demand. The south west monsoonal rainfall which is key to success of rain fed farming of the district covers 90% of total rainfall.

Table 2.13: Blocks under different Agro-Ecological Situations.

Agro-Climatic Zone	Blocks Covered	Area in '000 ha.	% of Geo-Graphical Area	Soil Type
Malwa Plateau	Dhar, Tirla, Nalcha, Badnavar, Sardarpur	425275	51.87	Medium black shallow soil
Nimar Valley	Manavar, Umarban, Dharampuri, Nisarpur	184358	22.01	Deep black soil
Jhabua Hills	Kuksi, Bagh, Dahi, Gandhwani	209908	25.97	Medium black soil, Deep black soil

The district receives surplus rainfall during August and September while remaining period the soil moisture control section remains partly dry requiring irrigation for achieving potential production. The region experiences hot summer and mild winter, mean annual temperature varying from 18 to 22ºC. The Vindhya Range runs east and west through the district. The northern part of the district lies on the Malwa plateau. The north western portion of the district lies in the watershed of the Mahi River and its tributaries, while the northeastern part of the district lies in the watershed of the Chambal River, which drains into the Ganges via the Yamuna River. The portion of the district south of the ridge of the Vindhya lies in the watershed of the Narmada River, which forms the southern boundary of the district.

Table 2.14: Rainfall Data of different Blocks. (m.m.)

Blocks	2006	2007	2008	2009	2010
Dhar	1102.6	1393	680	699.6	1068.9
Tirla	1092.8	1064.4	601.5	689.4	990.8
Nalcha	1206.4	1252.2	650.9	820	818
Badnavar	1554.8	1034.6	824	652.8	598.4
Kuksi	967.6	940	639.2	593.4	641.2
Bagh	1187	1155	588	593	723
Nisarpur	--	--	--	--	--
Dahi	1194	1016	719	596	556
Manavar	1050	1117	778	688	710
Umarban	--	--	--	--	--
Gandhwani	1171	1220	585	679	830
Sardarpur	1288	906	620	655.3	720
Dharampuri	696	507	446	380	754
Dhar District	**1137.3**	**1055**	**648.3**	**640.6**	**764.9**

The normal maximum temperature received during the month of May is 41.8^0 C and minimum during the month of January 11.2^0C. The normal annual means maximum and minimum temperature of Dhar district is 34^0C & 19.5^0C respectively. The climate of Dhar district, MP characterized by hot summer and general dryness except during the south west monsoon season. The year may divide into four seasons. The cold season, December to February is followed by the hot season from March to about the middle of June. The period from the middle of June to September is the south west monsoon season. October and November form the post monsoon or transition period.

The district extends over three Agro Climatic Divisions. They are the Malwa in the north, the Vindhyachal range in central zone and the Narmada valley along the southern boundary. However, the valley is again closed up by the hills in the south-western part. The maximum area of the district covers under Malwa Plateau zone (Table 2.13). There is uncertainty in the rainfall and vary year to year. Data in table 2.14 shows the variation of rainfall (700 mm to 1500 mm) in the district in last 4 years.

2.2.7 Agriculture

Agriculture is the main occupation of people in the district. The area of the district which mostly covers the old disjointed parts of the former state of Dhar presents, in its lower parts, a phenomenon of rising lands from the Narmada valley into rugged and broken hills and valleys with water courses and soil that is too rich. The rest of it is an open and undulating plateau with the soil being black and of high fertility. The principal agriculture seasons are Kharif, the autumn or rain harvest and Rabi the spring or cold water harvest. The more important among the crops of the district include, jowar, makka, or maize, bajara, rice (known locally as sal), kodon (also known as bhadli), tuar, mung and urad, tilli or sesamum and remeli, kapas or cotton and tobacco, all grown in Kharif. While gehun or wheat, chana or gram, jau or barley, masur or lentil. tiwada and batla, alsi or linseed and sarson or mustard and sugarcane are all Rabi crops.

In Dhar district, poor soil quality and unavailability of a permanent source of irrigation are major factors hindering agricultural growth. According to Soil Resource Atlas-Dhar, about 70% of the district is under moderate erosion and severe to very severe erosion (30 %) area and more then 50% of the area of the district soil has low to medium organic carbon status. About 50% area of the district has very low to low available water holding capacity. Poor soil quality and absence of suitable technology for irrigation together used to force local tribal to migrate to other areas in search of livelihood.

2.2.8 Land Utilization

Out of 1022759 Ha of land, the net sown area is around 52%, forest 29%, fallow 2.23% and 8% land under other uses. The percentage area of net sown to the total cultivable area is 95.53% which is much higher than state average. Khurai, Rehli, Rahatgarh and Sagar have maximum net sown area. Deori, Shagarh and Banda have maximum forest area compared to other blocks. Table 2.15 provides the information about comparison with the state figure of land use. Its shows that Sagar is richer in land use pattern of forest and net sown area.

Table 2.15: Land Use Pattern of Dhar. (ha.)

Particulars	Dhar		Madhya Pradesh
	Area	(%)	(%)
Total	815300.00	100.00	100.00
Forest	120623.00	14.79	27.93
Net Sown Area	504454.00	61.87	49.01
Fallow	4965.00	0.61	3.85
Area not suitable for cultivation	14641.00	1.80	10.23
Pasture Land	47108.00	5.78	0.00
Others Lands	123509.00	15.15	4.42

2.2.9 Cropping pattern

Dhar is known as soybean district where the crop was grown to on an area of 247.27 thousand hectares. In Rabi season wheat was the most important crop which covered 188.42 thousand hectares area.

Table 2.16: Cropping Pattern in Dhar District. (000 ha.)

S.N.	Crops	Area	Percentage to GCA
1.	Paddy	1.80	0.24
2.	Jowar	17.7	2.38
3.	Maize	61.9	8.32
4.	Arhar	0.34	0.05
5.	Soybean	247.27	33.24
6.	Wheat	188.42	25.33
7.	Gram	41.82	5.62
8.	Total cereals	275.36	37.02
9	Total pulses	66.30	8.91
10.	Total food grain	341.66	45.93
11.	Total oilseed	252.34	33.92
12	Total gross cropped area (GCA)	743.86	100

Source: District Profile, District Planning and Statistics Department, Dhar.

The maize and gram crop was also one of the important Kharif and Rabi season respectively covered 61.9 thousand hectares and 41.82 thousand hectares area in the district (Table 2.16).

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CHAPTER-III

RESULTS AND DISCUSSION

This chapter deal with the results of findings obtained from selected farmers and discussion with the state department officials. The chapter divided in to follow sub section.

1. Soil testing infrastructure.
2. Growth and gap of sample target and achievement.
3. Cost of sample analysis.
4. Profile of sample respondent.
5. Incremental cost and return structure, and
6. Constraints in soil testing technology.

3.1. Soil testing infrastructure in the state

The soil testing facilities available across the state has been given in the table 3.1. The table reveled that there were 70 soil testing labs exist in the year covering 50 districts together. The maximum number of labs were exist in Malwa Plateau (13) followed by Kymore Plateau and Satpura Hills (11) and Vindhya Plateau (10). The other agro climatic zone also had more then one soil testing lab in their area.

The coverage or catchments of per lab was 0.63 lakh farmers and 0.47 lakh hectares land or cultivable land. Agro climatic region wise the highest farmers covered by labs was found in Central Narmada Valley (1.15 lakh) followed by Vindhya Plateau (1.06 lakh) Chhattisgarh Plains (0.70 lakh) and Kymore Plateau and Satpura Hills (0.67 lakh).

As for coverage of area under each lab revealed that lab situated in Chhattisgarh plain (Bhalaghat district) covered 0.72 lakh hectare, followed by Central Narmada Valley (0.65 lakh hectare), Northern Hills of Chhattisgarh (0.60 lakh hectare) and Kymore Plateau and Satpura Hills (0.51 lakh hectares). Other labs also covered a significant area and provide service to needy farmers. (Table 3.1) It is also observed from the data that labs situated in Satpura Plateau (0.34 lakh hectares) covered the lowest area. This also indicated that infrastructure available per lakh hectare was appreciable in Satpura Plateau.

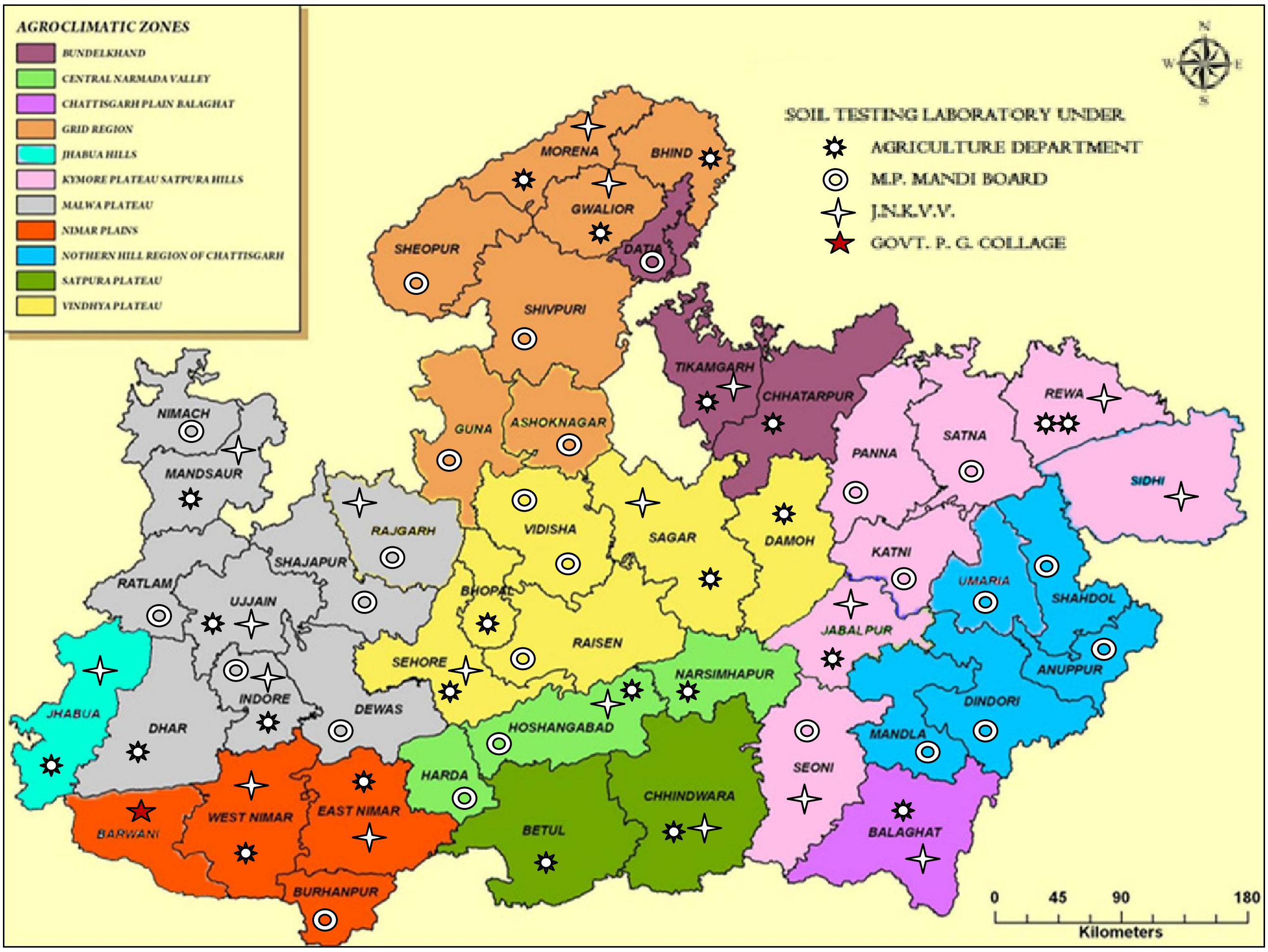

Fig. 3.1 Agro-climatic zone wise Soil testing Infrastructure in Madhya Pradesh.

Table 3.1: Soil Testing Infrastructure in Madhya Pradesh (2010 - 11).

S. No	Agro climatic Zones	Districts (No.)	Soil Testing Labs (No.)	No. of Farmers (Lakh)	Net area sown (lakh /ha.)	Lab available	
						Per lakh farmers	Per lakh hectare
1	Chhattisgarh plains	1	2	2.88	2.75	0.70	0.72
2	Northern Hill of CG	6	5	8.12	8.34	0.62	0.60
3	Kymore Plateau & Satpura Hills	7	11	16.37	21.55	0.67	0.51
4	Central Narmada Valley	2	4	3.47	6.10	1.15	0.65
5	Vindhya Plateau	6	10	9.42	24.38	1.06	0.41
6	Gird Region	7	9	13.50	17.85	0.67	0.50
7	Bundelkhand	3	4	10.89	8.84	0.37	0.45
8	Satpura Hills	2	3	5.64	8.70	0.53	0.34
9	Malwa Plateau	9	13	23.37	31.14	0.56	0.42
10	Nimar Plains	5	7	11.80	14.46	0.59	0.48
11	Jhabua Hills	2	2	5.10	4.00	0.39	0.50
Total		50	70	110.56	148.11	0.66	0.51

Overall, in Madhya Pradesh each soil testing lab covered 0.66 lakh farmers covered 0.51 lakh hectares. The above table clearly indicated that state need more and more soil testing lab as each lab had a large number of farmers and land.

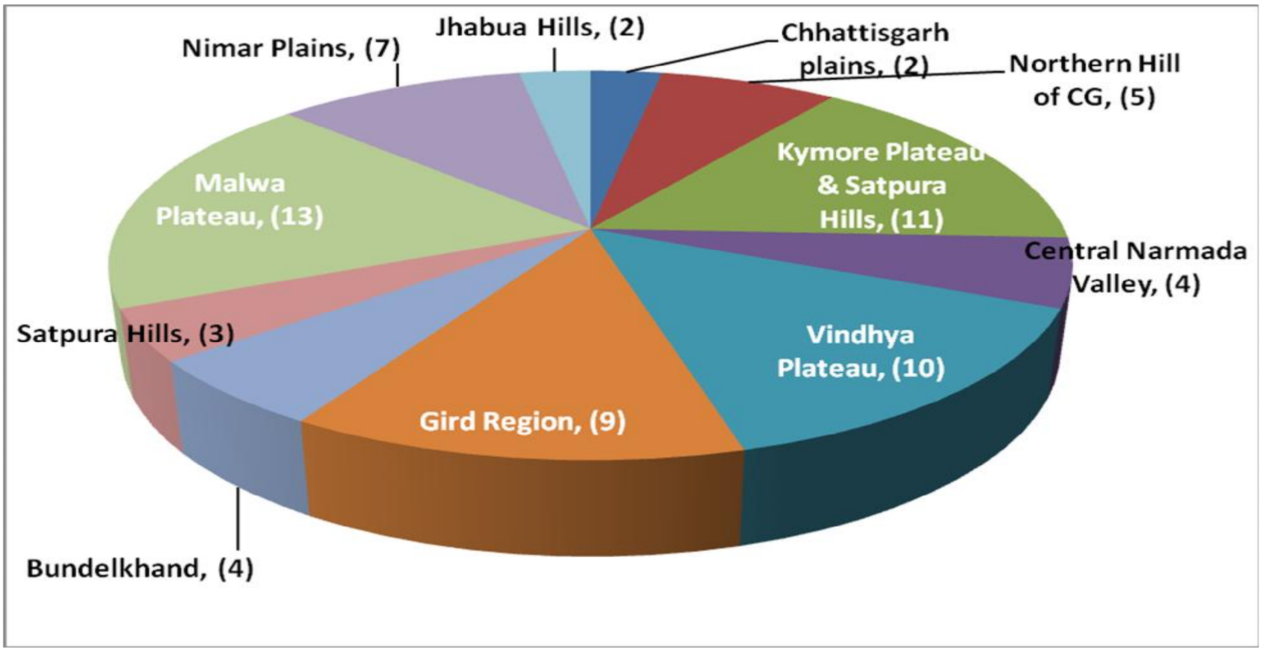

Fig. 3.2: Agro Climatic Region Wise Soil Testing Infrastructure in Madhya Pradesh.

3.2 Gap in sample target and achievement

The gap in soil sample targeted and achieved has been presented in table 3.2.It is observed from the data that there were 19.95% and 21.18% gaps noted between target and achievement respectively in Sagar and Dhar districts in the selected year of the study.

Table 3.2: Gap in Sample Targeted and Achievement, Sagar District of Madhya Pradesh. (Triennium ending)

Particular		Sagar	Dhar	Total
A)Triennium Average of Base Year	Target	10,000	15,000	25000
	Achieved	3653	8785	12438
	Gap	6,347 (63.47)	6,215 (41.43)	12,562 (50.25)
B)Triennium Average of current year	Target	10,000	11000	21000
	Achieved	8005	8670	16675
	Gap	1,995 (19.95)	2,330 (21.18)	4,325 (20.60)
Change over base year	Target	0	-4,000	-4000
	Achieved	4352 (119.13)	-115 (-1.31)	4237 (34.06)

Figures in parenthesis show percentages to total.

The highest gap was noted in Sagar district (63.47 %) and lowest gap was noted in Dhar district (41.43%) in the base year of the study. The target of Sagar soil testing lab were found to be same in base as well as current years. Whereas target were found to be decreased in current year as compared to base year in Dhar district of Madhya Pradesh.

3.2.1 Target and achievement of samples.

The target of soil samples were found to decreased from 15000 (2001-02) to 14000 (2010-11) with the growth of -3.55% per year. It is also noted that the target were decreased by -496.97 soil sample per year in Dhar district of Madhya Pradesh.

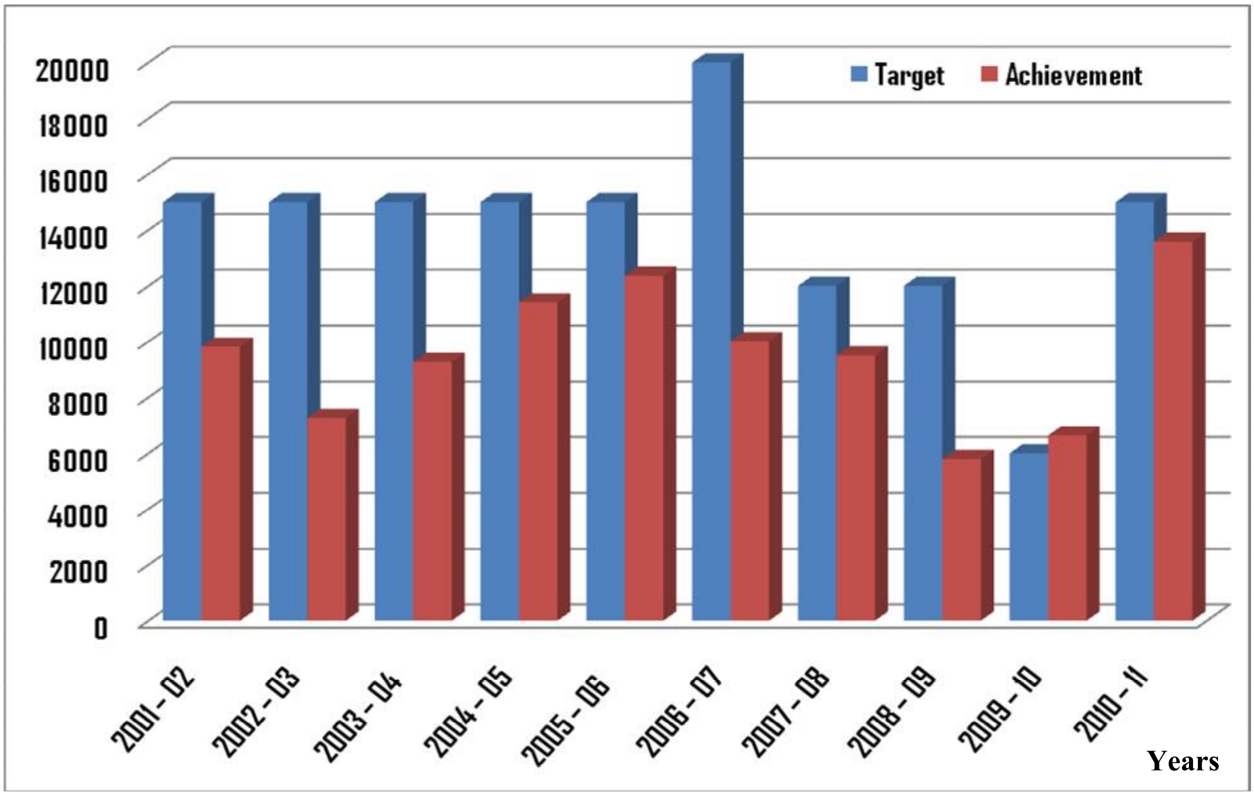

Fig. 3.3: Target and Achievement of Samples in Dhar District of Madhya Pradesh.

While, the achievement were found to be increased from 9811 (2001-02) to 13581 (2010-11) with a rate of 24.25 soil sample per year and growth of 0.25% per year. There was found – 9.46% gap (2010-11) to -51.71% gap (2008-09) between target and achievement revealed that this particular soil testing lab not full fill their target in any of year of last 10 year. (Table 3.3)

Table 3.3: Growth and Gap of Sample Targeted and Achieved in Dhar District of Madhya Pradesh.

S.No.	Year	Target	Achievement	Gap	% gap
1	**2001 – 02**	15000	9811	-5189	-34.59
2	**2002 – 03**	15000	7269	-7731	-51.54
3	**2003 – 04**	15000	9274	-5726	-38.17
4	**2004 – 05**	15000	11411	-3589	-23.93
5	**2005 – 06**	15000	12355	-2645	-17.63
6	**2006 – 07**	20000	10014	-9986	-49.93
7	**2007 – 08**	12000	9500	-2500	-20.83
8	**2008 – 09**	12000	5795	-6205	-51.71
9	**2009 – 10**	6000	6632	632	10.53
10	**2010 – 11**	15000	13581	-1419	-9.46
	Mean	14000	9564	-4436	--
Standard Deviation		3559.03	2489.04	3153.13	--
Coefficient of Variance		0.25	0.26	0.71	--
Regression Coefficient		-496.97	24.25	-521.22	--
	Growth (%)	-3.55	0.25	-11.75	--

The target were found to be same i.e. 10000 soil samples per year of soil testing lab sagar and there were found an average of gap of 40% between target and achievement. The achievement of the soil sample was also analyse and it is found that the achevement of soil sample is increase from 2197 (2001-02) to 9615 (2010-11) showed an growth of 10.87% per annum and with a rate of 657.21 sample per year. (table 3.4)

Table 3.4: Growth and Gap of Sample Targeted and Achieved in Sagar District of Madhya Pradesh.

S.No.	Year	Target	Achievement	Gap	% gap
1	**2001 – 02**	10000	2197	-7803	78.03
2	**2002 – 03**	10000	3215	-6785	67.85
3	**2003 – 04**	10000	5548	-4452	44.52
4	**2004 – 05**	10000	5312	-4688	46.88
5	**2005 – 06**	10000	6310	-3690	36.90
6	**2006 – 07**	10000	7072	-2928	29.28
7	**2007 – 08**	10000	6778	-3222	32.22
8	**2008 – 09**	10000	7019	-2981	29.81
9	**2009 – 10**	10000	7381	-2619	26.19
10	**2010 – 11**	10000	9615	-385	3.85
	Mean	10000	6045	-3955	--
Standard Deviation		0.00	2127.62	2127.62	--
Coefficient of Variance		0.00	0.35	0.54	--
Regression Coefficient		0.00	657.21	-657.21	--
	Growth	0.00	10.87	-16.62	--

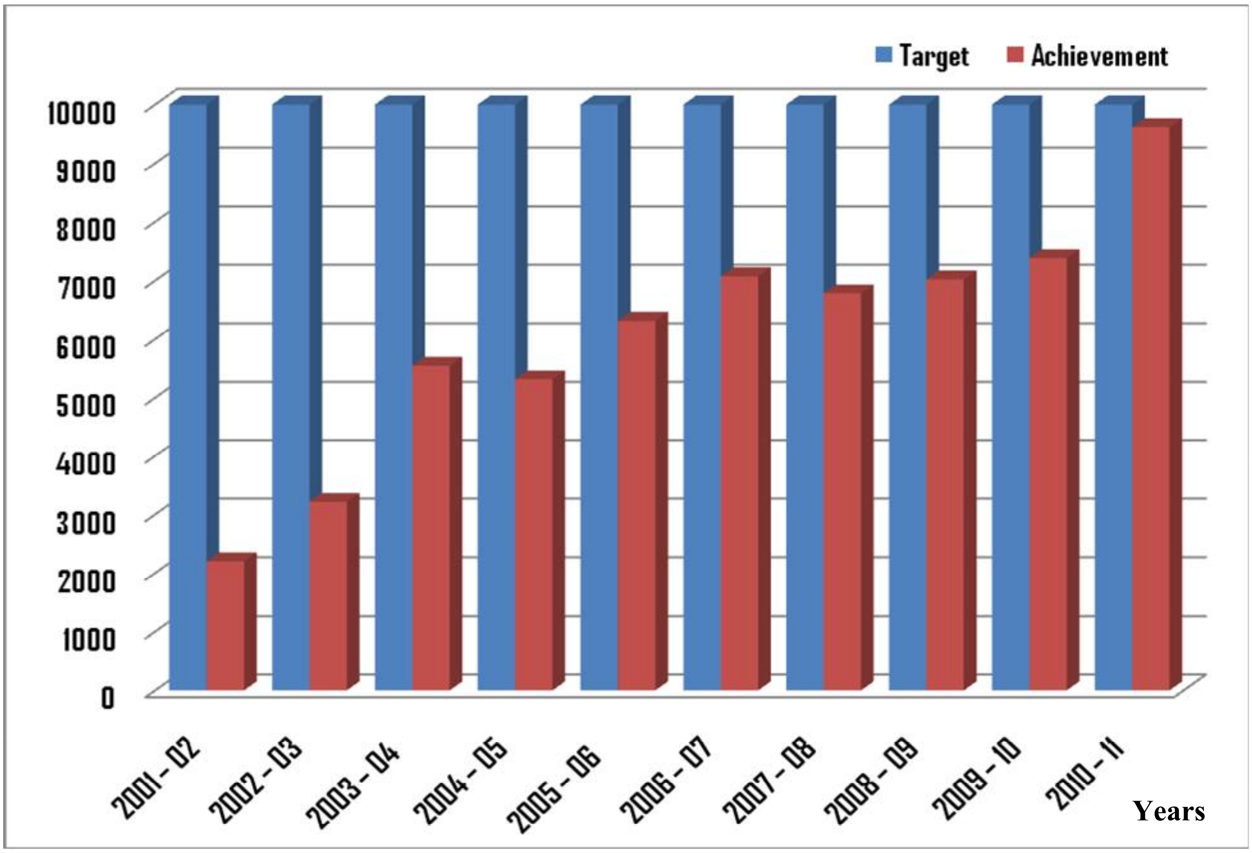

Fig. 3.4: Target and Achievement of Samples in Sagar District of Madhya Pradesh.

3.3. Cost of sample analysis

The bifurcation of cost of soil samples analysis reveals that the share of fixed cost was found only 6.37% to total cost incurred in analysis of soil samples. The scientific apparatus and equipments (14.15%), building (52.46%), furniture (6.10%) are the main components of total fixed cost. The distribution of variable cost of different component reveals that glassware accounted for 45.65%, chemical for 11.04% electricity for 2.92% and staff for analysis purpose 39.53% contribution in the total variable cost. (Table 3.5) The cost of analysis for sample comes to be Rs. 239.23 per sample. Government has gave these facilities to farmers only in Rs. 10/-. Hence, there is a net loss of Rs. 229.23 to the Government. Hence, there is necessity to increased target and achievement of soil sample per year. As the number of sample increases the cost of sample will be go down.

Table 3.5: Cost of Analysis of Soil Sample in a Year (Rs.)

S.No.	Particulars	Cost/Year	% to total
Fixed cost			
1	Building	240000	52.46
2	Furniture	27900	6.10
3	Tools & electrical material	4800	1.05
4	Scientific Apparatus & Equipment	64752	14.15
5	Other	120000	26.23
	Total	457452 (6.37)	100
Variable Cost			
1	Staff	2656000	39.53
2	Books	2000	0.03
3	Electricity	196000	2.92
4	Transportation	54000	0.80
5	Water	2400	0.04
6	Chemical's	741640	11.04
7	Glass ware	3067440	45.65
	Total	6719480 (93.63)	100
	Total cost (30000 samples)	**7176932 (100)**	
	10000 sample	2392310.67	
	Cost per sample	239.23	

Figures in parenthesis show percentages to total.

3.4 Profile of sample respondents

The profile of the sample farmer from whom the data of the study were collected their distribution according to different parameters of soil testing report analysis and socio economic profile their land utilizing and cropping pattern analysed and presented in this subject.

3.4.1 Distribution of respondents

The 71 per cent farmers received soil testing report from the respective labs of their district. Out of these 71 farmers out of the selected 100 farmers, 49 (69.01%) farmers adopted the recommendations and applied the fertilizer or other chemical for improvement of their crops, while remaining 22 (30.99%) did not followed these recommendations due to several constraints.

Table 3.6: Distribution of Sample Respondents.

Particulars	Sagar	Dhar	Overall
Total Respondents	50	50	100
Who Received Report	36 (72.00)	35 (70.00)	71 (71.00)
Who Adopt Recommendation	26 (72.22)	23 (65.71)	49 (49.00)

Figures in parenthesis show percentages to total

The data revealed that the percentage of adoption was much higher in Sagar district (72.22%) as compared to Dhar district (65.71%). As for number of farmers who received the recommendation the number was almost equal in both the districts i.e. 36 in Sagar and 35 in Dhar district farmers received lab report of soil test (Table 3.6).

3.4.2 Caste

The majority of the respondents related to General category (46%) followed by SC (30%), OBC (17%) and ST (7%). Almost different selected districts, in Sagar majority were also belongs to general category (52%) followed by SC (34%) and OBC SC (14%). While, in Dhar majority of farmer related to general category (40%) followed by SC (26%), OBC SC (20%) and ST (14%).(Table 3.7)

Table 3.7: Social Group of Family of Sample Respondents.

Group	Sagar	Dhar	Over All
SC	17 (34)	13 (26)	30 (30)
ST	0 (0)	7 (14)	7 (7)
OBC	7 (14)	10 (20)	17 (17)
GEN	26 (52)	20 (40)	46 (46)
Total	50 (100)	50 (100)	100

Figures in parenthesis show percentages to total

3.4.3 Education of head of households.

Education plays an important role in decision making and in taking decision in agriculture it is a very influencing factor which decides the growth of agriculture or in adoption of new farm technologies. The table 3.8 showed that out of 100 farmers selected for the study the majority of farmers educated up to middle (31%) followed by primary school (28%), illiterate (15%), higher secondary school (12%) and degree level education (7%). In Dhar, the number of head of the household's received education up to middle was (32%) followed by illiterate (26%), primary (24%), HSSC (8%), Higher school (6%) and college education (4%).

Table 3.8: Education of head of Households of Sample Respondents.

Name	Sagar	Dhar	Over All
Illiterate	2 (4)	13 (26)	15 (15)
Up to Primary	16 (32)	12 (24)	28 (28)
Up to Middle	15 (30)	16 (32)	31 (31)
Up to Higher school	4 (8	3 (6)	7 (7)
Up to H.S.S.C	8 (16)	4 (8)	12 (12)
Collage	5 (10)	2 (4)	7 (7)
Total	50 (100)	50 (100)	100 (100)

Figures in parenthesis show percentages to total

In Sagar, the literacy percentage was very high and almost 96 per cent head of households were literate, of the total literate 16 educated up to primary (32%), 15 up to middle (30%), 8 up to HSSC (16%) and 5 up to degree level education (10%) thus, study showed that literacy percentage among head of households of Sagar district was more as compared to Dhar district.

Table 3.9: Land Use Pattern of an average farmer. (ha.)

Particulars	Sagar	Dhar	Over All
Cultivated land	3.41 (100.00)	3.69 (100.00)	3.55 (100.00)
Permanent Fallow	0.16 (4.69)	0 (0.00)	0.08 (2.25)
Old Fallow	0 (0.00)	0.05 (1.36)	0.03 (0.85)
Current Fallow	0 (0.00)	0.02 (0.54)	0.01 (0.28)
Leased in	0.03 (0.88)	0.14 (3.79)	0.09 (2.54)
Leased out	0 0.00)	0 (0.00)	0 (0.00)
Irr. Area	2.97 (87.10)	3.46 (93.77)	3.22 (90.70)
Cropping Intensity	197.17	197.94	197.57

Figures in parenthesis show percentages to cultivated land.

3.4.4 Land Use Pattern

The land were found to be intensely used by the respondents of the study area as their cropping intensity were found to be noticed 197.57%. The average size of holding of sample respondents was found to be 3.55 ha. out of which 90.70% land irrigated. Nm. of the farmers was found to be leased out their land to other farmers, while only 2.54% of the total land was found to be leased in by the respondents (Table 3.9).

3.4.5 Source of Irrigation

In Dhar district the tube well was the major source of irrigation, which alone accounted for 74.57 per cent of the total irrigation area. Remaining 22.25 per cent was irrigated by well and a very small part of the area was irrigated through other sources (3.46%) including rivers, ponds and Nallas. (Table 3.10)

Table 3.10: Irrigated Area through different Source of Irrigation. (ha.)

Particulars	**Sagar**	**Dhar**	**Over All**
Well	2.43 (81.82)	0.77 (22.25)	1.6 (49.69)
Tube well	0.19 (6.40)	2.58 (74.57)	1.38 (42.86)
Canal	0.24 (8.08)	0 (0.00)	0.12 (3.73)
Other	0.12 (4.04)	0.11 (3.18)	0.11 (3.42)
Total	2.97 (100.00)	3.46 (100.00)	3.22 (100.00)

Figures in parenthesis show percentages to total.

In Sagar district the situation was different and wells contributed maximum irrigation facility. Overall 82.00 percent area was irrigated through wells and tube wells contributed only 6.40 per cent to total irrigated area. Remaining area was irrigated by canal (8.08%) and other sources (4.04%).

3.4.6 Cropping Pattern

An average farmer of the study area found to be used their 50/50 percent of gross cropped area both in Kharif and Rabi Season. Soybean (96.03%) was found to main crop of Kharif season.

Table3.11: Average Cropping Pattern of the Sample Respondents.

S.No.	Crops	Sagar	Dhar	Over All
Kharif				
1	Soybean	3.23 (95.56)	3.54 (96.46)	3.39 (96.03)
2	Arhar	0.11 (3.25)	0 (0.00)	0.05 (1.42)
3	Groundnut	0.01 (0.30)	0.01 (0.27)	0.01 (0.28)
4	Urad	0.03 (0.89)	0 (0.00)	0.02 (0.57)
5	Maize	0 (0.00)	0.09 (2.45)	0.05 (1.42)
6	Fodder(K)	0 (0.00)	0.03 (0.82)	0.02 (0.57)
Total		3.38 (100.00) **(50.22)**	3.67 (100.00) **(50.21)**	3.53 (100.00) **(50.36)**
Rabi				
1	Wheat	2.06 (61.49)	2.08 (57.14)	2.07 (59.31)
2	Gram	0.93 (27.76)	1.33 (36.54)	1.13 (32.38)
3	Masoor	0.17 (5.07)	0.04 (1.10)	0.1 (2.87)
4	Pea	0.07 (2.09)	0.03 (0.82)	0.05 (1.43)
5	Vegetable	0.1 (2.99)	0.09 (2.47)	0.09 (2.58)
6	Spices	0 (0.00)	0.05 (1.37)	0.02 (0.57)
7	Tomato	0.02 (0.60)	0 (0.00)	0.01 (0.29)
8	Ginger	0.01 (0.30)	0.01 (0.27)	0.01 (0.29)
9	Barseem	0 (0.00)	0.02 (0.55)	0.01 (0.29)
Total		3.35 (100.00) **(49.78)**	3.64 (100.00) **(49.79)**	3.49 (100.00) **(49.64)**
Gross Cropped Area		6.73 **(100)**	7.31 **(100)**	7.02 **(100)**

Figures in parenthesis show percentage to their respective total, figures in parenthesis and bold show percentage to gross cropped area.

While wheat (59.31%) and gram (32.38%) were found to be main crop of Rabi season. Arhar (3.25%), groundnut (0.30%) and urad (0.89%) were also grown by the farmers of sagar district in Kharif as minor crops, while in maize (0.27%), fodder (0.82%) and groundnut (0.27%) were the other minor crops of dhar district in the Kharif season.

3.5 Incremental cost and return structure

Impact of soil testing analysis has been done by analysis cost and return incurred in before and after the adoption of soil testing recommendation. Although, there were no significant difference found in different locations. Hence there pooled analysis has been taken into consideration for all the crops. In which farmers adopted the recommendation of soil testing considering the rate prevailing in the year 2010-2011.

3.5.1 Soybean

The data related to per ha. input used in soybean is given in table 3.12. It is observed from the data there were no difference in input used found in before and after adoption of recommendation of soil testing.

Table3.12: Per hectare input item wise Expenditure of Soybean Crop. (Rs./ha)

S.No.	Input	Before	After	Diff.	Percent
1	Seed	3667.95	3667.95	0.00	0
2	Seed treatment	0.00	0.00	0.00	0.00
3	Culture				
	Rizobium	0.00	0.00	0.00	0.00
	P.S.B.	0.00	0.00	0.00	0.00
4	Manures	0.00	0.00	0.00	0.00
5	Fertilizer				
	UREA	0.00	0.00	0.00	0.00
	D.A.P.	1200.42	960.34	-240.08	-20.00
	S.S.P.	1029.17	617.5	-411.67	-40.00
	M.O.P.	0.00	0.00	0.00	0.00
	12:32:16	0.00	0.00	0.00	0.00
	Zinc Sulphate	0.00	0.00	0.00	0.00
	Other	0.00	0.00	0.00	0.00
6	Weedicide	0.00	494	494	∞
7	Plant protection				
	Insecticide	0.00	489.88	489.88	∞
	Fungicide	0.00	0.00	0.00	0.00
	Total input cost	5897.54	6229.67	332.13	5.63

Except in adoption of DAP and SSP in which the farmer used 20.00% and 40.00% less expenses after adoption of recommendation, while the expenses of weedicide and insecticide increased at it maximum level. The total input cost were found to be increased by 332.13 Rs. /ha after adoption of recommendation practices. The per hectare operational expenditure in soybean were found to be decreased by 51.66% after adoption of recommendation of soil testing analysis by the cultivators. This expenditure was found to be decreased more in hired labour (93.28%) as compared to bullock and machine hrs. (38.95%).

Table 3.13: Per hectare Operational Expenditure of Soybean Crop. (Rs./ha)

S.No.	Labours	Before	After	Diff.	Percent
1	Total Family Labour	32.93	32.93	0.00	0.00
2	Total Hired Labour	5516.33	370.50	-5145.83	-93.28
3	Total Bullock Labour	0.00	0.00	0.00	0.00
4	Total Machine Labour	2515.28	3495.05	979.77	38.95
	Total Labour Cost	8064.55	3898.48	-4166.07	-51.66

Adoption of recommendations of soil testing labs had positive impact on returns per hectares obtained by an average cultivator from soybean crop. Adoption of recommendations reveals that there is 29.74% increase in production of soybean, consequently gross returns also increase by 29.33% and net income at variable cost increased by 57.32% and the total cost the increase in income was noted to be 67.22%.

Table 3.14: Incremental Cost after adoption of Soil Testing Recommendation by the Farmers in Soybean Crop. (Rs/ha)

Particulars	Before	After	Diff.	Percent diff.
Total operational cost	8064.55	3898.48	-4166.1	-51.66
Total input cost	5897.54	6229.67	332.13	5.63
Interest on working capital	464.94	337.27	-127.67	-27.46
Depreciation	1344.25	1344.25	0	0
Total Variable Cost	15771.3	11809.7	-3961.6	-25.12
Intrest on fixed capital	258.16	333.79	75.63	29.29
Land revenue	9.88	9.88	0	0
Rental value of land	7742.76	10013.8	2271.03	29.33
Total Fixed Cost	8010.81	10357.5	2346.65	29.29
Total Cost of Cultivation	23782.1	22167.1	-1615	-6.79
Total Cost of Production	1560.03	1120.41	-439.62	-28.18

Incremental in cost of cultivation in soybean crop after adopting recommendation of soil testing lab reveals very interesting results. Surprisingly the labour cost on soybean cultivation has reduced to 51.66 per cent after adopting soil testing reports. This was might be due to the fact that after soil testing analysis farmer came in direct touch with the officer's/staff of the Agriculture Department and mechanized their farming at his level best. There was slight increase in input cost (5.63%), but interest on working capital reduced by 27.46%. In case of fixed cost due to increase in rental value of land by 29.33% similar increase in interest on fixed capital (29.29%) was observed. By adopting recommendation of soil testing laboratory the cost of cultivation of soybean reduced by 6.79% and cost of production of per quintal soybean had gone down by 28.18%.

Table 3.15: Incremental Return after adoption of Soil Testing Recommendation by the Farmers in Soybean Crop. (Rs/ha)

S.No.	Particulars	Before	After	Diff.	Percent diff.
A.	**Yield in physical unit(q/ha)**				
	Main product	15.23	19.76	4.53	29.74
	By product	22.84	27.78	4.94	21.63
B.	**Returns**				
	Main product	44171.83	57304.00	13132.17	29.73
	By product	2284.75	2778.75	494.00	21.62
C.	**Gross returns**	46456.58	60082.75	13626.17	29.33
D.	**Cost of cultivation**	23782.09	22167.13	-1614.95	-6.79
E.	**Net income**				
	at Variable cost	30685.30	48273.08	17587.77	57.32
	at Total cost	22674.50	37915.62	15241.12	67.22
F.	**Cost - Benefit ratio**				
	at Variable cost	2.95	5.09	2.14	72.72
	at Total cost	1.95	2.71	0.76	38.75

This indicates that after testing soils in cost of production of farmer reduce to 28.18%, while the return were increased 67.22% then the before soil testing as cultivator adopted balance use of fertilizer. The cost benefit ratio both of variables and fixed cost was also found higher for the cultivators after adoption of recommendations of soil testing.

5.5.2 Wheat

In case of wheat crop the observations were also found similar as soybean. In wheat crop the respondents were found to be used more urea (89.33%) NPK 12:32:16 (963.53%) fertilizer, and weedicide (50%) and lesser dose of DAP fertilizer (-80.00%) (Table 3.16) after the recommendation adopted by them. With the result of their total input cost was found to be decreased by 61.32% after adopting recommendation of soil testing laboratory report.

Table 3.16: Per hectare input item wise Expenditure of Wheat Crop. (Rs. /ha)

S.No.	Input	Before	After	Diff.	Percent
1	Seed	2107.12	2289.22	182.1	8.64
2	Seed treatment	0.00	0.00	0.00	0.00
3	**Culture**				
	Rizobium	0.00	0.00	0.00	0.00
	P.S.B.	0.00	20.69	20.69	∞
4	Manures	0.00	254.02	254.02	∞
5	**Fertilizer**				
	UREA	436.31	826.07	389.77	89.33
	D.A.P.	201.14	40.23	-160.91	-80.00
	S.S.P.	762.36	762.36	0.00	0.00
	M.O.P.	0.00	0.00	0.00	0.00
	12:32:16	157.34	1673.36	1516.02	963.53
	Zinc Sulphate	0	82.77	82.77	∞
	Other	0.00	0.00	0.00	0.00
6	Weedicide	331.1	496.65	165.55	50.00
7	**Plant protection**				
	Insecticide	0.00	0.00	0.00	0.00
	Fungicide	0.00	0.00	0.00	0.00
	Total input cost	3995.36	6445.37	2450.01	61.32

The per hectare expenditure of wheat were found to be increased by 1.16% only after adoption of soil testing analysis by the cultivators. This increased in operational cost was only due to higher hired labour used in different operation specially in fertilizer application.

Table 3.17: Per hectare Operational Expenditure of Wheat Crop. (Rs./ha)

S.No.	Labours	Before	After	Diff.	Percent
1	Total Family Labour	869.14	918.80	49.66	5.71
2	Total Hired Labour	2715.01	1928.65	-786.36	-28.96
3	Total Bullock Labour	297.99	347.65	49.66	0.00
4	Total Machine Labour	3944.22	4722.30	778.08	19.73
	Total Labour Cost	7826.36	7917.41	91.05	1.16

Table 3.18: Incremental Cost after adoption of Soil Testing Recommendation by the Farmers in Wheat Crop. (Rs/ha)

Particulars	Before	After	Diff.	Percent diff.
Total operational cost	7826.4	7917.4	91.1	1.2
Total input cost	3995.4	6445.4	2450.0	61.3
Interest on working capital	393.7	478.3	84.6	21.5
Depreciation	1382.2	1382.2	0.0	0.0
Total Variable Cost	13597.6	16223.3	2625.7	19.3
Intrest on fixed capital	268.3	311.7	43.5	16.2
Land revenue	9.9	9.9	0.0	0.0
Rental value of land	8045.7	9350.8	1305.1	16.2
Total Fixed Cost	8323.8	9672.4	1348.5	16.2
Total Cost of Cultivation	21921.4	25895.6	3974.2	18.1
Total Cost of Production	567.3	551.9	-15.4	-2.7

Table 3.19 presents' very interesting results and indicates that adoption of recommendations of soil testing increased yield of main as well as by products by 21.42% and 16.27%, respectively.

Table 3.19: Incremental Return after adoption of Soil Testing Recommendation by the Farmers in Wheat Crop. (Rs/ha)

S.No.	Particulars	Before	After	Diff.	Percent diff.
A.	**Yield in physical unit(q/ha)**				
	Main product	38.61	46.88	8.27	21.42
	By product	19.30	22.44	3.14	16.27
B.	**Returns**				
	Main product	46343.29	53860.57	7517.28	16.22
	By product	1930.97	2244.19	313.22	16.22
C.	**Gross returns**	48274.26	56104.76	7830.50	16.22
D.	**Cost of cultivation**	21921.42	25895.64	3974.23	18.13
E.	**Net income**				
	at Variable cost	34676.69	39881.50	5204.81	15.01
	at Total cost	26352.85	30209.12	3856.27	14.63
F.	**Cost - Benefit ratio**				
	at Variable cost	3.55	3.46	-0.09	-2.59
	at Total cost	2.20	2.17	-0.04	-1.62

Similar was the case of returns per hectares from wheat crop. There was remarkable difference (Rs. 7830.50) per hectares in gross returns from wheat crop after adoption of recommendations of soil testing lab. However no difference in cost benefit ratio was observed, Hence, it is clear that cultivator used their resources more economical after the adoption of soil testing technique.

5.5.3 Gram

There were found to be increase expenses of Rs. 612.52/ha. after adoption of recommendation of soil testing by the respondents in gram crop. This was found to be due to increased in due to increased in plant protection measure and reduce expenses incurred and fertilizer.

Table 3.20: Per hectare input item wise Expenditure of Gram Crop. (Rs./ha)

S.No.	Input	Before	After	Diff.	Percent
1	Seed	2881.67	2680.96	-200.71	-6.96
2	Seed treatment	0.00	0.00	0.00	0.00
3	Culture				
	Rizobium	0.00	0.00	0.00	0.00
	P.S.B.	0.00	0.00	0.00	0.00
4	Manures	0.00	0.00	0.00	0.00
5	Fertilizer				
	UREA	0.00	0.00	0.00	0.00
	D.A.P.	401.00	198.00	-203.00	-50.62
	S.S.P.	0.00	117.50	117.50	∞
	M.O.P.	0.00	0.00	0.00	0.00
	12:32:16	0.00	0.00	0.00	0.00
	Zinc Sulphate	0.00	0.00	0.00	0.00
	Other	0.00	0.00	0.00	0.00
6	Weedicide	0.00	0.00	0.00	0.00
7	Plant Protection				
	Insecticide	422.33	504.00	81.67	19.34
	Fungicide	0.00	817.10	817.10	∞
	Total input cost	3705.00	4317.56	612.56	16.53

The total operational expenditure were found to be increased by 7.10% (Rs.452.83/ha.) after adoption of recommendation of soil testing analysis by the sample respondents. This increased was found to be noticed due to higher use of machinery in their field.

Table 3.21: Per hectare Operational Expenditure of Gram Crop. (Rs./ha)

S.No.	Labours	Before	After	Diff.	Percent
1	Total Family Labour	1893.67	1893.67	0.00	0.00
2	Total Hired Labour	2140.67	2140.67	0.00	0.00
3	Total Bullock Labour	988.00	988.00	0.00	0.00
4	Total Machine Labour	1358.50	1811.33	452.83	33.33
	Total Labour Cost	6380.83	6833.67	452.83	7.10

Table 3.22: Incremental Cost after adoption of Soil Testing Recommendation by the Farmers in Gram Crop (Rs/ha)

Particulars	Before	After	Diff.	Percent diff.
Total operational cost	6380.83	6833.67	452.83	7.10
Total input cost	3705.00	4317.56	612.56	16.53
Interest on working capital	335.86	371.34	35.48	10.56
Depreciation	278.28	278.28	0.00	0.00
Total Variable Cost	10699.97	11800.85	1100.87	10.29
Intrest on fixed capital	154.41	216.05	61.63	39.91
Land revenue	9.88	9.88	0.00	0.00
Rental value of land	4627.13	6477.99	1850.85	40.00
Total Fixed Cost	4791.43	6703.91	1912.49	39.91
Total Cost of Cultivation	15491.40	18504.76	3013.36	19.45
Total Cost of Production	1253.76	1069.66	-184.11	-14.68

Table 3.22 present different story than soybean and wheat crop. In gram the expenditure on labour cost, input cost and total cost of cultivation is found respectively more (7.10%, 16.53% and 19.45%) after adoption of recommendation of soil testing technology. Due to the fact that, before soil testing they were not used fertilizers in their gram crop. Cultivator only invested on seed only.

Table 3.23: Incremental Return after adoption of Soil Testing Recommendation by the Farmers in Gram Crop (Rs/ha)

S.No.	Particulars	Before	After	Diff.	Percent diff.
A.	**Yield physical (q/ha)**				
	Main product	12.35	17.29	4.94	40.00
	By product	7.41	10.37	2.96	39.95
B.	**Returns**				
	Main product	27170.00	38038.00	10868.00	40.00
	By product	592.80	829.92	237.12	40.00
C.	**Gross returns**	27762.80	38867.92	11105.12	40.00
D.	**Cost of cultivation**	15491.40	18504.76	3013.36	19.45
E.	**Net income**				
	at Variable cost	17062.83	27067.07	10004.25	58.63
	at Total cost	12271.40	20363.16	8091.76	65.94
F.	**Cost - Benefit ratio**				
	at Variable cost	2.59	3.29	0.70	26.94
	at Total cost	1.79	2.10	0.31	17.20

While looking to the returns from gram crop it is observed that gram crop gave 40% (Table 3.23) more returns after adoption of soil testing technology. Returns of both the variable and fixed cost and total cost were found to increase nearly 40% high after adoption of recommendation of soil testing.

However, there was no remarkable difference in cost benefit ratio was found before and after analysis of soil, resulting that they used their existing resources more economical after adoption of soil testing technology.

5.5.4 Potato

There were found to increased expenses of Rs. 1301.69/ha. in cultivation of potato crop after adoption of recommendation of soil testing laboratories by the cultivators. This expense has been notice only for urea (200%) and single super phosphate (100%) fertilizer. (Table 3.24)

Table 3.24: Per hectare input item wise Expenditure of Potato Crop. (Rs./ha)

S.No.	Input	Before	After	Diff.	Percent
1	Seed	41990.00	41990.00	0.00	0.00
2	Seed treatment	0.00	0.00	0.00	0.00
3	Culture				
	Rizobium	0.00	0.00	0.00	0.00
	P.S.B.	0.00	0.00	0.00	0.00
4	Manures	0.00	86.45	86.45	∞
5	Fertilizer				
	UREA	309.99	929.96	619.97	200.00
	D.A.P.	0.00	0.00	0.00	∞
	S.S.P.	308.75	617.50	308.75	100.00
	M.O.P.	0.00	286.52	286.52	∞
	12:32:16	0.00	0.00	0.00	0.00
	Zinc Sulphat	0.00	0.00	0.00	0.00
	Other	0.00	0.00	0.00	0.00
6	Weedicide	0.00	0.00	0.00	0.00
	Plant protection				
	Insecticide	0.00	0.00	0.00	0.00
7	Fungicide	0.00	0.00	0.00	0.00
	Total input cost	42608.74	43910.43	1301.69	3.05

Table 3.25: Per hectare Operational Expenditure of Potato Crop. (Rs./ha)

S.No.	Labours	Before	After	Diff.	Percent
1	Total Family Labour	1482.00	1482.00	0.00	0.00
2	Total Hired Labour	5681.00	5928.00	247.00	4.35
3	Total Bullock Labour	2964.00	3334.50	370.50	0.00
4	Total Machine Labour	0.00	0.00	0.00	0.00
	Total Labour Cost	10127.00	10744.50	617.50	6.10

In potato cultivation, there were found to be 6.10% (Rs. 617.50/ha) increased in total operational cost after adoption of recommended soil testing analysis result by the respondents. This increased in operational cost was noticed due to higher hired and bullock labour. (Table. 3.25)

Table 3.26: Incremental Cost after adoption of Soil Testing Recommendation by the Farmers in Potato Crop. (Rs/ha)

Particulars	Before	After	Diff.	Percent diff.
Total operational cost	10127.00	10744.50	617.50	6.10
Total input cost	42608.74	43910.43	1301.69	3.05
Interest on working capital	1756.10	1820.01	63.91	3.64
Depreciation	423.59	423.59	0.00	0.00
Total Variable Cost	54915.43	56898.53	1983.10	3.61
Intrest on fixed capital	480.13	537.70	57.58	11.99
Land revenue	9.88	9.88	0.00	0.00
Rental value of land	14408.33	16137.33	1729.00	12.00
Total Fixed Cost	14898.34	16684.92	1786.58	11.99
Total Cost of Cultivation	69813.77	73583.44	3769.67	5.40
Total Cost of Production	565.29	425.58	-139.71	-24.71

Like soybean, wheat and gram, potato growers also used slightly higher labour (6.10%) and input (3.05%) after adoption of the recommendations of soil testing. The cost of cultivation also found higher (5.40%) while the cost of production is found 24.71% per cent less (Table 3.26) after adopting soil testing recommendations.

Very interesting results about returns from potato crop was observed. (Table 3.27) The returns and yield was found to be increased by 40% after adoption of recommended doses of fertilizers after getting soil testing report. The net income at variable and fixed cost was found to be increased respectively by 103.37% and 185.20% after adoption soil testing reports instructions. The cost benefit ratio in potato crop was also found higher after adoption of soil testing technology.

Table 3.27: Incremental Return after adoption of Soil Testing Recommendation by the Farmers in Potato Crop. (Rs/ha)

S.No.	Particulars	Before	After	Diff.	Percent diff.
A.	**Yield in physical unit(q/ha)**				
	Main product	123.50	172.90	49.40	40.00
	By product	0.00	0.00	0.00	0.00
B.	**Returns**				
	Main product	86450.00	121030.00	34580.00	40.00
	By product	0.00	0.00	0.00	0.00
C.	**Gross returns**	86450.00	121030.00	34580.00	40.00
D.	**Cost of cultivation**	69813.77	73583.44	3769.67	5.40
E.	**Net income**				
	at Variable cost	31534.57	64131.47	32596.90	103.37
	at Total cost	16636.23	47446.56	30810.33	185.20
F.	**Cost - Benefit ratio**				
	at Variable cost	1.57	2.13	0.55	35.12
	at Total cost	1.24	1.64	0.41	32.83

5.5.5 Garlic :

There were found to be increased of 5.25% of total input expenses after adoption of recommendation of soil testing analysis by the respondents. This increased was found to be increased in urea (100%) and Single Super Phosphate (50%) fertilizer. (Table 3.28).

Table 3.28: Per hectare input item wise Expenditure of Garlic Crop. (Rs./ha)

S.No.	Input	Before	After	Diff.	Percent
1	Seed	12005.00	12005.00	0.00	0.00
2	Seed treatment	0.00	0.00	0.00	∞
3	Culture				
	Rizobium	0.00	0.00	0.00	∞
	P.S.B.	0.00	0.00	0.00	∞
4	Manures	0.00	74.10	74.10	∞
5	Fertilizer				
	UREA	247.99	495.98	247.99	100.00
	D.A.P.	345.00	345.00	0.00	0.00
	S.S.P.	247.00	370.50	123.50	50.00
	M.O.P.	0.00	229.22	229.22	∞
	12:32:16	0.00	0.00	0.00	∞
	Zinc Sulphat	0.00	0.00	0.00	∞
	Other	0.00	0.00	0.00	∞
6	Weedicide	0.00	0.00	0.00	∞
	Plant protection				
	Insecticide	0.00	0.00	0.00	∞
7	Fungicide	0.00	0.00	0.00	∞
	Total input cost	12844.99	13519.79	674.80	5.25

In garlic cultivation, there were found to be 3.57% increased in the total operational expenses after adoption of recommended soil testing analysis by the respondents. This increased was noticed due to higher hired labour used in the crop.

Table 3.29: Per hectare Operational Expenditure of Garlic Crop. (Rs./ha)

S.No.	Labours	Before	After	Diff.	Percent
1	Total Family Labour	3458.00	2964.00	-494.00	-14.29
2	Total Hired Labour	5928.00	6916.00	988.00	16.67
3	Total Bullock Labour	4446.00	4446.00	0.00	0.00
4	Total Machine Labour	0.00	0.00	0.00	0.00
	Total Labour Cost	13832.00	14326.00	494.00	3.57

The Incremental cost and return on different items is presented in table 3.30 and 3.31 after adopting soil testing recommendations in garlic production. As evident that the labour and input costs both are slightly higher after adoption of recommendations of soil testing.

Table 3.30: Incremental Cost after adoption of Soil Testing Recommendation by the Farmers in Garlic Crop. (Rs/ha)

Particulars	Before	After	Diff.	Percent diff.
Total operational cost	13832.00	14326.00	494.00	3.57
Total input cost	12844.99	13519.79	674.80	5.25
Interest on working capital	888.34	927.26	38.92	4.38
Depreciation	1694.37	1694.37	0.00	0.00
Total Variable Cost	29259.70	30467.43	1207.73	4.13
Intrest on fixed capital	370.46	460.93	90.48	24.42
Land revenue	9.88	9.88	0.00	0.00
Rental value of land	11115.00	13832.00	2717.00	24.44
Total Fixed Cost	11495.34	14302.81	2807.48	24.42
Total Cost of Cultivation	40755.04	44770.24	4015.20	9.85
Total Cost of Production	1833.34	1510.47	-322.87	-17.61

The same was the observation in total, variable and fixed cost. The cost of cultivation per hectare was found Rs. 4015.20/ha. more after adoption of recommendation but the cost of production was found less.

Table 3.31: Incremental Return after adoption of Soil Testing Recommendation by the Farmers in Garlic Crop. (Rs/ha)

S.No.	Particulars	Before	After	Diff.	Percent diff.
A.	**Yield in physical unit(q/ha)**				
	Main product	22.23	29.64	7.41	33.33
	By product	0.00	0.00	0.00	0.00
B.	**Returns**				
	Main product	66690.00	82992.00	16302.00	24.44
	By product	0.00	0.00	0.00	0.00
C.	**Gross returns**	66690.00	82992.00	16302.00	24.44
D.	**Cost of cultivation**	40755.04	44770.24	4015.20	9.85
E.	**Net income**				
	at Variable cost	37430.30	52524.57	15094.27	40.33
	at Total cost	25934.96	38221.76	12286.80	47.38
F.	**Cost - Benefit ratio**				
	at Variable cost	2.28	2.72	0.44	19.51
	at Total cost	1.64	1.85	0.22	13.28

Returns from garlic were found 24.22% more after adoption of soil testing technology. This was due to the fact that after adoption of soil testing technology cultivator get higher yield by using balance dose of fertilizer and use their resource more efficiently as they came direct contact to the Agriculture Officers.

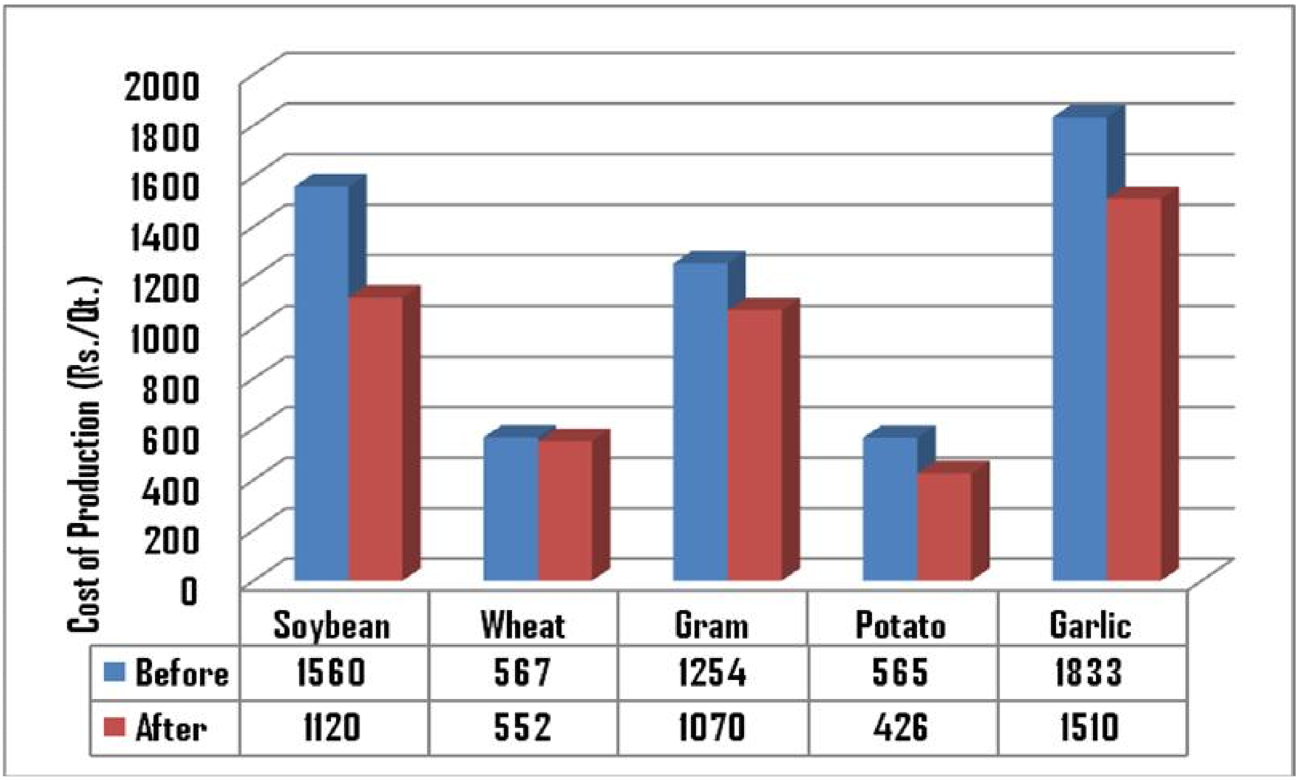

Fig. 3.5: Incremental Cost of Production in Different Crops.

It is concluded that the cost of production from different crop was found decreased (Fig 3.5) from Rs.1560/q to Rs.1120/q (soybean); Rs.567/q to Rs.552/q (Wheat); Rs.1254/q to Rs.1070/q (Gram); Rs.565/q to Rs.426/q (Potato) and Rs.1833/q to Rs.1510/q (Garlic) while, the net income (Rs./ha) was found increased (Fig 3.6) from Rs.30685/ha to Rs.48273/ha (soybean); Rs.34677/ha to Rs.39881/ha (Wheat); Rs.17063/ha to Rs.27067/ha (Gram); Rs.31535/ha to Rs.64131/ha (Potato) and Rs.34677/ha to Rs.39881/ha (Garlic) after adoption of recommendation of soil testing technology.

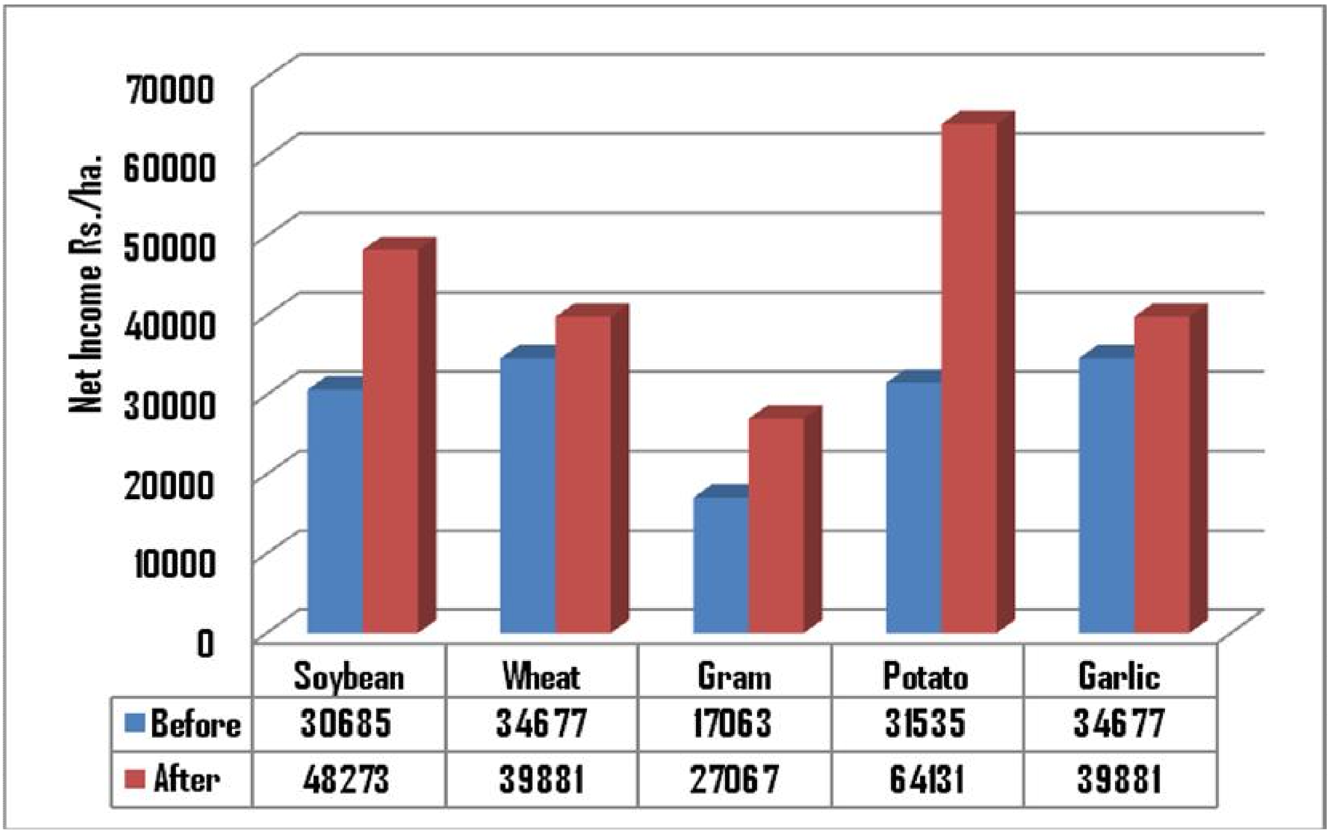

Fig. 3.6: Incremental Net Income in Different Crops.

3.6 Constraints in adoption of soil testing technology

The constraints reported by the sample cultivators in adoption of soil testing technology are presented in Table 3.32. It is observed from the data that lack of knowledge about soil testing facility among cultivators (70%) was found the main constraint in adoption of soil testing technology followed by non availability of soil testing reports in time to cultivator (62%), less cooperation from Agriculture

Table 3.32 : Constraints in adopting of Soil Testing Technology.

S.No	Constraints	Respondents (%)
1	Lack of knowledge about testing facility	70
2	Non availability of soil testing report in time	62
3	Less cooperation from Agriculture Officers/staff	46
4	Complicated methods of Soil Sampling	30
5	Technology is far different from farming practices	26
6	Lack of Training for testing	22
7	High cost of recommendation	20
8	Difficulty in adoption of recommendation	20
9	Soil testing is incredible	12
10	Lab situated far away from the village	12

Officers/Staff of Agriculture Department (46%), complicated method of taking soil sampling (30%), technology totally different from farming practices (26%), lack of training about soil testing technology (22%), high cost of adoption of recommended practices (20%,) difficulty in adoption of recommendations (20%), incredibility of soil testing report (12%) and situation of soil testing labs not with the reach of cultivators (12%), were the other main constraints reported by farmers during the course of investigation.

1. Lack of Knowledge about Soil Testing Facilities

The majority of famers not know the importance of soil testing analysis. They not know that their soils are deficient in essential major and minor elements. They suggested at the time of collection soil samples from the farmers the importance of soil analysis must be communicate to them for proper adoption of recommended soil testing report.

2. Non availability of Soil Testing Report

The report of analysis of soil sample found not available in time. There is found a big time lag between sample collection and receipt of report. So many times they contact to field staff of the Department of Agriculture i.e. Rural Agriculture Extension Officer but failed to take report. Hence, efforts to be made the analysis of soil sample must be done in time and the report of analyzed sample delivered in time so that farmer followed these recommendations and availed the benefits of the soil sample analysis.

3. Less Cooperation from Agricultural Officers / Staff

The 40 per cent of farmers reported that field staff is less cooperated in this matter. It is observed during the course of investigation that a particular staff has already have various assignments and due to lack of trained field staff the majority of them are not in position to solve the questions related to fertilizer and fertilizer application for cultivation of field crops.

4. Complicated Method of Soil Sample

The majority of farmers not know the method and procedure for obtaining soil samples. As the soil sample must be true representative of the field. It requires care and skill. Although it is the task of the field staff appointed by the concern department but may a times they also depends on farmers.

5. Technology far different from farm Practices

The 26 per cent of farmers reported that they have no interest in collection soil sample from the field as it is not related to farm management and is far different from the practices of crop cultivation.

6. Lack of Training for Collection of Soil Samples

The training programme related to collection of soil samples are not found to be conducted by the scientists of the Krishi Vigyan Kendra and officers of the department. Due to this farmers are not conscious with the importance of soil testing analysis.

7. High Cost of Recommendation

The chemical and fertilizer which are recommended in the soil testing report are so costly that farmers are not having enough money to purchase them from the market. Many of chemicals which are the part of recommendation are not available in time in the near market. This also increased the cost of recommendation.

8. Difficulties in adoption of Recommendation

The 20 per cent of respondents reported that they have difficulties in adoption recommendation of soil testing report due their illiteracy. Hence, it is the duty of field staff to motivate them in adoption of recommendation.

9. Soil Testing is incredible

The 12 per cent farmer reported that it is hard to believe in the recommendation of soil report as they submitted sample of same field in two times in a particular season and they got two different recommendation of these samples.

10. Laboratory Situated far away from the village

The some farmer also reported that the laboratory not in their reach so they have not direct touch with the officers of the laboratory. They has to depends on the field staff of the agriculture department.

The following shortcomings were also observed during the course of investigation in the study area. :

1. The soil testing laboratories of the state had not sufficient staff and the present staff also found to engage in other official works.
2. Laboratory equipment are often not calibrated. There is no system of inter-intra lab soil analysis check, hence, accuracy of analysis is not ascertained and soil analysis often may not be accurate, thus recommendation arising out of such an analysis is not expected to be sound.
3. The In-charge of the labs, many a times are, not soil scientists. Hence analysis and interpretation of results do not have adequate technical input.
4. Quantities of the chemicals are often not supplied according to the sample analysing capacity while the labs are expected to work as per the target set for the year. This situation results in poor quality of work or under utilization of already existing low capacity.
5. There is no system of regular / periodical training of the lab staff, thus, the staff does not remain in touch with the latest available equipment / method of testing and formulating recommendation etc.
6. Soil Testing Service charging nominal fee (Rs. 5/-) which does not call for the seriousness of farmers, hence, their involvement in the programme is not much.
7. Soil Testing labs do not get the feedback on the outcome of their recommendations and have no chance of improving / modifying the recommendation based on the outcome of various recommendations made in the past.
8. The initial system of attaching an agronomist with the soil testing labs, to maintain a linkage with the labs and the farmer to ensure implementation of recommendation has been discontinued.

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CHAPTER IV

SUMMARY, CONCLUSIONS AND SUGGESTIONS

Looking to the importance of the soil testing in farmers' field this study had been conducted as the review of various studies reported that the recommendations of soil testing labs are useful for farmers for increasing their levels of output but the majority of the farmers has not been interested in this, due to lack of knowledge about soil testing facilities, testing of soils is incredible, labs are situated far away, and non availability of soil testing report etc. Hence, there is found an urgent need to evaluate the adequacy, usefulness, effectiveness and contribution of these soil testing labs to the development of agriculture.

In Madhya Pradesh total numbers of laboratories are 70, out of which Soil Testing laboratory of Sagar & Dhar (M.P.) has been selected purposively for the study. The soil testing laboratory of Sagar district covers farmers of Sagar and Damoh districts and Soil testing laboratory situated at Dhar covers Dhar district

Both primary and secondary data were collected for the study. The primary data were collected from respondents with the help of pretested interview schedule related to the year 2009-10 and 1010-11. The Secondary data were collected from the office of Joint Directorate Soil Testing Department of Agriculture Vindhyachal Bhawan, Bhopal and from respected Soil Testing laboratory of Sagar & Dhar (M.P.) from their published and unpublished records. The secondary data related from 2001-02 to 2010-11 years. (10 years)

The findings of the study are as follows:

- There were 70 soil testing labs exist in the year covering 50 districts together. The maximum number of labs were exist in Malwa Plateau (13) followed by Kymore Plateau and Satpura Hills (11) and Vindhya Plateau (10). The other agro climatic zone also had more than one soil testing lab in their area.
- The coverage or catchments of per lab was 0.63 lakh farmers and 0.47 lakh hectares land or cultivable land. Agro climatic region wise the highest farmers covered by labs was found in Central Narmada Valley (1.15 lakh) followed by Vindhya Plateau (1.06 lakh) Chhattisgarh Plains (0.70 lakh) and Kymore Plateau and Satpura Hills (0.67 lakh).

- As for coverage of area under each lab revealed that lab situated in Chhattisgarh plain (Bhalaghat district) covered 0.72 lakh hectare, followed by Central Narmada Valley (0.65 lakh hectare), Northern Hills of Chhattisgarh (0.60 lakh hectare) and Kymore Plateau and Satpura Hills (0.51 lakh hectares). Other labs also covered a significant area and provide service to needy farmers. It is also observed from the data that labs situated in Satpura Plateau (0.34 lakh hectares) covered the lowest area. This also indicated that infrastructure available per lakh hectare was appreciable in Satpura Plateau.
- In Madhya Pradesh each soil testing lab covered 0.66 lakh farmers covered 0.51 lakh hectares. The above table clearly indicated that state need more and more soil testing lab as each lab had a large number of farmers and land
- There were 19.95% and 21.18% gaps noted between target and achievement respectively in Sagar and Dhar districts. The target of Sagar soil testing lab were found to be same in base as well as current years. Whereas target were found to be decreased in current year as compared to base year in Dhar district of Madhya Pradesh. The target were found to be same i.e. 10000 soil samples per year of soil testing lab sagar and there were found an average of gap of 40% between target and achievement. The achievement of the soil sample was also analyse and it is found that the achevement of soil sample is increase from 2197 (2001-02) to 9615 (2010-11) showed an growth of 10.87% per annum and with a rate of 657.21 sample per year.
- The cost of analysis for sample comes to be Rs. 239.23 per sample. Government has gave these facilities to farmers only in Rs. 10/-. Hence, there is a net loss of Rs. 229.23 to the Government. Hence, there is necessity to increased target and achievement of soil sample per year. As the number of sample increases the cost of sample will be go down.

Table 4.1: Distribution of Sample Respondents.

Particulars	Sagar	Dhar	Overall
Total Respondents	50	50	100
Who Received Report	36 (72.00)	35 (70.00)	71 (71.00)
Who Adopt Recommendation	26 (72.22)	23 (65.71)	49 (49.00)

Figures in parenthesis show percentages to total

- The 71 per cent farmers received soil testing report from the respective labs of their district. Out of these 71 farmers out of the 100 selected farmers , 49 (69.01%) farmers adopted the recommendations and applied the fertilizer or other chemical for improvement of their crops, while remaining 22 (30.99%) did not followed these recommendations due to several constraints.
- The per hectare expenditure on seed, fertilizer and plant protection measures of adopted farmers increased for all crops after adopting soil testing analysis recommendation. The per hectare expenditure on labour was also found increased in all crops except in soybean. The cost of cultivation and cost of production of all the crops reduced drastically, while cost benefit ratio was found increased after adaption of recommendation of soil testing.

Table 4.2: Incremental return after adoption of soil testing recommendation by the farmers in different crops (Rs/ha)

Particulars	Soybean		Wheat		Gram		Potato		Garlic	
	Before	After	Before	After	Before	After	Before	After	Before	After
Yield physical unit (q/ha)										
Main product	15.23	19.76 (29.74)	38.61	46.88 (21.42)	12.35	17.29 (40.00)	123.50	172.90 (40.00)	22.23	29.64 (33.33)
By product	22.84	27.78 (21.63)	19.30	22.44 (16.27)	7.41	10.37 (39.95)	0.00	0.00 (0.00)	0.00	0.00 (0.00)
Returns										
Main product	19801	25688 (29.73)	34757	42192 (21.39)	27170	38038 (40.00)	49400	69160 (40.00)	55575	74100 (33.33)
By product	1370	1667 (21.62)	772	898 (16.22)	444	622 (40.00)	0	0 (0.00)	0	0 (0.00)
Gross returns	21172	27355 (29.20)	35529	43090 (21.28)	27614	38660 (40.00)	49400	69160 (40.00)	55575	74100 (33.33)
Net income										
at Variable cost	11978	20187 (68.54)	25793	31133 (20.70)	21015	29509 (39.93)	16646	34581 (107.75)	32008	49395 (54.32)
at Total cost	8321	15466 (85.86)	19664	24011 (22.11)	16249	22841 (39.94)	8128	25042 (208.10)	22427	36623 (63.30)
Cost - Benefit ratio										
at Variable cost	2.30	3.82	3.65	3.60	4.18	4.22	1.51	2.00	2.36	3.00
at Total cost	1.65	2.30	2.24	2.26	2.43	2.44	1.20	1.57	1.68	1.98

Figures in parenthesis show percentages difference to before.

- The lack of knowledge about soil testing technology (70%) non-availability of soil testing report (62%), less co operation from officers of agriculture department (46%) and complicated method of testing soil sample (30%) were found the main constraints in adoption of soil testing recommendations.

Suggestions

The present infrastructure of soil testing facility is found to be insufficient in different agro climatic regions of Madhya Pradesh. Whatever infrastructure is available is not functioning properly hence, coverage of target/achievement needs to be increased by employing skill and trained staff in these labs. This is needs to be increased quantity as quality of soil sample testing.

There is an ample scope to improve the analyzing capacity as well as dissemination ability of the soil testing laboratories. If this, coupled with professional management through proper linkages, can bring radical changes in the soil testing service in the state to extent the farmers' satisfaction.

Each laboratory may be provided with the required staff, according to its capacity. Each laboratory may be headed by a technical person having M.Sc. (Soil Science & Agri. Chemistry) as an essential qualification or B.Sc. (Ag.) with a minimum of 5 years experience of working in soil testing / soil Survey / fertilizer testing lab. There should be no relaxation in this stipulation so that the technical flaw in the programme is removed.

In-charge of the soil testing lab may participate in the *kharif /rabi* conferences being organized by the state to formulate various recommendations relating to input use/crop variety etc. Orientation training of the in-charge may be organized once a year for a period of minimum 3 days in any of one the Agriculture University of the State.

Special care may be taken for collection of representative soil samples. Validity of sample has to ensure at all levels-starting from collection stage to storage in lab even after analysis.

Since the reports are often not received in time by the farmers, when sent through usual postal system, a system of online communication of reports may be started by which the soil testing laboratory may send the report to the Block Development Officer (BDO) to at least cut the postal delays. The farmers often visit BDO's office for various other activities and may be able to collect reports. This however also presupposes that all the soil testing laboratories are provided with computer facilities. Keeping the cost in mind, the system of on-line communication reports may be started in the selected laboratories initially and then to cover all the labs.

The laboratories may be kept informed on the outcome of the recommendations made by them on fertilizer use at least on representative and typical case by case basis, e.g. where the recommendation has given as expected / better than expected results and where it has not given results as expected.

The Department of Agriculture ensures an effective and live linkage between the field and the laboratory. It is to be appreciable if each lab may adopt at least one nearby village from where sample may be collected by the laboratory staff and recommendations are also communicated / handed over directly by the laboratory staff to the farmers and to follow the outcome of the programme. Each lab can take up one village as a mission to see the utility of the programme by itself and find out shortcomings so that the whole programme can be improved on the basis of such direct observation / study. Presently, the labs are literally cut off from the field and work in isolation of the whole programme.

The state government in Madhya Pradesh already charging the fee of Rs. 5/- per sample but it is too less. A sufficient fee will bring an accountability on the part of the lab to make a sound recommendation because farmers will participate in sample collection or at least will know that a sample has been collected and will be expected to appreciate the value of the report received on the basis of some cost borne by them. They will start asking the question if report is not received in time or is not found to be useful when the recommendation is followed as advised by the lab. Charging the fee will also help the states to supplement the requirement of funds by the laboratories. A minimum fee of Rs.20 per sample analysis may be charged. Estimated cost of analysis of a sample is approximately Rs. 80 for physical parameters + NPK analysis while with the micronutrients it would be about Rs. 100 (Only chemicals and 20% of glass breakages are considered as part of the cost for this purpose).

Soil analysis and fertilizer recommendation is only a part of the soil testing service. To a good measure, the efficiency of the service depends upon the care and efforts put forth by extension workers and the farmers in collection and dispatch of the samples to the laboratories and obtaining reports timely. Its effectiveness also depends upon the proper follow up in conveying the recommendations to the farmers, including the actual use of fertilizer according to the recommendations. The role of extension service, soil chemists and the agronomists in the field is important. The service is suffering both from technological aspect and due to inadequate and untrained manpower. Weakness of the programme in its various aspects as discussed above needs improvement.

The soil health card so issued to the farmers may be periodically updated so as the farmers are aware about the changing fertility status of their land. This card may also be useful to the farmers in getting loans for agriculture purposes where agricultural value of the land may be one of the factors.

Governments' recent policy change on fertilizer subsidy w.e.f. 01.04.2010, stipulates that fertilizers subsidy will be worked out on the basis of their nutrient content. This would ensure that special attention is paid on the individual soil nutrient deficiency and application of fertilizers on the basis of such deficit nutrient. It would further require the formulation of fertilizer products according to the needs of nutrients in a given soil / crop. This would be possible only when the soil testing labs are in a position to give information on soil nutrient deficiencies on smaller area basis, say village-wise, if not on individual farmer's basis. This will further emphasise on the need of strengthening the soil testing service in the state both in quality and quality. In the new policy of giving nutrient based fertilizer subsidy, a specific emphasis on 'Nutrient' will focus on nutrient-wise soil deficiency and the production and promotion of fertilizers according to the need of such deficient nutrient. This will call for greater attention on the use of soil nutrient deficiency based fertilizers. However, this policy will ensure that no fertilizer gets less or more emphasis than the other due to any consideration such as, production technology or use of raw material and thus, on the basis of cost of production etc. It will ensure uniformity of subsidy in all types of fertilizers.

If the fertilizer industry will venture to produce and promote the products on the basis of requirement of specific soil nutrient deficiency, the industry will have to get into the soil testing programme in a big way and generate such information as a measure of good supplement to soil testing programme basically being run by the Government. The fertilizer industry may adopt at least one district in a State and ensure and monitor that the fertilizer in the adopted district is used on the basis of plant nutrient deficiency as determined through accurate soil testing.

The awareness about soil testing facility, its need and importance is at the farmers' level hence, awareness building must be taken up by extension activities. As the adoption of recommendations of soil testing reduces cost of production of crops and increases returns. This fact may be popularized among the farmers' so that they can be benefited. Sufficient field staff with trained personal should be kept at village level and method as well as result demonstrations of these technologies may be taken up at the village level which popularized the impact of these technologies in front of the cultivators.

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