Resource use efficiency of onion cultivation at different levels of adoption in Sehore district of Madhya Pradesh

THESIS

Submitted to the

Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior

In partial fulfillment of the requirements for
the degree of

MASTER OF SCIENCE

In

AGRICULTURE

(AGRICULTURAL ECONOMICS AND FARM MANAGEMENT)

By

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2011

CERTIFICATE-I

This is to certify that the thesis entitled "**Resource use efficiency of onion cultivation at different levels of adoption in Sehore district of Madhya Pradesh"** submitted in partial fulfillment of the requirements for the degree of Master of Science/Doctor of Philosophy in Agriculture/Horticulture of the Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior is a record of the bonafide research work carried out by **Mr.Sunil Goyal**, **ID No. RA/SH/1202/2009** under my guidance and supervision. The subject of the thesis has been approved by the student's Advisory Committee and the Director of Instruction.

No part of the thesis has been submitted for any other degree of diploma (Certificate awarded etc) or has been published/ published part has fully acknowledged. All the assistance and help received during the course the course of the investigation has been acknowledged by him/her.

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ACKNOWLEDGEMENT

Thanks to almighty God for giving me an opportunity to express my gratitude to all those who have given me a helping hands to make this study a successful one. Words are insufficient to express the emotions and therefore, my acknowledgement is many times than my expressions. I wish to avail this opportunity in ex-pressing my deep sense of gratitude to my advisor, Dr. P.K.Malviya, Associate Professor, Agricultural Economics and Farm Management, R.A.K. College of Agriculture, Sehore (M.P.) for his invaluable guidance, immense labour, untiring interest, valuable comments, criticism and sympathetic treatment in every step and work in completion of this work and finalization of this manuscript.

I am indebted to the members of advisory committee, Dr. P.S.Raghuwanshi, Head of Section (Agril. Economics), Dr.(Smt) S.B.Tambi, Professor and Head of Section (Agril. Extension), for their suggestions and encouragement during the preparation of this manuscript.

I am obliged to Dr.V.S.Goutam, Dean, R.A.K. College of Agriculture, Sehore (M.P.) for their inspiration and help during my studies.

No appropriate words could be treated in the lexicon to convey my sub line obeisance to express my deep sense of gratitude to my parents Shri. R.R.Goyal and Smt. Resham Devi Goyal and Sister Madhu Goyal and brothers Mr. Dinesh Goyal, Suresh Goyal all my family members whose love and affection inspired me during this course of investigation brought me to this success.

Heartily thanks are due to my friendsAtul Thakur, Ahailendra yadev, Pushpendra, Vinod, Dinesh. J.P.malviya. Nagin verma, Bhojraj parmar, Jagdish Parmar and Deepak patari all my colleagues and friend who helped me directly or indirectly during the coerces of this investigations.

Last but not the least, My thanks are due to the Mr. Praveen Kumar Soni (Computer Teacher) Who given me his valuable time and supportive backing without any time boundation.

My thanks are due to the Staff members of academic section of all my respondence where valuable response had made this manuscript to see the light of the Day.

Place: Sehore

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CHAPTER - I
INTRODUCTION

Agricultural development in respect of crop production, fruit and vegetable production, animal production and other allied entrepreneur occupies an important place in the economic development of our country as its population is increasing at a rapid rate leading to an expanding demand for agricultural production. The increase in total agricultural production or any specific crops is possible by expanding of area under cultivation of crops/crop or by increasing the productivity per unit of area and input. Agricultural production is not a smooth and continues process; it bristles with a number of hurdles. Prior to green revolution, agriculture production in India was mostly stagnant. The sixties and seventies witnessed significant, unprecedented and for, reaching changes in agriculture. The scale of production has witnessed a sea change and agriculture has shown signs of a 'take off'.

It is felt known that a basic need of Indian agriculture is an increase in the productivity of different crops with optimal use of production resources. The main contributory factors that influence the productivity found to technological and resource use status of farm and adoption of improved agronomical and farm practices etc. These factors have to be viewed in any efforts designed to increase production. Even the limitation of season and climate can be overcome in some measure by selecting suitable techniques. Madhya Pradesh is one of the front runners that benefited from the improved production agricultural technologies, because of its rich resource endowments. It took lead in adoption of the yield increasing technologies, as a result of spread of the technology the production of agriculture increased in year to year.

Horticulture has been recognized as a vibrant sector in agriculture, which provides avenues for diversification, enhanced returns per unit area, better land and water used with opportunities for employment generation. The wide range of horticultural crops provide ample opportunities to farmers to adopted multi layer cropping for minimizing risk of crop failure, maximizing their farm income. Onion is one of the important horticultural crop enhance the farmers economy with agricultural development played vitally role in Indian economy. The new farming strategy calls for the adoption of balanced and efficient use of modern inputs for profitable and increase

in production. The use of modern technology needs a careful management of resources before allocating the area under any crop. Farmers should well aware with different types of costs incurred and returned obtained from particular crop, for minimizing the risk factor and easily adoption of modern technology of particular crop. If farmers will have such valuable information then they can allocate a manageable area under particular crop and can also achieve a desirable benefit.

On the other hand the problem is arising that the pattern of onion production has been changing over time in different regions. The shifts in preference of domestic consumers, increasing urbanization, rising incomes, demographic and social factors and the changes in productivity of onion have brought about changes in the pattern of consumption and hence, the demand for onion. The production pattern of onion also affected due to use of resource pattern, level of production technology and price factor of input and output respectively. It has been found in various studies that the yield of onion is directly influencing with level of technology used in production, or we can say that the influence of technology development in onion production and its adoption is augmenting regarding total production and productivity of onion is being recognized. However, wide gap prevails between the performance of technology at the progressive farmer's level and of the fields of general farmers. The constraint operating due to modern onion production technology are more of capital intensive and the farmers have to invest more on yield attributing inputs like seed, fertilizers, plant protection measures and irrigation etc. Due to high cost of inputs and ignorance about improve practices general farmers found to not judicious application of improve technology. In this respect question arising that "are investment on modern technology was proportionately enhanced the output and net return? needs investigation and verification in respective of onion growing area.

Sehore district in Madhya Pradesh is one of the agricultural in respect of crops and horticultural under developed area. Small and medium land holders have dominated in the area. The viability and sustainability of such tiny holdings is doughtfull particularly in view of the on going process of globalization. The small land holders in district are poor; usually under nourished and poverty stricken, by and large practices subsistence agriculture with very limited marketable surplus. Their plight caused for

urgent need to augment their income for insuring food security and alleviating poverty. Experiences gain suggested that diversification of agriculture towards high value commercial crop production have helped small holders to augment to their income. Onion is an important herbaceous annual for bulb production of which the average productivity in area is very marginal found good substitute of general crops growing in the area. Onion has been an integral part of the Indian diet and the demand for onion has been growing year after year. There has been a steady increase in the area and production of onion in Sehore district over the years.

Most of the onion produced in India comes from the states of Maharashtra, Gujarat and Uttar Pradesh. Though, onion is also grown in Madhya Pradesh. In Madhya Pradesh the onion production is found 625975 Metric tonnes with cultivated area of 28790 hectares in 2008-09. Keeping the economic view of onion production in Madhya Pradesh the farmers should aware it profitability and the pattern of resources use in its cultivation is paramount important, particularly in Sehore district where onion cultivation is become very popular now a days due to higher demand in to nearby mega city i.e. Bhopal and Indore.

The main purpose of this study is to evaluate the efficiency with which the farmers in Sehore use their resource in the cultivation of onion crop and resultant more economic returns against general crop production. The result of profitability and resource use efficiency in onion production with different level use of production technology will indicate the scope existed to increase there area, production and productivity also with judicious use of scares and important inputs. This may also help in turn-out negative return in to positive by over come the inefficient use of different inputs used in the cultivation of different crops. The specific objectives of the study are as follow:

Objectives of the study:

1. To analyse the adoption and yield gap at different adoption levels.
2. To analyse the profitability of onion production at different adoption levels.
3. To determine the resource use efficiency at various level of adoption.
4. To identify the important constraints responsible for the exiting yield gap.

5. To suggest ways and means for increasing onion production in area under study.

Limitation of the study:

(a) In this study only those factors are considered which are under the control of the respondents and contributes significantly toward returns and use of resources in onion production.

(b) The coverage of study is limited to area of Sehore district only comprising of limited respondents. This is due to the fact that coverage of large area is beyond the capacity of investigator.

(c) The primary data collected for the study were entirely based on memory of the cultivators because cultivators do not keep any records regarding their farm practices.

(d) The data are pertaining to the agriculture year 2010-11 only.

Significant of study:

Onion production occupies an important place in the economic development of farmers. So as to boost up the onion production, improved production technology is being continuously developed but in different level. That is reason, the production of onion per hectare in study area found to low. The increase in onion production is possible by expanding of area under cultivation or by increasing the productivity per unit of input using in cultivation. The scope for bringing more area under the onion being very limited, therefore, the crux of the problem of increase in onion production and productivity remains unsettled without answering the question, i.e. how to increase output per unit of input. The one way of approaching the problem of increasing onion production is to examine how efficiently the farmers are using their resources. If resource use is inefficient, onion production can be increased by making adjustments in the present use of factor inputs in optimal direction. In case, it is efficient the only, way out for increasing onion production would be the adoption of modern inputs and improved production technology in economic level.

CHAPTER II

REVIEW OF LITERATURE

This chapter is mainly concerned with the foremost studies conducted on the aspects of problem so far. Though onion is the most important cash crops in our country but less research work has been done regarding production, constraint in production, resource use efficiency and other economic aspects. The onion cultivation requires more resources and capital in comparision to food grain crop production. We can say that onion is capital-intensive cultivation and most of the farmers in Madhya Pradesh are having very few resources on their farm. So the study emphasized that how can farmers save their existing resources is paramount important. The present research work on production and resource use efficiency of onion has been reviewed in this chapter. The literature will guide for further research in respect to efficient use of resources in cultivation of onion on farm level.

Raghuwanshi *et al.* (1974), studied the regional specialization in cultivation of commercial crops in saproom valley of Himachal Pradesh. He reported negative values of elasticity's of production for fertilizer in hill capsicum demonstrated its excessive use with possibilities to economies.

Bal Singh and Bal (1983), conducted a study using cobb-Douglus production function for studying resources productivity and factor share in crop production in central district of Punjab. They found that the elasticity of production for value of independent variables such as human labour, fertilizer, weedicide etc., has declined, but that of irrigation increased in 1980-81 over 1972-73. The average farm size has decreased from 8.17 to 6.22hectare. Per hectare use of human labour decreased from 636.11 men hours to 568.11 men hours during 1972-73 to 1980-81 period. The average level of use of other factors has increased during this period MVP were higher than the factor cost for human labour and fertilizer.

Babar,V.S and Waghmare,R.E.(1985), onion is an important crop in Maharashtra, with Sri Lanka the main export outlet. The study examines the level and productivity of inputs used in both kharif and rabi seasons for 210 onion growers in 1978/97, on three sizes of farm. Human labour, draught power and organic manure were the major inputs in the kharif season. Marginal productivity of labour was higher

than its cost in both seasons.

Chand,L. (1985), the total production of potatoes and onions in Madhya Pradesh during 1979/80 was around 212.9 thousand and 138.7 thousand respectively. The paper examines the potential of various districts of Madhya Pradesh in regard to production of these two crops, and makes suggestions for increasing the production of the two crops in the State as a whole.

Alshi Bhole and Bidwal (1988), conducted a study on the constraints of crop production. They observed that the constraints in the adoption of new technology such as hybrid seed, fertilizers and pesticides for increasing production in Akola, Yavatmal, Amravati and Buldhana district of Vidharbha in Maharashtra for the year 1987-88 and found that the extent of adoption of recommended practices was more in preparatory tillage and sowing operation and less in manuring, fertilizers and plant protection operations, non availability of farm yard manure in the village lack of money to purchase the manure, risk due to uncertainty of rains, wrong belief among the farmers about fertilizers use and inadequate amount of loan to purchase fertilizers were the main constraint faced by most of the respondents. The use of pesticides failure to understand the importance of preventive measures and non availability of plant protection equipment were the major constraints in the use of pesticides.

Bhalerao, *et al*. (1992), studies input use efficiency of seeds, fertilizer insecticides, human labour and irrigation with the help of Cobb. Douglas production function fitted to data obtained from vegetables, rainfed and irrigated groundnut and mixed and pure mustard. The efficiency of input use is studied by estimating marginal value productivity (MVP), marginal cost (MC) ratio. The results indicate negative bi-values for labour for all the crops except mustard and over-use or misuse of seed, fertilizers and irrigation for some of the vegetables. MVP-MC ratio, which are mostly greater than unity in vegetables and irrigated groundnut for most of the inputs, indicate their efficient use, and less than unity of some of the vegetables, rainfed groundnut and pure mustard, indicate less than optimum use.

Sharma,A.K. *et al.* (1992), conducted a study on economics of vegetable farming in mid - hills of H.P. The specific objectives of the study were to examine the profitability of different vegetable crops and input output relationship in the production of selected

vegetables. They have selected 16 vegetable crops like potato, ladyfinger, chilies, radish etc. The study revealed that the lady's finger (Rs. 20420/ha)and the chillies (Rs.12351/ha) Kharif cauliflower (Rs.32307/ha) cabbage (Rs. 20271/ha) and potato (Rs. 26,033/ha) in rabi – zaid cauliflower (Rs. 22130/ha) cabbage (Rs.19063/ha) and peas (Rs. 18117/ha) in Rabi bottle gourd (Rs. 9568/ha) brinjal (Rs. 8895/ha) and bitter gourd (Rs. 8739/ha) in zaid – Kharif were the most remunerative vegetable crops. It was examined that the coefficient of multiple determination (R^2) for all the regression equations was significant and varied between 0.633 to 0.858. The elasticity coefficients associated with bullock labour were positive and significant only in cauliflower (0.116) and potato (0.356). The regression coefficient revealed that one percent increase in human labour will increase the income by 0.64, 0.67, 0.37, 0.32 and 0.72 percent in lady's finger, chillies, cauliflower, cabbage and potato respectively.

Bavanthade,T.L. *et al.* (1993), study in Maharashtra is an important onion producing state. Sixty-eight farmers were selected from 6 villages in the Amravati district. The holdings were classified according to their area of production: average areas for Group I, II and III were 209.54, 241.07 and 255.3 ha, respectively. The production costs for A (running costs), B (A + fixed costs) and C (B + family labour input) were 13 164.85, 19 020.23 and 19 668.12 Rs/ha, respectively. On average, the losses during harvest and storage were ~73%, the yield was 2335.3 q/ha, and the gross return was 33 878.44 Rs/ha. Using costs A, B and C, the net returns were 20 713.59, 14 858.48 and 14 210.32 Rs/ha. Using costs A and C, the net return/rupee of input was 1.57 and 0.72, respectively. At cost C, the cost:benefit ratio was 1:1.70, the production cost was 83.61 Rs/q and the profit was 59.19 Rs/q, using the prevailing average price of 142.8 Rs/q.

Vagdevi,T.N.S. *et al.* (1993), study the costs and returns of vegetable production in Krishna district, Andhra Pradesh, India are studied using data collected from a sample of 72 farmers. Four vegetable crops are covered (aubergines, okra, ridgegourds and tomatoes). Production cost was highest for aubergines followed by tomatoes. Net return was highest for aubergines and lowest for okra.

Kiresur,V.R. *et al.* (1993), study of the costs and returns of vegetable growing was carried out in Dharwad and Hubli taluks in Dharwad district, Andhra Pradesh, India.

The sample included 81 tomato growers, 69 aubergine cultivators, 55 onion producers and 83 potato farmers. Data were collected for 1985/86. The costs of production were highest for potatoes followed by onions, tomatoes and aubergines. The highest net returns were obtained from aubergines (Rs 58/quintal) in Dharwad taluk, followed by onions (Rs 51/q) in Hubli taluk. Net profit was lowest for potatoes.

Thakur *et al.* (1994), worked returns and profits per hectare for farmers for different vegetables in kullu and Solan in Himachal Pradesh. They observed that in Kullu the actual costs of production, yield, income and profit from chilies was Rs. 14927.72, 89.31 quintal, Rs. 39787.61 and Rs. 24859.89 per hectare respectively that of in Solan was worked out to be Rs.15230.00, 89.32q Rs. 61496.82 and Rs.46266.82 per hectare respectively. It was noted that vegetable production was highly capital intensive but at the same time highly remunerative. There was much to learn and adopt in terms of modern methods of production marketing and new technology adoption for very high production and income of vegetable by the farmers of Kullu and other areas from the vegetable growers at Saproon valley in Solan. They used very advanced technology, methods of vegetable marketing and much higher levels and quality of inputs. The production costs and income of the farmers in Solan were strikingly higher than farmers in Kullu due to the use of all recommended package of practices.

Atul Chandra (1997), The Malwa plateau is located in central western part of Madhya Pradesh. The climate of Malwa region is dry and the summers are neither very hot nor the winters very cold. Annual rainfall is between 750 and 1250 mm. The major fruit crops grown are: citrus, guava, ber [Ziziphus mauritiana], mango, banana, pawpaws and grapes. Rainy season and summer vegetables are also grown, including potato, sweet potato, tomato, onion, chillies and garlic. Ujjain and Indore divisions are famous for flower cultivation. Kathiawar peninsula (also known as Saurashtra) is the most conspicuous peninsula of western India. Fruits such as mango, sapodillas, guava, citrus, ber, banana, pomegranate, date palm and coconut; vegetables such as onion, aubergines, cluster bean, okra, tomato, cabbage, cauliflower, chillies and garlic; and spices such as cumin, turmeric and coriander are grown. Cultivars developed for cultivation in these parts of India are described. Guava cultivars Gwalior-27 and Dharidar are promising. Pea cultivars Jawahar Mattar-1, JM-2 and JM-3 are promising.

A few promising cultivars of dolichos bean [Lablab purpureus] (JDL-17, JDL-37, JDL-71, JDL-77, JDL-79 and JDL-152) have been bred which are promising.

Naik, *et al.* (1997), the study was conducted to evaluate the economics of onion production in Bijapur district using 1992/93 data. Multi stage sampling design was employed and 80 sample farmers were selected comprising 33 small and 47 large farmers. The study revealed that the per hectare cost of cultivation was Rs. 13,203/- and Rs. 14,396/- on small and large farms respectively. It was also found that the human labour, bullock labour, rental value of land, interest on working capital and FYM were the major contributors to the total cost of cultivation. The per hectare net income realized was Rs. 20,968/- and Rs. 23,924/- on small and large farm, respectively.

Sailaja,D. *et al.* (1998), study the using data collected from 90 farmers in Guntur district, Andhra Pradesh, the resource use efficiency and productivity of tomato, brinjal [aubergine], cauliflower and coccinia [gourds] production are examined [year not given]. Results indicate vegetable production is profitable despite major constraints such as the non-availability of quality seed, inadequate credit and marketing facilities; shortage of water; and inefficiency postharvest handling.

Waman,G.K*. et al.* (1998), reveals that the survey was conducted to investigate adoption of 13 recommended cultivation practices by onion growers in Yeola tahsil, Nasik district, Maharashtra, India [n=150, 1995]. Results reveal that a majority of onion growers had a medium level of adoption of the recommended onion production technology. Level of education, size of family, interest in modern farming and sources of information were found to significantly influence adoption behaviour.

Mohapatra.S.C. (1999), observed that average cost of cultivation of onion per hectare was Rs.17949. The cost of production of onion worked out to Rs.97 per quintal. Among various components of operational costs, human labour accounted for more than 33 per cent of total cost followed by expenditure on manures and fertilizers (16.66 %), seeds (11.10%), plant protection chemicals (9.69%) and bullock labour (6.94%). Total fixed cost constituted 17.16 per cent of total cost constituted 17.16 per cent of total cost of cultivation of onion crop.

Shah Deepak (1999), found that the total cost of onion production to much higher in rabi season compared to during kharif season. This held true for all categories of

onion producers. In general, the per acre total cost of onion production for an average category of farmer in kharif season was estimated at Rs.11678 and the same figure during rabi season stood at Rs.12949, showing an increase in total cost to the tune of 11 per cent in rabi season over that of kharif season. In both the seasons, the production cost as proportion of total cost varied from 80 to 85 per cent across various categories of producers and the remaining 15-20 per cent of the same owed it to marketing cost. A note worthy feature observed was the decline in labour cost as proportion of total cost with an increase in land holding size of producers. This held true both in kharif and rabi seasons. On the other hand, material input cost as proportion of total cost increased with an increase in land holding size of the producers. It increased from 14 per cent for marginal category to 18 per cent for the large category. Most of the material input cost owned it to expenditure made on the purchase of fertilizers. Medium and large category of producers were seen to spend more on fertilizer input as compared to marginal and small category. This shows the obvious fact that because of better purchasing power rich farmers could use more yield ensuring inputs like fertilizers. In general, for an average category of onion producers, the per acre net return was estimated at Rs.5098 in the kharif season and at Rs.6282 in the rabi season. Thus, the average category of producer was to obtain 23 per cent higher net income from one-acre onion farm during the rabi season as compared to kharif season. In this sequel, the input-output ratio was seen to be higher in rabi(1:1.49) compared to kharif season (1:1.44).

Pandey,U.B. (2000), presents the constraints limiting onion productivity and increasing postharvest losses in Andhra Pradesh, India, and the strategies to increase productivity and minimize post harvest losses by adopting production and post harvest technologies in onion production such as the use of quality seeds of the recommended variety, selection of suitable land, use of manures and fertilizers, weeding, irrigation, suitable chemical treatments and proper storage.

Kamble,A.S. *et al.* (2002), the cost and return structure of onion production in Bellary and Dharwad districts, Karnataka, India was evaluated based on data from 120 sample farms (38 small, 38 medium, and 44 large farms). Mean per hectare total cost of cultivation in Dharwad district was Rs. 7338.55, 8723.78, and 7916.97 on small,

medium and large farms, respectively. In Bellary district, mean per hectare total cost of cultivation was Rs. 9739.39, 11 190.37, and 11 874.39 on small, medium and large farms, respectively. Mean per hectare net returns in Dharwad district were Rs. 6602.45, 11 426.97, and 7484.28 on small, medium and large farms, respectively. In Bellary district, mean per hectare net returns were Rs. 6350.13, 4553.60, and 6558.78 on small, medium and large farms, respectively.

Balappa,S.R. and Hugas,L.B. (2003), the study analyses the costs and returns of onion production as well as the channels, costs, and margins of onion marketing in north Karnataka, India. The analysis is based on data for the year 1999-2000 collected from a sample of 150 growers, 30 wholesalers, 30 commission agents, and 30 retailers. It is revealed that although farmers are producing adequate quantities of onions to meet consumer demand, they are facing problems in marketing their produce. On the other hand, market intermediaries are accruing higher margins by incurring less costs.

Dixit,S.N. and Singh,S.P. (2003), experiments were conducted in a farmer's field in Madhya Pradesh, India, during the rabi season from 1998/99 to 2000/01 to study the effects of improved farming techniques and farmers' practice on the yield and profitability of tomato and onion. The adoption of improved farming practices recorded an average yields of 256 quintal/ha for tomato and 200 quintal/ha for onion, which were higher by 43.5 and 39.5% than the yields recorded for farmers' practice. The average net returns obtained with the adoption of improved farming practices were 12 868.70 and 27 424.30 rupees/ha for tomato and onion, respectively. The average incremental cost benefit ratios recorded for tomato (2.73) and onion (3.087) indicated the profitability of using improved farming technologies.

Pratibha Tewari; Kavia,Z.D; Gajja,B.L. and Bhati,T.K.(2003), study the cost structure and the use of inputs in vegetable production were examined in a sample of 30 family farms in Jodhpur district, Rajasthan, India. The results indicate that the level of inputs used in the production of vegetables is low and there is a lot of scope to improve the productivity of vegetables by increasing the use of seeds, pesticides, fertilizers, and other inputs.

Verma,A.R; Rajput,A.M and Patidar,R.S (2004), this paper analyses the economics of onion production on different farm size groups in Indore district, Madhya

Pradesh, India. Primary data for the year 2000-01 on cost of cultivation, fixed assets, yield, returns, and constraints in production and marketing were collected from a sample of 80 farmers (40 small-, 25 medium- and 15 large-scale farmers). Production function analysis is employed to evaluate resource productivities and resource-use efficiency. The growth of onion exports is also examined based on estimates from time-series data.

Yadav,B.D.; Khandelwal,R.B. and Sharma,Y.K. (2004), a field experiment was conducted in Jaipur, Rajasthan, India, during the rabi seasons of 1999-2000, 2000-01 and 2001-02 to find out the effects of nitrogen and Azospirillum brasilense on the yield of onion cv. RO-1 bulbs. Treatment consisted of four levels of nitrogen (no nitrogen, 50%, 75% and 100% of recommended rate of nitrogen (i.e. 100 kg/ha)) and two levels of biofertilizer (with and without Azospirillum brasilense). Application of nitrogen fertilizer and biofertilizer had significant independent effects on yield of onion bulbs. Significant and highest yield (336.5 q/ha) was recorded with 100 kg N/ha, which was at par with 75 kg N/ha (328.4 q/ha). The improvement in bulb yield was 14.1 and 11.4%, respectively, over the control treatment (without nitrogen application). Azospirillum inoculation recorded a higher bulb yield of onion (323.7 q/ha) over the control (310.9 q/ha). A slight increase in available nitrogen content in soil was observed with increasing nitrogen rate in all the samplings. With the application of Azospirillum, an increasing trend of available nitrogen content of soil for all the samplings was found and a significant difference was noticed in the 2nd sampling of third year and 3rd sampling of first year only, and the increase in available nitrogen was 10.97 and 11.14 kg/ha, respectively. Treatment with 100 kg N/ha + Azospirillum brasilense inoculation recorded the highest net profit per hectare (Rs. 32791.95) which was at par with 75 kg N/ha + Azospirillum brasilense (Rs. 31287.95).

Durgawati,W. *et al.* (2005), Conducted a study on Economic analysis of onion and potato in the Malwa Region of Madhya Pradesh and revealed that in small size group the obtained gross income from onion Rs.55290 (maximum) fallowed by Rs. 51870 in medium size and Rs. 50472 minimums in large size. The average productivity and gross return of the study area onion was recorded 87.57q./ha and Rs.52554, respectively. In potato crop the gross income was Rs.56,100(maximum) in small size

group followed by 54200 in medium size of and Rs. 53880 minimum in large size. The average productivity and gross return of the study area from potato was recorded 120.4q./ha and Rs. 55319, respectively.

Bhaskar,G. (2006), revealed that the technological gap between the recommended and used level by actual farmers in their field on per hectare basis was also calculated and presented in study. This is the situation or existing technological position and non-transference of some part of technology on farmer's fields due to some constraints. The data as derived in the study show that nearly 27 percent technological gap exists on cotton field, can be full fill to get the potential yield. The technological gap index (percent) among the different components of technologies, indicates that the maximum gap was incurred in case of high yielding variety (34%) followed by application of fertilizer (NPK) 24.59 percent and plant protection measures 22.44 percent respectively between recommended and farmers field adoption level.

Chouhan,S.S. (2009), revealed that the overall adoptions of recommended technology were worked out to 77.09 per cent per farm amongst the chilli producer over to recommendation. The figures of analysis indicated that only about three-fourth share of the chilli production technologies developed and recommended by the agricultural scientist have gone for adoption by the users. It was also observed that the quantity of inputs recommended and the quantity of inputs adopted per unit of area was having wide gap.

Patel Alkesh (2009), revealed that on an average the cost of cultivation per hectare of onion crop found to Rs.17860.55 as cost 'A_1' and it was the 64.52 per cent of the total cost. There is no cost $A_{2,}$ because farmers used their own land for the cultivation of onion. It is also revering that the average operational or variable cost that is cost B1 found to Rs.18032.98 per hectare which was 65.14 per cent of total cost. In case of cost B2 the average value was found to Rs.21532.98 per hectare and it was 77.78 per cent of total cost. It is noted from the study that cost C1, C2 and C3 found to Rs.21983.39, Rs.25483.39 and Rs.27681.73 per hectare in cultivation of onion respectively. The cost C1 and C2 was 79.41 and 92.05 per cent of total cost C3 respectively.

CHAPTER- III

MATERIAL AND METHODS

Material and methods are important steps in research process which gives the idea how the research is done systematically. We can say that it is guideline to understand a systematic of reasoning investigation of a subject in order to discover relevant information for present study. In this chapter, the material and methods used for necessary knowledge about gathering material and arranging them, participation in the field work when required and also knowledge about techniques for the collection of data appropriate to particular problems, in the use of statistics. Hence, in the present study the nature of data, its collection, sampling procedure and analytical tools used are considered in detail with the view of the stated objectives.

This research study is split into following four sections:

1. The study area.

2. Sampling procedure.

3. Nature and collection of data and method of enquiry.

4. Analytical procedure

Study area:

The study was conducted in Sehore block of Sehore district in Madhya Pradesh. Sehore district was selected purposively due to more acreage under onion cultivation and conventions as well as knowing to well acquaintance of researcher.

There are five blocks in the district Sehore i.e. Sehore, Ichhawar, Ashta, Budhni, and Nasrullaganj. The district Sehore lies between latitude $22^0$46” to $23^0$40” North and longitude $76^0$22” to $78^0$57” East. The district is situated at 1500 feet above sea level. It is surrounded by Dewas, Shajapur, Bhopal and Hoshangabad district respectively.

Sampling Procedure:

The multi stage random sampling technique was used for drawing a sample for the present study. At first stage, Sehore block of Sehore district was selected purposively due to suitable area for onion crop and well known for researcher. At second stage, a list of highly onion producing villages was prepared with the area under

onion. These villages were put in ascending order of their acreage under onion. Among all, main onion producing villages of Sehore block, five villages namely Lasudiya Parihar, Mogrram, Bhukedi, Sekadakedi and Hasnabad were selected randomly based on the area under onion crop. At the third stage of selection, a list of onion growing cultivators of each village was prepared in ascending order of their size of holding under onion crop and finally 75 farmers was selected randomly for the study purpose.

Nature of data:

For the present study, both primary and secondary data were collected.

Primary data:

Primary data were collected from sample onion growers. The primary data were recorded regarding general information of the onion growers, cropping pattern, farm resource structure and resource use pattern in onion cultivation etc. The specific and detail information on cost incurred and returns obtained in the cultivation of onion were also collected from the sample respondent.

Secondary data:

The required secondary data were collected from Department of Agriculture/Horticulture and other statistical data were collected from published record of Statistics Department.

Period of the study:

All the collected primary data were related to the agricultural year 2010-11.

Collection of data:

The data were collected using survey method. The data on different aspects were collected through pre-tested interview schedule. Each of the selected sample onion growers were approached personally for recording relevant data (Appendix-1).

Analytical procedure:

The primary data were classified and tabulated in the light of stated objectives of the study and analyzed as per the suitable statistics and economic tools as follows:

i) Adoption pattern of improved production technology:

The selected onion growers were classified into three categories with respect to level of adoption (low, moderate and high). Having identified the number of farmers under each category the indices of adoption was calculated as under

$$\text{Adoption index (\%)} = \frac{\text{Adoption score obtained by respondent}}{\text{Possible maximum score}} \times 100$$

The adoption gap index was measured with following formula:

$$GI = \frac{R-A}{R} \times 100$$

Where,

GI = Adoption gap index in percentage

R= Recommended package of technology (Total score fixed for a component)

A= Actual adoption of the package of recommended technology (Score obtained by the farmer out of the total score)

ii) Yield gap:

The potential farm yield to be referred maximum yield in study area which is obtained on a farmer's field with the adoption of modern technology. The difference between the potential farm yield and actual average farm yield on overall farmers, high technological adoption level of farmers and low technological adoption level of farmers is termed as a yield gap in present study.

Farm level yield gap:

The definition and conceptualization of potential yield and yield gap model is considered in study. Potential farm yield is one which is obtainable on a farmer's field with the adoption of modern technology. The difference between the potential farm yield and actual average farm yield as well as high technological adoption level of farmers and low technological adoption level of farmers is termed as a yield gap in present study. In present study following yield gaps are studies:

Yield gap (I): Progressive farm (Potential yield) Vs. Actual average farms (attained yield) of different categories and is attributable to a range of biological and ecological limitations such as land and water husbandry conditions, varieties of weed, diseases and insects, problem of soil, socio-economic constrains such as cost and returns, credit, tradition and attitudes knowledge input availability and farm services institution etc.

Yield gap (II): Progressive farm (Potential yield) vs. high technological adoption level of farmer's and low technological adoption level of farmer's yield also calculated. This yield gap is actual due to technological adoption on the farm.

iii) Economics of graded onion production technology: -

The economics of onion production at different level of technology adopted by sample farmers was calculated as below. The yield level reported by different technological status was treated as proxy for technology. The yield thus, reported was grouped in to at least three level, one each below and above the average yield of the crop in the area. The number of cases falling in a particular yield slab is considered for the cost estimates as shown below.

Total cost	Cost of production	Grass value	Net profit	B.C.Ratio
(Q/ha.)	(Rs/ha)	(Q/ha.)	(Rs/ha.)	(Rs/ha.)

The estimates of profitability were based on different cost and return incurred in onion cultivation.

(a) Cost concepts:

The cost of cultivation classified as recommended by, "Special Expert Committee on Cost Estimates, GOI, New Delhi", was used in this study. The cost concepts are given below:

Cost A_1: It includes: -

i. Value of hired human labour,
ii. Value of hired and owned bullock labour,
iii. Value of hired and owned machinery labour,
iv. Value of owned and purchased seed,

v. Value of fertilizers, manures and chemicals,
vi. Value of insecticide and pesticides,
vii. Expenditure on irrigation,
viii. Land revenue and taxes,
ix. Interest paid on crop loan if taken,
x. Depreciation on farm assets excluding land,
xi. Interest on working capital,
xii. Miscellaneous expenses.

Cost A_2: It includes-

Cost A_1 + rent paid for leased in land

Cost B_1: It includes-

Cost A_2 + interest on value of owned fixed capital assets. (Excluding land)

Cost B_2: It includes-

Cost B_1 + rental value of owned land

Cost C_1: It includes-

Cost B_1+ imputed value of family labour

Cost C_2: It includes-

Cost B_2 +imputed value of family labour

Cost C_3: Cost C_2 + 10 percent of cost C_1 to account for managerial input of the farmer.

Evaluation of farm inputs:

Methods followed in evaluating different farm input for the present study are described in the following paragraphs.

Hired human labour:

The farmers normally engage permanent farm labour on the basis yearly wages and casual labour on daily wages basis, for performing farm operations. The casual labour was evaluated on the basis of actual wages prevailed in the locality. The wages of male and female labour included payment given both in cash or kind. The value of kind

components given to the labour was calculated at their prevailing market prices.

Family labour:

The family labour cost was evaluated at the rate of prevailing wages in the locality for casual hired labour at various stages of operations.

Bullock and machinery labour:

Estimation of bullock and machine labour charges on actual wage prevailed in the locality were considered.

For estimation of depreciation, interest on working capital, interest on fixed capital and rental value of owned land, following standard norms were used.

Depreciation on farm assets:

The straight-line method is used for calculating rate of depreciation. The depreciation rates for different farm assets were consider @ 10 per cent.

Interest on working capital:

It is worked out @ 12.50 percent for half of the duration of the crop.

Interest on fixed capital:

Interest is charged @ 10 percent per annum on the value of implements, machineries, farm building, and irrigation structure and drought animals. It excludes interest on land input, because rental value of owned land is calculated separately.

Rental value of owned land:

It is calculated on the basis of $1/6^{th}$ of the gross income or prevalent rate in the area for the same.

Allocation of joint costs:

Allocation of joint cost such as depreciation and interest on fixed capital were made on the basis of proportion of area under the onion crop to the gross cropped area.

Value of farm produce:

This includes the value of main product and the by product of the crop. The harvest

price of the crop was considered for calculating the value of main produce. The value of by product was calculated at the prevailing price in the locality.

Profitability concepts:

For the estimation of profitability from onion, the following efficiency measures are used in this study:

(i) Gross income,
(ii) Farm business income,
(iii) Farm investment income,
(iv) Net farm income,
(v) Family labour income,
(vi) Input- output ratio,

These are defined as under: -

(a) Gross income: It is defined as: total value of main product +by product.

(b) Farm business income: It is the gross value of output at farm harvest prices (Main product +by product) – cost 'A_1'

(c) Farm investment income: It is defined as: net farm income + interest on fixed capital +rental value of owned land.

(d) Family labour income: it is defined as: gross income- cost 'B_2'

(e) Net farm income: It is defined as: gross income – cost 'C_3'

(f) Input – output ratio

$$\text{Input- output ratio} = \frac{\text{Gross income}}{\text{Cost of cultivation}}$$

iv) Analytical procedure for estimation of resources productivity:

Cobb-Douglus production functions were used for the estimation of resource productivity in cultivation of onion, it is widely used by various research workers for studying resource productivity and they obtain precise results.

$$Y = ax_1^{b1}.\ x_2^{b2}.\ x_3^{b3} \ldots\ldots\ldots X_k^{bk}$$

It is converted in to logarithmic form, so that it can be solved by the least square

method. The logarithmic from of the Cobb-Douglus function is express as under:

$$\text{Log } y = \log a + b_1 \log x_1 + b_2 \log x_2 \ldots\ldots\ldots + b_k \log x_k.$$

Where: y = Dependent variable (gross income)

a = Constant or intercept value

b_1 to b_k = are regression coefficients of X_1 to X_k variables and

X_1 to X_k = are variables.

Selection of variables:

In this study, the following variables were chosen for functional relationship between gross income from onion and expenditure on different input items on per hectare basis and they are as follows:

X1 = Human labour

X2 = Seed

X3 = Fertilizer

X4 = Plant protection

X5 = Irrigation

Y = Gross income

Definition of variables: -

Independent variables

(i) Expenditure on human labour in rupees (X_1): -

The human labour input was recorded in terms of day of eight hours of work, separately for man, women and child labour employed for different farm operations in cultivation of onion during the crop period. The labours input for regression analysis were measured in terms of adult men day of eight hours. It included family labour and permanent and hired human labour.

(ii) Expenditure on seed in rupees (X_2): -

It included the value of owned and purchased seed at the prevailing market price in reference year in selected villages and measured in rupees per hectare.

(iii) Expenditure on fertilizers and manures in rupees (X_3): -

The actual market price of fertilizer at the time of sowing, and for purchased manure, actual paid out price was taken as cost of this input. For farm produced manure the cost was taken on the basis of prevailing market price in the area at the time of sowing, and this variable was measured in rupees per hectare.

(iv) Expenditure on plant protection in rupees (X_4): -

The actual market prices of insecticides and pesticides use in the cultivation of onion were measured in rupees per hectare.

(v) Expenditure on irrigation in rupees (X_5): -

This variable constituted the fuel charges for diesel engine, electric charges for electric pump, repairing and maintenance charges, canal water charges, depreciation and interest on fixed capital invested on irrigation structure. The amount paid for irrigation water hired from other sources was also included in this variable where as manual labour engaged in irrigation was not included in this variable.

Dependent variables: -

Gross value of output (Y): Gross value was calculated by converting the physical products into value terms by multiplying the output of onion crop.

V) The constraint operating in onion production:

The constraint operating could be physical or biological, technological and socio-economic. The constraint analysis was based on the opinion survey of the farmers under study

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CHAPTER –IV
RESULTS

The present chapter is the most important of the study that consists analysis of the data collected and the inferences drawn from the data with cause and effect relationship to find the final conclusion. The inferences were based on the economics and statistical tools applied for the study. As per the stated objective the micro level analysis of general information of sampled farmers were revealed with technological utilization pattern of input in onion production. As per objective an attempt also has been made to analyze the comprehensive study of economics of onion production on different level of technology to show the profitability of technology over onion production. In this way, the study represents the picture of possible costs of production and return from per unit area with different level of technology. The extant of yield gap with the use of different level of technology was also calculated.

Onion production occupies an important place in the economic development of farmers as a vegetable production. But, due to certain constraint the productivity per unit of area in the district found to low which ultimate result low production of onion in the district as per the market demand. The increase in the onion production is possible by expanding of area under cultivation of onion or by increasing the productivity per unit of inputs. The scope for bringing more area under the onion being very limited, therefore, the crux of the problem of increase onion production and productivity remains unsettled without answering the question i.e. how to increase production of onion per unit of input/area. The one way of approaching the problem of increasing onion production is to examine how efficiently the farmers are using their resources. If resource use is inefficient, onion production can be increased by making adjustments in the present use of factors inputs in optimal direction. In case, it is efficient, the only way out for increasing onion production would be the adoption of modern inputs and improved farm technology of production. Taking consideration as above, there is

purpose to evaluate the resource use efficiency with which the study farmers use their main resources in the cultivation of onion.

In the last, having actual performance of sample farms with regard to cultivation of onion, it would be appropriate to mention the features which act as constraints in increasing the production and productivity as well as in adoption of improved technology is the paramount important of the study and considered in present chapter.

Micro level analysis of primary data:

Finally, the primary data collected for study has been analyzed and the results of the study are presented under following headings:

4.1. Socio economic characteristics of respondence,

4.2. Land resource use pattern,

4.3. Adoption of improved onion production technology,

4.4. Estimation of yield gap,

4.5. Economics of onion production at different level of technology and

4.6. Resource use efficiency at various level of adoption.

4.7. Identification the important constraints responsible for existing yield gap and suggestions their off.

4.1 Socio economic characteristics of respondence:

Socio economic characteristics of farmers is one of the most important independent variable which directly or indirectly influence the level of adoption of improved onion production technology which ultimately changed the production level and profitability per unit of production area. In present study the socio economic characteristics of respondents included the age, education, size of family and work force available in a family. The detail information of socio economic per family is presented in following statements.

Age and education level of respondents:

The farmers generally take the important decisions of the farms with reference to input use, cropping pattern and other farm managerial decisions. Therefore, it is

pertinent to have an idea regarding the age and education level of the sample farmers. The age and education level of sample farmers is presented in table 4.1:

Table 4.1: Age and education level of sample farmers.

S.No.	Particulars	**Overall Average**	
1.	**Average age (years)**	44.65	
	Education	**Frequency**	**Percentage**
1.	**Illiterate**	23	30.66
2.	Up to primary (5th standard)	21	28.00
3.	**Up to middle (8th standard)**	15	20.00
4.	Up to H.S.S.C. (12th standard)	09	12.00
5.	**Graduate and above**	07	9.34
	Total	**75**	**(100.00)**

The study reveals that out of total the average age of respondents were found to 44.65 years.

The literacy position shows that among the over all sample farmers, the illiterate respondents found to 30.66 per cent or 23 farmers. Among the literate respondents the maximum 21 (28.00%) found up to primary education followed by middle school 15 (20.00%) respondents, 09 (12.00%) respondents got H.S.S.C level of education and only 07 people (9.34%) got higher education respectively.

It is concluded that the average size of age of respondents found to 44.65 years. As per the literacy position, the maximum percentage of respondents found to literate 69.34 per cent and among the literate the maximum respondents found to educate up to primary education i.e. 28.00 per cent.

Average size of family and work force:

Farm family is one unit which includes the total number of members to cultivate the given operational area. They may be male, female and children. On the other hand the work force is not only the total population by which one is concerned while studying the employment but also that part which can do full or partial work relating to the farm.

The study about size of family and work force available in a family are important because it to be factor influencing economic status of farm family. The detail of these information are presented in table 4.2

Fig:1: Distribution of respondents according to their Education level.

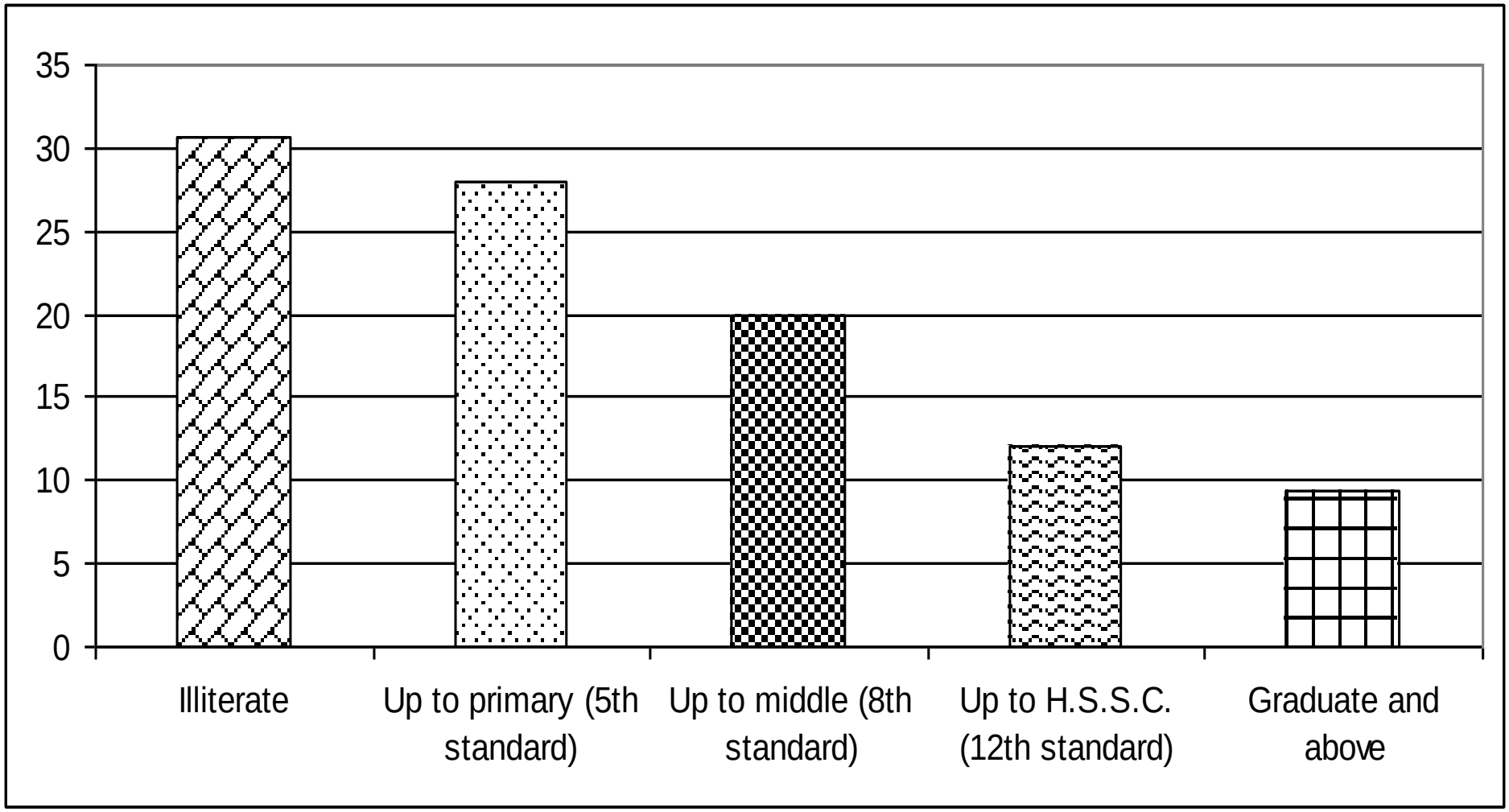

Table 4.2. Size of family and work force available (Per family)

S.No.	Particulars	Overall Average	
		Frequency	**Percentage**
1.	**Number of male**	1.81	24.20
2.	Number of female	1.64	21.92
3.	**Number of children**	4.03	53.88
4.	**Strength of family**	**7.48**	**100.00**
5.	**Number of male worker**	1.51	53.36
6.	**Number of female workers**	1.32	46.64
7.	Total workers	**2.83**	**100.00**

The above table revealed that the average size of farm family was found to 7.48 in study area and it include 1.81 male, 1.64 female and 4.03 children. The contributions of family size revealed that 24.20 per cent of the family member was male followed by 21.92 per cent female and the highest percentage of family members was children i.e. 53.88 per cent per family.

It is concluded that children was found to dominant in total strength of family.

Structure of working population:

From the table 4.2, it is revealed that the average number of active members on the farm was 2.83. It is also showed that male workers found to higher (53.36%) as comparison to female worker (46.64%) of total workers in a family.

4.2 Land resource use pattern:

As operational holding of the farmer is the basic unit of study. Farm business activities like production of crops are determined by the physical and financial resources available to the farmers, opportunities for utilization of these resources and other factors that effect the crop productions. The detail land utilization pattern of sample farmer is presented in table 4.3.

Fig:2: Distribution of respondents according to their Size of family:

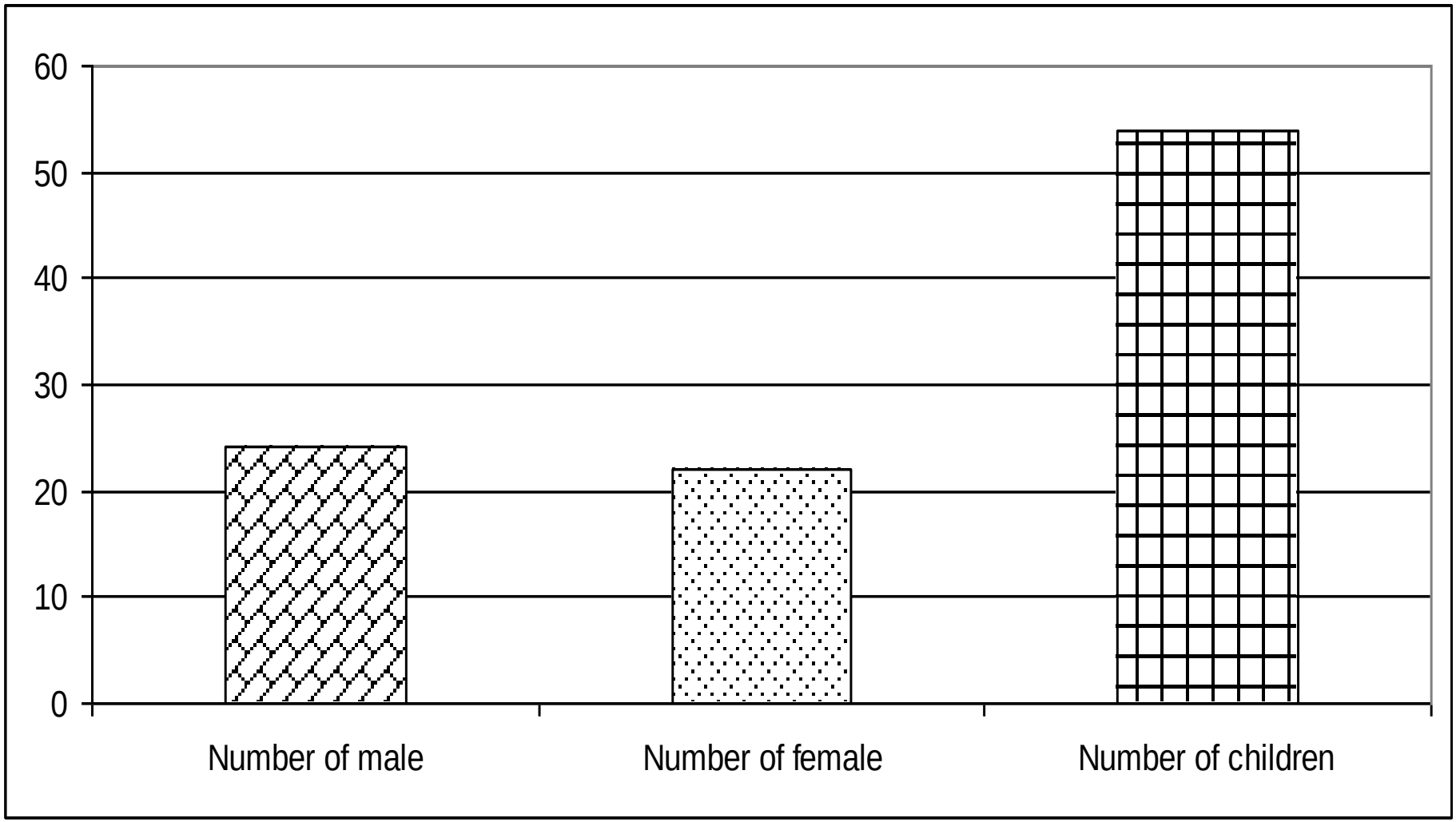

Fig:3: Distribution of respondents according to their Work Force:

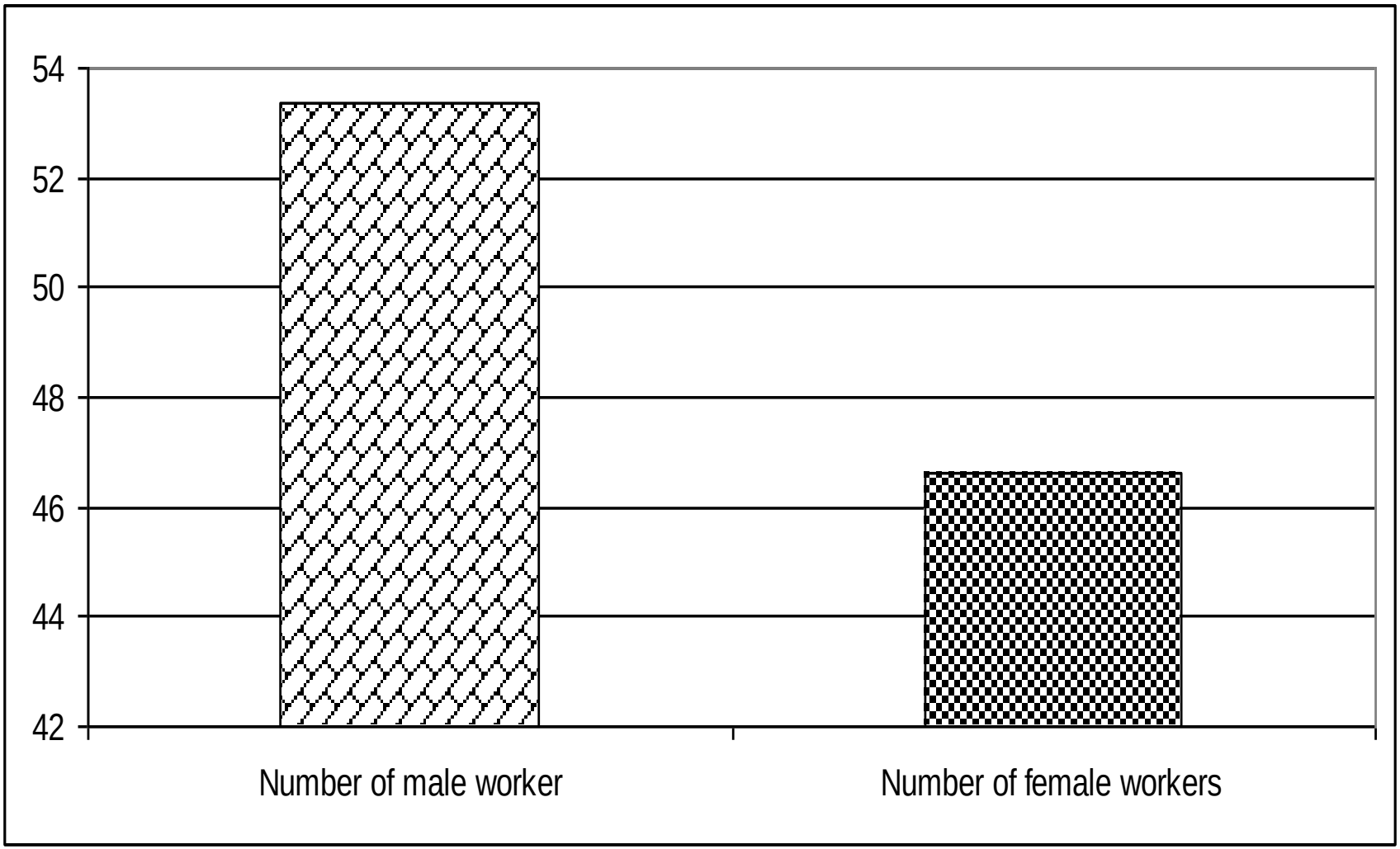

Table 4.3: Land utilization pattern of sample farmers. (Hectare Per farm)

S.No.	Particulars	Overall Average	
		Hectare	**Percentage**
1.	**Size of holding**	4.92	(100.00)
2.	Cultivated area	4.70	95.53
3.	**Irrigated area**	3.43	69.72
4.	Kharif crops area	4.66	94.72
5.	**Rabi crops area**	3.50	71.14
6.	**Gross cropped area**	8.16	165.85
7.	Area under onion	**0.89**	**18.10**

The table indicated that the average size of holding was found to on an average 4.92 hectare per farm. Among them the cultivated are was found to 95.53 per cent of total average size of holding which was on an average 4.70 hectare per farm. The irrigated area is one factor which found to able for double cropping system. The average gross cropped area was found as higher 165.85 per cent of total holding due to higher irrigation availability. The study shows that there is 69.72 per cent of average size of holding found to irrigate. This factors found to suitable for onion cultivation in the area.

The area under onion is the important factor considered in the study and it occupied on an average 18.10 per cent of the total area which represents on an average 0.89 hectare per farm.

Investment on fixed farm assets: -

The value of the fixed farm assets in the farming generally determines the absolute farm profitability, which is invested during the past years. The data on average value of investment of fixed farm assets is presented in table 4.4.

Table: 4.4: Value of the total farm assets on sample holding.

(Rs/farm)

S. No.	Particulars	Average investment (Rs. thousand)	Percent to total
1.	Land	1419	79.07
2.	Farm building	198.93	11.08
3.	Irrigation structure	109.13	6.08
4.	Implements Major	55.72	3.10

5	Implements Minor	8.48	0.47
6	Other	3.29	0.18
7.	Total assets excluding land	375.61	20.93
8.	Total assets	1794.61	(100.00)

As evident from the table 4.4, land is the costliest assets out of all the farm assets. The over all average, percentage investment on land to the total value of assets on the sample holding found to 79.07 per cent. The investment on total farm building found to on an average 11.08 per cent followed by irrigation structure 6.08 per cent and farm implements was on average 3.57 per cent of total assets value respectively.

The percentage investments on total assets excluding land on sample holding found on an average 20.93 per cent of total assets value.

4.3 Adoption of improved onion production technology:

(A) Status of adoption the improved onion production technology:

In general, the aim of agricultural economist is, to reduce the marginal cost of output for getting the maximum profit with the use of improved agricultural production technology. This can occur either by employing (adopting) the existing inputs but in different composition (a change in technique) or by introducing new factors of production either for replacing old ones or simply as additional inputs (technological innovation). With regards to above fact, application of adequate quantities of farm power with other inputs like high yielding variety (better seeds), adequate fertilizer application, plant protection measures, irrigation etc. is a main necessary condition for optimum output in agriculture, hence considered for study in onion production also.

Table 4.5 present four main indicators of technological process or technological status at farm level of onion production in study area i.e. adoption of high yielding variety, fertilizer consumption, application of plant protection measures and irrigation respectively.

Table 4.5: Technological status at farm level of onion production.

S.No.	Technology	Adoption index %
1.	**Adoption of high yielding variety seed**	**74.51**
2.	**Fertilizer application (NPK)**	**76.56**
3.	**Plant protection measure**	**59.74**
4.	**Irrigation application**	**77.02**
5.	**Over all technological adoption level**	**71.96**

Agricultural scientist suggested that for higher production it is essential that seeds should be of proven quality and recommended as high yielding. Study revealed that the area under onion cultivation increases under high yielding varieties. The percentage adoption of high yielding variety was found on an average 74.51 per cent on per farm. The study reveled that maximum farmers have adopted cultivation of improved varieties of onion.

With the introduction of high yielding variety the use of chemical fertilizers has increased considerably. This is clear from the study that the total consumption of fertilizer (N.P.K.) during the study period was found to 76.56 per cent to recommendation on onion farm. The use of chemical fertilizer was found to common practices amongst the onion producers in the area, but the lacunae lies in using inadequate doses of N.P.K. per unit of area.

Recommended plant protection measures should be used and haphazard use of insecticides and pesticides should be avoided to get the optimum yield. But the study revealed that there was low adoption of plant protection measures by the onion producers. This was found on an average 59.74 per cent over to recommendation per farm.

Irrigation is essential factor of production in onion cultivation. Many study revealed that in stares moisture condition, onion production was affected adversely. In

the area due to erratic and low rainfall condition, onion production found to low. The data revealed that irrigation used by onion growers was also found to low due to unavailability of irrigation facilities and electricity problem in the area. The irrigation percentage adopted by onion growers were found to 77.02 per cent as against the recommendation.

The overall adoptions of recommended technology were worked out to 71.96 per cent per farm amongst the onion producer over to recommendation of all technology. The figures of analysis indicated that less then three-fourth share of the onion production technologies developed and recommended by the agricultural scientist have gone for adoption by the users. It was also observed that the quantity of inputs recommended and the quantity of inputs adopted per unit of area was having wide gap i.e. 28.04 per cent. On other words, it can be say that there exist 28.04 per cent of adoption gap of onion production technology in study area.

(B) Adoption Pattern of improved technology by sample farmers:

Prier to find out the economics of different technological level of onion production on existing farm situation, it is necessary to clear out the technological use pattern in onion growers. Table 4.6 shows the number of farmers in different category used different level of improved technology on their farm.

Table 4.6: Number of farmers adopting different level of technology in onion production.

S.No.	Technology	Level of technology used below 75 Per cent		Level of technology used above 75 Per cent	
		Frequency (No. of respondents)	Average adoption index (%)	Frequency (No. of respondents)	Average adoption index (%)
1.	Adoption of high yielding variety seed	49	68	26	82
2.	Fertilizer application (NPK)	20	73	55	81

3.	Plant protection measure	72	61	03	57
4.	Irrigation application	39	63	36	92
5.	Over all technological adoption level	45	67	30	78

Note: Figure in parenthesis denotes percentage of their respective category.

Table 4.6 reveled that out of 75 total sample farmers, 45 farmers were adopted below 75 per cent of the overall recommended onion production technology followed by 30 farmers adopted above 70 per cent of the overall recommended onion production technology.

It is evident from the data that majority of the respondents (60.00%) of total had adopted low technology i.e. 67 per cent of recommended technology. On the other hand, it is clear that only 40 per cent respondents had adopted high adoption level i.e. above 75 per cent of recommended technology. The overall on an average 78 per cent of recommended technology to found to adopted by the high adoption level of farmers in the area. This point bring out to one things clearly that large number of onion cultivators (60.00%) were still practicing non-progressive method of onion farming and did not adopted most of the selected modern agricultural technologies. Having identified the number of farmers under each category as low and high adoption level, the index of adoption were calculated and presented in table 4.6.

It could be concluded that the index of onion production technology adoption level found to varied between 67 to 78 per cent on low adopter group to high adopter group farmer's category respectively. But the average adoption of index technology was found to 71.96 per cent.

The individual technology wise adoption pattern of recommended onion production technology reveals that the maximum technology was adopted by onion growers found to irrigation application i.e. on an average 77.02 per cent of overall recommended technology. This practice was more in high level of technology users (92.00%). The next important technology was adopted by onion growers found to fertilizer application i.e. on an average 76.56 per cent of overall recommended technology. This practice was more in high level of technology users (81.00%) followed

by adoption of high yielding variety seed i.e. on an average 74.51 per cent of overall recommended technology. This practice was more in high level of technology users (82.00%) and adoption of plant protection measure i.e. on an average 59.74 per cent of overall recommended technology. This practice was more in low level of technology users (61.00%).

It is concluded that there existed a wide gap in adoption of recommended technology and varied as per the individual technology. It is also revealed that the adoption index of all technology was found to higher in the farmers of high adoption level group accept plant protection measure.

4.4: Estimation of yield gap:

The actual farm yield needs to be compared under different situations to be of more use for decision making. The most widely used term ‘potential’ yield is defined as the yield of the crop which is obtainable on farmers fields under farmers environments with the modern production inputs and techniques giving maximum yield. The difference between the potential farm yield and the average farm yield as well as high technological adoption level of farmer’s field and low technological adoption level of farmer’s field’s yield may be called as the yield gaps which are considered in the present study. The table 4.7 revealed quantification of yield gap between potential (progressive farm) and actual farm situation (average farm) as well as high technological adoption level of farmer’s fields and low technological adoption level of farmers field’s conditions respectively.

Table 4.7: Yield of onion under different situations.

S.No.	Situation	Yield (Q./Ha.)	Termed as	Remarks
1.	Assured input supply (progressive farm)	178.94	Attainable	Supply of recommended yield attributing inputs assured, improved practices and farmers management.
2.	Real farm situation (average existing farm)	150.37	Actual	Farmers own resources with marginal use of yield attributing inputs and management with normal practices followed in the area.
3.	Farm used less than 75% yield attributing inputs	146.90	Low inputs users	Farmers own resources with low adoption practices and meager use of improved inputs.
4.	Farm used more than 75% yield attributing inputs	153.84	High inputs users	Farmers own resources with high adoption practices and higher use of improved inputs.

The quantification of yield gap i.e. **Yield gap (I):** Progressive farm (Potential yield) Vs. Actual average farms (attained yield) of different categories and is attributable to a range of biological and ecological limitations such as land and water husbandry conditions, varieties of weed, diseases and insects, problem of soil, socio-economic constrains such as cost and returns, credit, tradition and attitudes knowledge input availability and farm services institution etc. **Yield gap (II):** Progressive farm (Potential yield) vs. high technological adoption level of farmer's and low technological adoption level of farmer's yield also calculated. This yield gap is actual due to technological adoption on the farm.

The different yield gap is presented in table 4.8.

Table 4.8: Magnitude of yield gap in onion production.

S.No.	Situation	Extant of gap		Contributing factors
		Q/Ha.	%	
1.	Feasible yield (Potential yield)	--	--	Management
2.	Attainable actual yield	28.57	15.00	Resource knowledge
3.	Poor yield	32.04	17.90	Low adoption practices
4.	Higher average yield	26.10	14.58	High adoption practices

The above table indicated that there exists a reservoir of untapped yield potential of onion in study area. The contributing factors as derived in the study shows that about 17.90 per cent yield of the farmers can be increased merely by improved management practices and with adoption of improved inputs and practices which shows the extension gap or technological adoption gap. The study also revealed that with the increase of improved production practices and inputs; the high technological adopter farmers can increase their yield upto 14.58 per cent of progressive farmer's yield.

It is concluded that, the potential yield on progressive farms was found to 178.94 quintal per hectare which shows on an average farm quite low yield i.e. 150.37 quintal per hectare i.e. 15.00 per cent less than potential yield of the area which can be achieved with the use of improved management practices and yield attributing inputs.

4.5 Economics of onion production at different level of technology:

The most important objective of present study is to analyse the economics of onion production in different level of technological status. The economics of production may be analysing with the help of cost and return concepts. In study these two concepts are used to find out the economic level of onion production technology in study area. Table 4.9 refers the level of cost incurred in production of onion with use of different level of technology.

Table 4.9: Cost of cultivation of onion in different level of technology on sample holdings. **(Rs/ha)**

S.No.	Cost particulars	Level of technology		
		Below 75 %	*Above 75 %*	**Average**
1.	Hired human labour	1873.74	2396.15	2134.945
2.	Bullock labour	3060.17	3206.67	3133.42
3.	Machine power	1260.17	1261.21	1260.69
4.	Seed	2048.67	2411.53	2230.1
5.	Fertilizer	1555.75	1590.38	1573.065
6.	Irrigation	1547.78	3078.84	2313.31
7.	Plant protection	1395.57	2057.69	1726.63
8.	Interest on working capital	212.36	266.71	239.5339
9.	Depreciation	2544.83	2544.83	2544.83
10.	Land revenue	185.00	185.00	185
	Cost-A1	**15684.04**	**18999.01**	**17341.52**
11.	Interest on fixed capital	254.48	254.48	254.48
	Cost-B1	**15938.52**	**19253.49**	**17596**
12.	Rental value of land	3500	3500	3500
	Cost-B2	**19438.52**	**22753.49**	**21096**
13.	Imputed value of family labour	4025.95	3430.76	3728.355
	Cost-C1	**19964.47**	**22684.25**	**21324.36**
	Cost-C2	**23464.47**	**26184.25**	**24824.36**
	Cost-C3	**25810.92**	**28802.67**	**27306.8**

The cost of onion cultivation for different level of technology used and on the basis of different cost concepts, the data on cost of cultivation per hectare on sample holding revealed that the average cost A1 comes to Rs.17341.52. This cost found to higher in the farm of high adoption level i.e. Rs.18999.01 followed by Rs.15684.04 on

low adoption level of farm respectively. The reason for higher cost in high technological adoption status of onion production was due to judicious and higher use of inputs and their respective cost evolved in production process.

In case of cost B1 and B2, the cost of cultivation found to higher in high technological adoption farm respectively. The corresponding costs B1 were found to Rs.15938.52 and Rs.19253.49 per hectare respectively for the below 75 per cent and above 75 per cent technological status on sample holdings. The cost B2 comes Rs.19438.52 and Rs.22753.49 on similar condition. The average cost of B1 and B2 was found to Rs.17596.00 and Rs.21096.00 per hectare respectively.

In case of cost C1, C2 and C3, the average cost of cultivation per hectare was on an average found to Rs.21324.36, Rs.24824.36 and Rs.27306.80 per hectare respectively, when considered for all technological status and it was varied as per different technological status i.e. Rs.19964.47, Rs.23464.47 and Rs.25810.92 for below 75 per cent technological status followed by Rs. 22684.25, Rs.26184.25 and Rs.28802.67 in case of above 75 per cent technological status group.

It is concluded from the study that the total expenditure on onion cultivation per hectare (Cost C1, C2 and C3) in different technological status has specific trend between them i.e. the higher technological status showed higher cost of cultivation only might be the higher value involved to purchase the inputs and production practices involved.

Aggregate profitability of onion production: -

The profitability of onion production with using different level of technology in rupees per hectare at different profitability measures is presented in table 4.9.

Table 4.10: Aggregate profitability of onion production in different level of technology. (Rs/ha)

S.No.	Level of technology	Cost C3	Yield quintal per heater	Gross Income	Net farm income	B.C. Ratio
1.	Below 75 %	25810.92	146.90	58865.48	33054.56	2.28
2.	Above 75 %	28802.67	153.84	63386.54	34583.87	2.20
3.	Average	27306.8	150.37	61126.01	33819.22	2.24

The productivity of onion crop was highest (153.84 Q/ha) with the technological status above 75 per cent followed by (146.90 Q/ha.) on below 75 per cent technological statues respectively. The average productivity of onion crop on the sample holdings was found to (150.37 Q/ha.).

The gross income was found to directly relate with the productivity and the market price of the product. The overall average gross income per hectare of onion crop was found to Rs.61126.01. The net farm income also shows direct relationship with the different level of technology on sample holdings. The overall net farm income was found to on an average Rs.33819.22 per hectare, which varied and increased with higher technological level respectively. The on an average net income per hectare of onion production found Rs.33054.56 on low technological adoption groups followed by Rs.34583.87 per hectare from high technological adoption groups. This revealed that the profit would not increase unless managed the farm according to the technical requirement of crop. The increase in the investment in the farm of inputs used, resulted increase in productivity corresponding higher and subsequently produced more profit. Since onion is a commercial crop its profit is mainly affected by cost and productivity structure. The result showed that due to use of higher technological status the cost of cultivation found higher. But the higher technological status caused also higher productivity and ultimately, caused higher net profit. But in case of return over per rupees investment found higher 2.28 in case of lower adoption level followed by 2.20 in case of higher adoption level respectively.

It is concluded that, as discussed above the improved technology found to more input (capital) intensive and require higher initial investment but it prove to more profitable on per hectare basis. That is the reason that the profit is found to more as increasing trend with the used level of technology. On the other hand, with the use of higher technology the return over per rupees expenditure found to profitable in case of low adoption level.

4.6 Resource use efficiency at various level of adoption:-

The production function analysis was also carried out to examine the resources use efficiency in onion production using Cobb–Douglus production function with the help of least square technique and coefficients of elasticity of major resources on average

size of holding, along with value of R^2 and F ratio are presented in table (4.10).

Table 4.11 : Production function coefficients of onion.

Production Elasticity's Variables	**Regression value**	
	low adoption technology	High adoption technology
X_1 (Human Labour)	**0.468****	**0.788****
X_2 (Seed)	**0.748****	**0.454****
X_3 (Fertilizer)	**0.921****	**0.685****
X_4 (Plant protection)	**0.638****	**0.582****
X_5 (Irrigation)	**0.377****	**0.950****
R^2 (%)	**92.60**	**83.10**
F-Ratio	**97.938**	**23.530**

** indicate significant at 0.01 % probability level.

* indicate significant at 0.05 % probability level.

R^2 = Coefficient of multiple determinant.

The R^2 coefficient of multiple determinants for average size of holding in case of low and high technological adoption fields, clearly indicates that fitted function explains 92.60 per cent and 83.10 per cent variation in gross income from onion cultivation due to the included variables. The F-ratio for fitted function was found to highly significant for average size of lower adoption group (F ratio= 97.938) indicated that fitted Cobb-Douglus production function model was more useful and best fitted to the data. In case of high adoption level the F-ratio was only 23.530 indicated that that fitted Cobb-Douglus production function model in this case found to useful and best fitted to the data. From the table it was observed that the elasticity's of production of each input on an average sample onion farms found to positive significant and less than one, indicating that if increase each input by one percent then the gross income from onion will be increase by less than one percent in both the farm situation that is low adoption and high adoption categories.

The over all results of production function analysis clearly indicate that expenditure on human labour, seed, fertilizer, plant protection and irrigation were found

to be contributing significantly towards gross income on average holdings farm in low and high adoption groups respectively. It was also found that farmers were used proper and justified inputs in onion production because the regression values of each inputs found to very low varying from 0.337(minimum) to 0.950 (maximum) with significant values respectively.

4.7 Constraints and suggestions:

As mentioned earlier that productivity of onion in area under study was not very satisfactory there exist yield gap in certain situation of farms in respect of technological gap. The yield gap could be due to various reasons including poor management, low input application and agro-climatic factors. The failure to expand the area under onion could be mainly due to lack of marketing facilities and low price of output also. Such constraints should be taken care, so that not only area under onion can be expounded rapidly, but also to generate high income to the growers through increased productivity. Some of the constraints confronted by onion growers are presented below.

Constraints analysis of onion production: -

The constraint was reported based on the opinion survey of the sample farmers thus; the generalizations of results are the feedback of the farmers engaged in onion farming in the region. It is evident from the table that farmers were used different quantity of inputs in cultivation of per unit area. Thus, utilization of different level of inputs might be caused in yield difference in respective farm.

Several constraints barring the sustainable production of the local practices and with the improved production technologies at various level of onion crop in the area; these are related to resources management faults and stresses of abiotic and biotic nature.

The farmers' opinion was obtained regarding the factors affecting adversely the adoption of various improved technology and practices; same are presented in table 4.11.

Table 4.12: Production constraints identified by the sample farmers.

S. No.	Socio Economic constraints	Number of respondents	Percentage to total	Rank
		N=75	(%)	
1.	Lack of own funds	37	49.33	IV
2.	Lack of credit facilities	27	36.00	VII
3.	Traditional belief	12	16.00	X
4.	High cost of inputs	47	62.67	I
5.	Lack of knowledge about recommended dose of inputs	30	40.00	V
6.	Lack of knowledge about recommended practices	19	25.33	VIII
7.	Non availability of inputs in time	15	20.00	IX
8.	Non interested to high investment	28	37.33	VI
9.	Low price received of out put	42	56.00	II
10.	Unavailability of proper market	40	53.33	III

The highest majority of the farmers (62.67 per cent) reported the prices of improved inputs are high in market. Thus, they are not applying adequate quantity of these inputs. Farmers want subsidized supply of inputs, as it is the first suggestion by majority of the farmers. The next important factor was low price of out put, reported by 56.00 per cent of the total farmers.

The lack of proper market was also serious and important constraints, 53.33 per cent of total respondent reported this problem. Lack of own fund was a common and important constraint which was reported by 49.33 per cent of the total respondents. The problem of short of fund may be solved by supplying short-term credit which is very essential especially to small and medium farmers to adopt the improved technology and apply the proper dose of inputs etc.

Lack of knowledge about recommended dose of inputs and lack of knowledge about recommended practices are reported by 40.00 and 25.33 per cent of total farmers respectively. This huge portion of farmers that strengthening and streamlining the

existing extension services help in achieving higher productivity also suggests it. There is an extension gap contributing to the existing yield and technological adoption gap.

The onion growers should be motivated to invest more in cultivation process because onion found to capital and labour intensive crop which require more capital and labour to get the optimum profitability. The 37.33 per cent of the total onion growers found to non-interested in high investment in onion cultivation.

Non-availability of inputs in time was the constraints, reported by 20.00 per cent of the total farmers in study. Hence, timely supply of inputs is another issue suggested by these farmers. Due to unavailability of inputs in time may cause delay in agricultural operations which may reduce the yield substantially.

CHAPTER- V

DISCUSSION

In the chapter of result the data were analyzed, processed, prescribed and presented in the form of the objectives of the study. In this chapter the inference was drown to make the research's result in purposeful and to draw broad conclusions of the study. It is also called the presentation of the findings which have got in the chapter of result. Therefore, it is important that the results of the study are presented clearly and meaningful as per the objectives of the study.

The present study was carried out in Sehore district of Madhya Pradesh to estimate the different technological status of onion production in the area and their economics of production with different technological status existing in onion production system. In this way, the study represents the picture of possible costs of production and return from per unit area with different level of technology. The extant of yield gap with the use of different level of technology was also calculated.

Onion is an important commercial crop in Sehore district but the socio economic condition of farmers in area found to unsatisfactory with the result they are not applying judicious level of inputs and technology recommended for onion production. Though, the farmers in other developing area of the state are fetching the benefits of developed onion production technology. The influence of technology developed in respect of onion production and its adoption in augmenting economic development of farmers are being recognized. Study showed that the development efforts regarding onion production found to quite marginal level. Hence, the study revealed a very important to evaluate the superior productivity potential of the available technology package and their profitability in onion production under actual (progressive) farm situation compared with general prevailing farmer's practices (non-progressive) farms respectively.

The increase in the onion production is possible by expanding of area under cultivation of onion or by increasing the productivity per unit of inputs. The scope for bringing more area under the onion being very limited, therefore, the crux of the problem of increase onion production and productivity remains unsettled without answering the question i.e. how to increase production of onion per unit of input/area.

The one way of approaching the problem of increasing onion production is to examine how efficiently the farmers are using their resources. If resource use is inefficient, onion production can be increased by making adjustments in the present use of factors inputs in optimal direction. In case, it is efficient, the only way out for increasing onion production would be the adoption of modern inputs and improved farm technology of production. Taking consideration as above, there is purpose to evaluate the resource use efficiency with which the study farmers use their main resources in the cultivation of onion.

In the last, having actual performance of sample farms with regard to cultivation of onion, it would be appropriate to mention the features which act as constraints in increasing the production and productivity as well as in adoption of improved technology is the paramount important of the study and considered in present chapter.

The study depicted that the higher adoption of improved onion production technology have higher production potential/efficiency. Infect, the adoption level of these inputs i.e. high yielding varieties of seed, fertilizer, plant protection measure and irrigation were not found uniform and inadequate level in the area and among the different socio-economic groups of the farmers respectively. Infect, this study to know the real problems faced by the onion growers in production process to adopted the technology are paramount important in order to make suitable strategies for the further development in onion production and study revealed that the prices of improved input are high in the market followed by lack of own fund, unavailability of proper market and lack of technological know how. Hence, the development agencies should take care regarding execution of developmental programme of onion production with the help of extension agencies to solve the problems as above.

Indetail, the data base inference revealed that in general, the aim of agricultural economist is, to reduce the marginal cost of output for getting the maximum profit with the use of improved agricultural production technology. This can occur either by employing (adopting) the existing inputs but in different composition (a change in technique) or by introducing new factors of production either for replacing old ones or simply as additional inputs (technological innovation). With regards to above fact,

application of adequate quantities of farm power with other inputs like high yielding variety (better seeds), adequate fertilizer application, plant protection measures, irrigation etc. is a main necessary condition for optimum output in agriculture, hence considered for study in onion production also.

The overall adoptions of recommended technology were worked out to 71.96 per cent per farm amongst the onion producer over to recommendation of all technology. The figures of analysis indicated that less then three-fourth share of the onion production technologies developed and recommended by the agricultural scientist have gone for adoption by the users. It was also observed that the quantity of inputs recommended and the quantity of inputs adopted per unit of area was having wide gap i.e. 28.04 per cent. On other words, it can be say that there exist 28.04 per cent of adoption gap of onion production technology in study area.

It is found that the index of onion production technology adoption level found to vary between 67 to 78 per cent on low adopter group to high adopter group farmer's category respectively. But the average adoption of index technology was found to 71.96 per cent. It is also found that there existed a wide gap in adoption of recommended technology and varied as per the individual technology. It is also revealed that the adoption index of all technology was found to higher in the farmers of high adoption level group accept plant protection measure.

The actual farm yield needs to be compared under different situations to be of more use for decision making. The most widely used term 'potential' yield is defined as the yield of the crop which is obtainable on farmers fields under farmers environments with the modern production inputs and techniques giving maximum yield. The difference between the potential farm yield and the average farm yield as well as high technological adoption level of farmer's field and low technological adoption level of farmer's field's yield may be called as the yield gaps which are considered in the present study. It is concluded that, the potential yield on progressive farms was found to 178.94 quintal per hectare which shows on an average farm quite low yield i.e. 150.37 quintal per hectare i.e. 15.00 per cent less than potential yield of the area which can be achieved with the use of improved management practices and yield attributing inputs.

It is general believe that improved onion production technologies are capital

intensive and labour intensive also. The mean of above statement is that the onion production required huge initial investment per unit of area. In concern with above statement the cost of onion cultivation for different level of technology used and on the basis of different cost concepts, the data on cost of cultivation per hectare on sample holding revealed that the average cost A1 comes to Rs.17341.52. This cost found to higher in the farm of high adoption level i.e. Rs.18999.01 followed by Rs.15684.04 on low adoption level of farm respectively. The reason for higher cost in high technological adoption status of onion production was due to judicious and higher use of inputs and their respective cost evolved in production process. It is concluded from the study that the total expenditure on onion cultivation per hectare (Cost C1, C2 and C3) in different technological status has specific trend between them i.e. the higher technological status showed higher cost of cultivation only might be the higher value involved to purchase the inputs and production practices involved.

It is concluded that, as discussed above the improved technology found to more input (capital) intensive and require higher initial investment but it prove to more profitable on per hectare basis. That is the reason that the profit is found to more as increasing trend with the used level of technology. On the other hand, with the use of higher technology the return over per rupees expenditure found to profitable in case of low adoption level.

The R^2 coefficient of multiple determinants for average size of holding in case of low and high technological adoption fields, clearly indicates that fitted function explains 92.60 per cent and 83.10 per cent variation in gross income from onion cultivation due to the included variables. The F-ratio for fitted function was found to highly significant for average size of lower adoption group (F ratio= 97.938) indicated that fitted Cobb-Douglus production function model was more useful and best fitted to the data. In case of high adoption level the F-ratio was only 23.530 indicated that that fitted Cobb-Douglus production function model in this case found to useful and best fitted to the data. From the table it was observed that the elasticity's of production of each input on an average sample onion farms found to positive significant and less than one, indicating that if increase each input by one percent then the gross income from onion will be increase by less than one percent in both the farm situation that is low adoption

and high adoption categories.

As mentioned earlier that productivity of onion in area under study found to low, which could be due to various reasons including low input application, low managerial efficiency, erratic rain fall with adversely agro-climatic condition and other socio-economic features. The failure to expand the area under onion could be mainly due to lack of marketing facilities and low price of output also. Such constraints should be taken care, so that not only area under onion can be enhanced rapidly, but also to generate high income to the growers through increased productivity.

CHAPTER –VI

SUMMARY, CONCLUSION AND SUGGESTIONS

Summary: -

Onion is one of the most important cash crop as vegetable grown in India. It is used either in raw or dehydrated form to add flavor and taste to Indian cuisine. At present India stands second largest producer of onion in the world. In India onion is a consistent earner of foreign exchange and the exports of onion and onion products reach several destinations. The total production of onion in India is seen to have increased from 2.5 million tonnes during 1980-81 to more than 6.0 million tonnes in 2009. In Madhya Pradesh the onion production is found 625975 Metric tonnes with cultivated area of 28790 hectares in 2008-09. The cultivation of onion in Sehore district is steadily increasing but the yield is comparatively found to low as compare in well-endowed main onion growing states of the country. Such low yield levels can be attributed, among other things, to unavailability or different level of uses of new onion production technology, resources degradation associated with input intensification and low efficiencies in resources use.

On the economic view of onion production in Madhya Pradesh it is important to examine how efficiently the farmers are using their resources at different level. If resource use is found to inefficient at any adoption level of onion production technology then it can be increased by making adjustment in the present use of factors inputs in optimal direction. In case, it is efficient, the only way out for increasing onion production would be the adoption of modern inputs and improved onion production technology. Keeping the above facts in mind following objectives was considered for study. The specific objectives of the study were:

6. To analyse the adoption and yield gap at different adoption levels.
7. To analyse the profitability of onion production at different adoption levels.
8. To determine the resource use efficiency at various level of adoption.
9. To identify the important constraints responsible for the exiting yield gap.
10. To suggest ways and means for increasing onion production in area under study.

Sehore district of Madhya Pradesh has been selected for the purpose of this study because this district has sufficient area for onion in the state. For the study, three stage sampling technique was used for drawing the sample. At the first stage, Sehore block in Sehore district was selected purposively due to most suitable area for Onion crop and well known for researcher. At the second stage, a list of villages in selected block was prepared as per ascending order of area under onion crop. Among these villages, 5 villages were selected randomly. At the third stage for the selection of respondents, a list of Onion growing cultivators of each village was prepared in ascending order of their size of holding under onion crop and 75 farmers was selected randomly for the study.

Depending upon the objectives of the study both primary and secondary data was used. The primary data was collected from selected respondents using pre-tested questionnaire schedule through survey method. Each selected respondents was approached personally for recording relevant data. Secondary data regarding production, area, and yield etc was collected from the Department of Agriculture and Department of Statistics. The data was collected for the Agricultural year 2010-2011.

Adoption pattern of improved production technology:

The selected onion growers were classified into three categories with respect to level of adoption. Having identified the number of farmers under each category the indices of adoption was calculated as under

$$\text{Adoption index (\%)} = \frac{\text{Adoption score obtained by respondent}}{\text{Possible maximum score}} \times 100$$

The adoption gap index was measured with following formula:

$$GI = \frac{R-A}{R} \times 100$$

Where, GI = Adoption gap index in percentage

R= Recommended package of technology (Total score fixed for a component)

A= Actual adoption of the package of recommended technology (Score obtained by the farmer out of the total score)

Yield gap : The potential farm yield which is obtainable on a farmer's field with the adoption of modern technology. The difference between the potential farm yield and actual farm yield is termed as a yield gap.

Economics of cultivation:

Cost concept, A_1 to C_3 and profitability concept i.e. gross return, net return. B.C.Ratio was calculated for find of profitability.

Cobb-Douglas production function was used for the estimation of resource use efficiency as per one of the objective of study:

$$Y = ax_1^{b1} x_2^{b2} . x_3^{b3} \_\_\_\_\_ x_k^{bk}$$

Where,

Y= Dependant variable (gross income)

a= Constant or intercept value

b_1 to b_k= Regression coefficient of x_1 to x_k variables

x_1 to x_k = variables

Constraints prevailing in the way of cultivation of onion crop were enumerated according to their importance as given by the respondents.

Conclusion: -

From the foregoing results it could be concluded as under:

- The average size of holding was found to on an average 4.92 hectare per farm. Among them the cultivated are was found to 95.53 per cent of total average size of holding which was on an average 4.70 hectare per farm. The irrigated area is one factor which found to able for double cropping system. The average gross cropped area was found as higher 165.85 per cent of total holding due to higher irrigation availability. The study shows that there is 69.72 per cent of average size of holding found to irrigate.

- The area under onion is the important factor considered in the study and it occupied on an average 18.10 per cent of the total area which represents on an average 0.89 hectare per farm.
- The overall adoptions of recommended technology were worked out to 71.96 per cent per farm amongst the onion producer over to recommendation of all technology. The figures of analysis indicated that less then three-fourth share of the onion production technologies developed and recommended by the agricultural scientist have gone for adoption by the users. It was also observed that the quantity of inputs recommended and the quantity of inputs adopted per unit of area was having wide gap i.e. 28.04 per cent. On other words, it can be say that there exist 28.04 per cent of adoption gap of onion production technology in study area.
- It could be concluded that the index of onion production technology adoption level found to varied between 67 to 78 per cent on low adopter group to high adopter group farmer's category respectively. But the average adoption of index technology was found to 71.96 per cent.
- It is concluded that there existed a wide gap in adoption of recommended technology and varied as per the individual technology. It is also revealed that the adoption index of all technology was found to higher in the farmers of high adoption level group accept plant protection measure.
- It is concluded that, the potential yield on progressive farms was found to 178.94 quintal per hectare which shows on an average farm quite low yield i.e. 150.37 quintal per hectare i.e. 15.00 per cent less than potential yield of the area which can be achieved with the use of improved management practices and yield attributing inputs.
- The cost of onion cultivation for different level of technology used and on the basis of different cost concepts, the data on cost of cultivation per hectare on sample holding revealed that the average cost A1 comes to Rs.17341.52. This cost found to higher in the farm of high adoption level i.e. Rs.18999.01 followed by Rs.15684.04 on low adoption level of farm respectively. The reason for higher cost in high technological adoption status of onion production was due to

judicious and higher use of inputs and their respective cost evolved in production process.

- It is concluded that, as discussed above the improved technology found to more input (capital) intensive and require higher initial investment but it prove to more profitable on per hectare basis. That is the reason that the profit is found to more as increasing trend with the used level of technology. On the other hand, with the use of higher technology the return over per rupees expenditure found to profitable in case of low adoption level.
- The over all results of production function analysis clearly indicate that expenditure on human labour, seed, fertilizer, plant protection and irrigation were found to be contributing significantly towards gross income on average holdings farm in low and high adoption groups respectively. It was also found that farmers were used proper and justified inputs in onion production because the regression values of each inputs found to very low varying from 0.337(minimum) to 0.950 (maximum) with significant values respectively.

Suggestion: -

For further development of onion production in the area and to obtain higher remuneration per unit of area and production following suggestions may be considered.

1. The result of the study showed that adoption of new agricultural technology has lagged far behind. The onion productivity could be increased in the area through the increased use of improved inputs and practices. Hence, the planner of agriculture should be taken care for adoption of improved practices and if the farmers have lack of capital then it is advice for that purpose required amount should be financed by the financing agencies.

2. The data of the study showed that the adoption of improved onion production technology have higher production efficiency in the area. The use of higher production technology as recommended for onion production i.e. adequate use of high yielding varieties of seeds, fertilizer, plant protection measure and irrigation produced higher yield about 15.00 per cent over to the farms where low technology was adopted. On the other hand the poor farmers were not found to judicious use of recommended technology on their farm due to higher cost of

inputs and poor socio economic base. These farmers are growing onion not because it is remunerative but because it has relatively more cash value as compared to other food crops. Hence, inputs, seed, fertilizer and insecticide-pesticide should be sold to the farmers at subsidized rates, spicily to small and medium size onion growers.

3. The proper use of improved technology and improved practices of onion production need to be demonstrated. Hence, the extension worker and planner should be taken care on this point. It was revealed on the study that onion production required much higher initial investment. Hence, to reduce the risk aversion influence on productivity, an attractive crop insurance scheme needs to be implemented effectively in the area.

4. The study of onion cultivation revealed that onion was found to be profitable in the area. To get the maximum profit from cultivation of onion per unit of area, the farmers should be used the inputs required for its cultivation in a judicious manner with the efficient practices.

5. The results of resource use efficiency and resource use pattern in production of onion showed that adoption of new agricultural technology is marginal. The crop productivity could be increased in the area through the higher use of improved inputs and practices.

6. Some of the farmers follow uneconomic method of cultivation or not applying adequate inputs and practices, resulting into lower yield. They have lost faith in what is said but they have faith when they see with their own eyes, similarly farmer's follow apart from seed and fertilizer, traditional methods of plant protection measures and those who use scientific methods do not follow in proper time and as per recommendations. Hence, result of recommended technology is very necessary to demonstrate to the farmers. Agro-compatibility etc. have not reached to the majority of the farmers in the region, use of improved farm implements for various field preparations to reduce the cost of cultivation and other practices are also need to be made popular among the farm community of the area. The over all aim should to trained farmers in the onion

production techniques under existing economic and other requisite condition to the extent so as to improve productivity of onion crop.

7. Due to poor storage conditions in terms of ventilation, majority of the onion producers in the study area were seen to market onion immediately after the harvesting operation. This practice undoubtedly led to unremunerative prices on offer for most of these onion producers in the study area. This makes it necessary to create a chain of scientific onion storage.

8. Institutional credit facilities and input supply facilities at right time should be extended to the onion farmers on priority basis.

CHAPTER VII

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APPENDIX – I

AGRICULTURE ECONOMICS AND FARM MANAGEMENT SECTION

R. A. K. COLLEGE OF AGRICULTURE SEHORE (M.P.)

"Resource use efficiency of onion cultivation at different levels of adoption in Sehore district of Madhya Pradesh**"**

INTERVIEW SCHEDULE

Date: ……. Name of investigator: Sunil Goyal
Name of Guide : Dr. P.K. Malviya

(1) General information of the respondents:

(a) Name …….

(b) Village ……

(c) Age …….

(d) Education ……..

(e) Total land holding …….(ha.)

(f) No of land fragments ……(ha.)

(g) Cultivated area ……..(ha.)

(h) Irrigated area …….(ha.)

(i) Waste land …….(ha.)

(j) Source of irrigation ……...

(k) Area under vegetable and Orchard ……...(ha.)

(l) Area under Potato ……(ha.)

(m)Land revenue paid Rs. in year ……

(n) Land leased out …….. ha. Rent ……..Rs./year

(o) Land leased in …….ha. Rent paid ……..Rs./year

2) Cropping Pattern:

Kharif (ha.)

S. No.	Crop	Area	Irrigated	Unirrigated

Rabi (ha.)

S. No.	Crop	Area	Irrigated	Unirrigated

Zaid (ha.)

S. No.	Crop	Area	Irrigated	Unirrigated

(3) Information about form assets:

S. No.	Particulars	Year of Purchase /Construction	Quantity	Value in Rs.
1.	Land			
2.	Farm House			
3.	Store House			
4.	Farm Shed			
5.	Pump House			
6.	Tube Well/Well			
7.	Pump Elect/Diesel			
8.	Pipe Line and Implements			
Bullock operated implements:				
1.	Plough			
2.	Harrow			
3.	Nari / Duffan / Triffan			
4.	Pata / Cultivator			
5.	Bullock cart			
6.	Seed drill			
7.	Others			
Tractor operated implements:				
1.	Tractor			
2.	Cultivator			
3.	Seed drill			
4.	M.B. plough			
5.	Trolly			
6.	Harrow			
7.	Miscellaneous			
Hand operated implements:				
1.	Spade			
2.	Khurpi			

3.	Tokna / Rope e.t.c.			
Other implements:				
1.	Power thresher			
2.	Winnower			
3.	Chaff cutter			
4.	Milk machines			
5.	Others			

(4) Information about cost of cultivation:

Variety …… area (ha) ……..

1. Operational labour (Days)

S. No.	Practices	Human labour				Bullock labour		Machine labour	
		Male		Female		**Owned**	Hired	Owned	Hired
		F	H	F	H				
1.	**Nursery preparation**								
2.	**Field preparation**								
	(a) Ploughing (i) (ii)								
	(b) Harrowing (i) (ii)								
	(c) Leveling								
	(d) Land treatment								
	(e) Planting / Sowing								
3.	**Irrigation**								
	(a) Pre sowing no.								

	(b) Post sowing no.								
4.	**Supervision**								
5.	**Earthing**								
6.	**Digging**								
7.	**Transportation**								
8.	**Other**								

(5) Information about cost of cultivation:

Variety …… area (ha) ……..

(A) Operational labour (Rs.)

S. No.	Practices	Human labour				Bullock labour		Machine labour	
		Male		Female		**Owned**	Hired	Owned	Hired
		F	H	F	H				
1.	**Nursery preparation**								
2.	**Field preparation**								
	(a) Ploughing (i) (ii)								
	(b) Harrowing (i) (ii)								
	(c) Leveling								
	(d) Land treatment								
	(e) Planting / Sowing								
3.	**Irrigation**								

	(a) Pre sowing no. (b) Post sowing no.								
4.	**Supervision**								
5.	**Earthing**								
6.	**Digging**								
7.	**Transportation**								
8.	**Other**								

(B) Material used:

S. No.	Material	Price per unit	Material used	
			Qty	Cost
1.	Seed			
2.	Seed treatment			
3.	Fertilizer and Manures (i) Manure (ii) N. (iii) P (iv) K			
4.	Weed control (Intercultural) (a) Chemical name (b) Human (c) Mechanical			

5.	Plant protection (a) Insecticide used No. of spray (b) Fungicides used No. of spray			

5. Output

Month	Quantity	Price

6. Constraints in production practices:

A. Pertaining to technology ……YES/NO

1. Seed and seed treatment

a) Low germination
b) Low purity
c) Uneven germination due to uncontrolled depth.
d) Late sowing due to unavailable of seed in time.
e) Complete immunity not ensure by seed treatment.
f) Lack of local supply of improved seed.
g) Lack of knowledge about method of planting.
h) Unavailability of suitable variety as recommended.

2. Water management:

(a) Lack of irrigation.
(b) Undulated land.
(c) Lack of knowledge about irrigation method and time.

(d) Alternate irrigation is not possible.

(e) Defective land shaping.

(f) Stagnation of water in the field due to inadequate drainage system.

(g) Declining water table.

3. **Fertilizer and manorial management:**

(a) High doses of fertilizers spoil the soils.

(b) Induction of more disease and pests through application of fertilizer.

(c) Fertilizer application is more expensive.

(d) Loss of fertilizer through leaching and runoff.

(e) Due to poor soil condition.

(f) Lack of timely supply.

(g) Non availability of F.Y.M.

(h) Poor quality of F.Y.M.

(i) Lack of timely supply of F.Y.M.

(j) Lack of fertilizer supply.

(k) F.Y.M. application.

4. **Weed control:**

a) Chemical application not effective as hand weeding.
b) Difficulty in weeding in irrigated field.
c) Weedicide cause toxicity to crop.
d) Hand weeding time and labour consuming thus expensive.
e) High cost of weedicides.
f) Inadequate or nil knowledge of weedicide use.

5. **Disease and pest control:**

a) Spraying is not effective.
b) Most of the disease/pests are not controllable.
c) Lack of supply of plant protection material.
d) Good quality of chemicals is not available.

e) Lack of knowledge about plant protection.
f) High cost of chemicals.
g) Chemical are more toxic to the animals and human.

6. Earthing and digging:

a) Difficulty in earthing and digging due to stagnation of water in the field.
b) Appropriate time cannot be judge for digging.
c) Earthing is a time and labour consuming procedure.

B. Pertaining to labour management:

(a) Shortage of labour at the time of earthing and digging.
(b) High wages of labour at the time of earthing and digging.
(c) High labour mobilization at the time of earthing and digging.
(d) Skilled Labour shortage for the purpose of earthing and digging.
(e) Lack of potato digger.

C. Pertaining to institutional infrastructure.

1. Credit:

a) Non availability of credit in time.
b) Rate of interest is not only high but varies form agency to agency.
c) Complicated loaning procedure.
d) Recovery procedure in stringent.
e) Loan fees and other charges, as well as the cost involved in obtaining credit from agencies several times are very high.

2. Marketing:

a) Monopoly and forced marketing in vegetable market.
b) Late and inadequate return in the market.
c) Market located at distant palaces.
d) High transportation charges.
e) Unauthorized charges.

3. Extension:

a) Farmer training conducted at distance places.
b) Improved production technique is not demonstrated in the field.

c) Intensive contact of subject matter specialist from University and Agril. Department with farmer's is very low.
d) Key information and village youth are not feed with important technical information's.
e) Lack of knowledge of potato production technology.

VITA

Sunil Goyal, the author of thesis was born on 12th February 1986 in Sehore district of Madhya Pradesh. He completed his primary education at Govt.School at Sehore. He passed his High School and Higher Secondary Certificate Examination of Madhya Pradesh Board Bhopal from Govt.School at Ashta (M.P.).

He was selected through entrance examination (P.A.T.) and joined JNKVV, the College of Agriculture, Sehore (M.P.) in 2004 and obtained B.Sc. (Ag.) degree in 2009 with 6.42 OGPA out of 10.00point scale.

*The author continued his post graduation from R.A.K. College of Agriculture, Sehore (M.P.), to specialize in "**Department of Agricultural Economics And Farm Management**" and partial fulfillment of the requirements for the award of the same, he allotted with interesting problem as **"Resource use efficiency of onion cultivation at different levels of adoption in Sehore district of Madhya Pradesh"** for thesis work which has been duly completed by his and presented in this thesis.*

His achievement in the sports is praiseworthy. He actively participated in all the cultural activities of the college. Now, he is going to complete his master's degree programme by submission of this thesis.