

**ECONOMICS OF PRODUCTION AND MARKETING OF  
BANANA IN NEPAL**

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B.Sc. (Agri.)

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*Dissertation*

*Submitted To The Marathwada Agricultural University*

*In Partial Fulfilment Of The Requirement*

*For The Degree Of*

**MASTER OF SCIENCE**  
(Agriculture)

IN

**AGRICULTURAL ECONOMICS**

**DEPARTMENT OF AGRICULTURAL ECONOMICS AND STATISTICS  
MARATHWADA AGRICULTURAL UNIVERSITY  
PARBHANI 431 402 (M.S.) INDIA**

**1999**

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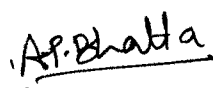
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## ***CERTIFICATE - I***

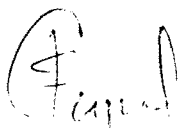
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Research Guide

## **CERTIFICATE - II**

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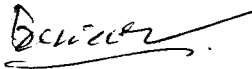
  
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## ACKNOWLEDGEMENT

Emotions cannot be adequately expressed in words because then emotions are transformed into mere formality. Formalities have to be completed. My acknowledgements are many than what I am expressing here.

I have this opportunity to express my deep sense of gratitude and sincere regards to my Guide Dr. H.N. Patil, Head, Department of Agricultural Economics and Statistics, Marathwada Agricultural University, Parbhani for his continuous untiring efforts in guiding me during the course of this work. His constructive criticism and critical review of the manuscript with patience led to successful articulation of this dissertation.

I am thankful to Dr. N.N. Shinde, Head, Department of Horticulture, MAU, Parbhani; Prof. P.R. Waghmare, Associate Professor and Dr. B.R. Pawar, Assistant Professor, Department of Agril. Economics and Statistics, the members of my Advisory Committee for their valuable suggestions, helpful comments and timely constructive criticisms. I am also thankful to Dr. T.G. Satpute, Associate Professor, Dept. of Agril. Econ. and Stat., MAU, Parbhani for his guidance during course of work.

My cordial thanks are due to all staff members of the Dept. of Agril. Econ. and Stat., College of Agriculture, MAU, Parbhani.

I am grateful to Indian Council for Cultural Relations (ICCR), New Delhi for awarding me scholarship under Nepal Aid Fund Scheme to pursue a M.Sc. degree. The field work part of this research was supported by Agro Enterprise Centre (AEC), Kathmandu, Nepal. My sincere

thanks goes to Dr. D.B. Shakya, present Managing Director and Mr. K.R. Tiwari, present Senior Program Manager of AEC.

For their invaluable support, hospitality and cooperation during the field work in Nepal, I would like to thank Mr. Ram, C. Bhatta (TCN), Mr. Dilip S. Thapa (ADB/N), Mr. Prakash Neupane (AEC), Bishnu P. Kharel (AEC), Tulsi Ram Subedi, Kalak B. Adhikari, Shyam Pandey, Krishna Baniya, Bishnu P. Pandey (Chairman, Bhiuran VDC) and all the sample farmers of Mahendranagar, Tikapur, Shankarnagar, Janakinagar and Bhiuran area.

I would like to express my sincere appreciation to my friends Krishna Poudel, Shri Niwas Gautam, Pradyumna, Amatya, Milind Sonkamble, Suresh Khade, Nagesh Yelvikar, Vinesh Rege and Nand Kumar Parab. Had these friends not taken care of me during this time, I doubt if I would have survived in Parbhani and completed the research work.

I hardly find any words to express my heartiest gratitude to my everloving parents, who have shaped my life and lead me from better to best. I appreciate with thanks to my sister Sabita and Shanti, brother Hem and Sunita, father and mother-in-law and brother-in-laws Sushil and Deepak for their love, inspiration and moral support throughout my life. Finally, with deep gratitude I express my thanks to my wife Anju, for her unfailing support and love for me, inspite of the fact that I had come to Parbhani (India) for my study, leaving her alone at home.

*AP Bhatta*

(ARUN P. BHATTA)

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DATED : 11/06/1999.

## C O N T E N T S

Chapter	Title	Pages
I	INTRODUCTION	1-7
II	REVIEW OF LITERATURE	8-31
III	METHODOLOGY	32-50
IV	CULTIVATION PRACTICES OF BANANA	51-68
V	RESULTS	69-130
VI	DISCUSSION	131-143
VII	SUMMARY AND CONCLUSION	144-153
	LITERATURE CITED	i-viii

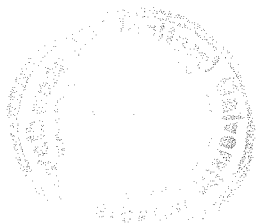
## LIST OF TABLES

Table No.	Title	Page No.
4.1	Field spacing for bananas	57
4.2	Major pests and diseases of banana	64-66
5.1	Selection of sample.	70
5.2	Socio economic condition of farm families	72
5.3	Sources of irrigation.	72
5.4	Land use classification.	74
5.5	Cropping pattern	74
5.6	Per hectare operationwise labour utilization Cv. W. Hybrid.	77
5.7	Per hectare operationwise labour utilization Cv. Harichal.	78
5.8	Per hectare operationwise labour utilization Cv. Malbhog.	79
5.9	Per hectare operationwise human labour utilization at an overall level	80
5.10	Per hectare labour utilization.	83
5.11	Per hectare utilization of various inputs	85
5.12	Per hectare utilisation of various inputs in India and Nepal.	89
5.13	Varietywise per hectare cost of cultivation of banana in Nepal (1998-99)	92-93
5.14	Itemwise per hectare cost of cultivation of banana in India (1998-99)	97
5.15	Per hectare costs and returns from banana cultivation	99
5.16	Per hectare costs and returns from banana cultivation (Nepal vs India)	102
5.17	Farmers perception on different banana varieties.	104

Table No.	Title	Page No.
5.18	Intercropping in banana	106
5.19	Different sources of loan.	109
5.20	Regionwise loan borrowed, rate of interest and pay back period	109
5.21	Correlation matrix between input and output in banana cultivation.	112
5.22	Multiple regression coefficient.	114
5.23	Resource use efficiency in banana production.	117
5.24	General information of wholesalers, retailers and pre-harvest contractor	119
5.25	Price spread and market margin of banana (per 100 fingers).	123
5.26	Constraints faced by the farmers in banana cultivation.	127
5.27	Constraints faced by intermediaries in marketing of banana.	127
5.28	Import of banana from India to Nepal.	130

## LIST OF FIGURES

Fig. No.	Title	Between pages
3.1	Map of Nepal showing study districts	33-34
5.1	Per hectare operationwise human labour utilization	80-81
5.2	Varietywise fertilizer use per ha	85-86
5.3	Cost of cultivation per hectare	93-94
5.4	Break up of cost of cultivation of banana	93-94
5.5	Varietywise per hectare returns from banana cultivation.	99-100
5.6	Different marketing channels existed in the study area.	122-123



**INTRODUCTION**

## **Chapter-I**

### **INTRODUCTION**

Banana is an important fruit crop in the tropical and subtropical parts of the world. It is the most common and ancient fruit crop grown to mankind (Butani, 1979).

Bananas are large, monocotyledonous herbs in the family Musaceae. The edible types are parthenocarpic and often infertile whereas their wild precursors are seeded and virtually inedible and usually possess inferior traits. Bananas evolved in South East Asia and in the Indian sub continent. Secondary centres of diversity occur in the high lands of East Africa, coastal East Africa, West Africa and Latin America. Its cultivation is distributed throughout the warmer countries and is confined to regions between 30°N and 30°S of the equator.

Banana is also grown in many other countries of the world namely Bangladesh, the Carribean islands, the Canary islands, Florida, Egypt, Israel, Ghana, Congo, South Africa, Figi, Hawaii, Taiwan, Indonesia, the Philippines, China, India, Brazil, Colombia, Eucador, Venezuela, Oceania, Papua New Guinea, Sri Lanka. The highest acreage of banana is in Africa, where bananas reach their maximum importance as starchy food. They are the staple food of the Buganda in Uganda, the Wahaya in Bukoba and the Wachagga in Tanzania.

In the year 1997-98, annual global production of banana was expected to exceed 80 million metric tonnes. Of the total banana production about 98.7 per cent is grown in the developing world, only about 10 per cent of the fruit enters the international market and the remaining is consumed by the local market (Vatika, 1997).

Non-exported fruit is often grown by poor, subsistence farmers as staple food or important dietary supplement. Fruit itself has dual use. Banana is a staple food for about 400 million people on the globe. These bananas have diverse genotypes (AA, AB, AAA, AAB, ABB, ABBA) and multiple users: they may be eaten raw, when ripe, or after they are baked, fried, boiled and brewed before and after ripening.

India is world's second largest producer of banana with total production of about 11.0 million tonnes of banana in 1997-98. However, the yield per unit is quite low, mainly because of diseases and pest problem. In India, Maharashtra tops in the list with about 50 t/ha while in Andhra Pradesh and Karnataka per hectare yield is less than half of it. The national (India) productivity of banana in 1997-98 was about 20 t/ha

Banana accounts for about 30 per cent of the total fruit production in India. Banana is unique crop in many ways. It can be grown almost in all seasons and altitudes. almost all parts of the plant can be used for various purposes. More than 50 per cent of the total banana cultivation in India is of the "Cavendish" type (Vatika, 1997).

Nepal is predominantly an agricultural country with little over half (57 %) of the population of working age reported economically active in 1991 and among them 81 per cent were engaged in agricultural activities. The contribution of agricultural sector to the total GDP was 39.13 per cent and that of non-agriculture sector 60.87 per cent during the year 1997-98 at factor cost.

Nepal has total agricultural land 3954.9 thousand hectares with average land holding size of 0.96 hectares; 45 per cent of country's population live below poverty line. Per capita GDP is estimated in the order of US \$ 220 for 1996.

In Nepal, banana is grown in Terai, Inner Terai and foot hills. Jhapa, Morang, Sunsari, Chitwan, Dhading and Tanahun are commercially banana growing districts. The number of district could be more if appropriate technologies and reliable markets are assured. In fact, banana is the second most important fruit crop in the Chitwan Valley (Dhakal et al., 1985) while it ranks third important fruit crop in the country. However, there are not many commercial banana orchards in Nepal. Even a few banana plants in the back yard do not produce good fruits because of lack of proper management practices and severe pest problems.

In the year 1995-96, the total area under banana in Nepal was 3819.36 hectares. The total production and national yield level was 45.53 thousand metric tonnes and 14.1 metric t/ha, respectively (SINA, 1996). The yield of banana in Nepal compares unfavourably with world standards.

In Kailali district of far Western Region, Dwarf Cavendish (Var. Harichal) is grown on about 7.0 hectares area. However, William hybrid developed by tissue culture labs, Katmandu is being grown in Kanchanpur district of the same region. The area was only 4.0 hectares and average productivity was estimated to be 29 MT/ha (Bhatta, 1997).

South Western Nepal is 29 degrees North of the equator and is sub tropical. Other sub tropical areas of the world (20 to 30 degrees north or south of the equator) that grow bananas are southern China, Southern Brazil, South Africa, parts of Australia, Canary Islands, Yemen and few other countries. Israel is even further north, suffers from climatic extremes, but seasonally grows bananas with advanced technology. Nepal can be added to this list of sub tropical banana growers.

Factors limiting banana production in Nepal are :

1. Temperatures less than 17 degrees C from November through February
2. Temperatures more than 38 degrees C in mid year.
3. Extreme drought with uneven irrigation
4. Excess rainfall during the monsoon of June, July and August (Stephens, 1998).

These are similar conditions found in other sub tropical countries where bananas are grown at various degrees of success. South Western Nepali banana growers will learn by trial and error and farm experimentation during

several seasons in order to gain experience on timing the crop to reduce stress caused by adverse climatic factors.

At present country's demand for bananas is being fulfilled by import of banana from India. About 90 quintals banana per month is imported to Dhangadhi and 48 quintals to Mahendranagar, the two major terai towns of FWR which is attached (close) with Indian towns (Bhatta, 1997). The quantity of banana entering in Nepal unrecorded at custom office was excluded.

In the year 1996-97, Nepal imported fruits worth of N Rs. 104.3 million from India.

At present three tissue culture labs are operating in Katmandu. They are supplying plantlets of mainly William hybrid variety. More number of farmers are attracted towards banana cultivation due to higher economic returns with assured markets. Some private sector organization like Agro Enterprise Center (AEC) is also promoting the commercialisation of banana in Kanchanpur district. Before expanding the area on a large scale, it is necessary that, detail costs and returns from banana cultivation be studied which is not worked out so far. The findings of the present study will act as guiding lamp to the prospective banana growers in making decision regarding plantation of banana orchards. The comparison of different varieties within the country and with the variety grown in India, mainly Maharashtra will help in identifying the differences and gaps in technologies which will be fruitful for banana growers of Nepal to bridge the technological gap for improving existing productivity level of banana cultivation.

The seasonality, bulkiness and perishability of this fruit render the task of marketing further delicate and difficult. In the process of marketing fruit has to pass through a number of marketing agencies and functionaries and in turn they take away high margins from the price paid by the consumer. The study of markets, marketing charges, market intermediaries involved needs to be studied in case of banana. The quantity of banana imported from India, its price and marketing margins, the channel through which it comes are not studied in the region. It is very essential to know the market first before boosting farmers for the commercial production of banana in the country. Such study on marketing aspect will help in identifying the consumers preferences, prices and volumes offered and possibility of import/export of banana to and from the country. With this view in mind the present study was conducted with following specific objectives.

- i) To estimate the costs and returns from banana cultivation.
- ii) To study productivity of resources.
- iii) To identify the channels for sale of bananas.
- iv) To estimate marketing cost, marketing margin and price spread in marketing of banana.
- v) To identify the constraints faced by the farmers in production and marketing of banana.
- vi) To study the import of banana in Nepal.

### **Scope of study**

The important aspects of the study lies in appraising the farmers about costs and returns of banana cultivation in Far Western and Western Development Regions of Nepal.

The study will provide more information on the use of available resources and its efficiency in banana cultivation. The study will also help the farmers in knowing whether there is any scope for reorganisation of resources so as to maximise profits. The study of marketing channels will enable the farmers to choose the better channel for selling banana which will minimise the cost of production. This study will also be useful to extension workers, planners and administrators.

**REVIEW OF  
LITERATURE**

## **Chapter-II**

### **REVIEW OF LITERATURE**

It is always worth while to study the work done on various aspects related to the problem by different research workers. Past research work done provides a sound footing to the problem. It also helps to have a clear idea regarding the concept used, methods employed, analysis and interpretation of the data collected etc. The review of such literature is useful in approaching the problem in a right direction and in analysing and interpreting the data in a systematic way. The work done on banana and other similar crops by different research workers are presented in this chapter.

The review is presented under five heads.

1. Economics of production
2. Productivity of resources
3. Marketing
4. Problems faced by banana growers and traders
5. Export/Import of banana.

## 2.1 Economics of production

In farm business, knowledge of cost concepts enables the cultivators to adjust and co-ordinate production resources for their profitable use. In view of this few production studies on banana by different research workers have been attempted in the following paragraphs.

Dani (1928) studied the cost of cultivation of banana which was IRs. 1824 including water at the rate of IRs. 40 per annum per acre and income of IRs. 554 per acre each year in Bombay state of India.

Naik (1949) found the net profit to the tune of IRs. 537 to IRs. 1000 per acre from banana cultivation in Maharashtra provinces of India.

Roy (1950) estimated the expenses for the first and second year as IRs. 505 and IRs. 367, respectively with an income of IRs. 711 and IRs. 1658 per acre.

Sundarraaj (1952) stressed the economic value of leaves and said that, about 2000 acres of banana are grown in Tanjore district of Madras provinces in India largely for the leaves. He reported that, the plants are desuckered in the first year, but in the second year, about 50 leaves are harvested per clump and sold in bunches of IRs. 100, half large and half small for an average price of IRs. 3 per bunch. The cost of cultivation was IRs. 500 in the first year and IRs. 400 in the second year. The income from the fruits was IRs. 1000 in the first year and IRs. 1500 from leaves in the second year.

Dhareshwar (1952) concluded that, manuring of banana with an application of potash fertilizer had increased the banana yield and improved the

quality but 0.4 lb of nitrogen along with FYM was the most profitable treatment.

Balvirverma *et al.* (1964) revealed that, the cost of FYM and fertilizers was IRs. 282 per acre, expenditure on planting and interculture was IRs. 128 per acre and irrigation charges were IRs. 1005 per acre, respectively. The total cost of cultivation was IRs. 1557 per acre. Average yield of fruits was 200 quintals per acre. Total gross income was worked out to be IRs. 3500 with net income of IRs. 1843 per acre.

Bhore (1968) worked out that, the cost of production of banana for one acre in Jalgaon district which was IRs. 2036.60 at cost A, IRs. 2482 at cost B and at cost C it was IRs. 2711.78 giving a gross income per acre of IRs. 4875.99 which gave a net profit of IRs. 2845.37 at cost A, IRs. 2393.44 at cost B and IRs. 2164.21 at cost C. He also pointed out that, cultivators using electric motor saved almost 50 per cent labour in irrigation operation. Three major items i.e. irrigation charges, manures and fertilizers, and human labour constitutes the major portion of the total cost i.e. 84 per cent.

Kohli *et al.* (1973) showed that, the cost of cultivation was IRs. 14310.99 per hectare with total return of IRs. 19800 giving a net profit of IRs. 5490.01 per hectare. The cost of cultivation of subsequent first and second ratoon crops was observed to be IRs. 6013.48 and 5083.87 per hectare, respectively. The net profit obtained was IRs. 13786.52 from first ratoon crop and IRs. 14717.13 from the second ratoon crop. Considering the overall investment in three years, the total capital required was IRs. 25407.34 giving

total net return of IRs. 50400. The average return per rupee investment was IRs. 1.34 from Robusta cultivation which is quite lucrative from the commercial angle.

, Magre (1974) found that, the total cost required for banana cultivation in Parbhani district of Maharashtra was IRs. 2423.64 considering the cost concept A, B and C. The average yield per acre was 142.55 quintals which was worth of IRs. 4271.69 giving net profit of IRs. 1848.05 at cost C. The average cost, value and net profit per quintal of banana was to the extent of IRs. 16.88, IRs. 29.95 and IRs. 13.07, respectively.

Pillai and Khader (1981) concluded that, the plants receiving 100 kg N, 40 kg P<sub>2</sub>O<sub>5</sub> and 40 kg K<sub>2</sub>O per acre produced the heaviest bunches (about 26 kg/bunch).

Jadhav *et al.* (1982) studied the benefit of applying iron Chelate to banana plantations. He observed that the application of iron chelate to banana plantation through the irrigation system for 3 years at 2.5 to 15.0 kg/ha had no effect on growth of yield. It is concluded that iron chelated application are necessary only where iron chlorosis or iron deficiency is present.

Robinson (1983) studied on bananas (Cv. William) planted in 1980 at 6 different densities ranging from 1000 to 2222 plants per hectare, those planted at 1666 per hectare having rectangular, hedge row or trainline spatial arrangements. Yield of the parent crop rises from 30 to 61 tonnes per hectare as plant density increased from 457 to 484 days. Differences in bunch weight were slight. Of the first ratoon plants, the percentage that had flowered by 31

October, 1982 varied between 96 per cent for the widest spacing and only 6 per cent for the closest spacing. Of the plants planted at 1666/ha, those on trainline arrangements were the slowest to flower.

Mustaffa (1983) observed banana grown at 950 m a.s.l. at 3 x 3, 3 x 2.4 and 2.4 x 2.4 m receiving N @ 50 to 250 gram per plant per year. The yields were highest (12.82 - 14.25 t/ha) on the closest planted plots receiving highest nitrogen dose. Close spacing hastened maturity and improved fruit quality but high nitrogen rates reversed this trend. The optimal rate was 150 gram N per plant.

Robinson and Alberts (1984) conducted an experiment on the Cv. Williams and concluded that by increasing the quantity of water applied, plant height, bunch mass and annual yield also increases until at 5000 m<sup>3</sup> of water per hectare onwards which yield levelled off, showing that extra water could be wasted. Drip irrigation at 6900 m<sup>3</sup>/ha gave only 8 per cent lower yield than sprinkler irrigation at 12500 m<sup>3</sup>/ha.

Chundawat *et al.* (1985) observed in 4 season trials with Cv. Basrai, N derived from 8 different sources was applied at 180 g/plant. The average yields were similar for all treatments but the best treatment was urea + caster cake (1:1). This treatment gave an average yield of 50.5 t/ha and a gross income of IRs. 27797/ha compared with the lowest income of Rs. 23058 per hectare with ammonium sulphate treatment.

Pawar (1987) worked on economics of production and marketing of banana in Maharashtra state of India. Altogether 167 cultivators were selected

at random from Basmat taluka (Dist. Hingoli) and Chalisgaon taluka (Dist. Jalgaon) and per hectare returns from banana cultivation <sup>were</sup> calculated using cost concepts A, B and C. The average gross income was IRs. 52733.40 and IRs. 29161.30 for Chalisgaon and Basmat talukas, respectively. On an average per hectare profit at cost C was higher in Chalisgaon (IRs. 29057.38) than in Basmat taluka (IRs. 13545.28). Average per hectare cost of cultivation was IRs. 15616.02 in Basmat taluka and IRs. 23676.02 in Chalisgaon taluka,

Shreshta *et al.* (1993) studied cost of cultivating banana in Chitwan Valley of Nepal. It was found out that, the improved variety such as Robusta resulted 20 per cent higher net return compared to local. But the cost of production for the improved banana was two and half times higher than the local. The average variable cost calculated was NRs. 50000 and NRs. 21000 per hectare with gross profit of NRs. 150000 and NRs. 100000 per hectare for improved (Robusta) and local (Malbhog) varieties respectively. The per hectare average net income was to the tune of NRs. 100000 and NRs. 79000 from improved (Robusta) and local (Malbhog) banana cultivation, respectively.

Batra *et al.* (1995) worked on economics of banana cultivation in Gujrat state of India. Estimates of banana yield ranged between 358 quintals per hectare and 464 quintals per hectare, according to the prevailing labour rates and material inputs in the studied area. Input cost was IRs. 18.76 per quintal for Basrai variety cultivation and Rs. 25.75 per quintal for Sinduri variety cultivation.

Maurya *et al.* (1996) calculated profitability of banana plantation in district Hajipur (Bihar) during the year 1993-94 based on sample of 60 banana growers selected from five villages in the district. It was found out that, the growers were growing high yielding varieties of banana. The study reveals that, banana production is the most profitable crop production activity in this area, but that it requires a large amount of capital investment.

Bhatta (1997) surveyed all the banana growers of far western terai of Nepal and concluded that, only 11.51 hectares area was under banana cultivation. The yield per hectare was estimated at 29 metric tonnes of fruit. The cost and gross return estimated per hectare of banana cultivation for variety Harichal was NRs. 105533 and NRs. 201600 with net profit of NRs. 96067 while for variety William hybrid, it was to the tune of NRs. 127533 and NRs. 270000 with net profit of NRs. 142467. While calculating the total cost, only variable costs were taken into consideration.

## **2.2 Resource productivity**

Raj Krishna (1964) fitted Cobb-Douglas function to estimate MVP of inputs for Punjab farmers. Three sets of equations were used by grouping some of the inputs in order to remove the multicollinearity. The study pointed out that MVP estimates of farm inputs were not so widely out of line with their acquisition costs.

Ram Saran (1964) used production function approach to measure the productivity of agricultural inputs by fitting Cobb-Douglas function to

input-output data obtained from the studies in the economics of farm management. He fitted functions for farm business as a whole, as well as for important crops using resources namely, land in acres, human and bullock labour in days, working expenses and manure in rupees. He compared productivity of inputs between different regions and found that in all the three states i.e. Uttar Pradesh, Andhra Pradesh and Tamil Nadu, increase in expenditure on the use of manure, fertilizer, improved seed, etc. could increase farm income.

Singh and Pandey (1971) found that, human labour, bullock labour, etc. have significant impact and compare the fertilizers response for rai, linseed, sunflower and ground nut in different locations in the country. He found that, the yield of the rai, linseed, sunflower and groundnut were highly associated with fertilizer and micronutrients application.

Satpute (1973) studied the resource productivities of high yielding varieties of jowar and cotton crops in Parbhani district of Maharashtra State. Production function technique was used as the analytical tool for establishing the relationship between output dependent variable on one hand, and the various agricultural inputs namely, manures and fertilizers, plant protection measures and labour on the other hand. The estimation of functional relationship was done separately for hybrid jowar and hybrid cotton. The functional relationship was derived specifically for comparing the productivities of agricultural inputs in production of both the crops. The Cobb-Douglas function was tried for the regression analysis. The elasticity of production of

inputs viz., manures and fertilizers and human and bullock labour appeared to be significant for the crops hybrid jowar CSH 1 and hybrid cotton H 4.

Salikram (1977) made comparative study of resource productivities on adopter and non adopter farm in Chandoli block, where intensive agriculture area programme was launched for paddy cultivation in 1964. Cobb-Douglas function was fitted to express the input output relationship and to workout the productivity of resources. The result of this study showed that, the marginal value productivities of all the inputs were high on both adopter and non adopter farms. The study concluded that, there is a further scope to increase income and profit by increasing the use of manures and fertilizers on these farms.

Oconner *et al.* (1978) studied the efficient allocation of resources when the production function has random production elasticities. Conditions for allocative efficiency are given for anticipated profit maximisation procedures for testing of hypothesis about resource allocation are given.

Menon (1979) studied the objectives on enquiring the economic aspects of grape cultivation and the resource use efficiency of different factors in the production of two dominant varieties of grape i.e. Bangalore Blue and Anab-e-Shahi. The results of Cobb-Douglas function analysis indicated about 88 to 89 per cent variation in the yield in two respective varieties of grapes. It was then concluded that there was still scope to increase the income by reallocation of resources.

Raydu (1983) studied the technological changes in agriculture with objectives of the five year development plans in India is to facilitate the

adoption of technological changes at farm level and improve their productivity. They also discussed the use of pumpsets, improved seeds, fertilizers and their effect on agricultural practices and production.

Talukdar and Banerjee (1984) studied the farm size and productivity and concluded that, there is a roughly inverse relationship between farm size and crop productivity in the area. Productivity is found to be influenced mainly by intensity of cropping. The fact that irrigation is at all the size groups may explain the low crop productivity of larger farms.

Banerjee (1985) studied the exact relationship between farm size and productivity in India from the view point of both acreage and total output. He also examined the factors explaining the relationship between farm size and productivity. It was found that, the value of output per unit of land is the better measure of farm size. Cropping intensity, fertilizer use per hectare, paid out cost and percentage of area irrigated to gross cropped area are the factors responsible for the inverse relationship between farm size and productivity.

Pawar (1987) studied productivity of resources in banana crop based on 167 samples from Basmat and Chalisgaon talukas in Maharashtra, India. Production function analysis was carried out in order to find out the contribution of selected variables in the output. The highest elasticity of production was noticed in male labour followed by number of suckers, area, bullock labour, manures and phoshatic fertilizers in Basmat taluka. The selected variables explained the variation in output to the extent of 85 per cent. The variables like area, number of suckers and male labour were associated significantly with the output.

Hsieh and Wu (1996) studied on the feasibility of banana grouping culture in Taiwan in order to achieve economies of scale. Results suggest that the minimum area of cultivation needs to be 8-10 hectare with ten producers involved.

Ambekar (1998) worked on resource productivity and resource use efficiency in papaya crop based on the 50 samples selected from 10 villages of Parbhani and Nanded districts of Maharashtra, India during year 1997-98. Cobb-Douglas type of production function was tried and factors such as land, fertilizer, labour, irrigation and plant protection were selected.

Results of the analysis indicated that, the inputs like land, male labour, female labour and plant protection turned out to be significant, indicating thereby the significant impact of these variables in the production of papaya. The value of  $R^2$  was 0.936<sup>which</sup> indicated that the selected variables explained the variation in the output by 93 per cent. The elasticity of land and irrigation was very high indicating thereby a great scope to increase the use of these inputs for increasing the productivity. The sum of elasticities (2.07) showed increasing returns to scale. It was also observed that, MVP's of land, male labour, female labour, irrigation and plant protection were very high compared to respective marginal costs, which resulted in the higher resource use efficiency.

### 2.3 Marketing

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In the primitive societies where man is dependent on his own efforts for his requirements, there was no trade, no market. But after passing through various economic stages viz., hunting pastoral agricultural and industrial, there arose a need of some organisations to make provision for the exchange or disposal of the goods to those who needed them.

Agricultural marketing organisation in India was developed on the recommendation of Royal Commission on Agriculture in 1934 and Central Agricultural Marketing Department in 1947.

It is the marketing which counts most in fruits. Fruits are generally perishable and price fluctuations are very common. Thus, the studies on marketing of fruit crops provide a basis for the market intelligence. In this regard, studies on economics and marketing of fruits are essential.

#### **Marketing channels, cost, margin and price spread**

Government of India (1967) conducted the marketing studies on banana in Jalgaon district of Maharashtra state (India) and it was reported that, the share of producer in consumer's rupee by way of selling banana through cooperative can be increased from 51.9 per cent to 64.5 per cent.

Karansingh and Gurutej (1971) worked on the market margin for selected fruits and vegetables in relation to the degree of perishability. In their study following marketing channels were observed.

- i) P - PHC - W - R - C
- ii) P - W - R - C
- iii) P - R - C

(P - producer, PHC - post harvest contractor, W - wholesaler, R - retailer and C - consumer)

Kalyankar and Rajmane (1980) conducted study in Parbhani district of Maharashtra State (India), and reported that, inspite of regulated marketing activities, the producer's share in consumer's rupee was about 75 per cent only. Unless producers are involved in marketing of their produce either through cooperatives or government monopoly agencies their share will not increase. The producer as well as consumer will not be benefited to the maximum possible extent without interference of the government or cooperative organisation in marketing of banana.

Tayde and Patil (1981) studied price spread in marketing of selected vegetables in Mahatma Phule Market, Pune (Maharashtra state) and concluded that, in selected vegetables the producer's share reduced from 57 to 32 per cent. While, the margin of the retailer increased from 33 to 60 per cent. They suggested that, for allowing lions share in consumer's rupee to the producer, the margin of the retailer should be checked.

Mahajan (1982) studied marketing of banana at Jalgaon market and reported that, the producer's share in consumer's rupee was 63.82 per cent, 63.00 per cent, 62.16 per cent and the market margin was 36.18 per cent, 37.00 per cent and 37.88 per cent when the produce is marketed through the

co-operative fruit sale society, group sale agency and private agency, respectively.

Nagraj *et al.* (1985) studied on marketing appraisal for few fruits and vegetables and observed the following main channels in banana :

- i) Producer - Pre-harvest contractor - retailer - consumer
- ii) Producer - Commission agent - retailer - consumer.

Pawar (1987) worked on economics of production and marketing of banana in Maharashtra state. He identified the following channels. Out of these channels most of the banana passes through second channel which is most popular one. He came across the four major marketing channels in Basmat and Chalisgaon markets of Parbhani and Jalgaon districts, respectively. In both talukas cultivators rarely sale their banana fruits to the cooperative societies.

- i) P - PHC - W - R - C
- ii) P - CA - W - R - C
- iii) P - W - R - C
- iv) P - CA - Processor - R - C

(P - producer, PHC - pre-harvest contractor, W - wholesaler, R - retailer, CA - commission agent and C - consumer).

Gadre *et al.* (1992) studied marketing efficiency and price spread in marketing of banana in Jalgaon market. They identified the following channels for marketing of banana.

- i) P - cooperative fruit sale society - CA - W - RC
- ii) P - group sale agency - CA - W - R - C

iii) P - private agency - CA - W - R - C

(P - producer, CA - commission agent, W - wholesaler, R - retailer, C - consumer).

Cooperative fruit sale society was found to be the agency which earned minimum profit. The percentage of returns to the value of products handled was found to be higher in channel (I), which accounts 1.77 per cent.

It was suggested that, the producer's share in consumer's rupee in channel-I can further be increased if the cooperative fruit sale society directly deals with the terminal market rather than selling the produce through the commission agents and the wholesalers.

Kale *et al.* (1992) studied on price spread and marketing margins for high grade banana. The per quintal and per dozen net price received by the producer was IRs. 184 and IRs. 2.45, respectively. The total cost of marketing was IRs. 64.50 and IRs. 0.86. The total profit earned by all the intermediaries was to the tune of IRs. 101.50 and IRs. 1.35, while <sup>price</sup> paid by the consumer was IRs. 350 and IRs. 4.65 per quintal and per dozen, respectively when the sale was carried out through private agents - intermediaries - commission agents - whole sellers - retailers - consumers, a most common channel.

Borle and Kalyankar (1993) studied price spread of banana in sale through Nanded cooperative fruit sale society. They observed that, per quintal price received by the producer from the wholesaler was IRs. 155.72 which comes to be 50.09 per cent of the consumer price. The margin of the wholesaler was 13.54 per cent while the margin of the processor and retailer was 8.58 and 8.46 per cent, respectively.

Kamatgikar (1994) studied on marketing of bananas in major south Indian markets, reported that most of the banana growers from Nanded district of Maharashtra state send their produce through cooperative society because of less commission being charged by the co-operative societies as compared to that of the private agencies. The payments were also quicker in cooperative societies than the private agencies.

The bulk of produce was available during June-July to December in all the three markets viz., Karimnagar, Mancherial and Belampalli of Andhra Pradesh. The average arrivals of banana in these three markets i.e. Karimnagar, Mancherial and Belampalli were 1080.46, 541.03 and 305.86 quintals, respectively. The average per quintal prices were IRs. 223.61, IRs. 224.94 and IRs. 216.52, respectively. The prices were highest in the month of July, August and September. The movement of high grade banana to Andhra Pradesh markets was through following channels.

- i) P - PHC - CA at MoS - W - PR - R - C
- ii) P - CoP - CA at MoS - W - PR - R - C
- iii) P - CoP - W at MoS - PR - R - C

(P - producer, PHC - pre-harvest contractor, Ca at MoS - Commission agent at market outside the state, CoP - cooperative fruit sale society, W - wholesaler, PR - processor, R - retailer, C - consumer).

The share of producer in consumer's rupee was 60.84, 60.96 and 59.93 per cent, respectively when the produce was disposed off through cooperative society and when sold through private agencies in Karimnagar,

Mancherial and Belampalli, the share of producer in consumer's rupee was 56.16, 56.31 and 55.23 per cent, respectively.

Bhatta (1997) prepared "A profile on banana in Far Western Development Region (FWDR) of Nepal". The study dealt with cost and returns from banana cultivation, and marketing of banana in local market. The study revealed that the following channels were most common in selling of bananas in Kailali and Kanchanpur district.

- i) Producer - wholesaler - retailer - consumer
- ii) Producer - retailer - consumer
- iii) Producer - consumer.

Among these channels, Channel-II was found to be the most common in the sale of bananas in these districts. The farm gate price for var. Dwarf Cavendish (Harichal) in Tikapur was NRs. 6-10 per dozen for unripped fruit, while it was NRs. 12-15 per dozen for variety William Hybrid in Mahendranagar.

Ambekar (1998) worked on economics of production and marketing of papaya in Marathwada region of Maharashtra, India and reported that, wholesalers and retailers were the two main intermediaries involved in the marketing of papaya in the study area.

The cost incurred per ton for marketing of papaya in sale through wholesaler was IRs. 682.30. In the total cost of marketing transportation alone contributed 82 per cent. The per ton average price received by wholesalers was IRs. 3017.28.

Majority of the retailers purchased papaya from commission agents (64.30 per cent) followed by wholesalers (28.57 per cent). Total expenditure incurred by retailers per ton was IRs. 515.75. In this also the major item of cost was transport charges (45.87 per cent).

Price spread in marketing of papaya was IRs. 2124.33. Total margin of wholesaler and retailer was to the extent of IRs. 761.89 (19.29 per cent). Producer's share in consumer's rupee was 47.32 per cent.

#### **2.4 Problems faced by banana growers and traders**

Agrawal (1981) worked on problems of agricultural marketing in India. He reported that, there are many defects in the present system of agricultural marketing in India. Because of these defects, the farmer does not get fair and reasonable prices for his produce. The following main defects were identified in agricultural marketing.

- i) Forced sale of product.
- ii) Large number of middlemen.
- iii) Unregulated market and malpractices in mandies.
- iv) Lack of proper grading and standardisation.
- v) Lack of proper storage facilities.
- vi) Lack of financial facilities
- vii) Transportation bottle necks.

Vigneshware (1986) in his study dynamics of fruit and vegetable marketing in India reported the following problems in marketing of fruits and vegetable.

- i) Fluctuation in the prices.
- ii) Excessive involvement of the intermediaries.
- iii) Lack of transport and storage.
- iv) Absence of grading and standardisation.
- v) Other problems such as absence of financial facilities, non availability of efficient marketing information, lack of packaging material and non existence of organization among the farmer.

Vigneshwara (1988) conducted study on problems faced by the banana growers. The problems faced by the banana growers in marketing of their produce were method of sale, transportation, absence of cooperative marketing society, non-existence of growers association, non-availability of prices and other information and problems of storage.

Satpute (1991) studied on marketing of banana in Marathwada region of Maharashtra, India. Altogether 120 banana growers from Basmat and Nanded talukas and 60 middleman from Nanded and Hyderabad markets were selected randomly. It was revealed that, lack of market information, absence of regulated market, inadequate transportation facilities, lack of storage facilities, high rate of commission, cheating by the intermediaries, inadequate financial support and lack of grading were the major problems posed to the banana growers. While, the problems faced by wholesalers and retailers were congested market yards, lack of government financial support and no control over wastage due to improper handling.

Shreshtha *et al.* (1993) studied on problems and constraints of the banana cultivation in Chitwan district of Nepal. The study revealed that most of the local genotypes were better in terms of pest incidence and winter leaf injury while the improved varieties suffered heavily from insect pests and disease incidence, winter leaf injury, and also had poor storing quality of fruits.

Over a dozen of problems and constraints have been identified in banana cultivation in Chitwan and its cultivation has rather declined because of these reasons in the recent years. Banana stem borer (*O. longicollis*), banana leaf scarring beetle, cold injury, sigatoka disease, cloke throat and improper nutrition were identified as the major limiting factors in its cultivation.

Kamatgikar (1994) studied on marketing of bananas in major South Indian markets. The ten banana growers from each seven selected villages in Nanded district of Maharashtra were selected randomly in order to study the difficulties faced by banana growers. To study the problems encountered by wholesalers and retailers in the marketing of banana, three markets in Andhra Pradesh viz., Karimangar, Mancherial and Belampalli were selected purposively.

The difficulties faced by banana growers in the study area were transportation of produce, lack of regulated markets, inadequate storage facilities, labour problem, non availability of finance, non remunerative prices for their produce and high rate of commission were the major difficulties faced by the banana growers. Absence of sufficient space for marketing, non availability of finance and more losses or wastage due to improper handling were the main problems reported by marketing intermediaries.

Gurung *et al.* (1994) studied on production and marketing constraints to fresh fruits and vegetables in the Western Hills of Nepal and observed the following marketing system.

- i) Very little organised marketing.
- ii) Complex and inefficient marketing system.
- iii) Lack of proper grading and standardization.
- iv) Lack of use of even the least appropriate packaging materials.
- v) Lack of mechanism of price and market information flows.
- vi) Very little coordination amongst, and few links between, market functionaries.
- vii) Price determination based on heavy bargaining, especially between producers and traders.
- viii) Multiple function played by one functionary.
- ix) Little price competition.
- x) Marketing functionaries are very opportunistic, largely aiming at realising short term benefits in various ways.
- xi) Lack of assured unbroken supply of produce by farmers, who in many instances are unable to meet seasonal demands.
- xii) Extensive use of bus roof racks to transport fruits and vegetables, and
- xiii) Lack of specialized trade, for example, fruit and vegetable traders, especially in Baglung and Palpa, were found to deal in other trades like hairdressing or running grocery or cloth shops.

Bhatta (1997) conducted a survey for preparing a profile on banana in Far Western Terai Region of Nepal. The problems reported by banana growers are listed below.

- i) Non availability of good quality saplings in the region.
- ii) Non availability of chemical fertilizers on time, and
- iii) Repayment system of loan not favourable to the growers.

## **2.5 Export/Import of banana**

Bansal (1994) in his report on export of fruit and vegetables - problems and prospects, mentioned that, India produces nearly 100 million tonnes of fruit and vegetables, 18 per cent of the gross value of agricultural output. However, approximately 1 per cent of this is exported. He has also mentioned the importance of export to the Indian economy and pinpointed the constraints to export and suggested prospects of increasing exports.

Mc Neil (1995) reviewed "World banana trade situation in selected countries". It was reported that the USA and EU are the world's largest importers of bananas, each imported about 3.5 million tonnes in 1993. Banana exports from selected countries in 1993 rose 2.8 per cent to reach a record of 10.8 million tonnes in 1993, Ecuador, Costa Rica and Colombia were the largest banana exporters accounting for over one half of the total world exports.

Love (1995) reported that banana consumption is the highest among fresh fruits consumed in the USA, spurred by banana retail prices that

continue to decrease relative to other fruits. Nearly all US banana imports come from Latin America, and 1995 imports are forecast to reach 8500 million pounds. Central America has increased its share of the US banana market, due to in part to lower prices relative to South America. The European Union (EU) policy of regulating its banana imports is likely diverting supplies to US markets and keeping prices competitive with other fruits. The EU policy favours EU and overseas territories, and African, Caribbean, and Pacific (ACP) countries by granting duty-free quotas, while setting quotas and charging tariffs on banana from Latin American countries.

Koirala *et al.* (1995) studied on comparative agricultural setting and performance of Nepal and India with special emphasis on differential supply of Nepalese versus imported produce by type of produce, quality, seasonality, and regularity of supply over different seasons. Their study have shown a high proportion of imported agricultural commodities, particularly high value products, in major Nepalese markets. Although few commodities from Nepal made their way into foreign markets, the overall balance of agricultural trade was found in serious deficit situation. In the year 1986-87, Nepal exported banana to India worth of NRs. 102.0 thousands while imported the same fruit from India worth of NRs. 3.75 million. The export and import of banana in the year 1990-91 was valued at NRs. 385.0 thousand and NRs. 7.24 million, respectively.

The imported produce generally has trader appealing virtues such as adequate and regular supplies, better packaging, better quality and lower prices. These characteristics common to many imported produce were derived

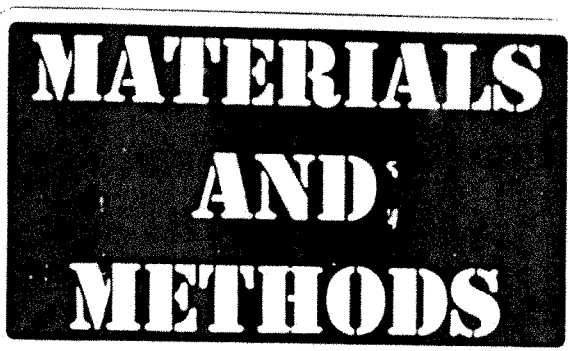
from large scale farming, use of improved technology, better storage and better market communications network. In contrast, predominance of subsistence and scattered farming with unreliable supplies of any agricultural commodities in Nepal is a situation not favourable to the traders in these commodities.

Costa (1996) studied on tropical fruit production in Bahia with especial reference to production for export. It is shown that Brazil is the main world producer of citrus fruit and banana. A total of 66 % of the Brazilian fresh fruit exports go to EU; 26 % to the MERCOSUL, 2 % to other European countries, 1 % to Canada, 1 % to the USA and 4 % to other countries.

Rastoin (1996) examined the world banana production from a geographical and strategic view point along with principal characteristics of international banana trade. It is shown that the banana occupies second place in world fruit exports behind citrus fruits. In 1994, over 80 million tonnes were produced. The European market is the largest in terms of price and size. In 1993, exports represented 22 % of world's production. This rate of internationalisation is high compared to other major agricultural products such as meat and cereals. However, there are strong disparities between regions, with central and South America exporting 59 % and 30 % of their production, respectively, and Asia and Africa only exporting 6 % and 5 %.

Bhatta (1997) reported that, quality of banana imported per month to Kailali and Kanchanpur district of Far Western Nepal from interior Indian markets during year 1995-96 was 90 quintals and 48 quintals, respectively. The quantity of banana entering unrecorded into these districts was not accounted in the study.

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**MATERIALS  
AND  
METHODS**

## **Chapter-III**

### **METHODOLOGY**

Adoption of a sound methodology is of vital importance in any scientific investigation. It consists of collection of data, designing of schedule, tabulation and analysis of data, presentation and interpretation of results. The different techniques used and methods adopted in the present study are discussed in this chapter.

This chapter deals with the following aspects :

1. Sampling design
2. Collection of data
3. Method of analysis

#### **3.1 Sampling design**

In the selection of the sample for the present study multistage sampling design was adopted. The first stage of sampling consisted of selection of the development region, second stage was selection of districts, third stage was the selection of village development committees (VDC's) and the fourth or ultimate stage was the selection of banana growers.

### **3.1.1 Selection of development regions**

Whole Nepal is divided into five development regions, viz., Eastern Development Region (EDR), Central Development Region (CDR), Western Development Region (WDR), Mid-Western Development Region (MWDR) and Far Western Development Region (FWDR).

Among these development regions, FWDR and WDR were selected purposively (Fig. 3.1) because in these regions deliberate attempts are being made to promote cultivation of banana. One of the such attempts was introduction of William Hybrid variety developed through tissue culture laboratories located in Katmandu in Far Western Terai (Mahendranagar) in the year 1995. Some private sector organisation like Agro Enterprise Center (AEC) supported by USAID with its Regional Liaison Office in Mahendranagar has been involved in the promotion of banana cultivation in FWDR. However, Dwarf Cavendish (Harichal) is the single variety found commercially grown in Tikapur and its adjacent villages. Hence, before expanding this variety on a commercial scale, it is necessary that, its economic performance (costs and returns) at farmers level needs to be evaluated. It is with this reason FWDR was selected purposively. In WDR the dominating varieties grown by the farmers are Malbhog (Two kinds locally named as Achami Malbhog and Jhapali Malbhog) covering about 90 per cent area followed by Robusta 10 per cent of the total area under banana cultivation. In order to make inter varietal comparisons regarding yield, maturity, incidence of insect pests and diseases, taste and quality, an equal number of sample of each variety from WDR was

# 12 NEPAL - POLITICAL

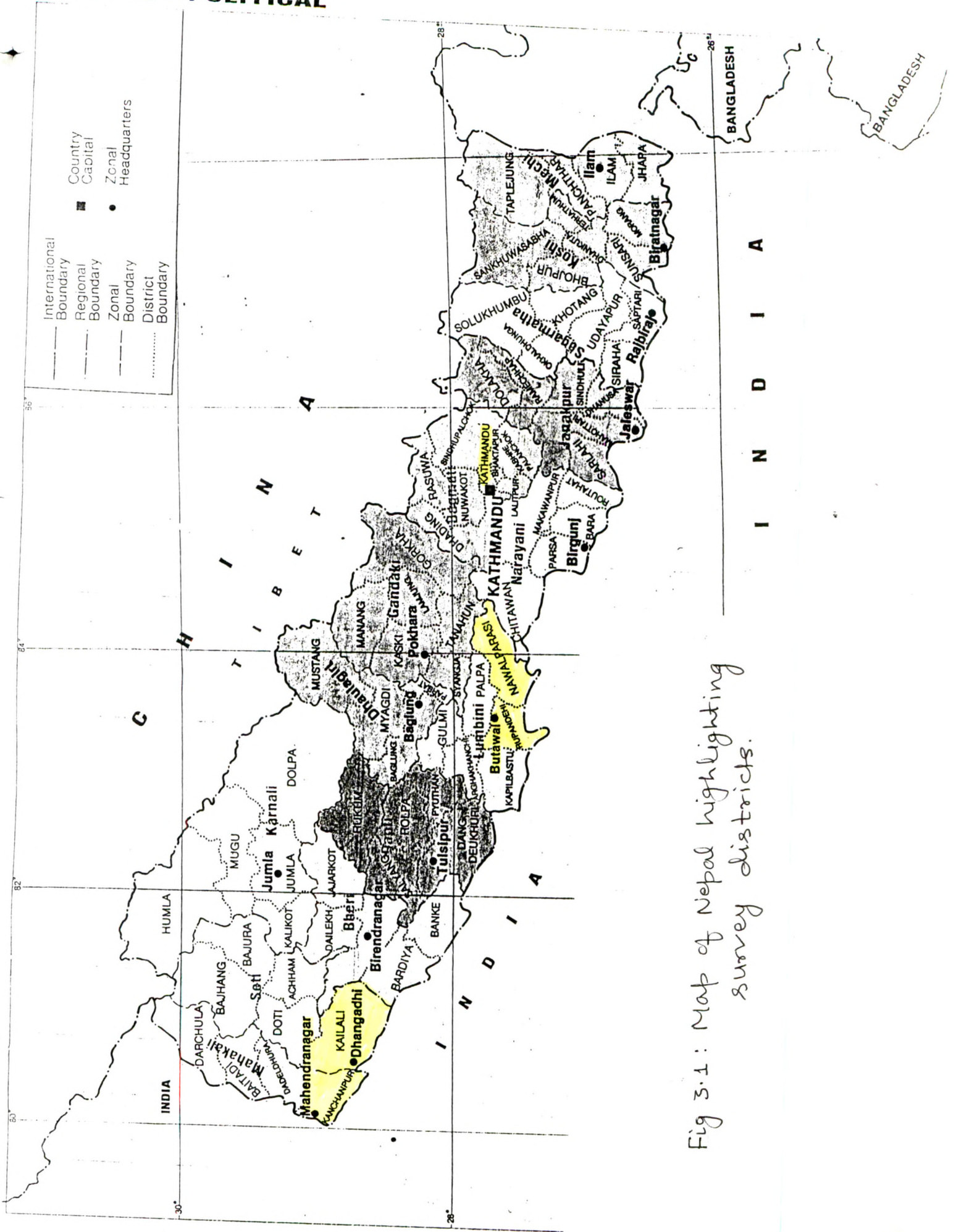


Fig 3.1: Map of Nepal highlighting survey districts.

selected purposively for facilitating comparisons. For undertaking comparative study between Nepal and India on economics of banana cultivation, leading banana producing state namely Maharashtra state was selected purposively.

### **3.1.2 Selection of districts**

Kanchanpur and Kailali are the only two terai districts in FWDR. William hybrid was the only variety found to be grown in Kanchanpur district while Dwarf Cavendish (Cv. Harichal) was the dominating variety in Kailali district (Bhatta, 1997). Both Kailali and Kanchanpur districts were selected purposively.

In WDR there are three terai districts namely Kapil Vastu, Rupandehi and Nawalparasi. Among these three districts, Nawalparasi is the leading district in banana growing. Hence, Nawalparasi was also selected purposively and few samples were also collected from Rupandehi district.

### **3.1.3 Selection of village development committees**

In the present study the VDC's selected in FWDR were Tikapur Municipality, Narayanpur and Dhansinghpur VDC's in Kailali district and Gulariyan VDC, Dodhar a VDC, and Mahendranagar municipality area of Kanchanpur district, respectively. These are the areas where few banana growers are producing and selling their bananas in the local market. Bhiuran VDC in Nawalparasi district and Krishnanagar and Janakinagar VDC's in Rupandehi district were also selected purposively on the basis that Bhiuran is

the main pocket area of banana in WDR where few suckers brought from Biratnagar were transplanted as early as 1985.

#### **3.1.4 Selection of banana growers**

From FWDR, such banana growers who had completed production cycle of banana on their farm were selected. In case of WDR, an equal number of banana growers i.e. 32 as that of FWDR were also selected purposively from banana growing pockets in WDR. Thus, an ultimate sample of banana growers was 64.

#### **3.1.5 Selection of wholesalers and retailers**

In the marketing of banana various intermediaries are involved. Among them, the important ones are wholesalers and retailers. Hence, 8 wholesalers, 10 retailers and 2 preharvest contractor were selected to examine the marketing cost, marketing margin and price spread in marketing of bananas in the study area.

### **3.2 Collection of data**

The present study is based on both primary and secondary time series data. The primary data were collected through survey method. Whereas, the secondary data were compiled from various published sources.

The data were collected through survey method by conducting personal interviews of sample banana growers, wholesalers and retailers. The

data were collected with the help of well structured pre-tested schedules specially designed for banana growers and marketing functionaries separately.

The schedule developed for banana growers covered the information on the following aspects.

- i) General information of family
- ii) Size of holding
- iii) Cropping pattern
- iv) Cost of cultivation for banana
- v) Yield data and disposal of produce
- vi) Information about loan obtained for cultivation of banana.
- vii) Marketing of produce and price obtained
- viii) Constraints faced by banana growers
- ix) Intercropping in banana and revenue realised from it.

Another three sets of schedules were prepared for wholesalers, retailers and pre-harvest contractors in which the following points were included.

- i) General information of wholesalers, retailers and pre-harvest contractor
- ii) Establishment expenditure of wholesalers, retailers and pre-harvest contractors.
- iii) Marketing of banana by wholesalers, retailers and pre-harvest contractors

- iv) Net margin of wholesalers, retailers and pre-harvest contractors, and
- v) Constraints faced by wholesalers, retailers and pre-harvest contractors.

After preparing the questionnaire schedule considering above points, it was pretested and data were collected by survey method pertaining to the agricultural year 1998-99. Each selected farmer, wholesaler and retailer were personally interviewed. Secondary data were collected from various published sources for the purpose of finding out the import of banana in Nepal.

### **3.3 Analysis of data**

#### **3.3.1 Data analysis methods**

After collection of the data schedules were scrutinised and edited. The data were tabulated in an appropriate tables. The data were analysed by both simple tabular analysis and functional analysis technique to arrive at meaningful conclusions

The tabular analysis comprised with arithmetic means, frequencies, ratios, percentages, etc. Whereas, in functional analysis production functions were fitted to the input and output data to ascertain the relationship between dependent and independent variables. In addition to this growth rates of import of banana in Nepal were calculated by fitting linear and exponential equations to the time series data of banana imports in Nepal.

### **3.3.2 Evaluation of inputs**

Inputs are the factors of production. They refer to those expenses of cultivation that are incurred in the form of cash and kind. The items considered under this are (i) physical inputs, and (ii) monetary inputs.

#### **3.3.2.1 Physical inputs**

##### **a) Human labour**

It includes male and female labours (either hired or family).

##### **i) Family labour**

It consists of actual work carried out by the family members for crop production. For convenience it has been valued on the basis of prevailing wages rate paid to the hired labour employed to perform various operations of crop production.

##### **ii) Hired labour**

This category includes the hired labour employed in the crop production. The payment paid in cash or kind has been considered on the basis of working days i.e. 8 hours a day.

Male and female labour units were charged @ Rs. 70 and 60 for the surveyed VDC's in Kailali and Kanchanpur districts and @ Rs. 90 and 70 for Bhiuran and Krishnagar and Janakinagar VDC's of Nawalparasi and Rupandehi districts, respectively. Here cost of meal served to the labour was converted in monetary terms and added in wage in cash to the hired labours.

**b) Bullock labour**

Owned bullock labour has been accounted as per the rates of hired bullock labour prevailing in the locality. It was charged @ Rs. 150 per day for one pair of bullock along with male labour who operated bullocks.

**c) Tractor labour**

Owned tractor labour has been accounted as per the rates of hired tractor labour prevailing in the locality. It was charged @ NRs. 350 and NRs. 400 per hour for Kanchanpur Municipality area and Tikapur and Narayanpur VDC's, respectively. In case of Bhiuran and Krishnanagar and Janakinagar VDC's, per hour rates of tractor labour were NRs. 360 and NRs. 300, respectively.

**d) Planting material (saplings/suckers)**

The common prevailing rates of different varieties during the time of survey were taken into consideration. Tissue culture saplings of variety William Hybrid were charged @ NRs. 10 per sapling including transportation cost. Suckers, either home produced or purchased from other cultivators were charged at the rate of NRs. 10-15, NRs. 3-10 and NRs. 3-5 for varieties William Hybrid, Dwarf Cavendish (Harichal) and Malbhog, respectively.

**e) Manures and fertilizers**

For the owned farm manure, the cost was taken into account according to prevailing prices in the region. The cost for purchased manures and chemical fertilizers was taken at price actually paid including transportation charges. Manures were charged @ NRs. 40-70 per quintal in different areas including transportation cost while fertilizers were charged @ NRs. 1857, NRs. 740, NRs. 935 per quintal for DAP, urea and potash, respectively excluding transportation charges.

**f) Insecticides, fungicides and plant growth hormones**

The cost of these were considered according to purchased value.

**g) Irrigation charges**

In case of canal irrigation, the irrigation charges were calculated by summing up the amount fixed per month by water users group and the cost equivalent to of labour contribution by banana growers, either family or hired in repair and maintenance of the canal. In case of borewell irrigation, per hour diesel and mobil oil charges were taken into account for calculating the irrigation charges.

**h) Depreciation of implements and repairing charges**

The depreciation charges were calculated by straight line method. Repair charges for electric motors and pump sets were noted, separately.

$$\text{Depreciation (per year)} = \frac{\text{Purchase price of the asset-the junk value}}{\text{Expected life (yrs)}}$$

### **3.3.2.2 Monetary inputs**

#### **a) Land revenue**

Land revenue was considered on the basis of actual payment by the cultivators.

#### **b) Interest on working capital**

The rate of interest charged was 14 per cent per annum, the rate at which Agriculture Development Bank in Nepal advances loan to banana growers. Crop duration of 18 and 16 months for varieties William Hybrid and Dwarf Cavendish (Harichal) and Malbhog, respectively was considered for working out interest on working capital. The working capital was worked out on the current expenses such as expenditure on human labour, bullock labour, machine labour, planting material, manures and fertilizers, land revenue, implement charges, irrigation charges, plant protection charges, etc. Interest on working capital was worked out for half the duration of crop. For growing variety William hybrid a maximum of 18 months crop duration was considered while for Harichal and Malbhog, a maximum of 16 months period for each variety was taken into account while calculating interest on working capital.

**c) Interest on fixed capital**

The present value of total assets was calculated and then 10 per cent of average value of fixed assets was considered as the interest on fixed assets.

$$\text{Interest on fixed capital per hectare} = \frac{10\% \text{ of average value of fixed assets}}{\text{Average cropped area}}$$

**d) Rental value of land**

Rental value of land was calculated as 1/6th of the value of gross produce minus land revenue.

$$\text{Rental value of land} = \frac{1/6 \text{ of value of gross produce} - \text{land revenue}}$$

**Cost concepts**

The following cost concepts which are widely used in India were used for calculating the cost per hectare of banana cultivation in Nepal.

**Cost - A**

Actual paid out cost for owner cultivator. This cost approximates the actual expenditure incurred in cash and kind and includes following items.

1. Hired human labour (male and female)
2. Bullock labour
3. Tractor power drawn (charges)
4. Planting material (: saplings/suckers)
5. Manures and fertilizers

6. Irrigation
7. Plant protection measures
8. Land revenue
9. Depreciation and repair of implements
10. Interest on working capital.

### **Cost B**

It includes cost A plus interest on fixed capital and rental value of owned land or land rent paid to land lord in case of leased in land.

### **Cost C**

It includes cost B plus imputed value of family labour.

### **Gross returns**

Value of main product (banana fruits) was determined at current market prices fetched by the banana growers.

Net income from banana cultivation was obtained by deducting cost C from gross income. Farm business income was calculated by deducting cost A from gross income. Income of family labour and management was calculated by deducting cost B from gross income. Gross income per rupee of investment were obtained by dividing gross income by total cost (cost C).

- i) Net income = Gross income - Cost C
- ii) Farm business income = Gross income - Cost A
- iii) Family labour income = Gross income - Cost B

$$\text{iv) } \frac{\text{Gross income per rupee of investment}}{\text{Total cost (i.e. cost C)}} = \frac{\text{Gross income}}{\text{Total cost (i.e. cost C)}}$$

### 3.4 Relationship between factor inputs and output in banana cultivation

The study of relationship between output and important input factors was made with a view to determine the extent to which these factors explain variability in its yield. For this purpose, Cobb-Douglas type of production function was fitted to the <sup>per hectare</sup> input-output data collected from sample cultivators for different varieties.

The function was employed as follows :

$$Y = aX_1^{b_1} X_2^{b_2} X_3^{b_3} X_4^{b_4} X_5^{b_5} X_6^{b_6} X_7^{b_7} X_8^{b_8}$$

The power function transformed in linear form as :

$$\begin{aligned} \log Y &= \log a + b_1 \log X_1 + b_2 \log X_2 + b_3 \log X_3 + \\ & b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + \\ & b_8 \log X_8 \end{aligned}$$

Where,	
Y	= yield in quintals per hectare
X <sub>1</sub>	= human labour in days per hectare
X <sub>2</sub>	= machine labour in hrs per hectare
X <sub>3</sub>	= number of plantlets/suckers per hectare
X <sub>4</sub>	= quantity of manures (FYM) in quintals per hectare
X <sub>5</sub>	= expenditure incurred in irrigation (NRs/ha)
X <sub>6</sub>	= quantity of urea in kg per hectare
X <sub>7</sub>	= quantity of DAP in kg per hectare
X <sub>8</sub>	= quantity of murate of potash in kg per hectare

Log a is constant while  $b_1$  to  $b_8$  are regression parameters. The sum of regression coefficient ( $b_i$ ) indicates returns to scale. The marginal value productivity (MVP) for input  $X_1$  was calculated from following formula.

$$MVP(X_i) = b_i \frac{\bar{Y}}{X_i}$$

Where,

$\bar{Y}$  = geometric mean of gross income

$X_i$  = geometric mean of  $X_i$

$b_i$  = elasticity of production with respect to factor  $X_i$

The ratio of MVP to opportunity cost for each factor was also calculated in order to determine the efficiency of resource use.

### ✓ 3.5 Marketing

Marketing costs are the actual expenses required in bringing goods and services from producer to consumer. Accordingly costs in case of field crops begin when they leave the farm and end at the point where they reach the final consumer.

#### 3.5.1 Constituents of marketing cost

- i) Handling charges at local point
- ii) Assembling charges
- iii) Transport and storage cost
- iv) Processing cost
- v) Profit/margin taken out by different agencies.

### **8.5.2 Marketing margin**

It refers to the difference between price paid and price received by any specific marketing agency such as single wholesaler, single retailer, etc. or combination of marketing agencies.

To estimate marketing margins there are three methods viz., (i) lot method, (ii) aggregate method, and (iii) mode method. The first two methods would necessitate the examining of the records of accounts kept by intermediaries through out the successive marketing phases. The successful adoption of these methods is conditional on the trader's willingness to show their account books which contain a major part of the information needed for the purpose of the study.

Third method (i.e. mode) was found suitable for determining margins and price spreads in fruits. In this method similar quality of banana fruits at various stages of marketing were available and the commodity did not undergo any processing while reaching the final consumer. So prices per 100 fruits were compared at various stages of marketing to attain margins of different functionaries involved in the marketing of banana. The margins were worked out at a point of time and over period of time.

Marketing margins as worked out under mode method may be "concurrent" or "lagged margins". Concurrent margins referred to the difference between the prices prevailing at successive stages of marketing on the same date, while lagged margin is the difference between the price of farm produce obtainable at particular stage of marketing and the price paid for it at

preceding stage of marketing during an earlier period the length of time between the two dates being the average period for which the marketing agency holds the product.

Concurrent margins do not take into account the time elapses between purchase and sale of the produce by the same party either due to processing or stock holding for price consideration. Lagged margins take into account the latter between sale by the farmer and purchase by the consumers while carrying out his business.

In the present study mode method of estimating marketing margins of banana and the method used for working out margins was lagged method.

#### **3.5.4 Price spread**

Price spread refers to the difference between price paid by consumer and price received by producer. It gives fair idea about relative efficiency of various marketing system and channels.

#### **3.5.5 Producer's share in consumer's rupee**

It is the ratio of net price received by producer to the price paid by consumer and can be calculated as :

$$\text{Producer's share in consumer's rupee} = \frac{\text{Net price received by producer}}{\text{Price paid by consumer}} \times 100$$

### **3.5.6 Marketing channel**

The path/route which involves different intermediaries in marketing of produce reaching from producer to final consumer is known as marketing channel. There can be one or more than one marketing channel for the same produce. It was tried to find out the different marketing channels operating in far Western Development Region and Western Development Region of Nepal, separately.

### **3.5.7 Market functionaries operated**

#### **1. Wholesalers**

Wholesalers have got key position in marketing of fruits. They purchase the produce in lots either from pre-harvest contractor or directly from the producers in the market and sale it in lots to other intermediaries.

#### **2. Pre-harvest contractor**

Pre-harvest contractor is a intermediary in sale and purchase of fruits. He makes purchase contract before flowering, setting of fruits or maturity of fruits.

#### **3. Retailers**

Retailers are the traders who either own stall, squart or hawks. These retailers are spread all over the markets in cities and towns. They perform the function of purchase and sale of fruits. They sale fruits to final consumer.

The marketing cost, marketing margins, price spread and producers share in consumer's rupee in the marketing of banana was calculated.

### 3.6. Import/export of banana

The data pertaining to export and import of banana were compiled from the various volumes of FAO Trade Year Book. To examine the performance of external trade of Nepal in banana fruits the growth rates were computed by fitting the following trend equations to the time series data of export and import of banana during the period from 1978 to 1996.

For working out growth rates triennium ending ( ) average was taken as base and growth during the different time periods over base was estimated.

i) Linear growth trend equation :

$$Y = a + bx$$

ii) Exponential growth trend equation :

$$Y = ab^x$$

or

In log form

$$\text{Log } Y = \text{log } a + x \text{log } b$$

Wherein both (i) and (ii)

Y = volume of export (metric tonnes)/value of export  
( '000' IRs. )

- X = number of years  
 a = intercept (constant)  
 b = regression coefficient or trend value.

iii) Linear growth rate :

$$LGR = \frac{b}{Y} \times 100$$

Where,

- LGR = growth rate (linear)  
 Y = mean value of export volume/value

iv) Compound growth rate :

$$CGR = (b - 1) \times 100$$

The significance of linear and compound growth rates was tested with the help of correlation coefficient given by :

$$r = \frac{N \Sigma xy - (\Sigma x) (\Sigma y)}{\sqrt{[N \Sigma x^2 - (\Sigma x)^2] [N \Sigma y^2 - (\Sigma y)^2]}}$$

### 3.7 Problems faced by banana growers and traders

Problems and difficulties faced by banana growers and intermediaries in banana marketing were analysed with the help of tabular analysis.



**CULTIVATION PRACTICES  
OF BANANA**

## Chapter-IV

### CULTIVATION PRACTICES OF BANANA

Before probe into the cost structure of banana cultivation, it is worthwhile to have <sup>an</sup> idea about the cultivation practices and technology involved in it. Hence information about the package of practices of banana was collected and presented.

Banana is gaining popularity as an important remunerative fruit crop in Nepal, which is mostly grown in terai region of the country having sub-tropical climate. Local cultivars are successfully grown in inner terai and foot hills throughout the country. Commercial orchards with improved varieties are few in numbers. Local varieties are mostly grown in the back yards of the kitchen gardens. Ripened fresh fruits are generally consumed. However, local varieties are also used for making vegetables.

In comparison to other fruits, it has got more importance because of higher rate of economic returns in shorter period, high calorific and medicinal values, but there are some constraints in its cultivation such as susceptible to frost and water logging conditions, incidence of insect pests (especially banana borers and finger scarring beetles) and diseases (sigatoka and banana wilt).

IN Nepal, area under banana cultivation was 3819.36 hectares and it ranks third important fruit crop in the country (SINA, 1995-96).

## **Origin**

Indo-China and South East Asia are considered to be the centre of origin of cultivated bananas with greatest diversity in Asia and Pacific regions. Its cultivation is distributed throughout the warmer countries and is confined to regions between 30°N and 30°S of the equator.

## **Climate**

Banana is a crop of humid tropics but well suited for cultivation from humid sub-tropical to semi arid sub-tropics and from sea level upto an elevation of 2000 m above mean sea level. At higher altitudes banana cultivation is restricted to few varieties like 'hill banana' and ABB clones which are practiced in Palaney and Sevroy hills of Tamil Nadu, India.

For better production a temperature of 25-35°C range is suited though crop does not suffer from appreciable set backs between 10°C and 40°C. Beyond 42°C and below 10°C most of the physiological and morphological activities are arrested. Therefore areas with warmer winters and cooler summers are sought. Nevertheless, by modifying management, bananas can be grown successfully in Western Australia at peak summer temperatures of 40-45°C and also in Israel at winter temperatures of 1-8°C. Both high and low temperatures suppress the extrusion of leaves and the bunch exhibits a choked appearance. This phenomenon is referred to as May bunch or November Dump. Such aborted bunches have fewer hands with partially filled fruits. Cavendish groups are very sensitive to temperatures.

## **Soil**

Banana can be grown in almost all types of soils provided adequate soil moisture is available. Deep, well-drained, friable loamy soil with adequate organic matter is considered ideal for its cultivation. Having the restricted root zone, depth and drainage are the two most important considerations in selecting the soil for banana. Slightly alkaline soils can be used for its cultivation but saline soils with salinity exceeding 0.05 per cent are unsuitable. Wilt disease is less prevalent in alkaline soils. A soil pH of 6.0 to 7.5 is fine for bananas.

## **Commercial cultivars**

There are about 300 recorded cultivars of banana. The important cultivars are described below.

### **1. Dwarf Cavendish**

Musa (AAA) group - Syn. Basrai, Vaman Keli, Bhusaval (Andhra Pradesh), Pacha Vazhai, Mauritius, Kuzhi Vazhai (Tamil Nadu), Jahaji, Sindhuri, Singapuri, Hirvi.

It is a commercial cultivar of Gujarat, Maharashtra, Madhya Pradesh, Bihar and Karnataka. Also popular in Tamil Nadu and Andhra Pradesh. Plant is very dwarf (about 1.5 m), fruits large, curved, skin thick and greenish, flesh soft and sweet. The greenish colour of the fruit is retained to some extent even after ripening, but fruits ripen during the winter season develop yellow colour. It is susceptible to buncy top and leaf spot disease but

resistant to Panama wilt. The keeping quality of fruit is, however, not good. A bunch on an average weighs about 20 kg.

## 2. **Robusta**

Musa (AAA) group - Syn. Bombay green (Maharashtra), Pedda Pacha Arati (Andhra Pradesh), Harichal, Borjahaji.

It is a semi-tall sport of Dwarf Cavendish (Pacha-Vazhai) reaching a height of 2.0 - 2.25 m with strong pseudostem. Fruits large, skin thick, greenish to dull yellow, sweet and delicious. Fruit has poor keeping quality leading to break down of pulp after ripening, not suited for long distance transportation. Highly susceptible to Sigatoka leaf spot in humid tropics. Bunch weighs about 25-30 kg.

## 3. **Poovan (Tamil Nadu)**

Musa (AAB) group - Syn. Champa (West Bengal), Lalvelchi (Maharashtra), Karpura Chakrakeli (Andhra Pradesh), Palayangodan (Kerala), Kadali (Tamil Nadu), Dora Vazhai (Nilgiris), Bangalow Vazhai (Tamil Nadu), Mysore (Trinidad), Chini Champa. This is an important table cultivar of Tamil nadu, West Bengal and Kerala.

The plant is tall (2.5 - 3.0 m) hardy and grows vigorously under the ratooning system of cultivation. It can grow under unirrigated condition or with scanty irrigation. It comes to harvest 15-16 months after planting. The fruit is medium to small, yellow skinned, firm fleshed with a sub-acid taste. It

has a good keeping quality. It is resistant to Panama wilt and fairly resistant to bunchy top disease. But it is predominantly infected by banana streak virus (BSV) causing reduction in yield over generations. The average bunch weight is about 15 kg.

#### 4. **Rasthali**

Musa AAB group - Syn. Mutheli (Maharashtra), Malbhog (Bihar), Amruthapani (Andhra Pradesh), Rasabale (Karnataka), Sonkela (Kerala), Silkfig (Trinidad), Mortaman (West Bengal).

Plant is tall (2.5 - 3.0 m) and can be identified by the yellowish green stem with brownish blotches, reddish margins of the petiole and leaf sheath. Inflorescence emerges after 12-14 months of planting bearing a bunch of 15-20 kg. Fruits are medium-sized and similar to that of Poovan in appearance, skin thin, ivory-yellow in colour, flesh firm, sweet with a pleasant aroma. Its cultivation in India is decreasing due to susceptibility to Panama wilt. Fruits detaching at ripening limits this variety for long distance transportation.

Apart from these main commercial cultivars, some other varieties like Kanchkela (West Bengal), Hill Banana, Safed Velchi, Lalkela (Maharashtra), Kunnan (Kerala), Gros Michel, Giant Governor are also grown in some parts of India. The cultivars popular in Nepal are Robusta (Eastern Nepal), Achami Malbhog (Nawalparasi, Chitwan, etc.), Dwarf Cavendish (Rupendehi, Kailali, etc.), William Hybrid (Kanchanpur) and some other local

cultivars like Jhápali Malbhog, etc. The problem of choke throat is less in local Malbhog varieties and Williams as compared with Dwarf Cavendish.

## **Propagation**

### **Sucker and Rhizome**

Suckers are extensively used as a planting material in many countries. Sword sucker with a well developed rhizome weighing 500 - 750 g is generally used in India. In Nepal, both sword and water sucker are used. However, water suckers are used only if sufficient number of sword suckers are not available. In Western and Central Maharashtra, well developed rhizome with dormant lateral buds and 'dead' central bud is used. Apart from these, cut rhizomes called 'Bits' and 'Peepers' are also used successfully in many parts of India.

### **Micro propagation**

Micro propagation through the tissue culture has acquired the commercial significance owing to uniformity in crops earliness and freeness from disease and high yield.

Disease free plantlets with 3-4 leaves are generally supplied by the tissue culture laboratories in net pots for raising secondary nursery in well drained poly bags having soil, well decomposed composite manure and sand (1:2:1 v/v) along with fungicide and insecticide cocktail to ward off any soil borne infection. Plants are initially kept in shade (50 %) and as they harden,

shade is reduced gradually. After 6 weeks, plants do not require any shade. Normally two months of secondary nursery is good enough before the plants can be planted in the field.

### Preparation of land

The land should be deeply ploughed, harrowed and levelled properly. Pits of 0.6 m x 0.6 m x 0.6 m are dug sufficiently ahead at points fixed for planting.

### Planting distance

Some of the important varieties along with their recommended spacing etc. is shown in Table 4.1.

Table 4.1. Field spacing for banana.

Variety	Spacing	No. of plants per acre	No. of plants per hectare
Dwarf Cavendish Basrai	5.5' x 5.5' (165 cm x 165 cm)	1440	3600
Robusta, Grand - Naine, Williams, Poovan, Amruthapani	6.0' x 6.0' (180 cm x 180 cm)	1210	3025
Nendran (Tamil Nadu and Kerala)	6.0' x 5.0' (180 cm x 180 cm)	1210	3025

Source : Vatika From the seed and plant people winter 1997, Issue 4.

## **Planting time**

Banana can be planted throughout the year except in severe winter and during heavy rains when the soil is very wet. In Tamil Nadu, February planting is susceptible to leaf spot disease and December planting to strong winds. In North East region, March - April is preferred to avoid severe winter while in Bihar August - February is avoided for Dwarf Cavendish. In Andhra Pradesh August - November is the best season while in Maharashtra, October planting is susceptible to low temperature at bunch maturation.

In Nepal, February - April is generally preferred for planting. In some parts of Nepal, bananas are planted during May through July. The planting time should be so adjusted that the time of bunch emergence does not coincide with winter months. For this either plant in February so that March warmth will stimulate good growth to flower in 6 to 7 months (about September), then harvest before December, or plant about August to get good growth before the cold. The plant will recover from winter in March and produce new green leaves. Flowering will be over a longer period of time (toward mid-year), then fruit can mature during better and longer growing season.

## **Irrigation**

Being a succulent plant, banana requires high amount of water ranging from 1800 - 2500 mm annually which shall be met either by well distributed rainfall or through irrigation. Need for irrigation is also determined by the cultivar and soil type.

In Nepal, flood irrigation is normally followed by the farmers. Irrigation is done once in a week in summer and once in a fortnight in winter. Many time flooding results in excessive application of water. Drip irrigation method is not common in Nepal. However, it is practiced by the banana farmers in India in those places where water is scarce. Research elucidates 100 - 200 per cent increase in yield, 40 - 50 per cent savings in irrigation water and 30 per cent reduced requirement of nitrogenous fertilizer by this method.

### **Nutrition**

By nature banana is a heavy consumer of nutrients for its optimal growth and production, consuming 20-30 per cent of the cost involved in production. Some of the essential nutrients are :

### **Nitrogen**

Among macro nutrients nitrogen is considered to be the most essential element with its positive correlation with growth, development and yield in bananas.

For normal plant growth and development 100 to 250 g of nitrogen per plant is advised depending on soil nutrient status. Experiments have shown that banana responds better for urea followed by  $\text{NH}_4\text{NO}_3$  and least for  $\text{KNO}_3$  especially for acidic soils. It should be applied in split doses (4-5 dose) into the moist soil around the plant to prevent losses in the air.

Banana responds better to mixed application of nitrogen through organic and inorganic sources. Trial conducted at six locations elucidated the best yields and high net profit with the application of 25 per cent N in organic form (FYM), 75 per cent N in inorganic form along with growing of green manure like *Crotolaria*.

### **Phosphorus**

Phosphorus requirement of banana is comparatively low. Phosphorus is applied in single dose at the time of planting and quantity of  $P_2O_5$  depends upon soil type which vary from 20 to 40 gram per plant.

### **Potassium**

Potassium is indispensable in banana nutrition due to its role in vital functions. Application of potassium 100 g in two splits during vegetative and 100 g in 2 splits during reproductive phase is recommended depending upon cultivar.

Other macronutrients like Ca, Mg and S and micronutrients like Zn, Mn, F and Bo are used only when need arises.

Farmers should be encouraged to use well decomposed compost manures. Compost maintains a good organic mulch in the soil and provides needed nitrogen, some potassium and other nutrients. Several kilos of this natural fertilizer is best applied into the hole before planting. After the plant is two months old, incorporate another kilo or so into the soil around the plant. The more applications, the better.

## **Weed management**

Losses caused by weeds in banana plantations are more than that caused by pests and diseases. Experiments conducted in different regions suggest that 40 - 70 per cent losses are caused by weeds depending upon the cultivars and weed intensity. The initial 6 months is critical than the later 6 months. Integrated method of management which include growing of cowpea, spraying of weedicides and hand weeding is recommended.

Among the weeds, *Cyanodon dactylon* (L.) and *Cyprus rotundus* are predominant in India.

## **After care of banana plantation**

### **Sucker management**

Mother plants produce too many sucker and excess suckers should be removed with the help of knife at ground level; selection of future sucker and spacing is very important. Hence select the healthiest and largest one that is in line to maintain spacing.

### **Intercropping**

When bananas are first planted, there is plenty of sunlight and space. Intercropping helps to check the weed growth and to increase soil fertility and to augment the income. In Nepal vegetables, turmeric and maize are generally grown as intercrops. Also legumes like black gram, mung bean, cowpea, etc. are grown in between the rows of banana which benefits the soil and provide extra food.

## **Mulching**

Mulching practice suppresses weed growth and regulates plant micro climate. Black polythene is an effective mulch but sugarcane thrash, paddy straw and dried banana leaves and sheaths are cost effective apart from addition of organic manure to the soil.

## **Removal of dried and decayed leaves and plant parts**

Dried, diseased and decayed leaves and plant parts should be removed to keep the plantation clean. Removal of dried and diseased leaves helps in exposure of suckers to sunlight for better growth. For maximum yield a minimum of 12 leaves are required to be retained on the mother plant. The pseudostem should be removed after harvest. Clean and healthy plantation ensures less attack of pests and diseases.

## **Propping**

Where wind is a problem, pseudostem requires to be propped up with bamboos, especially, at the time of bunch emergence.

## **Denavelling**

Removal of male bud after completion of the female phase is referred to as denavelling. This practice is said to promote fruit development. The terminal male flower bud may be cut off a week after the bunch formation is completed. Denavelling not only saves the movement of food into unwanted sink but also ward off finger tip diseases.

### **Bunch covering**

Bunch covering helps to protect the fruits from sunscorching, cracking and beetle attack. Bunches are covered with dried leaves which sometimes form a source of inoculum for post harvest disease. Polythene sleeves are used in many countries for maintaining the fruit quality.

### **Pests and diseases**

Banana is susceptible to bunchy top and mosaic virus which can only be partially controlled by controlling the vector (aphids) population by insecticide treatment. Amongst diseases leaf spot and Panama wilt are the major threats. Nematodes are known to cause considerable damage to plants. A key to success banana farming lies in the selection of healthy planting material and maintenance of clean plantation. The common pests and diseases along with their symptoms and control measures is presented in Table 4.2.

### **Harvesting and yield**

The fruit is harvested when the ridges on the surface of the skin change from angular to round i.e. after the attainment of 3/4th full stage. After harvesting, the pseudostems should be cut leaving a stump of about 0.6 m height. This practice is called mattocking. Experimental evidence showed that the left over stump with its stored food material continues to nourish the daughter sucker (follower) till it withers and dries up.

Table 4.2. Major pests and diseases of banana.

Sr. No.	Name of the pest	Symptoms of damage	Control measures
1.	Rhizome Weevil	Tunneling of rhizome by grubs. Attacked rhizome gets riddled with holes and weakened. Secondary infection of fungi and bacteria accelerate rotting.	Application of Furadan 3 G @ 20 grammes or Thimet 10 G @ 12 grammes or neem cake @ 1/2 kg per pit at planting
2.	Pseudostem Weevil	Boring symptoms in the pseudostem which gets weakened and rotten.	Application of Furadan 3 G @ 20 grammes or Thimet 10 G @ 12 grammes or neem cake @ 1/2 kg per pit at planting
3.	Aphids	Nymphs and adults colonise under outer leaf base on the pseudostem and around crown. Leaves become dwarf, curled and bunch growth is affected. Aphids act as vectors of bunchy top and mosaic virus.	Spray any one of the systemic insecticides like Metasystox @ 1.25 ml or Nuvacron @ 1.25 ml or Demicron @ 0.5 ml per litre of water.
4.	Nematodes Besides causing root damage, nematodes act as pre-disposing factor for Panama wilt, which is caused by soil borne fungal pathogen.	<ol style="list-style-type: none"> <li>1. Black lesion in the roots.</li> <li>2. Decaying of the roots.</li> <li>3. Stunted growth of the plant and bunch size is affected.</li> </ol>	Application of Furadan 3 G @ 20 grammes or Thimet 10 G @ 12 grammes or neem cake @ 1/2 kg per pit at planting  Marigold serves as repellent and trap crop. It can be grown in the inter space to begin with.

Table 4.2. Contd....

Sr. No.	Name of the pest	Symptoms of damage	Control measures
A. VIRAL	i) Bunchy top	<ol style="list-style-type: none"> <li>1. Size of the leaf greatly reduced and there is a rosetting of reduced leaves.</li> <li>2. Broken dark green streaks along the veins, midrib or petiole.</li> <li>3. Leaves are brittle and dark in colour.</li> <li>4. In early infection bunches are not produced.</li> <li>5. In late infection after bunch emergence, further development of bunch is affected.</li> </ol>	<ol style="list-style-type: none"> <li>1. Remove and destroy affected plants along with rhizome.</li> <li>2. Spray any of the systemic insecticides like Metasystox @ 1.25 ml or Nuvacron @ 1.25 ml or Demicron @ 0.5 ml/litre of water to control aphid vector.</li> </ol>
ii)	Banana Bract Mosaic Virus (BBMV)	<ol style="list-style-type: none"> <li>1. Yellow green bands or mottling over an entire area of young leaves.</li> <li>2. Abnormal thickening of leaf veins.</li> <li>3. If bunches are produced they stick upright and bunch development is affected.</li> </ol>	<p>As mentioned for bunchy top. Avoid growing cucurbits in and around banana field.</p>
iii)	Banana steak virus (BSV)	<p>Conspicuous discoloration and necrotic streaks on the bracts of male inflorescence and on immature pseudostems</p>	<p>As mentioned above. Avoid growing cucurbits in and around banana fields.</p>

Table 4.2. Contd.....

Sr. No.	Name of the pest	Symptoms of damage	Control measures
B. FUNGAL			
i) Leaf spot		Brown spindle shaped spots on older leaves and drying of leaves.	Spray Bavistin @ 1 g or Kavach @ 2 g or Dithame M45 @ 2 g per litre of water.
ii) Cigar end rot		Tip of the fingers give the appearance of ash at the end of a cigar	Hand removal of floral remnants after bunch maturity. Spray Bavistin @ 1 g/litre of water.
iii) Panama Wilt (Dwarf Cavendish is tolerant to Panama wilt)		<ol style="list-style-type: none"> <li>1. Yellowing of the leaves.</li> <li>2. Buckling or hanging of the petiole.</li> <li>3. Splitting of the pseudostem.</li> <li>4. Brown discoloration of inner tissues of pseudostem/rhizome.</li> </ol>	<ol style="list-style-type: none"> <li>1. Apply recommended dose of farm yard manure.</li> <li>2. Avoid root injury through inter-cultural operations or nematode infestation.</li> <li>3. Make a hole (2 to 3" depth) at 30° angle at the base of pseudostem. Insert one capsule of Bavistin 200 mg per plant and close the hole with mud slurry OR inject 10 ml of 2 % Bavistin (20 ml/litre of water) on the hole and close it with mud slurry.</li> <li>4. If the infection is observed in the early stages, i.e. 3-4 months after planting, repeat any of the above treatments 2 months after the first application. If late infection is observed 6 months after planting, one application of any of the above treatments may be sufficient.</li> </ol>

The yield of banana depends upon a number of factors, such as cultivar, plant density, management practices, etc. A yield of 47.54 tonnes/ha with Robusta banana was obtained by Randhawa *et al.* (1972). A yield of about 54.0 tonnes/ha was recorded by Chattopadhyaya *et al.* (1980) from a plant population of 2500/ha in Cv. Giant Governor. Wilson (1981) noted 85 tonnes/ha for 'Dwarf' and 139 tonnes/ha for 'Williams' in the Zimbabwe Lowveld. If the cycle lasts 2 years, we must halve Wilson's figures to 43 to 70 tonnes/ha.

### **Ripening**

Several methods are used for artificial ripening of bananas. Cowdung cake and rice straw are burnt in earthen pots in godowns where banana bunches are arranged in a heap. Smoke from them causes ripening. Use of acetylene released from calcium carbide is also a common practice. If available, ripening could be much improved by applying compressed ethylene gas from a bottle or tank.

### **Grading and packaging**

Packaging of hands or demanded fruits in polythene bags are promising. It is successfully demonstrated that 100 gauge polythene bags with 0.2 per cent holes enhanced shelf life under room temperature as well as cold storage.

## **Transportation**

In India, transportation is mainly by road and to some extent by rail. In trucks bunches are loaded horizontally, layer by layer and in between cushioning with banana leaves. In Nepal, however, banana hands are packed in dokos (locally made device used for transportation of goods) and bus roof racks are extensively used for its transportation. For shorter distance, the bunches as such are even loaded horizontally on bus roof racks and transported.

## **Post harvest treatments**

Among the post harvest treatments to delay ripening of bananas are : skin coating with waxol i.e. coating with 12 per cent wax emulsion prolong shelf life by 10 days. Fruit dip or spray with a fungicide solution containing 400 ppm TBZ is effective in controlling many post harvest diseases. Studies have suggested that pre-harvest treatment, pre-cooling and packed in cardboard box can enhance the attractiveness of fruit and keep it longer.



**RESULTS**

## **Chapter-V**

### **RESULTS**

The present investigation is intended to study the cost of production and marketing of banana in Nepal. The primary data regarding cost of production and marketing of banana were collected from banana growers located in Nepal and India. The data so collected have been processed, tabulated and analysed and results are presented in this chapter.

#### **5.1 Area under banana**

It is revealed from Table 5.1 that, the total area under banana in the sample villages and towns was to the tune of 35.21 hectares. Tikapur Municipality area had maximum 12.23 hectares (34.73 %) area under banana followed by Bhiuran VDC 31.70 per cent, Mahendranagar Municipality 11.19 per cent, Janakinagar VDC 7.35 per cent and Shankarnagar VDC 5.8 per cent, respectively. Gulariya, Dodhara, Narayanpur and Dhansinghpur VDC's represented 0.94, 1.14, 4.34 and 2.81 per cent of the total area on the sample farms.

The varietywise area of banana planted on the sample farms revealed that the highest area was devoted to Harichal (Dwarf Cavendish) i.e. 19.38 ha (55.03 %) followed by Malbhog (31.70%) and William hybrid (13.27%), respectively.

Table 5.1. Selection of sample.

Sr. No.	Development Region	District	Village/town	No. of samples	Area (ha)	Variety	Percentage to total
1.	Far Western Development Region	Kanchanpur	Mahendranagar Municipality (W.No. 4, 5, 6, 8 and 10)	11	3.94	W.Hybrid	11.19
			Gulariya VDC	1	0.33	-do-	0.94
			Dodhara VDC (W.No. 1, 4, and 8)	3	0.40	-do-	1.14
			Sub total	15	4.67		13.27
	Far Western Development Region	Kailali	Tikapur Municipality (W.No. 7 and 8)	13	12.23	Harichal	34.73
			Narayanpur VDC (W.No. 2 and 9)	2	1.53	-do-	4.34
			Dhansinghpur VDC (W.No. 1 and 5)	2	0.99	-do-	2.81
			Sub total	27	19.38		55.03
2.	Western Development Region	Rupandehi	Janakinagar VDC (W.No. 9)	5	2.59	-do-	7.35
			Shankarnagar VDC (W.No. 5 and 9)	5	2.04	-do-	5.80
			Sub total	27	19.38		55.03
	Western Development Region	Nawalparasi	Bhiuran VDC (W.No. 1, 2, 3, 4, 8 and 9)	22	11.16	Malbhog	31.70
			Total	64	35.21		100.00

## **5.2 Socio-economic condition of farmers**

The information regarding socio-economic condition of farmers is presented in Table 5.2. Table 5.2(1) depicts that most of the banana growers belonged to middle age group i.e. 31 to 50 years (46.88 per cent) followed by young age group i.e. 16-30 yrs (32.81 %) and group III i.e. 51 to 70 years (20.31 per cent), respectively.

Information regarding education status of the sample farmers is given in Table 5.2(2).

The Table 5.2(2) reveals that, of the 64 sample banana growers, 13 (20.31 per cent) were illiterate and rest 51 (79.69 per cent) were found to be literate. Among literate the highest educational level attained by the sample farmers was higher secondary level (40.62 per cent) followed by graduate (17.19 per cent), intermediate (9.38 per cent), primary (7.81 per cent) and secondary (4.69 per cent), respectively.

## **5.3 Sources of irrigation**

Sources of irrigation indicates about the water availability in different seasons of the year. Study of sources of irrigation is also important as water is the critical input for the growth and development of the crop. Farmers Managed Irrigation Systems (FMIS) are most popular and successful in Nepal followed by borings and tubewells. Information of sources of irrigation on the sample farms is furnished in Table 5.3.

Table 5.2. Socio-economic condition of farm families.

Table 5.2(1). Age groups.

Age group (yrs)	No.	Percentage to total
Group I (16-30)	21	32.81
Group II (31-50)	30	46.88
Group III (51-70)	13	20.31
Total	64	100.00

Table 5.2(2). Educational status

Educational level	No.	Percentage to total
Primary	5	7.81
Secondary	3	4.69
Higher secondary	26	40.62
Intermediate	6	9.38
Graduate	11	17.19
Illiterate	13	20.31
Total	64	100.00

Table 5.3. Sources of irrigation.

Source	Area irrigated (ha)	Percentage to total
Ditches	41.69	24.13
Borings	52.79	30.55
Ditches and borings both	78.32	45.32
Total	172.80	100.00

The table 5.3 shows that ditches and boring (45.32 %) together had a major source of irrigation on the sample farms followed by boring (30.55 %) and ditches (24.13 %), respectively.

#### **5.4 Land use pattern**

Study of land utilization patterns is of great importance since land is the main limiting factor in agricultural production. Land use pattern indicates how efficiently the land resources available to the farmers were utilized. Land utilization pattern also indicates the area available for cultivation, gross cropped area and cropping intensity.

The land use classification is presented in Table 5.4.

The Table 5.4 indicates that, the average size of land holding of the sample farmers was worked out to be 2.70 ha, out of which whole area was under cultivation i.e. 55.67 per cent to gross cropped area. The double and triple cropped area was 1.94 and 0.21 hectares, respectively which in terms of percentage contributes 40.00 and 4.33 per cent to gross cropped area, respectively. The cent per cent area was under irrigation. Of the total irrigated land, 3.68 hectares area was permanently irrigated while, partially irrigated area was 1.17 hectares. The intensity of cropping was 179.62 per cent.

Table 5.4. Land use classification.

Particulars	Area (ha)	Percentage to total
Total holding (average)	2.70	55.67
Cultivable land	2.70	55.67
Net sown area	2.70	55.67
Double cropped area	1.94	40.00
Triple cropped area	0.21	4.33
Gross cropped area	4.85	100.00
Intensity of cropping	179.62 %	
Irrigated land :	4.85	
a) Seasonal	1.17	24.12
b) Permanent	3.68	75.88
Total		100.00

Table 5.5. Cropping pattern

Crops	Area (ha)	Percentage to total
Paddy	1.80	37.11
Wheat	1.31	27.01
Maize	0.14	2.89
Lentil	0.43	8.87
Mustard	0.20	4.12
Vegetables	0.21	4.33
Banana	0.76	15.67
Total	4.85	100.00

## **5.5 Cropping pattern**

Table 5.5 depicts the cropping pattern on the sample farms. It is observed that, the maximum area was under paddy (i.e. 37.11 per cent) followed by wheat, banana, lentil, vegetables, mustard and maize which accounted for 27.01, 15.67, 8.87, 4.33, 4.12 and 2.89 per cent of gross cropped area, respectively.

Foregoing analysis revealed that, food grains occupy predominant place in cropping pattern of the sample farms. Within foodgrains, cropping pattern scenario was dominated by cereals because in the total cropped area share of cereals was 67.01 per cent. The share of fruits and vegetables was 20.00 per cent.

## **5.6 Physical input use**

It includes the quantity of various inputs used for the cultivation of crop. The physical utilization of various inputs such as human labour, bullock labour, tractor power labour, manures, fertilizers, seeds, etc. per hectare for different varieties are presented in subsequent paras.

### **5.6.1 Per hectare operationwise use of labour**

#### **5.6.1.1 Use of human labour**

Human labour is one of the important inputs used in the cultivation of crops. In general, it is observed that the cultivators utilized the hired labour for various operations. Per hectare operationwise human labour utilization has

been presented in Table 5.6, 5.7 and 5.8 for varieties William Hybrid, Harichal and Malbhog, respectively.

Table 5.6 depicts that in the cultivation of William Hybrid, highest male labour was employed in preparatory tillage operation i.e. 69.5 mandays which contributes 27.03 per cent followed by application of fertilizers (top dressing) 23.41 per cent and interculturing operations 21.98 per cent respectively to total male labour utilization. Other operations like planting, harvesting of fruit and collection, irrigation and plant protection consumed 8.40, 7.87, 6.03 and 5.37 per cent to total male labour, respectively.

The per hectare operationwise labour use for banana cultivation at an overall level is given in Table 5.9 and shown in Fig. 5.1.

The Table 5.9 shows that, on an average, per hectare use of labour for banana cultivation worked out to be 268.01 human labour days. An operationwise distribution of labour use revealed that, the interculturing operations (31.02 %) were found to be the most labour consuming one followed by preparatory tillage operations (29.13 %), fertilization (16.43 %), planting (8.18 %), harvesting of fruits (5.40 %), plant protection (4.97 %) and irrigation (4.87 %), respectively. By and large similar trend in use of labour was witnessed for different varieties also.

With regards sexwise break of the total labour used for banana cultivation at an overall level it was seen that, the operations involved in cultivation of banana were male labour oriented (81.85 %) as compared to that of female labour (18.15 %).

Table 5.6. Per hectare operationwise labour utilization Cv. W. Hybrid.

Sr. No.	Operation	Family				Hired				Total			
		M	F	B	T	M	F	B	T	M	F	B	T
<b>1. Preparatory tillage</b>													
a)	Ploughing, harrowing and levelling, etc.	--	--	--	1.0	--	--	1.5	4.7	--	--	1.5	5.7
b)	Land marking and digging of pits	--	--	--	--	35.8	--	--	--	35.8	--	--	--
c)	Fertilization of pits (manure + basal dose of chemical fertilizer)												
i)	Transport	--	--	--	--	--	32.6	--	--	--	32.6	--	--
ii)	Application and filling of pits with soil	--	--	--	--	30.2	--	--	--	30.2	--	--	--
d)	Preparation of irrigation channels	--	--	--	--	3.5	--	--	--	3.5	--	--	--
	Sub-total	--	--	--	1.0	69.5	32.6	1.5	4.7	69.5	32.6	1.5	5.7
										(27.03)	(44.78)	(100)	(100)
<b>2. Planting</b>													
a)	Transport of planting material	1.5	--	--	--	--	--	--	--	1.5	--	--	--
b)	Planting	--	--	--	--	20.1	--	--	--	20.1	--	--	--
	Sub-total	1.5	--	--	--	20.1	--	--	--	21.6	--	--	--
										(8.40)			
<b>3. Interculture</b>													
a)	Gap filling	--	--	--	--	3.5	--	--	--	3.5	--	--	--
b)	Removal of extra suckers	--	--	--	--	31.8	--	--	--	31.8	--	--	--
c)	Weeding and hoeing	--	15.0	--	--	7.2	25.2	--	--	7.2	40.2	--	--
d)	Staking	7.2	--	--	--	--	--	--	--	7.2	--	--	--
e)	Removal of inflorescence	3.8	--	--	--	3.0	--	--	--	6.8	--	--	--
	Sub-total	11.0	15.0	--	--	45.5	25.2	--	--	56.5	40.2	--	--
										(21.98)	(55.22)		
4.	Fertilization (top dressing)	--	--	--	--	60.2	--	--	--	60.2	--	--	--
										(23.41)			
5.	Irrigation	15.5	--	--	--	--	--	--	--	15.5	--	--	--
										( 6.03)			
6.	Plant protection (top dressing)	--	--	--	--	13.8	--	--	--	13.8	--	--	--
										( 5.37)			
7.	Harvesting and collection	--	--	--	--	20.0	--	--	--	20.0	--	--	--
										( 7.78)			
	Total	28.0	15.0	--	1.0	229.1	57.8	1.5	4.7	257.1	72.8	1.5	5.7
										(100)	(100)	(100)	(100)

\*Figures in parentheses indicates percentage to total.

Table 5.7. Per hectare operationwise labour utilization Cv. Harichal.

Sr. No.	Operation	Family				Hired				Total			
		M	F	B	T	M	F	B	T	M	F	B	T
1.	Preparatory tillage												
a)	Ploughing, harrowing and levelling, etc.	--	--	--	--	--	--	--	6.2	--	--	--	6.2
b)	Land marking and digging of pits	--	--	--	--	23.6	--	--	--	23.6	--	--	--
c)	Fertilization of pits (manure + basal dose of chemical fertilizer)												
i)	Transport	--	8.0	--	--	16.4	--	--	--	16.4	8.0	--	--
ii)	Application and filling of pits with soil	0.5	--	--	--	22.2	--	--	--	22.7	--	--	--
d)	Preparation of irrigation channels	--	--	--	--	2.9	--	--	--	2.9	--	--	--
	Sub-total	0.5	8.0	--	--	65.1	--	--	6.2	65.6	8.0	--	6.2
										(28.5)	(25.6)	--	(100)
2.	Planting												
a)	Transport of planting material	--	--	--	--	0.5	--	--	--	0.5	--	--	--
b)	Planting	--	--	--	--	20.0	--	--	--	20.0	--	--	--
	Sub-total	--	--	--	--	20.5	--	--	--	20.5	--	--	--
										(8.90)			
3.	Interculture												
a)	Gap filling	--	--	--	--	2.0	--	--	--	2.0	--	--	--
b)	Removal of extra suckers	--	--	--	--	30.1	--	--	--	30.1	--	--	--
c)	Weeding and hoeing	--	--	--	--	15.9	23.3	--	--	15.9	23.3	--	--
d)	Staking	2.5	--	--	--	--	--	--	--	2.5	--	--	--
e)	Removal of inflorescence	4.9	--	--	--	--	--	--	--	4.9	--	--	--
	Sub-total	7.4	--	--	--	48.0	23.3	--	--	55.4	23.3	--	--
										(24.1)	(74.4)		
4.	Fertilization (top dressing)	1.0	--	--	--	39.6	--	--	--	40.6	--	--	--
										(17.6)			
5.	Irrigation	4.0	--	--	--	10.0	--	--	--	14.0	--	--	--
										(6.1)			
6.	Plant protection (top dressing)	--	--	--	--	13.8	--	--	--	13.8	--	--	--
										(6.0)			
7.	Harvesting and collection	4.1	--	--	--	16.2	--	--	--	20.3	--	--	--
										(8.8)			
	Total	17.0	8.0	--	--	213.2	3	--	6.2	230.2	31.3	--	6.2
										(100)	(100)		(100)

\*Figures in parentheses indicates percentage to total.

Table 5.8. Per hectare operationwise labour utilization Cv. Malbhog.

Sr. No.	Operation	Family				Hired				Total			
		M	F	B	T	M	F	B	T	M	F	B	T
1.	Preparatory tillage												
a)	Ploughing, harrowing and levelling, etc.	--	--	--	--	--	--	--	3.9	--	--	--	3.9
b)	Land marking and digging of pits	--	--	--	--	25.1	--	--	--	25.1	--	--	--
c)	Fertilization of pits (manure + basal dose of chemical fertilizer)												
i)	Transport	--	--	--	--	--	22.6	--	--	--	22.6	--	--
ii)	Application and filling of pits with soil	--	--	--	--	25.1	--	--	--	25.1	--	--	--
d)	Preparation of irrigation channels	--	--	--	--	3.0	--	--	--	3.0	--	--	--
	Sub-total	--	--	--	--	53.2	22.6	--	3.9	53.2	22.6	--	3.9
										(28.8)	(32.9)	--	(100)
2.	Planting												
a)	Transport of planting material	--	--	--	--	2.0	--	--	--	2.0	--	--	--
b)	Planting	--	--	--	--	22.6	--	--	--	22.6	--	--	--
	Sub-total	--	--	--	--	24.6	--	--	--	24.6	--	--	--
										(13.3)			
3.	Interculture												
a)	Gap filling	--	--	--	--	2.0	--	--	--	2.0	--	--	--
b)	Removal of extra suckers	--	--	--	--	22.0	--	--	--	22.0	--	--	--
c)	Weeding and hoeing	--	6.7	--	--	--	37.1	--	--	--	43.8	--	--
d)	Staking	2.7	--	--	--	10.4	--	--	--	13.1	--	--	--
e)	Removal of inflorescence	2.0	2.3	--	--	--	--	--	--	2.0	2.3	--	--
	Sub-total	4.7	9.0	--	--	34.4	37.1	--	--	39.1	46.1	--	--
										(21.1)	(67.1)		
4.	Fertilization (top dressing)	--	--	--	--	43.3	--	--	--	43.3	--	--	--
										(23.4)			
5.	Irrigation	--	--	--	--	10.4	--	--	--	10.4	--	--	--
										(5.6)			
6.	Plant protection (top dressing)	12.3	--	--	--	--	--	--	--	12.3	--	--	--
										(6.7)			
7.	Harvesting and collection	2.0	--	--	--	--	--	--	--	2.0	--	--	--
										(1.1)			
	Total	19.0	9.0	--	--	165.9	59.7	--	3.9	184.9	68.7	--	3.9
										(100)	(100)		(100)

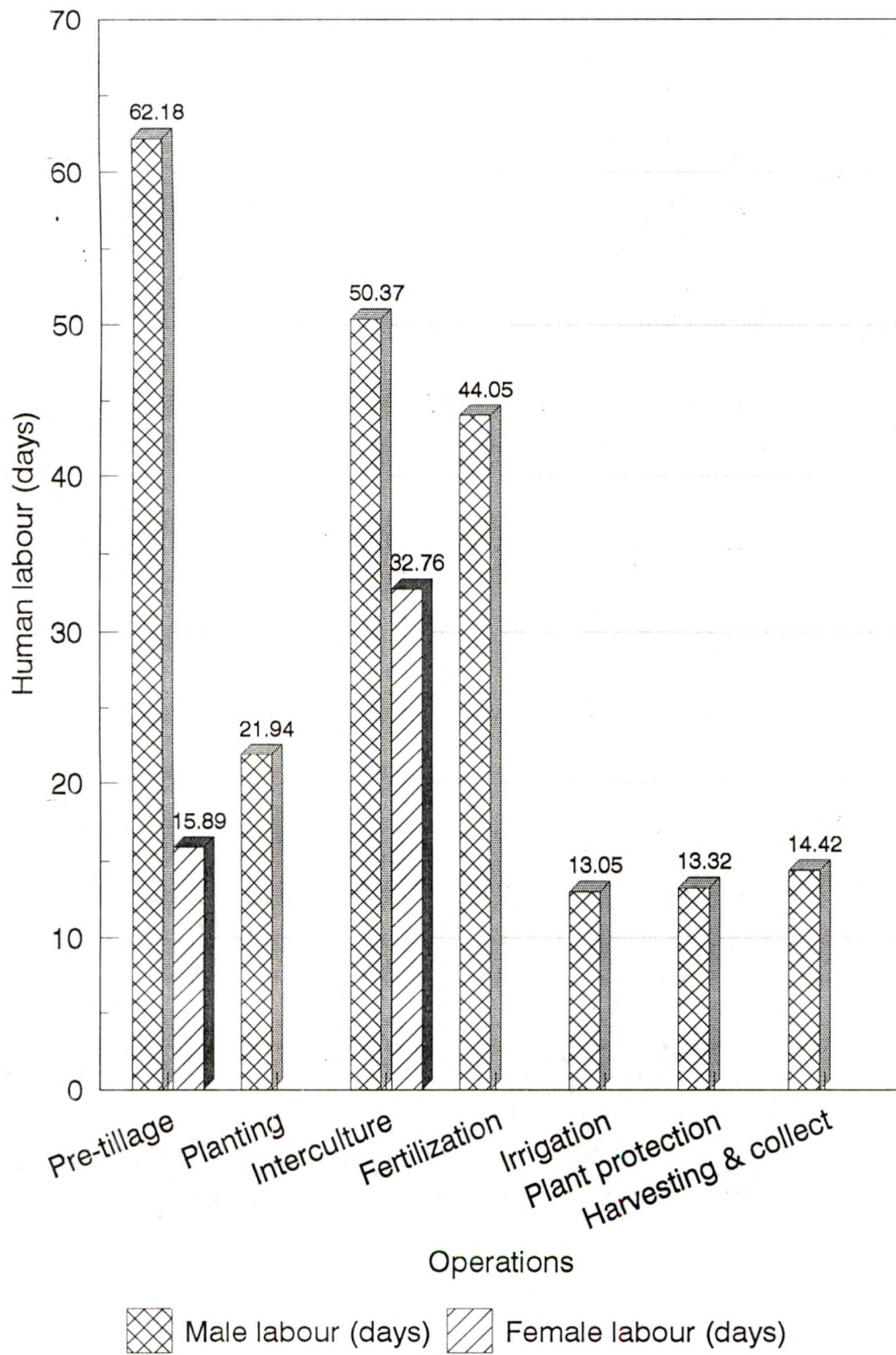
\*Figures in parentheses indicates percentage to total.

Table 5.9. Per hectare operationwise human labour utilization.

Operations	William Hybrid			Harichal			Malbhog			Overall		
	M	F	Total	M	F	Total	M	F	Total	M	F	Total
1. Pre-tillage operation	69.50	32.60	102.10 (30.95)*	65.60	8.00	73.60 (28.15)	53.20	22.60	75.80 (29.89)	62.18	15.89	78.07 (29.13)
2. Planting	21.60	--	21.60 ( 6.55)	20.50	--	20.50 ( 7.84)	24.60	--	24.60 ( 9.70)	21.94	--	21.94 ( 8.18)
3. Interculture operation	56.50	40.20	96.70 (29.31)	55.40	23.30	78.70 (30.10)	39.10	46.10	85.20 (33.60)	50.37	32.76	83.13 (31.02)
4. Fertilization	60.20	--	60.20 (18.25)	40.60	--	40.60 (15.52)	43.30	--	43.30 (17.07)	44.05	--	44.05 (16.43)
5. Irrigation	15.50	--	15.50 ( 4.70)	14.00	--	14.00 ( 5.35)	10.40	--	10.40 ( 4.10)	13.05	--	13.05 ( 4.87)
6. Plant protection	13.80	--	13.80 ( 4.18)	13.80	--	13.80 ( 5.28)	12.30	--	12.30 ( 4.85)	13.32	--	13.32 ( 4.97)
7. Harvesting and collection	20.00	--	20.00 ( 6.06)	20.30	--	20.30 ( 7.76)	2.00	--	2.00 ( 0.79)	14.45	--	14.45 ( 5.40)
Total	257.10	72.80	329.90 (100)	230.20	31.30	261.50 (100)	184.90	68.70	253.60 (100)	219.36	48.65	268.01 (100)

\*Figures in parentheses indicates percentage to total.

**Fig. 5.1. Per hectare operationwise human labour utilization (overall)**



The varietywise per hectare use of human labour for banana cultivation on the sample farms revealed that, the highest number of labour was used for William Hybrid (329.90 mandays) followed by Harichal (261.50 mandays) and Malbhog (253.60 mandays). Thus, inter varietal comparison of labour use indicated that, William Hybrid was found to be more labour intensive as compared to that of Harichal and Malbhog variety. However, in between Harichal and Malbhog varieties no significant difference was noticed in labour use.

The major difference lies with labour utilization for performing preparatory tillage operation in growing of William Hybrid and its counter part varieties for former variety more labour was used as compared to latter group of the varieties.

It is also observed that female labour was used only in preparatory tillage operations ( particularly in transport of manure) and in interculture operations (weeding and hoeing) which consumed 15.89 female days (32.66 per cent) and 32.76 female days (67.34 per cent), respectively. The Table also reflects that no female labour were used in operations like planting, fertilization, irrigation, plant protection and harvesting cum collection of the fruits.

#### **5.6.1.2 Use of bullock labour and tractor power**

Table 5.6 reflects that bullock and tractor labour were used only in preparatory tillage operations, particularly in ploughing, harrowing and

levelling; 1.5 bullock pair days and 5.7 hrs of tractor power were used per hectare of banana cultivation (var. William Hybrid).

No bullock labour was employed for the cultivation of Harichal and Malbhog varieties. Tractor labour utilization per hectare was 6.2 hrs and 3.9 hrs in the cultivation of Harichal and Malbhog varieties, respectively (Table 5.7 and 5.8).

## **5.6.2 Per hectare labour utilization**

### **5.6.2.1 Use of human labour**

Per hectare labour utilization has been presented in Table 5.10. It is seen from Table 5.10 that, total human labour utilization was highest for William Hybrid (257.10 male and 72.80 female days) followed by Harichal (230.2 male and 31.3 female days) and Malbhog (184.9 male and 68.7 female days), respectively. It can be noted that, total hired labour utilization for William Hybrid was 229.1 and 57.8 male and female labour days, respectively, which accounts for 69.44 and 17.52 per cent to total labour utilization, respectively. For variety Harichal, it was 213.2 and 23.3 male and female labour days, respectively, which in terms of percentage worked out 81.53 and 8.91 per cent to total human labour, respectively. In case of Malbhog variety, it was 165.9 and 599.7 male and female labour days which contributes 65.42 and 23.54 per cent to total human labour utilization, respectively.

The contribution of family labour use was worked out to be 28.0 male days (8.49 per cent) and 15.0 female days (4.55 per cent) for variety

Table 5.10. Per hectare labour utilization.

Labour	Unit	Amount			Percentage		
		W. hybrid	Harichal	Malbhog	W. hybrid	Harichal	Malbhog
<b>1. Human labour</b>							
	Days						
<u>Hired</u>							
a) Male		229.10	213.20	165.90	69.44	81.53	65.42
b) Female		57.80	23.30	59.70	17.52	8.91	23.54
<u>Family</u>							
a) Male		28.00	17.00	19.00	8.49	6.50	7.50
b) Female		15.00	8.00	9.00	4.55	3.05	3.54
<u>Total human labour</u>							
a) Male		257.10	230.20	184.90	77.93	88.03	72.91
b) Female		72.80	31.30	68.70	22.07	11.97	27.09
<hr/>							
Total		329.90	261.50	253.60	100.00	100.00	100.00
<hr/>							
<b>2. Bullock labour</b>							
	Pair days						
a) Family		--	--	--	--	--	--
b) Hired		1.50	--	--	100.00	--	--
<hr/>							
Total		1.50	--	--	100.00	--	--
<hr/>							
<b>3. Tractor power</b>							
	Hrs drawn						
a) Family		1.00	--	--	17.54	--	--
b) Hired		4.70	6.20	3.90	82.46	100.00	100.00
<hr/>							
Total		5.70	6.20	3.90	100.00	100.00	100.00

William Hybrid, 17.0 male days (6.50 per cent) and 8.0 female days (3.05 per cent) for variety Harichal and 19.0 male days (7.50 per cent) and 9.0 female days (3.54 per cent) for variety Malbhog, respectively.

#### **5.6.2.2 Use of bullock labour and tractor power**

Among three varieties, it was found that owned bullock labour was utilized only for var. William Hybrid which worked out to be 1.5 bullock labour days per ha and it was not used in case of varieties Harichal and Malbhog. However, tractor power was the main source for land preparation and its utilization was to the tune of 5.7, 6.2 and 3.9 hrs for varieties William Hybrid, Harichal and Malbhog, respectively, which perhaps were all hired except the case of William Hybrid where 1.0 hr was owned tractor labour. Per hectare use of seed, manures, fertilizers, plant protection and number of irrigations are given in Table 5.11.

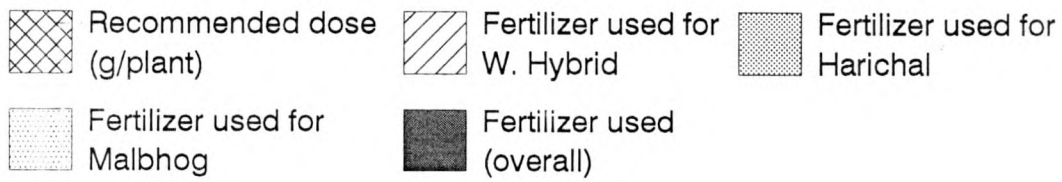
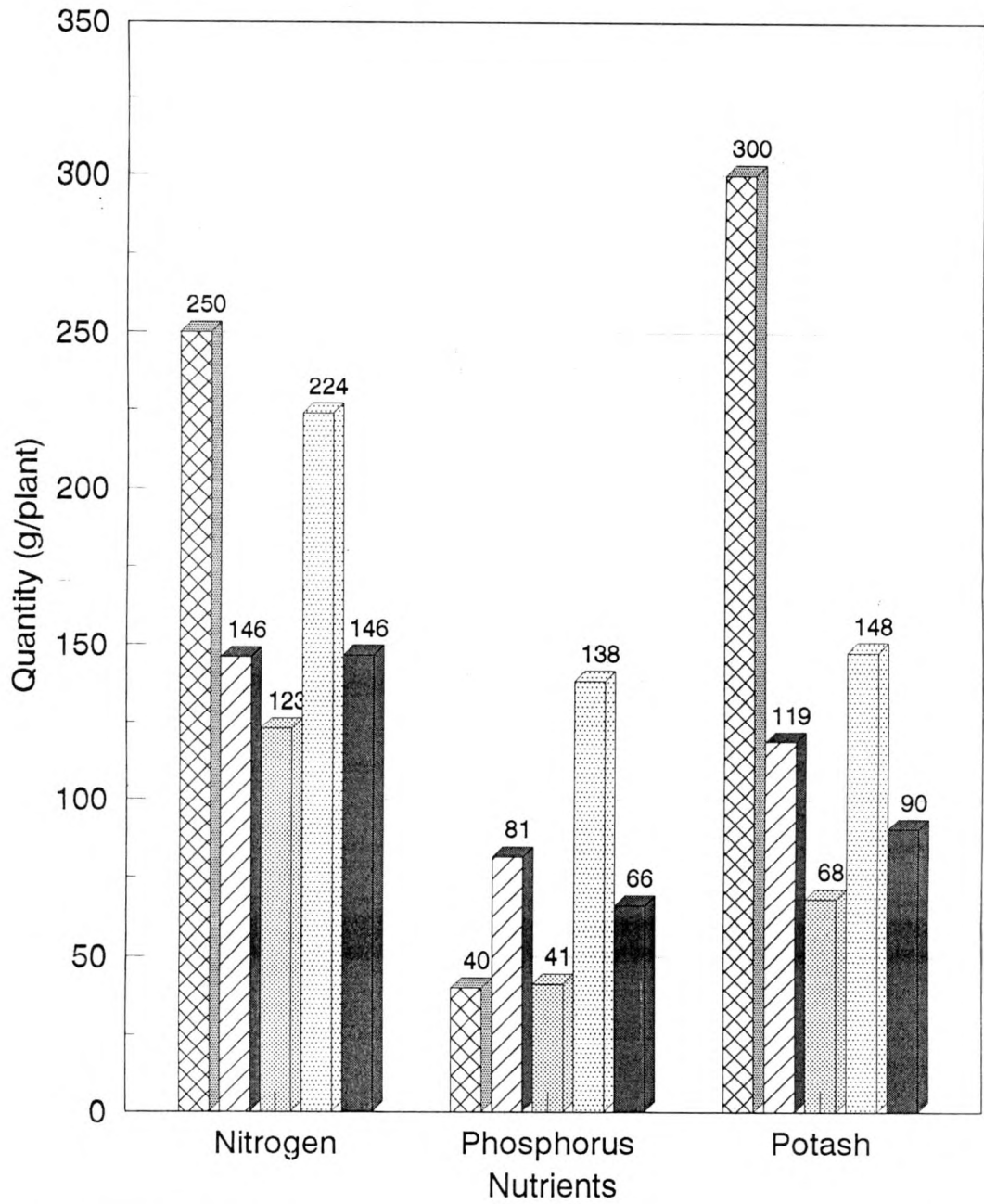
#### **5.6.3 Use of planting material**

It was found that, on an average 3038.5 suckers per hectare were used in the cultivation of William Hybrid. The number of suckers used per hectare for Harichal and Malbhog were 4194.9 and 2210.5, respectively. Only two sample farmers out of fifteen from Kanchanpur district had planted tissue cultured plantlets of William Hybrid brought from Katmandu. Rest of all the banana growers had planted suckers, either their own or bought from other farmers. High density planting was found practiced by farmers growing

Table 5.11. Per hectare utilization of various inputs.

Item	Units	Quantity				Rate per unit (NRS.)			
		W.Hybrid	Harichal	Malbhog	Overall	W.Hybrid	Harichal	Malbhog	Overall
1. Planting materials	No.	3038.50	4194.50	2210.50	3412.33	10.81	6.33	3.42	6.00
2. Manures	Qtl.	147.90	113.90	187.70	141.80	67.63	56.26	41.32	53.03
3. Fertilizers	kg								
a) Urea		753.10	975.74	815.41	895.39	7.40	7.40	7.40	7.40
b) DAP		537.47	375.90	664.87	488.92	18.57	18.57	18.57	18.57
c) MOP		601.92	476.26	543.90	514.36	9.35	9.35	9.35	9.35
4. Irrigation	No.	17.00	13.00	7.00	11.62				
5. Hormones	Lit.	--	2.00	--	2.00				220.00
6. Plant protection									
a) Liquid insecticides	Lit.	1.50	1.37	0.20	1.01				
b) Dust and granules (fungicides+ insecticides)	kg	3.09	4.87	22.80	10.31				

**Fig. 5.2. Varietywise N, P and K used (g/plant)**



Harichal variety (5' x 5') followed by William Hybrid (6' x 6') and Malbhog (7' x 7'), respectively. The range of sucker used for varieties William Hybrid, Harichal and Malbhog were 2857.14 to 3375.00, 3000.00 to 4545.45 and 1800.00 to 2442.42 per hectare, respectively.

#### **5.6.4 Use of manures**

It was found that, highest quantity of organic manures (187.70 q/ha) was used by the farmers growing Malbhog variety followed by William Hybrid (147.9 q/ha) and Harichal (113.9 q/ha) respectively. The chief manure used was FYM, in the range of 133.33 to 231.25 q/ha for William Hybrid, 80.00 to 313.00 q/ha for Harichal and in between 112.12 and 323.07 q/ha for Malbhog variety, respectively.

#### **5.6.5 Use of fertilizers**

All the farmers were using urea, DAP and MOP as sources of N, P and K, respectively. Table 5.11 indicates that, highest quantity of urea i.e. 975.74 kg/ha was used for cultivating banana Cv. Harichal followed by Malbhog 815.41 kg and William Hybrid 753.10 kg urea per hectare, respectively. For supplying phosphorus DAP was used to the tune of 664.87 kg, 537.47 kg and 375.90 kg per hectare for growing William Hybrid, Harichal and Malbhog varieties, respectively.

Highest quantity of potassium was used for William Hybrid i.e. 601.92 kg/ha followed by Malbhog 543.90 kg/ha and Harichal 476.26 kg/ha,

respectively. Urea, DAP and MOP were used in the range of 417.39 to 1616.84 kg/ha, 142.84 to 937.50 kg/ha and 142.85 to 750.00 kg/ha, respectively for William Hybrid while for Harichal, it was 303.02 to 1959.23 kg/ha, 100.00 to 943.47 kg/ha and 150.00 to 1515.15 kg/ha, respectively. The range of fertilizer use was 430.43 to 1732.43 kg urea/ha, 180.00 to 1200.00 kg DAP/ha and 180.00 to 1461.53 kg MoP/ha, respectively in the cultivation of banana Cv. Malbhog.

The quantities of N, P and K used versus recommended doses of N, P and K per plant are presented by bar diagram (Fig. 5.2). The figure reflects that only phosphorus was used in excess than the recommended dose while, nitrogen was used in between the range of recommended dose and potassium was not used even to the lowest level of recommended dose.

#### **5.6.6 Irrigation**

On an average, the number of irrigation turns applied to banana orchard were 17, 13 and 7 times for growing William Hybrid, Harichal and Malbhog varieties, respectively. The chief sources of irrigation found during the study were borings and ditches. Some cultivators who were having ditches as a source of irrigation had applied only three irrigations during summer months (due to less availability of water) while others having their own deep well borings had even applied as high as 12 irrigations during summer months (March to May).

### **5.6.7 Plant protection and hormones**

Hormones were used only by the farmers growing Harichal variety in Tikapur, which on an average was 2.0 litre per hectare. The major hormones found were Agromin and Sawan as their trade names.

Use of liquid insecticides were 1.50, 1.37 and 0.20 litres per hectare for varieties William hybrid, Harichal and Malbhog, respectively. Highest quantity of dust and granules was used by the farmers cultivating Malbhog variety banana i.e. 22.60 kg per hectare, while it was only 3.09 and 4.87 kg per hectare in case of William Hybrid and Harichal, respectively.

### **5.6.8 Per hectare utilisation of various inputs**

in Maharashtra and Nepal

Per hectare utilization of various inputs in India and Nepal has been presented in Table 5.12. The Table 5.12 reveals that, there is no much difference in number of suckers used per hectare in both the countries. However, the price per unit of sucker in Nepal was 3.75 times higher (i.e. NRs. 6.00 per sucker) than the price of sucker in Indian (NRs. 1.60 per sucker). The price per quintal of manures was also 1.65 times higher in Nepal (NRs. 53.03 per quintal) as compared with price of NRs. 32.00 per quintal in India. The quantity of manure used per hectare in India and Nepal was 195.49 and 141.80 quintals, respectively.

In case of chemical fertilizers, quantities used per hectare and prices per unit of nitrogenous fertilizer in Nepal was higher than India by 21.95

Table 5.12. Per hectare utilisation of various inputs in India and Nepal.

Item	Unit	India		Nepal	
		Qty.	Rate/unit (NRs.)	Qty.	Rate/unit (NRs.)
1. Suckers,	No.	3674.95	1.60	3412.33	6.00
2. Manures	Qtl.	195.49	32.00	141.80	53.03
3. Fertilizer	Kg.				
a) Nitrogen		409.74	12.51	499.70	16.08
b) Phosphorus		151.91	28.00	224.90	37.47
c) Potash		264.72	9.81	308.61	15.58
4. Hormones	Lit.	--		2.00	220.00
5. Plant protection					
a) Liquid insecticides	Lit.	--		1.01	
b) Dust and granules	Kg	--		10.31	
6. Human labour					
a) Male	days	216.09	64.00	219.36	70.80
b) Females	days	65.84	32.00	48.65	57.66
7. Bullock labour	Pair	27.27	121.58	1.50	129.85
	days				
8. Machine labour	hrs.	9.62	171.90	5.40	363.13

% and 28.53 % respectively. The per unit price of phosphorus in Nepal was NRs. 37.47 which is 1.33 times higher than that of India. This may be due to the reason that, single super phosphate (SSP) is extensively used by the farmers in India while it is not available in Nepal and farmers are bound to use diammonium phosphate (DAP) which contains 18 per cent N and 46 per cent  $P_2O_5$  and is quite costlier than SSP. The quantity of phosphorus used per hectare was 151.91 kg and 224.90 kg in India and Nepal, respectively. The per unit price of potash in Nepal is also 1.58 times higher than that of India which is NRs. 9.81 per kg in India. The quantity of potash used was to the tune of 264.72 kg and 308.61 kg in India and Nepal, respectively. It seems that, Nepalese farmers are using more chemical fertilizer per unit area than the banana growers of India. Other inputs like hormones (plant growth regulators) and insecticides and fungicides were not at all used by the banana cultivators of India. About 2.0 litre hormone, 1.01 litre of insecticide and 10.31 kg of dust and granules per hectare was used by the banana farmers in Nepal. It may be due to the problem of borers, finger scarring beetles and cut worms in bananas grown in Nepal.

In case of human labour utilisation in India it was 216.09 and 65.84 male and female days, respectively, while on an average, 219.36 male days and 48.65 female days were utilised per hectare in Nepal. The utilisation of bullock labour and machine labour in India was 18.18 and 1.78 times higher as compared with labour used per hectare in Nepal. The high quantity of bullock labour use in India is due to the reason that, it is utilized in

transportation of manures and fertilizers, weeding, harvesting and collection of fruits.

### **5.7(1) Per hectare cost of cultivation of banana in Nepal**

Cost of cultivation plays a vital role in the production of any crop as it serves the basis for price fixation. It is assumed that, the per unit price should include the cost of cultivation plus marginal profit. Also it gives a fair deal about the expenditure incurred on various items of cost. Keeping the view in mind, the cost of cultivation of banana for each variety was calculated and presented in Table 5.13.

Among the items of out pocket expenses i.e. cost A, planting material (i.e. suckers) was the major item which accounted for 20.33, 19.54 per cent to total cost for growing varieties William Hybrid and Harichal respectively followed by expenditure on manures and fertilizers 19.31 and 18.43 per cent for each variety. The higher rate of suckers prevailing in the areas may be due to non existence of banana nurseries in the study areas. Among chemical fertilizers, the expenditure on phosphatic fertilizer (DAP) was more for William hybrid and Malbhog, while for Harichal, it was more on nitrogenous fertilizer. The expenditure on hired human labour was 12.06 and 13.64 per cent of total cost, while for interest on working capital, it was 6.01 and 5.39 per cent for varieties William Hybrid and Harichal, respectively. In case of cost of cultivation of Malbhog variety manures and fertilizers accounted for 28.69 per cent to total cost followed by hired human labour (17.70 per

Table 5.13. Varietywise per hectare cost of cultivation of banana in Nepal (1998-99).

Item of cost	William Hybrid		Harichal		Malbhog		Overall	
	Cost (NRs.)	Percentage	Cost (NRs.)	Percentage	Cost (NRs.)	Percentage	Cost (NRs.)	Percentage
1. Hired human labour								
a) Male	16038.50	9.92	16766.10	12.33	14935.40	13.82	16089.34	12.30
b) Female	3468.90	2.14	1790.40	1.31	4183.60	3.88	2771.56	2.11
Total	19507.40	12.06	18556.50	13.64	19119.00	17.70	18860.90	14.41
2. Bullock labour	181.40	0.11	325.00	0.24	--	--	285.25	0.22
3. Tractor labour	1848.50	1.14	2286.80	1.68	1439.00	1.33	1959.95	1.50
4. Manures	10003.40	6.19	6409.10	4.71	7757.20	7.18	7313.10	5.59
5. Fertilizers								
a) Urea	5572.97	3.45	7220.53	5.31	6034.05	5.58	6625.94	5.06
b) DAP	9984.85	6.19	6980.51	5.13	12346.72	11.43	9079.83	6.94
c) MOP	5628.01	3.48	4453.07	3.28	5085.52	4.70	4809.36	3.67
6. Planting material	32873.60	20.33	26584.10	19.54	7564.50	7.00	21389.92	16.35
7. Plant protection	1892.90	1.17	2274.50	1.67	3088.30	2.86	2481.82	1.90
8. Hormones	--	--	441.80	0.33	--	--	441.80	0.34
9. Irrigation	4097.40	2.53	1950.30	1.43	840.00	0.78	1883.16	1.44
10. Incidental charges	280.00	0.17	230.80	0.17	320.00	0.30	265.15	0.20
11. Land revenue	120.00	0.07	120.00	0.09	90.00	0.08	110.49	0.08
12. Repairs	632.90	0.40	657.60	0.48	200.40	0.18	509.41	0.39
13. Interest on working capital	9725.44	6.01	7325.79	5.39	5962.57	5.53	7211.98	5.51
14. Depreciation	1039.20	0.64	628.50	0.46	262.00	0.24	566.80	0.44
Cost (A)	103387.97	63.94	86444.90	63.55	70109.26	64.89	83794.86	64.04

Table 5.13. Contd...

Item of cost	William Hybrid		Harichal		Malbhog		Overall	
	Cost (NRs.)	Percentage	Cost (NRs.)	Percentage	Cost (NRs.)	Percentage	Cost (NRs.)	Percentage
15. Rental value of land	53880.00	33.33	46751.80	34.37	35116.20	32.50	44009.26	33.64
16. Interest on fixed capital	1551.10	0.96	654.70	0.48	412.00	0.38	696.66	0.53
Cost (B)	158819.07	98.23	133851.40	98.40	105637.46	97.77	128500.78	98.21
17. Family labour								
a) Male	1960.00	1.21	1539.80	1.13	1683.20	1.56	1640.98	1.25
b) Female	900.00	0.56	640.00	0.47	720.00	0.67	699.84	0.54
Cost (C)	161679.07	100.00	136031.20	100.00	108040.66	100.00	130841.60	100.00

**Fig. 5.3. Varietywise per hectare cost of cultivation of banana**

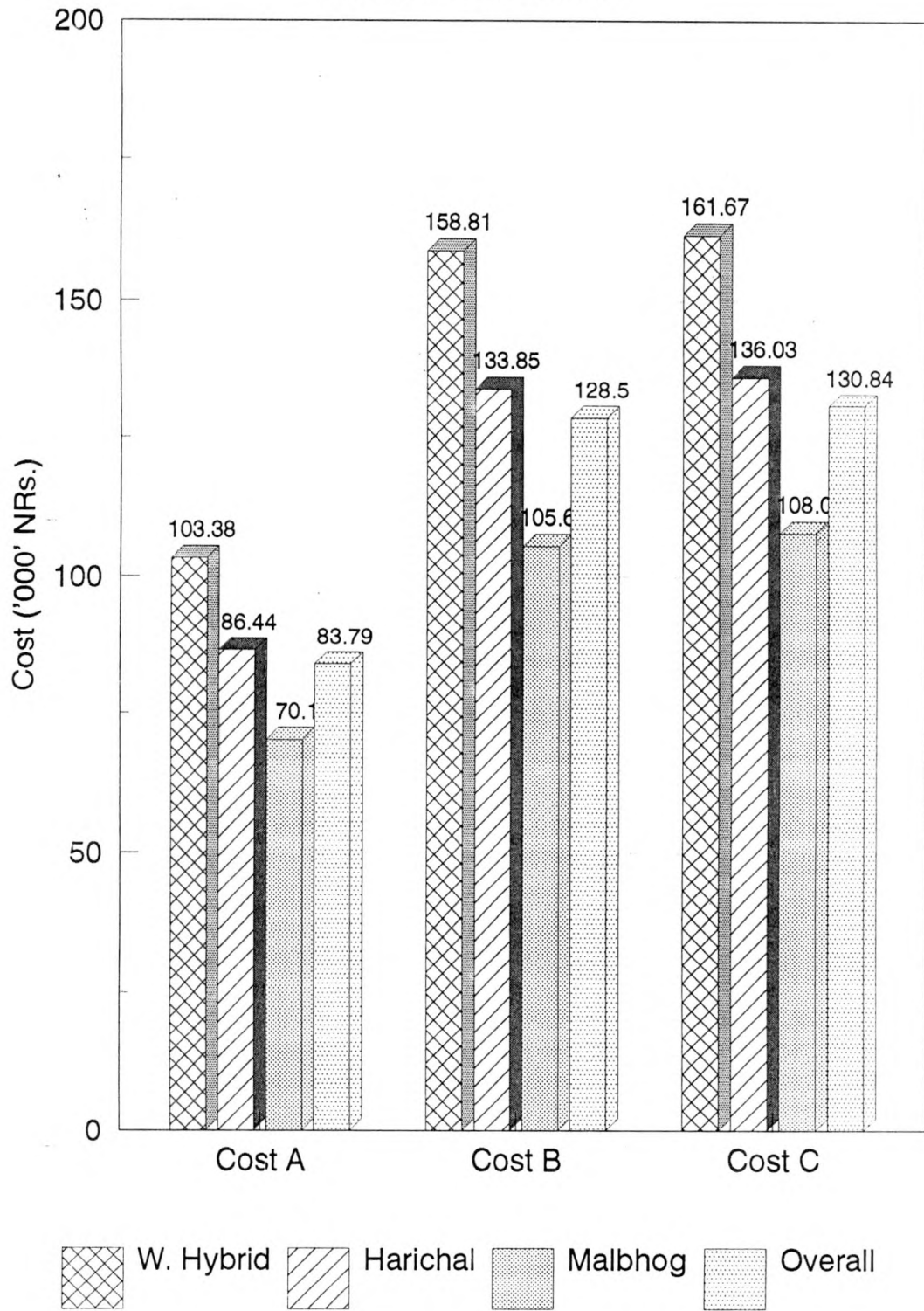
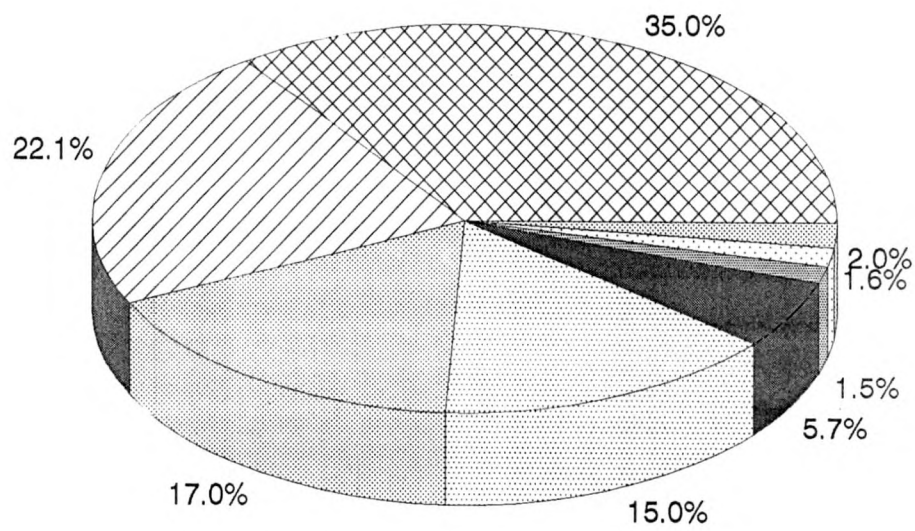


Table . Break up of cost of cultivation of banana (overall).

Item of cost	Percentage to total cost			
	W.Hybrid	Harichal	Malbhog	Overall
1. Rental value of land	33.33	34.37	32.50	33.64
2. Manures and fertilizers	19.31	18.43	28.89	21.26
3. Planting material	20.33	19.54	7.00	16.35
4. Hired human labour	12.06	13.64	17.70	14.41
5. Interest on working capital	6.01	5.39	5.53	5.51
6. Irrigation	2.53	1.43	0.78	1.44
7. Machine labour	1.14	1.68	1.33	1.50
8. Family labour	1.77	1.60	2.23	1.79
9. Plant protection	1.17	1.67	2.86	1.90
10. Others	2.35	2.25	1.18	2.20

**Fig. 5.4 Break up of cost of cultivation of banana (overall)**



- ☒ Rental value of land
- ▨ Manures and ferti.
- ▩ Planting material
- ▧ Hired human labour
- Interest on W.C.
- ▦ Irrigation
- ▤ Machine labour
- ▥ Plant protection

cent). Planting material contributed only 7.00 per cent. While interest on working capital accounts for 5.53 per cent to total cost. The combined cost on irrigation, machine labour, and plant protection measures showed similar trend of cost i.e. around 5.0 per cent for each variety.

From Table 5.13 it was seen that, at an overall level, per hectare total cost (cost C) of cultivation for banana in Nepal was NRs. 130841.60. Cost A and cost B contributed 64.04 per cent (NRs. 83794.86) and 98.21 per cent (NRs. 128500.78) in the total cost, respectively. Among the different costs, contribution of rental value of land to total cost was highest 33.64 per cent followed by manures and fertilizers 21.26 per cent. The contribution of planting material, hired human labour and interest on working capital was 16.35, 14.41 and 5.51 per cent to total cost, respectively which in monetary terms was NRs. 21389.92, NRs. 18860.90 and NRs. 7211.98, respectively for each items. The overall cost and cost A, cost B and cost C of each variety are also presented by graphs in Figure 5.3

Among the imputed cost, the rental value of land accounted for 33.33, 34.37 and 32.50 per cent to total cost for varieties William Hybrid, Harichal and Malbhog, respectively. This seems to be very high, as it is one sixth of gross returns of banana. The contribution of family labour in total cost was 1.77, 1.60 and 2.23 per cent, respectively.

On the perusal of Table 5.13, it was seen that, on an average the per hectare total cost (cost C) for cultivation of William Hybrid banana was worked out to be NRs. 161679.07, while the contribution of cost A and cost B

in the total cost was to the extent of 63.94 per cent (NRs. 103387.97) and 98.23 per cent (NRs. 158819.07), respectively. The total cost for varieties Harichal and Malbhog was worked out to be NRs. 136031.20 and NRs. 108040.66, respectively. The contribution of cost A and cost B in the total cost was to the tune of 63.55 per cent (NRs. 86444.90) and 98.40 per cent (NRs. 133851.40) for variety Harichal and 64.89 per cent (NRs. 70109.26) and 97.77 per cent (NRs. 105637.46), respectively for growing banana Cv. Malbhog.

From the Table 5.13, it may be concluded that cost of production for improved varieties viz., William Hybrid and Harichal was 1.50 and 1.26 times higher than the local Malbhog variety. Lower cost of cultivation for local variety Malbhog was attributed to lower cost of planting material on account of local and cheaper source, lower interest on working capital due to relatively smaller sum invested as working capital for cultivation of Malbhog variety and the gross returns fetched to the growers were comparatively lower as compared to William Hybrid and Harichal in turn rental value of land was lower in case of Malbhog variety. All these factors jointly reduced the per hectare cost of cultivation for Malbhog variety as compared to that of William Hybrid and Harichal.

#### **5.7(2) Per hectare cost of cultivation of banana in India**

In order to compare the costs and returns from banana cultivation between Nepal and India, Maharashtra state which is major banana producing state in India was selected purposively for the present study. More over this

state is a major exporter of banana and Nepal largely rely upon import of banana from India. In view of this an attempt was made to have a comparative picture of the cost of cultivation for banana in Nepal vis-a-vis India. The results of the same are presented in this section. A total of 40 banana growers, 20 each from Basmat and Nanded taluka were selected randomly and per hectare cost of cultivation was calculated which is presented in Table 5.14.

The Table 5.14 shows that, among the items of out pocket expenses i.e. cost A, manures and fertilizers were the major items which accounted for 22.21 per cent to total cost (cost C) followed by hired human labour 9.68 per cent and suckers 7.16 per cent to total cost. The expenditure on irrigation, bullock labour and interest on working capital was 5.88, 4.03 and 4.84 per cent to total cost, respectively.

Among the imputed cost, the rental value of land accounted for 29.57 per cent to total cost. This seems to be very high, as it is 1/6th of gross returns of banana. The contribution of family labour in total cost was 9.71 per cent.

The Table 5.14 depicts that, on an average the per hectare total cost of cultivation for banana in India (Maharashtra) was IRs. 51345.66, while the contribution of cost A and cost B in the total cost was IRs. 29882.87 (58.20 per cent) and IRs. 46359.26 (90.29 per cent), respectively.

Table 5.14. Itemwise per hectare cost of cultivation of banana in India.

Items	Unit.	Quantity	Value (IRs.)	Percentage to total cost
1. Hired human labour	days			
a) Male		97.96	3918.40	7.63
b) Female		52.78	1055.60	2.05
Total		150.74	4974.00	9.68
2. Bullock labour	Pair days	27.27	2072.26	4.03
3. Machine labour	hrs.	9.62	1033.60	2.02
4. Manures	Qtls.	195.49	3909.80	7.61
5. Fertilizers	Kg			
a) Nitrogen		409.74	3204.16	6.24
b) Phosphorus		151.91	2658.58	5.20
c) Potash		264.72	1624.19	3.16
6. Planting material	No.	3674.95	3674.95	7.16
7. Plant protection			--	--
8. Irrigation			3021.57	5.88
9. Incidental charges			141.22	0.28
10. Repairs			222.45	0.43
11. Interest on working capital			2487.83	4.84
12. Land revenue			113.96	0.22
13. Depreciation			744.30	1.45
Cost (A)			29882.87	58.20
14. Rental value of land			15183.15	29.57
15. Interest on fixed capital			1293.24	2.52
Cost (B)			46359.26	90.29
16. Family labour	days			
a) Male		118.13	4725.20	9.20
b) Female		13.06	261.20	0.51
Cost (C)			51345.66	100.00

### **5.8(1) Per hectare returns from banana cultivation**

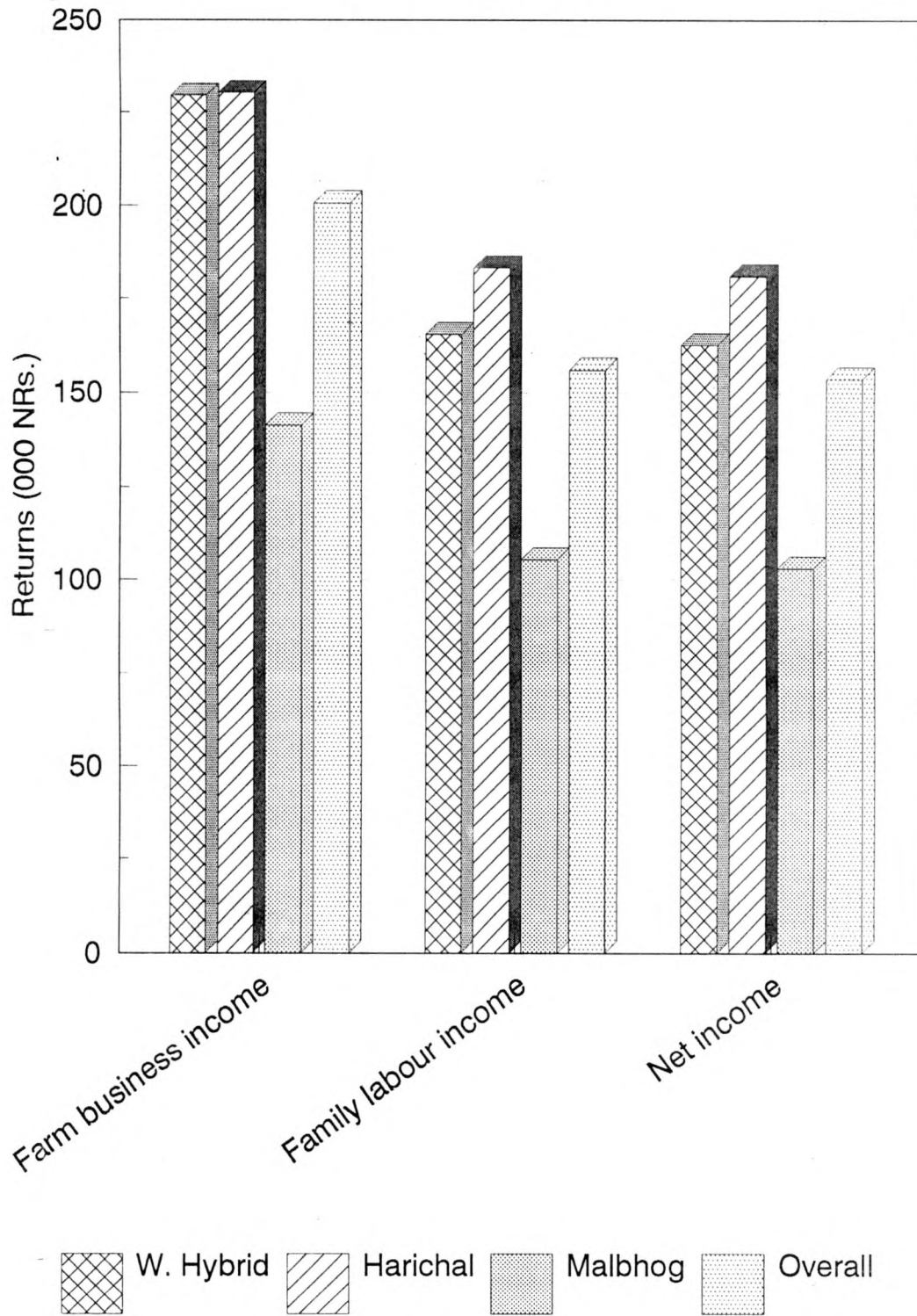
The per hectare returns from banana cultivation (variety wise) are presented in Table 5.15. It is seen from the Table 5.15 that on an average per hectare gross returns fetched in cultivation of banana were highest from William Hybrid i.e. NRs. 324000.00 followed by Harichal NRs. 316800.00, while it was lowest from cultivation of variety Malbhog (NRs. 211237.60). The per quintal cost of production was highest for cultivation of Malbhog variety i.e. NRs. 613.86 followed by William Hybrid NRs. 484.06 and Harichal NRs. 324.65. The overall returns at cost A (farm business income), cost B (family labour income) and cost C (net income) were highest from Harichal cultivation viz., NRs. 230355.10, NRs. 182948.6 and NRs. 180768.80, respectively, followed by William Hybrid i.e. NRs. 220612.03, NRs. 165180.93 and NRs. 162320.93, respectively. While it was only NRs. 141128.34, 105600.14 and 103196.94 from cultivation of Malbhog variety. The input-output ratio on cost A, cost B and cost C was highest for variety Harichal i.e. 1:3.66, 1:2.36 and 1:2.32 respectively followed by William Hybrid 1:3.13, 1:2.04 and 1:2.00 and Malbhog 1:3.01, 1:1.99 and 1:1.95, respectively.

The calculation of input-output ratio helps indicating the profitability of banana cultivation. By looking at input-output ratios, it is concluded that cultivation of Harichal variety is most profitable followed by William Hybrid and Malbhog, respectively.

Table 5.15. Per hectare costs and returns from banana cultivation (NRs.)

Particulars	W.Hybrid	Harichal	Malbhog	Overall
1. Gross returns	324000.00	316800.00	211237.60	284296.38
2. Per quintal cost of production	484.06	324.65	613.86	395.65
3. Costs				
a) Cost A	103387.97	86444.90	70109.26	83794.86
b) Cost B	158819.07	133851.40	105637.46	128500.78
c) Cost C	161679.07	136031.20	108040.66	130841.60
4. Returns at :				
a) Cost A (Farm business income)	220612.03	230355.10	141128.34	200501.52
b) Cost B (Family labour income)	165180.93	182948.60	105600.14	155795.60
c) Cost C (Net income)	162320.93	180768.80	103196.94	153454.78
5. Input output ratio : on				
a) Cost A	1:3.13	1:3.66	1:3.01	1:3.39
b) Cost B	1:2.04	1:2.36	1:1.99	1:2.21
c) Cost C	1:2.00	1:2.32	1:1.95	1:2.17

**Fig. 5.5. Varietywise per hectare returns from banana cultivation**



At an overall level gross income was NRs. 284296.38. Per quintal cost of production was NRs. 395.65, profits at cost A, cost B and cost C were NRs. 200501.52, NRs. 155795.6 and NRs. 153454.78, respectively. The input-output ratio at cost A, cost B and cost C was 1:3.39, 1:2.21 and 1:2.17 respectively. The overall profits and profits for each varieties are also graphically presented (Fig.5.5).

Input-output or Cost-benefit ratio is an appropriate indicator to judge economic viability on any enterprise. Thumb rule of deciding economic viability is that, if CBR is greater than unity the concerned enterprise is treated as viable one. Based on this indicator, all the varieties selected for the present study are turned out to be economically viable as CBR or input output ratio was greater than unity even at commercial cost i.e. cost C. However, varietal comparison of profitability in cultivation of banana on the sample farms revealed that, Harichal had an edge over rest of the two varieties. Hence, from economic point of view, under resource constraints situation cultivation of Harichal variety needs to be encouraged.

The CBR for banana cultivation at an overall level in Nepal at commercial cost i.e. cost C computed at 2.17. This implies that a rupee spent on cultivation of banana in lieu of this, it brings in returns to the tune of NRs. 2.17 as a gross returns to the banana growers in Nepal, after adjusting the cost incurred on cultivation, the net residue retained by the banana growers worked out to be NRs. 1.17. This is very lucrative proposition due to high pay off. In view of this, the efforts need to be put on for encouraging the farmers to

expand area under banana plantation. This has got more relevance because, large quantities of banana are being imported in Nepal to meet out demand of the inhabitant from Nepal.

#### **5.8(2) Per hectare returns from banana cultivation**

in India

(A\* comparative analysis)

The per hectare costs and returns from banana cultivation in India and Nepal are presented in Table 5.16 for making comparisons between the two countries.

The Table 5.16 indicates that, on an average per hectare gross returns obtained from banana cultivation in India was NRs. 146852.26 which is 1.93 times lower than the gross returns obtained per hectare in Nepal. However, cost per quintal of production in Nepal was 1.83 (NRs. 395.65) times higher than that of India (NRs. 215.04).

The overall profit at cost A (i.e. farm business income) was NRs. 99039.66 in India which is 2.02 times lower as compared with the returns obtained at cost A in Nepal. The returns at cost B (family labour income) and cost C (net income) was NRs. 155795.60 and NRs. 153454.78 in Nepal which is 2.14 and 2.37 times higher than the returns obtained in India at cost B (NRs. 72677.44) and cost C (NRs. 64699.2), respectively.

Foregoing analysis revealed as far as per unit returns from banana cultivation are concerned the Nepalese growers are at advantageous position as compared to that of Indian banana growers.

Table 5.16. Per hectare costs and returns from banana cultivation  
(Nepal vs India).

Particulars	India (IRs.)	Nepal (NRs.)
1. Yield (q/ha)	382.03	330.70
2. Farm gate price/quintal	240.24	859.67
	(384.39)	
3. Gross returns	91782.66	284296.38
	(146852.26)	
4. Per quintal cost of production	134.40	395.65
	(215.04)	
5. Costs		
a) Cost A	29882.87	83794.860
	(47812.59)	
b) Cost B	46359.26	128500.78
	(74174.81)	
c) Cost C	51345.66	130841.60
	(82153.05)	
6. Returns at		
a) Cost A	61899.79	200501.52
(Farm business income)	(99039.66)	
b) Cost B	45423.40	155795.60
(Family labour income)	(72677.44)	
c) Cost C	40437.00	153454.78
(Net income)	(64699.20)	
7. Input output ratio on		
a) Cost A	1:3.07	1:3.39
b) Cost B	1:1.98	1:2.21
c) Cost C	1:1.79	1:2.17

\*Figures in parentheses are values in NRs.

Note : IRs. 1.00 = NRs. 1.60.

The yield levels/productivity realised by the Indian banana growers were 382.03 q per ha. Whereas, in Nepal it was 330.70 q/ha. Thus Indian farmers had an edge over Nepalese farmers in productivity by about 16 per cent increase over Nepals productivity. This has resulted in lowering the per quintal cost of cultivation under Indian situation. However, the per quintal price fetched from sale of banana by the Indian and Nepalese farmers was NRs. 384.39 and NRs. 859.67, respectively herein the Nepalese farmers enjoyed comparative advantage in higher fetching price by 123.64 per cent. This has caused in raising input-output or **CBR** in case of banana cultivation under Nepal's situation. This is quite obvious because Nepal is net importer of banana so naturally, the domestic prices prevailing in Nepal were much higher than those in India.

#### **5.9 Farmers perception on different varieties of banana grown in Nepal**

The farmers perception on different varieties grown in the study area are presented in Table 5.17. The Table 5.17 indicates that in general time of planting and harvesting is almost same for each variety except in William Hybrid where tissue cultured plantlets take additional 3 months in maturity compared with Harichal and Malbhog varieties planted with suckers. High density planting was practiced in the cultivation of variety Harichal i.e. 5' x 5' followed by William hybrid 6' x 6' and Malbhog 7' x 7', respectively. Due to this reason it was found that per hectare average yield was highest from

Table 5.17 Farmers perception on different banana varieties.

Particulars	W. Hybrid	Harichal	Malbhog
1. General time of planting	February- July	February- July	February- July
2. Average time of bunch emergence			
a) Sucker as planting material	9-12 mnths	8-11 mnths	9-12 mnths
b) Plantlets as planting material	12-14	--	--
3. Bunch maturity period			
a) During summer	2.5-3 mnths	2.5-3 mnths	2.5-3 mnths
b) During winter	3-4 mnths	3-5 mnths	3-4 mnths
4. Planting distance	6' x 6' (180x180 cm)	5' x 5' (150x150 cm)	7' x 7' (210x210 cm)
5. Average yield per ha	334 qtls	419 qtls	176 qtls
6. Average fingers per bunch	120	108	100
7. Staking needed	Moderate	Least	More
8. Weevil problem	Less	More	Less
9. Beetle problem	More	More	Less
10. Choke throat	Less	More	Less
11. Storing quality of fruit	Poor	Poor	Best
12. Market price	Fair	Fair	Good
13. Different cultural requirements	Accurate	Accurate	Intermediate

cultivation of Harichal i.e. 419 quintals followed by William Hybrid 334 quintals and Malbhog 176 quintals per hectare, respectively. Though the yield of local Malbhog variety was less as compared to other varieties, it was found better in terms of pest and winter leaf injury tolerance while the improved William Hybrid and Harichal varieties suffered from insect pests, winter leaf injury and also had poor shelf life of fruits. Among the three varieties selected, Malbhog was most liked in the Katmandu market due to its peculiar taste and subsequently it reflects in fetching higher price in the market. Average number of fingers per bunch reported was highest in William Hybrid i.e. 120 followed by Harichal 108 and Malbhog 100 fingers, respectively. In terms of cultural practices requirements, growers of William Hybrid and Harichal reported the need of accurate management whereas for Malbhog it was intermediate.

#### **5.10 Intercropping in banana**

Intercropping means growing of crops in between the rows of the main crop when the main crop is in its initial phase of growth and development so as to utilize vacant space optimally. Farmers generally practices intercropping in order get extra income from the same piece of land.

At earlier stages of growth, intercrops can easily be grown in banana plantation. The intercrops practiced in banana at different places are listed in Table 5.18.

Table 5.18 reveals that, vegetables like tomato, cabbage, brinjal, chilly, corriander, etc. were intercropped with William Hybrid in

Table 5.18. Intercropping in banana.

Place	Variety	Intercrops
1. Mahendranagar Municipality area	W.Hybrid	Vegetables (Tomato, cabbage, brinjal, chilli, corriander, etc.)
2. Tikapur Municipality area and adjoining VDC's	Harichal	Vegetables , legumes( blackgram, mung bean and cowpea)
3. Janakinagar and Shankarnagar VDC's	Harichal	Spring maize and vegetables.
4. Bhiuran VDC	Malbhog	Spring maize and turmeric.

Mahendranagar area. Two of the sample farmers had earned NRs. 12000.00 from 0.5 hectare area by growing tomato and brinjal in between the rows of banana plants. In Tikapur and its surroundings, chief crops intercropped with Harichal were vegetables and legumes (blackgram, mung bean and cow pea). Vegetables were grown for simply home consumption while legumes for dual purpose viz., home consumption plus sale and green manuring after the produce is harvested. One of the farmer had even earned NRs. 20000.00 from one hectare area by intercropping banana with colocasia. In case of Jankinagar, Shankarnagar and Bhiuran VDC's , maize was the main crop used for intercropping with banana during the month of March-April when bananas are in its early phase of growth and development. Some farmers of Janakinagar and Shankarnagar area reported that, an extra income of NRs. 15000.00 per hectare was derived from intercropping maize in banana fields.

#### **5.11 Different sources of loan for banana cultivation**

Banana is a perennial crop which requires heavy investment as a result of which cultivators have to rely upon external sources for loan. In Nepal, agricultural loans are generally provided by Agriculture Development Bank, Nepal (ADB/N), an autonomous institution under the control of Ministry of Finance, His Majesty's Government of Nepal (HMGN). As per the directives of Nepal Rastra Bank, other commercial banks should also extend 12 per cent of their total lending to the priority sectors like agriculture, cottage industries and small business. The bank provides three kinds of loans viz.,

short term loan (not exceeding six months), medium term loan (6 months to five year) and long term loan (5 year to 20 years). Loan for banana falls under the category of medium term.

The sources of borrowing by the banana growers are given in Table 5.19.

The Table 5.19 reveals that, out of 64 banana growers 30 (46.30 %) had availed the facility of loan for banana cultivation. Among the different sources of borrowing, ADB/N was found to be a major lending agency to the banana growers, which extended 93.33 per cent of the total lending to the banana sector. Only two farmers (one-one each) had approached Rastriya Banijya Bank (one of the major commercial bank in the country) and Grameen Bikas Bank (A prototype Grameen Bank of Bangladesh for assisting the poorest of the poor women living in remote areas) for loan borrowing.

The total amount of loan borrowed, rate of interest and its pay back period is furnished in Table 5.20. It is seen from the table that, total amount of loan borrowed by sample farmers was NRs. 3.752 million, average rate of interest was around 15 per cent (14.86 per cent) and pay back period was 3.6 years, respectively. Regionwise data on loan revealed that, highest amount was borrowed in Mahendranagar i.e. NRs. 2.315 million followed by Tikapur NRs. 1.114 million respectively. The amount of loan borrowed in Janakinagar and Shankarnagar was NRs. 1.515 lakh, while it was 1.72 lakh in Bhiuran. Amount of loan borrowed per farm was NRs. 125000.00, whereas long per heectare was NRs. 142153.15.

Table 5.19. Different sources of loan.

Source	No. of borrowers in				Total
	Mahendra-nagar	Tikapur	Janakinagar and Shankarnagar	Bhiuran	
1. Agriculture Development Bank (ADB/N)	11	8	4	5	28
2. Rastriya Banijya Bank	1	--	--	--	1
3. Grameen Bikas Bank	--	1	--	--	1
Total	12	9	4	5	30

Table 5.20. Regionwise loan borrowed, rate of interest and pay back period

Region	Total amount (NRs.)	Rate of interest (per cent)	Pay back period (yrs)
1. Mahendranagar	2.32 million	14.75	4.28
2. Tikapur	1.11 million	15.00	2.54
3. Janakinagar and Shankarnagar	1.52 lakh	16.00	4.00
4. Bhiuran	1.72 lakh	14.00	3.60
Overall	3.75 million	14.86	3.60
5. Loan per farm	125000.00		
6. Loan peer hectare	142153.15		

Foregoing analysis revealed that ADB/N had come to the rescue of banana growers to meet out their loan requirement for intensive cultivation of banana and thereby to step up their income from this venture.

### 5.12 Functional analysis

To examine influence of independent variables or inputs on output (Y) Cobb-Douglas type of production function was fitted to the input-output data collected from banana growers. Selection of the function was made based on R<sup>2</sup> value and in present study Cobb-Douglas type of production function turned out to be better fit. The results of the same are given in Table 5.21.

$$Y = X_1^{b1} X_2^{b2} X_3^{b3} X_4^{b4} X_5^{b5} X_6^{b6} X_7^{b7} X_8^{b8},$$

Where,

- Y = yield in quintals per ha
- X<sub>1</sub> = human labour used in days per ha
- X<sub>2</sub> = machine labour used in hrs per ha
- X<sub>3</sub> = plantlets/suckers used per ha
- X<sub>4</sub> = manure used in quintals per ha
- X<sub>5</sub> = irrigation in NRs. per ha
- X<sub>6</sub> = urea used in kg per ha
- X<sub>7</sub> = DAP used in kg per ha
- X<sub>8</sub> = MOP used in kg per ha.

### 5.12.1 Correlation matrix

The coefficients of correlation were computed to find out relationship between each input and output. The results of correlation are given in Table 5.21. It is revealed from the Table that, all the selected input variables except manures and phosphatic fertilizer i.e. DAP were statistically significant with the yield of banana.

The correlation coefficient between independent variables indicated that human labour was significantly associated with variables like machine labour, manures, irrigation, N, P and K while it was non significant with number of suckers used per hectare. The variable machine labour was turned out to be significant with input variables, manure, urea, DAP and potash. It had no relationship with variable suckers used per hectare. Similarly, it was non significant with the variable irrigation. significant relationship of variable  $X_3$  (suckers) was noticed with irrigation only. While, it was negatively associated with variables manures and DAP. At the same time, it was non significant with urea and MOP. As regards to manure, it was significantly associated with urea, DAP and potash while it was non significant with irrigation. Irrigation was non significant with urea and potash while negatively associated with DAP. Urea, DAP and Potash were significantly associated with each other.

As none of independent variables was highly correlated with each other, there was less chance for the existence of multicollinearity.

Table 5.21. Correlation matrix between input and output in banana cultivation.

Input variable	HL X1	ML X2	Suck. X3	Man. X4	Irri. X5	Urea X6	DAP X7	MOP X8	Yield (Y)
Human labour (X1)	1.000	0.617**	0.237	0.680**	0.610**	0.530**	0.581**	0.601**	0.465**
Machine labour (X2)		1.000	-0.000	0.649**	0.179	0.639**	0.692**	0.706**	0.342*
Sucker (X3)			1.000	-0.096	0.419*	0.139	-0.008	0.261	0.668**
Manure (X4)				1.000	0.165	0.540**	0.653**	0.570**	0.082NS
Irrigation (X5)					1.000	0.099	-0.007	0.126	0.632**
Urea (X6)						1.000	0.746**	0.782**	0.323*
DAP (X7)							1.000	0.830**	0.245NS
MOP (X8)								1.000	0.486**

\*\* - Significant at 1 % level

Tab. r value at 1 % = 0.432

\* - Significant at 5 % level

Tab. r value at 5 % = 0.306

NS - Non significant.

### 5.12.2 Resource productivity

In order to examine the influence of different inputs viz., human labour ( $X_1$ ), machine labour ( $X_2$ ), suckers ( $X_3$ ), farm yard manure ( $X_4$ ), irrigation ( $X_5$ ), urea ( $X_6$ ), DAP ( $X_7$ ) and murate of potash ( $X_8$ ) on yield ( $Y$ ) of banana, Cobb-Douglas production function was fitted with the above inputs as independent variables and yield of banana crop as dependent variable.  $B_0$ ,  $R^2$  and F-values were found to be 3.90885, 0.751 and 20.725, respectively, showing thereby best fit.

The Table 5.22 shows that, the regression coefficient of barring an exception of  $X_1$  variable (human labour),  $X_4$  variable (FYM) and  $X_6$  variable (urea), all the variables incorporated in the model born an excepted sign i.e. positive, thereby indicating positive contribution of all these variables towards the yield of banana on the sample farms. However, regression coefficient of  $X_1$ ,  $X_4$ ,  $X_6$  and  $X_7$  were turned out to be statistically non significant and regression coefficients of rest of the variables were found to be statistically significant at different levels of probability. Further, it was seen that, contribution of  $X_5$  variable i.e. irrigation used in the productivity of banana was highly significant. This was followed by  $X_3$ ,  $X_8$ ,  $X_4$ ,  $X_2$  variables. This suggests that, an increase in use of these inputs (except  $X_4$  which is negatively significant) above the present mean levels will increase the per unit area yield level of the sample banana farms, other things agroclimatic condition etc. remains *Ceteris paribus*.

Table 5.22. Multiple regression coefficient.

Resource	(bi)	SE	't' value
1. X <sub>1</sub> Human labour	-0.309665	0.264665	-1.17002NS
2. X <sub>2</sub> Machine labour	0.16209	0.082264	1.97045*
3. X <sub>3</sub> Suckers	0.248417	0.059284	4.19028**
4. X <sub>4</sub> Manure	-0.146981	0.070029	-2.09885NS
5. X <sub>5</sub> Irrigation	0.16121	0.032685	4.93221**
6. X <sub>6</sub> Urea	-0.035385	0.05687	-0.6221NS
7. X <sub>7</sub> DAP	0.038894	0.06964	0.55846NS
8. X <sub>8</sub> MOP	0.17582	0.06994	2.51371*

\*\* - Significant at 1 % level

Bo = 3.90885

\* - Significant at 5 % level

R<sup>2</sup> = 0.751

NS - Non Significant

F value = 20.725

One of the advantage of Cobb-Douglas function is that the regression coefficients  $b_i$ 's directly represent the elasticity of production. It indicates the per cent change in output associated with one per cent change in input factor. Among the significant variables, elasticity of production of variable sucker numbers was 0.2484 which means one per cent increase in number of suckers, increased the yield of banana by 0.24 per cent. Similarly, 1 per cent increase in potash, machine labour and irrigation increased the banana yield by 0.17, 0.16 and 0.16 per cent respectively. The negative elasticity in respect of nitrogenous fertilizer (urea) may be due to excess use of it in banana cultivation. Similarly negative elasticities of human labour and FYM may be due to less utilisation of these inputs in banana cultivation, their use might not have attained saturation level.

The sum of elasticities indicates the returns to scale. As indicated, the sum of elasticities of production with respect to independent input variables  $X_1$  through  $X_8$  for production of banana crop on the sample farm was 0.32, it implies decreasing returns to scale. This indicates that, banana growers were operating in the stage-II of classical production function. This postulates that banana producer should first consider input and output prices before adding extra input variables. The addition of input should be up to the point where the additional cost of an input is equal to the additional revenue which the input yields. In other words, the addition of inputs should be carried out upto the level where the value of marginal product equals the price of the factor in the market.

The coefficient of multiple determination i.e.  $R^2$  for the sample as a whole computed to be 0.751. This implies that, the variation in output explained by the independent variables chosen for the present study was more than 75 per cent. The remaining variation in output may be due to those input factors which have been left out from the model.

The F value was significant at 1 per cent level of probability thereby indicating proper selection of the model and specification of the variables.

### **5.12.3 Resource use efficiency**

An efficiency of resource use in production of banana was tested with the help of MVP/MC ratio and the results of resource use efficiency are furnished in Table 5.23.

The MPV/MC ratio for the use of variables  $X_2$ ,  $X_3$ ,  $X_5$  and  $X_8$  was greater than unity. This shows that, the present input levels of machine labour, suckers, irrigation and murate of potash are economical and there exist scope for enhancement to further increase in returns from incremental production (MP). The MVP/MC ratio for the variables human labour, FYM, urea and DAP was not computed as the regression coefficients of these variables was not significant.

The foregoing analysis revealed that on the sample farms use of machine labour, suckers, irrigation and potash fertilizer was efficient.

Table 5.23. Resource use efficiency in banana production.

Input	MPP	MVP	MC	E=MVP/MC
1. X <sub>2</sub> Machine labour	9.926	8533.18	362.95	23.51
2. X <sub>3</sub> Suckers	0.024	20.63	6.00	3.43
3. X <sub>5</sub> Irrigation	4.846	4166.00	162.06	25.70
4. X <sub>8</sub> MOP	0.113	97.14	9.35	10.39

## **5.13 Marketing**

Marketing plays a vital role as it directly affects on the income of producer. The marketing is as important as the production of crop. As various intermediaries are involved in the marketing process they reap away the large share in consumers rupee. In marketing of banana there exists mainly two intermediators i.e. wholesalers and retailers. The marketing of banana was studied in order to find out marketing channels, market margins and price spread in marketing of banana in Nepal. The results of present investigation are presented under following heads.

- i) General information about wholesalers and retailers
- ii) Marketing channels
- iii) Price spread and market margin.

### **5.13.1 General information about wholesalers, retailers and pre-harvest contractor**

Different age groups of wholesalers, retailers and pre-harvest contractors are presented in Table 5.24. It was observed from Table 5.24(1) that, maximum number of wholesalers were upto 30 years of age which contributes 50 per cent to total number of wholesalers followed by 37.50 and 12.50 per cent each to total number of wholesalers for age group of 31 to 40 and 41 to 50 years respectively. In case of retailers, the numbers were 2 (20 per cent), 3 (30 per cent), 2 (20 per cent) and 3 (30 per cent) each belonging to

Table 5.24. General information of wholesalers, retailers and pre-harvest contractor

Table 5.24(1). Distribution of marketing functionaries according to age.

Age group (yrs)	Wholesaler		Retailer		Pre-harvest contractor	
	No.	%	No.	%	No.	%
I Up to 30	4	50.00	2	20.00	--	--
II 31 to 40	3	37.50	3	30.00	2	100.00
III 41 to 50	1	12.50	2	20.00	--	--
IV 51 to 60	--	--	3	30.00	--	--
<b>Total</b>	<b>8</b>	<b>100.00</b>	<b>10</b>	<b>100.00</b>	<b>2</b>	<b>100.00</b>

Table 5.24(2). Educational status of marketing functionaries.

Particulars	Wholesaler		Retailer		Pre-harvest contractor	
	No.	%	No.	%	No.	%
I Primary	--	--	--	--	--	--
II Secondary	4	50.00	2	20.00	2	100.00
III Higher secondary	1	12.50	3	30.00	--	--
IV Graduate	--	--	1	10.00	--	--
V Illiterate	3	37.50	4	40.00	--	--
<b>Total</b>	<b>8</b>	<b>100.00</b>	<b>10</b>	<b>100.00</b>	<b>2</b>	<b>100.00</b>

Table 5.24(3). Experience of trade.

Particulars	Experience (yrs)	Range (yrs)
1. Wholesaler	8.25	1-12
2. Retailer	9.05	0.5-26
3. Pre-harvest contractor	9.00	4-14

age groups of upto 30 years, 31 to 40 years, 41 to 50 years and 51 to 60 years respectively. The pre-harvest contractors belonging to age group 31 to 40 were two in number.

Educational status of the sample intermediaries in marketing of banana is shown in Table 5.24(2).

From the Table 5.24(2) it is observed that, most of the wholesalers were educated upto secondary level i.e. 4 which contributes 50.00 per cent, followed by higher secondary which contributes 12.50 per cent in the total number of wholesalers. Three wholesalers (37.50 per cent) were illiterate. In case of retailers, maximum number of them are illiterate i.e. 4 which contributes 40 per cent to total number of retailers followed by higher secondary, secondary, and graduate each contributing 30, 20 and 10 per cent in the total number of retailers, respectively. All the pre-harvest contractors were educated upto secondary level.

The experience of trade by wholesalers, retailers and pre-harvest contractors is presented in Table 5.24(3).

Table 5.24(3) depicts that, the wholesalers were having 8.25 years experience (range 1-12 years) in the trade. The experience in trade reported by retailers and pre-harvest contractors were 9.05 years (range 0.5 - 26.0 years) and 9.00 years (range 4-14 years), respectively.

### 5.13.2 Marketing channels

The produce passes through several hands before it reaches to the final consumer. Marketing channels are the pathways through which the fruit travels to reach to the final consumer. In the present study it was tried to study the marketing channels of banana produced in different study areas. It was observed that, most of the bananas produced in Mahendranagar district were sold for local consumption through channel (I) (Fig 5.6). Remaining quantities were sold through channel (II). In Tikapur of Kailali district it was found that most of the bananas produced were locally consumed. Bananas were supplied to local consumers mainly through channel II. Remaining quantities of the produce is sold outside Tikapur (i.e. Dhangadhi) through channel No. III. In case of Rupandehi district, bananas produced in Janakinagar and Shankarnagar VDC's were sold through channel IV. Pre-harvest contractor fixes the price just before the maturity of fruits. It was found that, method of sale was on count basis. Similarly, bananas produced in vicinity of Bhiuran VDC <sup>were</sup> also sold through channel V. Here also price fixation was practiced on count basis. The pre-harvest contractor residing in the village generally sale the banana in Kathmandu wholesale market . Malbhog is the dominating variety in Bhiuran area which is popular in Kathmandu market for its taste and keeping quality.

### 5.13.3 Marketing cost, price spread and market margin

per 100 fingers

In the marketing of banana different agencies are involved. The

agencies or intermediaries work in the market and get their share from the consumer's rupee. This is called as price spread. The efficient marketing calls for reduction in the gap between price paid by the consumer and price received by the producer.

Four markets viz., Mahendranagar, Dhangadhi, Kathmandu and Butwal were studied during year 1998-99. Marketing cost, price spread and marketing margin in the marketing of banana through all the channels were calculated per 100 fingers basis and the results are presented in Table 5.25.

**i) Mahendranagar market**

In this market, the channel through which locally produced bananas (Cv. William Hybrid) were sold was studied. Table 5.25 shows that, the share of producer in consumer's rupee was highest i.e. 94.53 per cent when bananas were sold through channel I followed by channel II (81.26 per cent) of the three markets selected for study. This may be due to less number of intermediaries involved in the marketing channel I and II. Longer the marketing channel, higher will be the consumer's price and eventually the share of producer in consumer's rupee will decrease. It is also observed from Table 5.25 that, retailers purchased the fruits at the rate of NRs. 108.30 per 100 fingers (i.e. NRs. 13 per dozen). Price paid by the consumer was NRs. 133.28 per 100 fingers (i.e. NRs. 16 per dozen) in which expenditure incurred by the retailer and his margin were NRs. 4.00 (3 per cent) and NRs. 20.98 (15.74 per cent), respectively. The market margin was to the extent of 18.74 per cent i.e.

Fig. 5.6. Different marketing channels existed in the study area.

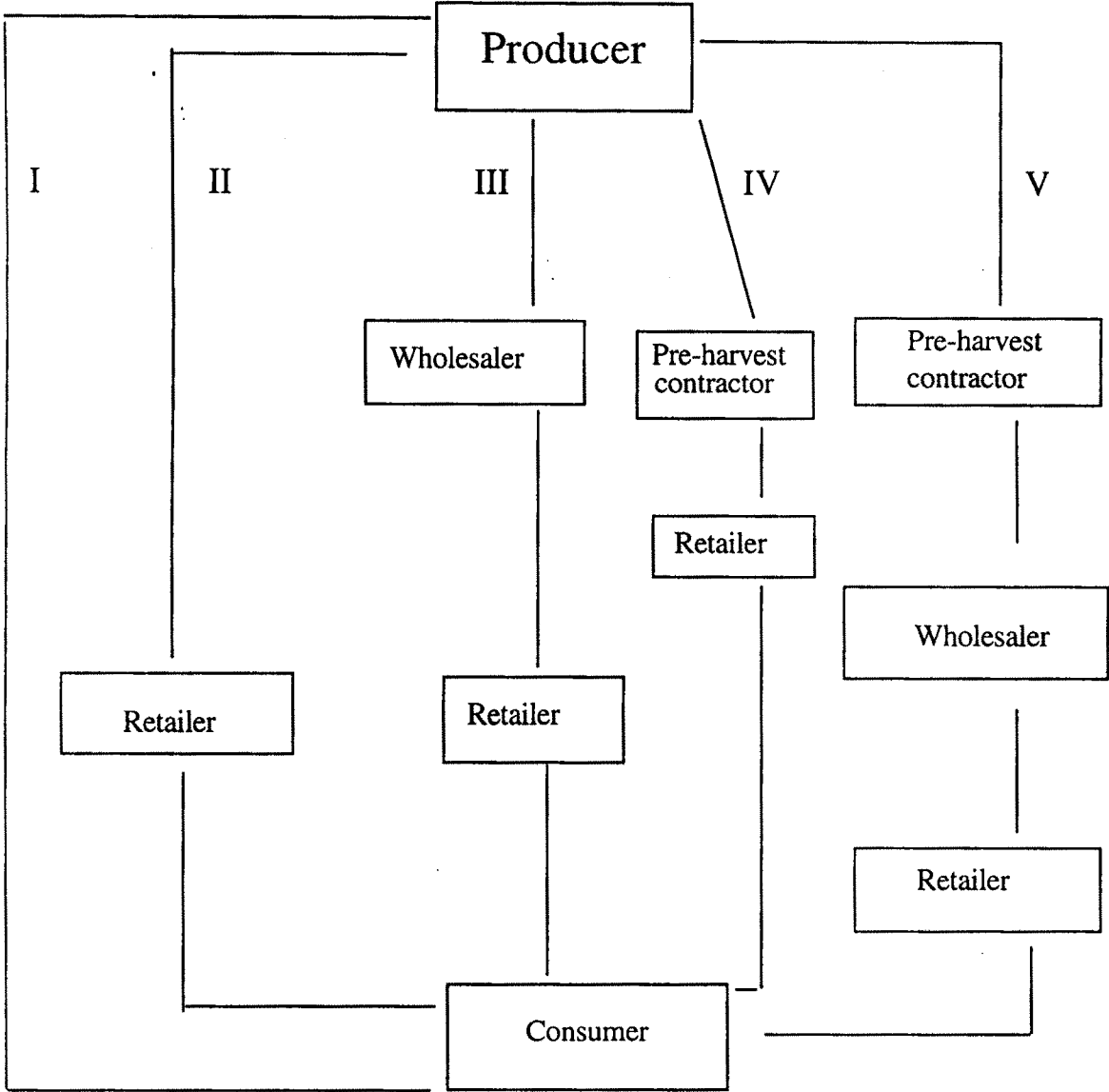


Table 5.25. Price spread and market margin of banana (per 100 fingers).

Sr. No.	Particulars	Channels				
		I	II	III	IV	V
1.	Net price received by the producer	126.00 (94.53)	108.30 (81.26)	183.30 (66.67)	70.00 (56.02)	100.00 (46.17)
2.	Marketing charges incurred by the producer	7.28 (5.47)	--	--	--	--
3.	Price paid by the pre-harvest contractor at farmers field	--	--	--	70.00	100.00
	i) Marketing charges incurred by pre-harvest contractor at market outside the district	--	--	--	6.12 (4.90)	13.00 ( 6.00)
	ii) Profit of the pre-harvest contractor at market outside the district	--	--	--	23.88 (19.11)	47.00 (21.70)
4.	Price paid by the wholesaler producer	--	--	83.30	--	160.00
	i) Marketing charges incurred by the wholesaler	--	--	3.80 (3.04)	--	8.10 ( 3.74)
	ii) Profit of the wholesaler	--	--	13.66 (10.93)	--	17.70 ( 8.17)
5.	Price paid by the retailer	--	108.30	100.76	100.00	185.80
	i) Marketing charges incurred by the retailer	--	4.00 (3.00)	5.00 (4.00)	6.50 (5.20)	7.20 ( 3.33)
	ii) Profit of the retailer	--	20.98 (15.74)	19.19 (15.36)	18.45 (14.77)	23.58 (10.89)
6.	Price paid by the consumer	133.28 (100.0)	133.28 (100.0)	124.95 (100.0)	124.95 (100.0)	216.58 (100.0)
	Market margin	7.28 (5.47)	24.98 ( 18.74)	41.65 (33.33)	54.95 (43.98)	116.58 (53.83)

\* Figures in parentheses indicate percentages to consumer's rupee.

NRs. 24.98 per 100 fingers of banana sale. In case of channel I marketing margin was only NRs. 7.28 (5.47 per cent).

**ii) Dhangadhi market**

Most of the bananas produced in Tikapur and its vicinities are consumed locally. However, few quantities of the produce are transported to Dhangadhi town by the wholesalers. The marketing channel involving wholesaler and retailer was studied and presented in Table 5.25. The table reveals that retailers purchased the fruits, from the wholesalers at the rate of NRs. 100.76 per 100 fingers in which expenditure of wholesaler and his margin were included, which were NRs. 3.80 (3.04 per cent) and N Rs. 13.66 (10.93 per cent), respectively. Expenditure incurred by retailer was NRs. 5.00 and margin of retailer was NRs. 19.19 which contributes 4.00 per cent and 15.36 per cent of consumer's price. It was also observed that, consumers purchased banana at the rate of NRs. 124.95 per 100 fingers (i.e. NRs. 15 per dozen). The marketing margin was NRs. 41.65 (33.33 per cent) while the share of producer in consumer's rupee was 66.67 per cent.

**iii) Kathmandu market**

Of the three markets studied, only in Kathmandu there exists a well established fruit and vegetable wholesale market namely Kalimati fruits and vegetables wholesale market. It was reported by the pre-harvest contractors that, more than 90 per cent of the bananas Cv. Malbhog produced in Bhiuran

VDC and its interior areas are sold in Kalimati fruit and vegetable wholesale market. An attempt was made to study the price spread in the marketing of local banana Cv. Malbhog which is presented in Table 5.25.

The Table 5.25 depicts that farm gate price was NRs. 100 per 100 fingers. Wholesalers purchased the fruits from preharvest contractor at the rate of NRs. 160 in which expenses and margin of the pre-harvest contractor were included, which were NRs. 13 (6 per cent) and NRs. 47 (21.70 per cent) per hundred fingers, respectively. Retailers purchased the fruits from wholesalers at the rate of NRs. 185.8 per hundred fingers. The expenditure and margin of the wholesaler were 3.77 (NRs. 8.10) per cent and 8.17 (NRs. 17.70) per cent of the consumers price, respectively. While for retailers it were 3.33 per cent (NRs. 7.2) and 10.89 per cent (NRs. 23.58), respectively. The price paid by the consumer per hundred fingers was NRs. 216.58. The marketing margin was worked out to be NRs. (53.83 per cent) and share of producer in consumer's rupee was 46.17 per cent.

**iv) Butwal market**

The bananas produced in Shankarnagar and Janakinagar were sold in Butwal markeet through channel IV. Farm gate price per 100 fingers was NRs. 70.00. Retailers purchased the fruits from pre-harvest contractors @ NRs. 100.00 in which expenses and margin of the pre-harvest contractor were included, which were NRs. 6.12 (4,90 peer cent) and NRs. 23.88 (19.11 per cent) per hundred finger, respectively. Price paid by consumer was NRs.

124.95, in which 5.20 per cent (NRs. 6.50) and 14.77 per cent (NRs. 18.45) were the marketing charges incurred and profit of the retailer respectively. Producers share in consumers rupee was 56.02 per cent. The marketing margin was NRs. 54.95 (43.98 %)

## **5.14 Constraints**

### **5.14.1 Constraints faced by the banana cultivators**

The information regarding constraints faced by the cultivators is presented in Table 5.26. It was reported that, various constraints with regard to labour, chemical fertilizers, plant protection, loan, marketing facilities, etc. were faced by the cultivators. Shortage of water during summer season was reported by maximum number of banana growers i.e. 20 which contributes 31.25 per cent of the total farmers interviewed. This problem was found in those areas where small ditches were the chief sources of irrigation. Water was in short supply during March to May when the plant requires irrigation more frequently. Shortage of labour was reported by 11 respondents i.e. 17.18 per cent. A lot of problems regarding chemical fertilizers <sup>were</sup> mentioned by the growers. They were : non-availability of chemical fertilizers in time (25.00 per cent), duplicate fertilizers available in the market (29.68 per cent), and high prices of chemical fertilizers (12.50 per cent), respectively. Problem of insect pests was major problem reported by 28.12 per cent farmers. Borer and finger scarring beetle were the major insects reported causing problem in banana cultivation. Problem of duplicate pesticides was mentioned by 4.68 per cent of the farmers.

Table 5.26. Constraints faced by the farmers in banana cultivation.

Sr. No.	Constraints	Number	Percentage
1.	Shortage of labour	11	17.18
2.	Non availability of chemical fertilizers on time	16	25.00
3.	Duplicate fertilizers	19	29.68
4.	High prices of chemical fertilizers	8	12.50
5.	Shortage of water in ditches during summer season	20	31.25
6.	Problem of insect pests	18	28.12
7.	Duplicate pesticides	3	4.68
8.	Loan advancing procedure is lengthy	3	4.68
9.	Less loan sanctioned than actually needed	3	4.68
10.	Repayment of loan not favourable	3	4.68
11.	Invisible charges necessary for loan sanction	3	4.68
12.	Lack of skilled agricultural technicians	3	4.68
13.	Lack of regulated markets	8	12.50
14.	Delayed payments	5	7.81

Table 5.27. Constraints faced by intermediaries in marketing of banana.

Sr. No.	Constraints	Number	Percentage
1.	Fruits are more perishable	18	90.00
2.	Lack of adequate marketing facilities	6	30.00
3.	Lapsed payment	2	10.00
4.	Unnecessary hassles at custom and police check posts (both at India and Nepal) during import of banana from India	7	35.00

Major constraints with respect to loan were : lengthy procedure of loan advancement, less loan provided than actually needed, repayment system of loan not favourable and paying of invisible charges during loan sanction, each reported by 4.68 per cent of the cultivators, respectively.

In case of marketing of banana problems like lack of adequate transport facilities and lack of regulated markets were reported by 4.68 and 12.50 per cent of producers, respectively. Other problems reported were delayed payment of the produce and lack of skilled agricultural technicians, each mentioned by 7.81 and 4.68 per cent of the total sample farmers.

#### **5.14.2 Constraints faced by intermediaries in marketing of banana**

The information regarding constraints faced by the intermediaries, particularly wholesalers, retailers and pre-harvest contractors is listed in Table 5.27. The Table 5.27 depicts that major problem reported was perishable nature of the fruit due to which it gets quickly damaged with in few days after ripening, if not disposed off in time. This problem was reported by 90 per cent of the interviewed intermediaries. Unnecessary hassles at customs and checkpoints of India and Nepal during import of banana from India was reported by 35 per cent of respondents followed by lack of adequate marketing facilities 30 per cent and lapsed payment by 10 per cent of the total respondents, respectively.

### 5.15 Import of banana in Nepal

Nepal imports banana only from India. Hence data on export of banana from India to Nepal were compiled from various published sources in India and it is assumed that India's export of banana to Nepal is equivalent to Nepal's import. Based upon this assumption, mean, C.V. and linear growth rates of import volume of banana to Nepal during the period 1978-96 were calculated and presented in Table 5.28.

The Table 5.28 shows that, on an average per annum import of banana in Nepal from India during the period from, 1978-96 was worked out to be 335.53 metric tonnes. An import of banana to Nepal during the period of 1978-96 increased from one ton in the year 1979 to 842 ton in the year 1988. Import of banana from India increased significantly @ 13.02 per cent per annum. Similarly, in value terms, import of banana from India increased from IRs. one thousand in the year 1979 to IRs. 1289 thousand in the year 1988. Import value registered significant growth @ 8.91 per cent per annum. This revealed that pace of growth in import of banana in terms of value was higher than that of volume.

With regards to growth in unit value paid in import of banana from India, it was seen that, price paid for imported banana from India exhibited declining trend and price declined @ -3.08 per cent during the period from 1978-96. However, decline in price paid for imported banana was turned out to be statistically non significant.

Table 5.28. Import of banana to Nepal (1978 to 1996)

Year	Qty. (MT)	Value ('000' IRs.)	Value/MT (IRs.)
1978	2	5	2500.0
1979	1	1	1000.0
1980	1	1	1000.0
1981	1	3	3000.0
1982	110	325	2954.5
1983	43	295	6860.4
1984	77	455	5909.0
1985	59	352	5966.1
1986	97	602	6206.2
1987	170	663	3900.0
1988	842	1289	1530.9
1989	1273	1257	1016.2
1990	1	1	1000.0
1991	251	305	1215.0
1992	470	768	1634.0
1993	816	2124	2602.9
1994	21	114	5428.6
1995	375	609	1624.0
1996	278	424	1525.2
Mean	335.53	584.90	2942.01
CV	134.31	99.94	71.04
LGR	13.02	8.91	-3.08
'r' value	0.54*	0.50*	-0.24NS

\* - Significant at 5 % level.  
 NS - Non significant  
 CV - Coefficient of variation  
 LGR- Linear growth rate



**DISCUSSION**

## Chapter-VI

### DISCUSSION

Due to higher rate of economic returns with assured markets, more and more number of farmers are attracted towards banana crop in the study area. The most popular varieties in the areas surveyed were local Malbhog, Dwarf Cavendish ( Cv. Harichal ) and William Hybrid respectively. Before going into large scale cultivation of these varieties, it is necessary that detail costs and returns of each varieties should be worked out. Hence, detailed investigation with regard to economics of production and marketing of banana was carried out. The results are presented in the previous chapter while in this chapter the results obtained are discussed by comparing them with similar studies conducted elsewhere.

The most of the banana growers were educated upto Higher Secondary belong to age group II i.e. 31-50 years, the average land holding was 2.70 hectares of which whole area was irrigated, either by ditches or deep well borings. The cropping pattern of selected farm families was dominated by cereals which accounts for 67.01 per cent of gross cropped area while banana area was only 15.70 per cent of it. The intensity of cropping was 179.62 per cent.

## 6.1 Economics of production

The per hectare human labour utilisation for banana was 329.9, 261.5 and 253.6 mandays for varieties William Hybrid, Harichal and Malbhog, respectively. The overall human labour utilisation was 268.06 mandays. Pawar (1987) reported that banana needed higher employment of human labour of 515.94 mandays under Indian situation. The use of male labour was higher as compared to female. The use of bullock and machine labour was 1.5 pair days and 5.4 hours, respectively. Shete *et al.* (1997) reported that 31.85 pair bullock days and 4.97 hrs of tractor labour used per hectare in cultivation of banana in Western Maharashtra region of India during year 1994-95. The operationwise labour utilisation revealed that at an overall level, maximum labour was utilised (31.02 per cent) in interculturing operations followed by preparatory tillage operations 29.13 per cent.

Use of inorganic fertilizer like N, P, K, at an overall level was 499.70, 224.90 and 308.61 kg per hectare. Among these nutrients, only phosphorus was used slightly more than the recommended dose. Farm yard manure was used at the rate of 141.80 quintals per hectare. Shete *et al.* (1997) also found similar results of fertilizer use with 370.12, 199.96 and 264.72 kg N, P and K per hectare in Western Maharashtra region of India during year 1995-96.

The comparison on per hectare utilisation of various inputs in Maharashtra i.e. India and Nepal revealed that, at an overall level, N, P and K used in Nepal were slightly higher as compared to India. However, per unit

price of P and K in Nepal was 1.33 and 1.58 times higher as compared with the price of India. Also price of suckers and compost manures were higher in Nepal i.e. 3.75 and 1.65 times higher than the per unit prices of suckers and manures in India. The high price of sucker in Nepal may be due to the reason that there is high demand for suckers during recent years. However, there are not even a single government or private banana nursery established in the study area. Due to short supply of suckers, the prices were high. Hormones and insecticides and fungicides were not at all used by the banana growers in India. Pawar (1987) and Shete *et al.* (1997) have also reported no use of hormones and plant protection chemicals in Maharashtra (India). Use of bullock labour in India was 27.27 pair days per hectare which is 18.18 times higher than bullock labour utilised in Nepal. This may be due to the reason that only few farmers have employed bullock labour, particularly for ploughing and harrowing operations in Nepal in contrast they are employed in ploughing, harrowing, manure transportation and collection of fruits in India.

The per hectare cost of cultivation of banana at an overall level in Nepal was worked out to be NRs. 130841.60 of which cost A accounted for 64.04 per cent i.e. NRs. 83794.86. Pawar (1987) also reported 49.23 per cent contribution of cost A in the total cost of cultivation of banana in Maharashtra (India). Shete *et al.* (1997) also reported similar results of contribution of cost A to the tune of 55.62 per cent in the cost C. Among the items of cost A, the manures and fertilizers were the major items which contributed 21.26 per cent of the total cost. Hired human labour accounted for 14.41 per cent to the total

cost. Pawar (1987) reported that, 16.99 per cent cost was born on manures and fertilizers while hired human labour contributed 9.71 per cent to total cost in Chalisgaon taluka of Maharashtra (India). Shete *et al.* (1997) also reported that, manures and fertilizers were the major items among cost A which contributed 17.18 per cent to total cost. The contribution of hired human labour was about 6.59 per cent of the total cost.

Gross returns obtained at an overall level were NRs. 284296.38 and the net returns at cost C was NRs. 1 30841.60. Shreshta *et al.* (1993) in his study conducted in Chitwan, Nepal calculated net income per hectare of banana cultivation as NRs. 100000.00. Bhatta (1997) reported per hectare income from banana as NRs. 113522.43 in FWR, Nepal.

The cost benefit ratio obtained was 1:2.17. Pawar (1987) reported that if the farmer invest IRs. 1 in fruit production of banana in Chalisgaon taluka of Maharashtra he can get a gross income of IRs. 2.23.

The per hectare cost of cultivation of banana in Basmat and Nanded taluka of Marathwada region of Maharashtra (India) was worked out to be IRs. 51345.66 of which cost A contributed 58.20 per cent i.e. IRs. 29882.87. Shete *et al.* (1997) worked out the cost of cultivation of banana orchard as IRs. 30179.95. Pawar (1987) mentioned the contribution of cost A to total cost as 52.64 per cent in Basmat taluka of Maharashtra. Manures and fertilizers together were the major items which accounted for 22.21 per cent (IRs. 11596.73) to total cost. Hired labour contributed 9.68 per cent to total cost. Pawar (1987) and Shete *et al.* (1997) had also reported similar findings.

Gross returns obtained were IRs. 91782.66 and the net returns at cost C was IRs. 40437.00. Pawar (1987) calculated a net return of IRs. 29057.38 at cost C in Chalisgaon taluka of Maharashtra (India).

The input-output ratio at cost C was 1:1.78. Pawar (1987) calculated cost-benefit ratio as 1:1.87 in his study conducted in Basmat taluka of Maharashtra (India).

The comparative performance of different varieties of banana revealed that highest yield i.e. 419 q/ha. was realised from Harichal cultivation followed by William Hybrid 334 q/ha and Malbhog 176 q/ha, respectively. The variation in yield was mainly due to closer spacing i.e. 5' x 5' adopted in the cultivation of Harichal as against wide spacing practiced in William Hybrid (6' x 6') and local Malbhog (7' x 7'), respectively. Bhan and Mujumdar (1961) observed that closer spacing increased the yield/ha than the wider spacing due to larger population.

The yield of local Malbhog was found less as compared to improved varieties. However, it was found better in terms of storability, winter leaf injury and other cultural requirements. The improved varieties suffered from insect pests, winter leaf injury and also they had poor shelf life of fruits and require more and accurate cultural requirements. Shreshta *et al.* (1993) also reported the similar results in their studies conducted in Chitwan, Nepal.

Vegetables, legumes, maize and turmeric were the main intercrops found successfully grown in banana orchards in Nepal.

The information on loan borrowing revealed that only 36.80 per cent sample farmers had availed the facility of loan for banana cultivation. ADB/N was found to be a major lending agency extending 93.33 per cent of total lending to the banana sector. Guru-Gharana (1997) reported that ADB/N accounts for 85.00 per cent of total institutional rural credit (the rest from commercial banks). The rate of interest was around 15.00 per cent (14.86 per cent) and pay back period of loan 3.6 years. This seems to consistent with Banks current policy of 14.00 per cent interest rate and 3-5 years of pay back period for loan on banana enterprise. Loan per farm and per hectare was worked out to be NRs. 125000.00 and NRs. 142153.15, respectively.

## **6.2 Resource productivity**

In order to examine the productivity of various resources used in the production of banana crop, Cobb-Douglas type of production function was tried. The factors such as human labour, machine labour, sucker numbers, FYM, irrigation, urea, DAP and MOP were tried. The correlation matrix indicated that except FYM and DAP all the selected variables were significantly associated with the output. The correlation coefficients among the independent variables indicated that human labour was significantly associated with the machine labour, manures, irrigation, urea, DAP and MOP while non significant with the input variable sucker numbers. Suckers were negatively associated with FYM and phosphatic fertilizer i.e. DAP. Irrigation was also negatively associated with input variable DAP. Machine labour had no relation

with suckers. While all other variables were positively associated with each other. As none of the independent variables were highly correlated with each other, multicollinearity problem was not suspected.

One of the advantages of Cobb-Douglas production function is that, it can be easily converted into log linear function and regression coefficients directly represents the elasticities of production. In India most of the economists like Ramsaran (1964), Rajkrishna (1964), Sethuraman (1971), Salikram (1977) and Banerjee (1985) studied the productivity of resources by using Cobb-Douglas production function.

Results of the analysis indicated that, the inputs like machine labour, number of suckers, irrigation, and potassium fertilizer (MOP) turned out to be significant, indicating thereby the significant impact of these variables in the production of banana. The coefficient of multiple determination ( $R^2 = 0.751$ ) indicated that selected variables explain the variation in the output by 75 per cent. As the regression coefficient directly represents the elasticity of production, the elasticity of production of input variables machine labour, number of suckers, irrigation, MOP having values 0.16, 0.24, 0.16 and 0.17, respectively indicated that one per cent increase in these variables, increased the output by 0.16, 0.24, 0.16 and 0.17 per cent, respectively. Pawar (1987) reported that number of suckers used were statistically significant with the banana yield in Basmat taluka of Maharashtra (India). Ambekar (1998) in his study on productivity of resources and resource use efficiency in papaya crop found out that the input variables like human labour and irrigation were

statistically significant with the yield of papaya. However, he has also mentioned that nitrogen and phosphorous were non significant with output. Pawar (1987) reported that inputs like manure, N, P and male labour were non significant with the yield of banana in Chalisgaon taluka of Maharashtra (India).

Sum of elasticities indicates returns to scale. It was 0.32 showing thereby decreasing returns to scale. This is general phenomenon in agriculture that we mostly get decreasing returns to scale. The sample banana growers were operating in II zone of classical production function. Before increasing significant variables factor product price ratio should be considered.

The marginal value productivities of only significant variables were worked out. It is observed that MVP's of machine labour, suckers, irrigation and murate of potash were very high compared to respective marginal costs, which resulted in the higher resources efficiency. Salikram (1977) observed the high MVP's and concluded that there was a further scope to increase yield by increasing the use of manure and fertilizers. While in the present study use of manure and nitrogenous fertilizer (urea) was less than the upper limit of recommended dose. Only phosphatic fertilizer (i.e. DAP) was slightly used in excess than the recommended dose. These variables were turned out to be non significant. Patel *et al.* (1979) observed that the regression coefficient in respect of various input factors like human labour, irrigation and fertilizer were highly responsive. Ambekar (1998) reported high MVP's of land, male and female labour, irrigation and plant protection measures in the production of papaya in Marathwada region, India.

### 6.3 Marketing

The marketing of produce is as much important as the production of crop. Production of any farm products is completed only after it reaches to the final consumer. The marketing process therefore, has been regarded as a part and parcel of the production activity. The success in marketing of any produce depends upon the efficiency with which it is marketed. Banana is one of the such a fruit crop which is perishable in nature and requires greater care in marketing.

The present study has been undertaken with a view to identify the existing marketing channels, price spread, and marketing margin in marketing of banana in study area.

Most of the intermediaries belonged to age group II i.e. 31 to 40 years and educated up to secondary level. However, 35 per cent of them were illiterate.

The experience of trade in banana mentioned by wholesales, retailers and pre-harvest contractors were 8.25 yrs (range 1-12 yrs), 9.05 yrs (range 1/2 - 26 yrs) and 9.00 yrs (range 4-14 yrs), respectively. The study on marketing channels revealed that, the bananas produced in Mahendranagar area i.e. William Hybrid were sold in the local markets. The sale of banana were mainly by following two channels.

- i) Producer - Consumer
- ii) Producer - Retailer - Consumer

Similarly bananas produced in Tikapur and its vicinities (Cv. Harichal) passes through the following two main channels.

- ii) Producer - Retailer - Consumer
- iii) Producer - Wholesaler - Retailer - Consumer

Channel II was popular for the sale of bananas in local markets. However, when the produce is in bulk quantity, bananas pass to Dhangadhi market through channel III.

It was observed during the investigation that, there were no any specialised processors involved in ripening of bananas, rather the wholesalers and /or retailers themselves were involved in ripening of bananas. Calcium carbide was the chief material used for this purpose.

In case of bananas produced in Bhiuran VDC (Cv. Malbhog) the following channels were in operation to dispose off the produce.

- iv) Producer - pre-harvest contractor - retailer - consumer
- v) Producer - pre-harvest contractor - wholesaler - retailer - consumer

The movement of banana to local markets viz., Arunkhola and Chormara was by channel IV. However, Channel V was the most popular through which more than 90.0 per cent of produce was sold in Kathmandu market. Satpute (1991) has mentioned that producer - processor cum retailer - consumer was one of the channel for the disposal of low grade banana in

Nanded market of Maharashtra. Kamatgikar (1994) reported that P - PHC - W - P - R - C and P - PCR - C were two channels through which bananas passed in the local market Nanded of Marathwada region of Maharashtra.

Where, P - producer, PHC - pre-harvest contractor, PCR - processor cum retailer, W - wholesaler, P - processor, R - retailer and C - consumer.

An estimation of per 100 fingers price spread revealed that, price received by producers in three regions viz., Mahendranagar, Tikapur and Bhiuran was NRs. 108.30, NRs. 83.30 and NRs. 100.00 per 100 fingers, respectively, while consumers paid price in these three markets viz., Mahendranagar, Tikapur/Dhangadhi and Kathmandu were NRs. 133.28, NRs. 124.95 and NRs. 216.58 per 100 fingers, respectively. Hence, producer's share in consumer's rupee was worked out to be 81.26 per cent, 66.67 per cent and 46.17 per cent, respectively for these three regions. It is seen from the results that, marketing margin for three markets were 18.74 per cent, 33.33 per cent and 53.83 per cent, respectively. It can be noted that marketing margin is least i.e. 18.74 per cent where no any intermediary intervened. It increases as the number of intermediaries increases and was highest for the Kathmandu market i.e. 53.83 per cent of the total price paid by the consumer in Kathmandu market. This result was in conformity with the results reported by Nagraj *et al.* (1985). The wide gap of producer's share in consumer's rupee may be due to the inclusion of high transportation cost incurred by cultivators and higher margin of middlemen. Satpute (1991) reported producer's share in consumer's rupee equal to 52 per cent with marketing margin of 48 per cent. Kamatgikar

(1994) calculated producers share in consumers rupee more than 55 per cent for different markets and channels. The marketing margin was also more than 39 per cent.

From the results it was seen that highest profits were retained by pre-harvest contractor i.e. 21.70 per cent. This may be due to the fact that the pre-harvest contractor collects the fruit from villages at lower prices, transports them to Kathmandu and ultimately gets better prices due to good reputation of Malbhog variety in Kathmandu. The marketing charges incurred by the wholesalers and retailers were around 4 per cent in these three markets. The profit of wholesalers was 10.93 per cent and 8.17 per cent in Dhangadhi and Kathmandu market respectively. The profit of retailer was around 16 per cent in Mahendranagar and Dhangadhi markets while it was around 11 per cent in Kathmandu market. Kamatgikar (1994) has also mentioned the similar results in his study "Marketing of banana in major south Indian markets".

#### **6.4 Constraints faced by cultivators and traders**

The difficulties reported by intermediaries were difficult in marketing due to perishable nature of fruit, lack of adequate marketing facilities, delayed payments and unnecessary hassles at customs and police checkpoints both in India and Nepal.

Regarding constraints faced by cultivators in the production of banana, majority of respondents i.e. 31.25 per cent reported shortage of water in ditches during summer as the major hindrance to production followed by

predominance of duplicate fertilizers (when good quality fertilizer is in short supply) in local markets mentioned by 29.68 per cent of total growers. The other constraints recorded were problem of insect pests (28.12 per cent) non availability of chemical fertilizers in time (25.00 per cent), shortage of labour (17.18 per cent), high prices of chemical fertilizers (12.50 per cent) and lack of regulated markets (12.50 per cent).

## 6.5 Import of banana in Nepal

The study on import of banana in Nepal reflected that, on an average 335.53 metric tonnes of banana per annum were imported from India during the period 1978-96. Import of banana from India increased significantly @ 13.02 per cent per annum.

In terms of value, average price paid per annum during the period 1978-96 was IRs. 584.90 thousands. The import of banana registered significant growth @ 8.91 per cent per annum in value terms.

The price paid for imported banana in unit value was turned out to be statistically non-significant and price declined @ -3.08 per cent per annum. Koirala *et al.* (1995) reported that, in the year 1986-87, Nepal imported banana worth of NRs. 3758.00 thousand from India which had increased by 92.89 per cent in the year 1990-91 (NRs. 7249.00 thousand).



**SUMMARY**

## Chapter-VII

### SUMMARY AND CONCLUSION

In Nepal, during recent years more number of farmers are shifting towards banana cultivation due to its higher demand in local markets and thereby fetching good prices the farmers are being tempted. Presently, major demand of banana is being met out through import from India. It is becoming popular among Nepalese farmers not only due to higher economic returns but also due to early returns (12-16 months) as compared to other fruits like citrus and mangoes grown in the country. In 1995-96, the total area under banana in country was 3819 hectares with a production of 45531 metric tonnes of fruit. Banana is highly nutritive in terms of its calorific value as well as medicinal values. The area under banana crop in Mahendranagar and Tikapur is increasing and there exists scope for its cultivation.

Mahendranagar and Tikapur are the banana pockets in FWR which is shifting towards commercialisation. Bhiuran is the leading banana pocket area in MWR in terms of area and production. Under such changed circumstances it was felt necessary to take up a study on "Economics of production and marketing of banana in Nepal" with following specific objectives.

- i) To estimate the costs and returns from banana cultivation.
- ii) To study the productivity of resources.
- iii) To identify the channels for sale of bananas.

- iv) To estimate marketing cost, marketing margin, and price spread in marketing of banana.
- v) To study the import of banana in Nepal.

In conformity with the above objectives, multistage sampling design was adopted for selection of sample.

The present study is based on the primary data of 64 banana growers and 20 marketing functionaries selected randomly. The data pertained to the year 1998-99. Besides this for comparing economics of banana cultivation in Nepal vis-a-vis India, secondary data were collected. In order to achieve the sixth objective i.e. import of banana in Nepal, the time series data for the period from 1978 to 1996 were also collected.

To collect the data from respondents, survey method of data collection was adopted. The data were analysed by employing simple statistical tests viz., means, frequencies, ratio, percentage, etc. were employed to arrive at meaningful conclusions. To study resource productivity of banana cultivation linear and Cobb-Douglas production functions were fitted to the resource use and output forthcoming thereof. Similarly, to study trends in import of banana to Nepal linear and exponential equations were fitted to the time series data on import of banana. To test significance of the results various statistical tests were conducted. The results and conclusions emerged from the present study are presented in the following sections.

Total area under banana crop on the sample farms was 35.21 hectares. Most of the banana farmers (46.9 per cent) belonged to IIInd age group i.e. 31-50 years. Higher literacy percentage (79.70 per cent) was observed among sample banana growers. Some of them (17.20 per cent) were even educated upto graduate level.

On the sample farms, borings and ditches together were found to be the major sources of irrigation (45.32 per cent) to irrigate banana gardens. The average land holding was 2.70 hectares which was cent per cent irrigated and cropping pattern on the sample farms was dominated by cereals (67.01 per cent). The intensity of cropping was 179.62 per cent.

The study of labour utilisation indicated that, at an overall level per hectare average human labour utilisation was 268.01 days (219.36 male days and 48.65 female days). The highest number of human labour was used for William Hybrid (329.90 days) followed by Harichal (261.50 days) and Malbhog (253.60 days), respectively. An operationwise distribution of labour use revealed that, the interculturing operations (31.02 per cent) were found to be the most labour consuming one followed by preparatory operations (29.13 per cent) and fertilization (16.43 per cent), respectively. By and large similar trend in use of labour was witnessed for different varieties also. Average per hectare bullock labour utilisation was 1.50 pair days while per hectare use of tractor, at an overall level was 5.40 hours.

The analysis in respect of per hectare utilisation of physical inputs other than labour revealed that, at an overall level, 3412.33 suckers per hectare were used. Varietywise utilisation of suckers indicated that, highest number of suckers (4194.50/ha) were used for Harichal while lowest (2210.5/ha) for Malbhog cultivation. The average per hectare utilisation of FYM was 141.80 quintals and the fertilizer use with respect to N, P and K was 499.70, 224.90 and 308.61 kgs, respectively. The fertilizer use was slightly higher in case of P and lower in case of K than the recommended one. The per hectare average number of irrigation was 11.00. Plant hormones, liquid insecticides and dust and granules was used @ 2.00 l/ha, 1.01 l/ha and 10.31 kg/ha, respectively.

A comparative study on utilisation of various inputs between Nepal and India indicated that, use of suckers, manures, bullock labour and machine labour was more in India than Nepal. However, per unit prices of sucker, manure, bullock labour and male labour in Nepal was 3.75, 1.65, 1.06 and 2.11 times higher than that of India, respectively. There was not much difference in the utilization of human labour. However, use of N, P and K per hectare was more in Nepal as compared to that in India. Also per unit prices of N, P and K in Nepal were found to be 1.28, 1.33 and 1.58 times higher than per unit prices prevailing in India. Plant hormones and pesticides were not at all used by growers in India.

An analysis in respect of per hectare cost of cultivation revealed that, at an overall level, total cost i.e. cost C was worked out to be NRs. 130841.60. Cost of cultivation per hectare was highest for Cv. William Hybrid (NRs. 161679.07) and lowest for Cv. Malbhog (NRs. 108040.66). Among the different costs, rental value of land consumed largest share (i.e. 33.64 per cent) to total cost followed by manures and fertilizers 21.26 per cent, planting material 16.35 per cent and hired human labour 14.41 per cent, respectively. Similar trend in cost of cultivation was also observed for each variety.

Per hectare total cost of cultivation in India was worked out to be IRs. 51345.66 of which rental value of land accounted highest share i.e. 29.57 per cent to cost C followed by manures and fertilizers 22.21 per cent, hired human labour 9.68 per cent and planting material 7.16 per cent, respectively. The lower cost of cultivation in India is due to lower prices of various inputs which considerably decreased the total cost.

On an average, per hectare yield of banana for all the varieties together obtained in Nepal was to the tune of 333.70 quintals valued at NRs. 284296.38. The net income was NRs. 153454.78. The varietywise per hectare yield of banana in Nepal revealed that, the highest yield levels were recorded by Harichal (419 q/ha) and the lowest was Malbhog (176 q/ha). Varietywise, per hectare returns from banana cultivation indicated that, highest returns were realised from Harichal i.e. NRs. 180768.30/ha and least from Malbhog of NRs. 103196.94/ha. In case of India, average yield per hectare was 382.03 quintals in 15 months period which is valued at IRs. 91782.66 (NRs. 146852.26). The returns at cost C was IRs. 40437.00 (NRs. 64699.60). The C/B ratio in India and Nepal at cost C was worked out to be 1:1.79 and 1:2.17 thereby indicating economic viability of banana enterprise in both the countries. In view of this efforts need to be stressed on for encouraging the farmers of Nepal to expand area under banana as country's demand is fulfilled largely by imports from India.

Comparative performance of different varieties cultivated in Nepal revealed that, per hectare cost of cultivation for improved varieties viz., William Hybrid and Harichal was 1.50 and 1.26 times higher than the local Malbhog variety. However, the returns fetched from growing improved varieties viz., William Hybrid and Harichal were higher than that of local variety Malbhog by 57.30 and 75.10 per cent, respectively. The local Malbhog variety was found to be better for with standing to winter leaf injury and resistance to insect pests and diseases as compared to that of improved varieties.

The functional analysis revealed that regression coefficients of machine labour, suckers, irrigation and potash (MOP) inputs were positive and statistically turned out to be significant indicating thereby scope to increase the levels of these inputs so as to step up productivity of banana. The sum of elasticities of production was smaller than unity thereby showing decreasing returns to scale. This implied that, the sample banana growers were operating in second stage of classical production function. Further, it was seen that MVP/MC ratio for the inputs namely machine labour, planting material (suckers), irrigation and potash (MOP) was greater than unity thereby exhibiting their efficient use for banana production.

In the marketing of banana, three major intermediaries i.e. wholesalers, retailers and pre-harvest contractors were involved. Most of the intermediaries (40.0 per cent) belonged to age group II i.e. 31 to 40 years and educated up to secondary level (40.0 per cent), 35.00 per cent of them were illiterate. They were having around 9.00 years of experience in trade.

Study on marketing channel revealed that five channels for sale viz., (i) channel I, direct sale, (ii) channel II, sale through retailer, (iii) channel III, sale through wholesaler, (iv) channel IV, sale through pre-harvest contractor, (v) channel V, sale through pre-harvest contractor and wholesaler were identified in the study area. With regards to the marketing margins it was observed that, the marketing margins for per 100 fingers of banana were the lowest in the channel I i.e. direct sale to the consumers. Whereas, the highest marketing margins were involved in channel V (NRs. 116.58) i.e. producer - pre-harvest contractor - wholesaler - retailer - consumer.

The producer share in the consumer's price was the highest in channel I i.e. producer - consumer (94.53 per cent) whereas, it was the lowest in channel V (46.17 per cent) i.e. producer - pre-harvest contractor - wholesaler - retailer - consumer.

The main constraints in the cultivation of banana reported by the producers were shortage of water in ditches during summer (31.25 per cent), predominance of duplicate fertilizer in local markets (29.68 per cent) and problem of insects especially borers and finger scarring beetles (28.12 per cent), respectively.

Perishable nature of fruit (90.0 per cent), lack of adequate marketing facilities (30.0 per cent) and unnecessary hassles at customs and police check posts (35.0 per cent) during the import of banana from India were the major difficulties mentioned by marketing intermediaries in the marketing of banana.

A study on import of banana from India revealed that, about 335.53 metric tonnes of banana per annum were imported from India during the period of 1978-96. In value terms it was IRs. 584.90 thousands (NRs. 935.84 thousand) per annum. The import of banana registered a significant growth @ 13.02 per cent and 8.91 per cent per annum in terms of volume and value, respectively.

On the basis of the findings of the present research work, the following conclusions are emanated.

1. At an overall level, the per hectare total cost of cultivation of banana for all the varieties together worked out to be NRs. 130841.60 whereas the per hectare gross returns obtained from

banana cultivation at an overall level estimated at NRs. 284296.38. After deduction of the total cost of cultivation from the gross return the net returns realised by the banana cultivators in Nepal were NRs. 153454.18.

2. The average per hectare yield obtained in Nepal, at an overall level was 330.70 quintals as against 382.03 quintals obtained in India.
3. The per hectare total cost of cultivation of banana in India was worked out to be IRs. 51345.66 (NRs. 82153.05). The per hectare gross returns and net returns was to the tune of IRs. 91782.66 (NRs. 146852.26) and IRs. 40437.00 (NRs. 64699.20), respectively.
4. The cost-benefit ratio was found to be greater than unity for all the varieties. This implied that cultivation of banana is economically viable venture in the study area of Nepal. However, the highest CBR was recorded in the cultivation of Harichal variety i.e. 1:2.32. As against this cost-benefit ratio for cultivation of banana in India was estimated at 1:1.79 which is greater than unity thereby indicating that in India too cultivation of banana is economically viable proposition.
5. The banana growers from Nepal had used the inputs such as machine labour, number of suckers, potash application and irrigation efficiently and still there exist scope for further use of these inputs.
6. In marketing of banana the producers share in consumer rupee was found to be the highest in channel I i.e. direct sale to consumer (

94.53 %) however it may not be possible to the growers to dispose off larger quantities through this channel. Looking to these limitation the next profitable channel for sale is channel II i.e. sale through retailers to consumers ( 81.26 %).

7. Import of banana from India to Nepal increase significantly both in terms of volume and value @ 13.02 and 8.91 per cent per annum, respectively.

### **Suggestions/poolicy implications**

1. Steps should be initiated to establish a banana nursery in the study area by government or by some private sector institutions to make available quality planting material.
2. Tissue culture laboratories should also think on line of producing plantlets of Harichal variety which was found to be the most remunerative during the survey since there exist high demand for suckers of this variety in the study area.
3. Efforts should be directed towards increasing banana area throughout the country which will have two fold effects viz., generation of employment to the local labours on the one hand and import substitution on the other hand. Here coordinated approach from government, NGO's, INGO's and other private sector organisations could help in accelerating banana cultivation on a commercial scale
4. More attention should be given on the introduction of cold resistant varieties in the study area.

5. The producers must be trained with the production technology of banana so that resources can be effectively utilised.
6. More amount of loan should be made available to banana growers and the procedures for sanctioning of loan should be simplified.
7. Good quality fertilizers should be made available on time and government should strictly stop the inflow of duplicate fertilizers into the country from interior border areas.
8. The market intermediaries reap away large share, which was observed in marketing of banana (Malbhog) i.e. channel V. This can be narrowed down if marketing is done through fruit growers cooperative society. Hence, establishment of fruit growers cooperative society in the study area is suggested for quick disposal of produce and better returns.
9. Appropriate post harvest technology needs to be developed which will reduce post harvest losses and increase the shelf life of fruit.
10. For the control of bores and beetles, selection of healthy planting materials and clean cultivation is recommended. Selection of right pesticide at the right time and its application in recommended doses is suggested for the control of borers and beetles.

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