A STUDY OF POTATO COMMODITY SYSTEM IN THE HILLS OF KUMAON REGION OF UTTARANCHAL

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By

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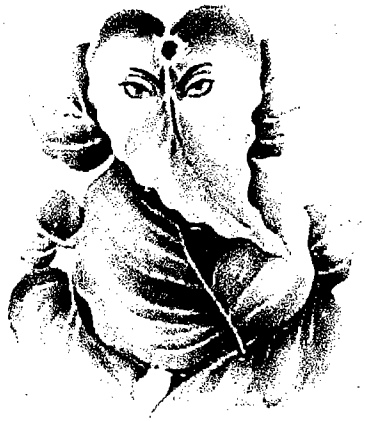

Dedicated to My Parents

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"Just don't give up trying to do what you really want to do. Where there is love and inspiration, I don't think you can go wrong".

Ella Fitzgerald

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CERTIFICATE

This is to certify that the thesis entitled **"A STUDY OF POTATO COMMODITY SYSTEM IN THE HILLS OF KUMAON REGION OF UTTARANCHAL"** submitted in partial fulfilment of the requirements for the degree of **DOCTOR OF PHILOSOPHY** with major in **Agricultural Economics** and minor in **Agricultural Statistics** of Post-Graduate Studies, G. B. Pant University of Agriculture & Technology, Pantnagar, is a record of *bona fide* research carried out by **Ms Ritambhara Singh, Id. No. 27755** under my supervision, and no part of the thesis has been submitted for any other degree or diploma.

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

4.7.05

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We, the undersigned, members of the Advisory Committee of **Ms. Ritambhara Singh, Id. No. 27755,** a candidate for the degree of **DOCTOR OF PHILOSOPHY** with major in **Agricultural Economics** and Minor in **Agricultural Statistics,** agree that the thesis entitled **"A STUDY OF POTATO COMMODITY SYSTEM IN THE HILLS OF KUMAON REGION OF UTTARANCHAL",** may be submitted in partial fulfilment of the requirements for the degree.

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CHAPTER 1

Introduction

INTRODUCTION

Poverty and large and fast growing population are significant and persistent problems in India. These problems, besides having close relationship with food insecurity are also related with poor health and malnutrition. Food and nutritional security is, therefore, an important national priority. Unfortunately nutritional security has not received due attention because the main emphasis has been on alleviating hunger. In other words, while the requirement of food in bulk has been receiving due attention of the policy makers and administrators, the important requirement of assimilable nutrition has received little attention. A developing country like India, needs not only the adequate quantity of food but also quality of a balanced nutritious food in order to enable its citizens to lead a healthy life. Burgeoning population results in greater demand and higher pressure on the limited land to produce required quantity of food. Pressure on land for non-agricultural use is also increasing tremendously.

Therefore, India should identify and practice crops, which are not only highly productive but nutritionally balanced. Potato meets both these requirements **(Shekhawat, 1999).** In the words of Dr. M.S. Swaminathan, "the present vulnerability of national food budgets to the vagaries of weather arises for over dependence on too few crops for our daily bread. Potato can help to minimize the food supply base and thereby help to minimize the risk of serious food shortages in the tropics and subtropics". Potato is the most important non-cereal food crop of the world. Developing countries today produce 37 per cent of world's total output of potatoes. This spectacular

growth of potato in developing countries, affirms its increasing importance as a source of food for the ever-growing population, rural employment, and income. In order of importance for food production, in comparison to 20 other major food crops on fresh weight basis, potato ranks 6th in the developing countries, 4th in the developed countries, 4th in the world and 3rd in India.

Potato is an important crop in India. Both area and production has increased manifolds during the past decades. The estimated area and production of potato during 2001-02 **(DES, Ministry of Agriculture, Government of India)** was 1.41 million hectare (m ha) and 24.00 Million Tonnes (MT), respectively, India produced 24.08 MT of potato from an area of 1.22 m.ha. in the same year with the highest productivity of 19.769 t/ha which was maximum in the past 50 years (Table 1.1). The productivity of crop in India is low (19.76 t/ha) as compared to Belgium (49.09 t/ha), New Zealand (45.0 t/ha), The Netherlands (43.04 t/ha), UK (39.66 t/ha), Israel (38.71 t/ha) and USA (38.27 t/ha). This may be due to the fact that wide ranging variations are found in agro-ecological setting of the different parts of the country.

Table 1.1: All India Area, Production and Yield of potato from 1950-51 to 2001-02

Year	Area (m ha)	Production (MT)	Yield (t/ha)
1950-51	0.24	1.66	6.917
1954-55	0.27	1.76	6.632
1959-60	0.36	2.73	7.550
1964-65	0.43	3.61	8.895
1969-70	0.50	3.91	7.888
1974-75	0.59	6.23	10.598
1979-80	0.69	8.33	12.152
1984-85	0.85	12.57	14.806
1989-90	0.94	14.77	15.714
1994-95	1.07	17.40	16.272
1999-2000	1.34	24.71	18.443
2000-01	1.22	22.49	18.404
2001-02	1.22	24.08	19.769

Source : CPRI, Shimla

Moreover, the growers lack in adoption of appropriate technologies suited to the biophysical and socio-economic situations. Thirdly, production of potato in India follows 3-4 year cycle. Severe 'gluts' were experienced during 1975, 1979, 1982, 1985, 1987 and of late in 1997 and 2000 causing heavy setback to the potato growers in the country. Low yield coupled with yearly fluctuations in potato prices pose serious threat against sustaining potato revolution in India. Therefore, all our efforts may be put in to improve potato productivity with low inputs including water economy and growing varieties with higher water use efficiency and salinity/drought tolerance to exploit areas not yet thought to be suitable for potato **(Chadha, 2001)**. Today India is the third largest producer of potato in the world, the other two being China and Russian Federation (Table 1.2).

Table 1.2 : Area, production and yield of potato in Major potato growing countries of the world (2001-02)

Country	Area ('000 ha)	Production ('000 tonnes)	Yield (t/ha)
World	19301	308195	15.968
China	4202	64045	15.242
Russia	3335	34500	10.345
India	1218.2	24082	19.769
Poland	1194	20401	17.083

Source: www.fao.org

Among all the vegetable crops, potato occupies a premium place in India both in terms of area and production as is revealed by Table 1.3.

Table 1.3: Estimated area and production of major horticultural crops during 2001-02

Crops	Area (mha)	Production (MT)
Fruits	3.95	46.60
Vegetable	6.89	96.54
•Brinjal	0.50	7.80
•Cabbage	0.27	5.70
•Cauliflower	0.27	4.70
•Okra	0.36	3.42
•Onion	0.52	4.85
•Pea	0.34	3.11
•Potato	1.41	24.00
•Tomato	0.52	7.42
•Others	2.70	35.54
Flowers	0.11	0.57
Spices	2.60	3.08
Cashewnut	0.73	0.46
Arecanut	0.29	0.33
Coconut	1.85	8.80
Other horticultural	0.12	0.17

Source: DES, Ministry of Agriculture, Government of India.

A remarkable progress is evident when we compare ACGR (Annual Compound Growth Rate, 1950-2000) of production of wheat (4.54 per cent) and rice (2.84 per cent) with potato (5.76 per cent). This has been made possible as a result of the development of location specific and problem based varieties and production technologies of potato **(Chadha, 2001).**

According to the estimates published by International Food Policy and Research Institute (IFPRI) and International Potato Center (CIP), India is likely to have the highest growth rate in production and productivity of potatoes during 1993-2020. During the same period, worldwide demand for potatoes is expected to increase by 40 per cent. The scenario calls for concerted efforts to capture the global market by producing International quality potatoes and

value added processed products. Projections made by Central Potato Research Institute, India, also indicate a production of 49 MT from an area of two m ha by 2020 **(Bist and Sharma, 1997).** To be nationally comfortable and globally competitive, we in India would have to keep pace and adapt to the new emerging trends in potato production and utilization.

Table 1.4: Statewise Area, Production and Yield of Potato in India during the year 2001-02

State/UT	Area ('000 ha)	Production ('000 tonnes)	Yield (t/ha)
Andhra Pradesh	2.4	14.7	6.125
Arunachal Pradesh	4.6	32.6	7.087
Assam	80.1	620.6	7.747
Bihar	140.8	1432.3	10.172
Chattisgarh	9.6	71.3	7.427
Gujarat	32.3	802.0	24.829
Harayana	13.8	305.0	22.101
Himachal Pradesh	12.1	145.3	12.008
Jammu and Kashmir	1.9	20.1	10.578
Karnataka	39.6	489.4	12.358
Madhya Pradesh	35.0	471.9	13.482
Maharashtra	16.8	77.1	4.589
Manipur	3.0	15.9	5.300
Meghalaya	18.3	144.0	7.868
Mizoram	0.7	4.5	6.428
Nagaland	5.1	57.4	11.254
Orissa	7.6	78.4	10.315
Punjab	70.5	1413.9	20.055
Rajasthan	2.4	27.8	11.583
Sikkim	6.2	25.8	4.161
Tamil Nadu	4.7	89.2	18.978
Tripura	5.4	106.3	19.685
Uttar Pradesh	389.9	9570.0	24.544
Uttaranchal	22.07	448.49	20.32
West Bengal	299.8	7822.3	26.091
Delhi	0.1	0.5	5.000
All India	1218.2	24082.0	19.76

Source: CPRI, Shimla

Table 1.4 shows statewise area, production and yield of potato in India during the year 2001-02.It clearly shows that during the year 2001-02 area

under potato crop was maximum in Uttar Pradesh followed by West Bengal and Bihar. Production also fashioned in a similar manner. Uttar Pradesh was the highest potato producing state followed by West Bengal and Bihar. Yield wise West Bengal ranked first followed by Gujarat and Uttar Pradesh. The state of Uttaranchal ranked fifth with a promising yield of 20.32 t/ha, which ensures the potential of potato crop in this state.

Potato is a crop, which not only provides more food on per hectare as well as per day basis but also is the cheapest and richest source of nutrients and calories. A comparative account of carbohydrate, fibre, fat and vitamin production (per ha/day) of potato and other major food crops is presented in the following Table 1.5.

Table 1.5: Carbohydrate, fibre, fat and vitamin production per ha/day) of potato and other major food crops

Crop	Carbohydrate (kg)	Fibre (g)	Fat (g)	Vit C (g)	Vit B (g)
Potato	42.5	752	188	32.0	2.5
Wheat	14.8	249	311	0.0	1.3
Rice	11.2	29	72	0.0	0.3
Maize	7.1	287	383	0.0	0.3
Soybean	2.0	352	1856	0.0	0.5

Source: Bist and Sharma (1997)

The table shows that potato has highest content of carbohydrate, fibre, Vit C and Vit B per hectare per day if compared with other major cereal and pulse crops. The fat content in potato is quite low against the myth that it is a rich source of fat. Potato also tops in dry matter and protein production (kg/ha/day) with present yield levels and future potential yields (Table 1.6).

Table 1.6: Dry matter and protein production (kg/ha/day) with present yield levels and future potential yields of potato and other major food crops

Crop	With present yields		With potential yields	
	Dry matter	Edible protein	Dry matter	Edible protein
Potato	47.6	3.0	111.6	7.1
Wheat	18.1	2.5	24.0	3.2
Rice	12.4	1.0	32.2	2.5
Maize	9.1	1.2	12.4	1.6

Source: Ezekiel *et al.*, 1999.

The major constituents of potato tuber are water, carbohydrates, crude proteins, fibre, fat and minerals. The per cent content of these items are given in Table 1.7.

Table 1.7: Major constituents of potato tuber

Constituents	Content (per cent)
Water	75-80
Carbohydrates	16-20
Crude proteins	2.5-3.0
Fibre	0.6
Fat	0.1
Minerals	1.0

Source: Shekhawat *et al.* (1992)

The table 1.7 shows that potato is a rich source of carbohydrates while the fat content is much less. Potatoes yield 10077 thousand calories per hectare as against 4629 and 3630 thousand calories by wheat and rice, respectively and thus, produce two to three times more calories in shorter time than these important cereals crops **(Singh and Choudhry, 1977).** Moreover, it is not a competitive crop for these cereals. Therefore, it gives supplementary advantages in the production of other crops. Some salient

features of potato that make it universally important crop **(Shekhawat and Naik, 1999)** can be summarised as:

- It is a short duration crop with higher potential yield as compared to any cereal crop.
- It has high protein calories ratio (17 g : 1000 K Cal)
- It allows farmer to harvest upto 80 per cent of dry matter.
- It yields more edible energy, protein and dry matter per unit area and time than many other crops.
- Wide flexibility in planting and harvesting dates makes it most suitable for inclusion in intensive cropping systems.
- It is highly nutritious as it is a source of carbohydrates, proteins, minerals, vitamin C and a number of B group vitamins and high quality dietary fibre.
- Biological value of protein in potato (about 71 per cent that of whole egg) is better than that of wheat (53 per cent), maize (54 per cent), peas (48 per cent), beans (46 per cent) and is comparable to cow's milk (75 per cent).
- In India, it can be grown throughout the year in one part or the other.
- It responds well to inputs and gives higher returns.
- It has high employment generation potential during crop raising, post harvest handling and processing.

Potato is a perishable and bulky produce. Therefore, the production of potato requires development of other subsidiary industries like cold storage, processing, transportation etc.

Inspite of the above advantages, the potato crop has not received its due place in food production planning in India, because since the beginning of the planning era efforts have centered around to increase food grain production. Plan outlays revealed that practically no outlay was provided for the development of horticultural crops upto the third Five Year Plan. Only a modest allocation of Rs. 34.78 million was done in fourth plan, which was increased to Rs 319.56 million in the seventh plan and to Rs. 1047 million in the eighth plan. It was Rs 5500 lakhs in the ninth plan and Rs.4744 lakhs in the tenth plan.

The per capita yearly consumption of potatoes in India is only 14 kg. It is now increasingly recognized by the nutritional experts that per capita consumption of potatoes should be increased to a much higher level. With the rise in per capita income and standard of living of the people, we can expect a sharp increase in the demand for potato. It will be a desirable development in view of the fact that it is a very nutritive crop, and a cheap source of protein as well as calories, which can correct some of the present nutritional imbalances. Potato also serves as a raw material in different industrial products and can be readily converted into fermentable sugars, maltose, dextrin, alcohol etc. and thus is important for the development of agro-industries. Besides its labour intensive nature, potato is a short duration crop and its inclusion in cropping pattern increases the cropping intensity, thereby increasing production per unit of area and time. Hence, there is a

great potential and scope to enlarge its area, step-up yield and enhance production and consumption in the country.

1.1 Problem Statement

The state of Uttaranchal is important in respect of potato cultivation in the country. The productivity of potato is higher (20.32 t/ha) in the state than the national average (19.76 t/ha) according to data furnished by Directorate of Horticulture and food processing, Chaubatia, Uttaranchal during the year 2001-02. Potato is a prime crop in the state as it is a good source of income and employment generation. Kumaon region has produced more than 50 per cent of total production of potato in the state in year 2001-02. Among 13 districts of Uttaranchal, Nainital district in Kumaon region accounts for the highest production (11.78 per cent) of potatoes in the state (Table 1.8).

To strengthen the strategy for commercialization and diversification of agriculture, the state of Uttaranchal plans to promote increasing area under horticulture and other ancillary activities. Though the strategy to increase acreage, yield and production of potatoes through improved technology are essential, but this by itself would not be sufficient for sustaining the growth of potato industry. It needs to be supported by excellent marketing strategies. The state of post harvest management and marketing infrastructure is far from developed particularly in the hilly regions and this needs to be strengthened. The agribusiness has not really progressed. Even the entrepreneurs who are keen to set up processing storage etc. don't find favour with bankers as they don't have credentials to provide security. The lack of regulation in the area has led to under developed infrastructure **(Kashyap, 2001)**. There is a great

Table 1.8: District wise Area Production, productivity of vegetables and potato in Uttaranchal (2001-02)

S.No.	District	Vegetables			Potato		
		Area (000 ha)	Prodn (0000 tonnes)	Pty (t/ha)	Area (000 ha)	Prodn (0000 tonnes)	Pty (t/ha)
1	Nainital	6.974 (8.68)	45.128 (9.16)	6.47	2.360 (10.69)	52.822 (11.78)	22.38
2	U.S.Nagar	4.603 (5.73)	48.269 (9.79)	10.49	2.414 (10.94)	52.059 (11.61)	21.57
3	Almora	7.490 (9.32)	29.116 (5.91)	3.89	2.371 (10.74)	52.661 (11.74)	22.21
4	Bageshwar	1.919 (2.39)	9.004 (1.83)	4.69	0.539 (2.44)	10.660 (2.38)	19.78
5	Pithoragarh	5.529 (6.88)	15.000 (3.04)	2.71	1.637 (7.42)	37.000 (8.35)	22.60
6	Champawat	3.487 (4.34)	22.587 (4.58)	5.48	1.883 (8.53)	31.360 (6.99)	16.65
A.	Kumaon (Total)	30.002 (37.35)	169.104 (34.32)	5.64	11.204 (50.75)	236.562 (52.75)	21.11
7	Dehradun	9.843 (12.25)	63.999 (12.98)	6.5	1.741 (7.88)	45.072 (10.05)	25.89
8	Pauri	7.964 (9.91)	23.287 (4.72)	2.92	1.422 (6.44)	22.596 (5.04)	15.89
9	Tehri	7.805 (9.72)	14.245 (2.89)	1.83	2.238 (10.14)	47.273 (10.54)	21.12
10	Chamoli	4.633 (5.77)	21.000 (4.26)	4.53	2.100 (9.51)	27.000 (6.02)	12.86
11	Rudraprayag	0.862 (1.07)	5.960 (1.21)	6.91	0.560 (2.54)	9.300 (2.07)	16.61
12	Uttarkashi	6.754 (8.41)	42.911 (8.71)	6.35	1.890 (8.56)	42.293 (9.42)	22.38
13	Haridwar	12.469 (15.52)	152.279 (30.90)	12.21	0.920 (4.17)	18.400 (4.10)	20.00
B.	Garhwal (Total)	50.330 (62.65)	323.681 (65.68)	6.43	10.871 (49.25)	211.934 (47.25)	19.50
C.	Uttaranchal(A+B)	80.332 (100)	492.785 (100)	6.13	22.075 (100)	448.496 (100)	20.32

Source : Directorate of Horticulture and Food Processing, Chaubatia, Uttaranchal

Note : Figures in parentheses indicate the percentage to total of Uttaranchal

need to modernize the whole system of the commodity including the supply of the inputs, financing and marketing of potato which is a perishable product. Traditional farm management studies and/or marketing studies on a particular commodity usually concentrate on a particular aspect of a problem investigated. While such an approach is useful, it fails to take into account the many related aspects of a commodity. All the aspects of a commodity from farm supplies to farming, assembling, storing and distribution and coordinating institutional arrangements are integrated. Hence, by considering one or few aspects of the commodity, realistic policy decisions to modernize its system, can not be taken.

The commodity system of an important crop like potato in the hills of kumaon region of Uttaranchal has five major parts or sub-systems viz., input supply, financing, production, marketing and consumption. To initiate any programme or policy for the improvement of whole of the potato commodity system, an understanding of the strengths and weaknesses of various segments of the existing system is necessary. These parts (sub-systems) are interdependent in a number of ways. Understanding of these interrelations and that of problems connected with each of the sub-system is also necessary for the modernization of whole potato system and initiating policy changes affecting it. The production of a commodity depends on the resource use pattern. A farmer has to maximize his income from given resources. Potato production in particular is directly related to the availability of inputs and services. A little delay may adversely affect the potato production. Potato production in hills has a special role in fulfilling the demand of people. While its production is concentrated around December and March in few

surplus states, in the state of Uttaranchal its production is concentrated around June to October.

Potato produced in Uttaranchal serves as an off-season crop in fulfilling a part of total demand of the plains, other being potato from Himachal Pradesh. The storage is not required at farm level, as the product is quickly disposed off in the market after the harvest due to its higher demand. However, marketing infrastructure facilities are also very crucial which are poor in the hills of the region. There is also need to have an efficient potato marketing system, as it is a pre-requisite to stable and remunerative prices to the producers. The potato trading is mainly in the hands of private traders. In the year of bumper harvests, there has been absolute slump in prices. In years of poor crop, prices shoot sky high. It makes uncertainty in the minds of producer and consumer both in terms of low prices received in case of former and high to be paid by the latter **(Diwakar and Muralidharan, 1980)**. Though the government has regulated the markets for the benefit of producers but in regulated markets also farmers are said to be exploited at the hands of traders. It is said that private traders (buyers) use to make unauthorised deductions from the farmers (sellers) even in regulated markets.

Hence, to take major policy decisions to promote the development of such a promising crop, the whole system of the commodity should be made efficient. The system approach emphasises the integration of all aspects of agri-business, from farm supply to production, assembling and distribution of the crop. It also includes all the institutions and arrangements that affect and coordinate the successive stages of a commodity flow, such as government,

markets, trade associations, cooperatives, financial institutions and educational organisations.

Inspite of over-whelming importance of potato in our country, as discussed in earlier pages, no systematic attempt has been made to study in detail its commodity system except for a few partial studies undertaken by the Directorate of Marketing and Inspection, Government of India, and others. The studies undertaken in particular have considered different aspects in an isolated manner. Uttaranchal opened new fields of agricultural and agri-business research since its formation in the year 2000. Inspite of the fact that potato is the single crop in the state having largest production than any other vegetable crop, no study on the commodity system of the potato has been done so far.

The above problematic situation calls for a thorough investigation into potato commodity system as a whole. The empirical findings of the study would serve as a guide to the policy makers, producers and all those who are interested in this crop in mobilising its potential and improving the efficiency of various functions of the system, which would ultimately benefit the producers. With this practical utility in mind, this study has been undertaken in the Kumaon hills of Uttaranchal state with the following major objectives:

1.2 Objectives of the study

1) To study the existing potato commodity system.

2) To project optimum potato commodity system under alternative scenarios.

3) To compare the existing and optimum potato commodity system under alternative scenarios and draw policy implications.

1.3 Organisation of the study

The whole study has been divided into seven chapters. In the introductory chapter, the problem was identified and conceptualized. The main objectives of the study were also given in this chapter. Chapter 2 has been devoted to a brief review of studies on various sub-systems of the commodity and agribusiness commodity system approach. Chapter 3 deals with the origin and history of potato and a brief description of cultivation practices of the crop in the state of Uttaranchal. Chapter 4 focusses on the profile of the study area. The data and its sources, methodology and analytical framework adopted for the study is discussed in the Chapter 5. Chapter 6 deals with the results and discussion while the last Chapter throws light on the summary and conclusion and policy implications of the study. A brief bibliography of relevant references and appendices of initial simplex programme of the Linear Programming Model is also given at the end of the manuscript.

CHAPTER 2

Review of Literature

REVIEW OF LITERATURE

An attempt has been made in this chapter to review the available literature relating to input supply, production, financing and marketing of potatoes and the agri-business commodity system. The reviewed literature has been classified into six sections. Section 2.1 through 2.5 present reviews on input supply, financing, production, marketing and agribusiness commodity system respectively. Finally the last section 2.6 presents comments on the reviewed work.

The literature reviewed here provides the basic background for this study with respect to consummation of the problem and formulation of an appropriate agribusiness potato commodity system model.

2.1 Reviews on input supply

The studies reviewed in this section deal with efficiency of various input supply systems, their performance and impact on production.

Alhavale *et al.* (1973) in their study on supply of fertilizers reported that out of two agencies, namely cooperatives and private dealers, operating in the Jabalpur district of Madhya Pradesh, cooperative had a larger share in total supply. The distribution cost formed 9.09 per cent for super phosphate, 8.19 per cent for ammonium sulphate 7.83 per cent for calcium ammonium nitrate of farmer- consumer's rupee.

Ghodke *et al.* (1973) used the data from trials as well as from 63 Haryana farmers. Using production function as the analytical tool they reported that farmers used either too much or too little of pesticides in

American cotton, lacking suitable guide lines. In both cases profits from pesticide application were sub-optical. Authors compared their results with the findings of Bhutani who found that application of six dustings (i.e., 163 kgs of dust/hectare) in cotton was desirable to have maximum economic gains. The results of the authors indicated that the gains could be maximised by using much smaller quantity of pesticide. It was recommended that the recommendations based on maximization of physical products are improper. The optimum quantity of pesticides was much smaller.

Rai *et al.* (1973) in their study on "Input supply and output performance in Haryana state" showed that there is direct relationship between input supply and output performance. Study showed an imbalance in the supply of different factors of production in different regions of the state. It was found that even in the advance district of Karnal where 70 per cent of total cropped area is irrigated and nitrogen consumption is 37 kgs per hectare, the analysis indicated sufficient scope for increasing production with an increase in the supply of inputs, primarily nitrogenous fertilizer and irrigation water.

Rajgopalan *et al.* (1973) attempted to study the efficiency of existing system of marketing of fertilizers in Tamil Nadu. The results showed that the marketing system is not efficient as increased satisfaction to farmers could be derived at increasing cost due to availability of desired type of fertilizers in time.

Sankhyan *et al.* (1973) studied the efficiency and impact of various fertilizer supply systems on production in the Punjab. In order to compare the

efficiency of fertilizer supply system (cooperatives and private trader), the distribution cost per quintal of different fertilizers were worked out for each system and compared. Distribution costs ranged from Rs.3.00 to Rs.10.50 per quintal in case of cooperative agency. However, this range was found from Rs.3.00 to Rs.20 per quintal in case of private trade. It was found that the distribution costs of fertilizers were generally higher in the case of private trade as compared to the cooperatives for a similar brand of fertilizer. These higher distribution costs for private trade were mainly due to higher margins. In order to investigate the effect of variations in the fertilizer supply system on production at farmer's level, wheat production was regressed on area under wheat, labour used and capital, with fertilizer supply systems as dummy variables and it was concluded that the system of fertilizers supply has no effect on production whatsoever at farmers level.

Singh *et al.* (1973) analysed the supplies of input factors and their performance in the form of average yield per hectare and total output of food production in the IADP district Aligarh. It was noticed that all the important crops of the district, had shown an increase in the average yields per hectare during the ten years period. Due to the supply of fertilizer, improved seeds and pesticides the total output of the district has been doubled during the ten year period together with increasing multiple cropping programme and increased area under irrigation.

Singh and Shri Ram (1973) studied the impact of different fertilizer supply systems on agricultural production in Moradabad district (U.P.). It was observed that 84.2 per cent of small farmers purchased fertilizers directly from the market while only 15.8 per cent reported to have got it through

cooperatives. None of the small farmer purchased fertilizers from agricultural seed store because of the uneasy approach, wastage of time in coming and going and white collar mentality of store incharge. In medium group also the higher percentage of farmers purchased fertilizers from market but in large group the share of market purchase was lowest. It was found that the sugarcane yield due to the impact of cooperative societies was highest in comparison to the other system because of the special attention given by sugarcane cooperative societies in fertilizer supply. The level of yields in respect of sugarcane, wheat, paddy and maize due to market supply were the lowest mainly because of adulteration and poor quality of fertilizers.

Calkins and Su-hua Tu (1978) surveyed the white potato production in Taiwan. In their attempt, to study the influence of pesticides and fertilizers on yield and net return from potato, they concluded that spraying pesticides in potato crop as a whole was non-economical, perhaps because farmers inappropriately mix many kind of pesticides together or spray on problems for which no control has been discovered. Their surprising results showed that with the more use of fertilizer, yields declined. As fertilizer value increased, there was a substitution of inorganic for organic sources and a progressive reduction in net profit and farm income. Regression analysis showed that there was a significant relationship (at 10 per cent) between fertilizer cost and yield only in late season crops whereas in early and mid season crops there was no significant relationship between fertilizer expenditure and level of output per hectare.

The study on **"Economics of production, marketing and storage of potato in district Farrukhabad (U.P.) (1979)"** reported that the supply of

good quality seeds at reasonable rates is the most important factor in potato cultivation. But as the availability of quality seed of potato was limited, majority of farmers were compelled to use their own home produced seed which was not of good quality. Farmers were still using traditional varieties of potato, namely ON 1645 which is low yielding and suffers from diseases.

Rao (1980) made an attempt to identify major factors influencing the pesticide use on different size groups of farms. Lorenz curve, Gini-Lorenz ratios, markov chain analysis, discriminant function analysis and demand function analysis were undertaken to study the stated objectives. It was found that the manufacturer- wholesaler- retailer – farmers distribution channel was relatively efficient of the other two distribution channels, viz., manufacturer – wholesaler – cooperatives – farmer and manufacturer-government- farmer. In view of the exploitation of farmers by private traders the present Government policy has to be streamlined. Pesticide price was the major variable affecting the demand for pesticide on major crops.

Theile (1997) found that in Andean countries of Bolivia, Peru and Ecuador, informal seed systems were more important than formal ones. The demand for seed in the formal system fell due to high cost of seed, limited access to credit, the slow rate of degeneration and the feasibility of producing seed in good physiological conditions. The supply of seed through the formal system was also inadequate. In the three countries, strategies were being developed to link formal seed systems to informal areas. Reasons to support such linkages were examined. The objectives and interventions strategies in the informal system of the three countries were analysed. The most appropriate strategy depended on the rate of degeneration of the seed, the

difference in costs and returns between using formal versus informal seed, the degree of market integration among target producers, and the resources available to the project.

2.2 Reviews on Financing

The studies discussed in this section are about the financing system of the crop.

Murthy *et al.* (1977) in their paper on crop loan requirements of farmers in Hoskote taluka of Bangalore district, Karnataka assessed the crop loan requirements of farmers and the extent to which they have been met by the Agricultural Development Branch of the State Bank of India at Hoskote in Bangalore. The analysis was based on data collected from a sample of 25 paddy growing and 25 potato growing farmers in Hoskote, relating to the year 1974-75. It was observed that the use of recommended technology in paddy cultivation involved an additional cash expenditure of Rs.876 per acre in paddy cultivation. The limit of finance provided by the State Bank of India in the study area was Rs.850 per acre of paddy, which was below the cash expenditure involved for adopting all the recommended practices by the farmers. The limit of financial aid fixed for potato cultivation in the area was Rs.2,150 per acre which was far less than the gross expenditure of Rs.4380 actually incurred by farmers in the area. The need was stressed for raising the limits of crop loan finance to Rs.1,275 and Rs.3,800 per acre for paddy and potato respectively.

Chandrakanth and Rebello (1980) examined the feasibility of crop insurance for potato growers under rainfed conditions in Hassan taluk of

Karnataka, India. It attempted (1) to identify the risks in potato cultivation faced by farmers; (2) to estimate the premium rates using normal curve technique; and (3) to bring out some important requirement of a crop insurance programme for potatoes using data from 150 farmers in the taluk for the years 1971/75. The most important causes of the yield variability, especially of the low yields obtained, were the failure of rains during critical periods of planting and tuber initiation, and the use of poor quality seed tubers. Whereas the risk of crop loss due to the first cause was insurable, the risk due to the second was not insurable. The quantum coverage was estimated at 5.3 tonnes per hectare to cover the operational cost of Rs.3441 per hectare at the average price of Rs.650 per tonne. The pure premium to be charged was worked out at 0.33 tonne per hectare or Rs.215 per hectare.

Singh and Joginder (1982) examined sources of credit for marketing potatoes, the impact of additional credit on farmers' marketing decisions, the comparative costs of cold storage of potatoes for alternative periods and markets, and capital and credit needs of different categories of farmers for potato storage and transport in Jullunder district, Punjab (India). The study covered the year 1977-78. The majority of producers sold their produce immediately after harvest on the farm or in the local town market. Most local sales through commission agents from whom the farmers had obtained loans for production, consumption and marketing. For orderly and efficient marketing, it is suggested that the producers should obtain marketing finance.

2.3 Reviews on potato production

The available studies on potato production are discussed below:

Singh and Choudhary (1977) found that the increase in potato production in Haryana state was generally more due to expansion in area under potatoes and improvement in yield played a secondary role. The area under potato in Haryana grew at a compound growth rate of 4.5 per annum between the year 1951-52 to 1975-76. The compound growth rate for production was 5.4 per cent. The economics of potato production for Haryana state as a whole, for the year 1975-76 showed that net income per hectare was Rs.1589.97. The cost of potato production was Rs.6757.67 per hectare. Among different cost items, seed cost was highest followed by the cost of fertilizers, rental value of land, irrigation and harvesting.

Calkins and Su-Hua Tu (1978) in their survey on potato production in Taiwan found that yield of table potato was highest in the middle season (November 2- December 9), when price was lowest, and on sandy loam soils. Total production costs were the highest in the early season (August 15-November 1) when farm income was also highest. Net return, however, was the greatest in the late season (after December 9), because farmers in that season had proportionately higher non-cash costs. Analysis showed that increases in production costs had a negative effect on net return and farm income. Producers of seed potato were found to be different from the producers of table potato in that they had higher production costs, price, farm income, net return, and percentage of qualified tuber.

In the study on **"Economics of production, marketing and storage of potato in district Farrukhabad, U.P." (1979)** costs on inputs and returns obtained from potato cultivation per hectare on sample holdings of potato farmers at three points of time, viz., 1971-72, 1975-76 and 1979-80 have been worked out. Study revealed that there has been a considerable increase in cost of cultivation per hectare of potato during 1978-79 over 1971-72. It was Rs.3749.69 during 1971-72 as against Rs.6227.00 during 1978-79. This rise in total cost was mainly due to rise in costs of all input factors in general and those of fertilizer and irrigation in particular. The per hectare cost of production (cost of cultivation + marketing charges per hectare) came to Rs.5073.99 during 1971-72, Rs.6470 during 1975-76 and Rs.7520.75 during 1978-79. As regards returns, potato yielded a net return of Rs.1530 during 1975-76 as against Rs.1843 during 1971-72. The farmers sustained a loss of Rs.770.75 per hectare during 1978-79 because of bumper production on one hand and distress sale on the other. The average yield per hectare at three points of time came to 190 quintals during 1971-72, 200 quintals during 1975-76 and 225 quintals per hectare during 1978-79.

Chatha and Sidhu (1980) have reported that the production of potato in Punjab increased significantly during the recent years. The compound growth rate of production during 1966-67 to 1971-72 was only 0.90 per cent per annum. It rose to 24.59 per cent during 1972-73 to 1977-78. The overall growth rate from 1966-67 to 1977-78 worked out at 12.69 per cent per annum. The increase in production resulted from the increase in acreage as well as from the increase in productivity. The factors responsible for the increase in acreage were the availability of good seed locally through the seed plot

technique and expansion of cold storage industry. It has been concluded that to maintain the tempo of potato production, development in the infrastructure of marketing should also be made.

Dahiya and Sharma (1980) analysed the data on cost of cultivation of potato in Farrukhabad district of Uttar Pradesh, India, since 1971 and showed that the cost of cultivation has been rising. Percentage break up of total cost indicated that there is a shift from seed as a major cost factor towards fertilizer, human labour and irrigation. During the last five years, the cost of cultivation ranged from Rs.5400 to Rs.2800 per hectare in the plain of North India. It was observed that seed, manure, fertilizer, labour and rent, irrigation water accounted for 70-90 per cent of total cultivation cost. Potato seed accounted for the highest, 33 to 54 per cent (average 41.6 per cent) of total cost followed by manure and fertilizer costing between 15 to 26 per cent (average 17.4 per cent). Other major cost item was labour between 12 to 20 per cent (average 14.90 per cent). Studies conducted in Farrukhabad in 1971-72 to 1975-76 vividly revealed a decline in cost benefit ratio due to escalation in production cost despite slight improvement in productivity and prices.

Rangaswamy *et al.* (1981) in their study on "Production and marketing of potato in Punjab" reported that most of the districts of the state had significantly positive growth rates in area production and yield for the period 1966-67 to 1979-80. Growth rates for the state were 8.5 per cent in area, 13.8 per cent in production and 3.8 per cent in yield. Potato had a key place in the cropping pattern on the sample farms as percentage area to gross cropped area devoted to potato was second only to that of wheat. On different sizes of farms, it was indicated that the proportion of area under food

crops was negatively related and of cash crops (potato) was positively related with the size of holding. The late potato crop commanded a very negligible area because the technological improvements in wheat cultivation facilitated wheat cultivation after potato harvest. In Tanda market area, the cropping intensity was pushed upto 2.06 by potato cultivation. Potato seed was the most expensive item as if accounted for about half of the total paid out cost. The total paid out costs per acre worked out of Rs.2820.00 and Rs.2420.00 for Hoshiarpur and Tanda farmers respectively yields being same (at 56 quintals per acre) for farms in both markets, Tanda farmers managed it at 14 per cent less costs than Hoshiarpur farmers.

Scott (1982) focussed on potato production and marketing in Central Peru. The first part summarized national potato production and marketing trends, and the impact of government programmes during last decade. The second part described and analyzed the physical and exchange sub system which linked producers with Lima wholesalers in 1979. Since 1972, potato production has dropped 40 per cent because of weather conditions and government policy favouring industry, export crops or cereals. In general, potato production suffered from a shortage of extension personnel and credit. In 1979 in the Central Sierra, most potatoes were grown by subsistence producers using traditional technology on rain-fed land, and were marketed by a few commercial producers. Subsistence producers generally had negative net returns from their potato operation. Almost all coastal producers had positive returns. The study also discussed the role of potato assemblers and the economics of transport employed. It recommended greater access to credit for production and marketing, extension and marketing information

throughout the potato marketing system. It also recommended better planning, financing and administration for the future success of public sector involvement in potato marketing.

Ahmed and Mondal (1984) investigated among 80 farmers in Munshigaon region, Bangladesh to discover the costs and returns of potato cultivation per unit area for different sizes of farms.

The average cost per acre was higher on small farms and lower on large farms, while production and net return per acre was higher on large farms and lowest on small farms. The major factors responsible for the high costs on small farms were the high costs of credit and of bullock power and human labour. The cost of credit was high on small farms because most of them had to borrow from money lenders at a high rate of interest. Production per acre was higher on large farms due to higher investments in irrigation and fertilizers. A number of recommendations were put forward to extend potato cultivation and to make potato growing more profitable on smaller farms.

Bajwa and Eberlin (1991) studied production and marketing of autumn potato in Gujranwala, Pakistan. Potato production was marked by alternate gluts and scarcity, resulting in severely fluctuating income for potato growers. This recurring phenomenon generated particular difficulties for small resource poor farmers. The Pakistan Swiss Potato Development Project has a special concern for such potato growers. During the 1989/90 autumn season, potato growers on average incurred a loss of Rs.9828 per hectare in Gujranwala. The mean costs of production and marketing were Rs.21509 per hectare and Rs.30.60 per bag, respectively. Seed cost accounted for the major share (39

per cent) of production costs. Two-thirds of the farmers in Gujranwala district are small but only 29 per cent of the potato growers are small. 60 per cent were tenant or tenant cum owners. Concrete recommendations are made for improving the lot of resource-poor farmers in particular and potato growers in general, including the need to investigate yields, fertilizer use, diseases, seed quality, alternative income sources, and the impact of delayed first irrigation.

Sharma *et al.* (1991) studied technological gap and production potential in potato farming of mid-hills of Himachal Pradesh, India; employing two- stage simple random sample of 150 farmers. The cost of production per quintal of potato was worked out to be Rs. 118. The study concluded that existing net profit of Rs. 6514 per hectare could be increased to Rs. 15609 if recommended package of practices is adopted. The maximum technological gap of 62 per cent was observed in the use of fertilizers. In the study area, working capital was the most crucial input and one rupee spent on it would fetch additional returns worth Rs 2.18 on sampled farm.

Singh *et al.* (1991) analysed potato cultivation in the eastern Uttar Pradesh. The study aimed at analysing resource utilization patterns at different levels of technology application in Jaunpur district. Data from a sample of 144 farms revealed that farmers operating at a higher level of technology adoption reap higher benefits from potato cultivation. However, their costs were high and could be lowered through a reduction in hired labour and greater use of farm inputs such as fertilizers and irrigation. To conclude resource utilization patterns were not optimal, but profitability increased with application of technological know-how.

Tripathi (1991) studied economics of potato cultivation in the high hills of Uttar Pradesh, India. Two villages were selected from Tehri Garhwal hills of Uttar Pradesh. In each of the selected village, 100 per cent farmers, who used to grow potato, were selected for the study. The data pertained to the year 1987-88. The average cost 'A', 'B' and 'C' were Rs.4639.17, Rs.5112.17 and Rs.726.77 per hectare for the cultivation of potato planted in March on the high hill farms, respectively. The seed shared the highest percentage of the operational cost being 53.68 per cent of the total cost 'A', followed by the bullock labour, fertilizer and manures. The use of plant protection measures was nil. The average expenditure on the human labour was Rs.2614.60 per hectare. The production of potato and the gross income were highest on the smallest size group of farms due to higher use of manure and fertilizers. The average net returns over costs 'A', 'B' and 'C' were Rs.8364.83, Rs.7891.83 and Rs.5277.23 per hectare respectively. These returns were highest on the smallest size group of farms. The average benefit cost ratios were 2.80, 2.54 and 1.68 over costs 'A', 'B' and 'C', respectively. The per quintal cost of production of potato planted in March was most economic on the smallest size group. The land, human labour and seed showed highly remarkable positive impact on the yield of the crop along with the significant impact of the bullock labour and fertilizers. The MPP and MVP price ratio were highly profitable for manure, bullock labour, fertilizer and land. Therefore, the return from potato planted in March can be made more profitable through increased use of these inputs at the existing level of production technology in the high hills of Uttar Pradesh.

Nolasco (1992) analysed potato production and marketing systems in the Dominican Republic's economy. The study was done on available Secondary data, a review of the literature and primary data gathered about current production, marketing and consumption patterns to put the historical figures into proper perspective. Analysis of secondary data indicated that potato production in the Dominican Republic showed a noteworthy increase between 1961 and 1973. Per capita potato consumption also increased during this period, particularly among low-income consumers. Farmers have had difficulties in getting access to the improved quality seed, especially in the area of San Jose de Ocoa. The study noted inadequacies in the existing flow of information about the potato sub-sector. This limitation hampered the design and development of appropriate policies for improving potato production with information. It, was possible nevertheless, to document the current and potential increase in production using improved quality seed; the increase in productivity and the development of varieties adapted to other growing areas; and improvements in the marketing system. The introduction of new products as a means of developing the processing industry was also noted. It was envisioned that this would facilitate an increase in consumption and contribute to a stabilization of supplies and prices.

Sinha and Singh (1996) made an economic analysis of potato cultivation based on data collected from 66 randomly selected farmers of Bihar Sharif block of Nalanda district. The study indicated that average cost of cultivation of potato was about Rs.22877 per hectare. The highest share in the total cost was recorded by seed, followed by manures and fertilizers and human labour. Average gross returns per hectare were Rs.54600 with the net

returns of Rs.31723. The return was about 239 per cent of the total cost of cultivation. Potato cultivation was acknowledged to be the most remunerative crop enterprise in the project area.

Dattatreyulu *et al.* (1999) presented an overview of potato production, exports, and marketing in India. It was suggested that to ensure remunerative prices to potato farmers, India has to embark on a new and dynamic marketing strategy. The strategy should encompass various elements including cultivation of required varieties in overseas markets, boosting production of processed potato, development of cold chains, and improvement of grading and packaging systems.

2.4 Reviews on marketing of potatoes

There are a large number of studies available on marketing of potatoes in India and abroad. The available studies are discussed as follows:

2.4.1 Disposal pattern of potatoes

George and Chokshi (1973) reported that as large as 98 per cent of total production of potato in Sabarmati river bed was sold leaving hardly 2 per cent for home consumption.

Chatha and Sidhu (1980) estimated the marketable surplus of potato in Punjab during 1977-78 at 73.45 per cent of total production which had dwindled from 95 per cent in 1970-71. This was so, because since the introduction of seed plot technique farmers were taking autumn crop alone, leading to the increased use of seed from local production. Seed alone consumed about 26 per cent of total production during 1977-78. The study indicated that recorded marketed surplus in state was lower than the

marketed surplus during 1972-73 to 1978-79. This was so, because a sizeable quantity was sold in big consuming markets outside the state owing to better prices there. The study showed that farmers marketed 51 per cent of their produce in their very fields, 13.82 per cent in potato markets with in the state, 23.40 per cent in big consuming markets outside the state and 11.78 per cent on cold storage premises.

Rangaswamy *et al.* (1981) reported that major part of potato crop is harvested and marketed, in Punjab state, in the months of November and December. Periodicity of sales show that farmers in Hoshiarpur market area, on an average, sold about 54 per cent of their total produce by direct sales in the month of November and 27 per cent in December. These percentages for Tanda farmers came to 37 and 46, respectively. The main season to harvest and market the major part of the crop in these two months is to get wheat crop after the potato.

Rizvi and Singh (1987) studied pattern of production and marketing of potato in Soraon development block of Allahabad, Uttar Pradesh for the agricultural year 1985/86. The study: (1) assessed potato yields on farms of different sizes; (2) looked at the marketable and marketed surpluses of potato according to size of farm, and (3) estimated the relative efficiency of marketing agencies engaged in potato marketing. Per household production of potato increased with farm size; per hectare production was higher on large farms, followed by medium farms. The average per household marketable surplus of potato was 225.36 quintals and average per household marketed surplus was 217.25 quintals. Marketing efficiency in terms of producer's share in the consumer's price was: (1) potato growers disposing of their potato in

the field (77 per cent); (2) farmers disposing of their potato in mandis (76 per cent); and (3) farmers storing potatoes in cold storage before selling (78 per cent).

2.4.2 Identification of marketing channels

Acharya and Bashir Ahmad (1975) observed in their study that small farms sold 8 per cent to consumers, 59 per cent to retailers, 28 per cent to wholesalers and only 5 per cent to the state government. But 60 per cent of the medium farmer's produce was sold to wholesalers, 27 per cent to retailers and 13 per cent to the consumers. Large farms sold 94 per cent of produce to wholesalers and the rest to retailers. Considering all farms together they found that 62 per cent went to wholesalers, 30 per cent to retailers and 6 per cent to consumers. Hence, per cent sale to wholesalers increased with size.

Singh and Chaudhry (1977) reported in their study that the more common among the prevailing marketing channels were: (i) producer-wholesaler-retailer-consumer, (ii) producer-primary wholesaler- secondary wholesaler-retailer – consumer, and (iii) producer- cold storage (proprietor)-wholesaler- retailer-consumer. Besides these channels, certain agencies like National Agricultural Cooperative Marketing Federation (NAFED) and Haryana State Cooperative Supply and Marketing Federation Ltd., also purchased the produce in the market.

Diwakar and Muralidharan (1981) identified 11 marketing channels used by sample potato producers of Farrukhabad district. Out of 11 channels only four channels, namely producer-commission agent-storer-secondary market-consumer, producer- commission agent cum purchaser-retailer-

consumer and producer-commission agent-wholesale purchaser – retailer-consumer, each accounted for more than 10 per cent of total quantity marketed.

Kiresur and Kumar (1988) made a case study on the impact of regulation on vegetable marketing in India. The study: (1) estimated the price spread and the producers' and market intermediaries' share in the consumer price in different vegetable marketing channels in Hubli market, Dharwad district, Karnataka, in regulated and non-regulated markets: (2) examined and compared the extent of variation in the wholesale prices of vegetables in regulated and unregulated markets; and (3) identified problems faced by farmers in the present system of marketing of vegetables. The study was restricted to four major vegetables: tomato and ambergine (traded in an unregulated market) and onion and potato (traded in a regulated market). The two common marketing channels through which the vegetables were sold were channel I: Producer/seller - Commission Agent cum Wholesaler -Retailer - Consumer and channel II: Producer/seller - village merchant - Commission agent cum wholesaler - Retailer - Consumer. The price spread and the wholesale price variability were lower in the case of regulated vegetables as compared to unregulated vegetables. A relatively larger proportion of farmers complained about problems confronting the marketing of unregulated vegetables (congestion of market, high hamali charges, and the absence of weighing, grading and cheaper transport facilities, etc.) as compared to the regulated markets.

Selvaraj and Krishnamoorthy (1991) examined the pattern of price behaviour, the existence of market channels, nature of price spread and the

relationship between market arrivals and price of potato based on data collected from a sample of 10 commission agents, 10 wholesalers and 10 retailers in Nilgiris district of Tamil Nadu. The role of cooperatives in marketing was investigated using the case of the Nilgiris Cooperative Marketing Society (NCMS) at Mettupalayam Market Centre. Two important channels for potato marketing were found: channel I (producer-NCMS- wholesaler- retailer - consumer and channel II (producer – mandies- wholesaler- retailer - consumer). It was observed that channel I was most efficient. The price behaviour analysis showed wide annual and seasonal fluctuation in prices.

Reddy and Achoth (1994) conducted a study to estimate the marketing efficiency of four marketing channels for potatoes in the region of Chikkaballapur, Kolar district, Karnataka state, India. Ninety potato growers and ten of each of the marketing intermediaries have interviewed to identify modes of disposal together with costs and margins. Channel IV (producer-commission agent-wholesaler-retailer – consumer) was the most efficient. The producers' share of the consumer price was as high as 64 per cent in this channel, whereas it was only about 45 per cent for the other three channels.

Jairath (1994) examined crop production, costs and returns, utilization, consumption, disposal and marketing patterns of sweet potatoes, together with farmers' and traders' preferences in two agro-ecological zones of India. Data were collected for the 1990 crop season from 20 farmers in a village in the Sub-Humid Sutlej Ganga Alluvial plains region (SHSGA) and from 19 farmers in a village in the Arid Western Plains regions (AWP). In AWP three local cultivars (Mungia, Dholi and Kali-Satha) were found to be popular. Net income (Rs.9943) and return on investment (127 per cent) in AWP were

higher than the levels obtained in SHSGA. The main marketing channels observed were: (1) farmer- village merchant –assembles – city traders – sub dealer retailers – consumer (2) farmers – agents and city traders – sub dealer retailers – consumer and (3) farmer- consumer.

2.4.3 Marketing costs and margins

Garg and Singh (1976) reported that the producer's share in consumer's price in Farrukhabad market amounted to 69.30 per cent, 29.70 per cent was accounted for by marketing cost. The marketing cost borne by the producer was 10.70 per cent and that by wholesaler and retailer about 10 per cent. The middleman's margin was 10 per cent of the price paid by the consumer per quintal. The per quintal expenditure borne by the producer, wholesaler and the retailer were Rs.5.35, Rs.2.50 and Rs.2.50 respectively. The middleman's share was Rs.5.00 per quintal.

Singh and Choudhry (1977) reported that the expenditure incurred by producer in bringing the potato to market constitute 8.80 per cent of potato price paid by consumers in big consumer markets, 11.50 per cent in medium markets and 9.20 per cent in small markets. The major items of marketing cost were commission, handling and transport charges and losses in storage for the post harvest months.

The bulletin on **Economics of production, marketing and storage of potato in district Farrukhabad, (U.P.) (1979)** reported that Farrukhabad potato mandi is a regulated area where auction method of sale is adopted. The marketing cost has been reduced from Rs.6.97 during 1971-72, when this commodity was not under regulation to Rs.5.35 per quintal during 1975-76

and Rs.5.75 per quintal during 1978-79 after regulations. Inspite of higher transport cost and the commission during 1975-76 and 1978-79 the total charges paid by producer have gone down than those of 1971-72. Producer's share in consumer's rupee at Farrukhabad potato mandi came to 53.89 per cent during 1978-79 as against 63.30 per cent during 1975-76. This may be attributed towards distress sale by producers due to bumper production and large surpluses. The marketing cost and margins accounted for 30.70 per cent and 46.11 per cent during 1975-76 and 1978-79, respectively.

Diwakar and Muralidharan (1981) found that the per quintal marketing cost borne by farmer was higher than that of intermediaries. Moreover, the variations of marketing cost were higher in case of farmer than intermediaries. The major components of the cost of marketing of potato were transport and storage costs.

Rangaswamy *et al.* (1981) estimated that on average total marketing expenses per quintal for potato were about Rs.15.61 for Hoshiarpur farmers and Rs.14.33 for Tanda farmers. The higher expenses in the larger groups were attributed to the high cost of transportation for sales of their produce in the distant markets. Small farmers disposed off their produce in the nearby markets hence, had lower cost. During harvesting 60 paise out of each rupee in the price paid by the consumer in Hoshiarpur market. In Tanda, a smaller market, producer's share was larger at about 66 paise.

Singh *et al.* (1993) studied marketing of potato in Deesa taluka of Banaskantha district in Gujarat state, India. The study examined: (1) the pattern of potato marketing and marketed surplus; and (2) marketing costs

and returns from potato production. Data for 1984/85 were collected from a sample of 11 marginal, 17 small, 29 medium and 21 large farmers. The results indicated that area had potential for increasing potato production and farm income. Marketing costs borne by producers were high, particularly the trader's commission. In order to increase the producer's margin, the marketing system needed to be more efficient by means of enforcing market regulations and strengthening cooperative marketing in order that it can compete effectively with traders.

Kerur *et al.* (1998) examined costs and returns of potato marketing in Dharwad district, Karnataka. For evaluating the objectives of the study, primary data for the year 1995 were collected from a randomly selected 75 farmers growing potato and 30 sellers from Hubli market. Two main channels were identified for potato marketing. It was found that many farmers sold at low prices to village merchants due to perishability and the risk involved. The producer's share of the consumer's rupee was greater in channel I (producer-wholesaler- retailer – consumer) with a low marketing margin compared to channel II (producer – village merchant – wholesaler – retailer – consumer). Thus channel I was found to be the most efficient channel in the study area.

2.4.4 Price structure and behaviour

George and Chokshi (1973) emphatically pointed out that wholesale prices of potato were lowest during the harvest season and increased steadily over the subsequent months while retail prices didn't show much variation over time.

George and Govindan (1975) also confirmed the existence of seasonal cycles both in prices and arrivals of potatoes in Ahmedabad market. They revealed that seasonal cycles were probably the outcame of seasonality of production. During December and January the market was flooded with fresh arrivals of potatoes and price touched the lowest level. They observed in subsequent months, arrivals gradually slackened and prices moved up and reached the peak level in the pre-harvest period of local potatoes.

Singh (1975) revealed in his study that average seasonal price (auction price) was Rs.60 per quintal and average retail price was Rs.132.50 per quintal.

Garg and Singh (1976) in their study observed that the prices were highest in November, December, May and June, and lowest in January, February, March in Farrukhabad market.

Agricultural Prices-Commission (1976) reported that All India Index Number of wholesale prices declined from 243.1 in September, 1974 to 116.5 in April, 1975. In comparison with the corresponding level in the previous year, the index in April, 1977 was lower by 36 per cent. The commission pointed out that decline was more obvious when one considered the absolute level of prices particularly in the important primary market of Farrukhabad in U.P. where the wholesale price dropped from Rs.95.00 per quintal in November, 1974 to Rs.18.50 per quintal in April, 1975. But in the following three months May to July, the prices at this centre firmed up and rose to the level of Rs.72.50 per quintal in July 1975. It is pertinent to note that while the fall in the prices in marketing period took place in all the states, prices in some

consuming states e.g. , Tamil Nadu, Karnataka, Maharashtra, remained considerably above the levels obtaining in surplus states. Thus when in April 1975, the price of potato per quintal in Farrukhabad was Rs.18.50, it was Rs.97.77 in Mattupalayan and Rs.71.20 in Bombay.

Chatha and Sidhu (1980) observed the intra year price fluctuations besides inter year price fluctuations. The price of potato started falling in December and touched lowest level in January, because of the heavy arrivals. The Index of arrivals remained above average (100) from December to March but index of prices remained below average from December to May, because the affect of glut in peak season disappeared.

Dahiya and Sharma (1980) reported that marketing problem of potato arises from the fluctuations in prices, perishable nature of commodity and inadequate cold storage facilities coupled with inadequate availability of railway wagons or trucks for transporting from surplus to deficit states. On account of inelastic demand and heavy supply during peak period from January to April, prices slump causing serious losses to growers. Similarly, because of market inadequacy consumers pay high price from May to December. In Uttar Pradesh, Farrukhabad is a regular glut prone area. Other main centres of glut are Jullunder, Ludhiana in Punjab, Sahabad in Haryana, Budaun and Jaunpur in Uttar Pradesh and Bihar Sharif and Patna in Bihar.

Diwakar and Muralidharan (1980) studied the phenomenon of spatial and temporal variations in potato prices. Analysis showed that prices of different varieties of potato in same market as well as prices of same variety in different markets of Farrukhabad district moved very much in sympathy with

each other, i.e. there is a very high degree of market integration within the district. Further it was found that market in a producing region, Farrukhabad district, were integrated but no integration was found between producing and consuming markets situated in different regions of the country, because of perishable nature and high transport cost. Temporal integration of potato prices in different markets of Farrukhabad district were also examined and was found that price difference over time were not at all explained in terms of storage costs alone in selected markets of the district.

Balakrishnan *et al.* (1981) showed that the price fluctuations of potato at Mettupalayam market are governed not only by the supply of potato from Nilgiris, but also by the arrivals from the up country markets and their price. The seasonal price fluctuations are predictable so a farmer may plan the timing of his production/sale to some extent to coincide with periods of high price. Lack of storage facilities in this centre is another reason for post harvest glut and consequent low prices received by producer.

The **University of Allahabad, Agricultural Economic Research Centre (1981)** studied marketing of potato in Farrukhabad district of Western Uttar Pradesh. Four markets, two of them large-Farrukhabad, Chhibraman, and two small-Kamalganj and Kayamganj, were selected for study. After a first chapter on methodology, (2) discussed the production and disposal of the potato crop, (3) and (4) analyze marketing and storage, price structure and marketing margins. The problems and points of view of different officials are presented in (5) while (6) presents conclusions. The price was highest in October and November and lowest in April and May. The supply of inputs was

quite inadequate and untimely. The condition of link roads was a major problem for transport.

Kalyankar and Rajmane (1987) conducted a study on marketing of potato in Jalna district of Maharashtra state. Findings of the study on arrivals and prices of potato in Jalna market (Maharashtra) for 1973-82 showed that March was the peak month for arrivals while minimum arrivals were recorded in November. Seasonal price indices showed that the increase in the off season price compared with the immediate post harvest price was around 20 per cent. The producer's share in consumer's rupee was 65.71 per cent, i.e., Rs.110.40 in Rs.167.99 per quintal paid by the consumer, the remaining 34.29 per cent being spread over different marketing agencies. The study emphasized the need to stabilize prices during peak harvesting periods by providing cold storage facilities in the producing centres and establishing wholesale and retail markets in the potato producing area to minimise the marketing costs of potatoes.

2.4.5 Marketing pattern and problems of marketing

Chatha and Sidhu (1980) examined the problems of potato marketing in the Punjab State. It was based on information collected from 80 potato growers, 10 commission agents, five primary wholesalers, five secondary wholesalers and 10 palledars randomly selected from Jullundur city in Punjab in 1978-79. The trends in area cultivated, production, marketable surplus, price behaviour, marketing channels, price spreads, role of cold storage industry, scope for processing, procurement and price support policy for potato were examined.

Konak and Isikli (1985) studied potato production, marketing and consumption in the Odemis region of Turkey. 109 farmers, 42 distributors and 90 households were surveyed for the 1978/79 production year. The results show that potato accounted for 82 per cent of total gross income of the farms. Average yield in this area was higher than that of Turkey as a whole. The average plot size was 0.59 hectare and almost all production was stored in the 1978/79 production year. The problems farmers faced included shortages of healthy seed, fertilizers and storage facilities. A suitable marketing organization to stabilize price fluctuation is needed. It was found that 60 per cent to 68 per cent of the consumer price was received by producers and 32 per cent to 40 per cent by middlemen, of which 79 per cent accrued to retailers and 21 per cent to wholesalers. The proportion of household income spent on potato purchases was two per cent for high income and five per cent for low income, families. The level of consumption was also influenced by socio-cultural factors and dietary habits.

Scott (1987) analysed the marketing patterns for Thailand's potatoes in order to assess future commercial prospects for this crop both at home and abroad. The report utilized a food systems approach as an analytical framework. Thus, potato marketing activities were scrutinized in the context of potato production and consumption patterns. Informal interviews with growers, traders and consumers carried out in 1984 in Thailand and Singapore served as one source of data for this report. A literature review and official statistics provided further information. Results emphasized the unusual features of potato marketing in Thailand, e.g., the importance of hotels and restaurants in the marketing chain. Additional findings such as

high retail marketing margins were likely to be thought provoking for other south-east Asian countries as well. Recommendations suggested that to address marketing problems efforts to develop production and consumption should be undertaken simultaneously.

Ahmed and Elias (1988) in their paper on marketing of potato at trader's level in some selected areas of Bangladesh maintained that the extension and regulation of agricultural markets are necessary requirements for optimum production processes. Data on marketing of potatoes at trader level were based on seven upzilas in five districts of Bangladesh. A total of 28 wholesalers, 22 beparis, eight farias and 24 retailers were interviewed in the study. The quantity of potatoes purchased by wholesalers was found to be higher than that of other traders. Transport methods varied according to locality and storage losses varied considerably between different types of traders.

Sarkar *et al.* (1992) analysed the economics of marketing of potatoes by farmers in some selected areas of Sadar Upozilla of Naogaon district. The study revealed that average potato production was positively related with the size of farm under potato cultivation. The per farm sale was the highest (152 quintals) for large farms and the lowest (42 quintals) for small farms and the largest volume of sale (69 per cent) was made at the market place. The major elements of marketing cost of farmers were transportation, storage and wastage. The study revealed that higher proportion of potatoes (36 per cent) kept for table purpose was stored at house while higher volume of potato (33 per cent) used for seed purpose were stored in cold storage. The findings indicated an inverse relationship between farmer's net share and the length of

marketing channel i.e. the larger the marketing channel, the lower was the farmer's net share.

Hoque (1996) examined potato marketing in Munshiganj and Comilla districts of Bangladesh. The marketing practices in both districts were more or less the same. Generally, the farmers didn't practice grading of potato after harvesting but only separate the worn-eaten/moth-eaten and rotten potato. The potato was then stored either in their dwelling house, or in the house purposely made for storing potato or cold store. The most common vehicles used for transporting potato were indigenous boats, launchs, tractors, trucks and rickshaw van. The traders were identified as the main source of market information for the farmers which implied a market inefficiency since the farmers lacked the perfect knowledge of market price. Potato marketing channel in Munshiganj and Comilla district consisted of several market participants namely : 1) potato farmers, 2) beparis, 3) cold storage owners, 4) aratdar/commission agent (5) retailers and (6) consumers. The majority of the potato produced was sold to the Beparis by the farmers. The quantity sold by the farmers directly to the retailer was very minimal (1.18 per cent). The quantity sold directly to the retailer was also less than one per cent in both districts. The marketing system was found to be inefficient largely because of high marketing costs due to poor feeder road conditions and lack of infrastructure. High magnitude of losses was also manifested. Some of the reasons for these losses were lack of proper storing facilities, lack of grading and lack of post harvest technology. It was also found that the marketing efficiency of the wholesaling (Beparis' level) was better than retailing. A high seasonal price variation was observed within a marketing season but the

difference in variability between two districts was very small. The wholesale prices were found to be largely influenced by the farm level prices. The potato market was spatially integrated. The price changes in one market would lead identical price changes in others. The major problems identified by the farmers were low price during the harvest, high transportation cost to move the potato to assembly market, lack of storage credit facilities, high cold storage feeds and prices of fertilizers and pesticides during planting. The primary problems identified by the traders, on the other hand, were found to be high capital requirement, unavailability of bank loan for potato trading business and high transportation costs.

Kuznetsova (1996) studied problems of potato production and marketing in the Bryansk province. This province in Central – Western Russia, is well-known for both ware and industrial potato production. There has been a popular misconception that Bryansk potatoes have been contaminated by radioactive fallout from Chernobyl in neighbouring Ukraine, but widespread monitoring indicated no evidence of this. Production and sales have nevertheless been depressed, with the growing area produced by more than twice since 1989. The private and subsidiary sectors accounted for a considerable proportion of production, though some large scale enterprises maintained output. However, much machinery was diverted from larger farms to subsidiary holdings at peak times. Fertiliser inputs fell and seed quality deteriorated. Traditionally, state purchasing was the only channel of sale, but this was reduced and there were difficulties in finding new outlets, forcing the diversion of surplus potatoes to stock-feed or payments in kind. The regional agricultural administration created a marketing service to seek new outlets

such as trading links with non-potato growing regions and develop an organized wholesaling system. It was suggested that this will require major improvements in advertising, grading presentation, and storage as well as adequate market regulation to benefit both producers and consumers.

Yadav *et al.* (2000) studied price spread and marketing problems of potato in Basti district, Uttar Pradesh, India. 38 marginal farmers, 33 small farmers and 19 other farmers were selected for the study. In all, 90 farmers were selected from six villages. The data pertained to the year 1996-97. Three different marketing channels were being operated in the study area. The pattern of disposal revealed that marginal farmers were selling higher produce, i.e. 61.94 per cent of total sale, to consumer and retailers, while small and other farmers were found to be selling 84.57 and 93.84 per cent, respectively to the wholesaler. Substantial amount of consumer rupee (i.e. 93.68 per cent) was finely realized by the producer selling directly to consumer. However, producer's share in consumer rupee was recorded as 56.35 per cent when only one intermediary was involved in the marketing process. When two intermediaries were involved, the producer's share was 44.10 per cent. Storage was found to be the important marketing function, which when done by the producer accrued 49.98 per cent of consumer rupee to producer, however, when this function was performed by wholesaler, it accrued only 22.49 per cent to producer. The major marketing problems identified were lack of storage, transportation and marketing knowledge.

Pandey *et al.* (2003) estimated the price spread and the producers' and market intermediaries' share in the consumer price of potato in the "producer-commission agent-retailer- consumer" marketing channel in Shimla,

Himachal Pradesh, India. Data were obtained from 25 potato growers, 10 commission agents and 25 retailers. Producers had around 73 per cent share of the consumer's price while retailers and commission agents earned a profit of about 3.50 and eight per cent. The price spread and marketing efficiency was about 27 and three per cent, respectively.

2.5 Reviews on Agribusiness Commodity System

An attempt has been made in this section to review the available literature relating to agribusiness commodity system. The study by D.K. Desai discusses the evolution of the concept of agribusiness and its application. The available studies are discussed below:

Gupta *et al.* (1969) studied the problems of modernization of paddy-rice system of Thanjavur, Raipur and Bilaspur. They studied the implications of modernization in the paddy-rice system using simple tabular analysis. For the purpose, the whole paddy-rice system, viz., from the producers of paddy to the consumers of rice and by products was considered. Thus the authors tried to look at the whole system rather than confining themselves to milling alone. In Thanjavur, modernization in post-harvest operations was only a resultant factor growing out of the increased paddy production. A 150 per cent increase in production seemed possible by putting more land in Kuruvai from Samba. The net worth of Thanjavur Cooperative Marketing Federation (TCMF) throughout the district has also shown its potential both in the distribution of inputs and paddy procurement. The TCMF has provided a vertical integration. It supplied the district farmers with all agricultural inputs including tested seeds, tractors on custom hires and other technical advice.

On the output side, it was capable of processing about 25 per cent of marketed paddy. This gave better prices to farmers. It demonstrated that its procurement costs were lower than other competing agencies. It was found that there was good scope for modernization of sheller rice mills. On the other hand Raipur-Bilaspur ecological was very different with only about 15 per cent of the total cropped area having irrigation facilities. In this area HYV programme had not made much headway and productivity have not increased much. In this area, there were large number of shellers and huller mills mostly privately owned. The millers of the area procure paddy through organised and unorganised mandis and are still doubtful about the advantages of modernisation.

George and Choukidar (1972) studied the commodity system of paddy at micro level in the West Godavari district in simple descriptive fashion without using any analytical tool. They analyzed the productive aspect of paddy in relation to the use of farm for local and high yielding varieties, and studied the shifts in the varieties of paddy grown by farmers. The other important element, which this study covered, was the marketing behaviour of farmers in terms of the pattern of disposal, the period of disposal and the nature of price realization during different seasons. Scope of the study has been restricted to production and marketing patterns of paddy.

George and Chokshi (1973) through descriptive study aimed at understanding the major elements in the Sabarmati river bed potato system in the vicinity of Ahmedabad, like production practices and their economics, patterns of storage, transportation and disposal and the structural aspects of Ahmedabad potato market. The use pattern of fertiliser indicated that the rate

per acre increased with the increase in area under potatoes. The average cultivation cost of potatoes was Rs.3711 per acre and the average yield was 17206 kilograms per acre. Disposal pattern indicated that about 98 per cent of the total production of potatoes was sold. More than 75 per cent of the total sales were made through wholesalers. Only few farmers brought potatoes to market immediately after harvest. The wholesale price of potatoes was the least during the harvest season and increased steadily after the subsequent months. The farmers realised better prices from wholesalers than from federation. The average cost came to Rs. 3.00 per quintal on an average for storage upto July a loss of about two per cent occurred per month. Farmers spent about eight per cent of their realisation towards marketing expenses like transport costs market fee, labour charges on weighing and commission to the agents.

George and Choukidar (1973) made an attempt to understand the dynamic process influencing the paddy-rice system at the macro level. The study analysed the following aspects of the system: 1) changes in input use pattern, 2) post harvest technology, 3) procurement of paddy, and 4) distribution of rice. It was found that the area under paddy during 1970-71 was 11 per cent higher than the 1960-61 acreage. During the two decades 1950-51 to 1970-71 paddy production has more than doubled. Total increase in production is due to yield effect, area effect and the interaction between changes in yield and areas. Further it was found that in many areas, the supply of inputs required for paddy production was inadequate. Farmer very often didn't get proper quality seeds, fertilisers and pesticides. Credit was often a limiting factor in the use of inputs. It was recommended that the

improvement in paddy production should be accompanied by improvements in the processing sector. It was suggested to have better coordination of activities affecting the various segments of paddy-rice system.

Chauhan *et al.* (1974) studied the agribusiness system for rapeseed and mustard at the micro-level in Agra district of Uttar Pradesh, India. The study described the system by studying various participants, viz., farmer, village trader, market wholesaler, commission agent and oil millers. The average cost of cultivation (cost C) per acre for the crop was Rs.559, of which operational cost formed 64 per cent of the total cost. The average net profit was Rs.297. In the marketing process of this crop, various functionaries such as wholesaler, wholesale cum commission agent, commission agent, brokers and retailers are involved in the Agra market, the major trading centre for rapeseed and mustard. Village traders were the most important assembling agency and in Kheragarh market of the district as much as 70 per cent of the market arrivals were brought by village traders. Majority of the farmers (81 per cent) preferred to sell to the village traders. The selected of mills of the area were able to utilise 77 per cent of the installed capacity. The average cost of processing per quintal of rapeseed and mustard was Rs.4.84 and overall net gain was Rs.10.92 per quintal of rapeseed and mustard procured.

Desai (1974) attempted to integrate the business and non-business components of the agribusiness system so that the managers in agriculture sector can help in development of commercial and non-commercial activities and understand the linkages among these activities. He called this as the agricultural system. He developed an agribusiness flow chart, 1961, for India from input-output table for 1961. It showed that the contribution of

agribusiness to gross output of the economy was 41.44 per cent. In India, farm purchases constituted only 1.42 per cent of the total consumer expenditure on agricultural products in 1961. The most important sector in the agribusiness was the farming sector. A substantial portion of agricultural produce was sold to consumers without any processing. It was found that of the consumer expenditure on food and fibre products, 71.25 per cent was on unprocessed foods. The value added by farmers through production, wholesaler and retailer in supplying unprocessed farm products to consumer and to processors formed 85.92 per cent of total consumer expenditure. This shows that in India agribusiness is not well developed and farming sector dominates scene. Desai concluded that the systems approach used in agribusiness tries to differentiate different sectors of the system and builds an inter-relationship.

George (1974) in his study on commodity system for mandarin oranges in the Nagpur district presented the production and marketing patterns, processing facilities available and the consumer's attitude. The average size of orange garden of sample farmers was 3.41 acre and about 81 per cent of the total area was occupied by orange trees less than 13 years old. The average plantation cost was Rs.258 and the average maintenance cost per acre was Rs.562. About 80 per cent of the maintenance expenditure was incurred on manures and fertilizers, interculture and irrigation. Farmers sold 98.70 per cent of orange yield. Prices realized by farmers varied according to the period of sales and the agencies handling oranges. Orange processing plants have not influenced market prices and consequently the farmer's returns haven't been affected in any significant manner. Processed

citrus items were consumed by a very small number of upper income families only. It was because of the cost structure of processing industry. Expenses in sugar, preservatives and packaging material constituted the bulk of total cost, oranges accounting for a very small fraction of the cost of production.

Goldberg (1974) in his study described the fruit and vegetable system of Central America. It was reported that Central American fruit and vegetable system is a relatively small agribusiness commodity system-really a combination of a number of specific crop commodity systems with only six per cent of total farm sales. Dominant input in this agribusiness was labour with purchased labour accounting for approximately 84 per cent of the farmer's purchased inputs. A significant percentage of farm production is consumed domestically.

Pathmanathan (1978) assessed in-service training needs in the wheat and beef commodity systems of Victoria. In their report "The training needs of agribusiness-a commodity system approach", they defined the two selected commodity systems in their macro-environment. They concentrated on the individual organization to determine the training needs for the managerial, professional and sales staff. A mail questionnaire survey was conducted with a multi-cluster sampling technique amongst 708 agribusiness organizations in Victoria and a final response rate of 57 per cent was achieved. The findings of this exploratory study indicated that (1) there was no appreciable difference in the expressed training needs between the two commodities studied, or amongst the three staff categories investigated; (2) there was a greater need for management knowledge than for production knowledge; (3) courses offered by technical and tertiary institutions in Victoria in the area of

agribusiness were not recipient-oriented, and were seen as unsuitable for their needs; and that (4) the demand for communication training seen in terms of potential staff numbers was considerable. Some recommendations arising from these findings have also been made to meet the training needs revealed by the study.

Singh (1982) examined the Agribusiness potato system of the typical potato grower of Farrukhabad district, Uttar Pradesh, India. He identified four sub systems viz., input supply, production, storage and marketing. Information on production pattern, crop operations, pattern of storage and sales, marketing costs, farm purchases and input costs, and availability of resources was collected from a sample of 100 farmers in Kamalganj and Bashpur blocks.

Dahiya and Sharma (1995) in their paper on "Development of potato agribusiness in India : Status and Strategy" examined the input supply, production trends, transport, storage and processing of potato, the export situation, and margins and competitiveness of potato marketing system in India with a view to suggest a suitable strategy for the development of potato sector. The marketing system is not competitive mainly because of transport and storage bottlenecks. The paper suggested an effective marketing intervention scheme in the development of potato sector.

Takitane *et al.* (1995) in their study described the concept of coordination of agro industrial chains using the case of Illycafe, Italian express coffee company to illustrate the integration and coordination process, and top show how stimuli can be transmitted along the industrial chain and promote

technical progress. The agro industrial chain framework enable an evaluation of the capacity of organization as well as aspect of the coordination of the productive system. Analysis of this process enables an evaluation of the competitive basis of companies and the transmission of stimuli along the system. In the case of Illycafe the stimuli relating to feedback (i.e. consumer prepferences) appeared to be more intensive than those transmitted along the production system.

Mundil *et al.* (1997) laid the importance of the filiere (or commodity system) approach in Mauritian agricultural policy. The need to more sharply and practically define the Mauritian Agricultural policy has been increasingly recognized lately, both at the producer and the State level. They argued that such an approach is now necessary in order to increase the effectiveness of domestic agricultural policy. This approach also had the advantage of structuring the relationship between the ministry and institutional level and the producer level: it also allowed for the establishment of interactive structures involving the various operations in the filiere. The experience gained at the Agricultural Marketing Board (AMB) and initiatives in other institutions are used as illustrations.

2.6 Comments on Reviewed work

It is clear from the literature reviewed above that the studies conducted in India have laid emphasis on one of few aspects of the farm commodities in general and potatoes in particular. In India very few studies have been conducted employing commodity system approach. These studies are descriptive in nature and have given general description of some of the

aspects of commodity systems such as production, marketing and processing etc. To make the commodity system a basis for major policy decisions, it is necessary to take an integrated view of the various components of the system and to understand the interactions among them. The systems approach emphasizes the inter-dependence and interrelated nature of all aspects of agribusiness. However, the studies undertaken on commodity system in India have not followed the systems approach in real analytical sense rather these have mainly concentrated on the pattern of production and marketing. Further, on potato commodity system only two studies have been undertaken, one confined to the river bed around Ahmedabad city, a potato deficit area and other in Farrukhabad city, the largest potato producing and surplus state of the country. However, no work has been undertaken to study the agribusiness commodity system in the state of Uttaranchal, since its carving out of Uttar Pradesh in November 2000. Potato is a major crop in the state of Uttaranchal in terms of both area and production and it is also an off season crop for the plains, its importance can't be ignored as a source of meeting the potato requirement of the country during off season along with the state of Himachal Pradesh. Therefore, the present study was taken up with a view to study the agribusiness commodity system of potato, an important cash crop in the state, analytically from the viewpoint of producers and policy planners.

CHAPTER 3

About the crop-potato

ABOUT THE CROP-POTATO

This chapter briefly highlights the origin and history of potato and the cultivation practices of potato in Uttaranchal. The chapter has been organised into two sections. Section 3.1 deals with the origin and history of the potato while section 3.2 deals with the cultivation practices of the crop in the state of Uttaranchal.

3.1 Origin and History

Based on various considerations about genetic diversity, **Hawkes (1990)** concluded that potato might have been domesticated in what is now the lake Titicaca of Peru to North Bolivia and might have originated from wild diploid species *Solanum leptophyes* some 7,000-10,000 years ago, and the first domesticated species was *S. stenotomum*. The secondary center of origin is believed to be Chile. According to the hypothesis of **Vavilov (1951),** these regions were the centers of origin of potato.

S. tuberosum is the most important cultivated potato. Some authorities believe that *S. tuberosum* is a straight tetraploid of *S. stenotomum* but there are stronger evidences in support of allotetraploid origin of *S. tuberosum* by hybridization between *S. stenotomum* and *S. sparsipilum*.

Formerly, potato was considered to be a crop adopted primarily to temperate conditions. However, during the last century or so, potato crop definitely made its presence felt in the sub-tropics. It is certainly of New World Origin, having been brought to Europe in the late 16^{th} or early 17^{th} Century, some year after the discovery of America and Conquest of Peru. Potato has commonly grown in Spain and Italy by the late 16^{th} century. It was widely

grown in France by the mid of 17th Century. By mid 18th Century, it was taken to Norway and then to Sweden and Denmark from Scotland. From Europe, the potato spread to the rest part of the world. Either the Portuguese or the Britishers introduced it in India perhaps in late 16th or early 17th Century. The first record of the potato in India occurs in Terry's account of a banquet at Ajmer, given by Mr. Asaf Jaan to Sir Tomas Roo, the first British Ambassador to the court of Emperor Jahangir in 1615. It seems to have established itself in Surat (Gujarat) and Karnataka by 1875. Since then very little is known of the rest 150 years. However, by the beginning of the 19th Century the potato was accepted as an important vegetable crop. Major Young introduced potato in the hilly areas of Dehradun and Captain Mundi mentioned that cultivation of potato in Shimla hills was started in 1828. Potato cultivation had become well established by 1939 as source of income for the people of North Western hills **(Nagaich, 1977)**.

Organized research was started in the first quarter of the 19th century, work on scientific lines was started in Bombay and Madras Presidencies. Trials on potato were started in Ootacamund in 1848. Feasibility of using cut potato seed was demonstrated in 1914 in Assam. In Bengal, work at Darjeeling was initiated in 1878-79 where research on varietal trials, manures and fertilizers, seed production, storage and cropping system was undertaken. In the undivided Punjab, work on potato was carried out mainly in Shimla hills and Syalpur, Sialkot and subsequently at Kangra, Kuller, Palampur and Murrie hills. United Province, now known as Uttar Pradesh started work on varietal trials between 1882-1946 at Saharanpur, Lucknow, Chaubatia, Kanpur, Mussoorie, Nainital and Farrukhabad. Starting from 1958

to date a total of 35 high yielding varieties have been released for different agro-climatic situations in the country **(Shekhawat *et al*, 1992 and Phadtrase *et al.*, 2000)**. Not all varieties are presently under cultivation as new varieties have been replacing the old ones from time to time. As on date, 11 varieties are in the national seed production programme. These occupy nearly 95 per cent of the potato growing area in the country. Another five varieties which are relatively recent release, are accepted to gradually replace some of the varieties presently in the seed programme. A brief description of all these 16 varieties including maturity period, recommended regions and yield potential is presented in the following Table 3.1.

3.2 Cultivation practices

Now a brief outline of the cultivation practices in Uttaranchal is sketched. The knowledge is necessary as the study pertains to the commodity system approach of the crop. Moreover, it helped a lot while interviewing the farmers. Following statements will cover all the cultural practices **(Tripathi and Srivastava, 2002)**

3.2.1 Varieties

Different varieties have been recommended in the state according to the height above sea level as follows.

- **Irrigated valley** : Kufri Jyoti, Kufri Asoka, Kufri Anand
- **Mid to high hills**: Kufri Giriraj, Kufri Sheetman
- **Tarai and Bhabar:** Kufri Jyoti, Kufri Asoka, Kufri Jawahar and Kufri Bahar

3.2.2 Time of Sowing

- **Tarai and Bhabhar** : Second fortnight of October
- **Hilly area**

Table 3.1 : Description of varieties of potato

Varieties	Maturity (days)	Recommended for	Yield potential (t/ha)
Kufri Anand	100-110	U.P. plains and neighbouring states	35-40
Kufri Asoka	70-80	Bihar, Haryana, Punjab, U.P., West Bengal	40
Kufri Badshah	100-110	Gujarat, Haryana, J&K, M.P., Punjab, U.P.	50
Kufri Bahar	100-110	Haryana, J&K, H.P., U.P.	45
Kufri Chandramukhi	80-90	Bihar, Gujarat, Haryana, Parts of H.P., Karnataka, U.P., M.P., Maharashtra, Orissa, Punjab and West Bengal	25
Kufri Chipsona 1	90-110	Bihar and U.P.	40
Kufri Chipsona 2	90-110	Bihar and UP	35
Kufri Giriraj	130-135	North and South Indian hills	25
Kufri Jawahar	80-90	Haryana, Punjab, Gujarat, Karnataka, M.P.	40
Kufri Jyoti	110-130	N & SI hills, Gujarat, Karnataka, M.P., Maharashtra, Punjab, U.P. and West Bengal	20
Kufri Lalima	100-110	Parts of Bihar, U.P.	40
Kufri Lauvkar	75-80	Plateau of Karnataka, M.P. and Maharashtra	30
Kufri Pukhraj	70-90	Bihar, Gujarat, Haryana, H.P., Karnataka, M.P., Maharashtra, Orissa, Punjab, U.P. and West Bengal	40
Kufri Sindhuri	110-120	Bihar, Gujarat, M.P., Punjab and U.P.	40
Kufri Sutlaj	90-100	Bihar, Haryana, M.P., Punjab, and U.P.	40
Kufri Swarna	130-135	South Indian Hills	48

Source: Pandey, 2002

Irrigated 3000 ft : mid September to mid October

Irrigated 5000 ft : January/February

- **Non irrigated conditions, high hills, northern slope 7000 ft** : March/April.

3.2.3 Quantity of seed

25-30 quintals per hectare (50 nali) seed is recommended. The seed weighing 25-30 gm should be used after treating with 0.5 per cent Borax solution.

3.2.4 Use of Fertilizer

Table 3.2 shows the recommended dose of fertilizer for potato crop in different regions.

Table3.2: Recommended dose of fertilizer for potato in different regions.

Constituent	Hills (irrigated)	Hills (Non irrigated)	Tarai and Bhabar
Nitrogen (kg/ha)	120	100	150
Phosphorus (kg/ha)	100	80	100
Potassium (kg/ha)	100	80	100

Source: Tripathi and Srivastava, 2002

Whole manure, half nitrogen and whole phosphorus and potassium should be mixed and applied at the time of last ploughing. Remaining nitrogen should be given after 30-35 days of sowing.

3.2.5 Irrigation and weed control

Field should be irrigated on time in the areas where water is available. Earthing should be done on the plant. Mulching can be done in the hilly areas

for moisture conservation. This practice is more essential for unirrigated field and helps in increasing production.

3.2.6 Insect control

Epilacna, a common insect of potato, can be controlled by using 0.2 per cent carbaryl. Biting insect can be controlled by 0.2 per cent chlorophyriphos.

3.2.7 Disease control

- **Early and late blight :** 0.2 per cent Dithane M-45 should be applied on 40-45 days crop. Even after this, if the disease breaks, the mixture should be sprayed 3-4 times at the interval of 15 days. 0.2 per cent of Rhidomil can also be used.
- **Scab :** Sowing should be done after dipping the seed for 15 minutes in 0.3 per cent Borax solution.

3.2.8 Integrated Pest management (IPM)

Following are the various IPM practices that should be practiced in the crop

- Use certified seed (tuber)
- Treat the tuber with pseudomonas carbendazin (5 gm 1 gm) before sowing.
- Spray with Matribuzin (1 kg active ingredient per ha) just after sowing.
- Spray with Rhidomil MZ 72 (0.25 per cent) at the interval of 20 days on the occurrence of blight.
- Spray with pseudomonas (5 gm per litre water) on the standing crop of 60 days.

- Treat the tubers with 0.3 per cent boric acid after harvesting.

3.2.9 Yield

Hill region: Irrigated condition : 200-250 qtl/ha

Unirrigated condition: 150-200 qtl/ha

Tarai and Bhabar region: 300-350 qtl/ha

3.2.10 Precautionary notes

- Certified and disease free tubers should be used.
- Treated seed (tuber) should be used.
- Tuber should be 25-30 gm and with 2 eyes.
- The crop should be saved from early and late blight.
- The recommended variety for the area should be chosen.

CHAPTER 4

Profile of the study area

PROFILE OF THE STUDY AREA

The present study is based on a survey conducted in Nainital district (representative of hills of Kumaon region) of Uttaranchal.

This chapter has been organized into three sections. In section 4.1 brief geographical, demographical and agricultural background of the district is described. Section 4.2 covers the basic statistics of the selected blocks and alongwith general features of the potato markets of the area. Section 4.3 covers, in brief, the socio-economic profile of the sample potato producers.

4.1 Geographical, Demographical and Agricultural Features of Nainital District

4.1.1 Brief History

Legend Shiva Sati associates this place as where Sati's eyes (naina) fell and hence named after Goddess Naini. The history of this district is a saga of strife between many ethnic groups for their domination. Asuras and Nagas are said to be the earliest settlers of this region. Later period of history is dominated by the strife mainly between Khasiyar and Chands. Chands in 1488 established their domination after defeating Katyuris. At the end of the 18th Century Gorakhas established their suzerainty, which was challenged by the Britishers. Eventually war occurred between them in 1815. The district went into a popular revolt in 1857, which was quelled by British.

4.1.2 General

Nainital district of Uttaranchal is situated in the Himalayan and sub-himalayan regions between latitudes 28°-30°N and longitudes 78°-81°E, covering an area of about 3860 square Kilometer (sq. Km.). It is surrounded

on the east by Champawat, on the west by Pauri Garhwal, on the north by Almora and on the south by Udham Singh Nagar districts of Uttaranchal. On the basis of geographical conditions, the district is divided into two regions, viz., Bhabar and Hill. Bhabar is an area that lies between Tarai tract and foothills of the Shivalik Range of Himalaya. The soils in this area are porous and contain a lot of gravels in the soil column. The maximum area of Nainital district is covered by hill region. This region is manifested with wide agro-climatic variability ranging from sub-tropical to alpine zone. Consequently, the climate of the region varies from place to place in accordance with altitudinal variation, slope aspect, density and kind of vegetation. Nainital district includes eight blocks, viz., Dhari, Okhalkanda, Bhimtal, Betalghat, Ramgarh, Ramnagar, Haldwani and Kotabagh. Bhabar region covers Haldwani, Ramnagar and a part of Kotabagh and the remaining area falls in the hill region. The area under study falls within the purview of Ramgarh and Dhari blocks of the district.

4.1.3 Demographic features

The Nainital district of Uttaranchal has an area of 53483 sq. km and the population of 7.60 lakh with the rural population of 510720 and urban population of 249280. The percentage of Schedule caste and Schedule Tribes in the total population was 19.68 per cent and 0.58 per cent, respectively. The sex ratio was 906 (Table 4.1).

Table 4.1 : Demographic statistics for Nainital and Uttaranchal (2001)

Particulars	Unit	Nainital	Per cent of Uttaranchal	Uttaranchal
Total area	sq. km	4767	8.91	53483
Total population	Lakh nos.	7.60	8.96	84.80
Male	Lakh nos	4.0(52.63)	9.26	43.20(50.90)
Female	Lakh nos	3.6(47.37)	8.65	41.60(49.10)
rural	Nos.	510720(67.20)	6.0	
urban	Nos.	249280(32.80)	2.93	
schedule cast	Nos.	148960(19.60)	1.75	
schedule tribe	Nos.	4408(0.58)	0.05	
Literacy	Per cent	79.60		72.28
male	Per cent	87.39		84.02
female	Per cent	71.00		60.26
Population density	Per sq. km.	198.00		159.00
Sex ratio	No.of females per 1000 males	906		964

Source : Statistical bulletin, Nainital district,2004
Note: Figures in parentheses show the percentage to total in the respective group

4.1.4 Occupational Distribution of the Population

The mainstay of inhabitants in the district was agriculture as farmers and agricultural labourers together accounted for 55.70 per cent of the total work force (Table 4.2). Nearly ten per cent of the total workers were involved in the trading business. Plantation, construction and transportation, storage and communication were involving three to four per cent of the total work force of the district in the year 2001-02.

Table 4.2: Number of persons in different occupation in Nainital district (2001-02)

Sl. No.	Particulars	Total number	Percentage to total workers
1.	Total workers	206239	100
2.	Farmer	98756	47.88
3.	Agricultural labourers	16127	07.82
4.	Construction	7951	3.86
5.	Transportation, storage and communication	7926	3.79
6.	Plantation	8686	4.21
7.	Trading	19009	9.22
8.	Others	47884	23.22

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004

4.1.5 Land Holding Pattern

The distribution of operational holdings is set forth in Table 4.3. The table reveals that land holdings are mostly marginal or sub-marginal in Nainital district.

Table 4.3 : Distribution of operational holdings in Nainital district

Farm category	Holding size (ha)	Percentage to total operational holding
Marginal	< 1.0	60.2
Small	1.0-2.0	18.5
Medium	2.0-4.0	18.8
Large	> 4.0	2.5

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

According to Table 4.3, about 60.2 per cent of the holdings were less than one hectare (marginal) and 18.5 were upto two hectare (small). Large

farms accounted for only 2.5 per cent of total operational holdings covering an average area of more than four hectare per holding.

4.1.6 Climate and Rainfall

In January, the mean maximum temperature ranges between 9.7°C to 10.2°C and in May it varies from 23.5°C to 24.8°C. Annual relative humidity at 830 hours varies from 60-70 per cent. The annual total rainfall is more than 1800 mm, out of which more than 90 per cent precipitation is received from summer monsoon i.e. June to mid-October, eight per cent from the winter cyclone i.e. January-March and the remaining two per cent from the relating monsoon in mid October – December and pre-monsoon showers in April-May.

4.1.7 Soils

The soils have developed on rock with biotic and phylitic materials, under cool and moist climate and temperate forest cover. The soils are generally shallow and gravely. Deep soils are confined to hill slopes and valleys. The soils are brown to greyish brown and dark grey in colour and moderately acidic to neutral in reaction. Organic matter status, phosphorus content and potassium content are medium in soil. Bhabar soils are shallow with loamy sand with abundant quantities of gravels and stones. Water percolation through profile is very rapid and nutrient and moisture retention capacity and fertility of soils is low.

4.1.8 Land Use Pattern

Table 4.4 shows that total reported area of Nainital district was 413394 hectare, of which 73.17 per cent area was under forests and 6.17 per cent

area fell under uncultivated land Horticultural crops occupied 3.74 per cent of total reported area in the year 2001-02.

The gross sown area and net sown area were 84891 hectare and 52067 hectare, respectively. The cropping intensity of the district was 163.04.

Table 4.4 : Land use pattern in Nainital District (2001-02)

Sl. No.	Particulars	Area (ha)	Percentage to total reported area
1.	Total reported area	413394.00	100
2.	Area under forests	302474.00	73.17
3.	Uncultivated barren land	25502.00	6.17
4.	Current fallow	997.00	0.24
5.	Other fallow	4196.0	1.01
6.	Land use other than cultivation	2853.00	0.69
7.	Cultivable waste	8691.00	2.10
8.	Pasture land	1147.00	0.28
9.	Area under horticultural crops	15467.00	3.74
10.	Net sown area	52067.00	12.59
11.	Area sown more than once	32824.00	
12.	Gross cropped area	84891.00	
13.	Cropping intensity (percent)	163.04	

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.1.9 Irrigation

Canals were the major source of irrigation in Nainital district of Uttaranchal in 2001-02. About 80 per cent (24203 hectare) of total irrigated area was irrigated by canals (Table 4.5). Other important sources of irrigation were private tubewells (5.68 per cent) and government tube wells (11.16 per

cent). Of the total irrigated area approximately 2.91 per cent (878 hectare) was irrigated by other sources.

Table 4.5 : Sourcewise irrigated areas in Nainital district, Uttaranchal (2001-02)

Sl. No.	Source of irrigation	Irrigated area in hectare	Percentage to net irrigated area
1.	Canals	24203	80.24
2.	Tubewells		
	- private	1716	5.68
	- government	3366	11.16
3.	Wells	-	-
4.	Ponds	-	-
5.	Others	878	2.91
	Total	30163	100

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.1.10 Manuring and Fertilization

About 8859 metric tonnes of chemical fertilizers were distributed in the district in 2001-02 (Table 4.6). Distribution of nitrogen was 6083 metric tonnes in the Nainital district, which was highest (68.66 per cent) among all chemical fertilizers. Distribution of phosphorus and potassium was 1949 metric tonnes and 827 metric tonnes, respectively in the year.

Table 4.6: Distribution of fertilizer in Nainital District (2001-02)

Sl. No.	Particular	Quantity (metric tonnes)	Percentage to total quantity
1.	Nitrogen	6083	68.66
2.	Phosphorus	1949	22.00
3.	Potassium	827	9.33
	Total	8859	100

Source: Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.1.11 Cropping pattern and yield

Table 4.7 shows the area under different crops in Nainital district for the year 2001-02. The table 4.7 indicates that wheat and paddy were the most important crops occupying 47.70 and 18.87 per cent of the total cropped area respectively. Among other crops, sugarcane occupied largest area i.e. 7.96 per cent of the total cropped area while potato occupied 2.86 per cent of the total cropped area. Area under pulses was very small in the district. Yield wise sugarcane topped the list with an average yield of 633.04 quintals per hectare followed by potato (223.82 quintals per hectare). The average yield of cereals was 23.06 quintals per hectare while that of pulses was very low only 8.53 quintal per hectare.

Table 4.7 : Cropping pattern, production and yield of different crops in Nainital District (2001-02)

Sl. No.	Crops	Area (ha)	Percentage to total cropped area	Production (metric tonnes)	Productivity (quintals per hectare)
1.	Paddy	15507	18.87	37600	24.24
2.	Wheat	29374	47.70	78315	26.66
3.	Sava	615	0.75	753	12.24
4.	Jaon	900	1.04	1054	11.71
5.	Maize	7958	9.70	10792	13.56
6.	Mandua	3500	4.20	4741	13.55
7.	Total cereals	57854	70.16	133404	23.06
8.	Total pulses	2178	2.64	1857	8.53
9.	Total food grains	60032	72.80	135261	22.53
10.	Oilseeds	40017	4.86	3488	8.70
11.	Sugarcane	6565	7.96	415591	633.04
12.	Potato	2360	2.86	52822	223.82
13.	Fodder	1639	1.99	-	-
14.	Other	7858	9.53	-	-
	Total	82461	100.00	-	-

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.1.12 Area, production and productivity of potato in District Nainital during 1992-2002.

Table 4.8 shows that the area under potato increased continuously from 4.244 hectare in 1992-93 to 4.496 hectares in 1995-96. After that it drastically reduced to about half during 1996-97 and since then it is showing a fluctuating trend. It was 2.360 hectares in 2001-02. Production also decreased with the decreasing area and reduced from 109.689 thousand tonnes in 1992-93 to 52.822 thousand tonnes in 2001-02. Productivity showed a decreasing trend upto 2000-01 but increased slightly during 2001-02 to 22.38 tonnes per hectare in the district.

Table 4.8 : Area, production and productivity of potato in district Nainital

Year	Area (000'ha)	Production (000'tonnes)	Productivity (t/ha)
1992-93	4.244	109.689	25.85
1993-94	4.329	106.000	24.49
1994-95	4.409	106.050	24.05
1995-96	4.496	103.293	22.97
1996-97	2.227	46.455	20.86
1997-98	2.326	51.239	22.03
1998-99	2.400	51.400	21.42
1999-2000	2.442	51.300	21.01
2000-2001	2.350	50.235	21.38
2001-2002	2.360	52.822	22.38

Source: Department of Horticulture and Food Processing, Chaubatia (Almora), Uttaranchal

4.1.13 Livestock

Table 4.9 gives the category wise distribution of the livestock population in district Nainital during 2001-02. The total livestock population in

the district was estimated at about 484860, which comprised of 141710 cattle, 2303 sheep, 61474 goats and 106834 poultry. Of the livestock population of the district, cattle accounted for 29.23 per cent and poultry and goats accounted for 22.03 and 12.68 per cent, respectively.

Table 4.9: Distribution of livestock in Nainital district, Uttaranchal (1997-98)

Sl. No.	Livestock	Population	Percentage to total
1.	Total cattle	141710	29.23
2.	Sheep	2303	0.48
3.	Goats	61474	12.68
4.	Horses	3515	0.72
5.	Pigs	1076	0.22
6.	Poultry	106834	22.03
7.	Other animals	167948	34.64
8.	Total livestock population	484860	100

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.2 Geographical, Demographical and Agricultural features of Ramgarh and Dhari Blocks

4.2.1 General Description

The Dhari and Ramgarh blocks were selected as the representative of the district Nainital. The agro-ecological situation in the area varies from sub tropical to hilly temperate suitable for vegetable cultivation, floriculture, spices, animal husbandry and other agricultural activities. The important statistics for Dhari and Ramgarh blocks is set forth in Table 4.10.

Table 4.10 : Important statistics for Dhari and Ramgarh blocks

Particulars	Dhari	Ramgarh
Area (sq. km.)	104	142
Total villages (Nos.)	52	130
Total population (Nos.)	26425	37012
Number of families (Nos.)	4513	7116
Net reported area (ha)	22118	25658
Forests (ha)	9930	9646
Primary Agriculture Cooperative societies	06	06
Veterinary hospital (Nos.)	01	02
Nationalised bank branches (Nos.)	01	02
Regional Rural bank branches (Nos.)	02	02
Other non-nationalised bank branches (Nos.)	01	01

Source: Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.2.2 Irrigation

Water is the most scarce resource in the region. The level of under ground water is too low to be tapped economically. In most of the region, the agriculture is rainfed. However, the main source of irrigation is still canal. During peak seasons of water use it becomes a scarce commodity. The total irrigated area in Dhari and Ramgarh was 1200 ha and 1172 ha, respectively in the year 2002. In Dhari block 1125 ha (93.75 per cent) area was irrigated by canal. In Ramgarh block 1083 ha (92.41 per cent) was irrigated by canal. While 6.25 per cent and 7.59 per cent area respectively of Dhari and Ramgarh blocks was irrigated by other sources (Table 4.11).

Table 4.11 : Sourcewise irrigated area in Dhari and Ramgarh blocks

Sl. No.	Source of irrigation	Dhari		Ramgarh	
		Irrigated area (ha)	Percentage to net irrigated area	Irrigated area (ha)	Percentage to net irrigated area
1.	Canals	1125	93.75	1083	92.41
2.	Tube wells	-	-	-	-
	A. private	-	-	-	-
	B. govt.	-	-	-	-
3.	Wells	-	-	-	-
4.	Ponds	-	-	-	-
5.	Others	75	6.25	89	7.59
	Total	1200	100.00	1172	100.00

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.2.3 Occupational distribution of the population

Distribution of workers in Dhari and Ramgarh is presented in Table 4.12. The statistics show that there were 11791 and 14945 workers, respectively in Dhari and Ramgarh blocks. The proportion of farmers to total workforce was highest in both the blocks.

Table 4.12 : Distribution of workers in Dhari and Ramgarh blocks (2001-02)

Sl. No.	Categories	Dhari		Ramgarh	
		Numbers of workers	Percentage to total workforce	Numbers of workers	Percentage to total workforce
1	2	3	4	5	6
1.	Farmers	10462	88.72	11351	75.95
2.	Agricultural labourers	205	1.74	513	3.43
3.	Livestock, forest and plantation	208	1.76	514	3.44
4.	Mining	-	-	8	0.05
5.	Household industries	24	0.20	58	0.39

Table 4.12

1	2	3	4	5	6
6.	Non-household industries	27	0.22	64	0.43
7.	Construction work	94	0.79	178	1.19
8.	Business and commerce	160	1.36	409	2.74
9.	Transport, storage and communication	51	0.43	150	1.00
10.	Others	560	4.75	1700	11.38
	Total workers	11791	100.00	14945	100.00

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.2.4 Population structure and literacy

Total population was 26425 and 37012 in Dhari and Ramgarh blocks, respectively (Table 4.13). Males accounted for more than 50 per cent of the total population in both the blocks. Scheduled castes accounted for 37.04 per cent and 30.65 per cent of the total population in Dhari and Ramgarh block respectively, while scheduled tribes were very low in number in both the blocks.

The number of literates was 67.04 per cent and 66.35 per cent of the total population in Dhari and Ramgarh block, respectively. Further in block Dhari, of the total number of literates, 58.88 per cent were male and 41.12 per cent were female. On the other hand, 59.06 per cent literates were male and 40.94 per cent were female in block Ramgarh.

Table 4.13: Population structure of Dhari and Ramgarh blocks (Census 2001)

Population		Dhari		Ramgarh	
		Number	Percentage to total population	Number	Percentage to total population
Population					
	Male	13596	51.45	19034	51.43
	Female	12829	48.55	17978	48.57
	Total	26425	100.00	37012	100.00
Scheduled castes		9788	37.04	11346	30.65
Scheduled tribes		44	0.17	108	0.95
Literate					
	Male	10431(58.88)		14504(59.06)	
	Female	7285(41.12)		10052(40.94)	
	Total	17716(100.00)	67.04	24556(100.00)	66.35
Illiterate					
	Male	3165(36.34)		4530(36.37)	
	Female	5544(63.66)		7926(63.63)	
	Total	8709(100.00)	32.96	12456(100.00)	33.65

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.2.5 Land Use Pattern

The land utilization pattern of Dhari and Ramgarh blocks is given in Table 4.14. Table shows that total reported area was 22118 hectare and 25658 hectare in Dhari and Ramgarh blocks, respectively. The area under forests respectively for Dhari and Ramgarh blocks was 44.89 per cent and 37.60 per cent, area under horticultural crops was 16.37 per cent and 14.89 per cent while the uncultivated barren land was 14.50 per cent and 15.45 per

cent of the total reported area. Cropping intensity of both the blocks Dhari was around 119 per cent.

Table 4.14: Land utilization pattern in Dhari and Ramgarh blocks (2001-02)

Sl. No.	Land use	Dhari		Ramgarh	
		Area (ha)	Percentage to total reported area	Area (ha)	Percentage to total reported area
1.	Total reported area	22118.00	100.00	25658.00	100.00
2.	Area under forests	9930.00	44.89	9646.00	37.60
3.	Uncultivated barren land	3207.00	14.50	3965.0	15.45
4.	Current fallow	102.00	0.46	121.00	0.47
5.	Other fallow	420.00	1.90	428.00	1.67
6.	Usar and uncultivable waste land	427.00	1.93	273.00	1.06
7.	Land use other than agriculture	572.00	2.59	2404.00	9.37
8.	Pasture land	29.00	0.13	322.00	1.25
9.	Area under horticultural crops	3621.00	16.37	3819.00	14.89
10.	Net sown area	3810.00	17.23	4680.00	18.24
11.	Area sown more than once	752.00		915.00	
12.	Gross sown area	4543.00		5577.00	
13.	Cropping intensity (per cent)	119.24		119.17	

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004

4.2.6 Cropping pattern

Table 4.15 shows the area under different crops in Dhari and Ramgarh blocks. It indicates that in Dhari the gross cropped area was 3912 hectares while it was 5199 hectares in Ramgarh. In Dhari, wheat occupied largest area (914 hectare) followed by paddy (778 hectare) and potato (552 hectare), accounting for 23.36 per cent, 19.89 per cent and 14.12 per cent of the gross cropped area respectively. In Ramgarh, wheat occupied largest area (1722 hectare) followed by paddy (1078 hectare) and Mandua (697 hectare) accounting for 33.12 per cent, 20.73 per cent and 13.41 per cent of the gross cropped area, respectively. Potato accounted for 9.98 per cent of the gross cropped area in Ramgarh.

Table 4.15 : Area under different crops in Dhari and Ramgarh blocks (2001-02)

Sl. No.	Crops	Dhari		Ramgarh	
		Area (ha)	Percentage to gross cropped area	Area (ha)	Percentage to gross cropped area
1.	Paddy	778	19.89	1078	20.73
2.	Wheat	914	23.36	1722	33.12
3.	Sava	78	1.99	57	1.10
4.	Oat	210	5.37	81	1.56
5.	Maize	595	15.21	679	13.06
6.	Mandua	505	12.91	697	13.41
	Total cereals	3080	78.73	4314	82.98
7.	Total pulses	114	2.91	199	3.83
	Total foodgrains	3194	81.64	4513	86.81
8.	Oilseeds	166	4.24	167	3.21
9.	Sugarcane	-	-	-	-
10.	Potato	552	14.12	519	9.98
	Total	3912	100	5199	100

Source : Statistical Bulletin, Nainital District, Uttaranchal, 2004.

4.2.7 General features of the potato markets of the study area

In the study area, there is one regulated market viz. Haldwani. The market was regulated in the year 1971. It is an 'A' grade market. The market occupies an area of 44 acre out of which 30 acre area is for fruit and vegetable marketing and administrative bock while 14 acre is for foodgrain marketing. Though the market is primarily developed for the wholesale trade of fruits and vegetables, other farm products are also being traded therein in a reasonably good quantity. The sub markets are at Lalkuan, Kaladhungi, Bhowali, Mukhani, Lamachor and Lakhanmandi. However, out of six, only three are properly functioning viz., Lalkuan, Kaladhungi and Bhowali. Haldwani market virtually covers, defacto, the entire Kumaon division. The administration of the market is independent.

Infrastructural facilities available

The main infrastructural facilities available in Haldwani market are shown in Table 4.16.

Table 4.16 : Infrastructural facilities available in Haldwani market

	Facility	Number in the market
Shops		
	A type	88
	B type	95
	C type	128
Storage rural godowns (1000 mt capacity)		01
	Cold storage	-
	Trade godowns	80
	Auction platform	04
	Farmer's rest house	01

Table 4.16 Contd..

	Guest house	01
	Bank branches	03
	Farmer markets	22
	Dharam Kanta	01
Automated weighing machine		10
Miscellaneous		
	PCO	02
	Police check post	01
	Park	01
	Check post	03
	High mast light	01
	Staff quarters	40

Source: MANDI OFFICE, HALDWANI

The market intermediaries involved in the trade of potato, fruit and vegetable are 850, out of which wholesale cum commission agents are 531. Commission agents are only two and retailers are 317 in number respectively. However, only 10-15 retailers have registered themselves with the committee.

4.3 Socio-economic profile of the sample potato producers

This section deals with some farm-family structures of the potato producer of the study area. The information is based on the comprehensive survey of sample farmer. Cropping pattern and some of the economic factors such as average size of land holding, family size, and livestock wealth are discussed here.

4.3.1 Cropping pattern

The prevalent method of measurement of hill area is nail. 50 nali = 1 hectare, 20.5 nali = 1 acre. Though the practice is to use metric system of

measurement of area but seeing the very small size of holding of the sample farms, converting average area of nali into hectare resulted into fraction. It was not convenient then to describe further the share of different crops in that fractional area. Therefore, instead of hectare, the whole analysis and discussion of the results in the present study was done on acre basis.

The data on cropping pattern followed by the sample farmers is presented in Table 4.17

Table 4.17: Existing cropping pattern on sample farms in district Nainital during 2002-03

Area (in acres)

Particulars	Area as percentage of total cropped area					
	Total		Irrigated		Unirrigated	
	Area	%	Area	%	Area	%
Cabbage	0.581	16.34	0.1305 (22.46)	24.86	0.4505 (77.54)	4.86
Maize	0.488	13.72	0.088 (18.03)	16.76	0.40 (81.97)	13.19
Pea	0.306	8.60	0.0138 (4.51)	2.63	0.2922 (95.49)	9.65
Tomato	0.0367	1.03	0.0189(5.49)	3.59	0.0178 (48.51)	0.59
Gahat	0.0586	1.65	0.0028 (4.78)	0.53	0.0558(95.22)	1.84
Mandua	0.0455	1.28			0.0455(100.00)	1.50
Bhat	0.07	1.97			0.07(100.00)	2.31
Rajma	0.1639	4.61	0.0028(1.71)	0.53	0.1611(98.29)	5.31
Bean	0.0125	0.35			0.0125(100.00)	0.41
Wheat	0.0999	2.81	0.0039(3.90)	0.75	0.096(96.10)	3.17
Potato	1.6018	45.04	0.1857(11.59)	35.35	1.4161(88.41)	46.72
Gola	1.0214	28.72	0.1436(14.06)	27.34	0.8778 (85.94)	28.95
Shimla	0.3382	9.51	0.0255)7.54)	4.86	0.3127(92.46)	10.31
Garud	0.2422	6.81	0.0166(6.85)	3.16	0.2256(93.15)	7.46
Winter cabbage	0.0926	2.60	0.0788(85.09)	15.00	0.0138(14.91)	0.45
Total	3.5565	100.00	0.5252(14.77)	100.00	3.0313(85.23)	100.00

Note: Figures in parentheses show the percentage to total area under respective crop

Potato crop which is the mainstay of Nainital farmers occupied the highest percentage of total cropped area (45.04 per cent) for sample farmers, with varieties Gola, Shimla and Garud occupying 28.72, 9.51 and 6.81 per cent of total cropped area under potato crop respectively. Cabbage and maize also occupied dominant position in the cropping pattern by capturing the second (16.34 per cent) and third (13.72 per cent) highest percentage share in total cropped area, respectively after potato. Other than potato, the important crops sown in Rabi season were wheat and winter cabbage, which occupied 2.81 and 2.60 per cent of total cropped area respectively . This is due to the cause that during winters most of the sample areas get covered with heavy snow during December to February and so there is no scope for production of other crops. The common rotation followed in the area were : Cabbage-fallow-potato, cabbage/pea-fallow-potato/cabbage , cabbage-wheat-potato and cabbage/tomato-fallow-potato.

Out of the total cropped area 14.77 per cent was irrigated while 85.23 per cent was unirrigated. Mandua, bhat and Bean were cropped in unirrigated area only. Potato occupied 35.35 per cent of total irrigated area while 46.72 per cent of total unirrigated area. On the other hand, of the total area under potato, 11.59 per cent was irrigated while 88.41 per cent was unirrigated.

4.3.2 Productivity

Average productivity of crops on the sample farms is given in Table 4.18. The yields of crops were obtained separately for irrigated and unirrigated area separately.

Table 4.18 : Average productivity of different crops on sample farms in district Nainital, 2002-03.

Particulars	Productivity (qtls/acre)	
	Irrigated	Unirrigated
Cabbage	102.50	95.43
Maize	14.25	15.33
Pea	23.20	19.13
Tomato	80.50	72.00
Gahat	1.00	0.85
Mandua	-	0.87
Bhat	-	0.98
Rajma	8.00	7.42
Bean	-	8.81
Wheat	8.00	29.09
Potato	96.35	86.68
Gola	96.05	88.64
Shimla	93.04	70.72
Garud	100.00	81.58
Winter cabbage	92.50	85.43

The sample farmers harvested an yield of 96.35 quintals of potato per acre in irrigated area and 86.68 quintals per acre in unirrigated area. The different potato varieties of Gola, Shimla and Garud yielded 96.05, 93.04 and 100.00 quintal per qacre in irrigated area while 88.64, 70.72 and 81.58 quintals per acre in unirrigated area respectively. However, of all the crops, cabbage enjoyed highest yield of 102.50 quintals per acre in irrigated area and 95.43 quintals per acre in unirrigated area. Cabbage that was cropped with potato (or winter cabbage) yielded 92.50 and 85.43 quintals per acre from irrigated and unirrigated area respectively. Tomato was also an

important crop that yielded 80.50 quintals per acre in irrigated area while 72.00 quintals per acre in unirrigated area.

4.3.3 Size of land holding

The average size of land holding for the sample potato producer was found to be 37.29 nali or 1.864acre or 0.745 hectare of which 14.38 per cent was irrigated and 85.62 per cent was unirrigated.

4.3.4 Demographic features of sample farmers

The demographic features here include family composition and family type. The average composition of farm families of sample farms is shown in Table 4.19.

Table 4.19 : Average composition of sample farm families

Sl. No.	Particular	Average number of family members	Percentage
1.	Adult	4.99	67.25
	Males	2.90	-
	Female	2.09	-
2.	Children	2.43	32.75
	Male	1.30	-
	Female	1.13	-
	Total (1+2)	7.42	100.00

The sample of the study comprised of 90 farmers. The average family size of sample farmers was 7.42 out of which 4.99 (67.25 per cent) was adults. The number of adult males was 2.90 and that of females was 2.09 and children were 2.43 (32.75 per cent). Out of children, males were 53.50 per cent and females were 46.50 per cent.

The proportion of nuclear families (63.33 per cent) was more than joint families (36.67 per cent) as may be seen in Table 4.20

Table 4.20: Classification of sample farmers according to the type of farm families

Type of family	Number of family	Percentage
Joint	33	36.67
Nuclear	57	63.33
Total	90	100.00

4.3.5 Livestock wealth

The average livestock inventory of the sample farmer included 0.97 draught animals, 0.22 milch animals, 0.11 mules. The total number of animals per farm was 1.30.

CHAPTER 5

Methodology

METHODOLOGY

This chapter has been organised in three sections. Section 5.1 deals with sampling scheme and collection of data. Section 5.2 covers in detail the conceptual framework of the problem. This section is further divided into sub-sections representing various sub-systems of the agribusiness potato commodity system. In section 5.3, analytical framework is elaborated in great detail with the specification of model, selection of alternative processes and identification of the constraints. Synthetic potato commodity systems formulated to achieve the objectives of the present study are also presented in the last section.

5.1 Sampling scheme and collection of data

Kumaon region has produced 236.562 thousand tonnes of potato during 2001-02 **(Table 1.8)** from an area of 11.204 thousand hectares with a productivity of 21.11 tonnes per hectare.

Nainital district is the most important potato producing district in terms of production not only in Kumaon region but also in the whole state of Uttaranchal. Areawise also, it is the third largest potato growing district next only to Almora and Udham Singh Nagar. During 2001-02, the area under potato crop in Nainital district was 2.360 thousand hectares with overall production of 52.822 thousand tonnes. Hence, the Nainital district was purposively selected from Kumaon region for studying the agribusiness commodity system of potato crop. Out of eight development blocks in the district two blocks, viz. Dhari and Ramgarh having highest total cropped area

(552 ha and 519 ha, respectively) and production [10954 metric tonnes (mt) and 10360 metric tonnes (mt), respectively] under potato crop **(Appendix-IV)** were selected to represent the district purposively. Out of each block three potato producing villages were randomly selected viz., Padampuri, Managher and Pahadpani, from Dhari block and Satbhunga, Dadhima and Garhgaon, from Ramgarh block. Then a list of potato growing farmers for each of these villages was prepared and a sample of 15 farmers from each village was drawn randomly from the list. Thus the total sample of 90 farmers was drawn. Equal number of farmers was selected from each village because the total number of potato growers in all the villages were more or less equal. The required data on production pattern, crop operations, pattern of sales, marketing costs, input acquiring costs, farm assets, consumption pattern, sources of income, availability of resources etc., were collected from the sample farmers through personal interview on a well structured pre-tested questionnaire. The primary data thus collected from potato growers related to the year 2002-03. Relevant market information was collected from market intermediaries involved in potato marketing through personal interview on well-structured pre tested questionnaire for the same year. For this 30 Wholesaler cum Commission Agents and 30 retailers were randomly selected from the regulated market of Haldwani. Some relevant secondary information were also obtained from the offices of Directorate of Horticulture and Food Processing, Chaubatia, Uttaranchal; District Statistical Office, Nainital, Uttaranchal; Development Blocks' Offices and Mandi Samittee, Haldwani, Uttaranchal.

5.2 Conceptual framework of the problem

The word agribusiness as characterised by its originators (Harvard Business School) is the sum total of all operations involved in the manufacture and distribution of farm supplies, production operations on the farm and the storage, processing and distribution of farm commodities and items made from them[1]. It also includes the coordinating arrangements of government officials, market, future market, cooperatives, associations and educational institutions.

This study uses the concept of an agribusiness commodity system approach. The agribusiness commodity system approach concentrates, in detail on the function of a single farm commodity, its participants and coordinating arrangements[2]. The system approach emphasizes the interdependence and integration of all aspects of agribusiness, from farm supplies to farming, assembling, storing, processing and distribution of the crop. The importance of the concept of agribusiness lies in the fact that it views the whole agribusiness of a single commodity as a system. It defines, differentiates and integrates different parts of the commodity system called sub-systems. Hence, this approach of agri-business commodity system differs from more traditional approaches in its scope and methodology.

For an important commodity like potato, the approach of agribusiness commodity system focusses on functions of its sub-systems such as buying of

[1] Davis, J.H. and Goldberg, R.A. (1959)
[2] Goldberg, R.A. (1968)

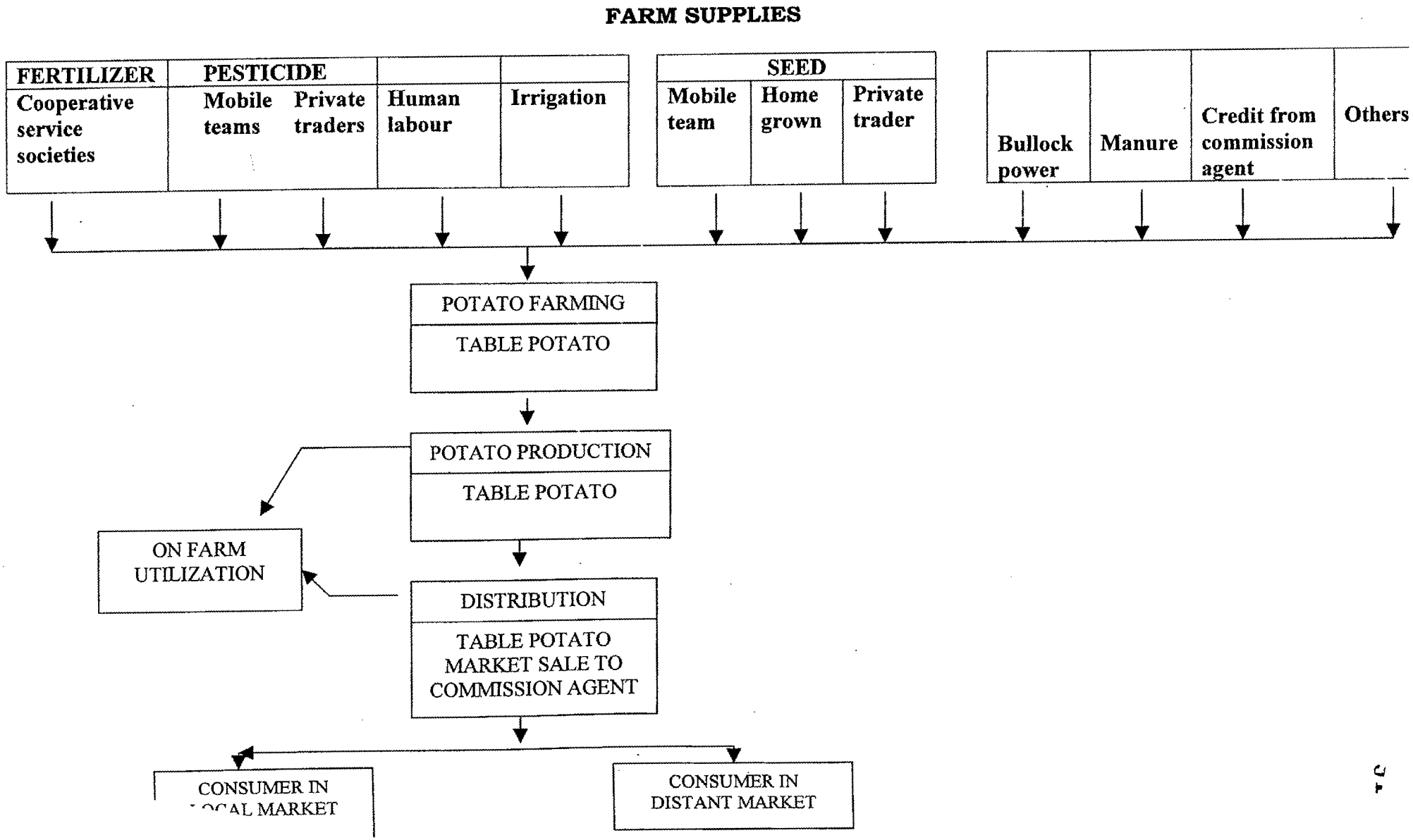
farm supplies and services, financing, potato production, its storage and marketing as integrated parts of whole of the potato system-including seasonality in functions like credit borrowing, production, storage, marketing etc. Seasonality in different functions of sub-systems of potato system is of importance as it is a crop which can be planted and harvested in different months and durations depending on the availability of land for sowing, farm product prices and crops to be followed. But since this study is confined to hills where potato is grown as an off season crop, it is planted in the months of February and March and harvested at different intervals between June to October.

The simplified agribusiness flow chart developed to reflect the composition of and linkages among different parts (sub-systems) of the potato system is presented in figure 1. To study the commodity system of potato, the whole system can be partitioned into the following five important sub-systems.

a. Farm supply or input supply sub-system
b. Agricultural credit or financing sub-system
c. Farming or production sub-system
d. Storage or potato storage sub-system and
e. Distribution or potato marketing sub-system.

The storage sub-system did not exist in the commodity system of potato in the study area as there is no need of storage at farm level or market level because potato produced in the hills acts as an off season crop for the plains. It comes at the time of high demand in plains and the harvest is thus quickly

Figure 1 : Potato commodity system of the potato producer in the study area



disposed off in the market. Therefore, the present study concentrated on the remaining four sub-systems which are discussed below.

a) Input supply sub-system

The quantum of agricultural production is directly related to the availability of resource inputs and their techniques of application[1]. A little delay and/or inadequacy in the supply of any of the required inputs adversely affect the crop production. Though the new technology capable of increasing potato production spectacularly has been evolved but the farmers in hills have not been able to fully exploit its potential mainly because of the constraints imposed by the input supply sub-system in terms of non-availability or inadequate and uncertain availability of vital farm inputs and their high prices.

Many empirical studies[2] have shown that the new production technology is highly dependent and responsive to yield increasing inputs particularly the purchased inputs. Of all the purchased inputs fertilizers and pesticides are decidedly the most important inputs for potato crop. Hence, only these inputs have been selected to examine the effect of different input supply alternatives on the production of potato crop. All the requirement of fertilizer is fulfilled through service cooperative societies. On the other hand pesticides are supplied by service mobile team/and private trader. Regarding seeds, farmers usually keep a part of crop as seed or purchase their requirements from private traders. Some limited quantities of seed is also supplied by the mobile team to the growers. In this study an attempt has

[1] Singh, R.S. and Shri Ram (1973); Sharma, D.P. and Desai, V.V. (1973) and Rai, K.N. , Gangwar, A.C. and Singh, P. (1973).

[2] Rai, Gangwar and Singh, Op. Cit, Desai and Sharma, Op. Cit, and Pandey, V.K. Singh, Katar and Uma Shankar (1977).

been made to examine the effect of different existing input supply processes (alternatives) on the production of potato crop, problems encountered and costs borne in acquiring different inputs as also identifying the efficient process (alternative) of acquiring the different inputs.

(b) Financing sub-system

The new technology of potato production demands heavy doses of purchased inputs, hence, potato cultivation requires relatively higher capital investment. Though, the farmers in the hills are diverging more towards organic farming and the climate does not allow heavy infestation by pest and insects, they don't need credit for crop production. There are times i.e. during severe winters when the climate is unfavourable for agricultural production, farmers use to borrow from the Wholesale cum Commission Agent (WCA) in the market to meet out contingencies. This is a sort of advance payment made to the farmer by the WCA. This is made available to the farmer at one to two per cent rate of interest per month. The loan is repaid by the farmer when he brings the potato crop for sale to that WCA. Such borrowing by the farmers is not for production purposes. This system which is found highly prevalent in the area bound the farmers to the particular WCA. In such cases he has to sale the crop to him only even if he receives high prices if sold to someone else.

The availability of adequate amount of credit alone is not sufficient. The sources of finance, the interest and non- interest costs of loans, the period of borrowing and the debt management also act as important factor in governing the behaviour of borrowers with respect to how much to borrow, when to borrow, from where to borrow etc. Financing as a sub-system of potato

commodity system involves the sources of finance, periods of borrowing, the management of debts i.e. repayment of borrowed funds along with interest.

(c) Production sub-system of potato and non-potato crops

In the area, the typical farm-firm is producing potato crop and non-potato crops. Potatoes are planted in the months of February through March and harvested between June to October depending on the product price, cash needs of farm household, and crops to be followed.

In northern parts of the country there are three distinct crop seasons, (i) kharif (July to November)[1], (ii) rabi (November to April) and (iii) zaid (April to June). No crop in the study area was sown in zaid season. So the land occupation period was considered only for two season i.e. kharif and rabi.

(d) Potato marketing sub-system

To study potato marketing sub-system, the pattern of marketed surplus of potato was studied for the agency (to whom potatoes are sold); time of sale and the place of sale. A potato producer has the choice to sell his potatoes in the field itself, after harvest or bring his produce to the market and sell to WCA. However, the farmer in the study area used to bring the produce in the market and sell to the WCA to whom he is bound to sell due to the advance payment taken for meeting the family consumption requirements and other needs. Farmer has also the choice to sell the potato in different months. Therefore, to sell potato a producer has to take decisions about the agency, place and time as these affect marketing costs borne by the producer and the

[1] ICAR (1980), p. 248

net receipts from potatoes.

5.3 Analytical framework

For achieving the first objective, simple statistical tools like arithmetic mean, percentages, frequency distribution etc. were used and the results were presented in the tabular form. Existing potato system together with its sub-systems is portrayed in figure 2 and was examined critically.

For achieving the second objective single period linear programming model was used for the analysis. One of the important considerations that led the use of the programming technique was to determine from farmers viewpoint, the optimum agribusiness commodity system of potato. In other words, to perform all functions from input buying, to marketing; including financing, production, assembling, wholesaling etc., optimally and in an integrated manner with the main aim of optimizing the income of farm-firm. If any of these functions is not performed efficiently, then the whole commodity system will be less productive and efficient due to poor interlinking of the components.

Linear programming technique, used here, provides a much more practical approach to the theory of firm than do classical and functional analysis, as through it all sub-systems of the whole system may be integrated. Marginal analysis can not handle the problems involving changes in resource levels and inequalities of resource supplies. Linear programming model makes it possible in more realistic manner and to permit the firm to produce a number of integrated products and activities which jointly use the production facilities, under varying levels of resources supplies and product/activity prices **(Singh, 1982)**.

To achieve the third objective the existing and optimum potato commodity system was compared and the effect of the optimal system on income of the grower was examined. Finally the important policy implications from the results of the study were drawn.

5.3.1 The MODEL

To find the optimal agribusiness potato systems, linear programming model of maximizing cash surplus over total cash expenses was employed for each synthetic situation developed by considering existing technology, resource constraints and existing as well as maximum and minimum level of sales pattern during selling months etc.

The formal structure of the model which was used for formulating optimum commodity system for potato for the representative farm situations involve set of activities and constraints corresponding to four sub-systems. Therefore, the objective function includes the activities related to the four sub-systems representing crop production, input supply, distribution (marketing) and financing. The model in its mathematical form is as follows:

$$\text{Maximise } Z = \sum_{j=1}^{55} C_j X_j + \sum_{j=56}^{59} C_j X_j + \sum_{j=60}^{64} C_j X_j + \sum_{j=65}^{76} C_j X_j \qquad \ldots(1)$$

Subject to constraints on :

(a) Crop production activities

$$\sum_{j=1}^{55} ai_j \; X_j \leq bi \;\; (i = 1,.....,5,10,11,....,19) \qquad \ldots(2)$$

(b) Input buying/selling activities

$$\sum_{j=56}^{59} ai_j \; X_j \; \leq bi \; (i = 6,.....,9) \qquad ....(3)$$

(c) Potato marketing activities

$$\sum_{j=60}^{64} ai_j \; X_j \; \leq bi \; (10,26,....,30) \qquad ....(4)$$

(d) Cash borrowing activities

$$\sum_{j=65}^{66} ai_j \; X_j \; \leq bi \; (i = 21,33,.....,34) \qquad ....(5)$$

(e) Credit repayment activities

$$\sum_{j=67}^{68} ai_j \; X_j \; \leq bi \; (i = 29,30) \qquad ....(6)$$

(e) Cash transfer activities

$$\sum_{j=69}^{74} ai_j \; X_j \; \leq bi \; (i = 20,.....,25) \qquad ....(7)$$

(f) Seasonal family living expenses activities

$$\sum_{j=75}^{76} ai_{ij} \; X_j \quad \geq bi \quad (i = 31,32) \qquad ....(8)$$

and $X_j \geq 0$

where,

Z = Cash surplus over total cash variable expenses (Rupees).

Cj= In Linear Programming Model, for maximizing objective function, Cj coefficients usually stand for returns per unit of j^{th} activity. However, in the model employed here, the returns from the activities were considered as part

of input output coefficients matrix (a_{ij}), and cash transfer activities were also introduced. Hence the C_j value for all the activities, but for X_{74} were considered as zero. C_j value for X_{74} (activity for transfer of cash to objective function) was taken as 1 to facilitate transfer of the surplus cash left at the end of the model period to the objective function **(Singh, 1982)**.

X_J = Units of the j^{th} activity

ai_J = Technical input –output coefficients. An $a_{ij} > 0$ indicates use of i^{th} resource or productive service by the activity. An $ai_J < 0$ indicates the contribution of the j^{th} activity towards i^{th} resource/service supply.

bi = The i^{th} constraint level.

5.3.2 Description of the model

The linear programming model specified above has three distinct elements, viz. (1) the alternative processes, (2) the constraints and, (3) the input-output coefficients matrix. Each of these elements is discussed in detail in the following paragraphs.

5.3.2.1 Alternative Processes (X_j)

The term process (also called activity) differs from that a product; in that a process can be distinguished by either different methods to produce the same product or transactions, or by distinct and separate products. Therefore, potato crop produced in different months by using different types of input combinations were taken as separate activities. As source of seed was mainly home grown potato the seed buying activity were not introduced in the model. Fertilizer requirement was completely fulfilled by cooperatives in the

area. The source of pesticide were private traders as well as the mobile team operating in the area, but the rates of pesticides from both the sources varied, so the pesticide purchase from two sources was considered as separate activities. In addition, a farm firm may purchase products or resources and services, sell farm products, borrow money or withdraw earnings for consumption etc. These also are processes, which were considered in the model. Each different way of doing a thing was treated as a different process or activity.

The potato producer in the area had several alternatives for the use of its resources. For example, he could choose from a number of different potato and non-potato production activities, different agencies to buy different inputs, different sales periods, different borrowing and repayment alternatives etc. A list of all the activities included in the model is given in Appendix-II. In the model, returns from all the activities were considered as part of input-output coefficient matrix (a_{ij}). Besides seasonwise and monthwise cash availability restrictions and cash transfer activities have also been introduced. Thus any surplus of cash at the end of last day of model year is transferred to the objective function (Z) and hence, C_j were taken as zero for all activities but for activity X_{74}, transfer of surplus cash to objective function, which has coefficient of 1. Therefore, the objective function contains only one coefficient i.e. 1 in column 74.

The activity set that provides alternatives for the use of given resources, services and facilities is discussed in brief in following paragraphs.

Production activities include the crop production activities both potato and non-potato. Non-potato crops include all the rainy and winter crops, other

than potato. Different potato activities/production processes were synthesized according to the different sowing and harvesting times of the potatoes, crop grown with different input combinations i.e. with or without pesticides and fertilizer.

Input buying activities include the buying of fertilizer nutrients and pesticides by respective sources.

Potato distribution (marketing) activities include time alternatives for sale of table potatoes in mandi to WCAs.

Financial management activities involve activities for borrowings, repayment of debts generated from borrowings and management of cash, initial as well as that generated during model period from July to October . To facilitate the management of cash through the planning period, specifications have been provided in the model to transfer cash surplus from one season/month to another. The production period considered is from July 2002 to October 2003. But the harvesting and marketing of potato starts from June/July to October, which in turn generates cash usually in these months. Therefore, to facilitate potato farmer to meet out contingency needs of cash, if any, activity X_{65} and X_{66} have been provided for borrowing from WCA in December and January (in rabi season) respectively the pre-production (of potato) planning period. Activities X_{69} and X_{70} represent the inter season cash transfers during i.e. Kharif to rabi and Rabi to July and that activities X_{71} to X_{73} represent the inter month cash transfers i.e. August to October. Finally activity X_{74} is provided for transfer of surplus cash to the objective function.

The model is designed for typical potato producing farm. The data indicated that some of the sample farmers kept milch animals to meet

requirements of the family. But, they did not take up dairying as a business enterprise; therefore, livestock activities were excluded from the model.

5.3.2.2 Constraints (bi)

A farmer, like any other decision maker, operates with limited resources. In the model framed for the present study availability of land, capital, and debts were considered as constraints. In addition, farmer also had certain behavioural preferences, likings and managerial limitations. Hence, some maximum and minimum limit constraints were also imposed on the size of certain activities to take care thereof. The maximum acreage restrictions were imposed on certain activities due to the perishable nature of the produce, labour intensive nature of crop, availability of market and other resources and effect on crop diversification etc. Hence, the maximum restriction was imposed on cabbage, maize, pea, tomato, bean and rajma so that the optimal plans give a balanced picture of the cropping pattern. Similarly minimum acreage limits were imposed due to the family needs of the farmer. In this context, minimum area restrictions were put on wheat and mandua because farmers were willing to grow them for their family consumption needs irrespective of their profitability. Besides these, constraints have also been used in the model to complete the linkages and interactions among the elements of the model. (A list of different constraints on the choice of farmers, in the study, alongwith their relation and levels are given in Appendix-III). The required set of data in determining the level of constraints, were derived as follows:

(i) Land restrictions

Total average operated land holding of the sample farmers was 1.864 acres of which 0.268 acre was irrigated and 1.596 acre was unirrigated. Initially, total cropped area was introduced as a constraint in the model. Further the constraints on land were specified based on the crop seasons (kharif and rabi) and irrigation (irrigated and unirrigated). The average figures for all the sample farmers supplied the land availability constraints as follows (1) kharif irrigated land of 0.268 acre (2) kharif unirrigated land of 1.596 acre (3) Rabi irrigated land of 0.268 acre and (4) Rabi unirrigated land of 1.596 acre. In the study, crop production activities were considered as per their actual season of land occupation.

(ii) Input material supply restrictions

Human labour did not appear as a costraint in the study area as the human labour was exchanged among the farmers on cooperative basis (hiring in=hiring out). The potato producer used mostly home grown seed. The mobile team run by the development block in the area also supplied potato seed but in highly restrictive quantity. Therefore the main source of seed to the farmer was their home grown seed. As such, there exists no constraint with respect to availability of seed.

The sole source of fertilizer purchase to the farmers in the study area were cooperatives. The supply of fertilizer from cooperatives was sufficient to fulfill the requirements of the farmers and hence the constraint was introduced with unrestricted supply.

The sources of supply of pesticides that existed in the study area were mobile team and private traders. Therefore pesticide purchase constraint was employed for these sources of supply.

(iii) Cash availability constraints

Cash availability at the beginning of year (kharif) was calculated by deducting cost of production and family living expenses from the total income (farm as well as non farm) of last year. The average availability of cash on synthesized farm in the beginning of year thus was worked out as Rs.16700 and was introduced as a constraint in the model in kharif season. Since the provision was made in the model to generate cash from the sale of potato and non-potato production activities, the availability of cash in other periods was not constrained. Instead, inter seasonal and inter month cash transfer activities were incorporated in the model to transfer surplus cash from one season/month to another and then finally to objective function.

(iv) Constraints on farm-family living consumption expenditure

Seasonal farm family expenses activities were introduced in the model. To provide for such activities, seasonal family consumption expenditure constraints were incorporated into the model.

(v) Maximum and minimum acreage constraints

As indicated earlier because of managerial restrictions emerging from the resource constraints, availability of market, perishability of produce etc., farmers restrict the area under certain crops. To calculate the maximum acreage limits for such crops, a sample of 10 per cent farmers, by listing the sample farmers taking the crop in descending order of maximum acreage were drawn from the top. The cropwise simple arithmetic averages of

maximum limits, thus arrived for winter cabbage, cabbage, maize, pea, tomato, rajma and bean were 0.95, 1.28, 1.12, 1.9, 0.375, 1.00 and 0.5 acres, respectively. Similarly, to calculate the minimum acreage limits for mandua and wheat, the pre determined activity for family consumption, 10 per cent sample of the farmers growing these crops was drawn listing them in ascending order. The crop wise simple arithmetic average of minimum limits, thus arrived for mandua and wheat were 0.075 and 0.125 acres, respectively.

(vi) Maximum credit borrowing constraints

During December and January (rabi season) producers borrowed from private traders in the market mainly to meet the family expenses and other contingencies if any. As there is a maximum limit on lending, therefore the level of money lender's borrowings during December (X_{65}) and January (X_{66}) was restricted at an average limit of total borrowings i.e. Rs.727.78 during December and Rs.1207.78 during January.

(vii) Constraints on sales pattern of potato

The average sales of potato for each sale months were restricted at 9.744, 29.484, 36.754, 43.094 and 17.094 quintals, respectively for the month of June, July, August, September and October. These quantities represent the existing sales pattern followed by the sample farmers

5.3.2.3 Input output coefficient matrix

The input-output coefficient (a_{ij}) of the matrix, X_j's, are comprised of input coefficients and output coefficients. The input coefficients represent the requirements of resources/or services/ or facilities per unit of activity and the output coefficients are the yields per unit of activity. Input-output coefficients for various activities were estimated as follows:

(i) Input-output coefficients for crop production activities

As discussed in sub-sections above, two broad classes of crop activities, viz., potato crop activities and non-potato crop activities are being undertaken by the typical farm firm. To estimate a_{ij} coefficients for all inputs use in potato and non-potato crop activities were computed on per acre basis. Since labour was being exchanged on cooperative basis, there was no cash expenditure made by the farmers on labour. Its cost was not considered while calculating cash expenses on different crop activities.

Per acre yields of various potato crop activities were considered at the time of their harvesting. Gross income from non-potato crops were considered in the season of their harvesting and/or threshing or winnowing and were computed taking the average product yield and average post harvest prices of the respective crops.

(ii) Input-output coefficients for input buying activities

The potato producing firm bought fertilizers and pesticides. As their cost has not been considered as a part of cash variable expenses in the crop production so here their cost was taken on per acre basis.

(iii) Input-output coefficients for potato marketing activities

The pattern of disposal of potato with place, time and agency was similar for all the farmers. The marketing charges incurred in disposal depend on the pattern of disposal. Average marketing charges incurred by the typical potato producer for the sale of potato may include expenses on transportation, commission of commission agent, dana and palledari and other miscellaneous items. Considering the expenses and the sale price, net

sale price was calculated and was considered as a_{ij} coefficient for potato sale activities.

(iv) Input-output coefficients for financing activities

The alternatives and constraints in the debt management include borrowings and the repayment of the debt. The typical farmer may borrow from cooperative credit societies and commercial banks, the other institutional agencies and/or money lender. But the farmer in the study area used to borrow only from private traders (Wholesale cum Commission Agents) in the market. The money was advanced to the farmer by the trader in the form of advance payment of the crop. They used to recover it from the crop sales of the last harvest with interest. The rate of interest varied from one per cent to two per cent per month. The average rate of interest was taken as 1.5 per cent per month for the present study. The borrowing took place during the months of December and January. The funds that were borrowed in December were to be repaid from the crop sales of September. Similarly the borrowings of January were to be repaid from the crop sales of October i.e. after 10 months. The debt to be repaid at the end of the period for each rupee of borrowed fund was Rs. 1.15.

(v) Input-output coefficients of activities pertaining to farm family living expenses

Data gathered from the sample farmers on seasonal family consumption expenditure include expenditure on health and food, clothing, social and religious functions, and education, during the reference period. To arrive at the input-output coefficients of seasonal consumption expenditure of

the farm household simple arithmetic mean of the expenses, listed above, incurred in a calender season were taken.

5.3.3 Formulation of synthetic potato commodity system

Farmers of the selected block are served by only one regulated market viz., Haldwani. Inspite of its regulation, the producers are still being exploited by the marketing agencies viz. WCAs as the unauthorized deductions on account of commission[1], and palledari are being made from the sellers in the market. By implementing the 'Agricultural Produce Marketing Board' Act more forcefully and effectively the malpractices can be put under check. The market situation, thus improved, will help the farmers sellers to realise higher net prices for their farm produce. Keeping this in mind, two synthetic situations for the study of potato commodity system were developed – one under existing market situation, the synthetic situation-I, and the other under improved market situation, the synthetic situation-II. The initial simplex table of linear programming model under situation-I (Plan A_1) is given in Appendix-I. The a_{ij} matrices for both the market situations were the same but for those row and column vectors representing potato marketing operations. The changed a_{ij} coefficients represented the per quintal net receipts under the respective situations.

Further it was seen that net prices realised in the month of September were highest among all the months of sale of potatoes, so three different alternatives were formulated for sales pattern in each of the synthetic situations.

[1] Commission from the seller is against the bye laws of Mandi laws.

Alternative A_1

Optimisation of potato system on a representative potato producing firm with the existing level of resource use and the existing level of per farm sales of potato in each month from June through October.

Alternative A_2

Optimisation of potato system with existing level of resource use and the minimum sales of potato in each month.

Alternative A_3

Optimisation of potato system with existing level of resource use and the maximum sales of potato in each month.

The minimum and maximum sale of potato in each month was calculated by using a specific methodology. The per cent sales of total production of potato of each farmer for each month were arranged in ascending order. Then the sales of 10 per cent on the top and 10 per cent of bottom of the list were added separately. The arithmetic averages of two groups for each month were calculated to arrive at minimum and maximum sales for the representative farm size during that specific month respectively.

The model was also run by withdrawing financial sub system i.e. borrowing and repayment activities so that to catch the relevance of financing sub system. The model with and without borrowing were compared in two market situation to observe an effect on the net farm family income.

CHAPTER 6

Results and Discussion

RESULTS AND DISCUSSION

This chapter has been organised into three sections. Each section deals with the particular objective, as per the sequence followed in objective formulation in chapter I.

6.1 Existing Potato Commodity System

In this section of the chapter, existing agribusiness commodity system of potato is examined. An attempt is made to study the various existing sub-systems so as to estimate the buying pattern and costs involved in input buying, cultivation of crops, disposal of potatoes and cash borrowings and the profitability of these many functions. This section is further divided in five sub-sections. Sub-section one deals with the input supply sub-system involving costs of acquiring different inputs and problems faced in acquiring inputs. Sub- section two deals with crop production sub-system involving costs and returns of various crops. Sub-section three deals with post harvest management and physical distribution system of potatoes. In sub-section four, the financing sub-system has been discussed. Finally, in sub-section five, the potato system has been dealt with by integrating the various sub-systems and processes thereof.

6.1.1 Input supply sub-system

Pesticides and fertilizers appeared as the most important purchased inputs for the potato crop in the study area. Their sources of supply also vary. While fertilizers were solely supplied by co-operative societies, the pesticides were supplied by the mobile team of the blocks working in the area and by the private traders. Therefore, potato producer has the option to acquire pesticide

from different sources. In order to compare the efficiency of various sources, the per unit costs of acquiring the inputs were worked out for each and compared. The acquisition costs were calculated in terms of on farm acquisition cost from the source of purchase including marketing margins, transportation costs etc. Problems faced by the sample farmers in getting various inputs through various sources were also identified.

6.1.1.1 Supply of fertilizer

It was observed that all the sample farmers purchased fertilizers from the cooperative societies. The sample farmers used three fertilizers viz., Urea, NPK and DAP. The acquisition cost of different fertilizers is presented in table 6.1.

Table 6.1: Acquisition cost of different fertilizers from cooperative societies

(Rs./qtl)

Fertilizer	Official retail price	Price offered by cooperative	Transportation cost	Labour charges	Total acquisition cost from cooperatives
Urea	512.80	512.00	12.00	32.00	556.00
NPK	856.00	856.00	15.00	25.00	896.00
DAP	946.80	946.00	13.50	30.00	989.50

The table shows that the prices of different fertilizers offered by cooperative societies were same as the official retail prices. But the acquisition cost of urea, NPK and DAP to farmers was estimated at Rs. 556.00, Rs. 896.00 and Rs. 989.50 per quintal respectively and exceeds by Rs. 43.20, Rs.40.00 and Rs.43.50 per quintal respectively over official retail price. The difference between the acquisition cost and official retail price was

on account of transportation cost and labour charges incurred by the farmers to bring the fertilizer from co-operative society to the farm.

The response of the farmers on various problems faced by them in obtaining fertilizer through cooperatives was collected. The different constraints faced by the farmer were classified on the basis of the extent of problem (as high, medium or low).

Among all the possible constraints (Insufficient quantity, non-availability at time, poor quality, inadequate supply, high prices, underweighment and adulteration) for which the response of the farmers was obtained, they pointed out only to the problem of high prices of fertilizers inspite of the fact that they were getting fertilizers from cooperative societies just at the official prices as fixed by the government. This merely indicates the poor purchasing power of the farmers. About 61per cent of the total sample farmers indicated the severity of the problem as high while 33.33 per cent and 5.56 per cent of the farmers indicated it as of medium and low level respectively.

6.1.1.2 Supply of pesticides

The farmers of the area purchased pesticides from the mobile team as well as from private traders. The common pesticides purchased from both the sources were Decis, Nuvan, Dithane M-45 and Chloropyriphos. Table 6.2 shows the acquisition cost of different pesticides from the mobile team and private traders. While the pesticides Decis, Nuvan, Dithane M-45 and Chloropyriphos were available to the farmers from both the sources, the requirement of Dicofol and Rhidomil was completely met from the private

Table 6.2: Acqusition cost of different pesticides from different sources (Rs./kg)

Pesticide	Prices offered by		Labour charges		Total acquisition cost	
	Mobile team	Private traders	Mobile team	Private traders	Mobile team	Private traders
Decis (I)	50.00	55.00	14.22	26.41	64.22	81.41
Nuvan (I)	500.00	505.50	16.50	22.00	516.50	527.50
Dithane M-45 (F)	200.00	200.00	14.22	26.41	214.22	226.41
Chloropyriphos (I)	265.00	275.00	11.00	20.00	276.00	295.00
Dicofol (I)	-	330.00		28.50		358.50
Rhidomil (F)	-	1098.00		25.25		1123.25

Note: I = Insecticide, F = Fungicide

traders. The prices offered by mobile team were 3.63 per cent to 9.1 per cent less than that offered by private traders except for Dithane M-45 for which price charged was same. The labour charges of acquiring pesticides from mobile team were also lower than that from private traders because private traders were placed at long distance. Thus total acquisition cost of pesticides from mobile team came much lower than that of private traders. Inspite of the lower acquisition costs of pesticides from mobile teams, farmers were not able to enjoy the benefits because supply of the pesticides with the mobile team was limited. Farmers in the study area also reported that the services rendered by the mobile team are poor. It was reported that the mobile team does not come to villages and the farmers have to go to the block where the mobile team is parked.

Table 6.3: Difficulties experienced by sample farmers in obtaining pesticides through different sources.

Difficulty experienced	Number of farmers using pesticides	Number of farmers experiencing difficulties in receiving supplies through								
		Mobile team			Private traders			Both		
Number of farmers	27 (100)	6(22.22)			14(51.85)			7(25.93)		
		H	M	L	H	M	L	H	M	L
Insufficient quantity		5 (83.33)		1 (16.67)						
Non availability at time			6 (100)							
Poor quality		4 (66.67)					2 (14.28)		4 (57.14)	
Unavailability of required brands			3 (50)	3 (50)						
High cost					11 (78.57)		3 (21.43)			

Note: H=high, M= medium, L=low.

Figures in parentheses indicate percentage to total in respective group

Table 6.3 shows the difficulties experienced by sample farmers in obtaining pesticides through different sources. It was found that only 27 farmers in the study area used pesticides. Out of them, 51.85 per cent farmers purchased pesticides exclusively from private traders, 22.22 per cent exclusively from mobile team while 25.93 per cent farmers purchased pesticides from both the sources.

All the farmers, who purchased pesticides from mobile teams reported the problem of insufficient quantity. Among them, 83.33 per cent reported the problem as high and 16.67 reported it as low. All the farmers reported the

problem of nonavailability of pesticides in time (medium level). About 67 per cent farmers were not satisfied with the quality of pesticides provided by mobile team. Unavailability of required brand of pesticides was reported as a problem by all the farmers of which 50 per cent each reported it as of medium and low level.

All the farmers who purchased pesticides from private traders reported the problem of high cost. Among them, 78.57 per cent reported the problem as high while 21.43 per cent reported it as low. Only 14.38 per cent farmers were not satisfied with the quality of pesticides that they purchased from private traders and reported the problem as low.

There were 25.93 per cent such farmers who purchased pesticides from both the sources i.e. mobile team as well as private traders. Out of these 57.14 per cent reported of the poor quality of pesticides as medium level.

6.1.1.3 Supply of potato seeds

Of the total potato producers studied, 96.67 per cent of the farmers used home grown seed, 33.33 per cent acquired seeds from the mobile team of the block functioning in the area and 7.78 per cent acquired seeds from private agencies.

Table 6.4: Acquisition cost of potato seed through different sources

(Rs./ Qtl)

Agency	Purchase price	transportation cost	Labour charges	Total acquisition cost
Home grown	585.00	-	-	585.00
Mobile team	975.00	20	12.18	1007.18
Private trader	1200.00	60	36.56	1296.56

Out of the total requirement of 10.95 quintals per farm, on an average the sample farmers used 10.58 quintals (96.62 per cent) of home grown seed while 0.04 quintal (0.36 per cent) and 0.33 quintal (3.02 per cent) of seed was purchased from mobile team and private traders respectively. The acquisition cost of seed from private trader was much higher (by 121.63 per cent) than that of the value of home grown seed (table 6.4). It was the major reason for a large number of farmers for using home grown seed as they are economically poor.

Difficulties faced by sample farmers in obtaining potato seeds from different sources were studied and the results are given in Table 6.5. Among all the farmers who used home grown seed, about 23 per cent complained of inadequate amount. However, the extent of the problem was medium. About 69 per cent of farmers on the other hand, reported that their seed was of poor quality and rated the problem as low. One third of sample farmers purchased seed from mobile team and all reported that mobile team could not meet their full requirement of seed. This was in fact, the complaint from all sample farmers. Sixty per cent farmers told that mobile team charged higher prices and rated the problem as high. Fourty per cent farmers complained of non availability of required variety and 66.67 per cent farmers mentioned of the poor quality of seed. This indicates that mobile teams were not working as per the expectations of the farmers.

Of all the farmers who purchased seed from private traders, 57.14 per cent complained of underweighment. Actually, the bag contained 75 kg seed

Table 6.5 : Difficulties faced by farmers in obtaining potato seed through different sources

Sl. No.	Number of farmers / Difficulty experienced	Number of farmers experiencing difficulty while receiving supplies								
		Home grown			Mobile team			Private trader		
		87(96.67)			30(33.33)			7(7.78)		
		High	Medium	Low	High	Medium	Low	High	Medium	Low
1.	Underweighment							4 (57.14)		
2.	Unsorted/ ungraded seed							2 (28.57)		
3.	Inadequate supply	20 (22.98)			30 (100.00)					
4.	High price				18 (60)	6 (20)	6(20)	5 (71.43)	2 (28.57)	
5.	Non availability of required variety					12 (40)			5 (71.43)	
6.	Other difficulty (poor quality, adulteration etc.)		60 (68.96)			20 (66.67)			2 (28.57)	

against the normal content of 80 kg. But price charged was for the full bag i.e. 80 kg. About 29 per cent farmers faced problem to high extent of unsorted/ungraded produce. About 71 per cent farmers complained the prices of seed offered by private traders as high while 28.57 per cent reported the problem but to medium extent. About 71.43 per cent farmers told that they could not get required variety from private traders and reported the problem as medium. There were about 29 per cent farmers who reported that the seeds provided by the private traders were adulterated.

6.1.2 Crop production sub-system

In this sub section, an attempt is made to discuss the estimated yields, costs of cultivation and profitability of potatoes as well as non potato crops in the study area.

6.1.2.1 Yield and cultivation costs and returns from non-potato crops

Per acre variable cash expenses on cultivation of and returns from various crops other than potato crops are presented in Table 6.6. In order to work out net cash accruing to the farmer from the cultivation of various non-potato crops, the gross value of output produced and variable cash expenses incurred have been taken into consideration. The variable cash expenses included expenditure on seed, manure, fertilizer, pesticides, irrigation, bullock charges and interest on working capital[1].

The net return over variable cash expenses among the non potato crops in irrigated area varied from Rs. 24.94 per acre for Gahat to as high as

[1] All the labour in the sample worked on cooperative basis. The cost of labour was thus non cash and hence was not considered while evaluating the variable cash expenses on various crops.

Rs. 37157.09 per acre for tomato. While for non potato crops, in unirrigated area, the net returns over variable cost varied from Rs.(-) 283.58 per acre (in a loss) for Mandua to as high as Rs. 33068.88 per acre for tomato. Other important crops to follow the tomato, in terms of net returns over variable cost (Rs. Per acre) were pea, rajma and cabbage (kharif) with the net returns of Rs.24564.49, Rs.21504.30 and Rs.20990.86 for irrigated area and Rs.19549.34, Rs. 20287.53 and Rs.19654.00 for unirrigated area respectively. Wheat in unirrigated area also yielded favourable net returns of Rs.20190.21 per acre, over variable costs.

Table 6.6 : Yield, cultivation costs and returns for different non-potato crops

Rs./acre

Sl. No.	Crop	Yield (quintal/ acre)	Gross returns	Variable cost	Net returns over variable cost
1.	A) Cabbage (Kharif)				
	(i) Irrigated	102.50	25625.00	4631.14	20990.86
	(ii) Unirrigated	95.43	23857.50	4203.50	19654.00
	B) Cabbage with potato				
	(i) Irrigated	92.50	18500.00	4689.18	13810.82
	(ii) Unirrigated	85.43	17086.00	4603.33	12482.67
2.	Maize irrigated	14.25	8550.00	622.53	7927.47
	Maize unirrigated	15.33	9498.00	748.18	8749.82
3.	Pea irrigated	23.20	27840.00	3275.57	24564.49
	Pea unirrigated	19.13	22956.00	3406.66	19549.34
4.	Tomato irrigated	80.50	42262.50	5105.41	37157.09
	Tomato unirrigated	72.00	37800.00	4731.12	33068.88
5.	Gahat irrigated	1.00	1800.00	1775.06	24.94
	Gahat unirrigated	0.85	1530.00	1745.07	-215.07
6.	Mandua irrigated	0.87	1305.00	1588.58	-283.58
7.	Bhat unirrigated	0.98	1960.00	1929.79	30.21
8.	Rajma irrigated	8.00	24000.00	2495.70	21504.30
	Rajma unirrigated	7.42	22260.00	1972.47	20287.53
9.	Bean unirrigated	8.89	7112.00	1046.27	6065.73
10.	Wheat irrigated	8.00	6400.00	2774.21	3625.79
	Wheat unirrigated	29.09	23272.00	3081.79	20190.21

6.1.2.2 Yield, cultivation costs and returns from potato production activities.

Three varieties of potato were found to be grown by the sample farmers in the study area namely Garud, Shimla and Gola. Further the crop was sown in two months i.e. February and March. The two production seasons for the crop were identified. The harvesting of February sown crop started from June and that of March sown started from July.

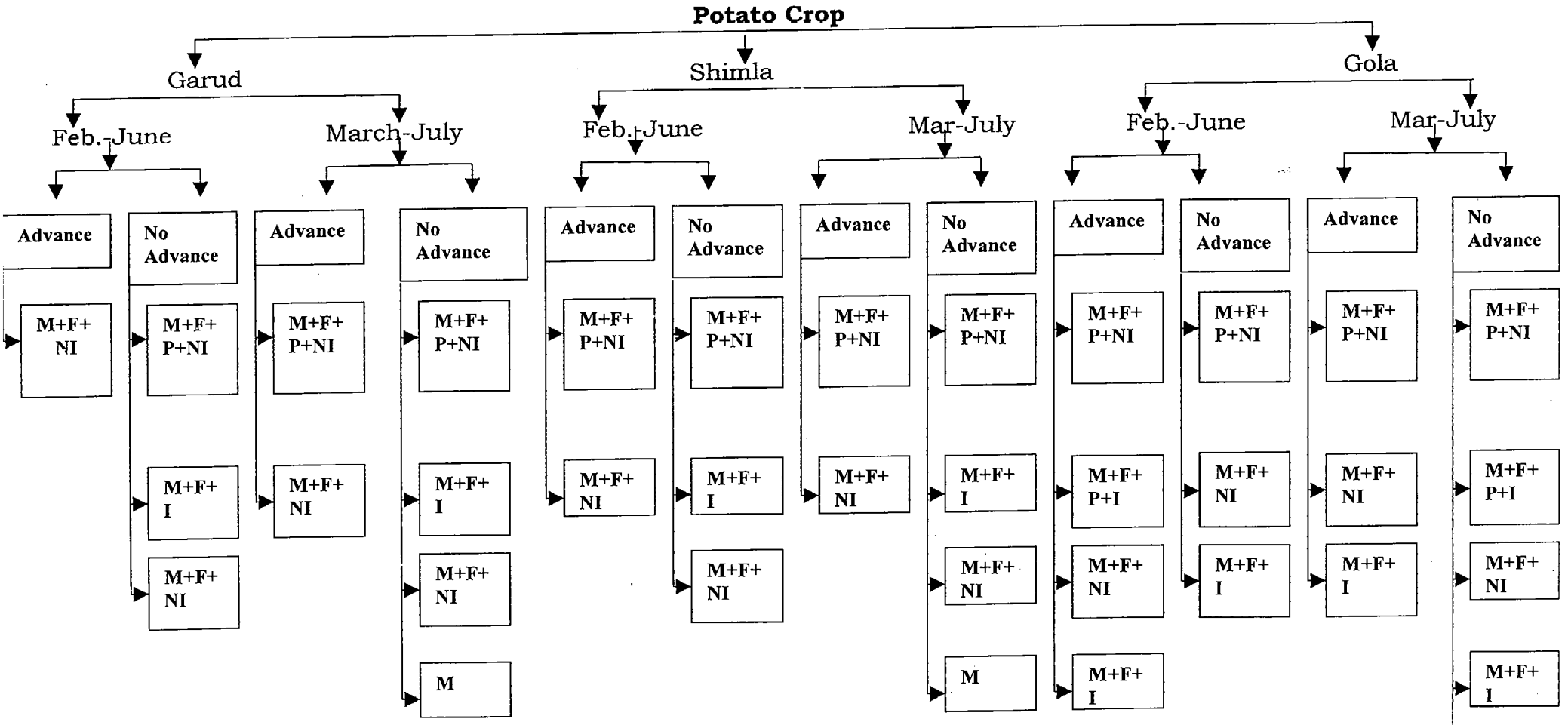
Next there were some sample farmers who took advance payment from the private traders (Wholesaler cum Commission Agents) in the market. Thus two different scenarios (with advance payment and without advance payment) emerged for all the three varieties sown in both seasons.

Then, it was found that manure (M), fertilizer (F) and pesticide (P) were the important inputs for potato crop along with irrigation (I). The following six combinations of these inputs were identified when the use pattern of these inputs by the sample farmers was considered.

(i) Manure + fertilizer + pesticide + irrigation
(ii) Manure + fertilizer + pesticide + no irrigation
(iii) Manure + fertilizer + irrigation
(iv) Manure + fertilizer + no irrigation
(v) Manure + irrigation
(vi) Manure + no irrigation

Thus, on the basis of varieties sown, their sowing period, mode of advance payment and combination of inputs viz., manure, fertilizer, pesticide and irrigation, different potato production activities were identified and given in figure 2. (A list of these activities is also given in Appendix II)

Figure 2 : Different potato production activities on sample farms



M: Manure F: Fertilizer P: Pesticide NI: No Irrigation I: Irrigation

In this sub-section the influence of fertilizer, pesticide and water use and sowing and harvesting periods on yields and consequently net returns from potato crops of three varieties are discussed and presented in Table 6.7and Table 6.8.

(a) Potato crops when the farmers were made advance payment by the private trader

Table 6.7 shows that the yield and consequently the gross returns[1] and net returns were higher for March-July crops than for February – June crops for the other two varieties except Gola. The yields were higher for irrigated crops than unirrigated ones. Variety wise also Gola yielded highest followed by Garud and Shimla. Thus gross returns were also highest for Gola indicating that the variety received highest price per quintal than others, in the market.

(b) Potato crops when the farmers were not made advance payment by the private trader

Table 6.8 shows comparative cultivation costs of and returns from different varieties of potato crops by different combination of inputs (no case of advance payment). It also shows the similar results as previous table. The yield was higher in irrigated area revealing that irrigation showed positive effect on yield of crop. Again Gola variety fetched greater gross returns compared to other varieties.

6.1.2.3 On-farm use and the marketed surplus of potato

The forms of potato utilization at farm level are not many but, is mostly consumed as vegetable. The processing and storage sub-systems were

[1] To calculate gross value the product of yield and monthly whole sale price of the actual month of harvest was taken.

Table 6.7: Yield, cultivation cost and returns from different varieties of potato crops by different combination of inputs (case of advance payment)

Sl No.	Particulars	Varieties							
		Garud		Shimla		Gola			
		M+F+P/ no irrigation	M+F/ no irrigation	M+F+P/ no irrigation	M+F/ no irrigation	M+F+P/ no irrigation	M+F+P/ irrigation	M+F/ no irrigation	M+F/ irrigation
	Feb. to June crop								
1.	Yield (qtls/acre)	-	74.20	65.00	74.60	90.23	110.00	82.00	100.00
2.	Variable cash cost (Rs. /acre)	-	10922.87	10271.74	10496.79	12353.18	13257.68	12857.26	13413.69
3.	Gross return (Rs./acre)	-	39317.14	32110.00	37008.57	47885.98	56511.00	43781.68	52502.86
4.	NROVC* (Rs./acre)	-	28394.27	21838.26	26511.78	35532.80	43253.32	30924.42	39089.17
	March to July crop								
1.	Yield (qtls/acre)	84.00	80.00	70.00	73.00	94.60	-	93.60	85.00
2.	Variable cash cost (Rs. /acre)	11223.70	11242.50	10746.14	10650.47	12993.31	-	12701.19	12902.60
3.	Gross return (Rs./acre)	49606.25	45718.00	37808.00	39441.67	56018.81	-	53619.45	50078.00
4.	NROVC* (Rs./acre)	38382.55	34476.50	27061.86	28791.20	43025.50	-	40918.26	37175.40

*Stands for net returns over variable cash cost

M = Manure, F = Fertilizer, P = Pesticides

Table 6.8 : Yield, cultivation costs and return from different varieties of potato crops by different combination of inputs (no case of advance payment)

Sl. No.	Particulars	Varieties												
		Garud				Shimla				Gola				
		M+F+P/ no irrigation	M+F/ irrigation	M+F/ no irrigation	M/ no irrigation	M+F+P/ no irrigation	M+F/ irrigation	M+F/ no irrigation	M/ no irrigation	M+F+P/ no irrigation	M+F+P irrigation	M+F/irrigation	M+F/ no irrigation	M/ no irrigation
Feb.- June crop														
1.	Yield (qtls/acre)	85.00	100.00	85.60	-	80.00	91.00	67.00	-	94.40	-	80.60	91.60	
2.	Variable cash cost (Rs. /acre)	11217.21	10572.80	11300.22	-	10232.47	10848.94	11447.00	-	12878.35	-	13094.44	12873.70	
3.	Gross return (Rs./acre)	48369.00	57275.33	47124.54	-	41800.00	48579.58	34315.00	-	53136.11	-	46408.74	50734.38	
4.	NROVC* (Rs./acre)	37151.79	46702.53	35824.32	-	31567.53	37730.64	22868.00	-	40257.76	-	33314.30	37860.68	
March to July crop														
1.	Yield (qtls/acre)	80.00	100.00	80.40	80.00	70.00	100.00	69.40	80.00	90.20	100.00	88.20	100.00	92.80
2.	Variable cash cost (Rs. /acre)	11536.22	11361.32	10936.33	10429.54	10551.87	10315.54	10511.48	9582.28	12688.11	12459.14	13034.59	12584.28	12340.46
3.	Gross return (Rs./acre)	47297.50	58271.33	47406.19	47380.50	38045.00	53570.00	37898.95	42078.57	50937.14	56732.00	49476.79	57782.57	53330.27
4.	NROVC* (Rs./acre)	35761.28	46910.01	36469.86	36951.00	27493.13	43254.46	27387.47	32496.29	38249.03	44272.86	36442.20	45198.29	48989.81

*Stands for net returns over variable cash cost

M = Manure, F = Fertilizer, P = Pesticides

absent in the study area. So the use of potato in processed form of the crop was not common. As the produce is an off-season crop for plains and there is high demand in plains, it is quickly disposed off in the market after harvesting. Hence, farmers generally sell the produce after accounting for their seasonal consumption and seed requirements.

The utilization pattern of potatoes by the sample farmers of Nainital district of Kumaon region is presented in Table 6.9. The percentage for potato production utilized by producers for domestic consumption and seed were 3.76 and 7.76 respectively. Total average quantity utilized for the said purposes was 15.70 quintals.

Table 6.9 : On-farm utilization pattern of potato, in the study area.

Sl. No.	Item	Quantity (qtls)
1.	Production	136.17(100)
2.	Consumption	5.12(3.76)
3.	Retention for seed	10.58(7.76)
	Total on farm utilization (2+3)	15.70(11.52)

Note: Figures in parentheses are percentage to the total production

Thus, it is very much clear from the Table 6.9 that the on-farm utilization of potatoes was only 11.52 per cent while remaining 88.48 per cent of the total production was sold out in the market.

6.1.3 Potato marketing sub-system

The potato marketing sub system includes post harvest management of the produce by the farmers and its physical distribution system. Grading, packaging, transportation and sales were the important post harvest activities performed by the potato growers. If these post harvest activities are managed efficiently, the outcome is obtained in terms of minimization of post harvest

losses, marketing cost and/or distress sale; and maximization of the gross returns in the form of price realized.

6.1.3.1 Post harvest management

6.1.3.1.1 Grading

All the sample farmers did grading of potato. It was found that 86.67 per cent farmers did grading immediately after harvest at farm itself and 16.67 per cent did the same at home Table 6.10 shows the reasons given by farmers for grading the potato at field/farm level.

Table 6.10: Reasons for grading the produce at field/farm level

Reason	Percent response
For convenience in sale	100.00
To earn high profit	91.11
To maintain quality	83.33
For retaining seed	50.00
For convenience in transport	24.44

Note: Sum total of percentage exceeds 100 due to multiple responses

All the farmers reported that they graded the potato due to convenience in selling. About 91 per cent reported that they did grading to earn high profit. Some farmers graded potato to maintain quality, for retaining seed and for convenience in transport. Farmers did not face any problem during grading.

Basis of grading

The potato was mainly graded on three basis viz, size, variety and freeness from insects and diseases. All the farmers graded it on the basis of size, 83.33 per cent on the basis of variety while 61.11 per cent farmers graded the potato on the basis of its insect and disease free nature.

Cost of grading

Labour is the only cost of grading at this stage of marketing. The average cost of grading was Rs.6.5 per quintal for an average quantity of 136.17 quintals graded per farm.

6.1.3.1.2 Packaging

All the sample farmers did packaging of their produce. The material used for packaging was gunny bag. The causes of using gunny bag for packaging by the percentage of farmers responding to different reasons are presented in Table 6.11. Nature of the produce was the most important cause which was pointed out by all the farmers. Other reasons for using gunny bags were convenience in transportation, high capacity and easy availability.

Table 6.11: Reason for using gunny bags by the sample farmers

Reason	Percent response
- Nature of produce	100.00
- Convenience in transportation	88.88
- High capacity	83.33
- Easily available	83.33

Note: Sum total of percentages exceeds 100 due to multiple responses.

Table 6.12 provides the details on packaging of potato by growers including type of package, size of package, quantity per package, cost per package, labour cost and costs per quintal on packaging. It was found that the cost of packaging potato incurred by the potato grower was Rs.31 per quintal which includes Rs.25.00 as cost of package and Rs. 6.00 as labour cost.

Table 6.12: Information about packaging of potato at grower's level

Particulars	Details
(a) Type of package used	Gunny bag
(b) Size of package	27" x 45"
(c) Number of packages used per quintal	1.25
(d) Quantity per package	80 kg
(e) Cost per package	Rs.20.00 (Rs.25 per quintal)
(f) Labour cost of package (Rs.per quintal)	Rs.6.00
(g) Total cost of packaging (Rs.per quintal) (e+f)	Rs.31.00

6.1.3.1.3 Storage

Storage at farm level was almost absent in the study area. This is so because the hill potato crop matures at such a time when there is very high demand in the plains; in fact it is an off-season crop from the viewpoint of plains. As a result the produce is immediately sent to the market at Haldwani. Farmers plan their harvesting operation keeping in mind the demand in the market, based on their experience and the contact with the caretaker who transports the produce of the farmers to Haldwani market. Moreover, there is no advantage in storing the potato being off seasonal crop as it fetches high price in the market at that time. In case the production to be stored for one day or so for waiting for the truck, it is kept at room temperature. The normal temperature in hills is low enough to have the safe storage for few days without deterioration in quality. Therefore, the cold stores have no roles to play in the potato commodity system in hills and so, the storage sub-system was absent in the study area.

6.1.3.1.4 Transportation

All the producers used to sell their produce in the Haldwani regulated market. So transportation played a vital role in the marketing sub-system. The overall average cost of transport is closely related with the distance the produce travelled. Even the mode of transport used is closely related with the distance travelled.

Basically Mule and Truck were found in use by sample farmers for transporting their produce. Under the prevailing system, the produce is taken from the farm (through mule) to the motorable road or at the point, where the

truck is available to transport the produce finally to Haldwani regulated market. As table 6.13 shows, the average cost of transportation was Rs.57 per quintal. It is to be mentioned here that the local caretakers play an important role in transporting potato from road to Haldwani market through truck. The caretaker is the person involved in the transportation who is responsible on behalf of the WCA (Wholesaler cum Commission Agent) in the regulated market to take care of the produce of the farmer. The truck belongs to the WCA's. Caretaker takes the truck to the point where the farmers are available with their produce on the motorable road. The produce is loaded on the truck and the caretaker brings it back to the market. As there is problem of availability of means of transport, so such type of practice as followed by the WCA's in the area facilitates the transportation of farmers' produce to the market.

Table 6.13: Analysis of transport system of potato

Where transported	Average distance (kms)	Means of transport	Transportation cost (Rs./qtl)
(a) From farm to road	4	Mule	32
(b) From road to Haldwani mandi	65	Truck	25
Total	69	Mule + Truck	57

The response of potato growers were obtained regarding the problems they face in the process of transportation. The major problems are shown in Table 6.14 which shows the poor condition of roads (73.34 per cent farmers) as the main problem followed by non-availability of desired means of transport at desired time and ease (26.66 per cent farmers).

Table 6.14: Problems in transportation of potato

Problem	Per cent growers faced
Poor roads	73.34
Non-availability of desired means of transport at desired time and ease	26.66

6.1.3.1.5 Sales pattern

The major buyers of potato from the growers of study area were wholesaler-cum-commission agents in the regulated market of Haldwani. All the sample growers sold their produce to wholesaler-cum-Commission agents.

Table 6.15 shows the percentage response of farmer for the reason behind the selection of buyer.

Table 6.15: Reasons for selection of Wholesaler-cum-Commission Agents as buyer of potato

Reason	Response	
	Frequency	Percent
Easy availability of buyer	82	91.11
Advance availed of	30	33.33
Reduce the frequent sale	65	72.22

Note: Due to multiple response, the sum total of percentage exceeds 100

Potato growers in the area were not found selling the produce to consumers (directly) or processors (directly). Processing units using potato as ingredient were reported to be absent in the area.

All the sample farmers told that the sale of their produce took place through open auction method. They believe that it is the most prevalent method in the Market, though they have no say whatsoever in deciding the trade practice to be adopted for sale of their produce.

How do the producers come to know of market price of the potato, tney intend to sell? The answers to this question were found varying. The sources of market information are decomposed in Table 6.16.

Table 6.16: Source of market information about potato

Source of market information	Percent of sample growers
- Local caretaker	93.33
- Neighbouring producers	66.67
- Personal visit to market	16.67
- Telephonic conversation	13.33

The table shows that the market intelligence system is inadequate and unorganized and needs to be strengthened. The local caretaker who arranges the transport of the produce to the market was the most important source of market information to the potato farmers in the study area

Table 6.17 gives the average frequency of sale in a season, the average quantity sold per season, average price received, amount of commission paid and other marketing expenses (miscellaneous) incurred by potato growers. It is explicit that producers are made to pay commission of five per cent to wholesaler-cum-commission agents, in violation of bye laws of APMC (Agricultural Produce Market Committee) Act. Farmers on an average received a price of Rs.585.00 per quintal of potato and they sold 25.91 quintals of potato per sale. The per season frequency of sale was 4.65

Table 6.17: Miscellaneous information on sales pattern of potato growers

Sl. No.	Particulars	Details
1.	Per season frequency of sale	4.65
2.	Average quantity sold per sale (qtl)	25.91
3.	Selling price (Rs. per quintal)	585.00
4.	Per cent commission paid	5.00
5.	Total commission paid (Rs.per quintal)	29.25
6.	Other expenditure (Rs. per quintal)	8.35

The month-wise pattern of marketed surplus of potatoes is given in Table 6.18. The table shows that maximum sale took place during September i.e. in the month of high prices. It is thus revealed that farmers were conscious of market prices and responded positively to the price. Highest price realized by the farmers was Rs 619 per quintal in the month of September. The quantity sold per farm was also highest in the same month being 36.78 quintal.

Table 6.18: Month-wise pattern of marketed surplus of potatoes

Period	Avg. whole sale prices (Rs./quintal)	Total quantity (qtls)	Quantity per farm (qtls)
June	476	784.70(7.24)	8.72(7.24)
July	599	2561.45(23.62)	28.46(23.62)
August	597	3215.70(29.66)	35.73(29.66)
September	619	3310.20(30.53)	36.78(30.53)
October	486	970.20(8.95)	10.78(8.95)
Total		10842.45(100.00)	120.47(100.00)

Note: Figures in parentheses are percentage to the total marketed surplus

6.1.3.1.6 Decomposition of marketing cost

The cost of various post harvest activities has already been given in the preceding sections. In the present section, the decomposition of the marketing cost of potato is presented. The results are presented in Table 6.19. It is revealed from the table that the marketing cost of potato was very high being Rs. 119.60 per quintal.

Table 6.19: Decomposition of marketing cost of potato

(Rs./qtl)

Sl. No.	Cost components	Costs
1	Packaging	25.00(20.90)
2.	Transportation	57.00(47.66)
3.	Commission paid	29.25(24.46)
4.	Other expenditure	8.35(6.98)
5.	Total marketing cost	119.60(100.0)

Note: Figures in parentheses are percentage to the total marketing cost

The major component of the marketing cost was transport cost (47.66 per cent). It was also found that the commission paid by the farmers against the bye-laws of Mandi Act adds up about a quarter share (24.46 per cent) in the total marketing cost. The marketing cost can be reduced only if the provisions of the market regulation act are fully implemented.

It has been pointed out earlier that the labour in the area worked on mutual exchange basis, thus was not included as cash cost while calculating cash expenses on cost of cultivation. Same was the case with grading and packaging labour. So their cost was also not considered for calculating marketing costs. Although if their cost is included (Rs. 6.50 per quintal for grading and Rs.6.00 per Quintal for packaging), total marketing cost will be arrived at Rs. 132.10 per quintal.

6.1.3.1.7 Marketing problem of potato growers

Potato growers of the study area faced a number of problems related to marketing, as revealed from findings so far. An attempt is made in this section to identify the number of farmers who faced different problems, according to the severity of these problems. The results are obtained based on the responses of potato growers to different problems and are presented in Table 6.20.

The table reveals that high cost, problem of stay, lack of effective market regulation, unnecessary deductions by the traders and lack of market extension and information were the problems which were faced by majority of the farmers to high extent. However, the problem of transportation can not be ignored, 61.11 per cent of the farmers felt it to medium extent and 38.89 per

cent to low extent. About 31 per cent of the farmers complained of faulty weighing practices in the Market.

Table 6.20: Problems faced by farmers during marketing of potato

Problem	Percentage of respondents		
	High	Medium	Low
Problem in transport means	-	61.11	38.89
High cost of packaging material	77.78	16.67	5.55
Problem of stay in market area	94.4	5.56	-
Lack of effective market regulation	85.56	14.44	-
Unnecessary deductions by the traders	83.33	5.56	11.11
Faulty method of weighing	-	31.11	-
Lack of market extension and information	72.22	-	-

Note: Due to multiple responses, the sum total of percentages exceeds 100

6.1.3.1.8 Period wise marketing expenses, and net prices realised by producers for sale of fresh table potato in market

The fresh table potato was sold by the producers just after the harvest of the crop during the months of June to October in market to the Wholesaler-cum-Commission Agents (private traders). The private traders offered the wholesale prices prevailing in the market.

The marketing costs which the producers have borne in case of sale of fresh table potatoes to private traders are shown in Table 6.21. Marketing costs included the charges on grading, packaging, transportation etc. The marketing costs were very high and excessive marketing costs resulted in reduction of returns realised by producers. Farmers transported their produce to the markets by trucks arranged by caretaker. Though, the Haldwani market is regulated market but the act is not implemented forcefully, therefore the

traders were able to make some unauthorised deduction from farmers-seller an account of dana, commission and palledari. The net prices realized by the farmer after meeting all marketing expenses were arrived at a minimum of Rs.362.94 in the month of June to a maximum of Rs. 497.36 in the month of September.

Table 6.21: Month wise marketing expenses borne and net prices realized by producers for the sale of fresh table potato in the market.

Rs./qtl.

Item	Rate	Sales effected through private traders				
		June	July	Aug.	Sept.	Oct.
Average wholesale prices	Rs./qtl	476	599	597	619	486
Packaging	Rs./qtl	25.00	25.00	25.00	25.00	25.00
Transport cost	Rs./qtl	57.00	57.00	57.00	57.00	57.00
Palledari	Rs./qtl	2.50	2.50	2.50	2.50	2.50
Dana	Re1.00/100	4.76	5.99	5.97	6.19	4.86
Commission	5 per cent of Average wholesale prices	23.80	29.95	29.85	30.95	24.30
Total marketing expenses	Rs./qtl	113.06	120.44	120.32	121.64	113.66
Net prices	Rs./qtl	362.94	478.56	476.68	497.36	372.34

6.1.3.2 Physical distribution system

The distribution system of potato comprises its movement from growers to the final consumers through various intermediaries. The intermediaries found in the study area included Wholesaler-cum- Commission Agent and retailer. The system of physical distribution included both channels of distribution and logistics thereof. The sequence through which commodity reaches the consumer is termed as the channel of distribution. The logistics comprises transportation etc.

6.1.3.2.1 Distribution channels

Following distribution channels were found existing in the marketing of potatoes in the study area:

(i) Producers – Wholesaler cum Commission Agent – retailer - consumer

(ii) Producer - Wholesaler cum Commission Agent of local market - Wholesaler cum Commission Agent of distant market – retailer - consumer.

Under this channel, potato was purchased by the Wholesalers cum Commission Agents of Markets, situated outside the region i.e. in distant places like Agra, Delhi etc. They took potato to their respective markets from where it was sold to consumers through retailers.

(iii) Producer-wholesaler-cum commission agent – Hotels/ Institutions-consumer.

6.1.3.2.2 Wholesaler cum Commission Agent of Haldwani market

a. Organization

Wholesaler cum Commission Agent was found existing in all the channels of potato distribution system. Wholesaler-cum Commission Agent is a middleman who takes the title of the produce and negotiates the sale of the produce he handles. He also operates from the shop, which is provided by the market committee on rent basis in the market yard.

(b) Purchase pattern and facilities provided by the mandi samittee

WCAs purchased potato from growers because of easy availability. The per day quantity of potato purchased was 70.86 qtls with an average purchase price of Rs.585.00. The purchase took place in the months of June-

October. Open auction method was reported to have been used by all the WCAs in purchase of potato. The information about criteria used by sample respondents for determining purchase price was obtained and it revealed that 80 per cent WCAs determine prices on the basis of graded/ungraded produce. While the demand and supply forces and freshness of potato were adjudged as price determining factors by 60 per cent and 40 per cent WCAs respectively. The facilities provided by the mandi samittees to WCAs were campus, road, shop, water, weighing machine, security and electricity.

(c) Activities

The Activities performed by the WCAs are briefly presented in table 6.22 and are discussed in detail under the following heads.

(i) Grading

All the respondents in the sample were found grading potato. Seventy per cent WCAs told that they practiced grading because of ease in sale while 63 per cent did the job for maintaining quality. The potato was graded on the bases of size (by 70 per cent WCAs. The whole lot is divided into three sub-lots i.e. small, medium and large and then packed). While 80 per cent WCAs reported that they grade the potato on the basis of quality and for 40 per cent WCAs insects/disease free nature was the basis. The grading charges were borne by WCAs themselves. The average grading charges for potato were Rs.2.50 per bag (of 80 kg). Thus the per quintal cost of grading was estimated as Rs.3.125. No WCA reported any problem in grading.

(i) Packaging

All respondents in the sample were found packing potatoes in gunny bags. The quantity packed per bag was 80 kg. The cost per package (gunny

bag) was Rs.16 per bag while the labour cost of packaging was Rs.3.00 per bag thus summing up the total cost of packaging as Rs.19 per bag or Rs.23.75 per quintals (Rs.0.2375 per kg). The reasons for using gunny bags for packaging were expressed as convenience in handling (by 80 per cent WCAs), easy availability (by 50 per cent WCAs) and capacity of package (by 30 per cent WCAs).

Of the total respondents, the high cost of packaging material was indicated as problem in packaging by 50 per cent WCAs while shortage of labour and non availability of packaging material were the problems quoted by 30 per cent respondents.

(ii) Storage

All the respondents in the entire sample reported to have sold potatoes without storing. As indicated earlier while discussing storage at farm level, due to high demand in the market; being off season, the need for storage does not arises.

(iii) Transportation

All the respondents transported potatoes through truck due to convenience. However, untimely and uneasy availability of means of transportation was indicated as a problem by 30 per cent of WCAs.

(iv) Sales pattern

All the WCAs in the sample sold potatoes through open auction method, the reason being the most prevailing common method. The price determination process depended upon various factors. The factors reported were freshness of produce (by 70 per cent WCAs), graded/ ungraded potatoes (by 60 per cent WCAs), prevailing mandi rate/ prices (by 50 per cent

WCAs) and forces of demand and supply (by 50 per cent WCAs). The average selling price of potato by WCAs was Rs 8.50 per kg for an average quantity sold of 75 kgs per day.

(v) Expenditures incurred by WCAs

As provided in the bye-laws of the market committee, WCAs pay a market fee of two per cent of the value of the produce and 0.5 per cent of Development Cess, charged to buyer of the produce. They are also required to pay annual licence fee of Rs.250 per year WCAs also pay rent for the shop provided to them by the market committee. The rent varies according to the shop. Other terms of expenses were electricity and water bills, paid monthly and salary/wages of the employees.

(vi) Income of the WCAs

The main sources of income of WCA was absolute margin (i.e. difference between the price paid and realised) and the commission charged for services rendered. As per the bye-laws of the market committee, WCAs are entitled to claim commission only from the buyers of the produce at the rate of three per cent, but they also charge commission from producer-seller of potato at high rate of five per cent. Besides the commission, the WCAs also charge for labour (palledar) at the rate of Rs.2.5 per bag for potato.

(vii) Facilities provided to potato growers

Thirty per cent WCAs reported that they availed loan from banks,

cooperatives and other institution to make advance payment to potato growers.

(ix) Problems of WCAs

Poor sanitation, lot of harassment from committee officials and their bureaucracy was reported as problem by 80 per cent, 30 per cent and 16.67 per cent WCAs respectively.

(x) Expectation of WCAs from market committee

Among the major expectations of WCAs from the market committee, important ones were place for rest and shelter (expressed by 80 per cent WCAs), expansion of area and proper arrangement of water, reduction of mandi shulk and licence fee (expressed by 75 per cent WCAs) electricity and sanitation (expressed by 60 per cent WCAs each), to lower rent of shops (expressed by 30 per cent WCAs) while 30 per cent WCAs gave no response in this regard.

Table 6.22 : Activities performed by wholesaler cum commission agent

i)	Purchase pattern		
	a)	Quantity of potato purchased per day (qtls)	70.86
	b)	Average purchase price (Rs./qtl)	585.00
	c)	Method of purchase	Open auction
ii)	Grading		
	a)	Cost of grading (Rs./qtl)	3.125
iii)	Packaging		
	a)	Quantity packed per bag (kgs)	80.00
	b)	Cost per bag (Rs.)	16.00
	c)	Cost of labour (Rs./bag)	3.00
	d)	Total cost of packaging (b+c) (Rs./bag)	19.00
	e)	Total cost of packaging (Rs./qtls)	23.75
iv)	Method of sale		Open Auction
	a)	Average selling price (Rs./qtl)	850.25
	b)	Average quantity sale (kg)	75.00
v)	Storage		NIL

6.1.3.2.3 Retailer of Haldwani market

(a) Organisation

Retailer is a middleman, found in distribution channels of produce, who sells it finally to the consumer. The produce is purchased by him from wholesaler cum commission agents in the market. They function in the retail market or Mandi itself through their temporary shops. The retailers, however, have to obtain the licence from the market committee of the local area. Usually standard weights are used by the retailers.

(b) Purchase pattern and facilities provided by the market committee

All the respondents (retailers) in the sample purchased potato from the local Mandi. But 83.33 per cent retailer reported the reason for this was easy availability of potato, 73.33 per cent as good quality of potato from Mandi. And 60 per cent told that nearness of the place was main reason.

The trade practices adopted by all the retailers in purchase of potato was open auction, the reason being most prevalent method (80 per cent) and no chance of cheating (66 per cent). The season of purchase of hilly potato was June-October. The per day quantity of potato purchased by retailer was 75 kgs at an average purchase price of Rs.8.50 per kg. The criteria used by sample retailer for determining purchase price of hill potato were size, freshness and variety (all by 83.33 per cent retailers), and market demand (by all of them).

Regarding the facilities provided by the market committee to retailers, their perceptions were found varying. Ninety per cent retailers told that no facility is provided to them by market committee except easy and timely availability of potato (by all of sample retailers).

(c) Activities

The Activities performed by the retailers are briefly presented in table 6.23 and are discussed in detail under the following heads.

(i) Grading

Only 63.33 per cent of the retailers did grading. They did it for convenience in selling. The reasons by remaining 36.67 per cent of the retailers not doing grading were purchase of graded potato (100 per cent) and shortage of time (45.45 per cent). Potato was graded on the bases of quality (78.95 per cent), size (63.16 per cent), variety (73.68 per cent), freshness (21.05 per cent) and insects and disease free nature (89.47 per cent).

The grading was performed by the retailers (73.87 per cent) themselves and in the mandi itself. Only 26 per cent retailers were found hiring labour. The average cost of grading was Rs. 1.02 per quintal. On an average 75 kg potato is purchased by the retailer per day and graded.

Of the total sample of graders, 63.17 per cent reported the problem of shortage of time for grading whereas 84.21 per cent reported no problem.

(i) Packaging

Of the total sample 73.33 per cent retailers found packing potato to bring them properly/conveniently to their spot. Out of those involved in packaging, 23 per cent hire labour for packing and rest perform the process themselves. On an average the per quintal cost of packaging was Rs.12.36 or Rs.0.12 per kg. The quantity packed per package was 80.00 kg. The cost of package (80 kg) was thus Rs.9.50.

Of the total sample of packers 81.81 per cent reported no problem in packaging while 18.19 per cent reported the problems of non-availability of labour and package in time.

(ii) Transportation

All the sample respondents were found performing the activity of transportation of potatoes. The average cost of transportation was Rs.9.50 per quintal.

(iii) Sales pattern

Buyers of potatoes from retailers were final consumers. The average quantity sold per retailer per day was 68 kg (90.67 per cent of total purchase of 75 kg per day) at an average selling price of Rs.12.50 per kg. The remaining quantity is tried to be sold the next day (93.33 per cent) or consumed by the family (6.67 per cent).

The price determination process is reported to depend upon various factors. These factors are freshness (86.66 per cent retailers), graded/ungraded potato (83 per cent retailers) and demand (93.33 per cent retailers).

The trade practice generally observed in retailing of potato was personal negotiation.

(iv) Problems of retailers and expectations from market committee

90 per cent retailers told that they had no problem while 10 per cent retailer faced problems of underweighment (40 per cent) and lack of means of transport (60 per cent).

Among the major expectations of retailers, the important ones were existence of mandi committee in their area of operations 92.33 per cent),

quality produce should be made available at reasonable prices (16.67 per cent) while 73.33 per cent gave no response.

Table 6.23 : Activities performed by retailer

i)	Purchase pattern		
	a)	Quantity of potato purchased per day (qtls)	75.00
	b)	Average purchase price (Rs./qtl)	850.25
ii)	Grading		
	a)	Cost of grading (Rs./qtl)	1.02
iii)	Packaging		
	a)	Cost of packaging (Rs./qtl)	12.36
iv)	Transportation		
	a)	Cost of transportation (Rs./qtl)	9.50
v)	Sale pattern		
	a)	Quantity sold per day (kg)	68.00
	b)	Average selling price (Rs./qtl)	1250.25

6.1.3.2.4 Price spread and Marketing efficiency

Of the total potato arrival in the market, 73.29 per cent was sold through channel II and channel III while remaining 26.71 per cent was sold through channel I. The price spread was calculated for only channel I in the present study because it was not possible to follow the produce to different distant markets. Also, the quantity of the produce flowing through channel II and III was not known separately.

In this section the price spread, costs and margins of various functionaries involved in channel I are discussed. Table 6.24 gives the detail. The producers marketed the potato to Wholesaler cum Commission Agents in the regulated market of Haldwani. Marketing cost incurred by the producers was Rs 119.60 per quintal of which 47.66 per cent, 24.46 per cent, 20.90 per cent and 6.98 per cent were towards transportation, commission, packaging and other expenses such as palledari and dana, respectively.

Table 6.24 presents the producer's share, margins and marketing cost for the same channel. It was found that the producer's share in consumer's rupee was only 37.23 per cent. The retailer's margin was very high i.e. 26.42 per cent. The marketing costs were also an important component contributing 18.46 per cent. The share of producer's marketing cost in the total marketing cost of the channel was 9.57 per cent while that of wholesaler's and retailer's marketing cost was 3.32 per cent and 5.57 per cent respectively. The high marketing costs lead to the decrease in the marketing efficiency of the channel which was only 0.59. Besides high costs, the high retailer's margin was also the cause of lower marketing efficiency.

Table 6.24 : Price spread for potato sold through channel I

	Functionaries/costs/margins	**Rs.qtl**
	Net price received by produce	465.40 (37.23)
	Expenses incurred by producer	
a)	Commission	29.25
b)	Other marketing charges	8.35
c)	Packaging	25.00
d)	Transportation	57.00
	Sub total	119.60
	Producer's sales price/wholesaler's purchase price	585.00
	Expenses incurred by wholesaler cum commission agent	
a)	Grading	3.13
b)	Packaging	23.75
c)	Marketing fee	14.62
	Sub total	41.50
	Wholesaler's margin	223.75(17.89)
	Wholesaler's sales price/retailers purchase price	850.25
	Expenses incurred by retailer	
a)	Grading	1.02
b)	Packaging	12.36
c)	Transportation	9.50
d)	Commission	25.51
e)	Market fee	21.25
	Sub total	69.64
	Retailer's margin	330.36(26.42)
	Total marketing cost of channel	230.74(18.46)
	Retailer's sales price/consumer's purchase price	1250.25(100.00)
	Marketing efficiency	0.59

6.1.4 Potato financing sub-system

Some of the sample farmers borrowed money from private traders in the market mainly to meet their family requirements. The borrowing was mainly during winters (December and January) when there is no income from crop production and off farm employment is also dampened due to cold. Of the total sample, 33.33 per cent farmers borrowed money from private traders. On an average, a farmer-borrower borrowed about Rs.1935.56. The interest charged by the private trader was 1-2 per cent per month, and the repayment is done from the sales proceeds of the potato during the months of September and October.

6.1.5 Existing potato commodity system in the study area.

In figure 3, the existing potato commodity system of a typical potato producer in the study area viz. hills of kumaon region of Uttaranchal. It appears from figure that a typical potato producer allocated approximately 1.60 acre of land (45.04 per cent of total cropped area) to potato cultivation and this crop alone contributed 84.09 per cent towards his gross cash revenue. The total potato production on the farm during the study period (2002-03) was 136.17 quintal. Of this 3.76 per cent was kept for domestic consumption and remaining 7.76 per cent was retained for seed purpose and remaining 88.48 per cent (120.47 quintals) was brought to market for sale. The per farm total variable cash expenses incurred by the producers to produce potatoes amounted to Rs.19507.43 The dominant inputs in potato cultivation was seed accounting for about 60 per cent of farmer's total variable cash expenses on potato cultivation. Further the variety Gola shared

relatively high share in the total expenses incurred on the crop than Shimla and Garud indicating simply that this variety occupied greater area on farm than two others.

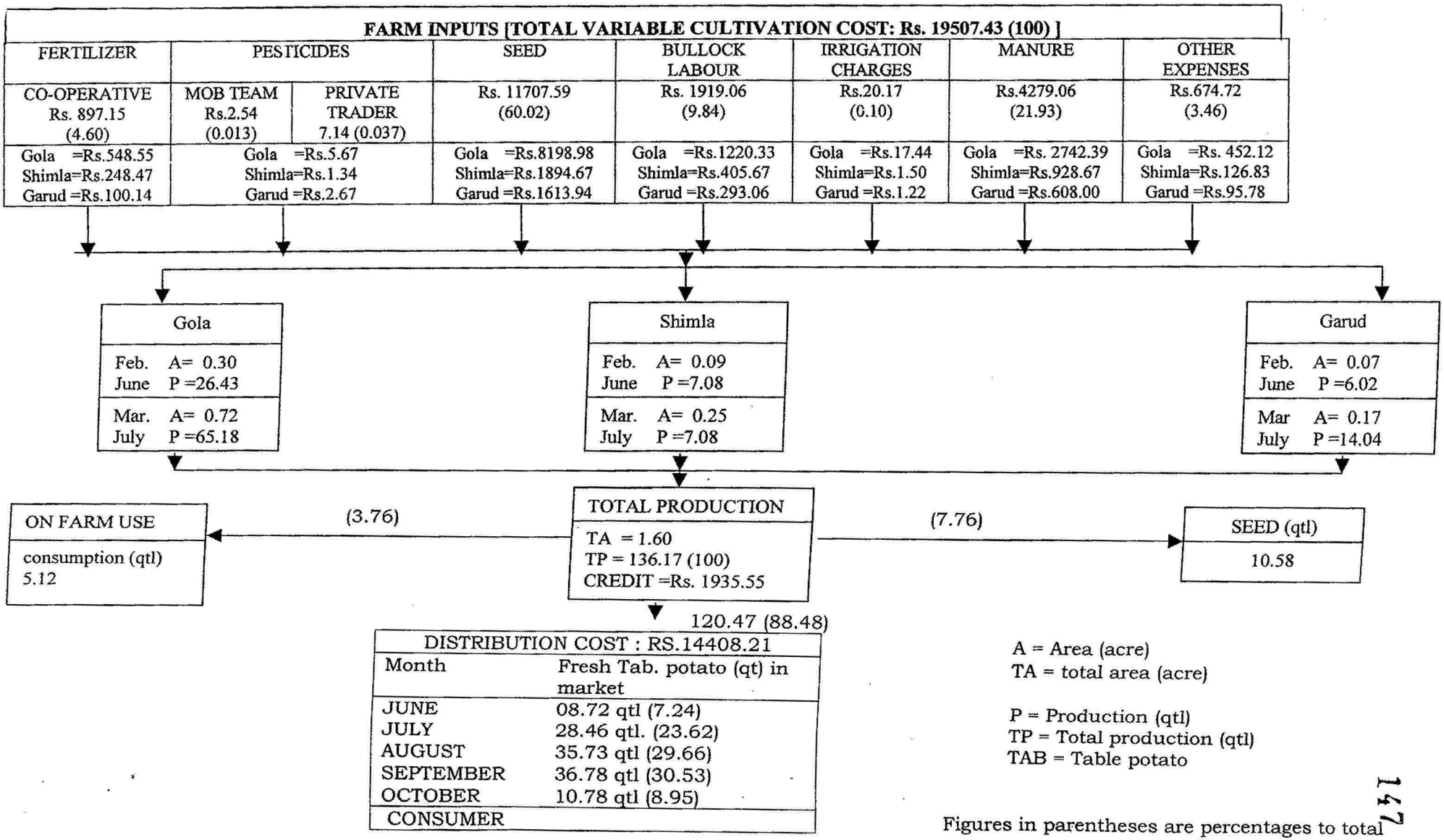
The total marketed surplus flowed through wholesaler cum commission agents in the market at different months. The marketing costs borne by the producer had quite a high share in the total cost of production. The share of marketing cost was about 45.50 per cent in the total cash cost of Rs.35789.56 per farm (Rs.262.83 per quintal) incurred on potato production.

Of the total marketed surplus of table potato about 7.24 per cent and 8.95 per cent was sold out in the months of June and October respectively. Maximum produce was disposed off in the months of August (29.66 per cent) and September (30.53 per cent). On an average a producer borrowed about Rs.1935.56 from private traders in the market to meet mainly non-production expenses.

In summary, the potato system is a highly commercial agribusiness commodity system in the study area. On the farms of potato producers of hills of Kumaon region, it is a big commodity system a combination of specialised commercial crop, potato, and a number of other specific crops.

By and large, the problem of potato growers centred on the input supply and marketing of potatoes. Though the cooperatives are supplying fertilizers at reasonable prices, the mobile teams in the area should be made more active in supplying pesticides and potato seeds of improved variety to the farmer in required quantity at right time. Farmers are not satisfied with the existing services of the mobile team. Farmers also reported about the high prices being charged for the inputs supplied by the private traders. Farmers

Figure 3: Existing potato commodity system of the potato producer in the study area



had grown three varieties of potato namely Gola, Shimla and Garud. Farmers in majority used home grown seed which results in low yield. Hence, there is a need to persuade the farmers to adopt the high yielding varieties evolved from CPRI, Shimla and other research stations and the supply of that seed should be ensured to them through improvement in input supply system. Main rotations involving potato were found cabbage-fallow-potato,cabbage/pea-fallow-potato/cabbage,cabbage- wheat/potato and cabbage/tomato-fallow-potato. The average variable cost per acre of potato cultivation was found Rs.22198.73 per acre. On an average the sample potato growers received net returns over variable cost of Rs.27584.77 per acre.

There is a scope to reduce the high marketing costs of potatoes by effectively implementing the APMC act. Transportation cost were the most important component of total marketing cost due to poor roads, not easy availability of transport and monopoly of transport agencies. Steps should be taken to regularise the transport charges.

6.2 Optimal potato commodity system

In this section, the optimum potato commodity systems, from producers view point, obtained from the solutions of the linear programming model by integrating different sub-systems under different situations are discussed. As it has been already discussed in the chapter on methodology that the two synthetic farm situations were formulated, one under the existing market situation (situation I) and the other under the improved market situation (situation II). In the existing market situation the WCAs make unauthorized deductions from the farmer as against the bye laws of market act. In the improved market situations, only those market charges which are due to the

producer-seller, according to the Mandi Samittee Adhiniyam, were considered. The net prices realized by the farmer in different months have already been presented in table 6.21. The net prices realised by the farmer under improved market situation are presented in table 6.25. Table shows that the market charges borne by a producer-seller for the sale of potatoes in the market vary uniformly as Rs.83.00 from the month of June to that of October. On comparing these charges with the existing charges, it was found that the charges borne in improved market conditions are lesser by 26.58 per cent to 31.76 per cent in different months. The net prices realised by the producer-seller in the market under improved market conditions vary from a minimum of Rs.393.00 in June to a maximum of Rs.536.00 in September in the sale period that comprised of five months from June through October. So, different sales pattern alternatives (existing, minimum and maximum sales pattern) were introduced in the model under both the market situations. The existing average sales pattern (A_1) of a farm-firm was 9.744, 29.484, 36.754, 43.094 and 17.094 in the month of June, July, August, September and October respectively. The other alternatives were A_2 where the minimum sales of 3.49, 19.96, 20.09, 20.17 and 6.22 quintals and A_3 where the maximum sales of 16.03, 39.59, 29.57, 41.43 and 31.39 quintals in the respective months of June, July, August, September and October were considered respectively.

Table 6.25: Monthwise marketing expenses borne and net prices realized by the producers for the sale of fresh table potato in improved market situation

	Item	Rate	Sales effected through private traders				
			June	July	Aug.	Sept.	Oct.
I.	Average wholesale prices	Rs./qtl	476	599	597	619	486
II.	Improved market situation						
	Packaging	Rs./qtl	25.00	25.00	25.00	25.00	25.00
	Transport cost	Rs./qtl	57.00	57.00	57.00	57.00	57.00
	Palledari	Rs./qtl	1.00	1.00	1.00	1.00	1.00
	Total marketing expenses	Rs./qtl	83.00	83.00	83.00	83.00	83.00
III.	Existing market situation	Rs./qtl	113.06	120.44	120.32	121.64	113.66
IV.	Percentage change in market expenses under improved situation over the existing market expenses		(-)26.58	(-)31.08	(-)31.02	(-)31.76	(-)26.97
V.	Net prices	Rs./qtl	393.00	516.00	514.00	536.00	403.00

During the period December and January when there is no income from crops and also the scope of off-farm employment is poor due to heavy snowfall, farmers used to borrow (advance payment) from the Wholesaler cum Commission Agents (WCAs) in the market mainly to meet out their family needs and other contingencies. This borrowing affects the potato system in the sense that the farmers have to sell their potato to the respective traders from whom they borrow. The traders charged an interest of one to two per cent per month from the farmers for the advance payment they made to them. The repayment is made after ten months from the crop sales of last months. The December borrowing was repaid from the crop sales of September and

January borrowing was repaid from the crop sales of October. Therefore while optimising the existing system at different sales alternatives; the existing borrowings were restricted at the average levels. The borrowing in the month of December was restricted at Rs.727.78 and that of January was restricted at Rs.1207.78. The different sub systems of potato commodity viz. crop production sub-system, input supply sub-system, marketing sub-system and financing sub-system under three optimum plans developed considering existing, minimum and maximum sales pattern in both the market situations are discussed. In sub-section 6.2.1, the results of optimum potato commodity systems under situation I (existing market conditions) as well as situation II (improved market conditions), when the financing sub-system was included, are presented and discussed under sub sub-sections 6.2.1.1 through sub sub-section 6.2.1.4. Under sub sub-section 6.2.1.5 alternative optimum potato systems derived under situation I and II, are evaluated economically

In sub-section 6.2.2, the results of optimum potato commodity systems under situation I (existing market conditions) as well as situation II (improved market conditions), when the financing sub-system was withdrawn, are presented and discussed.

6.2.1 Optimum potato commodity system with borrowing.

6.2.1.1 Optimum crop production sub systems under existing and improved market situations

To explore the potential of increasing cash surplus through simple reallocation of available land and capital among different crop activities, and by integrating different functions under existing (A_1), minimum (A_2) and maximum (A_3) sales pattern, optimum potato systems were worked out. The optimum crop production plans under situations I and II in the conditions of

different sales pattern as given in Table 6.26 were same. It reports the considerable reduction in the diversification of crops in comparison to the existing crop production plan (Table 4.17). It was also found that the cropping pattern of all the optimal plans (plan A_1, A_2 and A_3) were exactly the same. This was so because the sales pattern in post production period does not affect the cropping pattern in the production period.

Table 6.26: Optimum production sub systems in existing and improved market situation under different sales pattern alternatives

Crops	Plan A_1	Plan A_2	Plan A_3
Cabbage UI	0.146(3.92)	0.146(3.92)	0.146(3.92)
Pea I	0.268(7.19)	0.268(7.19)	0.268(7.19)
Tomato UI	0.375(10.06)	0.375(10.06)	0.375(10.06)
Mandua UI	0.075(2.01)	0.075(2.01)	0.075(2.01)
Rajma UI	1.00(26.82)	1.00(26.82)	1.00(26.82)
Wheat UI	0.125(3.35)	0.125(3.35)	0.125(3.35)
Potato I	0.268(7.19)	0.268(7.19)	0.268(7.19)
Potato UI	1.471(39.46)	1.471(39.46)	1.471(39.46)
Potato total	1.739(46.65)	1.739(46.65)	1.739(46.65)
Area under non potato crops	1.989(53.35)	1.989(53.35)	1.989(53.35)
Total area	3.728(100.00)	3.728(100.00)	3.728(100.00)
Irrigated area	0.536(14.38)	0.536(14.38)	0.536(14.38)
Unirrigated area	3.192(85.62)	3.192(85.62)	3.192(85.62)

Figures in parentheses indicate the percentage to total cropped area

The total cropped area under the optimum crop plan A_1 through plan A_3 was 3.728 acres. Potato crop was found to be the most prominent crop occupying about 46.65 per cent of the total cropped area in which 7.19 per cent was irrigated and 39.46 per cent was unirrigated.

Among non-potato crops, tomato appeared in the optimum plan with 0.375 acres, the upper limit prescribed for this activity. The activity appeared in unirrigated condition. Area under mandua and wheat crops appeared at 0.075 acre and 0.125 acre respectively in the optimum plans mainly because of the lower limits imposed on their area as they were predetermined

activities. In fact, wheat was the only winter crop other than potatoes, which appeared in the plans and occupied 3.35 per cent of the total cropped area under unirrigated condition. The levels of cabbage, pea and rajma were restricted at 1.28, 1.90 and 1.00 acres respectively; hence these crops could not exceed their respective upper limit. It was found that according to optimum plans, cabbage and rajma should occupy an unirrigated area of 0.146 acres and 1.00 acres, contributing 3.92 per cent and 26.82 per cent to total cropped area respectively. Pea should occupy an area of 0.268 acre i.e. 7.19 per cent of total cropped area. Comparing the optimum crop plans with the existing plan, it can be seen from the table 6.26 that area under all the crops increased in the optimal plan except cabbage and pea. Cabbage occupied 16.34 per cent area in the existing plan, which should be reduced to 3.92 per cent according to optimal plan A_1. Similarly area under pea should be reduced to 7.19 per cent in the optimal plan against 8.60 per cent in the existing plan. While area under tomato, mandua, rajma and wheat should be increased to 10.06, 2.01, 26.82 and 3.35 per cent against 1.03, 1.28, 4.61 and 2.61 per cent respectively in the existing plan (Table 4.17).

The area under potato, the main crop should also be increased to 46.65 per cent of total cropped area against 45.04 per cent in existing plan.

An increase in the total cropped area from 3.55 acres in the existing plan to 3.728 acre in the optimum plan was observed with the simple reallocation of land and other resources.

6.2.1.2 Optimum input supply sub-systems under existing and improved market situations

Table 6.27 shows the optimum expenditure on fertilizer from

cooperatives societies in the area. It has been discussed earlier all the farmers purchased all the required quantity of fertilizer from cooperative societies. Farmer has purchased fertilizer worth Rs.642.78 (92.33 kg) in the month of June for kharif crops and worth Rs.971.23 (126.79 kg) in the month of December for Rabi crops in the existing system. While he should allocate Rs.1105.27 to fertilizers in Rabi season and Rs.682.09 in kharif season according to the different optimum plans.

Table 6.27: Optimum input supply sub-systems in existing and improved market situation under different sales pattern alternatives

Input	Source	Optimal plans		
		Plan A_1	Plan A_2	Plan A_3
Fertilizer in kharif	Cooperatives	682.09	682.09	682.09
Fertilizer in Rabi	Cooperatives	1105.27	1105.27	1105.27
Pesticide	Private trader	63.33	63.33	63.33
Pesticide	Mobile team	43.64	43.64	43.64

The existing system revealed that the farmer has purchased pesticides worth Rs.18.87 from the mobile team and of Rs.27.92 from the private trader. The different optimal plans suggest that the farmer should purchase pesticides worth Rs.43.64 from the mobile team and that of Rs.63.33 from the private trader. The prices of the pesticides offered by mobile team were lower than that offered by private trader and also the acquisition cost of pesticides from mobile team was lesser than that from private trader. Due to the fact that the mobile team is unable to meet the full requirement of pesticides and also did not provide many required brands of pesticides, therefore farmer had to supplement their purchase from private trader.

6.2.1.3 Optimum potato marketing sub-systems under existing and improved market situations

Period-wise optimum marketing plans of potato commodity under situation I and II are given in Table 6.28. The sale of potatoes takes place through a single agency i.e. Wholesale cum Commission Agent. The optimum potato marketing plans A_1, A_2 and A_3 suggest the most profitable sales pattern ought to be followed by the farmer, i.e. the specific quantity ought to be sold out in the specific months.

While formulating the plans, it was assumed that the marketed surplus is equal to the total production. The total production of potatoes in the existing system was 136.17 quintals of which 9.744 quintals was sold out in the market in the month of June while 29.484, 36.754, 43.094 and 17.094 quintals in the months of July, August, September and October, respectively.

The different optimal plans from A_1 to A_3 showed that same quantity i.e. 168.33 quintals of potato should be produced because their production sub-systems and input supply sub systems are same. This quantity is 23.62 per cent more than that was produced by the farmers in the existing plan (136.17 quintals)

Table 6.28: Optimum potato marketing sub-systems in existing and improved market situations under different sales alternatives

Period	Unit	Existing plan	Optimal plans		
			A_1	A_2	A_3
June	qtls	9.74(7.15)	9.74(5.79)	3.49(2.07)	16.03(9.52)
July	qtls	29.48(21.65)	29.48(17.51)	19.95(11.86)	39.59(23.52)
August	qtls	36.75(27.00)	36.75(21.83)	20.09(11.93)	29.57(17.56)
September	qtls	43.09(31.64)	75.28(44.72)	118.58(70.45)	51.76(30.75)
October	qtls	17.09(12.56)	17.08(10.15)	6.22(3.69)	31.38(18.65)
Total	qtls	136.17(100)	168.33(100)	168.33(100)	168.33(100)

The optimum plans through table 6.28 show that maximum quantity of potato should be sold out in the month of September as is the case with

existing plan because the net prices of potato realised by the farmer in this month are highest. So in the existing system, where out of 136.17 quintals of total production, farmer sold only 31.64 per cent in September, he should sell 44.72 per cent of 168.33 quintals that ought to be produced if the resources are used optimally (plan A_1). If the farmers follows minimum sales pattern, he should sell according to plan A_2 2.07, 11.86, 11.93 and 3.69 per cent of total produce in the month of June, July, August and October respectively. And he should sell 70.45 per cent in the month of September. If the farmer follows maximum sales pattern i.e. the maximum quantity that ought to be sold out by him in different months, he should sell according to plan A_3 9.52, 23.52, 17.56 and 18.65 per cent of total produced in the month of June, July, August and October respectively. Thus he should sell only 30.75 per cent in the month of September. The different sales pattern alternatives were observed to catch the effect of sales pattern on the income of the farmer which is discussed in successive sub section 6.2.1.5.

6.2.1.4 Optimum financing sub-systems under existing and improved market situations

As it is discussed earlier that the farmers in the study area used to borrow from WCAs in the market during the month of December and January. The maximum limit was imposed on the borrowings considering the average level of borrowing per farm of Rs.727.78 in December and Rs.1207.78 in the month of January. Table 6.29 shows that the farmers should borrow Rs.727.78 in December and Rs.1207.78 in the month of January. The debts of the magnitude Rs.836.75 and Rs.1388.95 should be repaid in the month of September and October from the sales of potato crop.

Table 6.29: Optimum potato financing sub-systems in the existing and improved market situations under different sales alternatives

Borrowing period	Unit	Optimal plans		
		A_1	A_2	A_3
Borrowing				
December	Rupees	727.78	727.78	727.78
January	Rupees	1207.78	1207.78	1207.78
Repayment				
September	Rupees	836.95	836.95	836.95
October	Rupees	1388.95	1388.95	1388.95

6.2.1.5 Economic evaluation of alternative potato system derived under existing and improved market situation

An economic evaluation of alternative optimum potato systems is as follows:

(1) Total potato production under alternative potato systems with existing and improved market situation

Results on total production of potatoes realised under alternative potato systems for existing and improved market situation have been presented in table 6.28. Results show same production of potato under each plan from A_1 to A_3 under situation I as well as situation II i.e. 168.33 quintals (as there is only a change of sales pattern) as against 136.17 quintals in the existing plan.

(2) Net farm family income from alternative optimum potato systems under existing market situation

Table 6.30 presents net farm family income under existing and alternative optimum potato commodity systems and per cent increase or decrease in net income under alternative optimum systems over net income under existing system.

Table 6.30: Net farm family income under alternative optimum potato commodity system under existing market situation

Rs. /farm

Particulars	Existing plans	Optimum plans		
		A_1	A_2	A_3
Net farm family income	72816	93379	96103	91705
Percentage increase over net farm family income of existing system	-	28.24	31.98	25.94

The average net farm family income of the potato producer under existing situation amounted to Rs. 72816. A simple reallocation of land and cash inputs under different crops and the efficient integration of various functions on the farm could increase the net income under existing sales pattern (system A_1) by 28.24 per cent over the existing system. It can further increase the net income under minimum sales pattern (system A_2) by 31.98 per cent and a minimal of 25.94 per cent under maximum sales pattern (system A_3), over the existing system.

This indicates that even under the existing market situation, there is a scope of increasing farm income in the area through optimal allocation of available resources and better coordination and integration of various functions. Farmers should try to divert their sales from other months towards September.

(3) Net farm family income from alternative optimum potato commodity systems under improved market situation

Table 6.31 presents net farm family income under existing and alternative optimum potato commodity system and per cent increase or decrease in net income under alternative optimum system over net income under improved market situation.

Table 6.31: Net farm family income under alternative optimum potato commodity systems under improved market situation

Rs./farm

Particulars	Existing plan	Optimal plan		
		A_1	A_2	A_3
Net farm family income	72816	99579	102477	96735
Percentage increase over net farm family income in existing system	-	36.75	40.73	32.85

The average annual net income on the farm of a potato producer under the existing system was Rs.72816. With an objective of maximising net income under existing technology, a simple reallocation of inputs and optimum integration of various functions was done under improved market conditions and at alternative sales pattern. The result was an increase of net farm family income by about 36.75 per cent, 40.73 per cent and 32.85 per in the three optimal plans i.e. A_1, A_2 and A_3, respectively. Compared to the optimum plans A_1, A_2 and A_3 under situation I, the per cent increase in net farm family income was more in the optimal plans worked out under situation II. This highlights the effect of the assumption of ideal market conditions in situation II.

6.2.2 Optimum potato commodity system without borrowing

The existing system had its important part of financial sub-system. The sub system revealed that the borrowing is mainly done for consumption purpose which is repaid from crop sales. It was thought worthful to examine whether the financial sub-system has any important effect on other sub-systems and income of the farm family or not. Therefore, the model was run after withdrawing financial sub-system i.e. borrowing and repayment activities

under situation I and II as well. Thus the effect on various sub-systems and also on the net farm family income was observed.

6.2.2.1 Optimum production, input supply and marketing sub systems without borrowing under situation I and II

It was found that the cropping pattern under the condition of no borrowing in both the market situations was exactly the same as that under the condition of borrowing in both the market situations. It clearly indicates that whether the farmer borrows or not, the borrowing is not going to have any effect on any of the sub-system of the potato commodity system viz., production sub-system, input supply sub-system and marketing sub-system. Results of the analysis under this sub-section confirms that the borrowing by the farmers was for the consumption purposes. However, borrowing was found having impact on the net farm family income. Table 6.32 and 6.33 show the net farm family income under the condition of no borrowing in the two market situations I and II, respectively. .

Table 6.32: Net farm family income under alternative optimum potato commodity systems under existing market situation (without borrowing)

Rs./farm

Particulars	Existing plan	Optimal plan		
		A_1	A_2	A_3
Net farm family income	72816	93669	96393	91995
Percentage increase ove family income in existing	-	28.64	32.38	26.33

Table 6.33: Net farm family income under alternative optimum potato commodity systems under improved market situation (without borrowing)

Rs./farm

Particulars	Existing plan	Optimal plan		
		A_1	A_2	A_3
Net farm family income	72816	99870	102767	97026
Percentage increase over net farm family income in existing system	-	37.15	41.13	33.25

If the net farm family income in situation I under the condition of with and without borrowing (Table 6.30 and 6.32) is compared, then it reveals that there the net farm family income without borrowing is slightly higher than that with borrowing. Similar is the case with situation II (Table 6.31 and 6.33). Thus it can be easily concluded that the borrowing which is done by the farmers solely for consumption purpose does not cast any effect on the results of any of the sub system but reduces the net farm family income which is on account of payment of interest on loan.

6.3 Comparison of existing and optimum potato commodity systems

The existing and optimum potato commodity systems had already been discussed separately in previous sections 6.1 and 6.2, respectively. The present section has been devoted to compare the existing and optimum potato commodity system under alternative scenarios.

It was found that there was diversity in cropping pattern in the existing system. Under the existing system, a farmer allocated about 45 per cent of the total cropped area of 3.56 acres to potato cultivation followed by cabbage (16.34 per cent) and maize (13.72 per cent), among the major crops. The diversification considerably reduced in optimum systems. It was found that the total cropped area increased to 3.728 acres under optimum systems. According to alternative optimum systems, a farmer should allocate 46.65 per cent of the total cropped area to potato. Area under pea, cabbage, tomato and rajma increased in the optimum plans. Wheat and mandua were the two cereal crops that appeared in the optimal plans as the minimum area restriction was imposed for them. Farmer had purchased fertilizer worth

Rs.642.78 in the month of June for kharif crops and worth Rs.971.23 in the month of December for rabi crops in the existing system. While he should allocate Rs.1105.27 to fertilizers in rabi season and Rs.682.09 in kharif season according to the different optimum plans. This increase in expenses on fertilizer was mainly on account of increase in area under potato crop which require more fertilizer. The existing system revealed that the farmer had purchased pesticides worth Rs.18.87 from the mobile team and of Rs.27.92 from the private trader. The different optimal plans suggested that the farmer should purchase pesticides worth Rs.43.64 from the mobile team and that of Rs.63.33 from the private trader. The increase in the expenditure on pesticides in the optimum plans was obviously due to the increase in the total cropped area and increase in the area under crops like pea, tomato, rajma, cabbage etc in which disease incidence is relatively more. The total production of potatoes on an average farm, under the existing system was 136.17 quintals with a yield of 85.10 quintals per acre. While the alternative optimal plans revealed the production of 168.33 quintals with a yield of 96.79 quintals per acre. The marketing cost accounted for 45.50 per cent and 36.68 per cent of total cost of production in situation I and situation II respectively.

In existing system 33 per cent farmers used to borrow Rs.1935.56 from private traders in the market during December and January mainly for consumption purposes. Therefore, the borrowing in optimal plans was restricted at the same level. When the optimal plans were formulated with drawing financial sub-system, it was observed that no change in optimum cropping pattern occurred. This implies that farmers borrowed only for

meeting out consumption needs and contingencies of their family. They have sufficient cash of their own to meet out their working capital requirements.

The net farm family income of the potato farmers in the study area was Rs.72816 under existing production plan being followed by the farmers. Potential to increase the farm family income over existing level was found to the extent of Rs.91705 (25.94 per cent) in plan A_3 under situation I to Rs.102477 (40.73 per cent) in plan A_2 under situation II. The increase was to the extent of Rs.91995 (26.33 per cent) in plan A_1 under situation I to Rs.102767 (41.13 per cent) in plan A_2 under situation II when the financial sub system was withdrawn. It was also observed that the potential of increasing income was maximum when minimum sales restriction in different months was imposed and minimum when maximum sales restriction was imposed for different months of sale. The results thus suggest that farmers should follow the minimum sales strategy in different months other than September and should try to increase the sales in the months of September, the month of highest price. Of course, there is need to exercise precaution in doing so. Market demand and price trend should be kept in mind because excessive diversion of sale to September month may dampen the prices.

Table 6.34: Alternative optimum plans for potato commodity system

Plans	Area under potato (acre)	Total production (qtl)	Income (Rs./farm)	Credit (Rs./farm)		Expenditure on pesticide from		Expenditure on fertilizer from cooperatives		Sale of potatoes in market in				
				Private trader	Institution	Private trader	Mobile team	Kharif	Rabi	June	July	August	September	October
(Existing system)	1.60	136.17	72618	1935.56	0	27.92	18.87	642.98	971.23	9.744	29.484	36.754	49.094	17.094
al plans with borrowing ted at existing level														
SITUATION-I														
existing borrowing + existing sales pattern	1.739	168.33	93379	1935.56	0	63.33	43.64	682.09	1105.27	9.74	29.48	36.75	75.28	17.09
existing borrowing + minimum sales pattern	1.739	168.33	96103	1935.56	0	63.33	43.64	682.09	1105.27	3.49	19.96	20.09	118.58	6.22
existing borrowing + maximum sales pattern	1.739	168.33	91705	1935.56	0	63.33	43.64	682.09	1105.27	16.03	39.59	29.57	51.76	31.38
SITUATION-II														
existing borrowing + existing sales pattern	1.739	168.33	99579	1935.56	0	63.33	43.64	682.09	1105.27	9.74	29.48	36.75	75.28	17.09
existing borrowing + minimum sales pattern	1.739	168.33	102477	1935.56	0	63.33	43.64	682.09	1105.27	3.49	19.96	20.09	118.58	6.22
existing borrowing + maximum sales pattern	1.739	168.33	96735	1935.56	0	63.33	43.64	682.09	1105.27	16.03	39.59	29.57	51.76	31.38
al plans without ing														
SITUATION-I														
existing sales pattern	1.739	168.33	93669	0	0	63.33	43.64	682.09	1105.27	9.74	29.48	36.75	75.28	17.09
minimum sales pattern	1.739	168.33	96393	0	0	63.33	43.64	682.09	1105.27	3.49	19.96	20.09	118.58	6.22
maximum sales pattern	1.739	168.33	91995	0	0	63.33	43.64	682.09	1105.27	16.03	39.59	29.57	51.76	31.38
SITUATION-II														
existing sales pattern	1.739	168.33	99870	0	0	63.33	43.64	682.09	1105.27	9.74	29.48	36.75	75.28	17.09
minimum sales pattern	1.739	168.33	102767	0	0	63.33	43.64	682.09	1105.27	3.49	19.96	20.09	118.58	6.22
maximum sales pattern	1.739	168.33	97026	0	0	63.33	43.64	682.09	1105.27	16.03	39.59	29.57	51.76	31.38

CHAPTER 7

Summary and Conclusion

SUMMARY AND CONCLUSION

This chapter presents the summary view of the study, major conclusions and the policy implications emerging from the results of the study. The chapter is organised in three sections. In section 7.1 introduction, objectives and methodology are summarized. In section 7.2, salient findings of the study and in section 7.3 the policy recommendations of the study are presented.

7.1 Introduction, objectives and methodology

Potato is an important crop in the state of Uttaranchal. To strengthen the strategy for commercialisation and diversification of agriculture, the state of Uttaranchal plans to promote increasing area under horticulture and other ancillary activities. However, they need to be supported by excellent marketing strategies. The state of post-harvest management and marketing infrastructure is far from developed particularly in the hilly regions and this needs to be strengthened. There is a great need to modernise the whole system of the potato commodity including the supply of the inputs, financing and marketing of potato.

Traditional farm management studies and/or marketing studies on potato usually concentrated on a particular aspect of the problem investigated. Such an approach fails to take into account the many related aspects of the commodity since all the aspects from farm supplies to production, assembling, storing and distribution and coordinating institutional arrangements are integrated. Hence, by considering one or few aspects of the commodity, realistic policy decisions to modernise its system, can not be

taken. It is in this perspective; the study on commodity system of potatoes has assured great significance. The present study has, therefore, been undertaken with the following major objectives.

(1) To study the existing potato commodity system.

(2) To project optimum potato commodity system under alternative scenarios, and

(3) To compare the existing and optimum potato commodity system under alternative scenarios and draw policy implications.

The study was conducted in the hills of Kumaon region of Uttaranchal. Nainital district was purposively chosen due to highest production of potato among all districts in the region. The sample design of the study covered two blocks of Ramgarh and Dhari having maximum percentage of area under the crop. From the selected blocks a sample of six villages was drawn randomly. From the sampled villages a sample of 90 farmers, 15 farmers from each village, was drawn. Equal number of farmers were selected from each village because the number of potato growers were more or less equal in each village. Relevant market information was collected from market intermediaries; 30 Wholesaler cum Commission Agents and 30 retailers were randomly selected from the regulated market of Haldwani. Some relevant secondary information were also obtained from the offices of Directorate of Horticulture and Food Processing, District statistical Office, Development Blocks' Office, Mandi Samittee and Cooperative and Rural Banks.

To fulfill the objectives of the study the agribusiness commodity system approach was used. For the purpose, the whole agribusiness potato system

was partitioned into four important sub-systems: (i) input supply (ii) financing (iii) production and (iv) marketing. To analyse the existing agribusiness potato system simple statistical tools like arithmetic mean, percentages, frequency distribution etc. were used. However, to obtain the optimum potato system, from producer's view point, a single period linear programming model, of maximising cash surplus over total variable cash expenses was employed under the existing technology, resource constraints and existing as well as varying sales pattern under existing and improved market conditions. Moreover, the model was also run by withdrawing financing sub-system under same conditions as described above with the financing sub-system in order to examine the role of financing sub-system in potato commodity systems. Three alternative optimum potato commodity systems by varying sales pattern were formulated for two synthetic market situations i.e. one representing existing market situation (situation-I) and the other representing improved market situation (situation-II). These are summarized as follows.

Alternative A_1

Optimisation of potato system on a representative potato producing farm with the existing level of resource use and the existing level of per farm sales of potato in each month i.e. 9.744, 29.484, 36.754, 43.094 and 17.094 quintals for June, July, August, September and October respectively.

Alternative A_2

Optimization of potatc system with existing level of resource use and the minimum sales of potato in each month i.e. 3.49, 19.96, 20.09, 20.17 and 6.22 quintals for above mentioned months respectively.

Alternative A_3

Optimization of potato system with existing level of resource use and the maximum sales of potato in each month i.e. 16.03, 39.59, 29.57, 41.43 and 31.39 quintals for the said months respectively as under alternative A_1.

7.2 Salient findings of the study

Important findings of the study are discussed in the sub-sections 7.1.1 and 7.1.2 for existing and optimum potato commodity system.

7.2.1 Existing potato commodity system

For potato crop in the study area, fertilizers and pesticides appeared as the important cash inputs. Farmers acquired fertilizers from cooperative societies and pesticides from mobile teams of block and private traders. Under the existing system, the average acquisition cost of different fertilizers from cooperative societies exceeded over the official retail prices from Rs.30.00 to Rs.45.00 per quintal on account of transportation and labour. Regarding pesticides supplies, only 30 per cent farmers used pesticides and out of them 22.22 per cent purchased it from mobile team, 51.85 per cent purchased it from private trader while 25.93 purchased from both the sources. The acquisition cost of pesticides from private traders was higher than the mobile team. The prices offered by the mobile team were 3.63 per cent to 9.1 per cent lesser than that offered by private trader except for Dithane M-45 for which the prices charged by both the sources were same. The services rendered by mobile team were very poor as reported by all the farmers. The mobile team did not visit the villages in order to supply inputs. Moreover, quantity of the inputs supplied by the mobile team fell short of the requirement

of the farmers. Farmers also faced the problem of non-availability of certain pesticides with mobile team. Due to these problems, inspite of having greater acquiring cost, farmers have to depend on private traders in order to meet their demand of required pesticides. Of the total potato producers studied, 96.67 per cent of the farmers used home grown seed 33.33 per cent acquired seeds from the mobile team of the block offices while 7.78 per cent acquired seeds from private agencies. The cost of acquiring seed from private trader was quite high (Rs.96.56 per quintal) as against the value of home grown seed. That's why farmers used home grown seed. On an average, out of the total requirement of 10.95 quintals of seed per farm, farmers used 10.58 qtls (96.62 per cent) of home grown seed while 0.04 qtl (0.36 per cent) and 0.33 qtl (3.02 per cent) of seed was purchased from mobile team and private trader, respectively. Among the farmers using home grown seed, 68.16 per cent of farmers reported about the poor quality of their seed. All those farmers who purchased seed from mobile team reported that mobile team could not meet their full requirement of seed. Of all the farmers who purchased seed from private trader, 57.14 per cent complained of underweighment (75 kg bag instead of 80 kg), 28.57 per cent faced problem of unsorted/ungraded seed. Farmers reported the high prices of seed as a major problem.

On an average, under existing system, the per farm total cropped area was 3.55 acres. Potato, the most important crop, occupied as much as 45 per cent of the total cropped area followed by cabbage (16.34 per cent) and maize (13.72 per cent), among the major crops. Analysis showed that there was no relation between the cost and source of pesticide on yield of potato

crop. The use of pesticides was less because the cold climate in hills is less conducive to the infestation by insects/pests and diseases. The per farm total variable cost (cash expenses) incurred by the producers to produce potatoes amounted to Rs.19507.43. The total marketed surplus flows through Wholesaler cum Commission Agents in the market in different months during harvest period. The marketing costs borne by a typical producer accounted for quite a high share of the total cost of production. The share of marketing cost was about 45.50 per cent of the total cash cost of Rs.35789.56 per farm incurred on potato production. Thus per quintal cost of production of potato in the study area was Rs.262.83. Of the total potato produced per farm 88.48 per cent was the marketed surplus while 7.76 per cent was kept for family consumption and 3.36 per cent for seed purpose. Out of the total marketed surplus, about 7.24 per cent and 8.95 per cent was sold out in the months of June and October respectively. Maximum produce was disposed off in the month of September (30.53 per cent), the month of high prices. On an average a producer borrowed about Rs.1935.56 from private traders (Wholesaler cum Commission Agent) in the market mainly to meet consumption requirement and other contingencies in the months of December and January. Due to severe winters, fields remain covered with snow unsuitable for any crop cultivation. Consequently farmers have no income from crop activities during these months. Also, opportunities of off-farm employment also dampen. Under such situation farmers borrow from the private traders in the market and repay the loan from the sales of crop in the months of September and October i.e. after ten months at an interest rate of one to two per cent per month.

Results of the study further showed that though Haldwani market is a regulated market, farmers are still exploited by the private traders. The private traders take five per cent commission of the total value of produce from the farmers which is against the bye-laws of mandi. They also made unnecessary deductions on part of palledari and dana. Per quintal net receipts of the farmer in the existing market situation ranged from Rs.362.94 per quintal in June to Rs.497.36 in September. Major distribution channels were I) producer-Wholesaler cum Commission Agent-retailer-consumer II) producer-Wholesaler cum Commission Agent of local market- Wholesaler cum Commission Agent of distant market-retailer-consumer and III) producer-Wholesaler cum Commission Agent-institutions/hotels-consumer. Of the total potato arrival in the market, 73.29 per cent was sold through channel II and channel III while remaining 26.71 per cent was sold through channel I. The total price spread of the channel I can be broken up as 36.22 per cent as producer's share, 12.66 per cent as marketing cost, 24.70 as margin of wholesaler and 26.42 per cent as margin of retailer. The marketing efficiency of the channel was only 0.59. The price spread was calculated for only channel I in the present study because it was not possible to follow the produce to different distant markets. Also the quantity of the produce flowing through channel II and channel III was not known separately. The annual net farm family income of a potato producer under the existing system came to be Rs.72816.00.

7.2.2 Optimum agribusiness potato commodity systems

Results of different alternative optimum potato commodity systems comprising four sub-systems under existing resource use and at three

different levels of sales pattern under existing and improved market situations are summarised here. Moreover, the results of the system without borrowing in two market situations are also summarised.

In all the optimum crop production plans describing optimum potato agribusiness systems there was considerable reduction in the diversification of crops over the existing system and potato crop was found most prominent occupying about 46.65 per cent of the total cropped area. The total cropped area under all optimum plans A_1 through A_3 under both the situations viz. situation I and situation II was about 3.728 acres with and without borrowing activity. This increase in the area was due to the reduction in fallow land. The area under major food crops, wheat and mandua, in all the alternative optimum plans appeared at the minimum restricted level of 0.125 acre and 0.075 acre, respectively, as being predetermined activities. The production plans of alternative optimum system also indicated the cultivation of other commercial crops such as cabbage, pea, rajma and tomato on significant scale.

Total production of potatoes, under different alternative optimum potato commodity systems, was 168.34 quintal. Farmer should purchase fertilizer worth Rs.682.05 in kharif season and Rs.1105.27 in rabi season from cooperative societies to meet resource requirement of optimum plans. Further, the different optimal plans suggested that the farmer should purchase pesticides worth Rs.63.33 from the private trader and that of Rs.43.64 from the mobile team.

Different alternative optimum potato commodity systems suggested the disposal of 44.72 per cent (system A_1), 70.45 per cent (system A_2) and 30.75 per cent (system A_3) of potatoes in the month of September (month of highest prices).

The optimal plans showed the requirements of borrowed funds equal to Rs.1935.56, the limit imposed on the basis of average level of borrowing in the existing system.

Under the assumption that under synthetic situation II, the improved market situation, unauthorised deduction and other malpractices would not be allowed, the results revealed that there would be reduction in per quintal marketing expenses over situation I to the extent of 31.76 per cent. The marketing cost accounted for 36.68 per cent of total cost of production in the improved market situation.

The per cent increase in net farm family income of a potato producer under different alternative optimum systems (with borrowing) over the existing systems was of the order of 31.98 per cent in the optimal plan A_2 under situation I and to that of 40.73 per cent in the optimal plan A_2 under situation II. While under different alternative optimum systems (without borrowing) over the existing system an increase of the order of 32.38 per cent in situation I (plan A_2) and to the order of 41.13 per cent in situation II (plan A_2) was observed in farm family income. It clearly shows the negative effect of borrowing on income on account of interest payment for the borrowing is only for consumption purpose..

The results of linear programming exercise attempted in the study indicate that what ought to be done and what can be done? The answers to these questions would depend on how effectively appropriate agricultural extension, marketing infrastructure for input and output and credit programmes are planned and implemented in the study area. Every alternative optimum potato system may be the best one in its own specialty and for specific situation for which it was developed. But producers are the final decision makers. The farmers can choose from the optimal plans presented here that suit their managerial ability and resource restrictions being faced.

7.3 Policy Recommendations

The major policies emerging from the empirical analysis of the study are as follows:

(i) Results showed that mobile teams of the block were supplying seed and pesticides of superior quality to the farmers than private traders but their services were not to the satisfaction of the farmers. The services of mobile teams thus needs to be improved to ensure timely and adequate supply of improved seed and pesticides and also they should be supplied at the doorstep of the farmers as expected.

(ii) Seeds are the most important input in potato cultivation. Sample farmers were using home grown seed, which was not of good quality, due to higher cost of seed supplied from mobile teams and private trader. It is suggested that provision should be made from the government's side to supply improved seed to the farmer at subsidized

rate through mobile team/blocks which help to increase the productivity of the crop. Some free samples of seed of improved variety as released from CPRI, Shimla and other research stations can also be provided to the farmers for trial purpose and further multiplication at their own.

(iii) It was found, in few cases, the quantity of pesticides and seeds supplied by the private trader were sub-standard. So some provision should be made to check these malpractices and to test the potency and purity of such inputs including underweighment

(iv) Results of alternative optimum potato systems showed that, the farmers should dispose maximum quantity of potato in September (the month in which the net prices realised by the farmers are high) observing the market demand and price scenario in order to maximise their income as the case in existing system. In order to safeguard the interest of the producer , Government should adopt a price support policy for potato, a promising cash crop of kumaon hills.

(v) Marketing support system should be improved in terms of easy access to the market information, transportation, grading facilities etc.

(vi) Agricultural extension services from block or other sources (university/NGO) should be improved in order to acquaint the farmers with improved production package of the crop including post harvest operations.

(vii) Farmers were found dependent on the transport facilities provided by the Wholesaler cum Commission Agents as individually they cannot

afford to transport their surpluses of small quantity to market economically. Due to monopoly of the transport system operated by the WCAs farmers bear quite high transportation cost. The monopoly of the system needs to be broken off by developing effective alternative transport facilities for the transport of produce from production area to the market.

(viii) It was found that in the regulated market also malpractices and unauthorised deductions on account of dana, palledari and commission are prevalent and acts and regulation are not being followed honestly. Thus, there is a need to improve market conditions by implementing the mandi act effectively. It will improve the physical efficiency and keep up the interest of farmers by decreasing their marketing cost and increasing their income.

(ix) Results of the study also showed that the sample potato farmers do not require borrowing for the crop production purpose but they have to borrow for family expenses for which the sole source they have is the private trader in the market who charges quite high interest and also enforce the marketing of the produce through him where he could also exploit the farmer. There is therefore need for banking institutions to come forward to provide loan for non-productive purposes.

(x) Lastly, it is suggested that there is enough room for organizing farmers' cooperative societies/ self help groups to cope up with the problems being faced by the farmers in the study area either related to input buying or selling of their produce.

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Appendices

APPENDIX-I

Initial simplex table of linear programming model for potato commodity system under situation I (Plan A_1)

Maximize cash surplus

$$Z = 0X_1+0X_2 + 0X_3 + 0X_4 + 0X_5 + 0X_6 + 0X_7 + 0X_8 + 0X_9 + 0X_{10} + 0X_{11} + 0X_{12} + 0X_{13} + 0X_{14} + 0X_{15} + 0X_{16} + 0X_{17} + 0X_{18} + 0X_{20} + 0X_{21} + 0X_{22} + 0X_{23} + 0X_{24} + 0X_{25} + 0X_{26} + 0X_{27} + 0X_{28} + 0X_{29} + 0X_{30} + 0X_{31} + 0X_{32} + 0X_{32} + 0X_{34} + 0X_{35} + 0X_{36} + 0X_{37} + 0X_{38} + 0X_{39} + 0X_{40} + 0X_{41} + 0X_{42} + 0X_{43} + 0X_{44} + 0X_{45} + 0X_{46} + 0X_{47} + 0X_{48} + 0X_{49} + 0X_{50} + 0X_{51} + 0X_{52} + 0X_{53} + 0X_{54} + 0X_{55} + 0X_{56} + 0X_{57} + 0X_{58} + 0X_{59} + 0X_{60} + 0X_{61} + 0X_{62} + 0X_{63} + 0X_{64} + 0X_{66} + 0X_{67} + 0X_{68} + 0X_{69} + 0X_{70} + 0X_{71} + 0X_{72} + 0X_{73} + 1X_{74} + 0X_{75} + 0X_{76}.$$

Subject to:

$1X_1+1X_2 + 1X_3 + 1X_4 + 1X_5 + 1X_6 + 1X_7 + 1X_8 + 1X_9 + 1X_{10} + 1X_{11} + 1X_{12} + 1X_{13} + 1X_{14} + 1X_{15} + 1X_{16} + 1X_{17} + 1X_{18} + 1X_{20} + 1X_{21} + 1X_{22} + 1X_{23} + 1X_{24} +1X_{25} + 1X_{26} + 1X_{27} + 1X_{28} + 1X_{29} + 1X_{30} + 1X_{31} + 1X_{32} + 1X_{32} + 1X_{34} + 1X_{35} + 1X_{36} + 1X_{37} + 1X_{38} + 1X_{39} + 1X_{40} + 1X_{41} + 1X_{42} + 1X_{43} + 1X_{44} + 1X_{45} + 1X_{46} +1X_{47} + 1X_{48} + 1X_{49} + 1X_{50} + 1X_{51} + 1X_{52} + 1X_{53} + 1X_{54} + 1X_{55} \leq 3.728$ (total land available)

$1X_1 + 1X_3 + 1X_5 + 1X_7 + 1X_9 + 1X_{13} \leq 0.268$ (kharif irrigated land)

$1X_2+1X_4 + 1X_6 + 1X_8+1X_{10}+1X_{11} + 1X_{12} + 1X_{14} + 1X_{15} \leq 1.596$ (Kharif unirrigated land)

$1X_{16} + 1X_{18} + 1X_{24} + 1X_{26} + 1X_{33} + 1X_{38} + 1X_{42} + 1X_{44} + 1X_{48} + 1X_{52} + 1X_{54} + 1X_{55} \leq 0.268$ (Rabi irrigated land)

$1X_{17} + 1X_{19} + 1X_{20} + 1X_{21} +1X_{22} + 1X_{23} +1X_{25} + 1X_{27} + 1X_{28} + 1X_{29} +1X_{30} + 1X_{31} +1X_{32} + 1X_{34} + 1X_{35} + 1X_{36} +1X_{37} + 1X_{39} +1X_{40} + 1X_{41} + 1X_{43}+ 1X_{45} +1X_{46} + 1X_{47} +1X_{49} + 1X_{50} + 1X_{51} + 1X_{53} \leq 1.596$ (Rabi unirrigated land)

$196X_{16} + 257.53X_{17} + 56174X_{18} + 343.20X_{19} + 472.14X_{20} + 735.50X_{21} + 758.31X_{22} + 562.82X_{23} + 846X_{24} + 675.79X_{25} + 752X_{26} + 680X_{27} + 778X_{28} + 680X_{29} + 823X_{30} + 260.29X_{31} + 448.07X_{32} + 850X_{33} + 680X_{34} + 98X_{35} + 356.93X_{36} + 778X_{37} + 752X_{38} + 778X_{39} + 575.36X_{40} + 626.76X_{41} + 809.17X_{42} +392X_{43} + 787.33X_{44} + 408.43X_{45} + 778X_{47} + 752X_{48} + 742.42X_{49} + 549.55X_{51} + 852X_{52} + 478.11X_{53} + 767.52X_{54}-1X_{56} \leq 0$ (Fertilizer purchase in December)

$578.11X_1 + 549.73X_2 + 221.08X_3 + 215.02X_4 + 538.60X_5 + 420.56X_6 + 842.76X_7 + 752.62X_8 + 196X_9 + 171.66X_{10} + 131.88X_{11} + 141.93 X_{12} + 490X_{13} +165.37X_{14} + 531.56X_{15} - 1X_{57} \leq 0$ (Fertilizer purchase in June)

$28.93 X_1 + 3.45 X_2 + 43.19 X_5 + 9.23X_6 + 59.3X_7 + 71.1X_8 + 55.98X_{18} + 65.54X_{19} + 45.50 X_{21} + 1.05X_{23} + 1.8X_{24} + 4X_{29} + 4.75X_{31} + 3.18X_{37} + 3X_{40} +3.64X_{47} + 11.20X_{51} + 9.10X_{52} - 1X_{59} \leq 0$ (Pesticide purchase from mobile team)

$53.76X_1 + 8.48X_2 + 15.40X_5 + 11.92X_6 + 168.21X_7 + 84.18X_8 + 83.76X_{18} +105.15X_{19} + 46X_{21} + 15.26X_{23} + 7.975X_{24} +80X_{27} + 7.61X_{29} + 4.73X_{31} + 80X_{34} + 6.51X_{37} + 16.49X_{40} + 80X_{43} + 6X_{47} + 12.27X_{51} + 90.99X_{52} - 1X_{58} \leq 0$ (Pesticide purchase from private traders)

$$-74.20X_{20} - 65X_{21} - 74.60X_{22} - 90.23X_{23} - 110X_{24} - 82X_{25} - 100X_{26} - 84X_{27} - 80X_{28} - 70X_{29} - 73X_{30} - 94.60X_{31} - 93.60X_{32} - 88X_{33} - 85X_{34} - 100X_{35} - 85.60X_{36} - 80X_{37} - 91X_{38} - 67X_{39} - 94.40X_{40} - 80.60X_{41} - 91.60X_{42} - 80X_{43} - 100X_{44} - 80.40X_{45} - 80X_{46} - 70X_{47} - 100X_{48} - 69.4X_{49} - 80X_{50} - 90.2X_{51} - 100X_{52} - 88.20X_{53} - 100X_{54} - 92.80X_{55} + 1X_{60} + 1X_{61} + 1X_{62} + 1X_{63} + 1X_{64} \leq 0$$ (Production of potato)

$1X_1 + 1X_2 \leq 1.28$ (Maximum acreage under cabbage)
$1X_3 + 1X_4 \leq 1.12$ (Maximum acreage under maize)
$1X_5 + 1X_6 \leq 1.90$ (Maximum acreage under pea)
$1X_7 + 1X_8 \leq 0.375$ (Maximum acreage under tomato)
$1X_{11} \geq 0.075$ (Minimum acreage under mandua)
$1X_{13} + 1X_{14} \leq 1.00$ (Maximum acreage under rajma)
$1X_{15} \leq 0.50$ (Maximum acreage under bean)
$1X_{16} + 1X_{17} \geq 0.125$ (Minimum acreage under wheat)
$1X_{18} + 1X_{19} \leq 0.95$ (Maximum acreage under winter cabbage)

$$4007.89X_1 + 3628.16X_2 + 396.48X_3 + 528.31X_4 + 2657.37X_5 + 2944.66X_6 + 4069.86X_7 + 3799.32X_8 + 1574.64X_9 + 1569.56X_{10} + 1453.73X_{11} + 1784.67X_{12} + 1994.68X_{13} + 1803.38X_{14} + 502.76X_{15} + 1X_{69} + 1X_{75} \leq 16700$$ (cash availability in kharif)

$$-25625X_1 - 23857.50X_2 - 8550X_3 - 9498X_4 - 27840X_5 - 22956X_6 - 42262.50X_7 - 37799.32X_8 - 1800X_9 - 1530X_{10} - 1305X_{11} - 1960X_{12} - 24000X_{13} - 22260X_{14} - 7112X_{15} + 2573.80X_{16} + 2818.47X_{17} + 3958X_{18} + 4062.63X_{19} + 10440.11X_{20} + 9425.62X_{21} + 9722.04X_{22} + 11755.79X_{23} + 12341.36X_{24} + 12166.27X_{25} + 12644.77X_{26} + 10446.60X_{27} + 10447X_{28} + 10036.12X_{29} + 9808.95X_{30} + 12714.88X_{31} + 12243.02X_{32} + 12033.48X_{33} + 10440.11X_{34} + 10472.60X_{35} + 10935.26X_{36} + 9424.77X_{37} + 10080.02X_{38} + 10651.5X_{31} + 12266.42X_{40} + 12267.06X_{41} + 12232.82X_{42} + 11053.62X_{43} + 10556.28X_{44} + 10518.70X_{45} + 10429.50X_{46} + 9376.16X_{47} + 9546.62X_{48} + 9752.36X_{49} + 9582.28X_{50} + 12100.49X_{51} + 11483.68X_{52} + 12249.80X_{53} + 12095.41X_{54} + 12340.46X_{55} + 362.94X_{60} - 1X_{65} - 1X_{66} - 1X_{69} + 1X_{70} + 1X_{76} \leq 0$$ (cash availability in rabi).

$$-6400X_{16} - 23272X_{17} - 18500X_{18} - 17086X_{19} - 478.56X_{61} - 1X_{70} + 1X_{71} \leq 0$$ (cash availability in July)

$-476.68X_{62} - 1X_{71} + 1X_{72} \leq 0$ (cash availability in August)
$-497.36X_{63} + 1.15X_{67} - 1X_{72} + 1X_{73} \leq 0$ (cash availability in September)
$-372.34X_{64} + 1.15X_{68} - 1X_{73} + 1X_{74} \leq 0$ (cash availability in October)
$1X_{60} \geq 9.744$ (sale of potato in June)
$1X_{61} \geq 29.484$ (sale of potato in July)
$1X_{62} \geq 36.754$ (sale of potato in August)
$1X_{63} \geq 43.094$ (sale of potato in September)
$1X_{64} \geq 17.094$ (sale of potato in October)
$1X_{75} \geq 12000$ (family living expenses in kharif)
$1X_{76} \geq 14100$ (family living expenses in rabi)
$X_{65} \leq 727.78$ (borrowing from money lender during December)
$X_{66} \leq 1207.78$ (borrowing from money lender during January)

END.

APPENDIX-II
Activity set of the linear programming model

X_j	Description of activities

A) Non potato crop activity (acres)

X_1	Cabbage I
X_2	Cabbage UI
X_3	Maize I
X_4	Maize UI
X_5	Pea I
X_6	Pea UI
X_7	Tomato I
X_8	Tomato UI
X_9	Gahat I
X_{10}	Gahat UI
X_{11}	Mandua
X_{12}	Bhatt
X_{13}	Rajma I
X_{14}	Rajma UI
X_{15}	Bean
X_{16}	Wheat I
X_{17}	Wheat UI
X_{18}	Winter cabbage I
X_{19}	Winter cabbage UI

(B) Potato Crop Activity (acres)

(i) Feb-June potato activities (with advance payment)

X_{20}	Garud crop grown with manure and fertilizer
X_{21}	Shimla crop grown with manure, fertilizer and Pesticide
X_{22}	Shimla crop grown with manure and fertilizer
X_{23}	Gola crop grown with manure, fertilizer and pesticide
X_{24}	Gola crop grown with manure, fertilizer, pesticide and irrigation
X_{25}	Gola crop grown with manure and fertilizer
X_{26}	Gola crop grown with manure, fertilizer and irrigation

(ii) March-July potato activities (with advance payment)

X_{27}	Garud crop grown with manure, fertilizer and pesticide
X_{28}	Garud crop grown with manure and fertilizer
X_{29}	Shimla crop grown with manure, fertilizer and pesticide
X_{30}	Shimla crop grown with manure and fertilizer
X_{31}	Gola crop grown with manure, fertilizer and pesticide
X_{32}	Gola crop grown with manure and fertilizer
X_{33}	Gola crop grown with manure, fertilizer and irrigation

(iii) Feb-June potato activities (with no advance payment)

X_{34} Garud crop grown with manure, fertilizer and pesticide
X_{35} Garud crop grown with manure, fertilizer and irrigation
X_{36} Garud crop grown with manure and fertilizer
X_{37} Shimla crop grown with manure, fertilizer and pesticide
X_{38} Shimla crop grown with manure, fertilizer and irrigation
X_{39} Shimla crop grown with manure and fertilizer
X_{40} Gola crop grown with manure, fertilizer and pesticide
X_{41} Gola crop grown with manure and fertilizer
X_{42} Gola crop grown with manure, fertilizer and irrigation

(iv) March-July potato activities (with no advance payment)

X_{43} Garud crop grown with manure, fertilizer and pesticide
X_{44} Garud crop grown with manure, fertilizer and irrigation
X_{45} Garud crop grown with manure and fertilizer
X_{46} Garud crop grown with manure
X_{47} Shimla crop grown with manure, fertilizer and pesticide
X_{48} Shimla crop grown with manure, fertilizer and irrigation
X_{49} Shimla crop grown with manure and fertilizer
X_{50} Shimla crop grown with manure
X_{51} Gola crop grown with manure, fertilizer and pesticide
X_{52} Gola crop grown with manure, fertilizer, pesticide and irrigation
X_{53} Gola crop grown with manure and fertilizer
X_{54} Gola crop grown with manure, fertilizer and irrigation
X_{55} Gola crop grown with manure and irrigation

(C) Input buying/selling activity (Rs.)

X_{56} Purchase of fertilizer from cooperatives in December
X_{57} Purchase of fertilizer from cooperatives in June
X_{58} Purchase of pesticide from private traders
X_{59} Purchase of pesticide from mobile team

(D) Marketing Activity (quintals)

X_{60} Sale of potato to private trader in June
X_{61} Sale of potato to private trader in July
X_{62} Sale of potato to private trader in August
X_{63} Sale of potato to private trader in September
X_{64} Sale of potato to private trader in October

(E) Financing activity (Rupees)

X_{65} Borrowing from money lender in December
X_{66} Borrowing from money lender in January

X_{67} Repayment of borrowed funds in September
X_{68} Repayment of borrowed funds in December

(F) Cash transfer activity (Rupees)

X_{69} Transfer of cash from kharif to rabi
X_{70} Transfer of cash from kharif to July
X_{71} Transfer of cash from July to August
X_{72} Transfer of cash from August to September
X_{73} Transfer of cash from September to October
X_{74} Transfer of cash from October to Z.

(G) Family living expenses activity (Rupees)

X_{75} Farm family living expenses in Kharif
X_{76} Farm family living expenses in Rabi

APPENDIX-III
Row (constraints) specification of linear programming model

Row	Constraint	Relation	Level
1	Total available land	L	3.728 acre
2	Kharif irrigated land	L	0.268 acre
3	Kharif unirrigated land	L	1.596 acre
4	Rabi irrigated land	L	0.268 acre
5	Rabi unirrigated land	L	1.596 acre
6	Fertilizer purchase from cooperative in December	L	0
7	Fertilizer purchase from cooperative in June	L	0
8	Pesticide purchase from mobile team	L	0
9	Pesticide purchase from private trader	L	0
10	Production of potatoes	L	0
11	Maximum acreage under cabbage	L	1.28 acres
12	Maximum acreage under maize	L	1.12 acres
13	Maximum acreage under pea	L	1.9 acres
14	Maximum acreage under tomato	L	0.375 acres
15	Minimum acreage under mandua	G	0.075 acres
16	Maximum acreage under rajma	L	1.00 acre
17	Maximum acreage under bean	L	0.50 acre
18	Minimum acreage under wheat	G	0.125 acre
19	Maximum acreage under winter cabbage	L	0.95 acre
20	Cash availability in kharif	L	Rs.16700
21	Cash availability in rabi	L	0
22	Cash availability in July	L	0
23	Cash availability in August	L	0
24	Cash availability in September	L	0
25	Cash availability in October	L	0
26	Sale of potatoes during June	G	9.744 qtls
27	Sale of potatoes during July	G	29.484 qtls
28	Sale of potatoes during August	G	36.754 qtls
29	Sale of potatoes during September	G	43.094 qtls
30	Sale of potatoes during October	G	17.094 qtls
31	Farm household family living expenses during kharif	G	Rs.12000
32	Farm household family living expenses during rabi	G	Rs.14100
33	Money lender borrowing during December	L	Rs.727.78
34	Money lender borrowing during January	L	Rs.1207.78

APPENDIX-IV

Blockwise area, production and productivity of fruits, vegetables and potato in district Nainital (2001-02)

Area – hectare
Production-metric tonnes(mt)
Productivity- mt/hectare

S. No.	Name of the block	Fruits			Vegetables			Potato		
		Area	Product-ion	Product-ivity	Area	Product-ion	Product-ivity	Area	Product-ion	Product-ivity
1.	Ramnagar	1615	5910	3.65	1401	8200	5.85	149	3840	25.77
2.	Kotabagh	1843	5855	3.17	1000	6603	6.60	144	3710	25.76
3.	Ramnagar	8797	23440	2.64	606	4415	7.28	519	10360	19.96
4.	Bhimtal	2658	4591	1.72	1079	6302	5.84	389	8816	22.66
5.	Betalghat	4360	7366	1.68	931	5192	5.57	254	7420	29.21
6.	Dhari	6663	18705	2.80	827	5594	6.76	552	10954	19.84
7.	Okhalkanda	2228	4274	1.91	437	3777	8.64	224	3862	17.24
8.	Haldwani	796	2866	3.60	693	5045	7.28	129	3860	29.92
	Total	28960	73007	2.51	6974	45128	6.47	2360	52822	22.38

Source : Directorate of Horticulture and Food Processing, Chaubatia, Utaranchal

DEPARTMENT OF AGRICULTURAL ECONOMICS, COLLEGE OF AGRICULTURE, G.B. PANT UNIVERSITY OF AGRICULTURE AND TECHNOLOGY.

APPENDIX-V

1. QUESTIONNAIRE FOR POTATO GROWER

A) General Information

1. Name of the grower :
2. Father's Name :
3. Village :
4. Distance of village from road :
5. Distance of village from Market:
6. Block :
7. Tehsil :
8. District :
9. Family Information :

Name of member	Sex	Age (yrs)	Main occupation	Annual Income (Rs.)	Education

10. Type of family: Joint ..... Nuclear .....

B) Farm Information

1. Total area (Nali/Acre/Ha) :
2. Land available for agricultural (Nali/Acre/Ha)
   Irrigated ..... Unirrigated .....
3. Rental value of land (Rs./year/ha).....
4. Land revenue (Rs./year)
5. Average distance of farm from village/home

C) Cropping pattern :

Season/crop and variety	Area		Production	
	Irrigated	Unirrigated	Irrigated	Unirrigated
Kharif				
Rabi				
Zaid				

D) Farm Structure and Implements

Item	No.	year of purchase	Value at the time of purchase	Present value	Expected life (year)	Capacity
1. Farm building						
2. Bullock						
3. Source of irrig. - Pipe line - Tank - Other						
4. Bullock operated implements - Plough - Harrow - Patta - other						
5. Human operated implements - Spade - Sickle						
6. Others						

E) Cost of production

Particulars

1) Land preparation
   Ploughing (No.)
   Bullock labour (days)
   Farm Lab. (mds) M/F
   Hired Lab. (mds) M/F
2) FYM (AH) @
   Farm Lab. (mds)
   Hired lab. (mds)
3) Fertilizers (kg)
   Urea (Nit)
   DAP
   P_2O_5
   Other ((NPK – potato, regent
   Farm lab (mds)
   Hired lab. (mds)
4) Sowing/Transplanting
   Seed (kg)
   Seed treatment (Rs.)
   Family lab. (mds)
   Hired Lab. (mds)
5) Weedicide/Interculture (No.) & Qty. @
   Family labour (mds)

Hired labour (mds)

6) Plant protection chemicals (gm)
Farm Lab. (mds)
Hired lab. (mds)

7) Irrigation (No.) and source
Family labour (mds)
Hired Lab. (Mds)

8) Harvesting (No.) machines used
Farm labour
Hired labour

9) Threshing/Winnowing
Farm labour
Hired labour

F) Production of potato & non-potato crops

Crop	Area (Nali/acre/ha)	Picking (no.)	Av. prodn. / picking (qtl)	Total prodn. (qtl)

G) Production, marketed surplus and disposal pattern

Prodn. (qtl)	Home cons. (qtl)	For wage payment (qtl.)	For seed (qtl)	To whom sold (qty)	Price (Rs./kg)	Where sold	Cost of marketing (Rs.)

H) Problems in production of potato only

Problem	Input/Severity (Hig. med Low)						
	Seed	FYM	Fert.	Pest.	Human Lab.	Irrig.	Other
1. Insufficient quantity							
2. NA at time							
3. Poor quality							
4. Unavilability in the market/ inadequate supply							
5. Unavailability of required brand/variety							
6. High cost							
7. Source of availability unknown							
8. Lack of knowledge of							

applying of technique							
9. Any other (specify) adulterate in underweighment (loan), compulsions etc.							
	Yes/No. If yes or indicate		Describe how it affects qlty, price availability of product				
Climate 10. Risk Risk in disease	Low medium High Write % loss in last 5 years						
Marketing							
11. Lack of market at production place							
12. Limited to particular time of year							
13. Other restrictions or trade barriers							
14. Strong competition. - Market -Commission agent -Wholesaler							
15. Difficulty in obtaining payment							
16. Other							

Problems	Yes/No.	Severity		
		Low	Medium	High
Product				
18. Poor quality/ malpractice				
19. Exploitation by traders				
20. Unremunerative price				
21. Lack of quality control				
22. Other				
Transportation				
23. Damage				
24. Irregular				
25. Limited space				
26. Unavailability				
27. Freight costs too high				
28. Other				
Market Information				
29. Price Information				
30. Source				
31. Frequency				

I) GRADING

1. Do you grade vegetables/potato? Yes/No

If yes, Why?	If No, Why?
- To earn high profit	- Grading requires more time
- For convenience in selling	- Uneconomic
- To maintain the quality	- Due to NA of human labour
- For storage purpose	- Due to NA of sufficient space
- For convenience in transportation	- Techniques of grading not known
- Other purposes	- Other

2. At which place you grade the vegetable/potato

At farm/field	At home	Before departure to market	At market	At other place

And why?

- For convenience
- Based on need at the desired spot
- Other

3. What base do you follow for grading?

Quality	Size	Colour	Maturity	Variety	Freshness	Fresh from insects/ pest diseases

4. How many labourers are used for grading and what is their wage rate?
(mds) Rs./labour/day

5. Problems of grading?
   - Problem of bad weather
   - Problem of NA of human labour
   - Problem of space
   - Other

J) PACKAGING

1. Do you pack the product?
2. What packaging material do you use?
   And why?
   - Low price
   - Easily available
   - Convenience (for storage, transportation etc.)
   - High capacity

- Nature of vegetable (potato)
- Other

3. Information about means, quantity, labour used etc. for packaging

Size of package	Quantity per pack (qtl)	Price of package (Rs./package)	Labour used (mds)	Wage rate (Rs./Lab./day)

4. What problems do you face on account of package :

Problem indicating sensitivity	Solution

K) STORAGE

1. You store the product? Yes/No
   - Due to NA of storage facilities
   - Due to perishable nature of product
   - Due to non profitability of storage
   - Other
2. Identify the points in the post harvest system where storage takes
   Duration
   - On the farm
   - rural collecting point
   - regional collecting point
   - packaging house
   - other
3. Is present storage facility proper and sufficient according to you? Yes/No
   If no, then what kind of improvement do you want?
4. Are cold storage facilities available near your village/home? Yes/No.
   If yes, it comes under whose jurisdiction?
   - Pvt. organization
   - Government organization
   - Other

5. Per season average storage cost of potato for different types of cold storage item.

Cost item	Per quintal cost of storage (Rs.)		
	Qtl/cost	Qtl/cost	Harvest time/ After storage
- Cold storage charges			
- Transport cost			
- Cost of begs @/bag of kg by			
- Shortage in weight due to shrinkage, drying etc. __%			
- Potato cost due to pilferage, sprouting germination etc.			
- Washing, drying, sorting etc.			

6. Problem in storage

	Solution you need	Severity of problem		
		Low	Medium	High
- Quality deterioration				
- NA of storage facilities				
- High cost of storage				
- Distant location of store house from village				
- Others				

L) TRANSPORTATION

1. Do you transport the product? Yes/No

Information regarding transportation.

Where transported	Distance (km)	Means	Cost (Rs.)	Quantity (Qtl)	Time	Labour used mds	Wage rate Rs./mds	Other expenditure if any

2. Why do you use above means of transport means?
   - easily availability
   - Low cost
   - Convenience
   - Other

3. What kind of problems do you face during transportation?
   - NA of transport means at time and conveniently
   - Quantity and quality deterioration during transportation
   - Rough tough roads
   - Others

5. How much loss to the produce do occur during transportation due to following reasons?
   - Over loading
   - Lack of due care during loading and unloading
   - Inappropriate transport means
   - Others

M) SALES PATTERN

1) To whom do you sell potato?
   - To wholesaler
   - To retailer
   - To village trader
   - To other trader
   - To consumer
   - Other

And why?

   - Availability of buyer
   - Realizing high prices
   - Reduce the frequent sale
   - Less quantity of potato
   - No need for storage
   - No need for transportation
   - Advance taken from buyer

2. Why which method do you sell potato?
   - By open auction
   - By personal negotiation
   - Other

And Why?
   - Most prevalent method
   - Profitable
   - Other
   - Is the decision of method in your hand? Yes/No.

3. Sales information

To whom sold	Where sold	Frequency of sale	Time taken	Quantity sold (qtl)	Selling price (Rs./qtl)	Other expend. (Rs./qtl)	Commission paid (%)

4. Do you sell your product through contractor? Yes/No.
   - Less problematic
   - Economic needs
   - Availability of insufficient transport means
   - To avoid risk
   - Less quantity of produce
   - Debt taken from contractor
   - Other

5. Do you sell your produce through Cooperatives? Yes/No.
   If no? Why
   - Non existence of cooperative
   - Lack of honesty
   - Delay in payments
   - Other

6. How price is determined in the market?
   - By open auction
   - By personal negotiation among traders
   - By personal negotiation among producers and traders
   - Other

7. Through whom do you obtain market information?
   - Letters from traders
   - Neighbouring producers
   - Local caretakers
   - Radio
   - TV Market bulletins
   - News papers
   - Personal visit to the market
   - Telephone
   - Other means (specify)

8. What type of problems do you face in selling of potato and wheat improvement do you require therein?

Sl. No.	Problem	Response and sensitivity		Suggestions for improvement
		Yes	No	
1.	Problem in transportation			
2.	Lack of supply of packaging material			

3.	High cost of packaging material			
4.	Problem of stay in the market and problem of loading and unloading of produce			
5.	Lack of effective market regulation			
6.	Non-required charges by traders			
7.	Faulty method of weighing			
8.	Lack of finance in the market			
9.	Lack of market information about prices			
10.	Lack of market extension and information			
11.	Delay in sale			
12.	Delay in payment			
13.	Others			

N) Acquisition cost of different potato seed (Rs./qtl)

Category	Agency and qty bought	Transportation cost	Loss on account of underweighment of seed bags	Excess prices charged	Commission of agent
Certified seed					
Quality seed					

O) Acquisition cost of different fertilizers

Fertilizer	Official retail price (qty/rate)	Acquiring cooperative societies (qty/Rate)	Cost from private traders (qty/rate)	Differences in acquiring cost (Coop. Soc. – Pvt. traders)
Urea				
DAP				
SSP				
Potash murate				
NPK				

P) Acquisition cost of pesticide from various sources

Category	Plant protection (Qty/Rate)	Department/Block	Pvt. Trader (Qty/rate)
Dyfolaton			
Dithan M-45			
Cuman			
Other			

Q) List all pest and diseases and extent of damage caused by them.

Name of pest/diseases	Extent of damage	Measures adopted
1.		
2.		
3.		
4.		
5.		

R) Acquiring cost of water from various sources

Sources of irrigation	Duration of irrigation	Prices charged
1.		
2.		
3.		

S) Acquiring cost of credit from various sources

Particulars of loan	Time period	Coop. credit societies (Qty/rate)	Commercial banks (Qty/rate)	Money lender/ commiagen t (Qty/Rate)	Total
Kind					
Cash					
Total					

2. QUESTIONNAIRE FOR WHOLESALER CUM COMMISSION AGENT

APPENDIX-VI

A) GENERAL INFORMATION

1. Name :
2. Profession : Working since :
3. Address :
4. Licence fee :
5. Market fee :
6. Other expenses :
7. Commission received from producer-seller :
   - For self
   - For palledar
   - Other

B) PURCHASE PATTERN

1) Do you deal with potato?
2) From where do you purchase potato :
   a) From villages b) From market c) Other
   Quantity purchased Purchase price

   And Why?
   - Due to nearness of place
   - Due to good quality
   - Due to low purchase price
   - Any other (specify)
   -

3) Why do you trade with potato
   - Due to high profitability
   - Due to high demand
   - Any other (specify)

4) From whom do you purchase potato?
   - Growers
   - Commission agent/wholesaler-cum-commission-agent
   - Any other (specify)

   and Why?
   - Because of low purchase price
   - Because of easy availability (Availability of seller, transportation means etc.)
   - Because of loan given/borrowing

5) Through which method do you purchase

Method	Reasons
- Through open auction	
- Through under cover	
- Through personal negotiation	
- Any other	

6) Do you take loan from any institution Yes/No
if yes, from

1) Cooperative
1) Banks
2) Private institutions
3) Commission agents/

Purpose(s) of taking loan?

7) What factors do you consider during price determination.
- Graded/ungraded
- Freshness
- Other basis (colour, variety etc.)

1) For which type of potato you pay more

C) GRADING

1) Do you grade potato? Yes/No

If yes, why

- Grading is profitable
- Easy and convenient
- For maintaining the quality
- For convenient storage
- For convenient transportation
- Any other

If No, why?

- If involves more time
- Find it economically unnecessary
- Because of purchasing potato
- Due to NA of human labour
- Due to lack of space for grading

2) What is the basis of grading?

Quality	Size	Colour	Maturity	Variety	Freshnes s	Disease and insects free

1) How much labourers do you use for grading and how much are their charges?

2) What problems do you face in grading

D) PACKAGING

1) Do you pack the potato? Yes/No
If yes, Why?

2) Information regarding packaging material used quantity and labour used etc.

Package used	Quantity per package	Price of package	No. of labourers used for packaging	Labour charges (per labour per day in Rs.)

3) Why do you use above said means of packaging?
- Due to lower price
- Due to easy availability
- Due to convenience
- Due to more capacity
- Any other

4) What problems do you face in packaging?

D) STORAGE

1) Do you store potato? Yes/No

If Yes, Why?
-To earn more profit
-Because of available storage facility
-Any other

If No, why?
-Due to NA of proper storage facility
-Due to high perishability of potato
- Storage is not profitable
-Any other

2) Information regarding storage

Type of storage	Quantity stored	Expenditure in storage	Duration of storage	No. of lab. used	Lab. charges (/lab/day)	Other expenses	Loss in quantity

3) Problem during storage
- Quality deterioration
- Risk of receiving low price after storage
- Any other

E) TRANSPORTATION

- Do you transport potato? Yes/No
- Information regarding transportation

I - Inward transport
O – Outward transport

Place from where potato brought		Means of transport		Distance		Cost		Quantity brought		Time involved		No. of labourers		Lab. charges		Price before trans.		Price after trans.		Other expenses
I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	I	O	

- Why do you use above said transportation means?
  - On the basis of availability
  - On the basis of cost
  - On the basis of convenience
  - Any other

4) What problems do you face in transportation?
- Untimely and uneasy availability of means of transportation
- Loss in quantity and quality during transportation
- Poor roads
- Any other

5) What is the loss during transportation in your produce due to following reasons?
- Loading more quantity
- Carelessness during loading and unloading
- Due to poor packaging
- Improper transportation means
- Any other

F) SALES PATTERN

1) To whom do you sell the purchased potato?
- Retailer
- Consumer
- Wholesaler
- Any other

And why
- Due to availability

- Storage is not required
- Transportation is not required
- to receive higher price
- Due to lower frequency of sales
- Any other

2) Which method do you use for selling potato?
   - Through open auction
   - Through open cover
   - Through personal negotiation
   - Any other

   And why?
   - Method is prevalent
   - Method is profitable
   - Any other

3) Information regarding sales pattern:

To whom sold	Quantity sold	Selling price	Other expenses	Other commission

4) What points do you consider during price determination?
   - Whether the potato is graded or ungraded.
   - Fresh vegetable
   - Any other

5) Do you receive higher price for potato? Yes/No

6) Do you decide a minimum price/bid in sale of potato? Yes/No
   If yes, how?
   If no, why not?

7) Do you use any sales promotion method(s) to increase the sale of potato? Yes/No
   If yes, which measures are used?

8) What problems do you face in marketing of potato and what improvements do you want in this regard?

9) What facilities are provided to you by the mandi samittee?

10) What problems do you face from mandi samittee?

11) What are your expectations from mandi samittee?

3. QUESTIONNAIRE FOR RETAILER

APPENDIX-VII

I) GENERAL INFORMATION

1. Name
2. Profession — Working since
3. Name of firm and address
4. Licence fee
5. Market fee
6. Other charges payable:
   1) Commission
   2) Palledari
   3) Other

7. What is the rate of commission for potato?
8. What is the basis of deciding this rate
   - Quality
   - Perishability
   - Risk
   - Weight
   - Quantity

9. Weight measures - existing/prevalent
   Standard
   Approximate

B) PURCHASE PATTERN

1. From where do you purchase potato?
   - Mandi
   - Any other place

   Season — Quantity
   Purchase price

   And why?
   - Nearness of place/transportation cost
   - Quality
   - Lower price
   - Easy availability
   - Any other

2. From who do you purchase potato in what proportion
   - Wholesaler
   - Grower
   - Other traders

   And why?
   - Lower price
   - Easy availability
   - Repay the loan
   - Any other

3. Which method do you use to purchase it?
   - Open auction
   - Under cover
   - Personal negotiation
   - Any other

   And Why

5. Do you take loan from any institution? Yes/No
   If yes, from which institution
   - Cooperative
   - Bank
   - Any private institution
   - Any other

   and what is the purpose of taking loan?

6. Which points do you consider during price determination?
   - Size of produce
   - Freshness
   - Perishability
   - Maturity
   - Other (variety, off seasonal, market demand etc.)

C) GRADING

1. Do you grade potato? Yes/No
   If yes, why?
   - To earn more profit
   - For convenience in sale
   - Maintenance of quality
   - Protection from rapid deterioration
   - Any other

   If No, why?
   - Shortage of time
   - Economically unnecessary
   - Purchase of graded potato
   - NA of human labour
   - Shortage of space

2. What base(s) do you use in grading of potato

Quality	Size	Colour	Maturity	Variety	Freshnes s	Insect & diseases free

3. At which place, do you grade the vegetable
   - In Mandi
   - At the shop

- Any other

4. How much labour do you use in grading of potato
   Labour used per unit Labour charges

5. Is there any difference in price before and after grading? Yes/No
   Price before grading Price after grading

5. What problem do you face in grading of potato

D) PACKAGING

1. Do you pack the potato? Yes/No

2. What type of package do you use
   Gunny bag Basket Wooden case
   And why?
   - Price
   - Availability
   - Convenience
   - Size
   - Any other

3. Information regarding packaging

Type of package	Quantity/ package	Price of package	Labour used	Labour charges

4. What problems do you face in packing of potato?

E) TRANSPORTATION

1. Do you transport potato? Yes/No

2. Information regarding transportation:

Place from where transported	Means		Quality transported	Cost	Time involved	Labour used	Labour charges
	Owned	Hired					

3. Is there any difference in price before and after transportation?
   Yes/No

If yes, how much?

4. Loss during transportation?

5. Why do you use the above mentioned means of transportation?
   - Easy availability
   - Lower cost
   - Convenience
   - Any other

6. What problems do you face in transportation
   - Untimely and uneasy availability of transportation means.
   - Loss in quality and quantity during transportation
   - Poor roads
   - High transportation cost
   - Any other

F) SALES PATTERN

1. To whom do you sell the potato?
   - Consumer
   - Processor
   - Any other

   And why?
   - Due to availability of buyers
   - Transportation is not needed
   - Due to receiving higher prices
   - Due to convenience
   - Any other

2. Information regarding sales pattern:

To whom sold	Time involved in selling	Quantity sold	Selling price	Other expenditure	Other commission

3. Which points do you consider during price determination?
   - Whether the potato is graded/ungraded
   - Freshness of potato
   - Demand
   - Any other

4. Do you determine/decide any minimum price in sale of potato?
   Yes/No
   If yes, how?
   If no, why not?

5. Do you use any sales promotion technique to increase your sales?
   Yes/No
   If yes of wheat type
6. How do you cope with leftover product?
   - Try to sell at lower price
   - Store it
   - Try to consume at home
   - Try to sell it next day

7. Is there any difference in price at morning, afternoon and evening?
   If yes, why and how much?

8. What facilities are provided to you by mandi samiti?

9. What problems do you face from mandi samiti?

10. What are your expectations from mandi samiti?

4. QUESTIONNAIRE FOR PUBLIC SECTOR INSTITUTIONS

APPENDIX-VIII

1. Policies and strategies: Identify and describe existing government policies and strategies which directly or indirectly affect the production and/or marketing of this product.

2. Strategies used for implementation of policies.

3. Which policy or policies most strongly impact the crop production system to what degree, and why?

4. Do any of the policies/strategies impact post-harvest losses?
   yes/No

5. Institutions responsible for planning:

Department/Unit	Responsibilities

6. Institutions involved in production system

Department/unit	Responsibilities

7. Institutions involved in processing

Department/unit	Responsibilities

8. Institutions involved in post-harvest handling and/or marketing of crop

Department/unit	Responsibilities

9. Institutions responsible for research.

Department/unit	Type of research

10. Private institutions/organization involved with crop :

Name	Functions/Actions

11. Other ministries/departments directly or indirectly involved in the development of crop:

12. Identify the coordinating body, if any, responsible for the devt. of the crop industry and describe its function.

Name	Function

13. Indicate level of coordination of the various institutional activities:

	Well coordinated	Satisfactory	Poorly coordinated
Planning			
Production			
Processing			
Marketing			
Research			

14. Summary of key public and private sector institutions for the development of the crop industry.

Name of inst/unit/dept./or organization	Principal constraints

15. Problems

Nature of problem	Yes/No	Describe how problem affect quantity, quality, price, or availability of product.

Pre-production considerations agricultural sector policies

- Institutional organization
- taxes : import or export
- Price policies
- credit policies
- natural resource management
- irrigation policies
- production and distribution of seed material
- farm input supply
- technology
- marketing policies
- agro-processing policies
- import policies
- export policies

Public sector institution (identified institutions)

- political instability
- leadership
- deficient planning
- management skills
- insufficient staff
- poor quality staff
- staff motivation
- deficient equipment
- lack of operating capital
- weak services :
    - information
    - credit
    - research
    - extension
    - training
    - technical assistance
    - product standards
    - coordination
    - others

VITA

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ABSTRACT

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TITLE : A STUDY OF POTATO COMMODITY SYSTEM IN THE HILLS OF KUMAON REGION OF UTTARANCHAL

Potato is an important crop in the state of Uttaranchal. To strengthen the strategy for commercialization and diversification of agriculture, the state of Uttaranchal plans to promote increasing area under horticulture and other ancillary activities. However, they need to be supported by excellent marketing strategies. The state of post harvest management and marketing infrastructure is far from developed particularly in hilly regions and this needs to be strengthened. There is a great need to improve the whole system of the potato commodity including the supply of the inputs, financing and marketing of potato. In order to draw realistic policy decisions to modernise the potato commodity system in the hills of Kumaon region of Uttaranchal the present study was conducted with the objective (i) to study the existing potato commodity system (ii) to project the optimum potato commodity system under alternative scenarios, and (iii) to compare the existing and optimum potato commodity system under alternative scenarios and draw policy implication.

A sample of 90 potato growing farmers was drawn randomly from 3 villages each of two blocks (Ramgarh and Dhari) of Nainital District of Kumaon Region; 30 Wholesaler cum Commission Agents and 30 retailers were also selected randomly from the regulated market in the area in order to fulfill the data requirement of the study. To achieve the first objective, simple statistical tools-averages, percentages etc. were used. For second objective, single period linear programming model was used. To achieve third objective, the existing and optimal systems were compared and policy interventions were suggested.

It was found that in the existing system, the farmer has highly diversified cropping pattern. The farmers used to purchase fertilizers from cooperative, pesticides from mobile team of the block and private traders as well while they used mostly home grown seed. Mobile team offered inputs at lower rates but the services were very poor. On an average136.17 quintals of potatoes were produced from an area of 1.60 acres per farm which were quickly disposed off in the regulated market of Haldwani. Farmers faced the problem of unauthorised deductions in the market. On an average, the farmer borrowed Rs. 1935.56 from private trader in the market for family consumption purposes.

The optimal plans were developed with and without borrowing activities under existing market situation and improved market situation. The three alternative optimum plans on the basis of alternative sales pattern were developed for each situation (A_1 – existing sales pattern, A2 – minimum sales pattern and A_3 – maximum sales pattern). The empirical findings revealed that there exists ample scope of increasing farm income through optimal allocation of resources. Per cent income in farm income over existing income was more in improves market situation. The potential to increase income was more in the optimum plans without borrowing for the farmers borrowed only for consumption purposes.

The policy implications of the study are (i) The input supply system through mobile teams should be strengthened, malpractices in input supply system should be checked and price support should be declared by the Government for the crop. (ii) Extension services and market support system should be strengthened. (iii) Mandi Act should be implemented more forcefully (iv) Institutions should make easy provision of loaning for non-production purposes and (v) Farmers cooperatives and self help groups should be organized to overcome all the problems faced by the farmers in one step.

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