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Development of Ideal Agricultural Production Plan for the Foothill Agro-Ecological Situation of Sonitpur District of Assam– A Farming System Approach

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I

INTRODUCTION

Farming is a multifold activity and the prime occupation of the majority of people living in rural India. Over the years, a tremendous change in the field of agriculture has taken place both in terms of production technology and on the production front. Although there is a remarkable increase in the production of foodgrains since Independence, yet it is not sufficient to meet the demand of foodgrains requirement of the growing population of the country. At the same time it is expected to use the available resources in the production processes for increasing the production of food grains in a sustainable way so that there will not be a serious crisis in the future in terms of scarce resources. The farmers are always trying to increase their production so that their income could be maximised. They not only engage themselves in crop production but also take up a holistic approach in farming activities to raise their income. The activities like crops, animal rearing, homestead gardening (*Bari development*) etc., are taken up by the farmers through which the farmer can not only increase the farm income but also are able to use the farm resources efficiently in a more meaningful way. The farming systems based on scientific land use have not been studied adequately in this region. In general the farmers follow traditional farm practices and very often they are confronted with the problem of making decisions on the enterprise mix, methods of production, resource allocation, etc. Inclusion of many enterprises in the farm plan irrespective of the less remunerative and riskiness of the enterprises often lead to realisation of low farm income. Development of optimal production plan through appropriate planning will help the farmers in utilising their scarce resources optimally and also in maximising farm net returns. The demand of a farm family in terms of food, fuel and fibre is not generally met from the farming system followed by the farmers. Therefore, it is important to develop an ideal agricultural production plan which can provide at least the minimum requirement of a farm family in terms of food, fuel and fibre.

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In consideration of the above discussion, an attempt has been made to identify the major farming systems followed by the different groups of farmers in the foothills of Sonitpur district of Assam and to develop an ideal agricultural production plan for the groups of farmers in this agro-ecological situation of the selected district.

II

METHODOLOGY

The North Bank of river Brahmaputra consists of four districts, namely, Darrang, Sonitpur, Lakhimpur and Dhemaji. The four districts are divided into eight agro-ecological situations based on soils, climate, rainfall, temperature, elevation and cropping pattern. They are: (1) Medium land with medium rainfall, (2) Medium land with high rainfall, (3) Deep water situation with lower elevation, (4) Low land with lower elevation, (5) Riverine situation with lower elevation, (6) Upland with medium rainfall, (7) Upland with high rainfall and (8) Foothill situation with higher elevation.

The foothill situation is elevated flat upland along foothills, slightly undulating with dwarf hillocks and covered by forest vegetation stands. The northern part of the Sonitpur district lies in this foothill situation along the border of Arunachal Pradesh. The foothill agro-ecological situation was selected purposively and the study was conducted in the foothill situation of Biswanath sub-division of the Sonitpur district of Assam. The foothill area of the district is popularly known as Na-duar region which is a typical agro-ecological situation with dwarf hillocks, undulating, elevated flat highland and covered with forest vegetation stands. The twelve villages from the foothill situation, namely, Koilajuli, Samukhjuli, Dikhalmukh, Thandapani, Chawaldhowa, Bhimajuli, Diring, Bagijuli, Radhachou, Namara, Lowerbalichou and Tinkhuti were selected for the study.

To select the ultimate unit of sample of the study, stratified multistage random sampling technique was followed. A total 120 farmers, of which 60 were small, 38 medium and 22 large, were selected from 12 villages of the three agricultural circles (Pabhoi, Zinjia and Bihali) of the sub-division based on their operational holding, viz., small (up to 2 ha), medium (2-3 ha) and large (above 3 ha). The data on the existing farming system, resource position of farms, existing cropping patterns, resource allocation to different enterprises, output produced on the farms, area under different crops, availability and utilisation of capital, prices of various inputs used and output produced, type and number of animal activities maintained, etc., were carefully recorded with the help of a pre-tested schedule during the year 2007-2008 for detailed analysis.

Simple tabular analysis as well as deterministic linear programming technique was followed for the study.

The deterministic programming model used as:

$$\text{Max } Z = Cx$$

Subject to,

$$Ax \begin{matrix} \leq \\ \geq \end{matrix} b \text{ and } x \geq 0$$

Where,

Z - Total net returns,

C - Vector of objective function coefficients for crop and animal activities,

X - Vector of crop and animal activities,

A - Matrix of input-output coefficients,

b - Vector of resource constraints.

Farming systems are generally location-specific. The components of a whole farming business were mainly crops, livestock, fishery and homestead (*Bari*) activities. On the basis of different activities the existing farming systems practised by the farmers were identified. A farming system was considered as a major farming system when at least 10 per cent of the farmers of the selected size group in the study area adopted it. The identified major farming systems were considered for preparation of synthetic plans for the area and finally ideal agricultural production (optimum) plans were developed for the different groups of farmers.

III

RESULTS AND DISCUSSION

The analysis of data revealed that the farmers in general laid emphasis on both crops and livestock activities in the study area. The main crop activities identified in the study area were rice, maize, rape and mustard, sugarcane, pulses, summer and winter vegetables, colocassia and sesamum. Rice is the dominant crop in the study area.

Farming Systems

Farming systems were identified mainly based on crops and animal activities. The *bari* activities were found to be more or less similar in all the size groups of farms so, homestead or *bari* activities were not considered for determination of the farming system. Altogether, 17 types of farming systems were identified. The identified farming systems varied from 9 in small size group to 7 in large size groups. Out of 17 farming systems identified three were practised mostly in small size group of farms while only 2 farming systems were practised by most of the farmers of medium and large group of farms. Details of the types of farming system identified for the different size group of farms and the major systems identified are given in

Table 1. Among the farming systems, only three systems on small farms and two each on medium and large farms were practised by most of the farmers in respective size groups. The farming systems (crop+dairy cow+goat+pigeon+duckery) and (crop+dairy cow+pigeon+duckery) were most popular among the farmers of the study area. The other systems in vogue in respective size groups were practised by very few farmers. Hence, in the present study only the major and largely practised systems on small, medium and large farms have been considered for optimisation and examine their effect on labour employment, capital utilisation and net returns.

TABLE 1. IDENTIFICATION OF FARMING SYSTEMS PRACTISED IN FOOTHILL SITUATION

Sl. No. (1)	Types of farming system (2)	Number of respondents		
		Small (3)	Medium (4)	Large (5)
1.	Crop + dairy cow + goat + pigeon + duckery	25(M)*	15(M)	6(M)
2.	Crop + dairy cow+ pigeon + duckery	11(M)	12(M)	5(M)
3.	Crop + goat+ duckery + poultry	7(M)	--	--
4.	Crop + dairy cow+ goat+ duckery +fishery	4	--	2
5.	Crop + dairy cow+ goat +piggyery	3	--	--
6.	Crop + dairy cow+ goat+ poultry	--	4	--
7.	Crop + goat+ duckery + pigeon + poultry	3	--	--
8.	Crop + dairy + poultry	3	--	--
9.	Crop + dairy + duckery + fishery	2	3	2
10.	Crop + dairy cow	--	--	2
11.	Crop + dairy cow + buffalo	--	1	--
12.	Crop + buffalo + dairy cow+ goat+ duckery	--	--	3
13.	Crop + buffalo + fishery + duckery	2	--	--
14.	Crop + buffalo +dairy cow + goat + poultry	--	--	2
15.	Crop + buffalo + dairy + goat + duckery + fishery	--	1	--
16.	Crop+ dairy cow+ goat+ bee keeping	--	1	--
17.	Crop + goat+ poultry	--	1	--
	Total	60	38	22

*M indicates major farming systems.

Optimal Plans

Tables 2 to 4 revealed the composition of the existing plans as well as the optimum plans for all the major farming systems of small, medium and large groups of farms in the foothill situation in Sonitpur district of Assam.

Optimisation of Existing Farming System

Cropping Pattern

Optimisation of existing plan has resulted in increased gross cropped area on farms of all size groups.

TABLE 2. EXISTING PLANS VS. OPTIMAL PLANS FOR SMALL SIZE GROUP OF FARMS OF FOOTHILL SITUATION

Particulars (1)	Unit (2)	Existing plans			Optimum plans			(8)
		FS1 P01 (3)	FS2 P02 (4)	FS3 P03 (5)	FS1 FS3 P11 P33 (6)	FS2 P22 (7)		
<i>Summer</i>								
1. Autumn rice (local)	Ha	0.040 (02.05)	0.045 (02.32)	0.050 (02.59)	0.025 (00.78)	0.025 (00.75)	0.030 (00.94)	
2. Autumn rice (HYV)	Ha	0.100 (05.13)	0.095 (04.90)	0.085 (04.40)	0.075 (02.34)	0.075 (02.24)	0.080 (02.50)	
3. Summer vegetables	Ha	0.205 (10.51)	0.215 (11.08)	0.205 (10.65)	0.900 (28.12)	0.950 (28.36)	0.890 (27.81)	
4. Jute	Ha	0.005 (0.25)	0.005 (0.26)	0.006 (0.31)	--	--	--	
<i>Kharif</i>								
1. Winter rice (local)	Ha	0.190 (09.74)	0.185 (09.54)	0.190 (09.85)	0.150 (04.69)	0.150 (04.48)	0.250 (07.81)	
2. Winter rice (HYV)	Ha	0.430 (22.05)	0.440 (22.68)	0.435 (22.54)	0.950 (29.69)	1.000 (29.85)	0.850 (26.56)	
3. Sesamum	Ha	0.090 (04.62)	0.080 (04.20)	0.085 (04.40)	--	--	--	
<i>Rabi</i>								
1. Mustard	Ha	0.185 (09.49)	0.180 (09.28)	0.200 (10.36)	0.050 (01.56)	0.050 (01.49)	0.100 (03.14)	
2. Maize	Ha	0.075 (03.85)	0.065 (03.35)	0.060 (03.11)	--	--	--	
3. Potato	Ha	0.075 (04.66)	0.085 (04.38)	0.085 (04.42)	--	--	--	
4. Vegetables	Ha	0.305 (15.64)	0.310 (15.98)	0.300 (15.54)	0.950 (29.69)	1.000 (29.85)	0.900 (28.12)	
5. Pulses	Ha	0.135 (06.92)	0.130 (06.75)	0.130 (06.74)	--	--	--	
6. Summer rice (local)	Ha	0.013 (00.67)	0.013 (00.68)	0.012 (0.050)	--	--	--	
7. Summer rice (HYV)	Ha	0.090 (04.62)	0.090 (04.65)	0.095 (04.92)	0.100 (03.12)	0.100 (02.98)	0.100 (03.12)	
Grossed cropped area	Ha	1.950 (100)	1.940 (100)	1.930 (100)	3.200 (100)	3.350 (100)	3.200 (100)	
Net cropped area	Ha	1.300	1.245	1.180	1.300	1.245	1.180	
Cropping intensity	Per cent	150.00	155.32	163.56	246.15	269.00	271.20	
<i>Other activities</i>								
1. Dairy (local)	Nos.	1.000	1.000	1.000	--	--	--	
2. Dairy (Improved)	Nos.	1.000	1.000	1.000	1.000	--	0.50	
3. Goat	Nos.	2.000	2.000	2.000	0.250	--	--	
4. Duckery	Nos.	4.000	5.000	6.000	0.250	0.250	0.250	
5. Pigeon	Nos.	3.000	3.000	3.000	0.500	0.500	0.500	
6. Buffalo	Nos.	0.100	0.100	0.100	--	--	0.500	
7. Poultry	Nos.	0.150	0.200	0.150	--	0.250	0.250	
8. Human labour	MD	203	210	212	350	295	349	
9. Bullock labour	PD	58	63	65	105	113	108	
10. Working capital	Rs.	18500	18000	18150	21800	23425	22700	
11. Net returns	Rs.	32900	29630	31500	39300	39980	38275	

Figures in parentheses indicate percentage.

P01 to P03 indicate existing plans (farming systems). P11 to P33 indicate optimum plans (Farming systems). The numbers indicate the unit number of the animals in each unit.

TABLE 3. EXISTING PLANS VS. OPTIMAL PLANS FOR MEDIUM SIZE GROUP OF FARMS OF FOOTHILL SITUATION

Particulars (1)	Unit (2)	Existing plans		Optimum plans	
		FS1 P01 (3)	FS2 P02 (4)	FS1 P11 (5)	FS2 P22 (6)
<i>Summer</i>					
1. Autumn rice (local)	Ha	0.085 (02.59)	0.080 (02.40)	0.050 (00.73)	0.040 (00.57)
2. Autumn rice (HYV)	Ha	0.171 (05.22)	0.175 (05.27)	0.100 (01.46)	0.120 (01.70)
3. Summer vegetables	Ha	0.243 (07.42)	0.250 (07.52)	1.700 (24.89)	1.690 (23.67)
4. Jute	Ha	0.040 (01.22)	0.050 (01.50)	0.080 (01.17)	--
5. Sugarcane	Ha	0.167 (05.10)	0.155 (04.67)	--	--
<i>Kharif</i>					
1. Winter rice (local)	Ha	0.463 (14.13)	0.500 (15.05)	0.300 (04.39)	0.250 (03.55)
2. Winter rice (HYV)	Ha	0.926 (28.27)	0.930 (28.00)	2.190 (32.06)	2.350 (33.33)
3. Sesamum	Ha	0.168 (05.13)	0.165 (04.97)	--	--
<i>Rabi</i>					
1. Mustard	Ha	0.291 (08.88)	0.285 (08.58)	0.170 (02.50)	0.150 (02.13)
2. Maize	Ha	0.155 (04.73)	0.160 (04.82)	--	--
3. Potato	Ha	0.057 (04.66)	0.067 (04.38)	--	--
4. Vegetables	Ha	0.170 (5.20)	0.175 (05.27)	1.060 (15.52)	1.100 (15.60)
5. Pulses	Ha	0.220 (06.71)	0.210 (06.32)	0.620 (09.08)	0.600 (08.51)
6. Summer rice (local)	Ha	0.040 (01.22)	0.030 (0.90)	--	--
7. Summer rice (HYV)	Ha	0.800 (02.44)	0.090 (02.71)	0.560 (08.20)	0.750 (10.64)
Grossed cropped area	Ha	3.276 (100)	3.322 (100)	6.830 (100)	7.050 (100)
Net cropped area	Ha	2.500	2.530	2.500	2.530
Cropping intensity	Per cent	131.04	131.30	273.20	278.65
<i>Other activities</i>					
1. Dairy (local)	Nos.	2.000	2.000	0.500	0.500
2. Dairy (Improved)	Nos.	1.000	1.000	0.500	0.500
3. Goat	Nos.	2.000	2.000	0.500	--
4. Duckery	Nos.	6.000	5.000	0.500	0.500
5. Pigeon	Nos.	4.000	4.000	0.500	0.500
6. Buffalo	Nos.	0.200	0.200	--	--
7. Poultry	Nos.	0.250	0.200	--	--
8. Human labour	MD	325	337	636	695
9. Bullock labour	PD	105	103	213.5	221
10. Working capital	Rs.	27325	28540	31950	34300
11. Net returns	Rs.	40275	39500	52856	53990

Figures in parentheses indicate percentage.

P01 to P03 indicate existing plans (farming systems). P11 to P33 indicate optimum plans (Farming systems). The numbers indicate the unit number of the animals in each unit.

TABLE 4. EXISTING PLANS VS. OPTIMAL PLANS FOR LARGE SIZE GROUP OF FARMS OF FOOTHILL SITUATION

Particulars (1)	Unit (2)	Existing plans		Optimum plans	
		FS1 P01 (3)	FS2 P02 (4)	FS1 P11 (5)	FS2 P22 (6)
<i>Summer</i>					
1. Autumn rice (local)	Ha	0.170 (03.30)	0.175 (03.32)	0.100 (01.12)	0.150 (01.56)
2. Autumn rice (HYV)	Ha	0.340 (06.60)	0.400 (07.58)	0.970 (10.85)	1.400 (14.58)
3. Summer vegetables	Ha	0.372 (07.22)	0.335 (06.95)	0.930 (10.40)	0.850 (08.05)
4. Jute	Ha	0.081 (01.22)	0.085 (01.50)	--	--
5. Sugarcane	Ha	0.233 (04.52)	0.220 (04.17)	0.080 (0.89)	0.600 (06.25)
<i>Kharif</i>					
1. Winter rice (local)	Ha	0.860 (16.69)	0.875 (16.58)	0.340 (03.80)	0.400 (04.17)
2. Winter rice (HYV)	Ha	1.721 (33.40)	1.800 (34.12)	3.150 (35.23)	3.250 (33.08)
3. Sesamum	Ha	0.157 (03.06)	0.160 (03.03)	--	--
<i>Rabi</i>					
1. Mustard	Ha	0.288 (05.59)	0.295 (05.58)	0.190 (02.12)	0.200 (02.08)
2. Maize	Ha	0.151 (02.93)	0.155 (02.94)	0.280 (03.13)	0.600 (06.25)
3. Potato	Ha	0.070 (01.36)	0.075 (01.42)	--	--
4. Vegetables	Ha	0.211 (04.10)	0.201 (03.81)	0.800 (08.95)	0.800 (08.33)
5. Pulses	Ha	0.305 (05.92)	0.300 (05.69)	0.830 (09.29)	0.800 (08.33)
6. Summer rice (local)	Ha	0.064 (01.24)	0.065 (01.23)	0.250 (02.80)	0.250 (02.60)
7. Summer rice (HYV)	Ha	0.129 (02.50)	0.135 (02.56)	0.300 (03.36)	0.300 (03.12)
Grossed cropped area	Ha	5.152 (100)	5.276 (100)	8.940 (100)	9.600 (100)
Net cropped area	Ha	4.288	4.300	4.288	4.300
Cropping intensity	Per cent	120.14	122.70	208.50	223.25
<i>Other activities</i>					
1. Dairy (local)	Nos.	2.000	2.000	0.600	0.600
2. Dairy (Improved)	Nos.	1.000	1.000	1.000	1.000
3. Goat	Nos.	2.000	2.000	0.500	.500
4. Duckery	Nos.	8.000	8.000	0.250	0.250
5. Pigeon	Nos.	6.000	6.000	0.500	0.500
6. Buffalo	Nos.	0.100	0.100	--	--
7. Poultry	Nos.	0.250	0.250	0.250	0.250
8. Human labour	MD	455	468	775	845
9. Bullock labour	PD	170	168	291	294
10. Working capital	Rs.	27950	29540	31250	31875
11. Net returns	Rs.	44890	45500	65230	64785

Figures in parentheses indicate percentage.

P01 to P03 indicate existing plans (Farming systems). P11 to P33 indicate optimum plans (Farming systems). The numbers indicate the unit number of the animals in each unit.

Small Group of Farms

The cropping intensity in the existing pattern varied from 150 to 163 per cent in small size group of farms. Optimisation of existing farming system led to increase in cropping intensity from 150, 155.32, 163.55 to 246.15, 269.00 and 271.20 per cent respectively in FS1, FS2 and FS3. Rice, which is one of the dominant crops in the existing plan, showed a decline in its area in optimal plans. Vegetables being the comparatively remunerative crops, their area increased in the optimal plans of all the farming systems. Mustard appeared in the optimum plans with relatively less area.

The livestock activities in the optimal plans were observed to be not encouraging which indicated that they were less remunerative compared to the crop activities. Improved dairy cow appeared in the optimal plan but with the restricted numbers. Duckery and pigeon appeared in the optimal plans but of course with the imposition of minimum and maximum restrictions. The animals were less remunerative compared to the crop activities like vegetables because of the traditional methods of rearing and local breeds of the livestock available in the study area.

Medium Group of Farms

The cropping intensities increased from 131 in the existing plan to 273 and 278 per cent in both the identified farming systems under FS1 and FS2 in the optimal plans. The area under summer rice (local) disappeared from the optimal plans while area under summer rice (HYV) increased in optimal plan (FS2). The winter rice (HYV) increased significantly in the optimal plans but area under winter rice (local) decreased in the optimal plans. The decrease of area under winter rice recorded 64.79 and 50 per cent in FS1 and FS2 respectively. Vegetables both in summer and winter showed an increase in area over the existing plans like the small group of farms. The increase in area under vegetables might be due to the growing profitability of vegetables in the area. Maize and potato disappeared from the optimal plans probably these crops are comparatively risky as well as less remunerative.

Among the animal activities, dairy, both local and improved, duckery and pigeon appeared in both the optimum plans with their minimum number restrictions. Goat enterprise was eliminated from the optimum plan of FS2.

Large Group of Farms

The increase in cropping intensities in the large group of farms recorded from 120.14 to 208.50 per cent and 122.70 to 223.25 per cent in FS1 and FS2 respectively. Rice (local) being a less remunerative crop, its area declined from about 67 to 34 per cent in FS1 and about 65 to 34 per cent in FS2. Though the area under rice (local) decreased but the area under HYV rice increased in optimal Plans FS1 and FS2 respectively. The percentage of decrease in area under winter rice (local) was

recorded at 39.50 and 45.71 per cent in FS1 and FS2 respectively. Pulses also appeared in optimal plans with increased area, the increase being from 5.92 per cent to 9.29 per cent in FS1 and 5.69 per cent to 8.33 per cent in FS2. Jute and potato were dropped from the optimum plans. Sugarcane being a remunerative crop figured in the optimal plan with increased area in FS2 but area under it decreased marginally in FS1. The percentage of decrease was recorded from 4.52 to 0.89 in FS1. The area under vegetables both summer and *rabi* increased significantly in both the optimal plans on FS1 and FS2. Mustard is the other crop which appeared with reduced area in both the optimal plans on FS1 and FS2. The percentage of decrease in area under mustard was recorded 65.97 and 67.80 in FS1 and FS2 respectively.

Among the livestock activities dairy (local and improved), buffalo and pigeon were included in both the optimum plans with their restricted number.

Labour Employment

The utilisation of resources had shown an increase use in the optimal plans as compared to the existing plans. As a result of the increase in the gross cropped area the requirement of human and bullock labour increased in the optimum plans for all the three categories of farms and for the major identified farming systems in the study area.

Small Group of Farms

The requirement of human labour had a direct relationship with the increase in gross cropped area. The increase in human labour was from 203 to 350 man-days in FS1, 210 to 295 man-days in the optimum plans of FS2 and 212 to 349 man-days in FS3 respectively. The requirement of bullock-pair days also followed the same trend like human labour. It increased from 58 to 105, 63 to 113 and from 65 to 108 bullock pair days respectively in the optimum plans of FS1, FS2 and FS3.

Medium Group of Farms

Human labour in terms of man-days increased from 325 to 636 and from 337 to 695 in the two identified major farming systems of this group of farms. In case of bullock labour their relative increase was from 105 to 214 and 103 to 221 pair days respectively in FS1 and FS2.

Large Group of Farms

In the case of the two identified farming systems for this group, FS1 and FS2 the increase in human labour was from 455 to 775 and 468 to 845, respectively. The increase in bullock pair-days was from 170 to 291 in FS1 and 168 to 294 in FS2.

Working Capital and Net Returns

The optimisation of major farming systems resulted in increase of gross cropped area by incorporating more area under relatively remunerative crops and also the number of animal activities. These led to increased utilisation of working capital in the optimum plans for all the size groups. The net returns had also increased in the developed optimum plans for the different groups of farms.

Small Group of Farms

The optimal plans took care of the utilisation of working capital and the available working capital was utilised efficiently in fullest possible way in the optimum plans. The increase in working capital requirement varied from Rs. 18,500 to Rs. 21,800 in FS1, from Rs. 18,000 to Rs. 23,425 in FS2 and from Rs. 18,150 to Rs. 22,700 in FS3 respectively. The increase in net returns was from Rs. 32,900, Rs. 29,630 and Rs. 31,500 to Rs. 39,300, Rs. 39,980 and Rs. 38,275 respectively in FS1, FS2 and FS3.

Medium Group of Farms

The requirement of working capital had a direct relationship with the increase in gross cropped area. More area brought under cultivation with remunerative crops required more amount of inputs. The increase in working capital in this category of farms was from Rs. 27,325 to Rs. 31,950 and Rs. 28,540 to Rs. 34,300 in FS1 and FS2 respectively.

The increase in net returns were from Rs. 40,275 to Rs. 52,856 and from Rs. 39,500 to Rs. 53,990 respectively in the identified two farming systems. This could be attributed to inclusion of a number of remunerative activities in the optimum plans.

Large Group of Farms

The requirement of working capital in the optimum plans showed a marginal increase from Rs. 27,950 to Rs. 31,250 and from Rs. 29,540 to Rs. 31,875 in FS1 and FS2, respectively. The net returns like other group of farms had also increased, the respective increase being from Rs. 44,890 to Rs. 65,230 and from Rs. 45,500 to Rs. 64,785 in FS1 and FS2 in the optimum plans of FS1 and FS2.

IV

CONCLUSIONS

Although a number of farming systems were in vogue in the foothill situation of the district, only a few of these were common among the farmers. The supply of human labour and bullock labour were found to be surplus while the availability of working capital was an important resource constraint. The farmers of all size groups were restrained more or less in modernisation of their farming due to inadequate and timely availability of the working capital. The effect of optimisation led to better utilisation of resources, increase in gross cropped area and higher net returns. However, the optimal plans could be made effective only when the constraints on resource availability like timely supply of capital in terms of liberal credit, creation of potential irrigation facilities and supply of other critical farm inputs are removed.

The results of this study can provide guidance for the Department of Agriculture, researchers, and policy makers for formulating agricultural policies pertaining to the hilly agriculture in general and the farmers of the foothill situation in particular.