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Linking Bank Credit with Farm Net Income: A Study in the North Bank Plains Zone of Assam

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ABSTRACT

The study has tried to analyse the impact of bank credit on technology adoption and uplifting the farm net returns and also various constraints in linking credit with production of important crops and livestocks in the North Bank Plains (NBP) zone of Assam along with exploring the scope for innovations in harnessing the increasing credit demand potential. The study conducted during the year 2013-14 covered in total 110 households (55 beneficiary and 55 non-beneficiary) of Sonitpur and Lakhimpur districts of the zone to assess the impact of bank credit on technology adoption, farm net return and production constraints of important crops. A deterministic linear programming model is employed to develop optimum feasible plans for both credit beneficiary and non-beneficiary farms. The study indicate that in case of beneficiary farmers net return generated per rupee of working capital is more as compared to the non-beneficiary farmers. Even without allowing the existing resource base to change merely increasing the credit inflow substantial increase in the farm net returns is possible in the optimal plans.

Keywords: Bank credit, Deterministic linear programming, Farm net returns gap index, Optimal plans, Technology components.

JEL: Q14, Q16

INTRODUCTION

Financial inclusion has been emerging as a major policy objective in the country and bank credit has occupied as a promising conduit in relieving the poor farmers particularly in terms of mechanisation and adoption of technologies. Most of the modern farm inputs are capital intensive which majority of the small and medium farmers consider as risky investments. Do bank credit really act as a positive impulse for increasing the farm net return in a state like Assam is matter of serious concern. Assam is predominantly an agricultural state and agriculture has been the mainstay of the state's economy. The state is endowed with fertile soil, high rainfall and a favourable climate for growing a number of cereal, pulse, fruit and vegetable crops. In Assam, the population are mainly rice consumers. Rice is the major foodgrain crop grown over an area of about 28 lakh hectares of land annually and occupied on an average about 70 per cent of the net cropped area in different districts of the state. Winter rice (*Sali*) is the most important rice crop in the state occupying about 70 per cent of the total annual rice area followed by autumn rice (*ahu*) occupying about 24 per cent and summer rice (boro) occupying about 6 percent of the total area under rice. Among the oilseeds, rapeseed and mustard are the major oilseed crops grown in

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the state and account for an area of about 92 per cent of the total oilseed production in the state. The other important oilseed crops grown in the state are sesamum, linseed, groundnut, sunflower and castor. The state has the share of around 0.70 per cent of the pulses produced in the country. The major pulses produced in the state are arhar (tur), summer green gram and black gram in a negligible area of about 16 thousand hectares during *kharif* season and green gram, black gram, pea, lentil, etc., are grown during *rabi* season. Among the fibre crops, jute is grown in an area of about 102 thousand hectares and purely as rainfed crop. The other important crops grown in the state are sugarcane, potato, different vegetables, fruits and spice crops. Even though the state is richly endowed in natural resources, development of agriculture has been slow over the decades and for most of the crops the average productivity are lower than the all India average. In most cases agriculture has been rainfed in the state. The irrigation potential created is only about 17 per cent of the net sown area of the state

The North Bank Plains (NBP) zone of Assam comprised the geographical area of 14,421sq km (14.42 lakh hectares), which is 18.37 per cent of the total geographical area of the state. This zone falls in humid and sub-humid climatic belt with an average rainfall of 2741 mm per year and covers the districts of Sonitpur, Lakhimpur, Dhemaji and Darrang. The net cropped area of these four districts of the zone together is about 5.09 lakh hectares, of which only about 11 per cent of land is brought under irrigation. There are two sources, viz., the agricultural credit given by various financial institutions and the subsidy provided under various schemes which help the farmers to take up risks of adopting the costlier farm inputs. In India though government's agricultural credit policy is aimed at increasing the flow of rural credit at reasonable rate targeting the farming community in large but a large section of the farmers still remains outside the purview of the credit reach. The institutional sources meet only 51 per cent of the credit requirement of the farm sector (Rao, 2003). Besides the coverage of institutional credit indicate biasedness towards large farmers rather than marginal and small farmers (Thorat, 2006). There has been significant development during the last two decades in improving the financial status of the rural farmers through promotion of self help groups (SHGs) through SHG-Bank linkage programmes and micro financial institution model (Mansuri, 2010).The present study makes an attempt to analyse the impact of institutional credit on technology adoption and uplifting the farm net returns of small, medium and large farmers and also various constraints in linking credit with production of important crops grown in the NBP zone of Assam along with exploring the scope for innovations in harnessing the increasing credit demand potential. The study also tried to formulate optimal farm plans for different categories of farmers with increasing farm net returns.

DATA AND METHODOLOGY

The study tried to make a comparison between two situations, viz., beneficiary and non-beneficiary situations. A detailed farm survey was conducted in two districts of the zone viz., Sonitpur and Lakhimpur representing farmers availing agricultural

credit (beneficiary situation) and farmers not availing agricultural credit (non-beneficiary situation). The survey covered in total 110 households (55 beneficiary and 55 non-beneficiary farmers) to assess the impact of institutional credit on technology adoption and production constraints of important crops. Out of beneficiary farmers 19 are small (<2.0ha), 24 are medium (<4.0 ha) and 12 are large (>4.0 ha). Among the non-beneficiary farmers, 22 are small, 18 are medium and 15 are large. Among the Rural Financial Institutions, Regional Rural Banks (RRBs) and co-operatives are the major sources of credit for the agricultural sector at the village level and co-operatives alone account for 45 per cent share in rural credit flow in agriculture (Gulati and Bathla, 2002). The lists of farmers availing credit for agricultural production are collected from the State Bank of India, Assam Gramin Vikas Bank, Assam Co-operative Apex Bank branches of Biswanath Chariali and Lakhimpur. A pretested questionnaire designed specifically for the purpose was used to collect the necessary farm level data from the selected farmers. The collected data pertained to the year 2013-14. The sampled farmers (both beneficiary and non-beneficiary) are from Choiduar and Borgang of Sonitpur district and Majgaon and Bardalani of Lakhimpur district.

The pattern of resources used has been studied in terms of land, labour (human and bullock labour) and working capital used per hectare by the beneficiary and non-beneficiary farmers. To study the levels of technology adoption, the average gap index for the selected set of technology components for each of the selected crops was computed. The gap index for a particular technology component under a crop was computed by using the formula:

$$GI = [(R-A)/R] \times 100$$

where, R = Recommended package
A = Adopted package by the farmer
GI = Gap index

The average gap for each of the selected crop was calculated as per the formula used by Ajore and Singh (1994) and shown below

$$\text{Average gap} = \sum(\text{gap index } i) / n$$

where, i = gap index in a particular major package
n = total number of major packages.

The following components of technology have been identified for computing gap index.

1. T1 : Seed bed and field preparation (number of hoeings/tillage operations)
2. T2 : Seed rate(kg/ha) and use of proper quality seed
3. T3 : Sowing time and method of sowing/planting
4. T4 : Manuring and fertilisation:
   Farm yard manure(q/ha)
   Nitrogen(kg/ha)
   Phosphorous(kg/ha)

Potassium(kg/ha)

5. T5 : Number of irrigations applied and percentage of area irrigated
6 T6 : Interculture and weed control (number of weedings)
7. T7 : Plant protection chemicals-insecticides, pesticides and weedicides.

A maximum score of '1' is given for the recommended package for each component. Based on deviation from the recommended package due weightage are given for the adoption of each technology component. The idea of finding out the adoption gaps are to know whether agricultural credit has really helped the farmers in adoption of modern technologies.

The farmers existing farm plans are compared with the optimal plans developed by using deterministic linear programming model as:

$$\text{Max } Z = \sum_{i=1}^{n} RiXi + \sum_{i'=1}^{m} Ri'Xi' - Wl \sum_{s=1}^{3} Lhs - Wb \sum_{s=1}^{3} Bhs - \sum_{s=1}^{3} Ocs - Ic \sum_{s=1}^{3} Cbs$$

Subject to

$$\sum_{i=1}^{n} aij\ Xi + \sum_{i'=1}^{m} ai'jXi' < Aj \quad (J=1..9) \text{ (land)}$$

$$\sum_{i=1}^{n} lis\ Xi + \sum_{i'=1}^{m} li'sXi' - Lhs < Ls \quad (s=1..3) \text{ (human labour)}$$

$$\sum_{i=1}^{n} bis\ Xi + \sum_{i'=1}^{m} bi'sXi' - Bhs < Bs \quad (s=1..3) \quad \text{(bullock labour)}$$

$$\sum_{i=1}^{n} cij\ Xi + \sum_{i'=1}^{m} ci'jXi' + Wl \sum_{s=1}^{3} Lhs + Wb \sum_{s=1}^{3} Bhs + Pc \sum_{s=1}^{3} Ocs - Ic \sum_{s=1}^{3} Cbs < Cs \text{ (capital)}$$

$$\sum_{i=1}^{n} aij\ Xj > Pj \quad (j=1..6) \text{ (Minimum area under specific crops)}$$

Non-negativity constraints

$$Xi > 0,\ Xi' > 0,\ Lhs > 0,\ Bhs > 0,\ Ocs > 0,\ Cbs > 0$$

where,
Z = Total net return
Ri = Net return per hectare of i-th crop activity
Xi = Activity level of ith crop
$Ri^{/}$ = Net return per unit of i-th livestock activity
$Xi^{/}$ = Activity level of i-th livestock
Wl = Wage rate per unit of hired human labour
Lhs = Number of hired human labour in sth season
Wb = Wage rate per unit of hired bullock labour
Bhs = Number of hired human labour in sth season
Pc = Price per unit of operating capital
Ocs = Units of operating capital
Ic = Rate of interest per season
Cbs = Amount of capital borrowed.

The following optimal plans were developed for comparison
P0: Existing plan
P1: Optimal plan with existing resources
P2: Optimal Plan with minimum area requirement and credit flexibility.

RESULTS AND DISCUSSION

Extent of Adoption Gap

The technology components under various crops were identified and the levels of adoption of these components were estimated. The crops selected for studying the extent of adoption gap in terms of selected technology components were rice (both *Sali* and A*hu*), wheat, rapeseed and mustard, jute and sugarcane. The extent of adoption gap in the production technologies of the selected crops by the beneficiary and non-beneficiary farmers are shown in Table 1. A perusal of the Table 1 indicate that in all the selected crops adoption gaps in terms of various technology components are higher in case of non-beneficiary farmers as compared to the beneficiary farmers. As the crops are grown under rainfed condition, as expected the adoption gaps in terms of the technology component irrigation (T5) in case of non-beneficiary farmers for winter or *Sali* rice which is the main rice crop of the zone are 91.06 per cent for small, 78.55 for medium and 72.46 per cent for large size groups. In case of beneficiary farmers the adoption gaps are in the range of 48.47, 40.33 and 32.63 per cent for small, medium and large categories, respectively, in growing *Sali* rice. This indicates that the irrigation application is less than 28 per cent in case of non-beneficiary farmers whereas in case of beneficiary irrigation application it is more than 51 per cent. In case of beneficiary farmers even there still exist substantial gaps in terms of various technology components though adoption rates are

TABLE 1. EXTENT OF ADOPTION GAP IN THE PRODUCTION TECHNOLOGIES OF IMPORTANT RAINFED CROPS OF NBP ZONE OF ASSAM

Crops and components of technology	Beneficiary farmers			Non-beneficiary farmers		
	Small	Medium	Large	Small	Medium	Large
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sali Rice						
T1	23.31	16.22	18.32	43.33	42.18	33.32
T2	21.27	15.33	16.34	34.43	33.37	31.67
T3	19.32	17.43	18.66	25.22	24.76	24.26
T4	15.76	14.84	13.67	73.45	77.62	69.41
T5	48.47	40.33	32.63	91.06	78.55	72.46
T6	15.22	14.18	19.36	16.37	16.96	17.42
T7	16.74	15.39	17.73	58.22	56.46	59.66
Ahu Rice						
T1	28.24	27.53	27.88	46.78	53.22	54.16
T2	27.84	26.33	27.67	54.67	57.64	58.19
T3	14.17	13.28	13.93	19.27	20.76	21.37
T4	22.32	21.53	22.68	68.86	69.63	69.27
T5	34.56	31.66	33.28	67.26	66.30	69.17
T6	27.32	28.98	29.31	32.17	35.79	41.83
T7	29.31	28.33	30.24	57.88	58.72	61.39
Wheat						
T1	25.39	24.64	26.33	30.46	31.75	31.27
T2	17.35	16.35	17.83	21.39	22.43	25.44
T3	17.96	17.44	18.29	19.04	19.32	19.69
T4	22.27	21.32	22.71	60.16	60.23	61.96
T5	42.99	38.47	39.73	86.93	88.39	89.38
T6	43.29	39.97	40.76	46.34	48.54	49.77
T7	24.77	22.64	25.22	71.56	73.25	79.33
Rapeseed and Mustard						
T1	13.54	12.27	13.64	15.38	16.45	17.83
T2	14.32	13.48	13.55	17.54	16.93	18.34
T3	12.65	11.86	13.21	16.85	16.44	17.32
T4	21.34	18.64	19.95	71.44	73.63	73.26
T5	36.47	35.31	37.84	90.37	91.33	95.43
T6	42.33	39.55	43.28	48.66	49.76	51.17
T7	34.59	33.88	35.32	54.23	56.84	58.31
Jute						
T1	16.62	16.04	17.26	19.21	18.77	21.32
T2	15.32	14.45	15.51	18.50	18.78	19.59
T3	14.65	13.66	14.22	19.55	20.58	21.54
T4	22.32	21.54	22.75	91.44	92.42	92.84
T5	46.47	45.31	47.42	93.37	95.15	94.67
T6	42.63	39.05	42.69	58.66	59.26	59.96
T7	44.59	43.45	45.32	54.47	55.28	56.42
Sugarcane						
T1	17.68	18.68	19.16	21.24	23.37	24.22
T2	15.37	15.37	16.38	23.53	24.52	25.27
T3	18.63	16.62	17.61	21.57	22.37	23.38
T4	26.46	25.42	25.83	91.28	90.13	92.16
T5	47.57	46.33	47.43	92.47	91.36	93.30
T6	41.44	40.27	41.84	59.64	54.47	56.49
T7	47.39	46.32	47.69	55.42	56.43	58.68

comparatively higher as compared to the non-beneficiary counterparts. The differences in gaps between beneficiary and non-beneficiary farm sizes varies from as

low as 20.02 per cent in case of *Sali* rice for small beneficiary and non-beneficiary under component T1 to as high as 70.88 per cent in case of medium beneficiary and non-beneficiary groups for T4 in case of jute. There are adoption gaps of more than 60 per cent in case of non-beneficiary farmers in all the crops in terms of technology components T4 (manuring and fertilisation) and T5 (irrigation). The adoption gap index demonstrated gaps of even more than 90 per cent in case of crops like sugarcane, jute, rapeseed and mustard for the non-beneficiary farmers. This clearly indicates that credit in various forms enabled the farmers significantly to adopt the technologies but there are still needs for more amount of capital inflow to be made to the farmers to bridge the existing adoption gaps.

Quantum of Credit and Subsidy

The amount of credit and subsidy received by the beneficiary farmers are shown in Table 2. It is observed that the subsidy component on credit varies from 25 to 50 per cent on various aspects on which the credits were provided. In case of small beneficiary farmers the average amount of credit received is highest at Rs. 56000.00 for purchase of dairy animals followed by Rs. 46500.00 for bullocks. The average amount of credit received by the small farmers for the purchase of pump sets, sprayers and equipments is Rs. 39710.00 and for crop production is Rs. 39000.00.The amount of subsidy was found to be 50 per cent for poultry and piggery enterprises for the small and medium group of beneficiary farmers. There is need for increasing the volume of credit under crop production for seasonal agricultural operations for the small and medium farmers. Considering the higher adoption gaps in terms of irrigation there is need for increasing credit flow as well as subsidy component to farmers for various irrigation equipments and structures. Not a single small farmer received any loan for purchase of tractors and power tillers and for farm development. The small farmers on partnership or co-operative basis should be encouraged to avail loans for such costly machineries and equipments. The credit institutions also should encourage financing small farmers under such projects. On an average credit to the amount of Rs. 255625.00 and subsidy of 30 per cent is provided to the large farmers for the purchase of tractors and power tillers. The medium and large farmers received on an average Rs. 64300.00 and Rs. 72150.00 respectively for farm development particularly for erection of fencing, earth filling and construction of sheds and etc.

Optimal Plans

Optimal plans have been generated considering the whole farm situation for a farm size group because in most cases the farmers follow mixed farming systems. The optimal plans developed by using the deterministic linear programming model are indicated in Tables 3 through 5. A perusal of the tables indicates that there exist

TABLE 2. AVERAGE QUANTUM OF AGRICULTURAL CREDIT & SUBSIDY RECEIVED BY VARIOUS CATEGORIES OF FARMERS IN THE NBP ZONE OF ASSAM.

(*Rs.*)

Particulars/purpose	Credit			Subsidy		
	Small	Medium	Large	Small	Medium	Large
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Purchase of pump sets, sprayers and equipments	39710.0	50400.0	71862.0	13898.5 (35.0)	15120.0 (30.0)	17965.5 (25.0)
2. Purchase of tractor and power tillers	----	208900.0	255625.0	----	62670.0 (30.0)	76687.5 (30.0)
3. Purchase of Bullocks	46500.0	57860.0	----	18600.0 (40.0)	17358.0 (30.0)	
4. Farm development	-----	64300.0	72150.0	----	----	----
5. Crop production	39000.0	55300.0	----	11700.0 (30.0)	16590.0 (30.0)	----
6. Dairy animals	56000.0	85000.0		22400.0 (40.0)	34000.0 (40.0)	
7. Poultry enterprise	30500.0	54500.0		15250.0 (50.0)	27250.0 (50.0)	
8. Piggery enterprise	40250.0	60500.0		20125.0 (50.0)	30250.0 (50.0)	

Figures in parentheses indicate percentage of total amount of credit.

scope to increase the farm net returns by merely optimising the existing resource allocations for both beneficiary and non-beneficiary farmers. Considering the prevalence of mixed farming systems in the study area the optimum plans are also developed with the provision of both crops and livestock enterprises. The optimum plans indicated decrease in the cropping intensities for all categories of farmers with increase in the size of livestock enterprises thereby indicating more profitability of livestock enterprises. Thus in the mixed farming system there is every possibility of shift in resource allocation towards livestock enterprises unless diversification through high value crops are introduced. There have been increase in the area under potato, wheat and oilseeds in the optimal plans as compared to decrease in area under rice crops in total. The increase in net returns in the optimal plans with existing resources are in the tune of Rs. 5630.00, Rs. 6418.00 and Rs. 8180.00 for small, medium and large non-beneficiary farmers respectively. In case of beneficiary farmers these increases are in the tune of Rs. 8930.00, Rs. 11218.00 and Rs. 12920.00 for small, medium and large farmers respectively. Among the crop enterprises HYV *Sali* rice, HYV *ahu* rice, wheat, oilseeds and vegetable crops were only get included in the optimal plans (along with all the livestock enterprises) of both beneficiary as well as non-beneficiary farmers and the local varieties were eliminated due to less profitability or non-profitability. As all these crops are capital intensive and considering the need in the study area capital flexibility constraint is incorporated to develop optimal plans (P2) by hiking the capital availability by 20 per cent for the beneficiary farmers. It is observed that a 20 per cent hike in the capital led to 22.50 per cent increase in net return in case of small beneficiary, 24.50 per cent in case of medium and 24.30 per cent increase in net return in case of large farmers (Table

5).These findings also substantiate the earlier findings of Atteri and Joshi (1983) that augmenting capital on the marginal and small farms through increased provision of credit at reasonable rates of interest helped them in adopting improved technology and thereby increased their productivity and made them economically viable. The optimal plans were developed for the non beneficiary farmers by optimising the existing plans and for the beneficiary farmers with the provision of increased amount of bank credit and subsidy components.

TABLE 3. NON-BENEFICIARY SITUATION: EXISTING PLAN (PO) VS OPTIMAL PLAN WITH EXISTING RESOURCES (P1)

		Small		Medium		Large	
Particulars	Unit	Po	P1	Po	P1	Po	P1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HYV ahu rice	ha	0.103	0.136	0.216	0.247	0.421	0.316
		(6.08)	(10.39)	(6.80)	(9.43)	(7.49)	(7.50)
Local ahu rice	ha	0.217	---	0.312	---	0.262	---
		(12.81)		(9.82)		(4.66)	
HYV Sali rice	ha	0.522	0.530	0.723	0.767	1.210	1.160
		(30.81)	(40.52)	(22.77)	(29.31)	(21.53)	(27.53)
Local Sali rice	ha	0.346	---	0.416	---	0.864	-----
		(20.42)		(13.1)		(15.37)	
Boro rice	ha	0.130	0.217	0.236	0.286	0.376	0.493
		(7.67)	(16.59)	(7.43)	(10.93)	(6.69)	(11.70)
Jute	ha	----	---	0.018	---	0.243	---
				(0.56)		(4.32)	
Wheat	ha	0.024	0.031	0.048	0.051	0.286	0.322
		(1.42)	(2.37)	(1.51)	(1.95)	(5.08)	(7.64)
Oilseed crops	ha	0.165	0.191	0.196	0.214	0.573	0.893
		(9.74)	(14.60)	(6.17)	(8.17)	(10.19)	(21.19)
Blackgram	ha	0.013	---	0.021	---	0.103	---
		(0.76)		(0.66)		(1.83)	
Green gram	ha	0.041	---	0.086	---	0.212	---
		(2.42)		(2.71)		(3.77)	
Potato	ha	0.065	0.082	0.106	0.113	0.152	0.262
		(3.83)	(6.27)	(3.33)	(4.31)	(2.70)	(6.22)
Maize	ha	0.022	---	0.051	---	0.176	---
		(1.29)		(1.60)		(3.13)	
Sugarcane	ha	---	---	0.200	0.043	0.272	0.296
				(6.29)	(1.64)	(4.84)	(7.02)
Vegetables	ha	0.046	0.121	0.561	0.896	0.469	0.471
		(2.71)	(9.25)	(17.66)	(34.23)	(8.34)	(11.18)
Gross cropped area	ha	1.694	1.308	3.175	2.617	5.619	4.213
Net area sown	ha	1.120	1.120	2.280	2.280	3.779	3.779
Cropping intensity	Per cent	151.25	116.78	139.25	114.78	148.69	111.48
Dairy	Nos.	2	5	5	8	7	11
Poultry	Nos.	13	68	78	147	84	186
Piggery	Nos.	---	---	5	18	7	20
Goatery	Nos.	4	10	7	21	10	24
Duckery	Nos.	8	21	10	32	15	38
Net returns	Rs.	54,520.0	60150.0	87150.0	93568.0	102350.0	110530.0
Working capital	Rs.	36,650.0	36650.0	53,350.0	53,350.0	77475.0	77475.0
Human labour	Man-days	191	191	213	213	251	251
Bullock labour	Pair-days	62	55	72	67	82	76

Figures in parentheses indicate percentage.

TABLE 4. BENEFICIARY SITUATION: EXISTING PLAN (PO) VS OPTIMAL PLAN WITH EXISTING RESOURCES (P1)

		Small		Medium		Large	
Particulars	Unit	Po	P1	Po	P1	Po	P1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HYV ahu rice	ha	0.123	0.141	0.222	0.243	0.316	0.423
		(6.89)	(11.21)	(7.30)	(10.38)	(5.77)	(9.09)
Local ahu rice	ha	0.345	---	0.423	---	0.522	---
		(19.34)		(13.91)		(9.52)	
HYV Sali rice	ha	0.560	0.771	0.734	0.712	1.212	1.243
		(56.08)	(61.28)	(24.14)	(30.68)	(22.12)	(26.71)
Local Sali rice	ha	0.495	---	0.378	---	0.378	---
		(27.76)		(12.43)		(6.90)	
Boro rice	ha	0.040	0.042	0.241	0.344	0.673	0.723
		(2.24)	(3.33)	(7.92)	(14.70)	(12.28)	(15.53)
Jute	ha	0.006	---	0.018	---	0.232	---
		(0.33)		(0.59)		(4.23)	
Wheat	ha	0.044	0.057	0.078	0.221	0.331	0.452
		(2.46)	(4.53)	(2.56)	(9.44)	(6.04)	(9.71)
Oilseed crops	ha	0.097	0.112	0.312	0.353	0.586	0.613
		(5.44)	(8.90)	(10.26)	(15.08)	(10.69)	(13.17)
Blackgram	ha	0.006	---	0.022	---	0.053	---
		(0.33)		(0.72)		(0.96)	
Green gram	ha	---	---	0.032	---	0.051	---
				(1.05)		(0.93)	
Potato	ha	0.006	0.014	0.112	0.146	0.237	0.336
		(0.33)	(1.11)	(3.68)	(6.24)	(4.32)	(7.22)
Maize	ha	0.022	---	0.123	---	0.132	---
		(1.23)		(4.04)		(2.40)	
Sugarcane	ha	---	---	0.112	---	0.212	0.302
				(3.68)		(3.87)	(6.49)
Vegetables	ha	0.039	0.121	0.233	0.317	0.543	0.561
		(2.18)	(9.61)	(7.66)	(13.54)	(9.91)	(12.05)
Gross cropped area	ha	1.783	1.258	3.040	2.340	5.478	4.653
Net area sown	ha	1.122	1.122	2.134	2.134	3.486	3.486
Cropping intensity	Per cent	158.91	112.12	142.45	109.46	157.14	133.47
Dairy	Nos.	2	5	5	9	7	12
Poultry	Nos.	55	108	98	164	120	280
Piggery	Nos.	3	7	6	19	13	30
Goatery	Nos.	4	12	8	21	10	31
Duckery	Nos.	8	27	10	37	17	34
Net returns	Rs.	78,120.0	87050.0	134050.0	145268.0	174550.0	187470.0
Working capital	Rs.	43,150.0	43150.0	63,350.0	63350.0	97475.0	97475.0
Human labour	Man-days	198	198	223	223	254	254
Bullock labour	Pair-days	61	53	78	66	86	79

Figures in parentheses indicate percentage.

From the comparison of the Tables 3, 4 and 5 net return per rupee of working capital invested have been computed and presented in Table 6. A perusal of the table indicate that in case of beneficiary farmers net return generated per rupee of working capital is more as compared to the non-beneficiary farmers. The net returns per rupee of working capital in the existing plans (P0) are 1.48 and 1.81 in case of non-beneficiary and beneficiary small farmers. For the medium size farmers in the existing plan the net return per rupee working capital are 1.63 and 2.12 respectively

TABLE 5. BENEFICIARY SITUATION: OPTIMAL PLAN WITH MINIMUM AREA REQUIREMENTS AND CAPITAL FLEXIBILITY (P2)

		Small		Medium		Large	
Particulars	Unit	P1	P2	P1	P2	Po	P1
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
HYV ahu rice	ha	0.141	0.123	0.243	0.222	0.423	0.316
		(11.21)	(10.44)	(10.38)	(9.55)	(9.09)	(6.94)
Local ahu rice	ha	---	---	---	---	---	---
HYV Sali rice	ha	0.771	0.560	0.712	0.734	1.243	1.212
		(61.28)	(47.53)	(30.68)	(31.58)	(26.71)	(26.64)
Local Sali rice	ha	---	---	---	---	---	---
Boro rice	ha	0.042	0.137	0.344	0.246	0.723	0.734
		(3.33)	(11.62)	(14.70)	(10.58)	(15.53)	(16.13)
Jute	ha	---	---	---	---	---	---
Wheat	ha	0.057	---	0.221	0.227	0.452	0.455
		(4.53)		(9.44)	(9.76)	(9.71)	(10.00)
Oilseed crops	ha	0.112	0.144	0.353	0.396	0.613	0.621
		(8.90)	(12.22)	(15.08)	(17.03)	(13.17)	(13.65)
Blackgram	ha	---	---	---	---	---	---
Green gram	ha	---	---	---	---	---	---
Potato	ha	0.014	0.076	0.146	0.174	0.336	0.342
		(1.11)	(6.45)	(6.24)	(7.48)	(7.22)	(7.51)
Maize	ha	---	---	---	---	---	---
Sugarcane	ha	---	---	---	---	0.302	0.302
						(6.49)	(6.64)
Vegetables	ha	0.121	0.138	0.317	0.325	0.561	0.566
		(9.61)	(11.71)	(13.54)	(13.98)	(12.05)	(12.44)
Gross cropped area	ha	1.258	1.178	2.340	2.324	4.653	4.548
Net area sown	ha	1.122	1.122	2.134	2.134	3.486	3.486
Cropping intensity	Per cent	112.12	104.99	109.46	108.90	133.47	130.46
Dairy	Nos.	5	8	9	11	12	15
Poultry	Nos.	108	152	164	202	280	324
Piggery	Nos.	7	7	19	35	30	43
Goatery	Nos.	12	22	21	21	31	34
Duckery	Nos.	27	43	37	45	34	52
Net returns	Rs.	87050.00	106636.25	145268.00	180858.12	187470.00	233025.21
Working capital	Rs.	43150.0	51780.0	63350.0	76020.0	97475.0	116970.0
Human labour	Man-days	198	198	223	223	254	254
Bullock labour	Pair-days	53	51	66	62	79	71

Figures within parentheses indicate percentage.

TABLE 6. NET RETURN GENERATED PER RUPEE OF WORKING CAPITAL INVESTED BY THE BENEFICIARY AND NON BENEFICIARY FARMERS (IN RS.)

	Non-beneficiary farmers		Beneficiary farmers		
Size groups	P0	P1	P0	P1	P2
(1)	(2)	(3)	(4)	(5)	(6)
Small	1.48	1.67	1.81	2.01	2.06
Medium	1.63	1.75	2.12	2.29	2.38
Large	1.32	1.43	1.79	1.92	1.99

for non-beneficiary and beneficiary groups respectively. These amounts are in the tune of 1.32 and 1.79 for the non-beneficiary and beneficiary large farm size groups. There have been further increase in the net return generated per rupee working capital invested in the optimal plans (P1 and P2) developed. In case of beneficiary situation

there are even increase of net return per rupee invested in P2 as compared to P1. In case of beneficiary small farmers it has increased from 2.01 in P1 to 2.06 in P2. In case of beneficiary medium and large farmers the increase was from 2.29 in P1 to 2.38 in P2 and from 1.92 in P1 to 1, 99 in P2 respectively .This has clearly indicated that even without allowing the existing resource base to change merely increasing the credit inflow substantial increase in the farm net returns are possible in the optimal plans thereby indicating a positive role of bank credit in improving farm net returns.

Constraints Faced Regarding Credit

Based on the perceptions of the farmers and bankers, the constraints faced were identified. A number of constrains were faced by the various stakeholders in the study area and are listed in Table 7. Lack of sufficient number of rural bank branches, lack of crop insurance schemes and lack of training on fund management and record keeping are strongly felt by the farmers both beneficiary and non-beneficiary (80 to 100 per cent of farmers) of the zone. These are the constraints that severely restraint the outreach of institutional agricultural finance. The need for making credit provision for farm infrastructure development has been widely felt. About 85 per cent

TABLE 7. CONSTRAINTS REGARDING AGRICULTURAL CREDIT ENCOUNTERED BY STAKEHOLDERS IN THE STUDY AREA

Sl. No. (1)	Beneficiary farmers (2)	Non-beneficiary farmers (3)	Banks and Government agencies (4)
1.	Low literacy and lack of knowledge of banking transaction (65per cent)	Lack of knowledge about financial schemes (100 per cent)	Low literacy and lack of knowledge of farmers about banking transaction,
2.	Lack of training on knowledge of fund management and record keeping (100 per cent)	Non availability of proper security deposits to be offered (85 per cent)	High credit risks due to non availability of proper security documents.
3.	Insufficient rural bank branches (80 per cent)	Insufficient rural bank branches (100 per cent)	Difficulties in close monitoring and supervision due to lack of sufficient bank supervisory staff.
4.	Getting loans for a permanent infrastructure set up (85 per cent)	Low literacy and lack of knowledge about banking transaction (85 per cent)	Mandatory target
5.	Lack of efficient delivery of banking service and lack of awareness and exposure about modern technologies (65 per cent)	----	Non repayment of loan instalment in time
6.	Market linkage and non availability of marketing credit (70 per cent)	----	----
7.	Insufficient amount of credit. Need increase of credit amount by 10-20 percent (60 per cent)	----	----
8.	Lack of crop insurance schemes (100 per cent)	Lack of crop insurance schemes (100 per cent)	----

Figures in parentheses indicate percentage of total farmers.

of the beneficiary farmers opined in favour of providing credit for infrastructure build up. Another important observation is the need for marketing credit in the study area which is essential for establishing the proper market linkages for the farmers. Inefficient credit delivery system and insufficient amount of credit are the constraints identified by 65 per cent of the beneficiary farmers. The amount of credit may be increased by 20 per cent from the existing levels as per needs of the farmers. The farmers who did not avail credit were because of ignorance about the credit schemes and lack of knowledge on banking transactions. The banks and the government agencies providing credit and subsidies considered high credit risks because of low literacy rates of the farmers and as majority of the farmers generally do not have proper documents of productive assets in their names to be offered as security. Further on account of mandatory targets and insufficient numbers of staffs, the banks could not fulfill 100 per cent credit needs of the farmers.

CONCLUSION AND POLICY SUGGESTIONS

The study indicated that there are adoption gaps of higher quantum on different technology components in the study area. The minimisation of adoption gaps in terms of various technology components require more amount of capital inflow to production. The farmers could not afford to apply the recommended technology in farming due to poor economic condition and lack of technical knowledge. To increase cropping intensity and crop diversification there is need to bring more areas under irrigation. To minimise the higher adoption gaps in terms of irrigation there is need for increasing credit flow as well as subsidy component to farmers for various irrigation equipments and structures. The study has clearly indicated that even without allowing the existing resource base to change, by merely increasing the credit inflow substantial increase in the farm net returns are possible in the optimal plans for all categories of farmers. There are needs for establishing more numbers of rural bank branches with sufficient staffs to cater to the needs of the rural farming community. Farmer's orientation and training regarding the proper utilisation of credit should also be taken up by the institutional lending agencies as mandatory programmes or with the help of NGO-Bank linkage programmes. Credit documentation should be made simplified and be made farmers friendly. The small farmers on partnership or cooperative basis should be encouraged to avail loans for purchase of costly modern farm machineries and equipments which otherwise they cannot afford to purchase and also not economical to use it individually. The credit institutions also should encourage financing small farmers working on co-operative basis under different developmental schemes. Loans for development of farm infrastructures should also be made available separately without clubbing it with seasonal agricultural loans.

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