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Impact of Livelihood and Nutritional Activities on Crop Diversification and Food Security of Households

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ABSTRACT

An attempt has been made in the present investigation to study the impact of livelihood and nutritional activities on rural households with special focus on the cropping intensity, crop diversification and household food security in Udaipur district of Rajasthan during the year 2013-14. The study covered 45 beneficiary and 45 non-beneficiary households. The results of the study revealed that the cropping intensity was relatively higher in case of beneficiary (171.83%) as compared to non-beneficiary households (147.44%). The value of Crop Diversification Index (ICD) was found higher in case of beneficiary (14.29%) than non-beneficiary households (10%). Household Dietary Diversity Score (HDDS) was relatively higher for beneficiary (5.22) than that of non-beneficiary households (3.38). Food Consumption Score (FCS) was relatively higher for beneficiary (38.51) than that of non-beneficiary households (26.82). The value of index of food security ranged from 2.93 (non-beneficiary) to 3.64 (beneficiary).

Key Words: Food security, Crop diversification, Food consumption score
JEL Classification: Q18, Q180

INTRODUCTION

Livelihood improvement in the country is possible through adoption of a wise admixture of appropriate technologies. For attaining equitable targeted growth, there has to be appropriate livelihood technology intermediation of practices, may it be land based, homestead based as well as non-farm based. Therefore, a programme 'Livelihood and Nutritional Security of Tribal Dominated Areas through Integrated Farming System and Technology Models' in four disadvantaged Banswara, Bungarpur, Udaipur and Sirohi districts of southern Rajasthan was initated. The project aimed at accelerating livelihood and nutritional security of rural households through horticulture and livestock based Integrated Farming System (IFS) Approach. The excellent technologies had been developed which can transform both the productivity and income of farmers-producers leading to livelihood and nutritional security. A large number of horticultural and livestock based innovative technologies had been made available to beneficiary households in hand. The modules of integrated farming system with judicious mix of proven technologies had been recognized as a vital tool for bringing food security, balanced food, quality food basket, enhanced farm income, higher employment generation, social upliftment and effective recycling of resources. Various interventions undertaken over the programme period has resulted in

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multifarious outcomes, ultimately leading to impact. It could be perceived from various angles such as change in cropping intensity, crop diversification and food security at household level. Thus, keeping the above background in mind, the present study was carried out in Udaipur, one of the four beneficiary districts of Rajasthan with the objectives (i) to assess cropping intensity and crop diversification, and (ii) to study the impact of livelihood and nutritional activities on the food security of households.

MATERIALS AND METHODS

The consortia project on 'Livelihood and Nutritional Security of Tribal Dominated Areas through Integrated Farming System and Technology Models' had been implemented by Maharana Pratap University of Agriculture and Technology (MPUAT) in Udaipur, Durgapur, Banswara and Sirohi districts of Rajasthan in 2007. Out of all operational districts, Udaipur district has been purposively selected for the present study. One cluster i.e. Mavli-I, out of four clusters, was selected from Udaipur district on the basis of maximum number of villages covered under the project. Keeping in view the available resources and time factor, with the researcher, the study was confined to only six villages of selected cluster in Udaipur district. Within selected cluster, the villages were stratified into beneficiary villages (villages covered under the project) and non-beneficiary villages (villages not covered under the project). Rathana, Bansliya and Rediya khedi were randomly selected as beneficiary villages while another three villages namely Khimakheda, Ganvda and Varni were considered as non-beneficiary villages. A complete enumeration of all the households in the selected villages with respect to technologies adopted, family size and land holdings was made. From six selected villages, 45 beneficiary households who had adopted atleast one IFS Technology from project and had land and life stock base and an equal number of non-beneficiary households (45) who had not taken any technology from project but had land and livestock base were randomly selected from the nearby villages to serve as valid basis of comparison. Thus, a total of 90 households (45 beneficiaries and 45 non-beneficiaries) were randomly selected from selected villages in order to compare and study the impact of livelihood and nutritional activities on the households for the present study. The study was based on a sample survey conducted for the year 2013-14. The data were collected with the help of well structured pretested schedules by personal interview method. The primary data on sown area, area allocated under different crops and different types of food items considered under diet were collected from selected households.

Analytical Framework

Crop Diversification: The formula developed by Rasul and Thapa (2004) was used to study the impact of project on crop diversification in the study area.

Where, ICD is the Index of Crop Diversification, P_a is the proportion of sown area (%), Subscripts a, b, c... n denotes different crops, and N_c was the number of crops.

The analysis was carried out based on the following scoring system of sustainability:

$$ICD = \frac{P_a + P_b + P_c + ...+ P_n}{N_C} (\%)$$

Household Dietary Diversity Score (HDDS) and Food Consumption Score (FCS)

The Household Dietary Diversity Score (HDDS) was an attractive proxy for

food security. The Food Consumption Score (FCS) was a more comprehensive indicator based on dietary diversity, food frequency and relative nutritional importance of various food groups. The HDDS was the sum of all food groups consumed by the households in the last 24 hours by the total number of households. To calculate the FCS, the types of food considered were reduced down to eight main food groups *viz.*, (i) Staples, (ii) Vegetables, (iii) Fruits, (iv) Pulses, (v) Meat and Fish, (vi) Milk, (vii) Oil and (viii) Sugar. After the calculations of food consumption score, households were categorized into poor (food insecure), borderline (moderately food insecure) or acceptable consumption (food secure) on the basis of World Food Program (WFP) thresholds as given below:

Score Index	ICD values (%)	Sustainable classifications
1	81-100	Very low sustainability
2	61-80	Low sustainability
3	41-60	Moderate sustainability
4	21-40	High sustainability
5	0-20	Very high sustainability

FCS	WFP Thresholds
01-21	Food insecure
21-35	Moderately food secure
>35	Food secure

$$\text{Index of Food Security} = \frac{Fd1 \cdot 1 + Fd2 \cdot 2 + Fd3 \cdot 3 + Fd4 \cdot 4 + Fd5 \cdot 5}{N}$$

Where,

Fd1 = Frequency of responses indicating food insecurity (temporal + permanent)

Fd2 = Frequency of responses indicating always not enough to eat

Fd3 = Frequency of responses indicating sometimes not enough to eat

Fd4 = Frequency of responses indicating enough but not always the desired food

Fd5 = Frequency of responses enough of kinds of the desired food

N = Sample size

Cropping Intensity: Croping Intensity indicates the additional and percentage of the area sown more than once to net sown area. It is measured by the formula:

$$\text{Cropping intensity} = \frac{\text{Gross cropped area}}{\text{Net sown area}} \text{ X } 100$$

RESULTS AND DISCUSSION

Under the limited scope for area expansion, the food production can be enhanced by raising cropping intensity. Higher cropping intensity means that a higher portion of net sown area is being cropped more than once during one agricultural year. It is evident from Table-1 that gross cropped area had enhanced by 16.40 per cent on beneficiary households compared to non-beneficiary households. The cropping intensity was observed higher on beneficiary households (170.83 per cent) compared to non-beneficiary households (147.44 per cent), which showed more efficient use of arable land by beneficiary households. The similar findings were reported by Rumi and Rana (2002), Meena *et al.* (2012) and Mula and Sarkar (2013). This might be due to adoption of technological interventions like new crop sequencing and varietal replacement in the study area. Thus, increased cropping intensity will help definitely in enhancement of livelihood status

TABLE 1: CROPPING INTENSITY ON BENEFICIARY AND NON-BENEFICIARY HOUSEHOLDS

Particulars	Beneficiary	Non-beneficiary	% difference
Net sown area (hectare)	34.99	34.83	0.47
Gross cropped area (hectare)	59.77	51.35	16.4
Cropping Intensity (%)	170.83	147.44	-

Figures in parentheses indicate percentages increase in area of beneficiary over non-beneficiary.

and food security of households.

Crop Diversification

Crop diversification is related to minimization of risks in farming. It indicates the increasing number of crops or production enterprises per farm which helps to insure the crops against various types of risk (Beets, 1990). The value of index starts from 100 (when only one crop is grown) and tends to become zero (when as many as 100 crops are grown). The lower is the index value, the higher will be crop diversification and thus, more sustainable will be the farming system as it is conducive to making efficient use of different types of nutrients available in soil and to increasing biodiversity (Dahal, 1996). It was observed that the crop diversification index (ICD) was 10 per cent on non-beneficiary farms and to 14.29 per cent on beneficiary households in the study area (Table 2). The similar observations were also reported by Mula and Sarkar (2013). Thus, as more area was brought under cultivation and high-yielding short-duration varieties were introduced, the growing of maize, wheat, black gram, green gram, barley, mustard and gram was replaced partly with other more profitable vegetable crops like lady's finger, bitter guard and pumpkin. This project could not succeed in shifting the degree of sustainability which remained to be very high (less than 20 per cent) in beneficiary and non-beneficiary households. Mula and Sarkar (2013) also reported enhanced crop diversification index on the beneficiary farms.

TABLE 2: PATTERN OF CROP DIVERSIFICATION ON BENEFICIARY AND NON-BENEFICIARY HOUSEHOLDS

Crops	Beneficiary	Non-Beneficiary
Maize	23.65 (39.56)	24.62 (17.95)
Wheat	14.58 (25.39)	15.23 (29.66)
Black gram	1.62 (2.71)	1.62 (3.15)
Green gram	2.11 (3.53)	1.78 (3.47)
Barley	2.43 (4.06)	- 0.97 (1.89)
Mustard	5.34 (8.93)	2.59 (5.04)
Gram	7.77 (13.50)	4.54 (8.84)
Lady's finger	0.97 (1.62)	-
Bitter Gard	0.81 (1.35)	-
Pumpkin	0.49 (0.82)	-
Gross cropped area	59.78 100.00)	51.35 (100.00)
Index of crop diversification	10	14.29
Degree of sustainability	Very high	Very high

Figures in the parentheses are the percentage of Gross Cropped Area.

Household Dietary Diversity Score (HDDS)

The HDDS was calculated using the detail of consumption of 13 types of food consumed by a household in the just one day before the survey (Table 3). The study revealed that Household Dietary Diversity Score for beneficiary households was relatively higher (5.22) than that of non-beneficiary households (3.38). The results indicated that the beneficiary households had access to diverse more fooditems than non-beneficiary households. Further, per cent share in total HDDS was observed highest from staples food (19.15%) followed by milk, cheese, yogurt or other milk product (16.60%), vegetables (12.34%), oils and fats (11.91%), sweets, sugar and honey (11.91%), potatoes, yams, cassava or any other foods made from roots or tubers (9.36%), condiments, coffee, tea including milk in tea (9.36%), beans, pea, lentil or nuts (7.23%), eggs (6.38%), poultry including chicken, duck (2.55%), red meat (2.13%), fruits (1.70%) and fresh or dried fish or shellfish (0.85%) food groups on beneficiary households. Similarly, the staples food (26.97%), milk, cheese, yogurt or other milk product (17.76%), sweets, sugar and honey (11.84%) and vegetables (9.87%) were the major items of food consumption on the non- beneficiary households. Thus staples food group contributed the highest share in total HDDS

in both the beneficiary and non-beneficiary household categories while fresh or dried fish or shellfish contributed the lowest share in total HDDS. The project had positive impact on enhancing HDDS on beneficiary households.

Food Consumption Score (FCS)

The FCS was calculated using the frequency and percentage of households about the consumption of eight food groups consumed by a household during the last seven days before the survey. A close examination of Table 4 revealed that Food Consumption Score (FCS) for beneficiary households (38.51) was relatively higher than that of non-beneficiary households (26.82).

The results indicated that the beneficiary households were more food secured than the non-beneficiary households. Further, per cent share in total FCS was observed to be the highest for staples (36.35 %) followed by milk (21.92 %), meat and fish (17.66 %), pulses (7.09 %), vegetables (5.97 %), sugar (5.76 %), oil (4.73 %) and fruits (0.52 %) of food groups on beneficiary households while it was also highest for staples (37.43 %) followed by milk (26.25 %), meat and fish (10.89 %), pulses (10.74 %), sugar (5.56 %), oil (4.70 %), vegetables (4.21 %) and fruits (0.22 %) of food groups on non-beneficiary households. The staples food group contributed the highest share in total FCS in both the categories while fruit group contributed the lowest share in total FCS, but the magnitude

TABLE 3: PATTERN OF HOUSEHOLD DIETARY DIVERSITY SCORE (HDDS) ON BENEFICIARY AND NON-BENEFICIARY HOUSEHOLDS

(Number of household)

Types of Food	Consumption of foods by beneficiary in last 24 hours	Consumption of foods by non-beneficiary in last 24 hours
Staples or food made from staples including millet, sorghum, maize, rice, wheat, or other local grains, e.g. bread, rice, nodules, biscuits or other foods	45 (19.15)	41 (26.97)
Potatoes, yams, cassava or any other foods made from roots or tubers	22 (9.36)	14 (9.21)
Vegetables	29 (12.34)	15 (9.87)
Fruits	4 (1.70)	1 (0.66)
Beans, pea, lentil or nuts	17 (7.23)	11 (9.87)
Red meat - beef, pork, lamb, goat, rabbit wild game, liver, kidney, heart or other organ meats	5 (2.13)	5 (3.29)
Poultry including chicken, Duck, other poultry	6 (2.55)	4 (2.63)
Eggs	15 (6.38)	11 (7.24)
Fresh or dried fish or shellfish	2 (0.85)	-
Milk, cheese, yoghurt, or other milk product	39 (16.60)	27 (17.76)
Oils and fats	28 (11.91)	12 (7.89)
Sweets, sugar, honey	28 (11.91)	18 (11.84)
Any other foods, such as condiments, coffee, tea including milk in tea	22 (9.36)	18 (11.84)
Total	235 (100.00)	152 (100.00)
Number of households	45	45
HDDS	5.22	3.38

Figures in parentheses indicate percentages of the total beneficiary and non-beneficiary households.

TABLE 4: PATTERN OF FOOD CONSUMPTION SCORE (FCS) ON BENEFICIARY AND NON-BENEFICIARY HOUSEHOLDS

Food Groups	Weights	Average days of consumption/week		FCS	
		Beneficiary	Non-Beneficiary	Beneficiary	Non-Beneficiary
Staples	2	7	5.02	14 (36.35)	10.04 (37.43)
Vegetables	1	2.3	1.13	2.3 (5.97)	1.13 (4.21)
Fruits	1	0.2	0.06	0.2 (0.52)	0.06 (0.22)
Pulses	3	0.91	0.96	2.73 (7.09)	2.88 (10.74)
Meat and Fish	4	1.7	0.73	6.8 (17.66)	2.92 (10.89)
Milk	4	2.11	1.76	8.44 (21.92)	7.04 (26.25)
Oil	0.5	3.64	2.53	1.82 (4.73)	1.26 (4.7)
Sugar	0.5	4.44	2.98	2.22 (5.76)	1.49 (5.56)
Food Consumption Score (FCS)				38.51 (100)	26.82 (100)
Classification of households				Acceptable consumption (food secure)	Borderline consumption (moderately food insecure)

was much more in case of beneficiary households compared to non-beneficiary households. Thus, project had positive impact on enhancing FCS on beneficiary households.

Index of Food Security (IFS)

The assessment of equity and food security is highly relevant for agricultural sustainability and livelihood security in the rural areas (Rasul and Thapa, 2004). Food security analysis through index of food security was done for both beneficiary and non-beneficiary households and same has been depicted in Table 5. In this study, households were asked whether or not their food supply was enough round the year.

It was observed that with the introduction of horticulture and livestock technologies and intensification of crop diversification, the overall food deficiency was less as compared to non beneficiary households for the beneficiary households who had temporal and permanent food insecurity, by 8.89 per cent for households who always had not enough food to eat and by 6.66 per cent for the households who sometimes did not have enough food to eat. Also, the overall food sufficiency enhanced from 17.78 to 22.22 per cent for those households who had enough food but not always the kind of food they desired and from 8.89 to 28.89 per cent for households who had enough of the kinds of food they desired. The overall index value of food security was 3.64 in beneficiary and it was 2.93 in non-beneficiary households. It is clear from the results that the food security index value was higher for beneficiary households than non-beneficiary households.

TABLE 5: FOOD SECURITY ANALYSIS OF HOUSEHOLDS THROUGH INDEX OF FOOD SECURITY

(Number of household)

Items	Weights (Wi)	Beneficiary	Non-Beneficiary
Food insecure temporal + permanent)	1	2 (4.44)	6 (13.13)
Always not enough to eat	2	3 (6.67)	7 (15.56)
Sometimes not enough to eat	3	17 (37.78)	20 (44.44)
Enough but not always the kind of food desired	4	10 (22.22)	8 (17.78)
Enough of the kind of food desired	5	13 (28.89)	4 (8.89)
Total sample size	-	45 (100.00)	45 (100.00)
Index of food security	-	3.64	2.93

CONCLUSION

It can be concluded from above discussion that the cropping intensity was relatively higher in case of beneficiary as compared to non-beneficiary households, which can be attributed to the adoption of technological interventions by beneficiary households. The value of crop diversification index was found more on beneficiary than non-beneficiary households, which indicated that more area was brought under cultivation and high-yielding short-duration varieties. Household Dietary Diversity Score as well as Food Consumption Score were somewhat high for beneficiary than that of non-beneficiary households which indicated that the beneficiary households were accessed more food than non-beneficiary ones. Further, the results of index of food security pointed out that food sufficiency enhanced on the beneficiary households.

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