International Journal of Agriculture Sciences
ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 13, 2020, pp.-10019-10023.
Available online at https://www.bioinfopublication.org/jouarchive.php?opt=&jouid=BPJ0000217

Research Article

CHARACTERIZATION OF PADDY PRODUCTION ENVIRONMENT IN HILLY AREA OF ALMORA DISTRICT: A MICRO-ECONOMIC EVIDENCE OF UTTARAKHAND, INDIA

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Received: July 01, 2020; Revised: July 07, 2020; Accepted: July 09, 2020; Published: July 15, 2020

Abstract: Objective of this study to characterize paddy production environments in hill. The productivity of paddy is not only lower but also stagnated from several years in the hills. To understanding the production practices of paddy cultivation, primary data of 60 randomly selected households from two villages namely: Adhuria and Balai from Almora district were collected for detailed analysis. The operational holding size is usually very small in the hills, therefore, the farmers having 10-20 and 20-40 nali cultivated land were classified as marginal and small, respectively. Descriptive statistics were applied for data analysis. Paddy was the major cereal in the surveyed area during kharif season and it accounts 47.66 and 58.13% area to total cropped area in terraces and valleys, respectively. The study was initiated to characterize physical and bio-physical conditions, households, cropping pattern, farming systems, input use in production practices and detailed cost and return analysis of two distinct paddy growing environments as terraces and valleys. The causes of low productivity of paddy is discussed in detail in this paper. There is need to design suitable policy and technological interventions for improvement in yield and profitability of paddy cultivation in hills.

Keywords: *Environment, Terrace, Valleys, Net returns, Characterization*

Citation: Singh S.V., *et al*., (2020) Characterization of Paddy Production Environment in Hilly Area of Almora district: A Micro-economic Evidence of Uttarakhand, India. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 12, Issue 13, pp.- 10019-10023.

Academic Editor / Reviewer: Ammayappan L., Reddypriya P., P. V. Jadhav, Mondal Biswajit, Dr A D Kalola

Introduction

India is one of the world's largest producers of rice, accounting for 22% of all world rice production. Rice is India's preeminent crop and is the staple food of the people of the eastern and southern parts of the country. Production of rice has increased from 53.60 million tonnes in the year 1980 to 74.60 million tonnes in 1990, 9 percent increase over the decade. By the year 2013-14, rice production had reached 106.29 million tonnes, second in the world only to China with its 144 million tonnes. Since 1950, the increase has been more than 350 percent. Most of this increase was the result of an increase in yields, the number of hectares increased only 40 percent during this period. Yields increased from 1.34 tonne per hectare in the year 1980 to 1.75 tonne per hectare in 1990. The per-hectare yield increased more than 262 percent between 1950 and 1992. The India's rice production reached to a record high of 104.32 million tonnes in 2011-12.

In 2013-14 crop year production of rice reached to 106.29 million tonnes due to better monsoon. But in crop year 2014-15 rice production decreased due to low rainfall and effect of cyclonic storm hud-hud at major paddy grown areas like Andhra Pradesh, Uttarakhand is one of the newly formed states of India, which falls under the North Western Himalayas (NWH) region. Eleven out of 13 districts in Uttarakhand fall under hilly area of NWH region. Rice is the major cereal crop of kharif season accounting for more than 54 percent of the total area under cereals in the state.

The annual rice production of the state is around 5.5 lakh tones from an area of about 2.80 lakh hectares. Half of this area is in the plains and half in the hills, but the total rice production of the plains is twice the total production of the hills. Rice is cultivated in all the 13 districts of the state, but maximum area (33%) is in district Udham Singh Nagar that produces about 48% of the total rice produced annually in the state. Districts Nainital, Haridwar and Dehradun occupy about 17.50 percent area and contribute 22.20 percent in the total production.

From productivity point of view, these districts are classified in the medium category. Rests of the nine districts are classified in the low productivity category. These nine districts together occupy about 49.20 percent area, but contribute only to 30 percent of the total production. After the creation of the state, a substantial area declined due to urbanization, industrialization and for other development purposes in the plains. Total area under cereals in Kharif was about five lakh ha from which share of hills and plains was about 3.70 and 1.30 lakh hectare, respectively. Rice is grown in an area of about 2.86 lakh hectares accounting for over 54% to the total area of cereal in kharif. Out of total 2.86 lakh ha rice, 1.44 lakh ha, which was nearly 51 percent, cultivated in hills and remaining 49 percent in the plains. Production of rice in the state was 532727 tones, out of which hills and plains constitute 196437 (36.80%) and 336290 (63.20%) tones, respectively. The average productivity of rice in the state as a whole was 1.90 t/ha, whereas in hills it is 1.1t/ha only. The highest productivity of rice is in the plains of districts Nainital and U.S.Nagar *i.e.* 3.0 and 2.6 t/ha, respectively. The highest productivity among hill districts is in Tehri Garhwal which is 1.60 t/ha. The objective of present study to characterize paddy production environments in hill. The productivity of paddy is not only lower but also stagnated from several years in the hills. To understanding the production practices of paddy cultivation, primary data of 60 randomly selected households were collected for detailed analysis.

Material and Methods

Survey design of study

A multi-stage purposive- cum- random sampling technique was used for the selection of district, block and villages. Almora district was selected purposively based on the existence of largest rice growing area as well as production whereas lowest productivity in the hills.

A complete list of all twelve blocks located in Almora district was obtained from the district headquarters and Takula block that have highest area under rice was selected purposively. For the selection of villages, a list of all villages falling under Takula block was prepared from the records of block headquarter and two villages namely; Adhuria and Balai which were located in terrace and valley, respectively and that have highest area under rice were selected for the present study. A separate list of rice growers of Adhuria and Balai villages was collected and arranged in ascending order based on land holding size and it was further categories into two groups *viz*., marginal and small farms based on land available for cultivation. The operational holding size is usually very small in the hills, therefore, the farmers having 10-20 and 20-40 naali cultivated land were classified as marginal and small farmers, respectively. The above measurement was designed in view of smaller holding size available in the hills. From this list, a sample of 30 rice growers from each village were selected randomly making a total sample size of 60 rice grower-farmers.

Analytical tools

Tabular analysis was adapted to general characteristics of the sample rice growers, determination of resource structure, costs and returns analysis.

The weighted mean of the variable X was calculated by using following formula.

$$Weighted\ mean = \frac{\sum W Xi}{\sum W}$$

Where,

W = Weight of Xi,

Xi = Variables

The arithmetic mean of the variable X was calculated by using following formula.

$$Arithmetic\ mean = \frac{\sum X}{N}$$

Where,

X= value of observations,

N= number of observations

Measures of farm profit

1.Gross return (Rs) =price of M.P. (Rs/per qtl) × yield of M.P.+ Price of B.P. x quantity of B.P.

2.Net return (Rs.) = Gross return–Cost of cultivation

Results and discussion

Characteristic of selected villages

The major characteristics of the study villages are summarized in [Table-1]. The average operational holding of sample farmers in terrace was slightly higher 0.28 ha as compared to 0.26 ha in valleys in study villages. The overall average operational holding of sample farmers was about 0.27 ha. In valleys nearly 84.30 percent of the fields have access to irrigation through hill canals. While terraces were mainly dependent on rainfall and very small portion was irrigated by hill springs. Average years of schooling of household head in valleys were slightly higher (8.40) as compared to terrace (7.60) and together

Table-1 *Characteristic of selected villages*

Characteristics	Terrace	Valleys	Overall
No. of households	30.00	30.00	60.00
Average age of household's head (years)	52.30	50.80	51.55
Average years of schooling of household head	7.60	8.40	8.00
Average household size (no. of family members)	5.20	5.80	5.50
Average operational holdings (ha)	0.28	0.26	0.27
Irrigated area (%)	1.79	84.30	41.77
Sources of irrigation	Spring	Hill Canal	-
Share of paddy in total cropped area in kharif season (%)	47.66	58.13	52.71
Average paddy yield (q/ha)	14.60	40.20	27.40
Average number of parcels	5.30	1.50	3.40
Average number of plot/parcels	18.93	5.75	12.34
Average size of parcel (ha)	0.05	0.17	0.11

They formed 8.00 years on overall basis. Average age of household's head was 52.30 year in terraces as compared to valleys where it was slightly lower *i.e*. 50.80 year. It is evident from the table that number of family members per family was 5.80 for valleys and 5.20 for terraces in target area. The overall average household size was 5.50 members per family. The difference in number of parcels and their size varies in two different paddy growing environments. Average numbers of parcels were more in the terraces than valleys, whereas number of plots per parcel almost equal. However, average size of parcel was smaller in terraces. It may due to hill slopes and undulating nature of land situation.

[Table-1] also indicates that paddy accounted for 47.66 and 58.13 percent share to total cropped area in kharif in terraces and valleys, respectively. The overall percentage area of paddy to total cropped area in kharif was 52.71 percent. This clearly indicates that paddy is most important crop in the kharif season which supports livelihood of farming community in study area. Average yield of paddy was 14.60 and 40.20 qtls per hectare in terraces and valleys, respectively. Low yield level of terrace was associated with the undulating land type, poor quality soil and non-use of modern inputs such as HYV seeds, fertilizers, irrigation etc. Shallow depths of soil available for cultivation on rocks in terraces restrict farmers to apply fertilizers in the crop due to poor moisture resume.

Characteristics of households

The [Table-2] shows the family structure and their education level on sample farms in both the paddy growing environments. The average numbers of members were 5.20 and 5.80 per family in terraces and valleys, respectively in study villages. On an average, families in terraces constitute 2.20 male adults, 0.70 male children, 1.60 female adults and 0.70 female children. While the average family size in valleys was little bit more as compared to terraces with 2.90 male adults, 0.85 male children, 1.45 female adults and 0.96 female children. Data also showed that almost similar composition and distribution of family members in both the environments.

The overall situation depicts an average picture of both environments *viz*., terraces and valleys and it reveals that an average family had 2.55 male adults, 0.78 male children, 1.53 female adults and 0.65 female children. This clearly shows that the percentage of males in average family size was higher in both environments. [Table-2] also represents the educational status of sample households. A very small proportion of male adults were illiterate on sample farms. It revealed from the table that a higher proportion of male adult population educated up to secondary level which accounted 23.08 percent in terraces followed by higher secondary and graduation levels. The proportion of male adults was educated up to graduation was more in valleys (10.34 %) than the terraces. Table also presents that majority of male children were studying up to secondary level which was 9.62 percent in terraces and 6.03 percent in valleys. In terraces the percentage of illiterate female adults was higher that is 15.38 percent, where as in valleys it was about 10.34 percent. A significant number of female adults per family were qualified up to secondary and very few were educated up to higher secondary. The situation becomes worse when move towards the higher education level *i.e*. graduation and above, only 2.59 percent female adults per family educated in valleys, while it was 1.92 percent for terraces.

A majority of female children falls under secondary level of education. It accounts for 7.69 percent in terraces as compared to 5.17 percent of valleys. On an average proportion of female children were 13.46 and 10.34 percent to total population in terraces and valleys, respectively. The overall situation of female adults reveals that 12.73 percent were illiterate and very few were graduate and above *i.e*. 2.27 percent. Male adults form illiterate 2.73 percent whereas educated up to graduation was 8.18 percent to total population. The proportion of male adults educated up to secondary and higher secondary was at satisfactory level. The overall condition of children (male +female) showed that more than 17.31 percent were educated up to secondary level.

Distribution of operational land holding

The concept of operational holding indicates that land is wholly or partially belongs to households for agricultural production purposes. It may be of different types land tenure arrangements like owned and self-operated or leased-in or partly leased-in.

Table-2 *Educational status and composition of household*

Particulars	Terrace	%	Valleys	%	Overall	%
No. of male adult per family						
Illiterate	0.20	3.85	0.10	1.72	0.15	2.73
Up to secondary	1.20	23.08	1.00	17.24	1.10	20.00
Higher sec	0.50	9.62	1.20	20.69	0.85	15.45
Graduation and above	0.30	5.77	0.60	10.34	0.45	8.18
No. of male adult per family	2.20	42.31	2.90	50.00	2.55	46.36
No. of male children per family						
Infant	0.10	1.92	0.20	3.45	0.15	2.73
Up to secondary	0.50	9.62	0.35	6.03	0.43	7.73
Higher sec	0.10	1.92	0.30	5.17	0.20	3.64
No. of male children per family	0.70	13.46	0.85	14.66	0.78	14.09
No. of female adult per family						
Illiterate	0.80	15.38	0.60	10.34	0.70	12.73
Up to secondary	0.40	7.69	0.50	8.62	0.45	8.18
Higher sec	0.30	5.77	0.20	3.45	0.25	4.55
Graduation and above	0.10	1.92	0.15	2.59	0.13	2.27
No. of female adult per family	1.60	30.77	1.45	25.00	1.53	27.73
No. of female children per family						
Infant	0.20	3.85	0.15	2.59	0.18	3.18
Up to secondary	0.40	7.69	0.30	5.17	0.35	6.36
Higher sec	0.10	1.92	0.15	2.59	0.13	2.27
No of female children per family	0.70	13.46	0.60	10.34	0.65	11.82
Family size	5.20	100.00	5.80	100.00	5.50	100.00

Table-3 *Land holding description of households*

Environments	Size of holding	Number	% to total	total area (ha)	% to total area	Irrigated area(ha)	% irrigated area
Terraces	Marginal	28	93.33	7.28	86.67	0.08	1.1
	Small	2	6.67	1.12	13.33	0.07	6.25
	Total	30	100	8.4	100	0.15	1.79
Valley							
	Marginal	29	96.67	7.25	92.59	6.21	85.66
	Small	1	3.33	0.58	7.41	0.39	67.24
	Total	30	100	7.83	100	6.6	84.3
Overall							
	Marginal	57	95	14.53	89.53	6.29	43.29
	Small	3	5	1.7	10.47	0.49	28.82
	Total	60	100	16.23	100	6.78	41.77

Table-4 *Cropping pattern by seasons and environments*

Crops	Terraces (ha)	Share (%)	Valleys (ha)	Share (%)	Grand total (ha)	Share (%)
Kharif						
Paddy	4.00	47.66	4.55	58.13	8.56	52.71
Mandua	2.28	27.10	1.59	20.37	3.87	23.85
Madira	0.57	6.73	0.00	0.00	0.57	3.48
Cowpea	0.08	0.93	0.02	0.28	0.10	0.62
Gahat	0.50	5.98	0.13	1.70	0.64	3.91
Soybean	0.55	6.54	0.58	7.36	1.13	6.93
Urd	0.13	1.50	0.31	3.96	0.44	2.68
Bhat	0.06	0.75	0.04	0.57	0.11	0.66
Bhat + Soybean	0.08	0.93	0.21	2.69	0.29	1.78
Groundnut	0.05	0.56	0.00	0.00	0.05	0.29
Maize	0.03	0.37	0.13	1.70	0.16	1.01
Chilli	0.02	0.19	0.25	3.25	0.27	1.67
Ginger	0.06	0.75	0.00	0.00	0.06	0.39
Total	8.40	100.00	7.83	100.00	16.23	100.00
Rabi						
Fallow	1.46	17.35	0.81	10.30	2.26	13.95
Wheat	4.18	49.81	4.19	53.46	8.37	51.57
Barley	1.41	16.79	1.31	16.78	2.72	16.79
Pea	0.17	2.05	0.07	0.85	0.24	1.47
Lentil	0.74	8.77	0.41	5.22	1.15	7.06
Mustard	0.38	4.48	0.50	6.35	0.87	5.38
Gram	0.03	0.37	0.10	1.27	0.13	0.81
Potato	0.03	0.37	0.45	5.78	0.48	2.98
Total	8.40	100.00	7.83	100.00	16.23	100.00
Grand total	16.8		15.66		32.46	

In this study land tenure system is entirely owned and operated by owner himself in the study area. [Table-3] indicates that majority of farmers belongs to marginal category that is 93.33 and 96.67 percent to total farmers in terrace and valleys environment, respectively. Whereas a very poor proportion of farmers fall in small category *i.e.* 6.67 and 3.33 percent from respective environments. This clearly indicates that a significant proportion of land holding was dominated by marginal category of farmers in target area. The average land holding size in terraces and valley was 0.28 and 0.26 hectare, respectively.

In terraces 6.67 percent of the sample farmers' fall under small size and occupying 13.33 percent cultivated area. Likewise, in valleys, 3.33 percent of small farmers holding 7.41 percent of cultivated land to total area. There was very small area under irrigation which was 7.35 percent to total cultivated area in terrace. While in valleys share of irrigated area were 85.66 and 67.24 percent to total cultivated area on marginal and small farms, respectively. Table indicates that on an average share of irrigated area was 41.77 percent to total cultivated area on sample farms. Area under irrigated land was differed on different farm size. Although, the sources of irrigation and extent of irrigation in both the environments are quite different and majority of irrigated area comes from valleys on aggregate level. The shares of irrigated area on marginal and small farms were 43.29 and 28.82 percent to total cultivated area in surveyed villages.

Cropping pattern

[Table-4] reveals the cropping pattern adopted by the sample farms in two districts paddy growing environments *viz*, terraces and valleys in the study area. It is evident from the table that paddy was the major cereal in the terraces and valleys during kharif season. However, paddy accounts 23.81 and 29.06 percent area to gross cropped area in terraces and valleys, respectively. Importance of paddy was also seeming very obvious during kharif because it occupied 47.66 and 58.13 percent to total cropped area in terrace and valleys, respectively. The other important crop of kharif was mandua, emerged as second major cereal and occupied 27.10 and 20.37 percent area to total cropped area in the respective environments. The other cereals, pulses, oilseeds and spices crops were minor in importance in terms of its acreage.

Table also presents that wheat was a major crop in rabi season in both the environments. Acreage of wheat was highest and it covered 49.81 and 53.46 percent area to total cropped area in terraces and valleys, respectively. Barley emerged out as a second most important crop accounted 16.79 percent area to total cropped area across the environments. In terraces lentil occupies considerable area (8.77%) followed by mustard (4.48%). Where as in valleys, Mustard, Potato and lentil were the other crops occupies 6.35, 5.78 and 5.22 percent area to total cropped area in rabi season.

A major portion of land was leftover fallow during rabi season in both the environments due to soil-deficient-moisture at sowing and planting time. Paddy is the major economic activity of households in kharif season as it seems from the table that coverage of this crop is 52.71 percent to total cropped area on an overall basis. Wheat is the major crop in rabi and it covered 51.57 percent area to total cropped area. It revealed that more than 85 percent of the total cropped area was devoted to subsistence food crops. Paddy and wheat both crops dominated in the agricultural production system in both the environments in study area.

Economic analysis of paddy cultivation

[Table-5] and [Table-6] revealed input use, cost and returns analysis of paddy cultivation on per hectare basis in two different paddy growing environments *viz*. rainfed terraces and irrigated valleys. Further tables 5.10 and 5.11 shows input use, cost and returns analysis of paddy cultivation by farm size in the selected villages of Takula block, district Almora. Rice is predominantly cultivated during the kharif season in the state. In hill, high yielding rice varieties were popular in the valleys, whereas traditional varieties were grown on the terraces which show contrasting conditions to valley situations. In terraces, farming activities begin immediately after rains occur as they are mainly rainfed. Valleys were irrigated by the hill canals. In both environments, land preparation was totally dependent on bullock power. Mechanization was not popular due to bio-physical conditions of land and small size of plots which have sloppy situations. However, rice establishment methods differ in both the environments. Terraces was entirely direct seeded rice (dry-seed and dry-soil), while in valleys, transplanting was the most popular rice establishment method.

Input use, cost and returns analysis of paddy cultivation

Paddy is planted predominantly during the kharif season. In valleys modern paddy varieties are popularized, traditional varieties were not in cultivation on sample farm. However, terraces showed contrast to valley situation where only traditional and local varieties are popular. In terraces, farming activities begins immediately after rain occurs as they are mainly rainfed and dependent on rainfall. The other site, valleys environment is well irrigated by the hill canals and springs. In both the environments, land preparation entirely dependent on draft/bullock power. Mechanization was not possible due to bio-physical conditions and small size and sloping land types of farms. Paddy crop establishment method was also differed in both the environments due to different physical and bio-physical condition of land types. Terraces is entirely direct seeded (dry-seed and dry soil), while in valleys paddy establishment done by establishing nursery followed by transplanting which is popular method in irrigated rice growing areas in Southeast Asia (Singh et al. 2017). Plant protection chemical application was negligible and fertilizers used only in valleys. The average grain yield of paddy in valleys was almost three times more to the average yield in the terraces.

Input use in paddy production

[Table-5] gives the information on input use in different paddy cultivating environments on sample farms. In terraces, 10 bullock days was required in land preparation for paddy cultivation. While in valleys it was somewhat higher and required 13 days. Paddy seed used 150 and 75 kg/ ha in terraces and valleys, respectively. The rate of FYM application were 125 and 100 qtls/ha in terraces and valleys, respectively. However, terraces are entirely rainfed while valleys are irrigated by hill canals with plain topography. Farmers of valleys used nitrogen and phosphorus inorganic fertilizers in their paddy crop and application rate were 50 and 25 kg/ha. In terraces consumption of fertilizer was almost zero. These all differences in the input use between these two distinct environments are due to differential land topography, size of plots and access to irrigation.

Total labor days employment in paddy cultivation in valleys was 139 man days, where as in terraces it was only 78 man days. Paddy establishment in valleys required 35 man days, which was 25.18 percent of the total labour use and it was followed by weeding and manure application with 25 and 11 man days respectively. Harvesting required 35 man days and threshing and winnowing together used 23 man days in valleys.

Table-5 *Input use in paddy cultivation on sample farm by environment*

Environments Particulars	Terraces	Valleys
Materials		
Bullock power (days)	10	13
Seed (Kg)	150	75
FYM (qtls)	125	100
Irrigation (no.)	-	7
Fertilizers (Kg)		
Nitrogen	-	50
Phosphorous	-	25
Labour days		
Nursery management*	-	3
Paddy establishment**	2	35
Manure application	14	11
Fertilizer application	-	3
Weeding	30	25
Irrigation	-	4
Total Pre-harvest labor	46	81
Harvesting	20	35
Threshing &Winnowing	12	23
Total labour days	78	139

**Preparation of nursery bed, FYM application, irrigation, seeding and care etc., ** 8 working hrs = one day*

In terraces weeding emerged out as important component of total labour days *i.e.* 30-man days, highest number of man days which accounts for about 38.46 percent to total labour days employed in paddy production. Other significant component was harvesting, manure application which accounts for 25.64 and 17.95 percent share to total labour days, respectively.

Cost and returns analysis of paddy cultivation by environments

The average cost and returns from paddy cultivation on per hectare basis are revealed from [Table-6]. The cost of cultivation of paddy was Rs. 57250/ha in the valley which is one and half times higher than to the terrace (Rs. 37350/ha).

The material cost, which includes bullock power, seed, FYM, irrigation and fertilizer use were worked out to be Rs. 13950/ha accounted for 37.35 percent to total cost incurred in terraces and Rs. 15550/ for valleys which accounted for 27.16 percent to total cost. Material cost was more in valleys due to use of chemical fertilizers. The table further revealed that among the different items of material cost, FYM was the most important followed by bullock power which accounted together 30.12 percent to total cost incurred in terraces. While in valleys bullock power was the most important component of material cost with 11.35 percent share to the total cost followed by FYM having 8.73 percent share to total cost of cultivation of paddy.

In two environments *viz*., terraces and valleys, human labour included only family and exchange laborers because hired labor is not available in the hills. Labor cost in paddy cultivation included nursery management, establishment, application of manure and fertilizer, weeding, harvesting, threshing and winnowing. The expenses on labor cost was Rs. 23400 in terraces and Rs. 41700/ha in Valleys which constitute 62.65 and 72.84 percent to total cost, respectively. Weeding emerged out as a main component of labor cost in terraces. It was Rs. 9000/ha for terraces and Rs. 7500 for valleys, followed by harvesting cost of Rs. 6000 and Rs. 10500/ha in terraces and valleys, respectively [Table-9]. These costs together constitute 40.16 percent share in terraces and 31.44 percent in the valleys. However, paddy establishment was the most important component of labour cost in valley followed by weeding, threshing and winnowing which formed about 18.34 percent to total cost. Other items of cost had relatively lesser share in total cost.

Table-6 *Costs and returns of paddy cultivation by environments (Rs/ha)*

Environments Particulars	Terraces	%age	Valleys	%age
Material Cost				
Bullock power	5000	13.39	6500	11.35
Seed	2700	7.23	1650	2.88
FYM	6250	16.73	5000	8.73
Irrigation	-	-	1400	2.45
Fertilizer*				
Nitrogen	-	-	400	0.70
Phosphorous	-	-	600	1.05
Sub-Total	13950	37.35	15550	27.16
Labor Cost				
Nursery management	-	-	900	1.57
Paddy establishment	600	1.61	10500	18.34
Manure application	4200	11.24	3300	5.76
Fertilizer application	-	-	900	1.57
Weeding	9000	24.10	7500	13.10
Irrigation	-	-	1200	2.10
Total Pre-harvest labor	13800	36.95	24300	42.45
Harvesting	6000	16.06	10500	18.34
Threshing & Winnowing	3600	9.64	6900	12.05
Sub-Total	9600	25.70	17400	30.39
Total cost	37350	100.00	57250	100.00
Yield				
MP (q/ha)	14.6	-	40.2	-
BP (q/ha)	15	-	45	-
Paddy MP (Rs/q)	1650	-	1700	-
Paddy BP (Rs/q)	100	-	100	-
Value of MP (Rs)	24090	-	68340	-
Value of BP (Rs)	1500	-	4500	-
Gross return (Rs)	25590	-	72840	-
Net return (Rs)	-11760	-	15590	-

•*Source of NPK: Urea, DAP and SSP.*

The yield of main product was higher in valleys *i.e*. 40.20 qtls per hectare as compared to terraces, where it was only 14.60 quintal. It may be due to non-adoption of modern technologies such as HYVs seeds and fertilizers in terraces.

Price of grain was also slightly higher in valleys *i.e*. Rs. 1700 per quintal which may be due to preferred quality of paddy by consumers as HYVs. The price of by-product (straw) is same (Rs. 100/qtls) across the paddy growing environments.

There are large differences observed in gross returns from paddy cultivation in two different growing environments. In Valleys gross returns are near to tipple (Rs. 72840/ha) than to terraces (Rs. 25590). This was happening due to extremely high yield of paddy grain in the valley where modern technologies of paddy production followed by the farmers. Valleys provide ideal paddy production situation in kharif season where all the newly developed technological interventions were adopted potentially. Surprising result were reported in this study from terrace where net returns of paddy cultivation are negative means gross return is less than the cost incurred in which is Rs. 11760 per hectare.

Conclusion

Since food security is the major issue in the hills, therefore, paddy producers are hardly concern for maximization of net return or profit. Producers are interested to use available land resources and to provide employment to their family members while opportunity cost of labor in the market is zero in kharif season. The analysis revealed that further research is required to improve the productivity of paddy in hilly areas of Uttarakhand.

Application of research: Development of suitable paddy varieties could also help to households in strengthening their food security by improving and enhancing yield of paddy.

Research Category: Agricultural Economics

Acknowledgement / Funding: Authors are thankful to Department of Agricultural Economics, S. H. University of Agriculture, Technology and Sciences, Prayagraj, 211007, Uttar Pradesh, India

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Research project name or number: PhD Thesis

Author Contributions: All authors equally contributed

Author statement: All authors read, reviewed, agreed and approved the final manuscript. Note-All authors agreed that- Written informed consent was obtained from all participants prior to publish / enrolment

Study area / Sample Collection: Almora district

Cultivar / Variety / Breed name: Rice

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

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