Original Research Article

Analysis of Socio-Economic Characteristics of Potato Growing Farms at different Altitudes in Pithoragarh District of Uttarakhand: A Statistical Approach

Devesh Kumar Pant[*], Virendra Singh and Mohd. Ismail Hashime

Department of Agricultural Economics, G. B. Pant University of Agriculture and Technology, Pantnagar-263145, Uttarakhand, India
*Corresponding author

A B S T R A C T

Keywords

Potato, Cropping intensity, Livestock, Age and non-farm income

The study aimed at showcasing the socio-economic characters of potato growing famers belonging to different altitudes of a geographically constrained hilly district Pithoragarh (Uttarakhand) was carried out based on randomly drawn sample of 90 farmers. The study revealed that the potato growing farmers had a high level of literacy (86.67 percent) with a mean age of 48.92 years, which varied from 55.37 years at low hills to 43.27 years at high hills. Potato, common bean, wheat were the principal crops grown in the study area across altitudes. Potato appeared as a crop of prime importance, occupying 34.93 percent, 27.67 percent and 22.80 percent of gross cropped area at high, mid and low hills, respectively. As reflected from the cropping intensity the land at mid and low hill was being used more intensively than their counterparts at high hills. The average size of holding at high, mid, low hills and aggregate level was found to be 2.60, 2.09, 1.60 and 2.10 acres per farm, respectively. The average number of livestock reared on potato growing farm was quite high with 22, 11 and 9 animals per farm at high, mid and low hills. It was noticed from the study that contribution of non-farm enterprises (sources of income) at high hills was significantly lower than that at mid and low hills. It was probably due to limited availability of supplementary avenues to support farm income in the high hills as compared to mid and low hills. From the statistical comparison of socio-economic variables across the altitudes, it was revealed that there existed a significant difference among the farmers at different altitudes.

Introduction

Agriculture is the backbone of Indian economy as more than half of the country's population depends directly or indirectly on agriculture. In this way, the agriculture has been playing a vital role in providing employment, reducing poverty, bringing socio-economic growth and sustainable economic development through gradual improvement of the rural economy. Today majority of the developing countries like India are confronting the problem of burgeoning population and poverty, leading to an increased demand for food on one hand and declining cultivable area on the other. Therefore, it is the need of the hour to identify and practice crop cultivation which

have wider adaptability with higher production potential per unit area and time, and also can serve as a versatile food with nutritional superiority and better storage quality. Potato is an important cash crop which fits to a range of farming systems due to its shorter vegetative cycle and higher yieldpotential with wider flexibility in planting and harvesting dates, meets almost all above requirements. In Indian context potato is economically significant not just due to its contribution to the livelihood of thousands of farmers and for its dominance in the agricultural consumption basket of the households, but also for its extending channels towards fast growing potato processing industry. The processing industry, a big consumer of potatoes, requires continuous and assured supply through out the year, but due to seasonal nature of production the smooth supply of fresh produce cannot be assured,as potato production in India takes place during rabi season in plains.This opens up a scope for potato production in hilly states of the country in kharif season (off-season) where the soil and climatic conditions are favourablelike Himanchal Pradesh, Uttarakhand, north-eastern states and ensure supply in the market during the lean seson. The potato grown in kharif season being an off-season produce in plains fetches a premium prices in the market. In Uttarakhand, 97 percent of area under potato is covered by hilly districts, where it is cultivated mainly during kharif season in the year. The major potato growing hilly districts of the state are Uttarkashi, Nainital, Chamoli, Pithoragarh, etc. The average productivity (111.39 q/ha) of the crop in Pithoragarh district is higher than that of state average productivity (Uttarakhand Agriculture Statistics, 2016). Pithoragarh, stands fourth in terms of area under potato, has an untapped potential of incresing productionin the state using modern production practices, butthe

majority ofpotato growing farmers in the districtbelongto the marginal or small farm category,characterized by poor resource endowment,weak accessiblity to market information, lack of transportation facilities, with meager farm investment and very low income coupled with traditional cultivation practices. Earlier studies (Zaidi and Munir, 2014; Njuguna *et al.,* 2012) have shown that socio-economic characteristics like age, educational, household size, income, etc. have significant effect on adoption of new technological innovations, advanced cultivation practices, etc. thereby impacting the agricultural production. In view of the above, an understanding of the same would be helpful to devise suitable policies for promoting potato cultivation in the potential pockets of the state.

Materials and Methods

This study was conducted in Pithoragarh, a hilly district of Uttarakhand, during the agricultural year 2016–17. District Pithoragarh is comprised of 8 community development blocks, out of which Munsyari block was selected purposively for the study, as the block occupies the highest area under potato cultivation and produces the highest potato in the district. In the next stage of sampling, six villages, two each from three altitudes (high hills, mid hills and low hills) in Munsyari block were selected using stratified random sampling technique. For all selected villages separate lists of potato growing farmers were prepared in consultation with village local people. From the prepared lists of potato growing farmers, 15 farmers were selected from each village, using random number table. Thus the study was based on a sample of 90 farmers. In order to achieve the objectives of the study, primary data on various socio-economic attributes of potato growing farmers was collected and analyzed using descriptive statistical tools. The fact cannot

be denied that land holding pattern, livestock population, sources of income, educational status, etc. of people residing in an area can vary across altitudes. In order to delineate the difference in socio-economic attributes across altitudes one-way ANOVA technique (Ostertagova and Ostertag, 2013) was used.

ANOVA is centered on the idea to reveal the variation between the samples and variation within the samples by analyzing their variances. The one-way ANOVA is passes following steps; Let $X_{11}, X_{12}, \ldots X_1 n_1$ are observation from sample 1, X_{21}, X_{22}, $X_{23}, \ldots X_{2n2}$ are observation from sample 2,......., $X_{K1}, X_{K2} \ldots X_K n_k$ are observation from sample k. And $n_1, n_2 \ldots n_k$ are the sample sizes. And total sample size $N = n_1 + n_2 + n_3 + \ldots + n_k$ and K is number of samples. Here samples means sample of farmers from different altitudes.

Total sum of squares SST = SSC + SSE

Where,

SSC = sum of squares for treatment (or between samples)

SSE = sum of squares for error (or within samples).

Formulas of SST, SSC and SSE are given below;

$$SST = \sum_{i=1}^{k} \sum_{j=1}^{n_i} \left(X_{ij} - \overline{X} \right)^2$$

$$SSE = \sum_{i=1}^{k} \sum_{j=1}^{n_i} \left(X_{ij} - \overline{X}_i \right)^2$$

$$SSC = \sum_{i=1}^{k} \sum_{j=1}^{n_i} \left(X_i - \overline{X} \right)^2$$

Where,

$\overline{X}_i$ = sample means (i=1, 2…..k)

$$\overline{X}_i = \frac{1}{n_i} \sum_{j=1}^{n_i} X_{ij}$$

$\overline{X}$ = grand mean. Formula of grand mean is as follows;

$$\overline{X} = \frac{1}{N} \sum_{i=1}^{k} \sum_{j=1}^{n_i} X_{ij}$$

The results of the computation that leads to the F-statistic are presented as below;

One-way analysis of variance (ANOVA)

Significance of Ftest indicates that all the sample means are not same and there exists atleast one pair with unequal means. If Ftest is found significant at appropriate level of significance, then critical difference (CD) is compared with absolute differences of sample means of each pair. And if absolute difference between a pair of samples is greater than the critical difference than there exists a significant difference in the means of that pair of samples. Critical difference (CD) is calculated as follows;

$$CD = t_{(\alpha, N-K)} \sqrt{\frac{MSE}{n_i} + \frac{MSE}{n_j}}$$

Where

α = level of significance.

MSE = mean sum of squares for error

n_i and n_j= sample sizes of ith and j^{th} samples respectively.

Results and Discussion

This section has been devoted for presentation of findings of the study. In order to have an understanding of the socio-economic characteristics of farmers–affect the management and organization of the farm as well as provide a base for further planning and development –have been analyzed and presented hereunder through various sub-sections;

Age-wise distribution of potato growing farmers in district Pithoragarh

The age of an individual has a great influence on one's ability to take part in economic activities and chances of benefiting from it. Though, a farmer in his young age is supposed to be enthusiastic, energetic, has courage to venture even into a new and risky field and is keen to learn new techniques/skills, but lacks experience, a factor of paramount importance in business like agriculture. And a farmer in the middle age is supposed to be energetic, able to judge the present events and forecast future course of events based on his experience and to take a well thought decision on organization and operation on the farm in contrast to an old age farmer with dull enthusiasm, lack energy and confidence and risk averter, therefore the age affects the production and income of the farmer.

The age-wise distribution of potato-growing farmers presented in table 1 shows that however most of the farmers (about 59 percent) across the altitudes belonged to the middle age group, but the proportion of middle aged farmers in high hills was more than that in mid and low hills. Finding of this study are similar with the studies of Kannan (2002), Sah (2005) and Roy *et al.,* (2013) where majority of famers also belonged to middle age group. Further, a considerable

portion of farmers (43.33 percent) in the low hills were in the old age group in contrast to the fact that a significant number of farmers belonged to young age group in high hills in comparison to other altitudes. A comparison of age of farmers of different altitudes reveals that the average age of farmers in high hills was lower than that in mid and low hills (Appendix - I).

The age wise-distribution of farmers suggests that majority of potato growing farmers in hills in general and in high hills in particular, were mature and experienced to adopt potato cultivation – a well thought decision – to increase their income.

Educational profile of potato growing farmers in district Pithoragarh

The education makes a person to understand, analyze and enable one to decide reasonably. The educational profile of potato growing farmers at different altitudes of district Pithoragarh has been presented in Table 2. A perusal of the table indicates that about 87 percent potato growing farmers across the altitude were literate. Further, one-third potato growing farmers (33.33 percent) in high hills were educated only upto primary level, while farmers with education up to primary level in mid hills and low hills were 26.67 percent and 13.33 percent, respectively. Also one-fifth of potato growing farmers in high hills were educated up to high school or senior secondary, while about 26.67 percent and 33.33 percent of the same in mid and low hills educated up to high school or senior secondary. No farmer in high hills was found to have education up to graduation or above, whereas a very few were found educated up to graduation or above in mid (6.67 percent) and low hills (10.00 percent).

A statistical comparison of educational level of potato growing farmers across different

altitudes depicts that there was significant difference in years of formal education of farmers between low and high hills (Appendix - I). Though, the difference in education level is attributed to difference in access to education facilities and affordability of individuals at different altitudes, but has direct effect on the level of understanding and capability of analysis intricacies involved in technical process.

Size and composition of family of potato growing farmers in district Pithoragarh

In farming business farm family plays a vital role; when he feeds his family – serves as a liability on the farm – and when supplies labour force – serves as a resource for production, thereby affects expenses and income on the farm. The size and composition of family of potato growing farmers has been presented in Table 3. The table shows that the average size of the familyof potato growing farmers was 5.77 persons per family at aggregate level, which ranged from 5.70 persons per family in case of high hills to 5.87 persons per family in case of low hills. A comparison of the average size of families revealed that there was no significant difference among families across the altitudes (Appendix - I).

The table also reflects the composition of farm families, it is clear that an average farm family at aggregate level was comprised of 2.12 adult male (36.80 percent), 2.09 adult female (36.22 percent) and 1.56 children (26.98 percent). Across altitudes no significant difference in the family composition was observed.

Size of operational holding and area under potato in district Pithoragarh

The size of operational land holding – production unit –determines the size of agricultural production and income on the farm. The average size of operational holding and area under potato crop across altitudes on potato growing farms in Pithoragarh district has been given in table 4. A glance on the table reveals that the average size of operational holding was the highest in high hills with a magnitude of 2.60 acres per farm, while the same was the lowest in low hills with a magnitude of 1.60 acres per farm. It can also be observed from the table that the proportionate area under potato crop was found to be the highest in mid hills (55.98 percent) followed by low (46.25 percent) and high hills (46.15 percent). A comparison among different altitudes shows that however, average size of operational holding was statistically different and higher in high hills than that at mid and low hills, but area under potato crop in mid hills was significantly higher than that in high and low hills (Appendix - I).

Thus, it can be concluded that size of operational holding and area under potato declines with decrease in altitude. This was due to the high population density in low hills.

Pattern of cropping followed by potato growers in districtPithoragarh

The pattern of cropping reflects the importance of the crops grown on a farm or in an area, and is determined by bio-physical, environmental and socio-economic factors. The potatocultivation in the district is very typical, as it is done in two seasons – at high and mid hills it is sown during the months of March–April and is harvested during the months of September–October i.e. in *kharif* season –at low hills it is sown during the months of October–November and is harvested during the months of April – May i.e. in *rabi* season, but the crop taken in *kharif* season is considered to be the main crop in the district.

The cropping pattern followed by potato growing farmers at different altitude in Pithoragarh district (table 5) reveals that potato was the most important crop on the selected farms, followed by common bean and wheat.

Table also shows that potato was the most cultivated crop at high hills with a proportion of around 35 percent of gross cropped area followed by common bean (25.83 percent). In case of mid-hills, potato was also found to be a crop of prime importance covering about 28 percent of gross cropped area, while wheat was observed to be the second most important crop in terms of area occupying about 27 percent of gross cropped area. In contrast to high and mid hills, potato (22.80 percent) occupies second place in terms of area after common bean (27.57 percent) in low hills.

It is also clear from the table that the intensity of cropping – as a ratio of gross cropped area to net cropped area – was found to be 131.97 percent, 201.56 percent, 203.43 percent at high hills, mid hills and low hills, respectively. The higher cropping intensity – a measure of extent of land use – observed at mid and low hills was due to the fact that the climatic conditions at these altitudes are not so erratic, therefore the farmers grow short duration crops like pulses, millets etc. during *rabi* season to achieve higher cropping intensity.

Size of livestock herd on potato growing farms in district Pithoragarh

The livestock enterprise in Indian context, in general and in hills in particulars, plays an important part, as it serves as a supplementary enterprise to agriculture and provides a good amount of livelihood to most of the farmers. The size of livestock herd on potato growing farms has been presented in table 6. The table shows that the highest number of livestock reared on potato growing farms was found in high hills (21.50 animals per farm) followed by mid hills (11.37 animals per farm) and low hills (9.27 animals per farm).

This was mainly due to the fact that farmers in high hills were rearing a considerably higher number of goats (18 goats per farm) as compared to mid (7.50 goats per farm) and low hills (5.83 goats per farm), as they can survive in the extremely cold climatic conditions.

In aggregate level, findings of this study are in contrast with the studies of Das (2003) and Roy *et al.,* (2013) wherein 4-7 animals per farm were observed in the study area in comparison to about 14 animals per farm in the present study.

The statistical comparison of livestock population reveals that livestock population at low hills was significantly lower than that at high hills (Appendix - I). Thus, it can be inferred that higher population of livestock in high hills may be due to the suitability of such livestock species to climatic conditions of high hills.

Investment pattern on potato growing farms in district Pithoragarh

Investment takes place on the farm on the basis of farm size, nature of enterprise(s) and availability of funds to the farmers. Investment pattern on potato growing farms on farm buildings, tools and equipments(except value of land) at different altitudes has been presented in table 7.

Table depicts that however, per farm investment was seemingly different at different altitudes with Rs.33475per farm in low hills and Rs.24322per farm in mid hills, but this difference across altitudes was found to be statistically insignificant (Appendix - I).

Table.1

Source of variation	Degrees of freedom (df)	Sum of squares (SS)	Mean sum of squares (MSS)	F_{cal}
Between the samples (Treatments)	K-1	SSC	MSC = SSC/K-1	F_{cal}= MSC/MSE
Within the samples (Error)	N-K	SSE	MSE = SSE/N-K	-
Total	N-1	SST	-	-

Table.2 Age-wise distribution of potato growing farmers in district Pithoragarh (Number)

Age group/Altitudes	High hills	Mid hills	Low hills	Overall
Young Age Group (<35 years)	6 (20.00)	4 (13.33)	3 (10.00)	13 (14.44)
Middle Age Group (35-60 years)	20 (66.67)	19 (63.33)	14 (46.67)	53 (58.89)
Old Age Group (>60 years)	4 (13.33)	7 (23.33)	13 (43.33)	24 (26.67)
Total	30 (100.00)	30 (100.00)	30 (100.00)	90 (100.00)
Average age of farmers (in years)	43.27	48.13	55.27	48.92

Note: Figures in parentheses indicate percentage to total no. of farmers

Table.3 Educational profile of potato growers in district Pithoragarh (Numbers)

S. No.	Educational status	High Hills	Mid Hills	Low Hills	Overall
1.	**Illiterate**	4 (13.33)	4 (13.33)	4 (13.33)	12 (13.33)
2.	**Literate**				
a.	Primary	10 (33.33)	8 (26.67)	4 (13.33)	22 (24.44)
b.	Junior high school	10 (33.33)	8 (26.67)	9 (30.00)	27 (30.00)
c.	High school/Senior secondary	6 (20.00)	8 (26.67)	10 (33.33)	24 (26.67)
d.	Graduate and above	0 (0.00)	2 (6.67)	3 (10.00)	5 (5.55)
	Sub total	26 (86.67)	26 (86.67)	26 (86.67)	78 (86.67)
	Total	30 (100.00)	30 (100.00)	30 (100.00)	90 (100.00)

Note: Figures in Parentheses indicate percentage to total

Table.4 Size and composition of family of potato growing farmers in district Pithoragarh (Persons per family)

Particulars	High Hills	Mid Hills	Low Hills	Overall
No. of adult males	2.00(35.09)	2.17(36.93)	2.20(38.37)	2.12(36.80)
No. of adult females	1.93(33.92)	2.07(35.23)	2.27(39.53)	2.09(36.22)
No. of children	1.76 (30.99)	1.64 (27.84)	1.27 (22.10)	1.56 (26.98)
Average size of family	5.70(100.00)	5.87(100.00)	5.73(100.00)	5.77(100.00)

Note: Figures in Parentheses show the percentage of familysize

Table.5 Pattern of land holding and area under potato crop in district Pithoragarh (Area/farm in Acre)

Particulars/Altitudes	High Hills	Mid Hills	Low Hills	Overall
Size of holding (acre)	2.60	2.09	1.60	2.10
Area under Potato (acre)	1.20	1.17	0.74	1.04
% Area under Potato	46.15	55.98	46.25	49.52

Table.6 Cropping Pattern on potato growing farms in district Pithoragarh (Area/farm in Acres)

Crops	High Hills	Mid Hills	Low Hills	Overall
Kharif				
Potato	1.20(34.93)	1.17(27.67)	0.00(0.00)	0.79(21.70)
Common bean	0.89(25.83)	0.43(10.31)	0.90(27.57)	0.74(20.35)
Horse gram	0.14(3.97)	0.12(2.80)	0.14(4.34)	0.13(3.63)
Soybean	0.14(4.16)	0.08(1.80)	0.15(4.70)	0.12(3.41)
Paddy	0.02(0.53)	0.13(3.06)	0.23(7.11)	0.13(3.47)
Finger millet	0.08(2.19)	0.04(0.96)	0.08(2.44)	0.06(1.79)
Other crops	0.13(3.97)	0.13(2.95)	0.09(2.93)	0.12(3.27)
Rabi				
Potato	0.00(0.00)	0.00(0.00)	0.74(22.80)	0.25(6.80)
Wheat	0.37(10.73)	1.14(27.08)	0.43(13.10)	0.64(17.76)
Lentil	0.14(4.07)	0.20(4.64)	0.14(4.42)	0.16(4.39)
Other crops	0.27(7.91)	0.75(17.94)	0.25(7.85)	0.44(11.77)
Zaid				
Buckwheat	0.01(0.41)	0.01(0.19)	0.02(0.48)	0.01(0.35)
French bean	0.01(0.41)	0.00(0.07)	0.01(0.46)	0.01(0.30)
Other crops	0.02(0.68)	0.02(0.50)	0.02(0.75)	0.02(0.63)
Net cropped area	2.60	2.09	1.60	2.10
Gross cropped area	3.43(100.00)	4.21(100.00)	3.25(100.00)	3.63(100.00)
Cropping intensity (%)	131.97	201.56	203.43	173.27

Note: Figure in parentheses shows the percentage of Gross cropped area.

Table.7 Size of livestock herd on potato growing farms in district Pithoragarh (No. per farm)

S. No.	Animals	High Hills	Mid Hills	Low Hills	Overall
1.	Cattle	1.63(7.60)	1.67(14.66)	1.57(16.91)	1.62(11.55)
2.	Bullock	1.53(7.13)	1.27(11.14)	0.93(10.07)	1.24(8.86)
3.	Buffalo	0.33(1.55)	0.27(2.35)	0.27(2.88)	0.29(2.06)
4.	Goat	18.00(83.72)	7.50(65.98)	5.83(62.95)	10.44(74.37)
5.	Others	0(0.00)	0.67(5.89)	0.67(7.23)	0.45(3.21)
	Total livestock	21.50(100)	11.37(100)	9.27(100)	14.04(100)

Note: Figures in Parentheses indicate percentage to total livestock

Table.8 Investment pattern on potato growing farms in district Pithoragarh (Rs. per Farm)

S. No.	Particulars	High Hills	Mid Hills	Low Hills	Overall
1.	Cattle shed	8245 (29.13)	10079 (41.44)	9881 (29.52)	9401 (32.76)
2.	Storage house	16254 (57.42)	10472 (43.06)	21283 (63.58)	16003 (55.76)
3.	Plough	1450 (5.12)	1260 (5.18)	652 (1.95)	1121 (3.91)
4.	Plank	0 (0.00)	158 (0.65)	150 (0.45)	103 (0.36)
5.	Sprayer	367 (1.30)	419 (1.72)	209 (0.62)	332 (1.16)
6.	Others#	1989 (7.02)	1935 (7.96)	1300 (3.88)	1741 (6.07)
	Total	**28305 (100.00)**	**24322 (100.00)**	**33475 (100.00)**	**28700 (100.00)**

Note: **1.** # indicate conventional implements.
       2. The figures are rounded off to the nearest rupee.

Table.9 Source-wise income on potato growing farms in district Pithoragarh (Rs. per household)

S. No.	Particulars	High Hills	Mid Hills	Low Hills	Overall
A	**Farm enterprises**				
1.	**Agriculture**	315125 (77.49)	202627 (52.72)	150303 (42.04)	222685 (58.17)
(i)	**Potato**	103320 (25.41)	113762 (29.60)	83047 (23.23)	100043 (26.13)
(ii)	**Other crop enterprises**	211805 (52.08)	88866 (23.12)	67256 (18.81)	122642 (32.04)
2.	**Livestock**	18230 (4.48)	13305 (3.46)	13202 (3.69)	14912 (3.90)
	Subtotal	333355 (81.97)	215932 (56.18)	163504 (45.73)	237597 (62.06)
B	**Non-farm sources**				
1.	**Salary and wages**	40000 (9.84)	67200 (17.48)	93600 (26.18)	66933 (17.48)
2.	**Business**	6800 (1.67)	10800 (2.81)	18000 (5.03)	11867 (3.10)
3.	**Self-employment**	8500 (2.09)	9200 (2.39)	32800 (9.17)	16833 (4.40)
4.	**Other**	18000 (4.43)	81200 (21.13)	49600 (13.87)	49600 (12.96)
	Subtotal	73300 (18.03)	168400 (43.82)	194000 (54.27)	145233 (37.94)
	TOTAL (A+B)	**406655 (100.00)**	**386332 (100.00)**	**357504 (100.00)**	**382831 (100.00)**

Note: Figures in Parentheses indicate percentage to total income

Appendix.I Statistical comparison of socio-economic variables at various altitudes of district Pithoragarh thorough one-way ANOVA technique

S.No.	Variable	F_{cal}	Critical difference (CD)	difference between mean values of variable at high and	difference between mean values of variable at high and	difference between mean values of variable at mid and
1.	Age of farmer	9.255	5.627	4.866	12.100	7.234
2.	Education level of farmer	3.263	1.426	0.923	1.807	0.884
3.	Size of family	0.167^{NS}	-			
4.	Size of operational holding	9.745	0.468	0.511	1.029	0.518
5.	Area under potato	6.385	0.288	0.038	0.461	1.089
6.	Livestock population	3.177	10.416	10.133	12.233	2.100
7.	Investment on farm machinery	0.528^{NS}	-	-	-	-
8.	Income from farm enterprises	8.642	83970.363	117422.400	169850.500	52428.100
9.	Income from non-farm enterprises	4.535	85265.680	97100.000	120700.000	23600.000

Note: 1. Critical difference (CD) has been calculated with 5% level of significance.
2.When Absolute difference > CD, then there is significant difference between mean values of variable at two altitudes.

A perusal of the table reveals that major item of investment on potato growing farms was the farm buildings (storage structure and cattle shed) which, taken together, occupied about 90 percent of total farm investment across the altitudes.

The investment on farm machinery and equipment was very low (about 10 percent of total farm investment). The low level of investment in farm machinery and equipments is a reflection of prevalence of traditional tools and methods of cultivation on potato growing farms across the altitudes.

Source-wise income on potato growing farms in district Pithoragarh

A farm household earns income from various sources such as cultivation of crops, rearing livestock, non-farm enterprises (occupations), from wages and salaries, etc. The source-wise income on potato growing farms has been presented in table 8. It is clear from the table that the average income on potato growing farms in Pithoragarh was Rs.382831 per household which varied from Rs.406655 per household in case of high hills to Rs.357504 in case of low hills. Out of total income the major part of income (62 percent of household income) was earned from farm enterprises across all altitudes. Among farm enterprises, potato crop was the most important source of income with a contribution of 26.13 percent of total household income at aggregate level.

It is also evident from the table that the potato crop was a prominent enterprise across altitudes contributed about one-fourth or more to the household income. It is also observed from the table 9 that the

contribution of farm enterprises (81.97 percent of household income) in high hills was substantially higher than non-farm enterprises (18.03 percent of household income). Though, the contribution of farm enterprise (about 56 percent) to household income in mid-hills was higher than non-farm enterprises (about 44 percent), but the contribution of farm enterprise (about 46 percent) in low hills was less than non-farm enterprises (about 54 percent). Across altitude comparison of income indicates that contribution of farm enterprises in high hills was significantly higher than in mid and low hills (Appendix - I).

Hence, it can be concluded that the farmers in low hills had more diverse sources of income, while their counterparts at mid and high altitudes had less diverse sources of income.

The socio-economic characteristics of the farmers affect the organization and management of the farm as well as the production and disposal of produce. The socio-economic characteristics play a vital role in planning of agricultural development. The study of age wise-distribution of farmers suggests that most of the farmers in the high hills belonged to young or middle-age group hence they were expected to be more receptive towards adoption of new farm production technologies as compared with other altitudes. It was also revealed from the study that farmers in low hills were more educated as compared to that in mid and high hills. This calls for an emphasis on expansion of educational facilities in high hills, as an educated farmer is able to better understand the intricacies involved in adoption of new ideas and farm practices along with broader vision of decision making. And it was also revealed from the study that the farmers in low hills had more diverse sources of income this calls for creation of more avenues of income earning in mid and high hills.

References

Agriculture Statistics Data. 2016. Avaliable at http://agriculture.uk.gov.in/pages/show/221- agriculture-statistics-data (accessed on April 10, 2018)

Das, S. 2003. A multivariate analysis of dairy farming practices among rehabilitated and nomadic van Gujjars in Haridwar, Uttranchal (Ph.D. Thesis), NDRI Deemed University, Karnal, India.

Economic survey. 2020. Available at https://www.indiabudget.gov.in/economicsurvey/(accessed on December 3, 2020)

Kannan, M. 2002. Knowledge and attitude of dairy entrepreneurs about improved dairy farming practices in Nagapattinam district of Tamil Nadu (M.Sc. Thesis), NDRI Deemed University, Karnal, India.

Njuguna, I.S.; Munyua, C.N. and Makal, S.K. 2015. Influence of demographic characteristics on adoption of improved potato varieties by smallholder farmers in Mumberes Division, Baringo County, Kenya. *Journal of Agricultural Extension and Rural Development,* 7(4): 114-121.

Osteragova, E. and Ostertag, O. 2013. Methodology and Application of One-Way ANOVA. *American journal of mechanical engineering*, 1(7): 256-

261.

Roy, M. L., Chandra, N., Kharbikar, H. L., Joshi, P., and Jethi, R. 2013. Socio-Economic Status of Hill Farmers: An Exploration from Almora District in Uttarakhand. *International Journal of Agriculture Food Science and Technology*, 4(4), 353-358.

Smart Potato Portal. Available at http://14.139.61.83/website19/home.aspx (accessed on December 4, 2020)

Zaidi, N.H. and Munir, A. 2014. Factors Affecting the Adoption of Agricultural Technology in Bijnor District of Western Uttar Pradesh. *International Journal of Social Science*, 3(2): 205-216.