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DETERMINANTS AND INCOME GENERATION FROM IMPROVED VARIETIES IN LOWER SHIVALIK RANGE OF UTTARAKHAND, INDIA

Pinaki Roy[1,2*], B.S. Hansra[3] and R. Roy Burman[4]

[1]Amity Institute of Organic Agriculture, Amity University, Noida (U.P)
[2]Krishi Anusandhan Bhawan-II, Indian Council of Agricultural Research, New Delhi - 110 012.
[3]Emeritus (Agriculture) Amity International Centre for Post - Harvest Technology & Cold Chain Management, Amity University, Uttar Pradesh, Noida - 201 313.
[4]Division of Agricultural extension, ICAR-Indian Agricultural Research Institute, New Delhi - 110 012.

Abstract

Majority of smallholder farmers rely on traditional technologies in lower Shivalik range of Uttarakhand and this has lowered the level of productivity. These farmers generally obtain very low crop yields because the local varieties used by farmers have low potential yield, unavailability of quality planting materials, little or no fertilizers are used, lack of knowledge about technical know-how. Keeping these points in view, three blocks from Haridwar district of Uttarakhand has been selected randomly to find out the factors for adoption of improved varieties. In the study, the result of quantile regression model revealed that operational land holding, extension contact, family type, house type and farm assets had significant influence on adoption. Improved wheat varieties were introduced which raised the average profit Rs.40000/- per ha of land, improved paddy varieties Pusa 1121, P5 and recorded estimated increased profit of Rs. 10,800/- per ha than the local variety (Sarbati). Thus, results showed a significant positive impact on productivity. This suggests that adoption of improved varieties significantly generate an improvement in farming and so far, household living standard. Hence, efforts should be intensified to ensure farmers have access to adequate quality improved seeds at the right time. All programs, strategies and policies that could lead to increase in improved adoption should be intensified in order to achieve the much desired enhance production and generate an improvement in rural farming households' welfare in Lower Shivalik range of Uttarakhand.

Key words: Improved Varieties, enhancing farmer's income

Introduction

Agriculture sector has been recognized as a key fundamental for spurring growth, overcoming poverty, and enhancing food security (Diagne *et al.,* 2009). One of the overarching goals of Indian agriculture development programs and policies is increasing agricultural productivity for accelerated economic growth. Particularly, majority of the population (70%) depend on agriculture for survival. Thus, agricultural sector has been recognized as a key fundamental for spurring growth, overcoming poverty, and enhancing food security. Productivity increase in agriculture can reduce poverty by increasing farmers' income, reducing food prices and thereby enhancing increments in consumption (Diagne *et al.,* 2009). Consistent with this argument, the Department for International Development (2003) estimated that a 1% increase in agricultural productivity reduces the percentage of poor people living on less than 1 dollar a day by between 0.6 and 2%, and no any other economic activity generates the same benefit for the poor. It is also of considerable significance that when agricultural production increases through the use of improved varieties of crops in a given area, farmers and their communities derive added socio-economic benefit. Such activities can increase the value of locally produced crops, generate local employment, stimulate local cash flow, and through processing, marketing, and related activities can bring about improvement in socio-economic status and the quality of life.

With increasing population and enhancement of income pressure on land and other resources around the world, agricultural productivity plays an important role in improving food supplies and food security. Improper use

***Author for correspondence :** E-mail : roypinaki51@gmail.com

of inorganic fertilizers, non-availability of adequate seed and planting materials as well as the selection of crops and cropping pattern which is not appropriate to the land is also resulting in degradation of soil and water resources substantially. Uttarakhand is primarily an agricultural state although its share in the country's total area and production is negligible. The contribution of agriculture to the state's domestic product is about 22.4 percent and 75-85 percent people of the state are dependent on agriculture for their livelihood (Roy *et al.*, 2016). The state possesses diverse agro-climatic endowments, the plains and hills present differing scenarios for agriculture while commercial agriculture is practiced in the plains.

Instead of adequate natural resources for successful crop growth like fertile soil, 87 percent irrigation water, the productivity was found not to reach a competitive level for various crops as compared to other parts of the lower Shivalik Hills (*i.e.*, Jammu region of J&K and Malwa region of Punjab) because of unavailability of improved planting materials (seed), poor access to modern technologies, poor productivity level leading to abysmally low marketable surplus in plains (Roy *et al.*, 2016). As a source of livelihood, agriculture remains the largest sector of Indian economy. Its output share fell from 28.3% in 1993-94 to 14.4% in 2011-12 and employment share declined from 64.8% to 48.9% over the same period (NITI Aayog, GOI, 2015). Given the low share of this workforce on average, it earns much lower income poorer than its counterpart in industry and services. So, this paper attempts to explore the possibilities to find out the factor which determine the adoption of improved varieties to upgrade the existing subsistence level of agriculture to competitive agriculture with the prevailing natural resources in Uttarakhand State and probing a suitable strategy for enhancing farm income of the region.

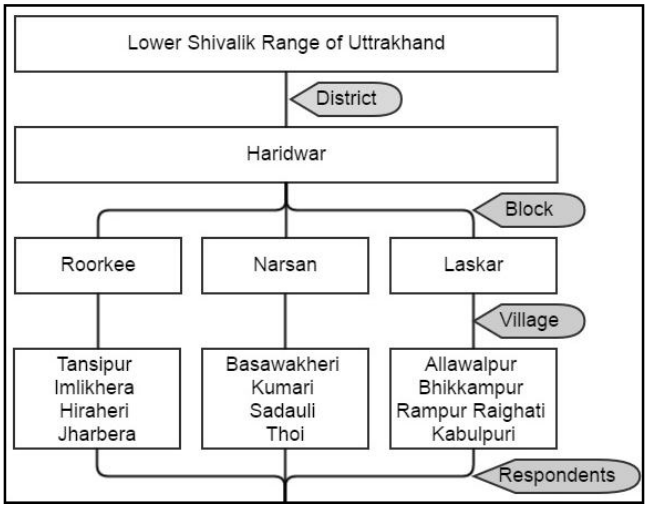

Fig. 1: Details of sampling procedure

Materials and Methods

The study was conducted in Roorkee, Laksar and Narsan blocks of Haridwar district of Uttarakhand. A total of sample of 360 farmers were taken randomly from the four villages of each block. Detail of sampling plan has been given below:

The data was obtained from structured interview schedule as well as focus group discussion. The raw data was subjected to analysis with the descriptive statistical tools (frequency, percentage) as well as with the help of econometric model. Quantile regression model has been adopted to find out the determinants of adoption.

Uniqueness of using this model is that instead of estimating the model with average effects using OLS linear model, it produces different effects along the distribution (quantile) of the dependent variable. The dependent variable is continuous with no zero or too many repeated values. This model estimates inter-quantile range regressions. One of the major contributions of this model is that it provides a categorization of different degree of adoption. The QR helped characterize the effects of age, operational land holding, and other explanatory variables on the entire distribution of adoption. In other words, the QR allows for examination of whether the effect of the explanatory variables is uniform across all degrees of adoption.

Results and Discussion

The Table 1 illustrates the results from the QR estimation for each quantile. The regression provides a more complete picture of how factors influence adoption level at different degrees. An additional advantage of

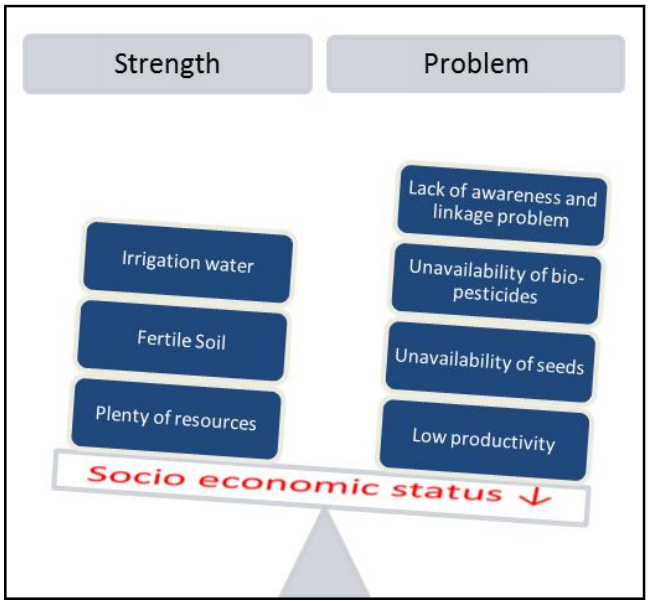

Fig. 2: Situational Analysis

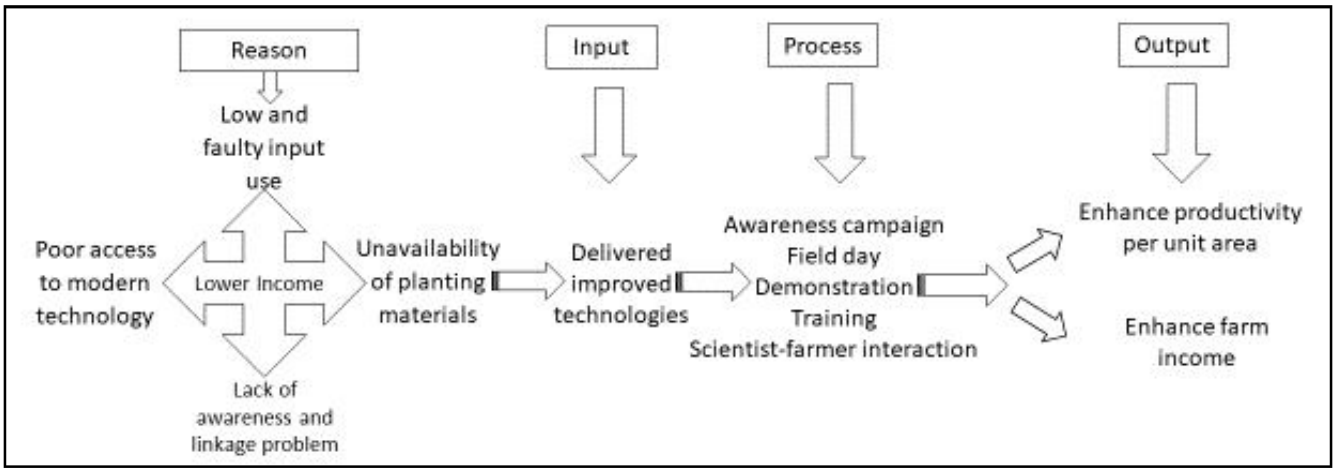

Fig. 3: Conceptual framework for Adoption of improved varieties.

using QR is the categorization of an operation's adoption degree by the number of crop varieties grown and estimated the effect of the explanatory variables over each quantile. The Pseudo R^2 is a measure of how well variables of the model can explain some phenomenon. More variability explains the model better. This model explains about 50% effect of independent variable in adoption level of farm community. Table 1 shows that extension contact (X5), rented house (X16) and farm assets (X18) possess significant positive factor leads lower adoption. The positive value of coefficient of extension contact (0.047) indicated that increase in the extension contacts among farmers can significantly enhance the adoption level. Similarly, positive values of

Table 1: Determinants of Adoption of Improved Varieties using Quartile Model.

Number of observation **Pseudo R square**	**360** **0.436** **1st quartile** **(25 percentile)**		**360** **0.407** **2nd quartile** **(Median)**		**360** **0.281** **3rd quartile** **(75 percentile)**	
Variables	**Coefficient**	**P>t**	**Coefficient**	**P>t**	**Coefficient**	**P>t**
Operational land holding (acre) (X1)	0.079(2.770)	0.006	0.121(3.890)	0.000	0.200 (5.070)	0.000
Age (years) (X2)	-0.005(-0.990)	0.324	-0.003(-0.560)	0.576	-0.004 (-0.560)	0.576
Education (ordinally measured)(X3)	0.042(0.860)	0.392	0.000(-0.010)	0.993	0.064 (1.060)	0.291
Family type (if joint=1, 0 otherwise) (X4)	0.172(1.530)	0.127	0.328(2.440)	0.015	0.591 (3.620)	0.000
Extension contact (ordinally measured) (X5)	0.047(2.820)	0.005	0.041(2.220)	0.027	0.035 (1.420)	0.155
Extension activity (ordinally measured) (X6)	0.010(0.410)	0.684	-0.031(-1.010)	0.316	-0.035 (-0.940)	0.346
Availability of information (ordinally measured) (X7)	0.003(0.060)	0.956	0.008(0.140)	0.886	0.031 (0.520)	0.606
Marital status (if single=1, 0 otherwise) (X8)	-0.246(-2.050)	0.041	-0.240(-1.700)	0.091	-0.201 (-1.150)	0.250
Mass media exposure (ordinally measured) (X9)	0.038(1.240)	0.216	0.050(1.520)	0.129	0.089 (2.370)	0.018
Frequency of use (ordinally measured) (X10)	0.003(0.180)	0.858	0.019(1.060)	0.291	0.008 (0.380)	0.702
Risk orientation (ordinally measured) (X11)	0.004(0.410)	0.680	-0.001(-0.050)	0.960	0.011 (0.670)	0.504
Innovativeness (ordinally measured) (X12)	0.017(1.830)	0.068	0.024(2.400)	0.017	0.018 (1.520)	0.130
Distance from input market (kms) (X13)	0.020(0.370)	0.710	-0.087(-1.240)	0.217	-0.216 (-2.610)	0.009
Distance from output market (kms) (X14)	-0.037(-0.590)	0.554	0.091(1.130)	0.261	0.227 (2.430)	0.016
Experience in farming (years) (X15)	-0.002(-0.410)	0.684	-0.002(-0.380)	0.705	0.000(-0.080)	0.935
House type (kuchha house= Base)	-	-	-	-	-	-
Rented (X16)	0.612(3.760)	0.000	0.269(1.510)	0.133	-0.233(-1.100)	0.271
Pucca house(X17)	0.547 (1.720)	0.086	0.039(0.110)	0.910	-0.402(-1.190)	0.235
Farm asset (in nos.) (X18)	0.385(5.800)	0.000	0.276(3.830)	0.000	0.254(2.940)	0.004
Livestock numbers (X19)	0.135(1.700)	0.090	0.081(0.680)	0.496	0.088 (0.820)	0.413
Possession of vehicle (if yes=1, 0 otherwise) (X20)	-0.156(-2.240)	0.026	-0.053(-0.440)	0.662	-0.090(-0.860)	0.390
Constant	-0.873(-1.230)	0.219	0.019(0.020)	0.982	-0.544(-0.500)	0.619

*Value in parenthesis indicate t-value

coefficients of rented house (0.612) and farm assets (0.385) implied that these coefficients have influenced the adoption positively. The operational land holding and farm assets have positive influence on medium and high adoption level. Positive coefficients of operational land holding (0.12 and 0.20) in both cases lead to more adoption compared to the first quartile. This indicates that adoption level increases with operational holding size and farm assets. Low level of extension contact causes lack of awareness about improved varieties of crops. Thus, they go for traditional varieties which results in lower production and low income. Majority of farmers depends on solely agriculture for their livelihood security. They had lower income from farm sector force them to live in rented house. Henceforth, they were not able to purchase all necessary farm assets which consequently leads lower adoption. Those farmers, who had more operational land, take more risk for adoption of improved varieties leads to higher production. When improved varieties has been grown it enhance yield as well as income helped them purchasing farm assets for crop production. Besides, family type (joint family) has also played a positive driving role for higher adoption which is justified with the positive coefficients value (0.591) of family type indicated that farmers belonged to joint family had higher adoption level. The family members engaged themselves directly in the farming activities. Moreover, economic constraints and lack of opportunities were much pronounced and therefore they can't opt for higher education which compels the younger members of the family to join hands with their elders in farm activities. As family members were involved in farming activities, farmers get leisure time to attain different agricultural programme. As a consequence, the awareness level of those farmers had been enhanced which helps in higher level of adoption of technologies.

Focusing on the stated problems improved HYV has been demonstrated at the farmers' fields to assess the benefit in economic terms which help them for the adoption and multiplication of improved technologies for future use. In Rabi 2015, improved HYV of wheat like HD-2967 and HD-3086 has been introduced and was compared with the existing wheat varieties (PBW-226, PBW-292). Similarly, In Kharif 2016, improved paddy varieties (P-1121 and PS-5) was compared with local variety (Sarbati) in economic terms. Simultaneously summer vegetable Bottle gourd (Pusa Naveen) has been introduced and compared with local ones. Mustard variety (PM-30) was compared with local variety and yield gap has been recorded. Table 1 clearly revealed that introduction of improved paddy varieties Pusa 1121, P5 and Pusa -1612 recorded average yield 50.13 qt/ha compared to local check (Sharbati) 45.60 qt/ha with 9.93 percent increased yield and estimated increased profit of Rs. 10,800/- per ha. Similarly, wheat varieties (HD-2967) and (HD-3086) recorded yield of 52 q/ha and 45 q/ha, respectively with an increase yield of 14 and 2 percent than the local check (PBW-226, PBW- 292) with an estimated profit of Rs. 40,000/- per hectare.

In Rabi 2016, mustard variety (Pusa Mustard 30) was preferred by the farmers with net profit of Rs.17121.25, Rs. 3887.50 and Rs 9193.75 in Roorkee, Laksar and Narsan block, respectively. IARI bottle gourd variety (Pusa Naveen) was introduced which is not only high yielding but also high calorie vegetable, providing 14 calories per 100 gm. Additionally, it is also a moderate source of Vitamin-C (100 g of raw fruit provides 10 mg or about 17% of RDA); a moderate source of thiamin, niacin (Vitamin B-3), pantothenic acid (Vitamin B-5), pyridoxine (Vitamin B-6) and minerals viz., calcium, iron, zinc, potassium, manganese and magnesium (Roy *et al.*, 2017). Moreover, introduction of Pusa Naveen showed economic benefit more than Rs. 48,000/- per hectare of land indicating higher net return compared to local varieties being grown by the farmers of the region. It was explored during the interview with targeted group of respondents that multi-dimensional constraints like non-availability of quality seed of recommended varieties, non-availability of reliable and recommended bio-pesticides, bio-fertilizers and bio-control agents, insufficiency of rural

Table 2: Comparative yield performance of improved varieties with the local ones.

Crop	Improved Variety	Yield (ha)	Local Variety	Yield (ha)	Proportionate change in yield (in percentage)	Profit (Rs)
Paddy	Pusa-1121	48.6	Sarbati	45.6	6.57	10,800
	Pusa-1612	52.3			14.69	
	Pusa-2511	49.5			8.55	
Wheat	HD 2967	52.09	PBW 292	45.72	13.93	40,000
	HD 3086	45.05	PBW 226	44.14	2.06	
Mustard	Pusa Mustard 30	37.5	Desi	30.0	25.0	10,067.5
Bottle gourd	Pusa Naveen	108.5	Desi	62.0	74.19	48,789

infrastructure, marketing of agricultural produce and infestation of wild animals have significant influence on the present state of agriculture. All these lead to poor socio-economic status of the farming people. It was observed that important aspects of agriculture in lower Shivalik region of Haridwar that need immediate attention to bring economic advantages to farm families was to enhance the output per hectare, which is a common measure of agricultural productivity. It was inferred that low and faulty input uses, poor access to modern technology and no real technological breakthrough was the reason thereof (Roy *et al.*, 2017).

Conclusion

In the study, the result of quantile regression model revealed that operational land holding, extension contact, family type, house type and farm assets are determinants of adoption of improved variety. The analysis on the revenue of the respondents' shows that introduction of improved varieties generated more profit than the local varieties available on that location. This result shows that the B:C ratio of improved varieties are double as compared to local varieties which shows a positive impact in increasing productivity and farm income of the farming community. Hence, in the long run productivity enhancement requires research towards discovery of robust seed varieties and other inputs, appropriate crops, input usage for a given soil type and effective extension practices which need to follow up to taking advantage of these potential would require institutional support and investment in technological innovations so as to accelerate agricultural growth and bring remunerative prices to farmers. Henceforth, it is necessary to motivate the farmers and building their capacity through organizing campaigns and method demonstration on location specific technological intervention. Extension professionals should develop innovative ways of mobilizing communities by carry out effective monitoring and intervention of their programmes for measuring social change and formulate the strategies to lead the farmers towards secured livelihoods. At the same time, it is imperative to mobilize and to educate the farming community about the existing policy and facilities as extended by the Govt. So, formulation strategies in order to development and strengthening of farmers' organizations through various extension strategies such as demonstration, field days, exposure visits and integrate with other organizations working at villages to achieve higher and sustainable agricultural productivity is necessary. Besides, arrangement of linking these activities with marketing facilities in the particular area should assume much more priority.

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