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Impact of socio- economic factors on the productivity of wheat growers of Samba district of J&K state of India

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Abstract
Many researchers have delineated the factors impacting productivity of crops but few have worked on the impact of socio- economic variables on the productivity. A study to find out the social, economic and biophysical variables impacting wheat productivity in Samba district of Jammu and Kashmir state was conducted. Multistage random and systematic sampling technique was adopted for selecting two blocks (one irrigated and one rainfed), 12 villages and 120 farmers. There was a significant difference in biophysical variables namely farm size, fragmented land holdings and irrigated land holding between the farmers of rainfed and irrigated belts. The area under wheat and its productivity was higher in the irrigated areas with a difference of 38 percent and 48 percent respectively. The socio- economic variables had no affect on the productivity of wheat but biophysical variables significantly impacted the wheat productivity. The economic variable namely farm households not having off- farm economic activity; biophysical variable namely irrigation facility had significantly caused a variation of more than 46 percent in the productivity of wheat crop. For enhancing the farm productivity and to increase their farm income, irrigation facilities need to be created.

Keywords: Productivity, biophysical, Rainfed, irrigated, land holding

Introduction
Agriculture accounts for over 29 percent of active labour force and 3.79 percent of GDP at global level (World Bank, 2015). There are so many crops that are cultivated all over the world for the benefit of mankind. Wheat is one amongst them and has contributed immensely to global food security. It is a cereal grain which is a worldwide staple food**.** There are many species of wheat which together makes up the genus *Triticum*; and the most widely grown is common wheat (*T. aestivum*). It is the leading cereal crop in world among the food grains. At global level it ranks first in terms of production (749 million tonnes) (2015-16). In India the production level of wheat had a quantum jump from 6.46 million tonnes from an area of 9.75 million ha in 1950-51 to more than 93 million tonnes from an area of about 30 million hectares during 2015-16. (DES, 2016) [1]

Wheat can be grown in both rainfed and irrigated conditions in different agro-climatic zones and in varied soil conditions. In the state of Jammu and Kashmir (J&K), 58 percent of the area under agriculture is rainfed and remaining 42 percent is irrigated. Wheat crop is cultivated in an area of 292380 ha out of which only 83655 ha area under wheat crop is irrigated. The productivity of wheat is 20.55q/ha in the state, compared to 31.46q/ha on national average during 2013-14. (DES, 2016) [1]

The productivity of wheat depends upon so many input factors like manure, fertilizer, irrigation availability and seed quality and also on improved package of practices. Inspite of all these reasons socio-economic condition of the farmers is also one of the factors that affect the productivity of farms sector as Koirala (2014) [4] found that land ownership, irrigation and education play important role in rice productivity. Masunga, 2014, [5] also reported that there was significant relationship between socioeconomic factors such as age, marital status, labour availability, farm size, source of income, household size, the level of education, and farming experience with tomato productivity. Keeping in view the above, this study was conducted to find out the impact of socio-economic and biophysical factors on the productivity of wheat in Samba district of J&K state, India. The null hypothesis framed was that the socio – economic characteristics of the farmers do not affect the output of wheat in the study area.

Methodology

About the Study Area

Samba district is situated between 32º 34' 0"N latitude and 75º 7'0" E longitudes. The district has an area of 245,016 km^2 and a population of 318,611 (2011 census). At 384 meters above sea level, Samba town is situated on the foothills of Shivalik Hills alongside the national highway on the bank of river Basantar. About two third of the area of district Samba is rainfed. The area on the southern side down the national highway is irrigated through ravi Tawi irrigation canal network and contributes towards cereal crop production and vegetable cultivation. The climate of the district, being located in the sub-tropical zone, is hot and dry in summer and cold in winter. Due to its existence in the foothills of the Shivaliks nights are bit cooler than that of neighbouring areas of Punjab state of India. The temperature ranges between 6 degree Celsius and 47 degree Celsius.

Sampling plan

Multistage sampling method was used for the selection of blocks, villages and respondents. There are four rural development units (blocks) in Samba district namely Purmandal, Vijaypur, Samba and Ghagwal. Out of these four blocks, two blocks namely Purmandal and Vijaypur were selected by using random sample without replacement method of sampling. The selected blocks have variation in their topography. Purmandal block is rainfed whereas Vijaypur block comes under irrigated belt. Thus, the study by virtue of this variation also throws light on comparison of unirrigated and irrigated blocks of Samba district. The list of villages which fall under Purmandal and Vijaypur block was downloaded from the official website of Samba district. There are 32 villages in Purmandal block and 123 villages in Vijaypur block. Out of these, six villages from each block were selected by the following systematic method of sampling. Thus in all, twelve villages were selected for present investigation. A comprehensive list of all the wheat growers of each selected village was prepared with the help of elected members of Panchayat (Sarpanch) and Namberdars (revenue officer) of selected villages. The criteria for preparing the list of wheat growers was that he/she should have grown wheat in a minimum 0.2 hectare of land during the last year. From the list prepared, ten wheat growers were selected as respondents by using random sampling without replacement A total of 120 wheat growers were selected as respondents to collect data for the present study.

Data collection

Interview schedule was developed for data collection after consulting the experts. The interview was conducted in local dialect i.e., Dogri. The respondents were interviewed at their home, or their farms and responses were recorded on the spot. Besides audio recording of all the interviews of the individual respondent was done and is saved for further references.

Statistical analysis

The data collected from the respondents were scored, tabulated and analysed by using both parametric and non-parametric statistical tests. Computer based SPSS (Statistical Package for Social Sciences) was used for applying different statistical tests.

In order to find out the relationship between dependent variable and independent variables, Karl Pearson correlation coefficient was calculated. Table 1

Table 1: Variables selected and their measurement

Variable	Code	Measurement
Dependent variable		
Wheat yield	Y_1	quintals per hectare
Independent variables		
Age	X_1	Chronological age of the respondent.
Education	X_2	number of years of formal schooling
Experience	X_3	number of years of experience in farming
Main occupation	X_4	1 for agriculture0 for others
Owned land	X_5	area in hectares
Irrigation facility	X_6	1 for yes0 for no
Number of fragments of land	X_7	in number
Farm mechanization	X_8	number of farm machine/ equipment
Telephone connectivity	X_9	1 for yes 0 for no
Family annual income	X_{10}	in rupees
Agriculture as a sole source of income	X_{11}	1 for yes 0 for no
Family size	X_{12}	number of members in the family

Results and Discussion

Socio- economic characteristics of wheat growers

The mean age of the respondents was 57 years. Majority of the farmers fell under middle age group. The probable reason for majority of respondents to be in middle age might be that the criteria of selection of the respondent was the head of the family, it is quite normal that the head of the family usually are of higher age, thus leading to these results. Table 2

Table 2: Descriptive statistics regarding socio-economic status of the farmer

Parameter	Rainfed (n=60)	Irrigated (n=60)	difference	Statistic (*p*-value)	Overall (n=120)
Mean age (years)	56.47± 13.25	57.62 ± 14.99	2	t= 0.44 (0.657)	57 ± 14.09
Young (18 to 45 years) (%farmers)	22	25	3	z= 0.50 (0.617)	21
Middle age (45-61 years)	48	48	0	--	41
Old age (61-87 years)	30	27	3	z= 0.47 (0.64)	38
Mean education (Formal number of schooling years completed)	6.23 ± 4.84	7 ± 4.12	1	t= 1.08(0.279)	6.7 ± 4.54
Education level (%farmers)					
Illiterate	32	20	12	z= 1.93 (0.05)	26
Below primary	1	2	1	z= 0.58 (0.56)	2
Primary	8	15	7	z= 1.55 (0.12)	12
Middle	21	30	9	z= 1.46 (0.14)	26
Matriculate	25	25	0	--	25
10+2	7	3	4	z=1.29 (0.19)	5
Graduate and above	6	5	1	z= 0.31 (0.75)	5
Average farming experience (years)	37.32 ± 16.16	34.27 ± 16.79	9	t= 1.01(0.313)	35.79 ± 16.48
Type of family(% households)					
Joint	45	48	3	z= 0.42 (0.66)	47

Nuclear	55	52	3	z= 0.42 (0.66)	53
Average family size (No.)	6.93 ± 3.17	6.08±3.11	14	t= 1.48(0.141)	6.51±3.15
Family Size (%farmers)					
2 to 6 members	50	72	22	z= 3.18(0.001)	61
6-11 members	38	26	12	z= 1.81 (0.06)	32
11 to 25 members	12	2	10	z= 2.77(0.001)	7
Average distance of village from (km)					
Nearest market	5.27±2.138	3.83±1.355	38	t= 4.39(0.001)	4.55±1.922
Pesticide retailer	5.27±2.138	3.33±1.714	58	t= 5.47(0.001)	4.3±2.16
Fertilizer retailer	5.27±2.138	3.33±1.714	58	t= 5.47(0.001)	4.3±2.16
Department of Agriculture	5.22±2.179	4.65±1.503	12	t= 1.61(0.110)	4.94±1.884
Agricultural University	21.5±15.651	39.17±1.879	82	t= 8.86(0.001)	30.33±14.209
Telephone connectivity (%farmers)	90	75	15	z= 2.79(0.001)	83
Mobile phone only	96	73	23	z= 4.49(0.001)	86
Landline only	4	9	5	z= 1.43 (0.15)	6
Mobile phone + Landline	0	18	18	z= 4.44(0.001)	8
Smart phone/android	2	3	1	z= 0.45 (0.65)	3
Social participation	7	12	5	z= 1.2 (0.22)	9
Average annual family income (in Rs)	262133.3±277274.6	161583.3±158168	62	t= 2.44 (0.02)	211858.3±230368
Agriculture	3616±10856	46283±91644		t= 3.58(0.001)	24950±68420
Other	272122±276802	117254±128893		t= 3.84(0.001)	193353±2274544

The results revealed that the mean education of the respondents was 6.7 years i.e. studied up to 7th class standard and more than one-fourth of respondents were educated up to middle and same were up to high school, followed by primary and below primary school education. The education up to higher secondary and graduates was low and about one-fourth of the respondents were illiterate. The probable reason for majority of respondents to be illiterate might be the illiteracy of their parents, non-realization of importance of formal education, lack of proper educational facility. Majority of the illiterate respondents were from middle age and old age category and have low annual income.

The average experience of the respondent in farming and cultivation of wheat crop was 36 years. The reasons may be that respondents were having agricultural back ground and living in villages. In a farm family, the children help their parents in farm activities right from childhood and gradually practices it on regular basis. As majority of the respondents were of middle age group hence they have more farming experience.

In India there has been mobile revolution in the last one and half decades. In the study area also mobile connectivity was 83 percent. More farmers possessing mobile phone as compared to landlines could be due to the attributes of handiness apart from mobility is a major factor that respondents possessed mobile/ cell phone than landline tele-phone connection.

Despite the farmers of the irrigated belt having higher operational land holding yet their per annum income was less than farmers of rainfed belt. Surprising finding was that the farm household income in the rainfed area was higher (Rs 262133/household/annum) compared with the farm households in the irrigated belt (Rs 161583/household/annum), a difference of 62 percent. (Table 2). The reason being that the farm households in the rainfed areas were having more off- farm economic activities namely government employ, private job and labour compared to farm households of irrigated belt. More than 50 percent of the farm households in the irrigated belt had agriculture as their main source of occupation compared to only 18 percent in the rainfed belt. The households solely dependent on on-farm income was higher in the irrigated belt (33%) compared to rainfed areas (8%). (Table 4). The share of Government employment was also higher in the rainfed belt.

Land holding

Table 3: Distribution of wheat growers on the basis of their farm size

Parameter	Rainfed (n=60)	Irrigated (n=60)	diff	Statistic	Total (n=120)
Average operation farm size (ha)	1.22±1.21	2.25±3.04	84	t=2.7 (0.009)**	1.74±2.36
Owned	1.22±1.21	1.31±0.88	9	t=0.49 (0.648)	1.27±1.05
Leased in	0	0.96±2.83	100	t= 2.64 (0.01)**	0.48±2.05
Leased out	0	0.02±0.15	100	t=1 (0.321)	0.01±0.11
Farmers with fragmented land holding (farmers)	77	57	20	z= 2.32 (0.02)**	67
Mean fragments (No.)	3.85±2.06	4.91±3.49	27	t= 1.68 (0.98)	4.3±2.8
Mean smallest land fragment (ha)	0.27±0.47	0.27±0.34	0	t= 0.52 (0.96)	0.27±0.41
Mean largest land fragment (ha)	0.64±0.79	0.77±0.76	10	t= 0.73 (0.46)	0.69±0.78
Average irrigated area (ha)	0.05±0.22	2.02±3.07	96	t= 4.95 (0.001)**	1.03±2.38
Average un-irrigated area (ha)	1.17±1.22	0.25±0.55	64	t= 5.33 (0.001)**	0.71±1.05
Irrigation availability (%farmers)	5	95	90	z= 9.86 (0.001)**	50
Shallow pump only	5	91	86	z= 8.97 (0.001)**	92
Canal only	0	5	5	z= 1.75 (0.08)	5
Canal + Shallow pump	0	4	4	z= 1.43 (0.15)	3
Categorization of operational farm size (% farmers)[1]					
Marginal (<1ha)	60	38	22	z= 2.37 (0.01)**	49
i) Small (1-2ha)	17	27	10	z= 1.32 (0.18)	22
ii) Semi medium (2-4ha)	18	22	4	z= 0.45 (0.64)	20
iii) Medium (4-10ha)	5	8	3	z= 0.73 (0.46)	7
Large (>10ha)	0	5	5	z= 1.75 (0.08)	2

[1]Categorization of the farm size as per MOA (2011)

The farmers in irrigated belt were having on an average higher land holding (2.25 ha) compared to rainfed farmers (1.22 ha) and the difference was significant. The difference in and holding was predominately driven by the farmers in irrigated belt on an average leased in 0.96 ha. None of the farmers in rainfed belt had either leased-in or leased-out land. The fragmentation of land holding was more in the rainfed agricultural area. It could be attributed to the fact that inheritance system of the land holding leads to its distribution amongst the children. It gets aggravated in the absence of land consolidation policy of the state. It all leads to fragmentation of land holding. The findings are in conformity with Gebeyehu (1995) [3]. There were large percentages (60%) of marginal farmers having landholding less than one hectare compared to 45 percent in irrigated belt and the difference was significant. There was no significance difference between irrigated and rainfed farm households with respect to small, semi-medium and medium categories of land holding. (table3) The reasons for higher operational land holding in irrigated block than rainfed block might be due to the fact that practising agriculture in irrigated areas is more remunerative then in rainfed areas. The same was also reported by the respondents. This might serve as a reason for the farmer of irrigated areas to lease-in the land for growing wheat.

The results revealed that 50 percent of the respondents were having an assured source of irrigation. In Vijaypur block 95 percent of the respondents had irrigation facility whereas in Purmandal block only five percent of the respondents had irrigation facility. The reason behind the findings was that Purmandal block was rainfed and people depends on rainfall for irrigation of their crops, whereas in Vijaypur block majority of the people have their own bore well as a source for irrigation and also have access to canal water. The above finding got support from the studies of Ekwa and Onuka (2006) [2].

Work force

The results in table 3. showed that in case of rainfed block only 18 percent of the respondents had agriculture as their main occupation whereas in irrigated block, 52 percent of the respondents had agriculture as their main occupation. The data revealed that 25 percent of respondent were solely dependent on agriculture and have no other source of income for livelihood and the remaining have at least one other source of income apart from agriculture. The non-profitable nature of agriculture in rainfed areas like Purmandal block force people to go for other livelihood generating avenues and it is clearly shown by the results found in the present study. Moreover there is a significance difference of agriculture as main occupation with respect to rainfed and irrigated blocks of Samba district. The findings are in line with Nagesh (2006) [6].

Table 4: Workforce status of wheat growers

Parameter	Rainfed (n=60)	Irrigated (n=60)	Diff	Statistic (*p*- value)	Total (n=120)
Work Force (No.)	265	237	6		502
Families having agriculture as main occupation (%)	18	52	34	z= 3.83(0.001)	55
Households solely dependent on farming (%)	8	33	35	z= 3.37(0.001)	21
Households having off-farm sources of income (%)	92	67	25	z= 3.37(0.001)	79
Agriculture + Govt. employee (%)	17	8	9	z= 1.38(0.167)	12
Agriculture + Retd. from govt. service (%)	3	10	7	z= 1.46(0.144)	7
Agriculture + Retd. from govt. Service + Govt. employe (%)	7	10	3	z= 0.66(0.509)	8
Agriculture + Labour (%)	22	20	2	z= 0.22(0.825)	21
Agriculture + Private employee (%)	12	8	4	z= 0.61 (0.542)	10
Agriculture + Govt. employee + Private job (%)	5	2	3	z= 1.02 (0.3.7)	3
Agriculture + Shop (%)	3	2	1	z= 0.58 (0.562)	3
Agriculture + Retd. from govt. service + Labour (%)	8	2	6	z= 1.67 (0.09)	5
Any other (%)	15	5	10	z= 1.46 (0.14)	10

Field Crop Cultivation

Table 5: Distribution of wheat growers on the basis of their field crops cultivation

Parameter	Rainfed (n=60)	Irrigated (n=60)	Diff	Statistic (*p*- value)	Total (n= 120)
Average area under wheat crop (ha)	0.85±0.62	1.9±2.59	123	t=2.16(0.035)	1.38±1.94
Average productivity of wheat crop (q/ha)	10.26±9.93	29.26±14.32	185	t=8.79 (0.001)	19.76±15.54
Average area under basmati (ha)	0.55±0.07	1.44±2.27	162	t= 0.75 (0.457)	1.42±2.25
Average productivity of basmati (q/ha)	26.5±9.19	27.68±10.22	4	t= 0.61 (0.545)	27.64±10.12
Average area under sharbati (ha)	0.4±0.14	0.6±0.86	50	t= 0.19 (0.846)	0.63±0.84
Average productivity of sharbati (q/ha)	29±15.5	40.57±13.47	40	t= 9.44 (0.01)	39.99±13.59
Average area under maize crop (ha)	0.45±0.38	0	100	--	0.45±0.38
Average productivity of maize crop (q/ha)	9.41±8.78	0	100	--	9.41±8.78

The productivity of wheat crop in the irrigated area was 29.26q/ha and in the rainfed it was 10.26 q/ha a difference of more than 185% and the difference was significant (Table 5).

The trend analysis of the yield data showed that irrigation availability was the main driver of productivity. Besides, the difference in productivity in the irrigated and unirrigated wheat production, the farmers exclusively dependent on on-farm income had higher productivity in both the irrigated and unirrigated areas compared to farmers having off-farm economic activities (Table 6) and that was a major reason that socio-economic variables were included in the linear regression model to find out the drivers of wheat productivity.

Table 6: Level of productivity of wheat on the basis of occupation

	Occupation						Statistic (*p*- value)
	Only Agriculture			Agriculture + other			
	Rainfed (n=5)	Irrigated (n=20)	Total (n=25)	Rainfed (n=55)	Irrigated (n=40)	Total (n=95)	
Operational farm size (ha)	1.04±0.72	4±4.4	3.4±4.1	1.24±1.24	1.4±1.45	1.3±1.3	t= 2.528(0.018)
Average yield of wheat crop (q/ha)	14.5±15.65	33.75±14.45	29.89±16.36	9.54±9.11	26.58±13.91	16.72±14.09	t= 3.684(0.001)

Possession of farm inventory

Table 7: Distribution of respondents on the basis of possession of farm machinery

Machine/Equipment	Occupation		Total (n=120)
	Only Agriculture (n=25)	Agriculture + Others (n=95)	
Plough	8	3	4
Tractor	32	13	18
Leveller	16	1	4
Bullock cart	4	1	2
Irrigation pump set	0	1	1
Thresher	20	2	6
Seed cum fertilizer drill	4	1	2
Tillers	20	5	8
Sprayer pump	44	25	29
Tralli	8	6	7
Cultivator	20	6	9
Rotavator	12	2	4
Storage bin	96	97	97

It is evident from the data presented in table 7 that households having agriculture as a sole source of income had more farm machinery than the respondents who were having other sources of income besides agriculture because as we seen that their main source of income was agriculture and therefore to increase the farm productivity he possess every farm machinery in order to get maximum produce as their livelihood solely depends on agriculture.

Relationship Analysis

The correlation coefficient of the independent variables namely age X_1, education X_2, experience X_3, main occupation X_4, owned land X_5, irrigation facility X_6, number of fragments X_7, farm mechanization X_8, telephone connectivity X_9, family annual income X_{10}, agriculture sole source of income X_{11} and family size X_{12} with dependent variable (yield of wheat crop) was found out. The independent variables having significant correlation with the independent variable yield were entered in the regression model. Forward stepwise method was applied to find out the best predicators causing variation in the productivity of wheat.

Table 8: Coefficient of correlation between socio- economic variables and wheat yield

S. No.	Variable	Wheat yield (r- value)
1	Age	0.118 NS
2	Education	0.136 NS
3	Experience	0.031 NS
4	Main occupation	0.291**
5	Owned land	0.194*
6	Irrigation facility	0.668**
7	Number of fragments	-0.166 NS
8	Farm mechanization	0.268**
9	Telephone connectivity	-0.161 NS
10	Family annual income	-0.320 NS
11	Agriculture sole source of income	0.347**
12	Family size	-0.008 NS

**Significant variables at 0.01 level of probability*Significant variables at 0.05 level of probability
NS: Non significant variables

It is apparent from table 8 that most of the selected variables had non- significant relationship with wheat yield. Main occupation, owned land, irrigation facility, farm mechanization and solely dependent on agriculture were having positive and significant correlation with the wheat yield. It clearly indicates that improvement in positively significant variables were much helpful to increase the yield of wheat crop. Table 3

Table 9: Factors Affecting productivity of wheat crop

Coefficient					
	Model	ß	Std. Error	t	Sig.
1	(Constant)	9.164	1.494	6.135	0.001
	Irrigation facility	206.2	2.112	9.753	0.001
2	(Constant)	8.670	1.487	5.831	0.001
	Irrigation facility	19.118	2.185	8.751	0.001
	Exclusively dependent on Agriculture income	5.935	2.690	2.207	0.029

R^2= 0.446 & Adjusted R^2= 0.442
R^2= 0.468 & Adjusted R^2= 0.459

The independent variables having significant correlation with the dependent variable wheat productivity were entered in the regression model. Forward stepwise method was applied to find out the best predicators causing variation in the productivity of wheat.

Only two variables irrigation availability and farmers exclusively dependent on agriculture caused a variation of 45.9 percent in wheat productivity.

Adjusted R^2 values indicates that irrigation availability caused 44 percent variation in productivity of wheat crop, whereas both irrigation availability and farmers exclusively dependent on agriculture income caused 46 percent variation in the productivity of wheat crop.

Y_1= 8.670+ 19.118 (X_6) + 5.935 (X_{11})

Ordinary Least Square (OLS) equation indicates that one unit increase in variable irrigation facility (X_6) and farmers exclusively dependent on agriculture income (X_{11}) it will

increase the productivity of wheat crop by 19.118 and 5.935 units.

Conclusion

There are many crops that are popular and have contributed immensely to the sustenance of humanity. Wheat is one of them and it is cultivated for different purposes. The importance of wheat to humanity deserves that every effort should be made to identify all factors limiting its production, hence, the aim of the study is to determine socio- economic factors of wheat growers affecting the output of wheat. Data on socio-economic characteristics were collected from the wheat farmers and analyzed using regression analysis and descriptive statistics. It can be concluded that respondents having agriculture as their sole source of income had significantly more productivity of wheat crop and possess more farm inventory than the respondents having off-farm income besides agriculture. The regression analysis of the data reflects that socio- economic variables namely age, education, experience, main occupation, owned land holding, number of fragments of total land, farm mechanization, telephone connectivity, family annual income, and family size were not affecting the productivity, but availability of irrigation facility and farmers economic activity had a significant impact on the productivity of wheat.

Providing irrigation facility by taking appropriate measures is the main recommendation as it will enhance the yield as well as socio economic status. Practicing agriculture as a main source of income for sustaining livelihood can become be of greater profit as compared to keeping it as a side business. Further implies that it is important to provide proper information about agriculture to the farmers so as to make them competent with their work. In view of the findings, the paper recommended that the socio-economic characteristics that influenced the output of wheat should be considered in the formulation of policies and programmes that are related to improving the output of wheat in the study area.

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