



## Productivity analysis of wheat (*Triticum aestivum*) in irrigated sub-tropics of Jammu

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### ABSTRACT

Present study was carried out in Jammu district of Jammu and Kashmir with 180 randomly selected wheat growers from three different blocks (R.S. Pura, Suchetgarh and Bishnah) with the objective to analyze the productivity status of wheat (*Triticum aestivum* L.) crop in irrigated sub-tropics during 2020–21. There was large variation in productivity of wheat crop in different wheat growing regions of the state. Results of the study revealed that all the farmers sown their wheat crop by broadcasting method, 36% farmers replaced their wheat seed and same percentage of farmers adopted the practice of seed treatment. All the farmers applied DAP and urea as basal dose at sowing time and herbicide for controlling narrow and broad leaved weeds. Only 45% farmers applied first irrigation at the crown root initiation stage. Second dose of urea was applied by 100% farmers after first irrigation and 60% farmers applied third dose of urea in their wheat crop. Only 18% of sampled farmers sprayed fungicides. Overall average wheat crop productivity of respondent farmers in study area was 2.789 t/ha and R. S. Pura block had significant difference in productivity of wheat crop as compared to Bishnah (P=.039) and Suchetgarh (P=.010) block.

**Keywords:** Adoption, Cropping pattern, Inputs, Productivity, Sub-tropics, Wheat

Increasing wheat (*Triticum aestivum* L.) productivity is one of the main challenges currently faced by global agriculture, particularly considering the rate of reduction in wheat yield gains over the last 20 years (Vigani *et al.* 2015). During Indus valley civilization era the original species was *Triticum sphaerococcum* (Indian wheat), which has now disappeared and is being replaced by present day species- *Triticum aestivum* (common bread wheat), *Triticum durum* (macaroni wheat) and *Triticum dicoccum* (emmer wheat). Being the second most important staple food crop after rice, wheat consumption in rural India has increased apparently due to the availability of this nutritious cereal (Sendhil *et al.* 2012). The year 2019 remained a landmark in achieving the production of 102.19 million tonnes and productivity of 3.507 t/ha (Anonymous 2019). Although research efforts are going worldwide for developing new varieties and on other aspects of wheat crop for enhanced productivity, however, more efforts are needed to ensure food and nutritional security of the burgeoning population. With 8.52% of the global research output on wheat and an average of 14.68 citations per paper, India was at 3<sup>rd</sup> position

in the world during 1996–2015 and CSIR was the top most funding agency for wheat research (Siwach 2020). In Jammu district wheat is the main crop followed by maize, paddy, pulses and oilseeds. Collectively, the three crops, viz. Rice, wheat and maize account for 84% of the total cropped area (Dixit *et al.* 2014). In Jammu and Kashmir, wheat is grown on an area of 0.29 mha with production of 0.48 mt (Sendhil *et al.* 2019). Keeping in view the importance of wheat crop as one of major food grain, grown in Jammu and Kashmir the present study was carried out to analyze productivity of wheat crop in irrigated area of Jammu division.

### MATERIALS AND METHODS

In Jammu division, wheat is grown under both irrigated and rain-fed conditions and also there is a large variation in wheat productivity in both situations. However major contribution in wheat production comes from irrigated areas of Jammu, Samba and Kathua districts. Multistage random cum purposive sampling was applied for drawing out the final sample for the present study. The study was carried out in Jammu district purposively because of the maximum irrigated area under wheat crop. Three blocks of Jammu, viz. R. S. Pura, Suchetgarh and Bishnah were taken up for study and 4 villages from each block were selected randomly. Wheat growing 15 farmers from each village were selected randomly with the help of random number generator. Thus,

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a total of 180 farmers; 60 from each block were interviewed with the help of interview schedule containing open and close ended questions during 2020–2021. Interview schedule was pre-tested in non-sampled area to remove ambiguity if any in questionnaire. Collected primary data were analyzed with the help of SPSS software and secondary data for the present study was obtained from different government reports and online sources.

## RESULTS AND DISCUSSION

Socio-personal profile of the sampled farmers shows that overall average age of the interviewed farmers was 55.29 years; average number of schooling years completed was 8 years (Table 1). Literacy is the key factor which determines the education level of an individual. If an individual is able to read and write they have a higher chance of choosing an appropriate field of work or further skills training in order to advance their livelihoods (Khatun and Roy 2012). Average operational land holding of sampled farmers was 1.28 ha which was higher than the average land holding of Jammu and Kashmir which is 0.67 ha and majority of the farmers (78%) in the state are marginal having less than 1.0 ha land holding. Overall average family size was five members and average farming experience was 35 years. Social participation was very less as only 9% sampled farmers reported that had some sort of social participation and that too in village panchayats. Private input dealers were the main source of information regarding use of various inputs in wheat cultivation. It was interesting to note that none of the farm household was exclusively dependent upon agriculture income for their livelihood security. It indicates that farmers were in the stage of diversifying their households' source of income. A rural household with

diverse sources of income earning activities has better chances of survival financially than a household which has only one source (Mphande 2016). Data presented in Table 1 further shows the cropping pattern being followed by farmers in the study area. Paddy is the main crop grown in rainy (*kharif*) season whereas wheat is the major grain crop during winter (*rabi*) season. However, berseem, pea and oat crops were also grown in winter (*rabi*) season by the farmers. A total of 35% farmers reported that they had grown summer vegetables mainly of *cucurbitaceae* family in zaid season. Thus, paddy-wheat, paddy-berseem, paddy-wheat-vegetable were the main crop-rotations followed by the farmers in study area. Kaloo *et al.* (2015) defined the cropping pattern of a region as the proportion of area of land under different crops at a point of time, the rotation of crops and the area under double cropping. The cropping pattern changes with space and time. In fact, no cropping pattern can be good and ideal for all times to come. Cropping system is based on the climatic soil and the water availability has to be evolved for realizing the potential production levels through efficient use of available resources. The main aim of the cropping pattern is to provide enough food for the family, fodder for the cattle and generate sufficient cash income for domestic and cultivation expenses. The objective is possible only by adopting the intensive farming which include multiple cropping and intercropping. There are limits to increase production of different crops through expansion of cultivable land as with the growing population the total area is being getting shrink day by day, hence the only way out is to put more emphasis on increasing the productivity levels by adopting the modern technologies besides diversification towards high value crops.

Adoption of agricultural technologies differs from

Table 1 Descriptive statistics and cropping pattern followed by respondent farmers

Parameter	R. S. Pura (n=60)	Suchetgarh (n=60)	Bishnah (n=60)	Overall (n=180)	
Average age (years)	54.62 ( $\pm 10.18$ )	55.95 ( $\pm 12.66$ )	52.25 ( $\pm 14.59$ )	55.29 ( $\pm 11.46$ )	
Average schooling years (no. of years)	6.40 ( $\pm 3.96$ )	9.75 ( $\pm 3.73$ )	6.89 ( $\pm 4.33$ )	8.13 ( $\pm 4.15$ )	
Average operational land holding (ha)	0.97 ( $\pm 0.74$ )	1.57 ( $\pm 1.20$ )	0.95 ( $\pm 0.70$ )	1.28 ( $\pm 1.04$ )	
Average family size (no)	5.20 ( $\pm 1.30$ )	5.13 ( $\pm 1.36$ )	4.42 ( $\pm 1.35$ )	5.16 ( $\pm 1.25$ )	
Average farming experience (in years)	33.37 ( $\pm 10.26$ )	34.13 ( $\pm 13.51$ )	29.50 ( $\pm 13.57$ )	33.75 ( $\pm 11.95$ )	
Social participation	3 (5.00)	9 (15.00)	5 (8.00)	17 (9.00)	
Input dealers as the major source of information	45 (75.00)	40 (67.00)	48 (80.00)	133 (74.00)	
<i>Cropping pattern practiced by sampled farmers</i>					
<i>Kharif</i>	Paddy	60 (100)	60 (100)	60 (100)	180 (100)
<i>Rabi</i>	Wheat	60 (100)	60 (100)	60 (100)	180 (100)
	Berseem	40 (67)	48 (80)	42 (70)	130 (73)
	Oat	5 (8.33)	0	0	5 (4)
	Pea	10 (17)	5 (8)	16 (27)	31 (12)
<i>Zaid</i>	Summer vegetables	25 (42)	18 (30)	32 (53)	75 (42)

Table 2 Adoption of different cultivation practices of wheat crop (% farmers)

Particular	R.S. Pura (n=60)	Suchetgarh (n=60)	Bishnah (n=60)	Overall (n=180)
Seed replacement of wheat crop	22 (37%)	18 (30%)	24 (40%)	64 (36%)
Variety of wheat HD-2967	32 (53%)	28 (47%)	36 (60%)	96 (50%)
Green choice	08 (14%)	05 (8%)	02 (3.33%)	15 (8%)
Ankur	05 (8%)	10 (17%)	05 (8.33%)	20 (11%)
Non-descript	15 (25%)	17 (28%)	17 (28.33)	49 (27%)
Seed treatment	22 (37%)	18 (30%)	24 (40)	64 (36%)
Average seed rate (kg/ha)	110	118	106	112
Applied irrigation at CRI* stage	15 (25%)	22 (37%)	24 (40%)	61 (34%)
Number of farmers used urea	60 (100%)	60 (100%)	60 (100%)	180 (100%)
Average quantity of urea used (kg/ha)	110	120	130	115
Farmers used DAP	60 (100%)	60 (100%)	60 (100%)	180 (100%)
Average quantity of DAP used (kg/ha)	120	100	115	105
Farmers used potash	08 (13%)	12 (20%)	20 (33%)	40 (22%)
FYM used	24 (40%)	20 (33%)	25 (42%)	69 (38%)
Herbicide (post-emergence for narrow leaved weed)	60 (100%)	60 (100%)	60 (100%)	180 (100%)
Herbicide (post emergence for broad leaved weed)	60 (100%)	60 (100%)	60 (100%)	180 (100%)
Fungicide spray	3 (5%)	4 (7%)	4 (7%)	11 (18%)

CRI\*, Crown root initiation

farmer to farmer which refers to both mental acceptance and also covers the use of new agricultural technologies. Adoption is defined as the use of recommended agricultural technologies on continuing basis (Singh *et al.* 2012). Regarding adoption of various cultivation practices of wheat crop, data (Table 2) shows that only 36% farmers replaced seed for sowing their wheat crop in study year. Among different wheat varieties 96% farmers had adopted the cultivation of HD-2967 variety in all the three study blocks. Only 36% respondent farmers adopted the practice of seed treatment. Average seed rate used by the respondent farmers was 112 kg/ha which was slightly higher than the recommended 100 kg/ha. Overwhelmingly 100% respondent farmers used urea and DAP in wheat cultivation. However, average quantity of urea used was 115 kg/ha and in case of DAP it was 105 kg/ha. About 38% farmers reported that they applied FYM due to which they reduce the dosages of different chemical fertilizers. Only 34% farmers applied irrigation at the critical stage of crown root initiation (CRI). Production of wheat is largely affected by unavailability of irrigation water at critical stages of growth (Ahmed *et al.* 2012). Irrigation water input is the critical factor affecting the productivity of wheat crop (Songqing *et al.* 2012). All farmers used post-emergence herbicides for mainly controlling narrow leaf weed (*Phalaris minor*). It is highly competitive weed among grassy weeds and can cause drastic yield reduction (25–30%) under heavy infestation (Yadav and Malik 2005) and even less intensity (15 plants/m<sup>2</sup>) caused significant decrease in yield (14%) (Kaur *et al.* 2012). In wheat, 18% farmers reported spray of propicanazole fungicide for controlling yellow rust which is the major and fatal disease affecting the productivity to

a large extent. The present findings were also supported by study conducted by Gretchen *et al.* (2019). Adequate and timely information about different aspects of production and protection practices of wheat cultivation enhances the adoption rate of different production recommendations. In the era of information technology, social media can also help to a large extent in bridging the knowledge deficit gap of farming community regarding wheat cultivation. “Wheat Doctor” or “*Gehoon Doctor*” a handy mobile App has been developed by ICAR-IWBR, Karnal, Haryana in Hindi for information sharing to farming community. It provides information along with pictures mainly on wheat production and protection practices including IPM strategies and post-harvest storage management (Anonymous 2019).

The perusal of data (Table 3) shows that overall average productivity of wheat crop in study area was 2.789 t/ha which is much lower than the national average of 3.507 t/ha (Anonymous 2019). There were several constraints of low productivity of wheat out of which poor extension of improved agronomic practices is on the top (Singh 2017). Moreover, poor agronomic practices such as higher seed rate, unsuitable varieties, faulty nutrient management as well as weed control etc. are responsible for low productivity of wheat in India (Bhagat *et al.* 2002, Tiwari *et al.* 2014). This scenario of low productivity of wheat needs to be improved by encouraging farmers to follow recommended package of practices including laying demonstration trials on farmers’ field. Interventions for adaptation and verification of potential technologies under local conditions tested on participating farmers’ fields jointly managed by researchers and farmers showed significantly higher spike length, number of grains/spike, grain yield, and total dry matter

Table 3 Productivity analysis of sampled wheat crop growers and constraints faced by respondent

Parameter	R. S. Pura (n=60)	Suchetgarh (n=60)	Bishnah (n=60)	Overall (n=180)		
Average productivity (t/ha) (S.D*)	2.903 ( $\pm$ .397)	2.713 ( $\pm$ .312)	2.751 ( $\pm$ .470)	2.789 ( $\pm$ .404)		
<i>Block wise one-way analysis of variance (ANOVA) in mean difference of productivity of wheat crop</i>						
Variable	(I) Blocks	(J) Blocks	Mean Difference (I-J)	Std. Error	P-value	Model summary
Productivity	Bishnah	Suchetgarh	0.3833	.72795	.599	F=49.281
		R.S.Pura	-1.5167*	.72795	.039	P=0.000
	Suchetgarh	Bishnah	-.3833	.72795	.599	
		R.S.Pura	-1.9000*	.72795	.010	
	R.S.Pura	Bishnah	1.5167*	.72795	.039	
		Suchetgarh	1.9000*	.72795	.010	
<i>Constraints reported by farmers in wheat cultivation</i>						
Constraints				Frequency (%)		
Uncertainty in canal irrigation				150 (83.00)		
Lack of subsidy in installation of electric motor pump sets for irrigation				130 (72.00)		
Low quality of weedicides				95 (53.00)		
Abnormal weather conditions at maturity time affects productivity of wheat crop				120 (67.00)		
Lack of quality seeds				79 (44.00)		

S.D\* denotes standard deviation

produced in the tested technologies as compared to farmers' practices (Nain *et al.* 2012). Adoption of improved package of practices of wheat in demonstrations plots resulted in increased yield compared to farmers practice (Verma *et al.* 2016). The productivity of respondent farmers of R. S. Pura block was higher as compared to Suchetgarh and Bishnah blocks. ANOVA technique was applied and data presented in Table 3 showed mean difference in productivity of wheat crop in three sampled blocks. It was evident from data that R. S. Pura block had significant difference in productivity of wheat crop from other two study blocks i.e. Suchetgarh (P=0.01) and Bishnah (P=0.04). However, there was no significant difference in productivity between Suchetgarh and Bishnah (P=0.599) block. Constraints reported by the sampled farmers in cultivation of wheat crop in irrigated sub-tropics were also analyzed (Table 3). Uncertainty in canal irrigation was the major constraint reported by the 83% sampled farmers followed by lack of adequate subsidy in installation of electric motor pump for irrigation (72%), abnormal weather conditions (67%), low quality of herbicides (53%) and lack of quality seeds (44%). In order to minimize these constraints, concerned agencies should take appropriate steps and provide timely and adequate information about availability of different inputs. Now a days ICT and social media is gearing up by way of forming WhatsApp groups of farmers across the states in order to quickly exchange the information regarding different aspects of agriculture production (Panda *et al.* 2019). WhatsApp being the potential source for socialization and

internalization promoted the creation of social wealth in the form of discussion forums of innovative farmers for learning exchange (Nain *et al.* 2019).

It is concluded that HD2967 variety of wheat is most preferred one for cultivation in the irrigated study area. Despite good network of field extension functionaries, private input dealers were mainly consulted by farmers for obtaining information regarding different agriculture activities. Seed replacement of wheat was very low and was the main factor for low productivity. Practice of seed treatment need to be properly encouraged among farmers. Further, it is recommended that quality seed of wheat is of utmost requirement of farmers in order to achieve higher productivity and the concerned agencies should make all efforts to ensure availability of the quality seed well in advance of sowing season. Timely awareness and training programmes for imparting adequate knowledge to farmers about different recommended wheat cultivation practices and adequate use of different social media such as WhatsApp group of farmers should be promoted for quick dissemination of information regarding wheat cultivation.

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