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Farmers' Varietal Preferences and Impact of Farmers Participatory Wheat Seed Production in North Western Himalayan Region

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ABSTRACT

This paper examines the impact of farmers' participatory seed production (FPSP) of improved wheat varieties suitable for North Western Himalayan region. A wide gap exists in wheat productivity in hills and plains region of Uttarakhand, with productivity in the plains being nearly double that in the hills. Before undertaking large seed production, farmers' preference with respect to different improved wheat varieties was recorded. The Wheat Preference Index (WPI) for VL 804, VL *Gehun* 829, VL *Gehun* 907 and VL *Gehun* 953 was found to be 3.64, 3.99, 4.59 and 4.61, respectively. The WPI of variety VL *Gehun* 953 (4.61) ranked highest majorly because of its higher productivity and superior seed quality. The cumulative growth of these varieties through FPSP was found to be 4777.2 ha in *rabi* 2021 from 457.2 ha in *rabi* 2016. The area diffusion effect of these improved wheat varieties through farmers participatory seed production was thus 10.4 times. In the year 2019-20, 145.8 quintal of seed of improved wheat variety was procured which is 10.4 times higher than the amount procured in 2015-16. Farmers earned 8.7 to 23.1 per cent higher economic gain from seed production of VL wheat varieties.

INTRODUCTION

Wheat is most important *rabi* cereal crop of North-western (NW) Himalayan states. In Uttarakhand, wheat occupies 42.4 per cent of the total area and contributes 49.4 per cent to the total cereal production (Anonymous, 2020). Of the total wheat area in the state, 45 per cent is in the hills and 55 per cent lies in the plains. A wide productivity gap, however, exists between the hills and plains, which is attributable to a host of factors ranging from inadequate availability of quality seed to limited use of other inputs and small-fragmented land holdings to rainfed growing conditions (Mittal et al., 2008; Raghuvanshi & Ansari, 2020; Subrahmanyeswari & Chander, 2022).

As per an estimate, quality seed alone contributes to 15-20 per cent in total crop production which can be further raised up to 40-50 per cent with good management practices (Singh et al., 2013; Natarajan et al., 2009). However, producing quality seeds suitable to different agro-climatic conditions in sufficient quantity and making it available at affordable prices at the right time and place has always been a challenging task (Hanchinal, 2012; Singh & Agarwal, 2018). A mechanism to create a valuable synthesis between local and research awareness probably leading to a more appropriate modern technology, and increase key stakeholder capacity to interact with new technology is the solution (Nain et al., 2012; Shitu et al., 2018). In India, more than 70 per cent seed usage, particularly for food crops, is through FSS (Farm Saved Seed) which results in low SRR (Seed Replacement Rate) (Ayyappan & Kochhar, 2010), and the situation in Uttarakhand hills is not much different. For achieving the desired level of SRR, production of adequate quantity of seeds of improved varieties is a pre-requisite. Nearly all the certified seed, be it of hill varieties or plains varieties, is produced in the plains, with majority of it undertaken by professional seed growers for the government seed agencies. The concept of 'seed village', which is a widely adopted

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and successful model for enhancing availability of quality seed, is being implemented in selected village clusters in the plains to complement the state seed agencies in meeting the quality seed requirement of hills varieties, particularly wheat, and by that means contribute to improving the SRR of wheat in the hill regions of the state. The farmers are the best evaluator but a scientific level evaluation is recommended for validation of the parameters for universal use (Sardar et al., 2019). Timely awareness and training programmes for imparting adequate knowledge to farmers about different recommended wheat cultivation practices and adequate use of different social media should be promoted for quick dissemination of information regarding wheat cultivation (Kumar et al., 2022). Research and large-scale demonstrations have revealed that the rate of adoption of improved cultivars by farmers in difficult and resource-poor regions of the world is positively influenced by the inclusion of farmers' preferences in the breeding objectives (Faisal et al., 2020). The present study reports the impact of farmer participatory seed production (FPSP) in a tribal village in the plains on the income of the farmers, and the resultant increase in the diffusion of VL wheat varieties in the state.

METHODOLOGY

Considering the importance of quality seeds in enhancing crop productivity, *Jhankat* and *Nakulia* villages of Udham Singh Nagar district, Uttarakhand were selected for undertaking farmers participatory seed production of improved wheat varieties suitable for hill region. Seed of improved wheat varieties VL 804, VL *Gehun* 829, VL *Gehun* 907 and VL *Gehun* 953 were distributed among selected farmers based on the area to be planted for seed production. All the varieties were highly resistant to yellow and brown rusts. A buyback arrangement was made to procure the produced seed by the ICAR-VPKAS at 20 per cent higher rate than the prevailing local market rate.

Spread of improved wheat varieties as a result of FPSP was analysed from *rabi* 2015-16 to *rabi* 2020-21. A total of 60 farmers engaged in seed production of wheat varieties were selected for the purpose of data collection. Six major traits, *viz*. productivity, maturity period, taste (quality of *chapati*), seed quality, rust resistance and tolerance to lodging were selected by reviewing the literature and consultation with experts and farmers for assessing the farmers' preferences. The weighted score for each identified trait was worked out based on the scoring given by farmers, other than the respondents, through focused group discussions. Weighted score for each identified trait was worked out using the rating given by the selected ten farmers on the scale of 1-10 based on their perceived significance of those quality parameters for seed production.

The preference of the farmers was measured by using the Wheat Preference Index (WPI). To calculate WPI, the farmers were asked to score the wheat varieties for various traits using 1-5 scale. These scores of individual farmers were added together to arrive at the total score of a particular trait for a variety. Further, to calculate the weighted score, each score was multiplied by the weight for each trait. Thereafter, the weighted scores were summed up to obtain an aggregate weighted score for each trait. The wheat varieties were then finally ranked according to the WPI (Sharma et al., 2017).

$$WPI = \frac{\sum_{k=1}^{m}\sum_{j=1}^{6}\sum_{i=1}^{n} W\,ijXijk}{\sum_{k=1}^{m}}$$

Where WPI = Wheat Preference Index
Wij = weight of the j^{th} characteristic of the i^{th} wheat variety,
Xijk = farmers' preference score assigned towards j^{th} characteristics of i^{th} wheat variety by k^{th} farmer,
i = wheat variety ranging from 1 to n
j = characteristics of wheat variety ranging from 1 to 6
k = number of respondent farmers ranging from 1 to m.

RESULTS AND DISCUSSION

Preference analysis

The individual weightage of the selected traits showed that yield had the highest weightage (0.21) followed by seed quality (0.18) and maturity period (0.17). Interestingly, rust resistance obtained the lowest weightage (0.14), implying that the farmers did not regard rust as a major threat to wheat crop, which in turn may be attributed to the fact that all the four varieties evaluated were resistant to rust (Gupta & Kant, 2012; Jethi et al., 2021), and (2) prophylactic/therapeutic spray of fungicides in wheat to manage rust and Karnal Bunt diseases is a regular practice in *Jhankat* and *Nakulia* villages.

The Wheat Preference Index (WPI) for VL 804, VL *Gehun* 829, VL *Gehun* 907 and VL *Gehun* 953 was found to be 3.64, 3.99, 4.59 and 4.61, respectively. The WPI of variety VL *Gehun* 953 (4.61) ranked highest and was followed by VL *Gehun* 907 (4.59). This revealed that farmers preferred VL *Gehun* 953 most for seed production among all the improved varieties demonstrated in farmers' fields.

Farmers' Preference for different traits was worked out with the help of weighted score on different traits of improved wheat

Table 1. Weighted score and wheat preference index (WPI) of improved wheat varieties selected for FPSP

Varietal traits	Individual weightage	VL *Gehun* 804	VL *Gehun* 829	VL *Gehun* 907	VL *Gehun* 953
Productivity	0.21	42.21	47.88	56.07	59.64
Maturity period	0.17	45.9	31.79	48.11	47.43
Seed Quality	0.18	43.02	50.4	49.14	49.32
Rust resistance	0.14	27.16	36.26	38.5	37.52
Tolerance to lodging	0.15	20.85	30.9	43.35	43.05
Taste (*chapati* quality)	0.15	39.15	42.6	40.65	39.90
		218.29	239.83	275.82	276.86
WPI		3.64	3.99	4.59	4.61
Rank		IV	III	II	I

varieties, *i.e.*, VL 804, VL *Gehun* 829, VL *Gehun* 907 and VL *Gehun* 953. Data in Table 1 revealed that farmers preferred VL Gehun 953 mainly for its productivity and seed quality. The criteria for preference of VL *Gehun* 829 were its taste (WS 42.6) and seed quality (WS 50.4). VL *Gehun* 829 received less preference score of 31.79 for maturity period as it matures relatively late. In the study area, wheat is followed by paddy which is grown in two seasons - *kharif* and *zaid*, and farmers, therefore, prefer timely sown and early maturing wheat varieties. Although on semi-medium, medium and large farms, paddy is planted mainly during *kharif* season, *zaid* season planting is also common (Raghav & Sen, 2015).

Spread of improved wheat varieties through FPSP

Spread of improved wheat varieties produced under FPSP was analysed from *rabi* 2015-16. Seed procured through FPSP is distributed to farmers of hills and other regions through different developmental programmes like Tribal Sub-Plan (TSP), Scheduled Caste Sub-Plan (SCSP), North Eastern Hills (NEH) component and other outreach programmes. A proportion of seed (@ 10% in the first year and @ 5% in the second year) was assumed to be retained by the farmers from the total produce for seed for the next crop and farmer-farmers exchange, leading to the spread of the cumulative growth to 4777.2 ha area from 457.2 ha. The area diffusion effect of these improved wheat varieties through different developmental programmes was 10.4 times (Table 2).

Economic gain from seed production

It is evident from Table 2 that there is a progressive increase in the area under FPSP of improved wheat varieties over the years. In year the 2019-20, a total of 145.8 quintal seed of improved wheat varieties was procured, which is 10.4 times higher than the quantity procured in 2015-16 (Table 3). Farmers received 20% higher rate for the seed than the MSP for the grain. It is evident from the data of 5 years that farmers earned 8.7 to 23.1 per cent higher economic gain from seed production of VL wheat varieties. Similar results were also reported by Thejashree & Umesh (2020). ICAR-VPKAS is the main institutional player for procuring seeds under FPSP whereas non-institutional channels included local traders and other farmers. A large amount of seed produced was sold as grain to the local traders, in spite of the fact that the procurement price was 20 per cent higher than MSP/prevalent market price. This was mainly because farmers have long-standing commercial relationships with the local traders, who are also readily accessible to the farmers. Besides, the farmers receive payment at once and in full, which is used by the farmers to meet their immediate cash requirement. Whereas, in seed procurement through institutional channels, the payment is often delayed as only partial payment is made at the time of procurement and remaining payment is released only after grading and quality testing.

CONCLUSION

A perennial shortage of quality seeds of hill wheat varieties exists in Uttarakhand, which adversely affects wheat productivity in the hills. Development of seed villages has emerged as a viable proposition to help mitigate this problem to an extent. Quality seed produced under the FPSP programmes benefits the farmers of the seed villages as well as the farmers who receive this seed at a reasonable price. Farmers Participatory Seed Production programme undertaken by ICAR-VPKAS has led to increased availability of quality seed of hill crop varieties. Upscaling of FPSP programme in the future by taking into consideration farmers' preferences for crop varieties will act as the major driver of improved crop productivity in the hills. The overall impact of the initiative will be visible in terms of increased crop production, enhanced technical knowledge, seed entrepreneurship development and improved socio-economic status of the farmers in the plains as well as hills.

Table 2. Spread of improved varieties procured under FPSP

Year	Seed procured under FPSP (q)	Estimated area covered by procured seed (ha)	Total production from the area covered by procured seed (q)	Estimated area covered by Farm saved and Farmer-Farmer exchanged seed (q) @ 15% of total production				
				2017	2018	2019	2020	2021
2015-16	14.1	14.1	564	56.4	112.8			
2016-17	73.3	73.3	2932		293.2	586.4		
2017-18	83	83	3320			332	664	
2018-19	141	141	5640				564	1128
2019-20	145.8	145.8	5832					583.2
Cumulative growth		457.2		513.6	919.6	1838	3066	4777.2
Total cumulative growth up to *rabi* 2021-22 (ha)						4777.2		
Area diffusion effect						10.4 times		

Table 3. Year wise seed production and seed disposal of improved wheat varieties under FPSP

Cropping seasons	2015-16	2016-17	2017-18	2018-19	2019-20
Area under FPSP (ha)	42.4	16	14.8	13	62.9
Total production (q)@ 40 q/ha	1696	640	592	520	2516
Seed procured under FPSP (q)	14.1	73.3	83	141	145.8
Economic gain by seed procured by ICAR-VPKAS (Rs.)	25380	146600	166000	282000	320760
Economic gain if seed sold as grain in local market (Rs.)	19352.25	107201.3	129604.5	233496	252598.5
Percent difference	18.03	23.1	15.3	8.7	14.2

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