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Participatory varietal selection in rapeseed-mustard

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Abstract

The present investigation of PVS in rapeseed-mustard comprised of nine mother trials were successfully conducted across four predominant oilseed districts of Kashmir valley during 2013-14 and 2014-15. In addition to it, twenty four baby trials (12 each year) of Shalimar sarson-1 and Shalimar sarson-2 each of 500m^2 area along with farmer's variety as check were conducted across the villages and over the years. All the trials were managed by the farmers under the supervision of breeder. The farmer walk was organized by the researchers at the farmer's field prior to harvest of the crop and farmers were allowed to select the varieties in a secret ballot box. On the basis of overall ranking of varieties by the farmers, the Shalimar sarson-1 & Shalimar sarson-2 (not notified) were the selected by the farmers across most of the districts. The main aim of the study was to increase the adoption of modern varieties to suit their agroecological nichesof the valley.

Key words: *B. rapa, B. napus, baby trial, mother trial, PVS*

Introduction

Rapeseed-Mustard group of crops is the major oilseed crop of India and this crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop.. The state occupies little more than 65.95 thousand hectares under oilseed crop with annual production of 58.3 thousand quintals with an average productivity 8.9 q (Anonymous, 2013-14). Brown sarson (*Brassica rapa var. Brown Sarson*) is major oilseed crop of Kashmir valley which is grown in *Rabi* season and covers an area of more than 45 thousand hectares. This is the only crop of the rapeseed-mustard group which fits well in the oilseed paddy rotation prevailing in the valley of Kashmir and is the dominant *Rabi* crop of the Kashmir valley. Anantnag, Pulwama, Kulgam Shopian & are the major oilseed growing districts and accounts for 69.06 % of total oilseed area in the state. However, the State of J&K, despite significant advancement in oilseed production technology, particularly in rapeseed-mustard is lying much behind in achieving a break through in oilseed production and one of important reason is low the seed replacement rate of around 12%. Even when new varieties are acceptable to farmers, the seed is either not available or too expensive. To overcome this problem a baseline survey was conducted by the scientists of MRCFC, Khudwani, SKUAST-K in various oilseed districts of Kashmir valley, it was found that that Farmer's participation in breeding can improve the selection of suitable varieties for complex environments because farmers' would be given the opportunity to screen new varieties on their specific environment rather in controlled experiment stations. Participatory experimentation in an agricultural context serves different (but connected) objectives: developing and adapting technology, learning, finally adoption of technology and empowerment (Choudhary and Surf, 2013; Hassenforder *et al*., 2015; Hellin *et al*., 2008). Since the R & D programme of SKUAST-K aims at development of new oilssed varieties, so there was ample variability in the form of pre-released, released & pipeline entries at the research station to start the PVS programme. Keeping in view,

SKUAST-K initiated a participatory breeding programme in field crops to support local seed systemunder the financial support of RKVY-1. This method increases the varietal choice for farmers to make the decision of selection or rejection and the output of plant breeding efforts thus can be more effectively exploited (Joshi and Witcombe, 1996).

Material & Methods

The present study of participatory plant breeding programmewas initiatedby SKUAST-K in 2013 in various field crops including rapeseed-mustard under externally funded project *"Farmers Participatory Crop Breeding for Strengthening local Seed System"* of RKVY-1. In this programme, PVS trials were conducted in rapeseed-mustard during *Rabi* 2013-14 & 2014-15. The six and three mother trials(on farm trials) which comprised of released, prereleased and advanced breeding linesalong with farmers variety (as local check) using farmers crop management practices were conducted inAnantnag, Pulwama, Kulgam&Budgam districts of Kashmir valley during 2013-14 & 2014-15 respectively (Table 1&2). In addition to it, 24 baby trials (small trials of 1 to 2 varieties that are given directly to farmers) were successfully orchestrated during *Rabi*,2013-14 & 2014-15 (Table 3). Each baby trial consisted of a test variety was allocated for one kanal (500m^2) of land and were single replicate and famers variety was used as check for comparisons (same land). The area was demarcated by the researchers but trials were laid and managed by the farmers using their own management and fertilizer inputs under the supervision of researchers. Evaluation of participatory trials was followed as per the method described by Joshi and Witcombe (1996). All the study sites are situated in the lower to intermediate altitude ranges where the climate is relatively favourable compared to high altitude zones of Kashmir valley.

A group of farmers were allowed to vote for their preferred genotypes as per their own selection and preferential indices during farm walk by depositing

Table 1: Summary of participatory mother trials of rapeseed-mustard conducted during rabi, 2013-14 & 2014-15

District	Village	No. of entries tested	Total no. of mother trials
Pulwama	Padgampora & Khenbagh	7+1	02
Anantnag	Wonpoh	7+1	02
Kulgam	Ruhpoora & Sursuroo	7+1	02
Total (2013-14)			06
Pulwama	Melangpora	6+1	01
Anantnag	Wonpoh	6+1	01
Kulgam	Khudwani	6+1	01
Total (2014-15)			03

Table 2: Promising entries tested in mother trials in PVS programme of *rapeseed-mustard* during 2013-14 & 2014-15

Genotypes 2013-14	Biological Status	Genotypes 2014-15	Biological Status
Shalimar Sarson-2	Released (Not notified)	KBS-3	Advanced Breeding Line
KBS-1	Advanced Breeding Line	KBS-5	-do-
KBS-2	- do -	*Shalimar Sarson-2*	Released (Not notified)
KBS-3	- do -	KGS-1	Prereleased
KBS-4	- do -	KGS-2	-do-
KBS-5	- do -	*Shalimar sarson-1*	Released Variety
Shalimar Sarson-1	Released	Farmers Variety	Check
Farmers variety	Check		

KBS-Khudwani Brown Sasrson (B. rapa var. Brown Sarson), KGS-Khudwani Gobhi Sarson (B. napus)

paper ballots in a bag in front of each plot. During the farm walk the bag was placed in front of each plot in the trial, and the bag served as ballot box for genotype. Each farmer was given 2 ballot of different color and was asked to vote for preferred variety. The preferential score (PS) was calculated as:

$$\frac{\text{No. of positive votes} - \text{No. of negative votes}}{\text{Total no. of votes}}$$ (De-Boef and Thijssen, 2007)

Statistical analysis: In mother trials, Tukey's honest significance testfor yield ($Kgha^{-1}$) was performed for comparison of varieties/genotypes using JMP software, whereas the Paired t-test comparisons were computed for baby trials to test the improved variety in comparison to the farmer's variety as check (Snedecor and Cochran, 1973).

Results and Discussion

The participatory approaches are advocated as being more effective in supporting rural development processes to bring in increased confidence of farmers and local people in their own knowledge, improved capacity of clients to innovation than traditional top-down extension approaches (Kraaijvanger *et al.*, 2016). In present investigation seven (2013-14) and six test genotypes (2014-15) includingfarmer's variety as check were evaluated through Mother trial evaluation system and based on farmer's skill and knowledge preferential ranking at all locations across Kashmir valley. The test entry *Shalimar Sarson-2* a latest released variety (not notified yet) has performed significantly better over the check and farmer varietyacross most of the

Table 3: Summary of baby trials of *rapeseed-mustard* conducted during *Rabi*, 2013-14 & 2014-15

District	Test Variety	Checks	Total no. of Baby Trials
Pulwama	*Shalimar Sarson-1*	Farmers variety	02
	Shalimar Sarson-2	Farmers variety	02
Anantnag	*Shalimar Sarson-1*	Farmers variety	02
	Shalimar Sarson-2	Farmers variety	02
Kulgam	*Shalimar Sarson-1*	Farmers variety	02
	Shalimar Sarson-2	Farmers variety	02
Total (2013-14)			12
Pulwama	*Shalimar Sarson-2*	Farmers variety	04
Anantnag	*Shalimar Sarson-2*	Farmers variety	03
Kulgam	*Shalimar Sarson-2*	Farmers variety	03
Budgam	*Shalimar Sarson-2*	Farmers variety	02
Total (2014-15)			12

Table 4: Mean Seed Yield (Kg/ha) & average of ranks recorded for different mother trials of *rapeseed-mustard* in farmers fields across Kashmir valley during *Rabi*, 2013-14

Test entry	Seed Yield (Pulwama)	Seed Yield (Kulgam)	Seed Yield (Anantnag)	Average Seed Yield (Kg/ha)	Average of Ranks	Pooled Preference
Shalimar Sarson-2	1415^{a}	1265^{a}	1322^{a}	1334^{a}±75.71	1.0	2.45
KBS-1	1060b^{c}	1037^{c}	1150^{c}	1082^{b}±59.71	7.3	-0.53
KBS-2	1187b^{c}	1195^{c}	1127^{ab}	1169^{ab}±37.16	6.3	0.01
KBS-3	1100^{c}	1215^{bc}	1205^{ab}	1173^{ab}±63.70	4.3	0.76
KBS-4	1275^{ab}	1127^{c}	1160^{bc}	1187^{ab} ±77.69	5.0	0.5
KBS-5	1295 ^{a}	1050^{c}	1165^{c}	1171^{ab}±122.57	3.0	1.4
Shalimar Sarson-1	1387^{a}	1200^{ab}	1280^{ab}	1289^{ab}±93.82	1.6	2.04
Farmers variety	1052^{c}	1055^{c}	1128^{c}	1078^{b}±43.08	6.0	-0.02

Levels not connected by same letter are significantly different

villages and over the years as well. The mean ranking and over all ranks on the basis of the observable characters by the group of farmers have revealed that the *Shalimar sarson-2* as the better performing variety (rank-1 & pooled preference 2.45) followed by *Shalimar sarson-1* in 2013-14 (Table 4). Similarly SS-2 &KGS-1 were ranked 1st and 2nd by the farmers across most of the districts, but the KGS-1 matured one week late than the check variety & was discarded by farmers (Table 5).The days to 50 % flowering & days to 80% maturity have revealed that the *Shalimar Sarson-2* matures at par with the farmers variety and fits well in a predominant rice-Sarson cropping system (Fig. 1) in Kashmir valley. The farmers variety used as check in the mother trial evaluation system has been out rightly rejected by the farmers.Joshi *et al.* (2007) through client oriented breedingdetermined farmer's preferences and adoptionand identified varieties for Bangladesh andNepal. Virk *et al.* (2003) used FGDs

Table 5: Mean Seed Yield (Kg/ha) & average of ranks recorded for different Mother Trials of *rapeseed-mustard* in farmers fields across Kashmir valley during *Rabi*, 2014-15

Test Entry	Seed Yield (Pulwama)	Seed Yield (Kulgam)	Seed Yield (Anantnag)	Seed Yield (Budgam)	Average Seed Yield (Kg/ha)	Average of Ranks	Pooled Preference
KBS-3	1210^{abc}	1085^{ab}	1100^{ab}	1140^{b}	$1133.75^{ab}\pm55.88$	3.8	1.48
KBS-5	1275^{bc}	1330^{c}	1145^{ab}	925^{b}	$1168.75^{ab}\pm180.06$	5.3	-0.45
Shalimar Sarson-2	1394^{a}	1180^{a}	1290^{a}	1397.5^{a}	$1315.37^{a}\pm103.11$	1.0	2.28
KGS-1	1410^{ab}	1240^{bc}	1270^{bc}	1102.5^{b}	$1255.62^{a}\pm126.13$	1.8	2.10
KGS-2	1050^{cd}	1260^{bc}	1135^{c}	1070^{b}	$1128.75^{ab}\pm94.73$	2.8	1.12
Shalimar Sarson-1	1125^{abc}	1240^{abc}	1340^{a}	1092.5^{b}	$1199.37^{ab}\pm113.11$	2.7	0.96
Farmers variety	960^{d}	1070^{c}	880^{c}	1011.5^{b}	$980.37^{b}\pm80.61$	4.9	-0.14

Levels not connected by same letter are significantly different

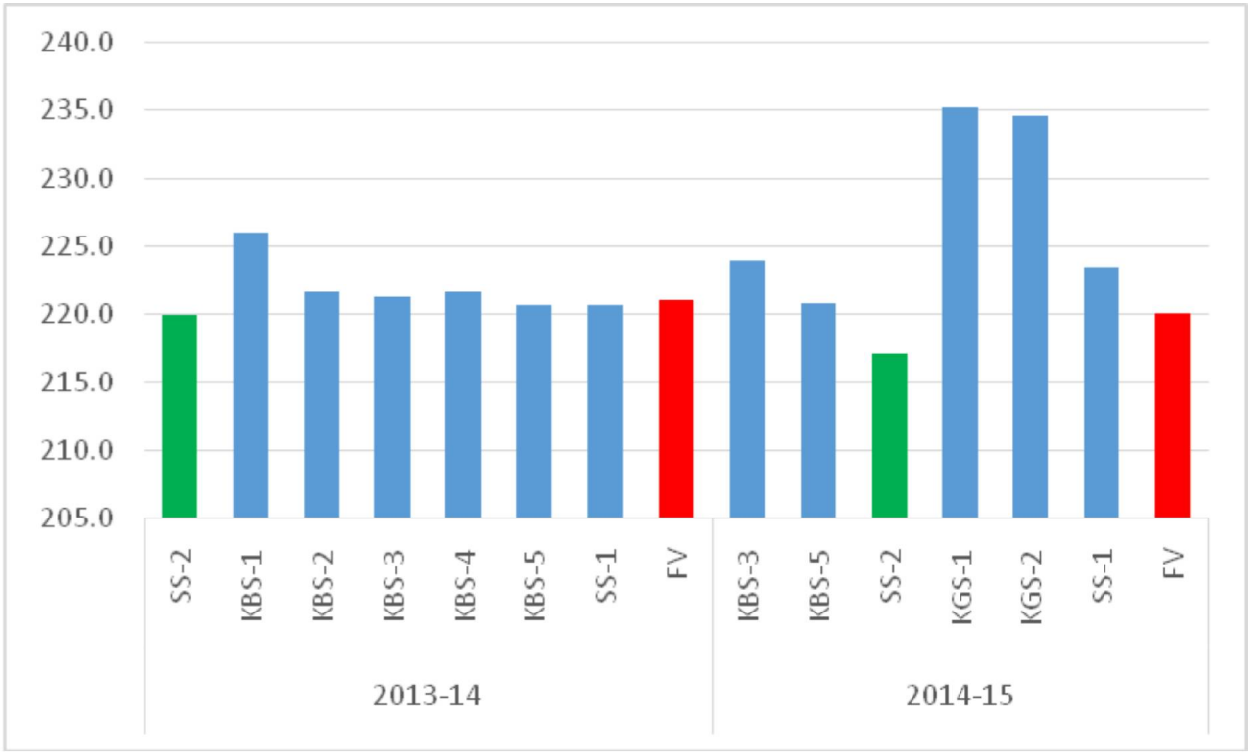

Fig ure 1: Average maturity period of test entries over locations (Days)

to evaluate the varieties for grain and straw yield, grain type, grain color through overall ranking. A PVS study was carried out by Sheikh *et al*. (2017) in *Phaseolus vulgaris* and the genotypes WB-185, WB-195, WB- 966 and SR-1 were selected and preferred by the farmers across locations and were found at higher in term of mean preference when compared by the farmer's variety. The similar type of study was undertaken by Ara *et al*. (2017) in rapeseed where by using the Focal Group Discussion through PVS, KBS-49 and KBS-33 were most preferred genotypes identified by the farmers.

The number of baby trials was numerous and diverse conditions were sampled and thus diverse conditions were sampled because the researchers had no control in selecting the plan site and everthing was famers managed.For this reason the response are likely to provide a more realistic estimate of the yields without changes in input levels or management practices. The improvement of all the test entries *viz*. SS-1, SS-2 and farmers variety using paired t-test are presented table -6. During the 2013-14, the *Shalimar sarson-1* and *Shalimar sarson-2* have shown yield superiority of 17.03% and 18.53% over the farmers variety as check respectively, however only one variety *Shalimar Sarson-2* was evaluated under baby trials during 2014-15 have shown respective significant yield advantage of 16.28%. The farmers have been demanding the seed of these varieties. Participatory varietal selection (PVS) in rice through focal group discussions (FGD) identified GSL-11 and SKUA-402 as the most preferred genotypes with highest ranks of 1.4 and 1.6 respectively (Rafiq *et al*., 2016). The farmer's participation in the process of on-farm research does not only enrich the speed up of information gathering, but also result in large scale adoption of the product of research. (Angarawai *et al.*, 2016). Cornish *et al*. (2015) observed in line with this that farmers not only acquired functionalknowledge but at the same time started managing their own learning. Considering the outcomes of their responses in relation to perceivedbenefits of involvement we see that farmers not only appreciated thetechnical benefits but also valued the process in which they had beeninvolved, they had learned how to learn together.

In order to make plant breeding the most successful and proficient, it should involve the farmers if not in all stages of variety development, but at least during variety testing and up-scaling.The results here provide very good evidence that involving farmers in the selection stage of variety development through on-farm testing would prove effective and efficient in identifying farmer preferred varieties to replace the older varieties and would enhance the seed replacement rate. In addition to it the farmersopinion in this method becomes part of the release process which follows the on-farm trials, only the variety (ies) that partners like will be proposed for release, thus increasing enormously the speed and the rate of adoption.

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Table 6: Results baby trials seed yield (q/ha) of test varieties in comparison to farmers variety across districts

District	2013-14			2014-15					
	SS-1	FV	Prob.	SS-2	FV	Prob.	SS-2	FV	Prob.
Pulwama	13.05 ± 0.24	10.71 ± 0.71	<0.01	14.28±0.53	12.11±1.26	<0.01	13.9±0.8	12.05±1.11	<0.01
Anantnag	12.59±0.6	11.25 ± 0.007		12.98±0.28	10.05±1.13		13.39±0.86	11.15±0.99	
Kulgam	11.58±0.43	10..63 ± 0.58		12.64±0.53	11.5±0.39		12.64±0.78	11.25±1.09	
Budgam	-	-	-	-	-	-	13.42±1.4	8.89±0.62	
Grand Mean	12.82±0.42	10.98±0.43		13.3±0.44	11.22±0.92		13.33±0.96	11.47±0.95	
Mean yield superiority (%)		17.03			18.53			16.28	

SS-1 & SS-2: Shalimar Sarson-1 & Shalimar Sarson-2: FV: Farmers variety

Grain yield is measured for one Kanal of land (500m^2) both for test variety and farmers variety, Paired t comparison was made over all the districts for each test variety

K: Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, J&K, India, PVS: Participatory Varietal Selection, RKVY: Rashtriya KrishiVigyanYojna, SS-1&SS-2: Shalimar Saron-1 & Shalimar Sarson-2.

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