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PARTICIPATORY VARIETAL SELECTION IN FODDER OATS UNDER HIMALAYAN CONDITIONS

[1]Uzma Mehraj, [1]Ishfaq Abidi, [1]*Mushtaq Ahmad, [2]Intikhab Aalum Jehangir, [1]Aijaz A Lone
[1]Division of Genetics and Pant Breeding,
[2]Division of Agronomy, Faculty of Agriculture FOA, Wadura
Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir Shalimar campus, Srinagar -191 121
*Corresponding author email: drmushtaqdarskuastk@rediffmail.com

ABSTRACT
A study was done on the participatory varietal selection (PVS) for adoption of improved forage oat varieties in Kashmir under Himalayan conditions. The study assessed how this approach influence farmers‟ uptake of the introduced forage oat varieties and determined socio-economic, bio-physical and institutional factors that influence the adoption of these improved forage oat varieties. Therefore a survey was carried out in Shopian, Pulwama, Srinagar, Bandipora and Gandarbal districts in Kashmir. Data were collected from 113 farmers using a pre-designed questionnaire. Before administering the individual questionnaire, a participatory rural appraisal (PRA) was conducted by selecting 50 households from 16 selected sites. The sites were selected from central, north and south areas of Kashmir valley. Three sites from Districts of Srinagar, four sites from Gandarbal, four from Shopian and five sites selected from Pulwama to identify background information, production constraints as well as the farmers perception about varietal specification of fodder oats. Descriptive statistics were generated using χ^2-test. The most preferred genotypes identified by the farmers through PVS were SKO-90, SKO-96 and SKO-98. These genotypes needs to be evaluated further by Baby Trial evaluation system on big plot size and over many more locations to corroborate the real performance and finally to recommend the varieties for up scaling through Participatory Seed Production under such ecologies.

KEY WORDS: participatory varietal selection, Himalayan conditions, Seed Production.

INTRODUCTION

Participatory Varietal Selection specifically refers to evaluation of released varieties, pipeline materials, advanced breeding lines, landraces or germplasm accessions on farmers' fields under his management practices. Participatory Varietal Selection (PVS) approaches can be used to rapidly and cost-effectively identify the best existing varieties. Participatory approaches explicitly increase the extent of client orientation. It allows the farmers to evaluate varieties for all traits and to make trade of between traits and tests varieties across more of the physical niches in which the crop is grown because the trials are replicated across more locations Witcombe *et al.* (2005). Farmers are increasingly participating in agricultural research as scientists and development workers become more aware of the philosophy of "farmer first and its effectiveness" (Witcombe and Joshi, 1995). Many farmer participatory approaches are possible in farmer participatory research for improved crop cultivars by farmers. Farmers Participatory Varietal Selection (PVS) approach is used to address the problems of the limited varietal choices available to farmers. In present investigation farmer participatory varietal selection (PVS) was used to identify farmer acceptable cultivars of fodder oats. Farmers' requirements in new crop cultivars (varieties) were determined and a search was carried out for released/ un-released cultivars that matched the needs of farmers in different areas of temperate Kashmir. Farmer participation is increasingly seen as a key to develop technologies which are more relevant to farmers' communities. In plant breeding, farmer participation is seen as key to increase the probability of adoption of new varieties and addresses the issue of selection efficiency in participatory plant breeding by testing the effect of selection environment on the performance of the selected lines Ceccarelli *et al.* (2003). The genotypes used for evaluation were tested in farmer managed, participatory trials, in order to identify farmer acceptable cultivars more effectively. Involving farmers in evaluation process using their skill experience and needs through participatory mode helped to define and evaluate the experimental material effectively and therefore the promising genotypes identified for different agro-ecological situations/locations can be mass-multiplied based on local requirements of farmers across different districts of Kashmir valley. The participatory varietal selection also was instrumental to minimize resource use, identify acceptable farmer varieties having good marketability that are most suitable for high altitude ecologies of Kashmir valley adding to the varietal profile to the fodder basket of tribal and resource poor farmers in the hill ecologies of Kashmir Himalayas. Keeping in view the large gap between demand and supply of forage oats and limited varietal profile and scarcity, the present research programme was carried out to evaluate twelve genotypes of fodder oats across diverse agro-ecological situations in participatory mode to assess their performance, suitability and utilization. Based on the experience gained through this investigation it become evident that appropriate use of participatory breeding

technique/methods during breeding process shortens the breeding cycles, saves time, has quick impact besides helping in the production of cost effective and improved crop varieties.

MATERIALS & METHODS

In the present investigation 10 *Avena sativa* genotypes including two checks viz. SKO-20, SKO-90, SKO-96, SKO-98, SKO-117, SKO-148, SKO-160, SKO-166, SKO-167, SKO-176, Sabzaar and Kent were evaluated through mother trial evaluation system to identify the most appropriate genotypes on the basis of preferences of the farmers and to find the varietal specification to bred in future in consultation with farmers. There were three Mother trials laid out in the farmers field including three Grandmother trials laid at Mountain livestock Research institute (MLRI), KVK-Malangpura and Experimental Farm of Division of Genetics and Plant Breeding, SKUAST-Kashmir (Shalimar) . The experiment was laid in Randomized Complete Block Design (RCBD) with three replications during *rabi* 2013.

RESULTS & DISCUSSION

Participatory varietal selection always has three phases: a means of identifying farmers" needs for a cultivar, a search for suitable material to test with farmers, and experimentation on farmers" fields. Farmers' needs were identified through participatory rural appraisal (PRA), which was conducted before laying out of the trails to identify background information, production constraints as well as the farmers perception about varietal specification of fodder oats. There were 14 easy questions in the questionnaire and the questions were asked in vernacular language and were filled in by the researcher himself after listening to the replies. Participatory Rural Appraisal (PRA) describes growing approaches and methods to enable farmers to share, enhance and analyze their knowledge of farming practices and conditions, to plan and to act. PRA has sources in activist participatory research, agro-ecosystem analysis field research on farming systems, and rapid rural appraisal (RRA). Besides, Participatory Rural Appraisal (PRA) technique is used to establish benchmark information on biophysical, socioeconomic, institutional and farming constraints, as well as farmers' needs, and researchable problems, Joshi *et al*. (2001). PPB/PVS approaches thus draw upon the comparative advantage of both formal and informal systems. A potential tool for enhancing biodiversity, production and economic status in areas of interest. Large scale multiplication and availability of location specific genotypes/varieties for different micro environments and altitudes of Kashmir Himalayas identified during present study shall therefore be instrumental in augmenting the feed and fodder requirements of different livestock's of small & marginal farmers securing their livelihoods and uplifting their economic status. Further the seed replacement rates of fodder oats which has been pathetically low in this part of country shall also improve through augmentation of farmers own saved seed and strengthening of local seed systems. Deploying diversity in farmer's fields using PPB/PVS shall also strengthen on-farm conservation measures creating sustainable ecosystems and thus can turn into dynamic form of in-situ conservation. Thus a new window of opportunity exists for plant breeders through participatory mode for further refinement and enriching the fodder basket of poor farmers particularly in marginal and disadvantageous pockets of Himalayan regions. It also offers skill and opportunity to researchers and hill farmers for searching new diversity, selection and exchange of variable populations that match their local preferences/ needs tapping the vast gene pool that is available in fodder crop. In addition plant Participatory Rural Appraisal (PRA) has been employed as an effective tool to get feedback and information regarding the likes and dislikes of end users (farmers) about various traits of oats so as to chalk out the strategy for breeding and evaluating the genotypes at farmers field through Participatory Varietal Selection (PVS) in order to increase the adoption rate of released varieties. The background information revealed that in Kashmir valley, fodder crop is cultivated on paddy fields and under orchard areas and is being fed as green forage or is dried as hay for winter stall feeding for livestock and sole-cropping is being widely practiced method due to limited number of favourable days available for other crop. Also it was found that crop is mostly dependent on rains as a source of irrigation water. Among major production constraints low yielding varieties was identified a significant factor in limiting fodder crop production. There is no threat regarding diseases and cold stress during any stages of crop growth. Further farmers saved seed of traditionally grown oat crop is the main source of seed to raise the new crop.

Regarding specification of new varieties for low production potential system of Kashmir valley, farmers showed their willingness for the varieties possessing early flowering, high tillering, tall stature, more grain panicle^{-1}, high biomass, thin clum and high germination per centage. The PRA proved to be quick and effective method of identifying and characterizing what the farmers grow and subsequently showed the importance of PRA as first step in choosing which cultivars should be tested with farmers.

After the farmers' needs have been identified, all that is required is to expose the farmers to the suitable cultivars. Evidence supports the assumption that farmers are not rapidly adopting new cultivars because most cultivars under cultivation are old (Witcombe and Joshi, 1995). Only a few of the released cultivars are widely grown. Client-oriented breeding explicitly takes into account the needs of end users (farmers, processors and consumers) in designing a new variety and then tests without delay the new products from the breeding programme with the target clients in the target environments (Witcombe *et al*., 2005). A major component of client-oriented breeding is participatory varietal selection (PVS) where farmers test varieties on their own fields with their own levels of inputs and management. PVS identifies new varieties that farmers prefer to grow for the traits they consider important and facilitates their adoption and spread resulting in positive and rapid impacts on food security and income (Joshi and Witcombe, 1996; Witcombe *et al*., 2001). Participatory Varietal Selection (PVS) approach

has been employed to evaluate, identify and disseminate different genotypes on farmer's field as per farmers tastes regarding various traits and their perception and aspirations about varietal specification.

PVS assumes that varieties exist that are better than those currently grown, but which farmers have not had the opportunity to test. In PVS, farmers are given varieties to test in their own fields. These varieties are chosen carefully. To save time and to ensure that seed is available we have used seed of cultivars that have already been released, not only from the target region but also other regions or countries. A successful PVS programme has four phases:

i. Participatory evaluation to identify farmers needs in a cultivar,
ii. A search for suitable material to test with farmers,
iii. Evaluation of its acceptability in farmers fields and
iv. Wider dissemination of farmer preferred cultivars.

PVS is both an extension and a research method. Varieties tested in PVS can rapidly spread from farmer to farmer. As well as exposing farmers to noval cultivars, PVS is effective in identifying locally adapted parental material and in identifying breeding goals-for example, early maturity that assists the selection of complementary parents. Most of the PVS programmes use a mother and baby trial system. The mother trials compare all the entries together in a farmer's field. In baby trails farmers compare a single variety with the variety they have grown in the past. PVS can provide valuable information to breeding programme it can identify general traits for adaption to environmental conditions or to cropping systems. PVS can also identify specific traits or characteristics wanted by farmers in particular areas. Farmers preferences are very imperative and modern cultivars are often rejected by farmers because of traits that have not been considered in the breeding process (LARC, 1995). The poor adoption of improved varieties may be due to limited accessibility of the new varieties seeds or poor adaptation of improved varieties to local condition (Joshi and Witcombe, 1995). In present investigation twelve genotypes including two checks were evaluated through Grandmother/Mother trial evaluation system and based on farmer's skill and knowledge preferential ranking was carried out at all six locations including the trials laid out by the farmer's in their own fields and Grand Mother trails at research stations/units. Just one week before harvest, at respective locations Focal Group Discussions (FGD) and farmer walks were organised to evaluate the trails. Based on the methodology of PRA at village Manduna (Pulwama) highest preferential scoring i.e. lowest rank value was recorded for genotype SKO-90 (1) followed by SKO-96 (2) and SKO-98 (3) (table-1). The lowest preference was recorded for SKO-117 (11) and SKO-176 (12). Similarly at village Trenz (Shopian) maximum scoring was recorded for genotypes SKO-96 (1) followed by SKO-90 (2) and Sabzaar (3) and the minimum for SKO-167 (11) and SKO-176 (11). The maximum numbers of farmer's votes were recorded for genotypes SKO-96 (1) followed by SKO-90 (2), SKO-98 (3) and SKO-160 (4) and so on at village Gandarbal, while as maximum numbers of negative votes were recorded for SKO-176 (11) and SKO-167 (12). At MLRI, Manasbal; KVK, Malangpora and Experimental Farm of Division of Genetics and Plant Breeding, SKUAST-K, Shalimar most preferred variety/genotypes were SKO-90 (1) and SKO-96 (2) followed by SKO-98 (3) and Sabzaar (4). The variety/genotype that received minimum number of negative votes was SKO-176 (11). There was significant interaction between varieties/ genotypes and locations as observed from the data of preferential ranking. Most of the variations in ranking between sites are for the lower ranked entries. The reasons for the preference of genotype/varieties were related to many traits including highest number of tillers, high green fodder yield, grain yield, early maturity, good plant height, thin culm diameter, high protein and ash content and low content of ADF and NDF. (Table-2) gives the picture of rank summation preferential data for different test entries as collected from six mother trials and evaluated by 113 farmers including the ones who grow the trials on their farm. Lowest cumulative rank that is the most preferred variety was recorded on SKO-90 with mean preference rank of 1.33 and SKO-96 identified as second best (1.8) and followed by SKO-98 (3.3) and Sabzaar (3.83). Clearly shows that SKO-90, SKO-96 SKO-98 and Sabzaar were statistically at par in term of rank summation index and mean preference ranking and significantly different with the test entries SKO-20, SKO-160, SKO-166, SKO-148 and Kent which among themselves could be categorized as one group. SKO-167, SKO-176 and SKO-177 were least preferred genotypes.

Based on the preferential scoring the genotypes identified as per farmer's preferences for different agro-ecozones are as:

Name of the village/area (District)	Genotypes identified	Preferential scoring	Genotypes having negative votes
Trenz, Panjoora, Pahnoo and Aarihal (Shopian)	SKO-96	1	SKO-167
	SKO-90	2	SKO-176
	Sabzaar	3	
Manduna, Galzurpora, Talangam, Malangpora and	SKO-90	1	SKO-117
Ratnipora (Pulwama)	SKO-96	2	SKO-176
	SKO-98	2	
Beihama, Doderhama, Saloora andArampora	SKO-96	1	SKO-176
(Gandarbal)	SKO-90	2	SKO-167
	SKO-98	3	
	SKO-160	4	
Batpora, Teilbal, Harwen and Khimber (Srinagar)	SKO-90	1	SKO-176
	SKO-96	2	
	SKO-98	3	
	Sabzaar	4	

TABLE 1: Farmers preference ranking (scoring) of different test varieties of oats at six locations

Genotypes	District, Pulwama Farmers trail (n=33, f=25)		District, Ganderbal Farmers trail (n=18, f=15)		District, Shopian Farmers trail (n=19, f=15)		District, Srinagar Station trail (n=25, f=20)		District, Pulwama Station trail (n=20, f=16)		District, Bandipora Station trail (n=22, f=19)	
	Positive Votes	Preferential scoring	Positive votes	Preferential scoring	Positive votes	Preferential scoring	Positive votes	Preferential scoring	Positive votes	Preferential scoring	Positive votes	Preferential scoring
SKO-20	11	-0.12	5	-0.33	8	0.06	10	0	9	0.125	8	-0.15
SKO-90	22	0.76	13	0.78	13	0.73	19	0.9	15	0.875	18	0.89
SKO-96	21	0.68	14	0.86	14	0.86	18	0.8	13	0.625	17	0.78
SKO-98	20	0.6	10	0.33	11	0.46	16	0.6	14	0.75	15	0.73
SKO-117	9	-0.28	4	-0.46	5	-0.03	9	-0.1	7	-0.125	7	-0.26
SKO-148	14	0.12	6	-0.2	6	-0.2	8	-0.2	10	0.25	6	-0.36
SKO-160	15	0.2	8	0.06	7	-0.06	15	0.5	11	0.378	10	0.05
SKO-166	16	0.28	9	0.2	9	0.2	15	0.5	8	0	9	-0.05
SKO-167	10	-0.2	5	-0.33	4	-0.46	11	0.1	7	-0.125	5	-0.47
SKO-176	8	-0.36	3	-0.2	4	-0.46	7	-0.3	4	-0.5	4	-0.57
Sabzaar	19	0.52	7	-0.06	12	0.6	17	0.7	12	0.5	16	0.68
Kent	17	0.36	4	-0.46	10	0.3	12	0.2	5	-0.375	13	0.36

n= Number of farmers assembled

f= Effective number of farmers who participated in preferential scoring

TABLE 2: Cumulative/average ranks of genotype over six locations

Genotypes	Individual ranks						Cumulative rank	Average of ranks	Pooled preference Score
	Mother trials			Grandmother trail					
	District, Pulwama Farmers trail	District, Ganderbal Farmers trail	District, Shopian Farmers trail	District, Srinagar Shalimar (Experimental farm)	District, Pulwama Malangpora (KVK)	District, Bandipora Manasbal (MLRI)			
SKO-20	9	8	7	8	7	8	47	7.8	-0.415
SKO-90	1	2	2	1	1	1	8	1.33	4 .935
SKO-96	2	1	1	2	3	2	11	1.8	4.605
SKO-98	3	3	4	4	2	4	20	3.3	3.470
SKO-117	11	9	10	9	9	9	57	9.5	-1.255
SKO-148	8	7	9	10	6	10	50	8.3	-0.590
SKO-160	7	5	8	5	5	6	36	6.0	1.128
SKO-166	6	4	6	5	8	7	36	6.0	1.130
SKO-167	12	8	11	7	9	11	58	9.6	-1.485
SKO-176	10	10	11	11	11	12	65	10.8	-2.390
Sabzaar	4	6	3	3	4	3	23	3.83	2.940
Kent	5	9	5	6	10	5	40	6.6	0.385
			SE				5.43	0.90	0.64

During present investigation the most commonly grown fodder oats genotypes identified in different districts of temperate Kashmir Himalayas and their attributes are summarized as:

Genotypes commonly grown	Desirable traits
Kent	Early maturing , good plant height and thin culm diameter
Sabzaar	Early maturing, high plant height, high green and dry fodder yield, more grain number and high moisture content.
Genotypes identified under present study	
Genotypes with positive votes	Desirable traits
SKO-90	High green and dry fodder yield, high chlorophyll content, early maturing, large number of tillers, thick culm diameter, more number of leaves, more protein and ash content and minimum ADF and NDF percentage
SKO-96	High biomass content, large number of tillers, more leaf stem ratio, high flag leaf length, more protein and ash content and high chlorophyll content
SKO-98	More grains yield per plant, high biomass and large number of panicles per plant
SKO-166	High green and dry fodder yield, higher number of panicles per plant and high grain yield.
SKO-148	High moisture content, large number of tillers and more palatable
Genotypes with negative votes	
SKO-176	Late maturing, short plant height, broad leaves and small number of grains per panicle
SKO-167	Late maturing, less number of tillers, broad leaves, short plant height and low grain yield.

The interviews from most of the farmers revealed that the reasons for the preference for a genotype were related to many traits including highest number of tillers, high green fodder yield, grain yield, early maturity, tall stature, resilience to insect pests and diseases and high moisture content. Participatory Varietal Selection (PVS) approach has been employed to evaluate, identify and disseminate different genotypes on farmers field as per farmers tastes regarding various traits and their perception and aspirations about varietal specification by different authors through their studies across various regions and crops viz, Joshi *et al.* (2005), Witcombe *et al.* (2005), Gyawali *et al.* (2010), Singh *et al.* (2006), Witcombe *et al.* (2006), Dorward *et al.* (2007), Paris *et al.* (2008), Singh *et al.* (2008), Manzanilla *et al.* (2011), Subedi *et al.* (2011), Ojehomon *et al.* (2012), Yadavendra and Witcombe (2013). PVS is a more rapid and cost effective way of identifying farmer preferred cultivars if suitable choices of cultivars exist. Compared to conventional plant breeding PPB/PVS approach is more likely to produce farmer acceptable products, particularly for marginal environments and disadvantageous pockets having different micro-climates /terrains and limited choice of varieties.

CONCLUSION

Participatory varietal selection in fodder oats (*Avena sativa*)" was conducted during *rabi* season of 2013-14 through mother trial evaluation system in Kashmir valley" to identify the most appropriate genotypes on the basis of preference of the farmers on the test varieties and determine their tastes and aspiration for the new varieties to be bred in future in consultation with farmers. In the present investigation, the genotypes SKO-90, SKO-96, SKO-98 and Sabzaar were identified by the farmers through their perceptions for traits like early flowering, highest number of tillers, tall stature, good biomass and grain yield, thin clum diameter, resilience to diseases and pests and good germination per centage. These varieties are therefore suggested for these niches after validation of results through multilocations and to confirm the real performance and after revalidation are recommended for last stage of Participatory Plant Breeding (PPB) which participatory seed production is used for up scaling. Genotypes identified for specific locations as per, farmers preferences and predication potential need to be popularized through fodder village programme in high altitude/rainfed areas to occupy different pockets improving livestock potential and livelihood security of resource poor farmers. The use of participatory approach shall strengthen local seed system, augment farmers own saved seed, increase winter fodder production catering the immediate needs of fodder farmers.

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