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Perception of Breeders and Farmers Regarding Participatory Plant Breeding Programme and its Problems in Punjab

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ABSTRACT

The study was undertaken to analyze the perception of breeders and farmers towards Participatory Plant Breeding in Punjab and to also determine the problems as perceived by the breeders and farmers regarding Participatory Plant Breeding in Punjab. The study was conducted in Punjab Agricultural University, Ludhiana and its research stations in different districts. The study comprised of two kinds of respondents viz. Breeders and Farmers. The total sample size was of 100, 50 breeders and 50 farmers who were randomly selected to take their perception regarding Participatory Plant Breeding in Punjab. Perception and Problems were measured on three-point continuum defined separately for each respectively. Majority of the farmers as well as the breeders agreed that the PPB will improve the rate of adoption of the varieties among the farmers, increase the farmers' organizational and social participation, increase resource poor farmers' access to improved varieties and allow the farmers with freedom of choice of traits in the varieties of the crops. Based on the findings of the study a PPB programme can be devised which can be tested for its feasibility and future prospects in crop improvement and diversification programmes.

Keywords: Breeders, Farmers, Participatory plant breeding, Perception, Problems

INTRODUCTION

Perception is a mode of apprehending reality and experience through the senses, thus enabling discernment of figure, form, language, behaviour, and action. Individual perception influences opinion, judgment, understanding of a situation or person, meaning of an experience, and how one responds to a situation (Denzin and Yvonna, 2011). However, perception is a process involving not only the senses but also complex underlying mechanisms. The use of participatory approaches is not new in agricultural development and over the last few decades it has found its way into formal crop improvement (Ceccarelli *et al.,* 2009). This has been in response to the need to improve the impact of research on the livelihoods of farmers. The reasoning has been that if farmer's priorities, needs and capacities are valued and better understood by researchers, extension agents and other professionals, they will be better equipped to make appropriate and sustainable recommendations (Scoones and Thompson, 1994), which, in turn, will positively influence farmer's choices and access to new technologies (Ravindra and Singh, 2019). Basically, PPB is a set of approaches that apply in situations where client demand for different varietal traits is poorly understood and difficult to diagnose with conventional market research methods such as in cases where the variability of the agro-ecological environment requires wide range of different genotypes, or producers are unable to obtain the complementary fertilizer and crop protection inputs needed for many new varieties (Ashby and Lilja, 2004). Participatory Plant Breeding (PPB)

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increases the benefits and is more effective at reaching women and the poor. There are many evidences that show that PPB approach improves the adoption of varieties to poor and resource poor farmers by including their preferences in the criteria for developing, testing and release of new varieties (Lilja and Dalton, 1997). It seems that from many aspects of PPB, the major concern is about the increase in costs on farm testing, more seed and experimental varieties will be needed, the trials need to be dispersed outside the experiment stations and different kinds of personnel may be needed to interact effectively with the farmers. Farmers need to be taken to research stations or trial sites where sufficient time is spent in interaction with them and they are involved at the design stage (Bhargava and Srivastava, 2019). Many scientists have supported decentralisation of research for plant breeding (Maurya *et al.,* 1988; Joshi and Sthapit, 1990; Sperling *et al.,* 1993; Sthapit *et al.,* 1994; Joshi and Witcombe, 2003; Witcombe *et al.,* 1996). Formal breeding systems in developing countries are highly centralised and do not focus on the problems of resource-poor farmers. This is quite clear by the poor adoption of officially released rice varieties in India (Maurya *et al.,* 1988; Joshi and Witcombe, 2003) and Nepal (Anonymous, 1995, Chemjong *et al.,* 1995). The study was undertaken to insight the Punjab farmers and breeders perception and also bring forth the problems as perceived by the breeders and farmers that may arise with the implementation of the PPB programme.

METHODOLOGY

The study was conducted in Punjab Agricultural University, Ludhiana and its research stations in different districts. The study comprised of two kinds of respondents viz. Breeders and Farmers. The study sample comprised of 50 breeders and 50 farmers. A list of breeders from the Department of Plant Breeding and Genetics and Regional Research Stations of PAU (Bathinda and Faridkot) was obtained and all the breeders were selected for this study. Also, 50 progressive farmers from the Seed Producers and Nursery Growers Association (SAPNA), Ludhiana were randomly selected to take their perception regarding Participatory Plant Breeding in Punjab. The selection of farmers from SAPNA was carried out because of their progressiveness and also that these farmers were approached first by the PAU for varietal trials. These conditions made it conducive for their selection and for appropriate responses to the questions in the questionnaire. The linkage mechanism referred to the concrete procedure, regular event, arrangement, device or channel which bridges the gap between the researchers and farmers and allows communication among them. The response of the breeders and farmers were taken on various linkage mechanism such as meetings, surveys, adaptive trials, demonstrations/Front Line Demonstrations, seminars/workshops, field days, problem identification etc. The response of the farmers was taken on a three-point continuum of always, sometimes and never with scores of 3, 2 and 1 respectively which was later analyzed and presented in Mean Scores. While the response of the breeders was taken on a dichotomous form of Yes and No. Perception was defined as the way in which the breeders and farmers understand or interpret various aspects of PPB such as its scope, benefits, opportunities, threats etc. The perception of the farmers and breeders was measured on a three point continuum of Agree, Neutral and Disagree with score of 3, 2 and 1 respectively. Whereas the problems referred to the obstacles as perceived by the breeders and farmers that can be faced while implementing Participatory Plant Breeding programme such as cost of this programme, time required, farmer profile, etc. The response of the both respondents was taken on a three point-continuum of Agree, Disagree and Can’t Say with score of 3, 2 and 1 respectively. A questionnaire was constructed to collect the data from the farmers. The questionnaire was prepared in local language i.e. in Punjabi to facilitate the farmers to easily understand and fill the same. The data were collected by distributing the questionnaire among the farmers and breeders. Proper precautions were taken to ensure unbiased response of the respondents by providing them necessary instructions after explaining the objectives of the study. In addition, discussions were also held with the farmers and breeders respectively for in-depth probing and understanding their perception about the PPB programme.

RESULTS AND DISCUSSION

The data in Table 1 revealed that the linkage mechanism used most often by the farmers was meetings held between breeders and farmers with a mean score of 2.34 and placed at rank 1 followed by training programmes conducted by PAU where breeders are invited as resource persons to share their knowledge with the farmers on different aspects of the crop breeding. The training programmes had a mean score of 2 and was placed at rank 2. Demonstrations/Front Line Demonstrations (FLDs) and informal discussion during field visits were placed at rank 3 and rank 4 with a mean score of 1.98 and 1.92 respectively. *Kisan Mela* was placed at rank 6 with a mean score of 1.62. Every month SAPNA farmers were coming for monthly meetings and training programmes which are regularly conducted by the extension wing of PAU for the farmers and are considered beneficial by them. PAU was also conducting more number of demonstrations and adaptive trials, etc. to connect more with farmers and expose them to new technology. These findings were in line with Gupta *et al.,* (2019).

Table 1: Distribution of farmers according to their linkage mechanisms with breeders (n=50)

S. No.	Linkage mechanism(s)	Mean Score	Rank
1.	Meetings	2.34	1
2.	Surveys	1.54	7
3.	Informal discussion during field visits	1.92	4
4.	Adaptive Trials	1.74	5
5.	Demonstrations/ Front Line Demonstrations (FLDs)	1.98	3
6.	Seminars/Workshops	1.46	9
7.	Field Days	1.48	8
8.	Training Programmes	2	2
9.	*Kisan Mela*	1.62	6

The data in Table 2 revealed that the 90 per cent of the farmers' main purpose of linkage with the breeders was to seek information regarding varieties of different crops followed by the purpose to give feedback regarding the varieties by 76 per cent of the farmers. A little more than 50 per cent of the farmers linked with the breeders to obtain the trials of new varieties.

Table 2: Distribution of farmers according to purpose of linkage with the breeders (n=50)

Purpose	f (%)
To seek information regarding varieties of different crops	45 (90)
To get trial of new varieties	27 (54)
To give feedback regarding the varieties	38 (76)

A perusal of data in Table 3 revealed that field day was the most used linkage mechanism of more than two-third of the breeders (78%) with the farmers followed by adaptive trials and front line demonstrations each used by 74 per cent of them respectively. Seminars/workshops were used by 64 per cent of the breeders as a linkage mechanism with the farmers followed by training programmes used by 56 per cent of the breeders. Surveys and problem identification were used by 46 per cent and 44 per cent of the breeders respectively. Only 16 per cent of the breeders linked with the farmers regarding varietal evaluation. It was found that PAU is regularly conducting the FLDs, adaptive trials, field days and training programmes from time to time and therefore, these linkage mechanism are most widely used by the breeders.

The data in Table 4 showed that the majority of the farmers and breeders agreed that the PPB will allow the farmers with the freedom of choice of traits in the varieties of crops which will further help in critical assessment of varieties by the farmers thereby leading to generation of appropriate varieties. While discussing

Table 3: Distribution of breeders according to their mode of linkage with farmers (n=50)

Linkage mechanism	f (%)
Surveys	23 (46)
Problem Identification	22 (44)
Research Planning	5 (10)
Varietal Evaluation	8 (16)
Informal discussions	5 (10)
Adaptive Trials	37 (74)
Front Line Demonstrations	37 (74)
Field Day	39 (78)
Training Programmes	28 (56)
Seminars/Workshops	32 (64)

Table 4: Distribution of respondents according to perception regarding various aspects of PPB

S.No.	Statements	Farmers (n=50)			Breeders (n=50)		
		A f (%)	N f (%)	D f (%)	A f (%)	N f (%)	D f (%)
1.	PPB may increase the acceptability of varieties to resource poor farmers	38 (76)	12 (24)	—	31 (62)	15 (30)	4 (8)
2.	PPB will raise the adoption level of the released varieties	43 (86)	7 (14)	—	42 (84)	8 (16)	—
3.	PPB will improve the rate of adoption i.e. the speed at which varieties are adopted by the farmers	46 (92)	4 (8)	—	40 (80)	10 (20)	—
4.	PPB may shorten the time of breeding programs to get appropriate materials into farmers' field	16 (32)	34 (68)	—	24 (48)	13 (26)	13 (26)
5.	PPB will help to maintain or increase plant genetic diversity in farmers' fields	28 (56)	22 (44)	—	31 (62)	11 (22)	8 (16)
6.	PPB carried out with farmer groups will improve farmers' organizational and social participation	40 (80)	10 (20)	—	45 (90)	5 (10)	—
7.	Individuals farmers' knowledge, skills and capacity to learn and experiment would increase with PPB	43 (86)	7 (14)	—	45 (90)	5 (10)	—
8.	PPB may increase resource poor farmers' access to improved varieties	38 (76)	12 (24)	—	31 (62)	15 (30)	4 (8)
9.	PPB involves higher research costs as compared to station-centered breeding	8 (16)	42 (84)	—	11 (22)	25 (50)	14 (28)
10.	PPB will provide the farmers with an opportunity to influence decision making in the release of varieties	42 (84)	8 (16)	—	42 (84)	7 (14)	1 (2)
11.	PPB will allow farmers with the freedom of choice of traits in the varieties of crops	46 (92)	4 (8)	—	41 (82)	8 (16)	1 (2)
12.	PPB makes use of traditional knowledge of the farmers	45 (90)	5 (10)	—	46 (92)	1 (2)	3 (6)
13.	PPB can be structured to provide opportunities for women to participate in the breeding programme	34 (68)	16 (32)	—	37 (74)	12 (24)	1 (2)
14.	PPB will strengthen research-farmer linkages	41 (82)	9 (18)	—	44 (88)	6 (12)	—
15.	PPB may help in documentation and validation of traditional knowledge of the farmers	29 (58)	21 (42)	—	43 (86)	6 (12)	1 (2)
16.	PPB will help in critical assessment of varieties by the farmers thereby leading to generation of appropriate varieties	48 (96)	2 (4)	—	48 (96)	2 (4)	—
17.	Generation of appropriate varieties through PPB will help in judicious use of funds for the dissemination of these varieties among the farmers	35 (70)	15 (30)	—	20 (40)	27 (54)	3 (6)
18.	Farmers engaged in seed production of crops will be capable of undertaking PPB	45 (90)	5 (10)	—	37 (74)	7 (14)	6 (12)
19.	Farmers are capable of contributing in breeding of crops through PPB	42 (84)	8 (16)	—	44 (88)	3 (6)	3 (6)
20.	PPB will lead to wastage of breeders' time	5 (10)	12 (24)	33 (66)	14 (28)	28 (56)	8 (16)

A=Agree, N= Neutral, D=Disagree

this point with the breeders, they mentioned that it has been observed that choice of traits differs among the farmers and breeders. Quoting an example for the same, one of the breeders mentioned that while they were aspiring for a high yield in a wheat variety, farmers preferred that the straw produced should also be in more quantity. More than 90 per cent of the farmers and breeders agreed that the PPB will make use of the traditional knowledge of the farmers in the development of new varieties. Majority of the farmers and breeders agreed that the PPB will raise the adoption level of the released varieties by the farmers involved and other farmers in that region as the varieties will be developed according to the requirements of the farmers involved belonging to a specific region. Majority of the farmers and breeders also agreed that the increase in adoption level will also result in increase of the rate of adoption i.e. the speed at which the varieties are adopted by the farmers. Majority of the farmers and less than two-third of the breeders (62%) opined that the PPB may increase the acceptability and accessibility of the improved varieties by the resource poor farmers. The findings were in line with the findings of Joshi and Witcombe (2003); Lilja and Aw-Hasaan (2002); Ashby and Lilja (2004); Mekbib (1997); Fukuda and Saad (2001); Moris *et al.* (1999).

Majority of the farmers and breeders agreed that the PPB carried out with farmers groups will improve farmers' organizational and social participation and also strengthen breeder-farmer linkages as farmers and breeder will be working on equal terms and sharing responsibilities and decision making. The findings were in line with the findings of Witcombe *et al.* (1996); Joshi and Witcombe (2003). Individual farmers' knowledge, skills and capacity to learn and experiment would increase with PPB was opined by majority of the farmers and breeders and they also mentioned that PPB will provide the farmers with an opportunity to influence decision making in the release of varieties. The findings were in line with the findings of Soleri *et al.* (2002). More than half of the farmers (56%) and less than two-third of the breeders (62%) agreed that PPB would help to maintain or increase plant genetic diversity in farmers' fields. The findings were in line with the findings of Cecceralli and Grando (2007); Ceccarelli *et al.* (2009) and Joshi and Witcombe (2003). Nearly one-third of the farmers (32%) and less than half of the breeders (48%) agreed that the PPB may shorten the time of breeding programs to get the appropriate materials into farmers' field. While 70 per cent of the farmers and 40 per cent of the breeders agreed that generation of appropriate varieties through PPB will help in judicious use of funds for the dissemination of these varieties among the farmers. More than half of the farmers (58%) and 86 per cent of the breeders opined that PPB may help in documentation and validation of traditional knowledge of the farmers as the farmers input are equally weighted in PPB. Majority of the farmers and breeders opined that farmers engaged in seed production of crops will be capable of undertaking PPB as well as farmers are capable of contributing in breeding of crops through PPB. Two-third of the farmers disagreed that PPB will lead to wastage of breeders' time because it will be ultimately lead to development of such a variety which will be adopted more by the farmers whereas 56 per cent of the breeders had a neutral stand for this statement. The findings were in line contrast with the findings of Ceccarelli *et al.* (2000) which showed that PPB increases research efficiency and does not lead to wastage of breeders' time.

A perusal of the data in Table 5 revealed that under the section of technical problems, majority of the farmers (90%) and 60 per cent of the breeders agreed that lack of farmers' knowledge regarding breeding techniques may slow down the breeding process causing delays in the development and release of the varieties. Majority of the farmers (94%) and 68 per cent of the breeders also agreed that scaling up of PPB to reach millions of farmers will prove to be difficult because covering a large number of farmers will be a difficult task. It is also one of the reasons why the breeders respondents didn't show their willingness. The findings further revealed that 74 per cent of the farmers were unable to say that data generated through PPB may be considered credible or not. The reason they mentioned was that they didn't know about the agencies which give credibility to breeding data as well as they didn't

Table 5: Distribution of respondents according to perceived problems regarding PPB

S.No.	Problems	Farmers (n=50)			Breeders (n=50)		
		A f (%)	D f (%)	CS f (%)	A f (%)	D f (%)	CS f (%)
A.	**Technical**						
1.	Data generated through PPB may not be considered credible	6 (12)	7 (14)	37 (74)	16 (32)	30 (60)	4 (8)
2.	Seed company representatives may be reluctant to market the varieties generated through PPB	11 (22)	6 (12)	33 (66)	32 (64)	18 (36)	—
3.	Lack of farmers' knowledge in this aspect may slow down the breeding process	45 (90)	—	5 (10)	30 (60)	20 (40)	—
4.	Scaling up this approach to reach millions of farmers is difficult	47 (94)	—	3 (6)	34 (68)	16 (32)	—
B.	**Economic**						
5.	PPB may be more costly than the conventional breeding programme	5 (10)	4 (8)	41 (82)	32 (64)	11 (22)	7 (14)
6.	Finding financial assistance to support the PPB programme will be a big challenge	18 (36)	13 (26)	19 (38)	40 (80)	5 (10)	5 (10)
7.	Conducting training/workshops for capacity building of farmers regarding breeding process may add extra cost	42 (84)	8 (16)	—	39 (78)	11 (22)	—
C.	**Institutional**						
8.	Lack of coordination among the stakeholders of various institutions	37 (74)	4 (8)	9 (18)	36 (72)	14 (28)	—
9.	Ownership problems may occur among farmers and breeders for the rights of the varieties production and distribution	36 (72)	6 (12)	8 (16)	42 (84)	8 (16)	—
D.	**Social**						
10.	Transformation of attitude and behaviour of the breeders to undertake PPB	32 (64)	8 (16)	10 (20)	20 (40)	21 (42)	9 (18)
11.	Transformation of attitude and behaviour of the farmers to undertake PPB	44 (88)	—	6 (12)	25 (50)	25 (50)	—

A=Agree, D=Disagree, CS=Can't Say

know all the aspects of the breeding data. Contrary to this, 60 per cent of breeders perceived that the data generated though PPB will be considered credible. Similarly, two-third of the farmers (66%) were not sure whether the seed company representatives would be reluctant to market the varieties generated through PPB while a little less than two-third of the breeders (64%) agreed to it. The findings were in line with the findings of Atlin *et al*. (2001) and Witcombe and Virk (2001). Majority of the farmers (84%) and breeders (78%) perceived that conducting training/workshops for capacity building of farmers regarding breeding process would add extra cost as the farmers need to be taught and made aware about every breeding process and technique. Majority of the farmers (82%) were not able to say whether the PPB may be more costly than the conventional breeding programme or not whereas a little less than two-third of the breeders (64%) agreed that PPB may be more costly than the conventional breeding programme as it will involve conducting training programmes and workshop to equip farmers with knowledge of breeding. But, at the same time they mentioned that the investments done on popularizing the varieties will be cut down as the varieties bred through PPB will be readily adopted by the farmers. Thus, overall PPB may not prove to be a costly venture. Similarly more than one-third of the farmers (38%) were not able to determine whether finding financial assistance to support the PPB programme will prove to be a big challenge or not whereas majority of the

breeders (80%) agreed that it will definitely be a challenge to find financial assistance for PPB programmes as its chance of success are not known yet. The findings were in line with the findings of Witcombe *et al.* (2005).

Majority of the farmers (74%) and breeders (72%) perceived that there would be a lack of co-ordination among the stakeholders of various institutions in conducting PPB as various social actors would be involved. Similarly under the institutional problems, majority of the farmers (72%) and breeders (84%) perceived that ownership problems will occur among farmers and breeders for the rights of the varieties production and distribution. The findings are in line with the findings of Smith *et al.* (2001); Morris *et al*. (1999) and Tripp (1997). The discussion with the breeders on this aspect revealed that IPR pertaining to the ownership of varieties is a very tedious task and therefore, it is better that the advanced material lies in safe hands. Under the social problems, a little less than two-third of the farmers i.e. 64 per cent and 40 per cent of the breeders believed that there will be a problem in transformation of attitude and behaviour of the breeders to undertake PPB. On the other hand, majority of the farmers (88%) and half of the breeders believed that there will be a problem in transformation of attitude and behaviour of the farmers to undertake PPB. It can be inferred that the farmers were positive regarding the transformation of attitude and behaviour in both the farmers and breeders in hope that PPB programme will be undertaken and the farmers would get an opportunity to present their voices regarding the development of varieties fulfilling their requirements for the same.

CONCLUSION

Over intensification of agriculture over the years along with industrialization, economic and infrastructural development has lead to degradation and over-exploitation of natural resources of the state especially water, land and biodiversity. Hence, for maintaining the state‘s economic prosperity in future, concerted efforts such as PPB would be required to protect the environment and promote sustainable use of natural resources. The farmers of the state of Punjab have been very progressive with time and would be readily available to accept programmes such as PPB if it helps them to increase their economic efficiency and come out of the stagnation of agriculture in the state. As majority of the farmers as well as the breeders agreed that the PPB will improve the rate of adoption of the varieties among the farmers, increase the farmers' organizational and social participation, increase resource poor farmers' access to improved varieties and allow the farmers with freedom of choice of traits in the varieties of the crops. Lack of farmers knowledge, finding assistance to support the PPB, added cost in conducting training/ workshops and ownership problems of the varieties production and distribution were found to be the major anticipated problems that may occur with PPB. A pilot project needs to be started on PPB to see the feasibility of this approach in Punjab where the initial findings of this study could be tried and tested in real conditions. PPB can also focus on niche areas such as problematic soils, organic farming, etc. This will depend on the emerging needs of the state and future thrust areas. And lastly, the funding agencies need to encourage the PPB approach in crop improvement programme. The findings of the study will help the policy makers and researchers in designing and implementing respectively the various aspects of PPB in such a way that it benefits everyone involved and justifies the investment made under the breeding programmes.

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