Participatory Varietal Selection in Watershed Programs
Principles and Practices

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1. Introduction

Rural livelihoods are diverse and many. Cultivating crops to meet the food needs, fodder needs of the cattle (in the mixed farming systems) and to generate income is the most important form of enterprise in India, where more than 65% of the population depend on agriculture for their livelihoods (Central Research Institute for Dryland agriculture [CRIDA] 1997).

The productivity of any crop cultivar depends not only on the genotype but also on the soil nutrient status, moisture availability and temperature, and their interaction among themselves and with several pests and diseases. Watershed with integrated genetic and nutrient resources management (IGNRM) is considered to be the most appropriate way for improving the livelihoods and environment sustainability simultaneously (Wani et al. 2002).

Selection of crops and improved cultivars within each crop to suit the agro-ecological regions is a major activity in the watershed program. The improved cultivar choice is done through the interaction involving scientists and farmers, and farmer organizations. Farmer participatory approach for the identification or breeding of improved crop cultivars can be usefully categorized into Participatory Varietal Selection (PVS) and Participatory Plant Breeding (PPB). Both PVS and PPB are relatively new approaches for crop improvement (Maurya, Bottrall and Farrington 1988; Witcombe *et al.* 1996 a). In IGNRM, we followed PVS extensively in several crops over the years.

While PVS involves selection of suitable varieties from finished or near finished products arising from on-station crop improvement programs through a process of evaluation by farmers on their fields and under their own management, and PPB involves selection from the breeder-developed segregating material by the farmers and is a logical extension of PVS. PVS is a more rapid and cost effective way of identifying farmer-preferred cultivars if a suitable choice of cultivars exists and therefore it should be a first choice. On the other hand, since PPB is more resource consuming, and needs to be used

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when the research process fails to identify any suitable cultivars for testing. PPB can exploit the results of PVS by using identified cultivars as parents of crosses (Witcombe *et al*. 1996).

We describe below briefly the principles and practices of farmer PVS methods as it applied in watershed program.

2. Classical plant breeding

The classical plant breeding (CPB) is directed evolution of crop plants of economic importance. The methods of breeding in the classical sense are governed by the theory of genetics. A classical plant breeder, after examining the needs of the farmers, consumers and trading community and the agroecological conditions, in particular, day length, temperature, rainfall-amount and distribution, determine the objectives of the breeding program and formulate the selection criteria- the traits that should be selected for. The weightage given to different traits in the selection also depends on the correlation of traits with the target economic trait and the economic importance of each of the correlated traits.

The steps involved in the classical program are:

1. Objectives of the program
2. Adaptation and agroecological features
3. Traits related to the final economic product
4. Selection of the parents
5. Generating variability by crossing the parents
6. Selection in the segregating generations
7. Testing the products for yield and other economically important traits
8. Releasing the product through national testing program
9. Adoption in the farmer fields

All the steps are generally implemented in the institutional set-up except the step nine on adoption, which involves the farmers and testing the products in the farmer fields under farmers supervision and management.

3. Participatory varietal selection:

The participatory varietal selection (PVS) is the selection of suitable varieties from finished or near finished products arising from plant breeding programs through the process of evaluation by farmers on their own fields and under their own management (Joshi and Witcombe, 1996). PVS program involves the farmers/consumers at various stages in the breeding programs. In some cases, right from the choice of parents to final product development and adoption is carried out involving farmers/consumers on farmers fields. In some other cases, segregating materials developed in research stations are evaluated on farmers fields and the farmers are asked to select the plants they like. Both of these situations constitute PPB. However, more often, the final sections developed in research stations are evaluated in farmers fields and farmers are asked to choose amongst the products.

A successful PVS programme has four phases: a means of identifying farmers' needs in a cultivar, a search for suitable material to test with farmers, experimentation on its acceptability in farmers' fields and wider dissemination of farmer-preferred traits/cultivars (Witcombe et al. 1996). – ref missing

4. Examples of PVS

There are several examples of PVS that have been adapted to a varying degree in various crops. PVS has been used to identify farmer acceptable cultivars in rice (Maurya, Bottrall and Farrington 1988, Joshi and Witcombe 1996, Sthapit, Joshi and Witcombe 1996), in chickpea (Maurya, Bottrall and Farrington 1998), in common bean (Mekbib 1997), in pearl millet (Baidu-Forson 1997; Weltzien *et al.* 1996), in potato (Thiele *et al.* 1997), in *rabi* sorghum (Rana *et al.* 1998) and in finger millet (Gowda *et al.* 2000).

5. Comparison of CPB with PVS methods

The advantages and disadvantages of CPB and PVS methods are contrasted below. Further details may be found in Witcombe et al. (1996).

CPB methods	PVS methods
i. Farmers needs though considered in setting up the objective of the program, are partially met in the institutional frame work	i. The farmer/consumers needs are fully met as the farmers are involved in all the steps
ii. Specific adaptation features are incorporated partially as the breeder has limited choice of locations for testing	ii. Specific adaptation features are fully

incorporated in the materials as farmers of different regions are allowed in the program setting and selection process

iii. Providing logistics to support the program is less cumbersome iii. Providing logistics to support the program is more cumbersome

iv. Opportunities to control variability due to environment is high and hence the genetic gain is expected to be high iv. Opportunities to control variability due to environment is low and hence the expected genetic gain is high

v. Success rate of adoption of the product by farmer is lowv. Success rate of adoption of the product is high

vi. Genetic vulnerability is caused by widely adapted varieties being grown over large areas vi. Varieties with specific adaptation to individual environments stand less risk for genetic vulnerability.

6. Crops and varieties in the watershed program

To help farmers to choose the crops and varieties within the crops, the seeds of several crops and varieties in each crop were provided to various farmers in villages of the watershed programs. These are briefly summarized here for 2002 and 2003.

Seed distributed in the watershed villages in *kharif* season 2002

S. No.	Crops	Varieties	Quantity of seed (Kg)
1	Sorghum	CSV 15, JJ 1041, SPV 1022, PSV 16, ICSV 745, SPV 1411, SPV 1359, NTJ 2	2154
2	Maize	Bioseed, Ratna 2232, Ratna 2201	1960
3	Black gram	T 9	150
4	Pearl millet	ICTP 8203	150
5	Castor	Kranthi, Jyothi	826
6	Pigeonpea	ICPL 87119	1676
7	Green gram	MGG 295	175
8	Groundnut	ICGS 76, ICGS 11, ICGS 44, ICGS 86590	2904
9	Chickpea	ICCC 37, ICCV 10, ICCV 2, KAK 2, Annigeri	5284

Seed distributed in the watershed villages in *kharif* season 2003

S.No.	Crops	Varieties	Quantity of seed (Kg)
1	Sorghum	SU 658, CSV 15, PSV 16, JJ1041, NTJ 2, SPV 1411, PVK 801, ICSV 745, SPV 1359, ICSR 93034, ICSV 93046, ICSV 745	2985
2	Pearl Millet	ICMV 221, ICTP 8203	1480
3	Maize	Ratna 2223, Ratna 2201	10545
4	Blackgram	T9	500
5	Greengram	MGG 295	2615

6	Castor	Kranthi, Jyothi, Haritha	5030
7	Pigeonpea	Asha, PRG 100, ICPL 88039	5255
8	Groundnut	ICGS 11, ICGS 76	920
9	Chickpea	ICCV 2, ICCC 37, ICCV 10	Nil
10	Sunflower	GK 2002	300
11	Safflower	Spiny, Non-spiny	120

7. Feed back of the farmers from the 2002 watershed program

The sorghum varieties CSV 15 and PVK 801 were well received by the farmers for the rainy season. Shallow sowing was recommended in pearl millet to overcome the poor germination due to deep sowing. Farmers of Bundi watershed, Rajasthan did not like the maize varieties and these varieties were not preferred in market due to poor grain quality. Asha variety of pigeon pea though failed to perform in Nalgonda district despite having wilt resistant than local, showed good performance in deep/black soils. It was appreciated for good cooking quality. Hence, early varieties are recommended for shallow/red soils. Castor varieties showed good response amongst farmers and other castor varieties can be tried with farmers. Groundnut varieties received mixed response from farmers. Though they had good pod yield, difficulty in sowing by using tropicultor and selling the produce in the market due to bold seed posed problem.

8. Feed back of the farmers from the 2003 watershed program

Varieties preferred by farmers have been supplied during *kharif* 2003 and cropping season is in progress. Feedback on this will be available once the crops are harvested.

9. Conclusions

PVS is effective and reliable for identifying appropriate cultivars for resource poor farmers. Farmers and their families assess all major parameters relevant to farmers and not just limited set of characteristics measured in the plant breeders' trials. The identification of farmer preferred varieties (traits) will form a guideline for the conventional plant breeding.

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