WIRFP Farmer-managed Participatory Research for Varietal Selection

Introduction

Resource-poor farmers seldom have access to technologies such as new crop varieties that may improve their livelihoods. Many farmers grow old varieties or landraces, and hence fail to benefit from the most modern products of plant breeding. Adoption of new varieties is lowest amongst the poor.

One of the main reasons for low cultivar replacement rates is that farmers have inadequate exposure to new cultivars. Farmers also often think new varieties are not better than those they already grow, so they are unwilling to try them.

Figure 1. **Farmers from the Western India Rainfed Farming Project inspecting the results of a PVS trial of blackgram.**

Gramin Vikas Trust is implementing the Western India Rainfed Farming Project, funded by the Department for International Development, United Kingdom; Government of India; State Governments and Krishak Bharati Cooperative Limited (KRIBHCO). The project is working for sustainable livelihood enhancement of poor women and men in highly risk-prone, tribal-dominated areas covering seven districts - namely Jhabua, Dhar and Ratlam (Madhya Pradesh) Banswara and Dungarpur (Rajasthan), Dahod and Panchmahals (Gujarat). This paper presents the results of collaborative research in participatory plant breeding with Gujarat, Rajasthan and Madhya Pradesh agricultural universities.

Participatory varietal selection (PVS)

One way of increasing the speed of adoption of new varieties is for farmers to be given a wide range of novel cultivars to test for themselves in their own fields. The method we use is participatory varietal selection (PVS).

The cultivars should be selected carefully. To save time, and ensure availability of seed, we have used already released cultivars, not only from the target region, but from other regions or countries.

For example, in India, rice and maize cultivars can be found that have only been released and widely grown in a single state, yet have a potential to be useful in others.

A successful participatory varietal selection programme has four phases:

1. Participatory evaluation to identify farmers' needs in a cultivar;
2. A search for suitable material to test with farmers;
3. Experimentation on its acceptability in farmers' fields;
4. Wider dissemination of farmer-preferred cultivars.

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Participatory plant breeding (PPB)

PVS is limited to employing the existing variation among cultivars, and sometimes well-accepted cultivars cannot be found. Participatory plant breeding (PPB), in which farmers select from segregating material, is a logical extension of PVS and is desirable when the possibilities of PVS have been exhausted (see *WIRFP Participatory Plant Breeding: Concepts and Examples*, May 2002).

The types of PVS

Descriptions of various approaches to PVS are presented here but the details will vary, depending upon the resources available.

Mother and baby trial system

Mother trials

Single-replicate designs (mother trials) are used to assess the relative performance of varieties. Many entries are grown together in the same field. The trials are researcher-designed but farmer-managed, and they are replicated across villages. They not only serve as demonstration plots or focal points for discussions, but are also specifically designed to provide quantitative, analysable data on yield.

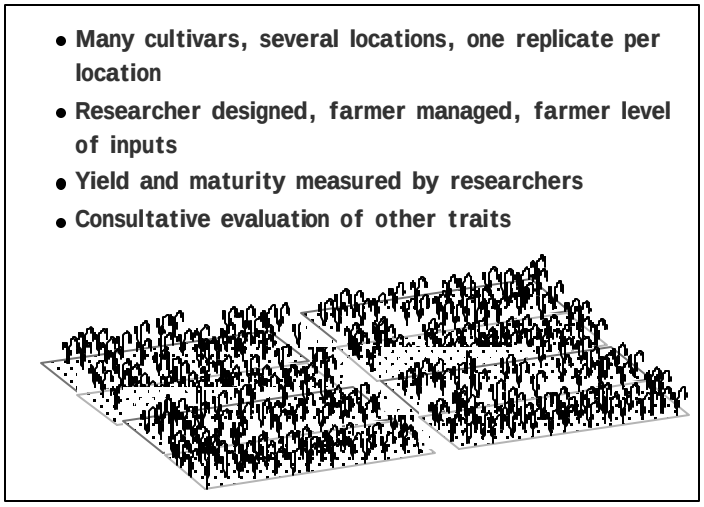

Figure 2. **The mother trial**

Baby trials

The project used the term 'Farmer-managed participatory research (FAMPAR) varietal trials' to describe the baby trials in the mother and baby trial system.

The mother and baby trial system recognises the difficulty of obtaining reliable yield data from many, widely dispersed participatory trials, so in these baby trials only farmers' perceptions on yield are collected. A farmer grows one new variety alongside the local variety under the customary management practices. Replication is across farmers, either in the same village or across villages. Even if there are many new varieties, only one is tested by any one farmer.

The trials are evaluated by participatory methods - farm walks, Focus Group Discussions and household-level questionnaires. Qualitative data, (for example, on yield) are obtained by project staff from interviews with farmers.

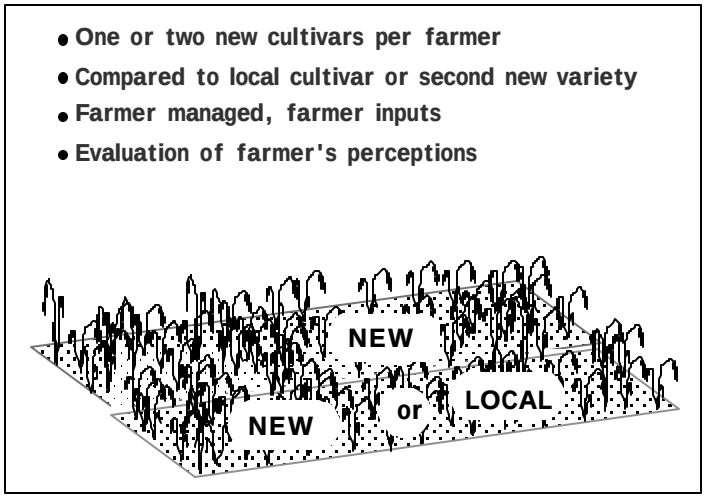

Figure 3. **The baby trial**

Informal research and development trials (IRD)

The mother and baby trials are followed by methods of popularisation (Table 1). Large numbers of small packets of seed are distributed free of cost to farmers. Once a variety is popular or released then seed sales and dissemination follow. The differences between mother trials, baby trials and IRD are summarised in Table 2.

IRD is a cheaper form of PVS because it uses less intensive evaluation. In IRD programmes, the small quantities of seed given to farmers are of the same range of varieties used in the FAMPAR baby trials.

Table 1. **The stages of popularisation.**

Stage	Process
Initial	Mother and baby trials
Adaptive*	IRD
After recommendation by project or SAU	Seed sales and dissemination

* can be done simultaneously with mother and baby trials.

Table 2. **The differences between mother trials, baby trials and IRD.**

Mother	Baby	IRD
Obtain yield data	Obtain perception data	Popularise
Few trials	Many trials	More trials than baby trials
Researcher designed and supervised	Simple design - farmer supervised	No design
All entries, single-replicate design, small plots	One or two entries, simple design, large plots	One entry – the identified variety
Yield is measured	Yield is not measured	Yield is not measured
Farmer's perceptions usually measured by matrix ranking	Farmer's perceptions measured by household-level questionnaires	Farmer's perceptions measured informally (by anecdote)
Farmer's management but more weeding	Farmer's management	Farmer's management
Farmer can be compensated for growing the trial	Farmer bears the cost and risk (but has free seed)	Farmer has free seed and benefit
Repeated on research station as a replicated design	Not repeated on research station	Not repeated on research station

No monitoring or participatory evaluation is done during the growing season, but farmers' perceptions are evaluated after harvest, using informal interviews.

In IRD the subsequent adoption and farmer-to-farmer seed dissemination provides the evidence for the degree of acceptance of each variety.

Mother and baby trials satisfy the needs of research, extension, and the farmer, while IRD is predominantly targeted at extension.

Kalinga III: A case study in rice

Farmers of rainfed uplands require varieties that mature in less than 100 days, but still produce a reasonably good yield of grain and fodder. Farmers greatly appreciate early maturity because it shortens the hunger gap and reduces the risks from drought when the rains stop too soon. An early harvest also fetches a higher market price if the farmer sells grain as part of his or her livelihood strategy.

We started the PVS programme in rice by asking farmers what they desired in their ideal variety (Table 3). The PRAs (participatory rural appraisals) revealed that the improved cultivars already on the market did not meet the farmers' needs. They had one or more undesirable traits and usually took too long to mature. The PRAs proved to be a quick and effective method of identifying and characterizing the landraces the farmers grew. The results of subsequent trials showed that they were an essential first step in choosing which cultivars should be tested with farmers.

Following the PRAs, we found over 10 varieties in various states that did meet farmers' needs, and tested them with farmers in many baby trials. Each farmer grew a single new variety alongside the local variety in the same field without any changes in management.

Table 3. **Focused PRAs conducted by Western India Rainfed Farming Project.**

Crop	Farmer-preferred traits
Rice	**Extra early (70 days) to early (85 days) maturing types; tall, non-lodging types; for upland situations with direct-drilling.**
Maize	**Extra-early (75 days) to early (85 days) maturing types; white, flinty grains.**
Black gram	**Early, spreading type with bold, shiny grains.**
Chickpea	**Early (70 days) maturity with less water requirement, better insect resistance and high market price.**

The performance of Kalinga III was outstanding (Figure 4). Farmers liked its drought-escaping earliness (Figure 5) and its higher yield than local early-maturing landraces. In baby trials, Kalinga III yielded over 40% more than local varieties. It also had superior grain quality, with thin husks and grains that remained unbroken on dehulling, and a finer grain with a better taste than local landraces.

In the year following the first trials, demand for Kalinga III seed exceeded supply. In subsequent years, more farmers were able to participate because they obtained seed from the large amount of seed saved by farmers who had already grown the new variety. Over three years, Kalinga III spread from the initial three study villages to more than 100 villages (figures 6 and 7).

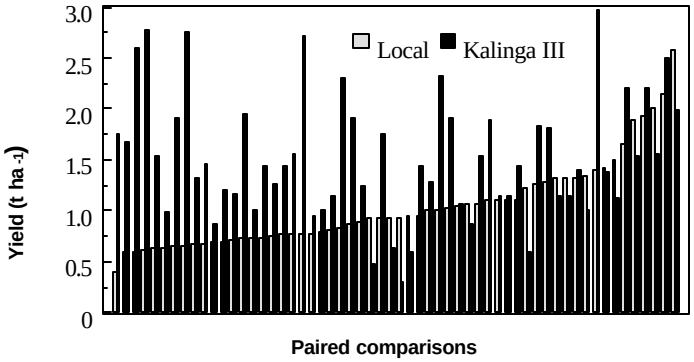

Figure 4. **Grain yield of the rice cultivar Kalinga III and local landraces, rainy season 1994.**

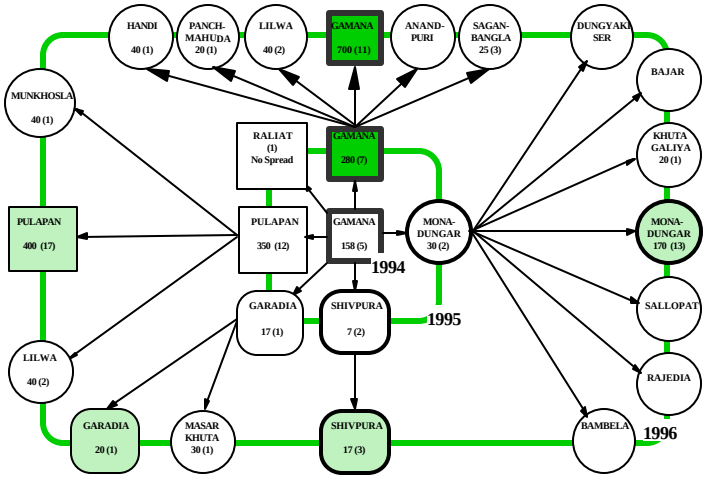

Figure 6. **Spread of Kalinga III from Gamana, Rajasthan, 1994-1996. Villages that occur once are indicated by a circle with a fine-lined border. Each village that occurs more than once has a unique symbol that is shaded for second- and third-year adoption. Seed distribution from the first harvest is indicated by thin arrows, and from the second harvest by thick arrows. Figures refer to kilograms of seed sown, and the numbers in parentheses refer to the number of households.**

Figure 5. **A happy farmer displays the results of PVS. On the left is Kalinga III, which has matured much earlier than the local variety on the right.**

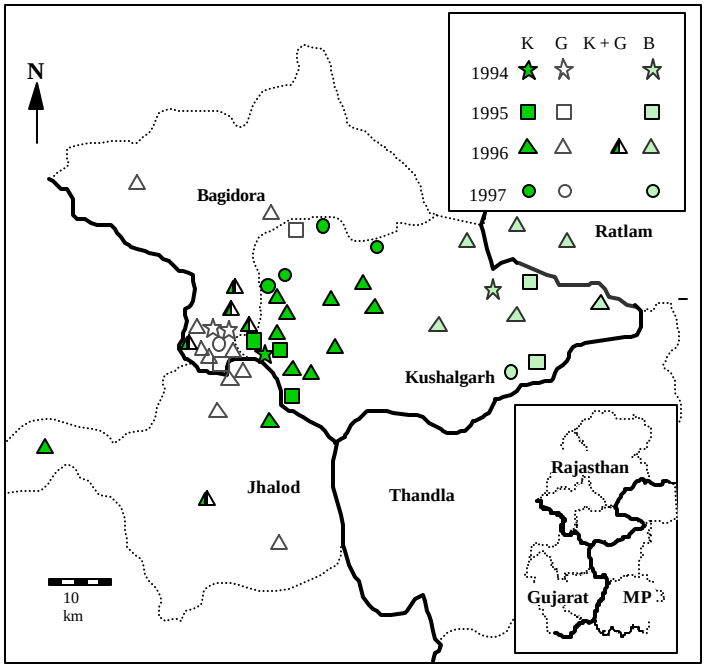

Figure 7. **Map of project area showing villages known by 1997 to have adopted the new rice variety Kalinga III, from an initial group of three study villages.**

K = originating from Kompura; G = originating from Gamana; K+G = originating from both Kompura and Gamana; B = originating from Bijori.

A case study in chickpea

Farmers were asked to compare four new varieties of chickpea with their local variety for many traits, including degree of pest attack, crop maturity, seed size and colour, taste, and market value.

From farm walks (see page 8), all farmers were aware of the four chickpea varieties, so they could make judgments on their overall preferences (Figure 8). Farmers were asked whether they would purchase seed of a new variety.

A marked preference was shown for the cultivars that had a good combination of earliness and yield. There was a 35-fold preference for ICCV 2, the most preferred cultivar, over ICCC 4, which was the recommended cultivar for the area (Figure 9).

ICCV 2 and ICCV 88202 had the most preferred combination of yield and earliness, followed by ICCV 10, which was high yielding but late to mature.

The cultivars ICCV 37 and ICCC 4 were markedly inferior to the local cultivar, Dahod yellow, because they flowered later but but failed to yield more.

Farmers prefer early cultivars because grain prices are higher early in the season and because they perceive that earlier-maturing cultivars will escape drought caused by receding soil moisture.

Figure 8. **Farmers and scientists examine a crop of the chickpea. The new varieties were preferred by farmers over the local landraces because of their earliness and yield.**

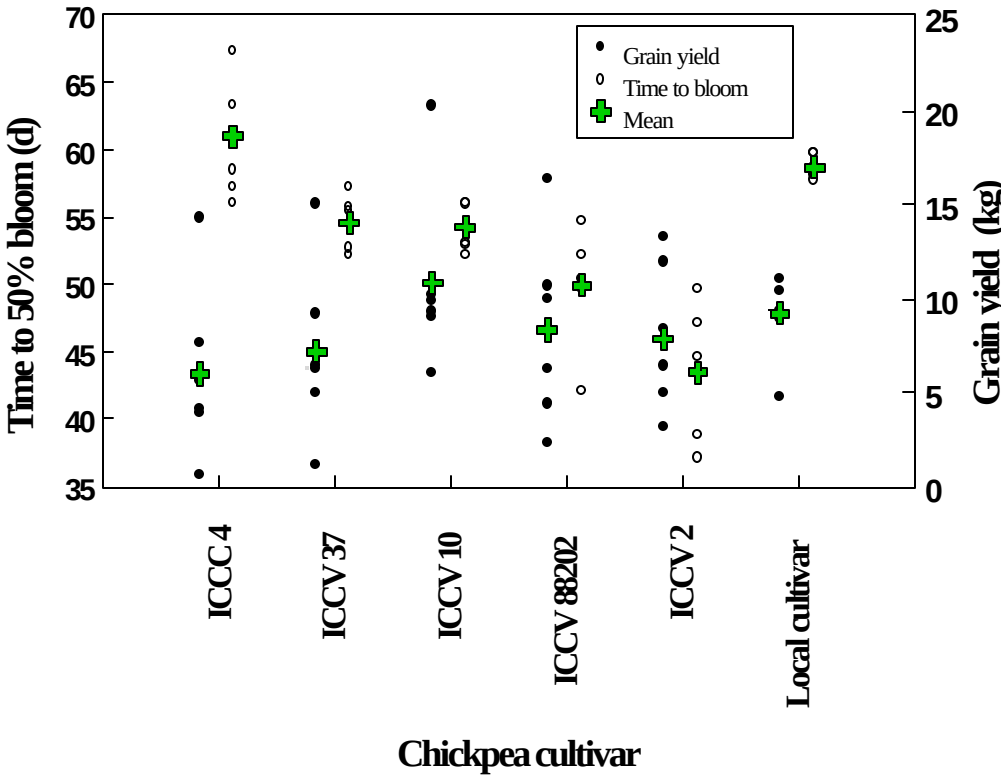

Figure 9. **Grain yield in six villages, time to bloom, and in five of the six villages, and mean grain yield and time to bloom across villages of six chickpea cultivars, post-rainy season 1992-93.**

A case study for black gram

Black gram was found to be the most important pulse crop in the cropping system of the project area. It is grown both as a mixed crop or an inter-crop with maize, and as a sole crop on many fields with poor soil fertility and stony, hilly areas.

An exploratory PRA revealed that:

- Farmers grew two landraces for different reasons (Table 5);
- Both the landraces were highly susceptible to powdery mildew and pod borer;
- Farmers had never seen or heard of any of the new disease-tolerant cultivars.

Table 5. **Local landraces of black gram**

Variety	Maturity (days)	Grain type	Other characters
Telia	70-75	Shiny, black bold seeds	Spreading type, fetches higher market price, as people in urban areas prefer shiny grains. Grown on better land for good yields. Susceptible to powdery mildew.
Kuvestya or Bhurya	75-80	Dull, black, medium-bold seeds	Non-spreading type. Pods with hairy structures. Less shattering type, highly susceptible to powdery mildew. Fetches lower price. Mostly grown as mixed crop with maize.

Figure 9. **Powdery mildew on a local landrace of black gram. The local varieties were susceptible to this disease, so farmers preferred the new cultivars, which were mildew-resistant.**

Following the PRA, a search for new back gram cultivars identified four promising possibilities (Table 6). Trials of four new varieties were conducted in each of three villages - one each in Gujarat, MP and Rajasthan. Focus Group Discussions (FGDs) took place after farm walks in the villages (see page 8).

The two most preferred cultivars, TPU-4 and IU 8-6, were liked for their higher yield (the pods were borne on bunches of 4-5 pods, whereas the local landrace had only one or two pods per bunch).

All the farmers commented on the lower pest attack in all the test varieties.

Overall, IU 8-6 was the most preferred cultivar as it had a better grain colour than T-9. Neither T-9 nor IU 8-6 are recommended by any of the extension services in the three states in which trials were conducted.

Table 6. **Black gram cultivars identified in the search for new varieties**

Cultivar	Duration (days)	Grain type	Plant type, disease reaction	Organisation of origin	Release details
T-9	80	Small, light, shiny	Semi-erect, highly susceptible to powdery mildew	CSAU, Kanpur	National release 1975
TPU 4	80	Medium-bold, dull black	Spreading type pod bearing in bunches, resistant to powdery mildew	BARC, Trombey, Mumbai	National release 1993
IU 8-6	75-80	Medium-bold, shiny black	Semi-erect, field tolerance to powdery mildew	INKVV, Indore, MP	NR*
IU 1-19	80	Medium-bold, dull black	as IU 8-6	As IU 8-6	NR

* NR = not released

PVS in summary

The importance of the approach

Most of the genotypes tested in the PVS programme have been released cultivars and not advanced lines. The released cultivars that were tested were unknown in many parts of their areas of adaptation because the areas for which they were recommended were imperfectly defined, and because they were inefficiently popularised.

The important features of the research were as follows:

- PRAs to identify the major characteristics of the local landraces. Cultivars unacceptable for easily defined characters such as grain type, crop duration and plant height were avoided.
- Identification of suitable improved, released cultivars provided a large number of choices for farmers.
- Testing in the most appropriate environment, the farmers' fields, with unchanged farmer management.
- Farmers and their families assessed all major farmer-relevant parameters - for example, taste, cooking quality, market value - not just the limited set of characteristics measured in plant breeders' trials.
- Farmer acceptability of cultivars assessed by measuring adoption in subsequent seasons.

Our results showed that farmers can obtain considerably higher yields by growing different cultivars without change in management. It means that the promotion of a recommended package of practices can be counter-productive, since it dissuades risk-averse farmers from trying new cultivars. The package of practices also persuades plant breeders to test cultivars under high levels of management that are atypical of resource-poor farmers' fields.

Our PVS programmes have been carried out over a number of years, with several crops and with many farmers. A general pattern has emerged showing that released recommended cultivars are rarely preferred (Table 7). It showed that some cultivars are being recommended outside their area of adaptation (for marginal areas when they are only appropriate for favourable environments), and that varieties that should be more widely recommended are recommended for too small an area.

Table 7. **Cultivars identified by PVS in the Western India Rainfed Farming Project**

Crop	Performance of recommended cultivars	Cultivars tested*		Cultivars identified	Release location	Year of release
		Rel.	Pre-rel.			
Rice	All recommended cultivars tried failed in farmers' fields	9	7	Kalinga III	Orissa Gujarat	1983 1955
Maize (white)	Recommended cultivar not distinguished from local by farmers	3	3	Shweta	U.P.	1980
Chickpea	One of the recommended cultivars, Dahod yellow, is the local cultivar. Other failed.	4	1	ICCV 2 ICCV 10 ICCV 88202	A.P. SZ** Not rel.	1989 1992 Not rel.
Black gram	Recommended cultivar T-9 was less preferred. Others not tested as very old.	2	2	TPU-4 IU 8-6	National Not rel.	1992 Not rel.

* Rel. = released cultivar. Pre-rel. = pre-released cultivar.

** SZ = Southern Zone, comprising A.P., southern M.P. and Tamil Nadu.

Tips for successful PVS

- Only one cultivar per farmer.
- Comparison of the new cultivars with local cultivars.
- Management practices and inputs are those customarily used by the farmer.

Benefits of PVS

PVS provides valuable information to breeding programmes. It can identify general traits for adaptation to environmental conditions or to cropping systems, such as when the crop is sown or how long it takes for the crop to come to maturity. PVS can also identify specific traits or characteristics wanted by farmers in particular areas.

Participatory Evaluation

Farm walks

The trials can be evaluated with varying degrees of intensity, depending on the resources available. One of the most useful components is the 'farm walk', in which the participating farmers visit each other's plots. This allows each cultivar to be assessed by a group of farmers on its performance across all the baby trials. It is the farm walk that allows comparative data to be collected on all the varieties in a trial.

Focus Group Discussions (FGDs)

Before and after the harvest, FGDs are carried out and data recorded on all aspects of the test entries, including taste, market value, threshing characteristics and storability. The FGD uses a standard proforma that has to be completed, but which allows the comments and the overall conclusions of the group to be recorded in a narrative fashion.

A 'matrix ranking' of the varieties is completed in which the varieties are ranked trait by trait. Although the ranking is done for many traits, the overall ranking on the acceptability of the varieties is the most important.

Household-level Questionnaires (HLQs)

Household-level questionnaires can be completed for individual households. These assess the reactions of household members to the variety they grew.

HLQs allow the assessment of every participating household, and reliable percentage scores can be obtained.

The questions posed include:

- Is the flowering time of the new variety earlier/same/later than the local variety?
- Is the yield of the new variety better/same/worse than the local variety?
- Is the grain quality of the new variety better/same /worse than the local variety?
- Is the market price of the new variety higher/ same/lower than the local variety?

Most importantly, an overall assessment of the desirability of the variety to the farmer is determined by asking:

- Overall, is the new variety better/same/worse than the local variety?

Building on the success

The Western India Rainfed Farming Project (WIRFP) now has probably the largest - certainly the most diverse - PVS programme of any development project. Collaborative arrangements for PPB programmes are in place with three universities* in Madhya Pradesh, Rajasthan and Gujarat. These programmes include six crops: maize, rice, horsegram, black gram, niger and sunn hemp.

A big advantage of this multi-university approach is that good varieties identified in one state can be entered in formal trials in three states covered by the WIRFP. Official release or recommendation of a variety helps in the dissemination of a variety. This approach should help ensure that varieties that are adapted to the WIRFP are not recommended in only a single state.

The PVS programmes follow the principles described in this paper, and products from PVS in rice, maize, black gram and chickpea are already in advanced trials. Considering the impact that just one new variety can have on improving farmers' livelihoods, the potential impact of this collaborative programme is immense.

* Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Madya Pradesh; Maharana Pratap University of Agriculture and Technology Udaipur, (MPUATU), Rajasthan; and Gujarat Agricultural University (GAU).

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