Participatory Varietal Selection: A Case Study on Small Millets in Karnataka

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Modern plant breeding has catered more to the needs of rich farmers who could afford high management under irrigated situations. In contrast, subsistence farmers growing millets in unfavourable environments use low levels of inputs and have not been benefited by high yielding variety (HYV) technology. In the present study, the usefulness of the participatory approach for identifying cultivars for harsh environments and acceptable to resource poor farmers has been demonstrated. In little millet five varieties, *viz.*, CO 2, PRC 3, OLM 20, Sukshema and TNAU 98 were selected for testing on farmers fields. Trials was conducted at Jekinakatti village of Savanur taluk and Chandapur Tanda of Ranebennur Taluk during 2002; Harabagonda village of Byadagi Taluk during 2003 in Haveri district. Simillary, for foxtail millet study was carried out in Metriki, Balukundi (during 2002) and Janekunte village (during 2003) of Bellary District using five varieties, namely, HMT 100-1, RS 118, TNAU 173, Krishnadevaraya and Narashimharaya and for finger millet, varieties were GPU 26, GPU 28, MR 1, L 5 and Indaf 9. Trials was conducted at Koda (Hirekerur Taluk) and Bisanahalli (Byadagi Taluk) of Haveri District; Badeladaku (Kudligi Taluk) and Hirekolach (Hivinahadagali Taluk) of Bellary district Kharif 2002. In Pre- and post harvest Focus Group Discussions (FGDs) revealed that the variety "Sukshema" in little millet "HMT 100-1" in foxtail millet and "GPU 28" in finger millet meet the criteria of farmer's requirement. Farmers also opined that the new variety has better grain and fodder yield potential and lodging resistance and they would adopt them in future.

Key Words: Little millet, Foxtail millet, Finger millet, Participatory selection

Introduction

Among rainfed crops, small millets as a group figure prominently. India is largest producer of small millets, which are often referred to as coarse cereals. Realisizing the nutritional superiority of these grains they are now considered as nutri–cereals (Nutritious grains). Small millets grown in India are finger millet, kodo millet, foxtail millet, little millet, proso millet and barnyard millet, which account for about 2.7 million ha and their cultivation extending from sea level in coastal Andhra Pradesh to 8,000 feet above sea level in hills of Uttarakhand and North-Eastern states. These crops are grown in diverse soils, varying rainfall regimes and in areas widely differing in thermo- and photo-periods. The resilience exhibited by these crops is helpful in their adjustment to different kinds of ecological niches and have made them quite indispensiable to rainfed, tribal and hill agriculture where crop substitution is difficult. That is why it is important to enhance production and productivity of these crops to ensure food and nutritional security.

In Karnataka, these grains are mainly used as food for human consumption. The straw is a precious fodder for bovines. The grain is processed and consumed in traditional way and almost the entire produce is utilized at the farm/ village level. Inspite of superior nutritional value of grains, their use is confirmed more to rural areas and very little finds its way to urban markets. The promotion of these crops can lead to efficient natural resource management and holistic approach in sustaining precions agro-biodiversity. Karnataka state accounts 50 per cent of the area; 54 per cent of total finger millet production of the country. Finger millet is being grown widely in southern part of the state while little millet and foxtail millet are important for Northern Karnataka.

Although, many varieties have been released for cultivation in these crops their adoption by farmers is minimal. In vast dry land areas where these crops are grown, situations are differing from the areas prevailing as the research station are encountered. As a result, improved varieties found superior well in research stations may not perform upto the expectation in farmers field (Thiele *et al*., 1997; Baidu–Forson, 1997; Sthapit *et al*., 1996). This situation has lead to farmers not showing preference to new varieties leading to negligible coverage by them in farmers field. Hence, farmers continue to cultivate local varieties having lower genetic potential as a consequence the grain yield productivity is low.

Keeping these things in view, the study was planned by providing cultivars acceptable to farmers through

participatory varietal selection. This gives closer farmer involvement from the initial stages of varietal evaluation and selection and help in identification of better varieties suitable for a given situation. This paper discusses the results of a case study on farmer participatory varietal selection in little millet, foxtail millet and finger millet in Northern Karnataka.

Materials and Methods

The project area consisted of Haveri and Bellary districts of Northern Karnataka. The details of the villages where the experiments were initiated are given in Table 1.

PRA (Participatory Rural Appraisal) was part of the study to understand the needs and preference of farmers on varietal choice. This was done by individual farmer survey using proforma developed for this purpose. Survey was conducted in project villages during summer 2002. Participatory Rural Appraisal showed that for all small millet growing farmers' grain and fodder yield were the main consideration. But, in finger millet, they also wanted blast resistance varieties.

Based on the farmers requirement from the basket of varieties available, five varieties in each crop were selected for testing with farmers from those released for Karnataka but not adopted and from those that were promising in state as well as All India Coordinated Trials (Table 2).

In each village, one variety along with the local was grown in an area of 1 acre by the individual farmer adopting the prevailing cultivation practices. In the same village each variety was given to 3 farmers to serve as replications. Five test entries were tested by 15 farmers at each village. Also, two farmers were given all the five varieties to gauge the comparative performance of all the five varieties.

After sowing, regular visits of the scientists during the crop growth period were made to keep up the continuous interaction with the farmers. This enabled proper execution of the trials as well as in the gathering farmers perception on the testing material.

Results and Discussion

The performances of the varieties in each FAMPAR (Farmers Managed Participatory Rural) trials in each village were judged visually as well as quantitatively by a group of 20 farmers specially formed for this purpose, so that the final judgment and ranking of varieties were solely made by the farmers themselves. The group visited all the trial plots. Scientists, extension officers and key officials also accompanied the group.

Table 1. Study areas for participating variety selection in millets

Crop	Year	Project area
Little millet	2002	Jekinakatti, Savanur Tq; Haveri Distt. Chandapur Tanda, Ranebennur Tq: Haveri
	2003	Harabagonda, Byadgi Tq; Haveri
Foxtail millet	2002	Metriki, Sandur Tq; Bellary Distt. Balakundi, Bellary Tq and Dist
	2003	Janakunte, Bellary Tq and Distt.
Finger millet	2002	Koda, Hirekerur Tq; Haveri Bisalahalli, Ranebennur Tq; Haveri Hirekolachi, Huvinahadagali Tq, Bellary Badeladaku, Kudligi Tq; Bellary Distt.

Table 2. Varieties selected for the study

Crop		Name of the variety	Special features
Little millet	i)	Sukshema	Released for Northern Karnataka in 2002
	ii)	Co 2	All India release
	iii)	PRC 3	All India release
	iv)	OLM 20	All India release
	v)	TNAU 98	Promising variety in Co-ordinated trial
Foxtail millet	i)	HMT 100-1	Promising variety at station trial
	ii)	RS-118	State released variety
	iii)	TNAU-173	Promising variety in station trials
	iv)	Krishnadevaraya	All India release
	v)	Narashimharaya	All India release
Finger millet	i)	GPU 26	Blast resistance released for Karnataka in 1999
	ii)	GPU 28	Blast resistance released for Karnataka 1998
	iii)	MR 1	High yielding
	iv)	L 5	High yielding
	v)	Indaf 9	High grain and fodder yield

The input provided by the group was used for formulating a pre-harvest ranking of varieties along with local check, by making important characters, namely, crop duration, panicle type and size, disease resistance, drought tolerance, grain density and estimated yield potential. After harvest, grain and fodder yield data were collected from all trial plots for a more critical comparison.

In FAMPAR, little millet trials mean grain yield data indicated that the cultivar Sukshema was superior to all the five entries in all the three locations (Table 3). Variety Sukshema recorded an overall mean yield of 10.30 q/ ha with the yield increase of 74% over local. The next performing variety was TNAU 98 which ranked second with a overall mean yield of 8.88 q/ ha, accounting to the tune of 50% increased yield over local. The varieties OLM 20, PRC 3 and CO 2 recorded 8.32 q/ ha, 8.18 q/ ha and 7.58 q/ ha, respectively.

In foxtail millet, grain yield data indicated that HMT 100-1 was superior to all the five entries over the locations. HMT 100-1 recorded an overall mean yield of 15.35 q/ ha with a yield increase of 36% over local (Table 4). The next best performing variety was Krishnadevaraya which ranked second with an overall mean yield of 13.73 q/ ha with increase yield of 22% over local. The varieties TNAU 173, Narasimharaya and RS 118 recorded mean yield of 13.50 q/ ha, 13.15 q/ ha and 12.46 q/ ha, respectively.

In finger millet among five cultivars tested GPU 28 was significantly superior in mean yield data over all the locations. Variety GPU 28 recorded 20.52 q/ha which was followed by L 5 which recorded 19.90 q/ ha. Where as, GPU 26, MR 1, Indaf 9 recorded 16.42 q/ ha, 15.22 q/ ha and 14.30 q/ ha, respectively (Table 5). The best performing variety GPU 28 showed 50% increase over local which was followed by L 5 (45%).

Participatory rural appraisal showed that the little millet growing farmers, grain and fodder yield were the main considerations. Based on yield, the variety "Sukshema" was found significantly superior to other

Table 3. Mean performance of five FAMPAR little millet varieties over three locations

S. No.	Variety	Grain yield q/ ha			Mean	Increase over local check (%)
		Jekinakatti	Channapura Tanda	Harabagonda		
1	Sukshema	14.66	10.08	6.16	10.30	73.69
2	TNAU 98	12.46	9.16	5.03	8.88	49.74
3	OLM 20	12.56	8.25	4.16	8.32	40.30
4	PRC 3	12.56	8.00	4.00	8.18	37.94
5	Co 2	11.33	7.91	3.50	7.58	27.82
6	Local	8.59	5.44	3.76	5.93	—

Table 4. Mean performance of five FAMPAR-foxtail millet varieties over three locations

S. No.	Variety	Grain yield q/ ha			Mean	Increase over local check (%)
		Halakundi	Metriki	Janakunte		
1	HMT 100-1	14.90	15.06	16.10	15.35	36.44
2	Krishnadevaraya	13.10	11.90	16.20	13.73	22.04
3	TNAU 173	14.00	13.40	13.10	13.50	20.00
4	Narasimharaya	12.50	12.65	14.30	13.15	16.88
5	RS 118	12.85	11.85	12.70	12.46	10.75
6	Local	11.14	11.12	11.50	11.25	—

Table 5. Mean performance of five FAMPAR-finger millet varieties over four locations

S. No.	Varieties	Grain yield q/ ha				Mean	Increase over local check (%)
		Haveri		Bellary			
		Koda	Bisanalli	Hirekolachi	Bedaladauku		
1	GPU 28	19.60	18.50	25.00	19.00	20.52	49.56
2	GPU 26	16.40	14.4	20.6	14.3	16.42	19.67
3	L 5	19.90	18.10	23.60	18.00	19.90	45.04
4	MR 1	13.80	13.10	20.50	13.50	15.22	10.93
5	Indaf 9	12.50	14.00	18.60	12.10	14.30	4.22
6	Local	13.00	11.80	18.30	11.80	13.72	—

entries. This variety was preferred by the farmers because of early maturity (85 days), high tillering, non-lodging and drough tolerant.

In foxtail millet, the farmers acceptaed "HMT 100-1" which matured in 85 days with moderate tillers, thin stems and healthy folliage even at harvest and superior to TNAU 173 and Narashimharaya in yielding ability.

In finger millet, the farmers selected "GUP 28" for normal planting in the 2nd fortnight of June to 1st fortnight of July. GPU 28 followed by L 5, GPU 26 and MR 1 were found superior for yield. Indaf 9 was not preferred by the farmers due to low yields and susceptablity to blast.

Pre- and post-harvest Focus Group Discussions (FGDs) by considering some of the important characters, namely, crop duration, ear head type and size, disease resistance, drought tolerance and grain and fodder yield revealed that the varieties "Sukshema" in little millet, "HMT 100-1" in foxtail millet and "GPU-28" in finger millet came very near to the farmers requirements. The farmers of the village had been satisfied with the performance of the these varieties and were keen to plant more areas with these varieties in the ensuring season.

Seed production programme had been taken at Agricultural Research Station, Hanumanamatti, for producuction of quality seeds of little millet variety "Sukshema", and foxtail millet variety "HMT 100-1" and finger millet variety "GPU 28". The quantity of seeds produced for distribution to farmers of the project village is presented in Table 6.

The spread of high yielding varieties has been limited in small millet. Hence, large scale demonstrations had been conducted to demonstrate the full potential of selected varieties identified from participatory varietal selection vis-a-vis local cultivars. The cluster of villages that were involved in conducting FAMPAR trails during 2002 and 2003 and areas where these crops were dominant were selected for demonstrations. The total number of demonstrations conducted during 2003 and 2004 in Haveri and Bellary districts are presented in the Table 7.

In each demonstration, farmers were given 4 kg seeds of improved variety and asked to grow selected variety along with local in area of 0.8 ha (one acre each of improved variety and local) by adopting prevailing cultivation practices. Regular visit by the scientists during the crop growth period were made to keep up the continuous interaction with the farmers. This enabled proper execution of demonstrations as well as gathering farmers perception on improved varieties. The crop-wise breakup of the details of beneficiaries in large scale demonstrations are given in Table 8.

In little millet the mean grain yield under improved variety (Sukshema) was 8.00 q/ ha in comparison with 5.72 q/ ha of local variety. The per cent increase in productivity of the improved variety over local was 40%. The fodder yield recorded by Sukshema was 4.60 t/ ha whereas of 3.43 t/ ha under local genotype. The productivity of finger millet in large-scale demonstrations registered an increase in grain yield to the extent of 63% with improved variety GPU 28 over

Table 6. Seed produced and distributed under the project during 2003-04

S. No.	Crop	Variety	2003 (Quantity)	2004 (Quantity)	Total (Quantity)
1	Little millet	Sukshema	10 q	22 q	32 q
2	Foxtail millet	HMT 100-1	10 q	10 q	20 q
3	Finger millet	GPU 28	4 q	4 q	8 q

Table 7. Number of demonstrations conducted

District	Crop	Year		Total
		2003	2004	
Haveri	Little millet	35	50	85
	Finger millet	35	9	44
	Foxtail millet	15	9	24
Bellary	Foxtail millet	10	35	45

Table 8. The mean productivity of grain and fodder yield increased through frontline demonstrations conducted

Sl. No.	Crop	Grain yield (q/ ha)		Increase over	Fodder yield (t/ ha)		Increase over
		Demonstration	Traditional	local (%)	Demonstration	Traditional	local (%)
1.	Little millet	8.00	5.72	39.8	4.60	5.43	34.1
2.	Finger millet	11.74	7.21	62.8	3.61	2.45	47.3
3.	Foxtail millet	11.52	7.99	44.1	4.29	3.11	37.9

local. Similarly, in foxtail millet, the increase in grain and fodder yield of improved variety "HMT 100-1" over local was 44% and 38%, respectively. The mean grain and fodder yield of HMT 100-1 was 11.52 q/ ha and 4.29 t/ ha, respectively, compared to 7.99 q/ ha and 3.40 t/ ha, respectively, of local variety.

The superior variety bred and released for large scale cultivation needs to be maintained for its genetic and physical purity in order to exploit its full genetic potential. The improved varieties are prone for genetic deterioration as they have a very carefully built up genetic constellation/ gene combination for higher productivity, regional adaption and inbuilt genetic resistance for biotc and abiotic stresses. In a well managed crop improvement programme maintenance of released variety becomes very important in order to prolong the consistency of performance. In this context training was given for production and supply of good quality seeds. The farmers who have been involved in conducting Frontline Demonstrations were given training for adopting proper procedure for maintaining the genetic architecture of the variety.

References

Baidu-Forson J (1997) On-station farmer participatory varietal evaluation: A strategy for client oriented breeding. *Exp. Agri.* **33:** 43-50.

Sthapit BR, KD Joshi and JR Witcombe (1996) Farmer participatory crop improvement. III Participatory Plant Breeding, A case study for rice in Nepal. *Exp. Agri.* **32:** 479-96.

Thiele G, G Gardner, R Torrez and Gabriel (1997) Farmer involvement in selecting new varieties: Potatoes in Bolivia. *Exp. Agri.* **33:** 275-90.