Farmer Participation in On-Station Evaluation of Plant and Grain Traits: the Case of Pearl Millet in Namibia

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Abstract

This study was initiated to develop information for use in breeding improved pearl millet genotypes for Namibia. A select group of farmers was encouraged to participate in on-station evaluation of varieties under test. Each variety was assessed separately, and both negative and positive characters were recorded.

Five pearl millet varieties which were found promising in the Namibian national pearl millet trial of 1992/93 were sown at the Omahenene Research Station during 1993/94 for evaluation of farmer preferences for plant and grain traits. The five varieties were evaluated against the farmers' local landrace variety (LLV) and Okashana 1. Based on farmers' experience, 15 highly preferred plant and grain traits were recorded. Each of the five experimental varieties was assessed for these traits and compared with the farmers' LLV and Okashana 1.

The study concluded that early maturity, grain size, and resistance to drought are the most preferred traits for pearl millet under Namibian growing conditions. The most preferred grain trait was palatability, followed by ease of processing (threshability, dehulling, and grinding to make flour). Varieties SDMV 92040 and SDMV 90016 were identified as satisfying most farmer requirements. These varieties were as short-duration and drought-tolerant as Okashana 1, produced a better tasting product, and were easier to dehull and grind into flour. They were also superior to the farmers' LLV in all these aspects.

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Introduction

Pearl millet is as important as maize in Namibia in terms of production and consumption, each cereal contributing approximately 25% of the national calorie consumption.

Pearl millet is grown widely in the seven regions of Namibia—Caprivi, Okavango, Oshikoto, Okashana, Ohangwena, Omusati, and Kunene—covering about 355 200 ha of land (Ministry of Agriculture, Windhoek, Namibia, pers. comm. 1994).

The importance of this crop to the Namibian people cannot be overstated. Only 8% of the country's area receives >500 mm yr^{-1} rainfall. About 37% receives 300-500 mm yr^{1} rainfall, and this is where most of the pearl millet is grown. The rest of the country receives <300 mm annual rainfall and is unsuitable for cultivation.

The main objective of this study was to capture the farmers' expertise which represents an extension of the on-farm trial. Farmers were given the opportunity to assess varieties at an early stage of the selection process, and thus were able to share their expertise directly with scientists on the station and select varieties for testing in their own fields. The participatory exercise made the farmers feel more responsible and committed to their on-farm trials. This is essential to instill among the farmers a sense of 'doing something for ourselves' as against 'something being done for us.' This type of participatory research helps in obtaining more specific information for breeders than that generally used.

This participatory approach also enables farmers to contribute their expertise and good judgement early on, which would facilitate identification of varieties for on-farm testing. With better understanding of farmers' priorities for plant and grain traits, breeders can more effectively address concerns of farmers at an early stage of crossing and selection. The risk of using resources on developing a variety which will eventually end up being rejected would therefore be reduced.

Materials and Methods

Five varieties, SDMV 90016, SDMV 92040, SDMV 91018, SDMV 92039, and ICMV-F 86415, and two controls (Okashana 1 and the farmers' LLV) were used in this study.

Women farmers from the Tunetu Women's Cooperative Project at Tsandi participated in evaluating grain size and color, dehulling, grinding, cooking quality, and palatability. The Cooperative derives money from selling pearl millet-derived products (*ontaku* and *oshithima*).

This particular group was chosen because, traditionally, women are closely involved in such activities every day and they are in a good position to evaluate these traits objectively and effectively.

The evaluation process

Grain size and color. Ten women took part in this exercise. Grain samples of each of the seven varieties were kept in numbered jars. Participants were individually interviewed and asked to assess grain size and color in confidence.

Dehulling. A 3-kg sample of grains of each of the seven varieties was dehulled using a mortar and pestle. The maximum time allowed for this activity was 9 min. Five judges and a time-keeper supervised the evaluation of dehulling.

Grinding. Assessment criteria and methods were the same as those used for dehulling.

Cooking quality test. Each of the seven varieties was cooked in a 2-L pot in a traditional manner: *omahangu* flour is added to boiling water, and the porridge is continuously stirred till it reaches the desired consistency. Time taken to cook and ease of cooking were carefully recorded. The fire was kept at the same level for all varieties. Farmers were particularly interested in obtaining a smooth porridge without lumps.

Palatability test. After cooking, each participant tasted the porridge prepared from each of the seven varieties. A housekeeper was appointed to make sure that each participant tasted all the samples.

After the sample tasting session, a panel discussion was held to rate and evaluate the varieties.

Results and Discussion

Farmers in Namibia always prefer short-duration, drought-resistant varieties with large, bold grains. Other preferred traits include good grain yield, good seed-set, pleasing color (mainly cream or light gray), high tillering ability, and ease of threshing. This is why the farmers interviewed selected Okashana 1 and SDMV 92040 (Tables 1-4). Okashana 1 is light gray in color, and SDMV 92040 is cream-colored. Both varieties have all the qualities described above.

SDMV 90016 is not bold-seeded but is cream-colored and has very good tillering ability. It has medium-sized seed (1000 seed mass 10-12 g compared to 12-14 g for Okashana 1). The varieties classified as "worst" by the farmers (Table 1) were characterized by either (long duration farmers' LLV), poor seed-set mainly due to drought, (ICMV-F 86415, farmers' local and SDMV 92039), or unpleasant color (ICMV-F 86415). These varieties performed particularly badly in poor, sandy soils. The farmers also pointed out that these varieties would be difficult to thresh because the glumes completely surround the grain, and the grain itself was not fully developed. This is a manifestation of drought.

Table 1. Evaluation priority plant and grain traits in on-station trials, Namibia, 1993.

Farmer rating	Selection criteria
High	
Okashana 1	Resists drought
SDMV 92040	Short duration
	Large grain size (Okashana, SDMV 92040)
SDMV 90016	Good seed-set
	Pleasing color (SDMV 90016, 92040)
	High tillering (SDMV 90016)
	Easy to thresh
Low	
ICMV 86415	Small grain size
LLV	Long duration
SDMV 92039	Poor seed-set
	Succumbs to drought
	Not a pleasing color
	Does poorly in poor soils

Women farmers from the Tunetu Women's Cooperative Project evaluated grain color and size, ease of dehulling, and grinding, food preparation qualities, and taste of the seven varieties. Each of these varieties was compared to the farmers' local variety and Okashana 1.

Only two varieties (SDMV 92040 and Okashana 1) had larger grains than those of the farmers' local variety. Seventy percent of the women farmers identified SDMV 92040 as superior to Okashana 1 in terms of grain size, while the remaining 30% thought the two varieties had similar grain size. Similarly, 90% of the farmers rated Okashana 1 superior to their LLV, while only 10% thought they were similar (Table 3). With regard to grain color, two varieties were identified as better than the farmers' local variety: SDMV 92040 (80% classified as better) and SDMV 90016 (40% classified as better and 40% as identical) (Table 3).

The Tunetu Women's Cooperative ranked three of the varieties—SDMV 92040, Okashana 1, and SDMV 90016—as "excellent" in terms of grain traits. With the exception of Okashana 1, they were all easy to dehull and grind (all took <9 min to process 3 kg grain). All three were also rated "very good" with regard to food (*mahangu pap*) preparation qualities.

Okashana 1 was identified as particularly difficult to dehull and grind. It normally required 2-3 runs to process Okashana 1 properly. Food preparation quality was evaluated according to the tendency of the flour to form lumps, and ease of breaking these to make a smooth porridge during cooking. The farmers' LLV was rated "very good" in terms of ease of dehulling, grinding, acceptable product color, and cooking quality. All the three varieties above, plus the farmers' LLV control were rated as having good taste and "very acceptable" by the panel.

Table 2. Farmer rating of grain traits and reasons for their choice, and grain yield, Namibia, 1993.

Variety/ rating	Grain yield ($kg\ plot^{-1}$)	Farmer score[1]	Reasons
SDMV 92040	3.0	5	Easy to dehull Easy to grind Acceptable color Large grain size
Okashana 1	3.6	5	Large grain size Acceptable taste Difficult to dehull Difficult to grind Acceptable cooking quality
SDMV 90016[2]	2.2	5	Easy to dehull Easy to grind Resists storage pests Good cooking qualities Good taste
Farmers' LLV	2.2	4	Acceptable color Easy to dehull Easy to grind Very good cooking quality Good taste
SDMV 91018	2.0	3	Small grain size Difficult to dehull Difficult to grind Taste unacceptable
ICMV-F86415	2.0	2	Poor seed-set Not a pleasing color Difficult to dehull Difficult to grind Unacceptable taste

1. Scored on a 1-5 scale, where 1 = poor, and 5 = excellent.
2. Some farmers thought that the wedge-shaped grains of SDMV 90016 would discourage storage pests.

SDMV 91018 was rated "average", and ICMV-86415 "poor". Both had small grains, and were difficult to dehull and grind into flour. Their taste was also scored as unacceptable, and ICMV-86415 was particularly noted as having an unpleasantly colored product. This variety is deep gray and the flour from it was very dark when compared with the others. All the varieties except ICMV-F 86415 and SDMV 91018 were rated as having better food preparation qualities than the farmers' LLV (Table 3). With regard to taste, only SDMV 90016 was rated better than the LLV control. However, SDMV 92040 was rated similar to the local, while on Okashana 1

Table 3. Overall grain preference ratings (%) of elite cultivars compared with the farmers' LLV, Namibia, 1993.

Grain trait	No. of responses	SDMV 92039			SDMV 92040		
		Better	Same	Worse	Better	Same	Worse
Grain size	10	10	10	80	70	30	0
Grain color	10	0	20	80	80	20	0
Dehulling	25	0	100	0	100	0	0
Grinding	25	0	100	0	100	0	0
Food prepn.	25	100	0	0	100	0	0
Food taste	25	0	0	100	0	100	0
		SDMV 90016			ICMV-F 86415		
		Better	Same	Worse	Better	Same	Worse
Grain size	10	10	20	70	0	10	90
Grain color	10	40	40	20	0	30	70
Dehulling	25	100	0	0	0	0	100
Grinding	25	100	0	0	0	0	100
Food prepn.	25	100	0	0	0	100	0
Food taste	25	100	0	0	0	0	100
		SDMV 91018			Okashana 1		
		Better	Same	Worse	Better	Same	Worse
Grain size	10	0	10	90	90	10	0
Grain color	10	0	40	60	20	30	50
Dehulling	25	0	0	100	0	0	0
Grinding	25	0	0	100	0	0	100
Food prepn.	25	0	100	0	100	0	0
Food taste	25	0	0	100	20	40	40

the farmers were split, with 20% rating it better than the LLV, 40% the same as the local and 40% worse than the LLV. SDMV 92039, ICMV-F 86415, and SDMV 91018 were rated by all panel members as worse than the LLV in terms of food taste. It is worth noting here that two of the varieties, SDMV 91018 and ICMV-F 86415, are currently under farmer verification in on-farm trials. If the above information had been available before sending them for large-scale demonstration and verification with farmers, a lot of resources could have been saved. This is how farmer participation early on in the breeding process becomes very useful.

In similar comparisons with Okashana 1, only SDMV 92040, and SDMV 90016 were identified as superior in terms of food taste. These varieties, plus the farmers' LLV were also rated superior to Okashana in terms of dehulling and grinding ease.

Table 4. Overall grain preference ratings (%) of elite cultivars compared with Okashana 1, Namibia, 1993.

Grain trait	No. of responses	SDMV 92039			SDMV 92040		
		Better	Same	Worse	Better	Same	Worse
Grain size	10	0	10	90	40	60	0
Grain color	10	0	30	70	60	40	0
Dehulling	25	0	0	100	100	0	0
Grinding	25	0	0	100	100	0	0
Food prepn.	25	0	100	0	100	0	0
Food taste	25	0	100	0	0	100	0
		SDMV 90016			ICMV-F 86415		
		Better	Same	Worse	Better	Same	Worse
Grain size	10	0	40	60	0	0	100
Grain color	10	50	20	30	10	20	70
Dehulling	25	100	0	0	0	0	100
Grinding	25	100	0	0	0	0	100
Food prepn.	25	0	100	0	0	100	0
Food taste	25	100	0	0	0	0	100
		SDMV 91018			Farmers' LLV		
		Better	Same	Worse	Better	Same	Worse
Grain size	10	0	0	100	0	0	100
Grain color	10	10	20	70	20	70	10
Dehulling	25	0	0	100	100	0	0
Grinding	25	0	0	100	100	0	0
Food prepn.	25	0	100	0	0	0	100
Food taste	25	0	0	100	40	40	20

However only SDMV 92040 was rated better than Okashana 1 in food preparation quality though SDMV 90016 was rated the same as Okashana 1.

The farmers' LLV was rated worse than Okashana 1 in this aspect, though SDMV 90016 was rated on a par with Okashana 1. It could be important to find out what causes differences in food preparation qualities. One explanation is the possible differences in their starch swelling temperature. As the porridge swells and thickens, it becomes difficult for more flour to dissolve; as a result lumps form and a smooth porridge cannot be obtained.

These studies showed that the farmers' LLV is very good for grinding and dehulling. It has a pleasing color and tastes good. This probably accounts for some of the reasons that the farmers have kept this variety for centuries. Some of the improved varieties such as SDMV 92040, SDMV 90016, and Okashana 1 have the same quali-

ties as the farmers' local control above, and in addition they mature about 3 weeks to 1 month earlier. This ensures food security for the farmer and his family in good years and in seasons of terminal drought. These varieties can also be sown up to 1 month later than the locals and still ensure some harvest for the family.

Conclusion

Identifying potential varieties such as the ones discussed above early in the breeding and selection process, and concentrating efforts and resources on further improving them will be more cost-effective, and bear better results. Farmer participation with breeders in evaluating, selecting, and advancing promising genetic materials early in the breeding program is a sure way of achieving this.