IDENTIFYING FARMERS' PREFERENCES FOR IMPROVED SORGHUM VARIETIES IN LIMPOPO, SOUTH AFRICA

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INTRODUCTION

Sorghum [*sorghum bicolor* (L.) Moench] is indigenous to Africa. Traditional varieties, well adapted to low-input conditions as well as to biotic and abiotic stress factors and exhibiting superior grain quality, are still cultivated. In South Africa, sorghum can be grown in all nine provinces (Sorghum Section 7 Committee, 2006). According to Mhkari (2003, personal communication) the area planted to sorghum, in the Limpopo Province by smallholder farmers is estimated to be 25 342 ha, the major producing districts being Sekhukhune (19 033 ha), Waterberg (3410 ha) and Capricorn (2899 ha). Average sorghum yield on smallholder farms observed for SADC countries was 0.8 t/ha (Rohrbach and Mutrio, 1998). The low productivity of traditional varieties grown, frequent occurrences of food shortage in sorghum-growing areas, and the extension of sorghum cultivation to marginal lands, requires extensive breeding programmes followed by the introduction of new varieties fitting smallholder farmers' needs (Haussamann et al., 2000). The main constraints to sorghum production, as perceived by farmers, are soil fertility, drought, bird damage, seed availability, and stem borers. Market access was another important constraint mentioned by some farmers. To deal with some of these constraints, the Agricultural Research Council-Grain Crops Institute (ARC-GCI) in collaboration with its partners has developed two projects: *Participatory evaluation and identification of sorghum cultivars for smallholder farmers*, and *Seed production of improved sorghum varieties*. ARC-GCI breeder leads the two projects in collaboration with extension officers from the Limpopo Provincial Department of Agriculture.

The potential of indigenous sorghum varieties in developing cultivars with improved agronomic and food processing properties was demonstrated by Toure et al. (1998). Participatory methods have been widely adopted by researchers working on applied agricultural problems including plant breeding. The project is based in Limpopo Province, where sorghum and millet cultivation is still practised traditionally. The objective of the project is to identify varieties with improved grain yield and agronomic performance.

MATERIALS AND METHODS

Twelve sorghum varieties, pre-selected on-station for their high yield, grain quality and resistance to drought, stem borers and aphids were included in the trials (Table 1). The trials were planted in cooperation with the Limpopo Department of Agriculture in the districts of Capricorn, Sekhukhune and Waterberg. The varieties were planted in the form of Mother/Baby (M/B) trials. Each M trial consists of two randomized blocks, one of which was applied by inorganic fertilizers according to soil nutrient analyses. Blocks included three replications planted in single row plots. Each B trial included three of the 12 varieties. Farmers planted the B trials on their own fields, next to their traditional variety and close to the M trial. This enabled farmers to observe both M and B trials. Farmers meeting were conducted annually where they gathered and evaluated and

gave their choice of the variety/ies they liked. Based on the farmers' selection the score was averaged and analysed. Descriptive statistics were conducted for farmer rating data, and means compared using Friedman's rank test. A one-way analysis of variance was run to evaluate the effect of varieties using GenStat for Windows (release 8.1).

Table 1. Sorghum varieties included in Mother/ Baby trials in Limpopo Province, South Africa.

Entry No.	Name	Origin	Seed colour	Resistance traits*
1	M33	USA	White	Grain mould
2	M48	SA	Red	Aphids, Stem borer
3	M57	Lesotho	White	Drought, Grain mould
4	M66	SA	White	Drought, Grain mould
5	M71	SMIP	White	Drought, Grain mould, Aphids, Stem borer
6	M79	SMIP	White	Stem borer
7	M80	SMIP	White	Grain mould, Aphids, Stem borer
8	M96	SA	White	Drought, Stem borer
9	M105	SMIP	White	Grain mould, Aphids
10	M127	SA	White	Drought, Aphids, Stem borer
11	M141	SMIP	White	Drought, Grain mould
12	M153	SA	Brown	Bird

SMIP = Sorghum and Millet Improvement Program, Zimbabwe.
* In addition to yield potential, varieties were chosen for showing desirable resistance to traits shown.

RESULTS AND DISCUSSION

Mother trials were affected by the severe drought which made it difficult to reach a conclusion. Relatively high grain yields were observed at Buffelshoek (Table 2). A timely precipitation just after planting ensured a good stand at the site. Varieties differed in their response to soil nutrient amendments. The best varieties for Buffelshoek were M153, M79, and M33. The best variety under low-input was M153, exhibiting high yields from zero and optimal soil nutrient amendments. Varieties showed a mean yield increase of 0.27 t/ha following nutrient amendments of 100 kg/ha of 3:2:0 (25) +Zn. The result further indicates the need to select best responding cultivars, so that the gain from fertilization can be economical. However, for convincing farmers to apply fertilizer, the yield obtained should be compared with the highest yield observed without fertilizer application. At Buffelshoek, none of the varieties fertilized produced more than M153 without nutrient amendments.

Grain characteristics (such as colour, size), drought and insect tolerance, as well as the usefulness of the variety to meet their needs, are the major factors determining farmers' choices. Breeders and farmers' selections in the study corresponded in most cases. Over seasons, farmers selected four varieties (M71, M66, M48 and M153) most frequently, and showed merits according to the results presented above. In addition to the four varieties, breeders wanted to give five more varieties (M33, M57, M80 and M141) a chance in the subsequent test seasons. The different farmers' needs can be tackled by developing different varieties rather than trying to produce multipurpose varieties. The four varieties selected by farmers and agreed by breeders are currently registered and seed multiplication system is started. Listing of variety traits that farmers use when they describe the advantages and disadvantages of a variety in a trial was also used.

Finally, the experience showed that in addition to improved varieties smallholder farmers in Limpopo need government support for inputs such as fertilizers and insecticides.

Table 2. Average grain yield and percent yield increase due to the application of fertilizers on sorghum varieties, Buffelshoek, Limpopo, 2001/02.

No.	Variety Name	Yield (t/ha)		Yield increase (%)	Final selection (breeder/ farmers)
		No fertilizer	Fertilized		
1	M33	1.05a*	1.34a	21.6	Yes (breeder)
2	M48	0.93ab	0.88b	-5.7	Yes (farmers/breeder)
3	M57	0.45c	0.98b	54.1	Yes (breeder)
4	M66	0.73bc	0.91b	19.8	Yes (farmers)
5	M71	0.64bc	0.81b	20.9	Yes (farmers/ breeder)
6	M79	1.24a	1.54a	19.5	
7	M80	0.90ab	1.53a	41.2	Yes (breeder)
8	M96	0.59bc	0.99b	40.4	
9	M105	075bc	0.93b	19.4	
10	M127	0.60bc	0.83b	27.7	
11	M141	0.86ab	0.98b	12.2	Yes (breeder)
12	M153	1.63a	1.55a	-5.2	Yes (farmers/ breeder)
Average		0.86	1.13	23.9	

* Means followed by the same letter in a column are not significantly different at P<0.05

At Mphanama, M127, M71 and M48 were the best performing varieties (Table 3). The result indicates that farmer participation in varietal evaluation improves the selection of suitable varieties.

Table 3. Average yield and yield response to nutrient application of 12 sorghum varieties, Mphanama, Limpopo, 2002/03.

No.	Variety Name	Yield (t/ha)		Yield increase (%)	Final selection (breeder/ farmers)
		Unfertilized	Fertilized		
1	M33	0.20c*	0.33c	39.4	
2	M48	1.54b	2.29a	32.8	Yes (farmers/ breeder)
3	M57	0.29c	0.51c	43.1	
4	M66	0.63c	1.23b	48.8	Yes (farmers)
5	M71	1.60b	2.17a	26.3	Yes (Farmers/ breeder)
6	M79	0.48c	0.76bc	36.8	
7	M80	1.22bc	0.72c	-41.0	
8	M96	0.17c	0.40c	57.5	
9	M105	0.22c	0.23c	4.3	
10	M127	2.17a	2.29a	5.2	Yes (breeder)
11	M141	0.75c	1.28b	41.1	Yes (breeder)
12	M153	0.51c	0.75bc	32.0	Yes (farmers/ breeder)
Average		0.82	1.05	22.6	

*Means followed by the same letter in a column are not significantly different at P<0.05

A farmers' field day to demonstrate improved sorghum varieties was conducted during 2005/06 at Serobaneng village, Capricron district. Farmers evaluated nine improved varieties and one local variety, and gave their choice (Table 4).

Table 4. Sorghum varieties by farmers (39) at Serobaneng, Capricorn, Limpopo, 2005/06.

No.	Variety	Number of farmers selected
1.	M71	34
2.	M57	28
3.	M81	19
4.	M26	10
5.	M141	10
6.	Farmers' local	8
7.	M48	7
8.	M66	2
9.	M105	1
10.	M153	1

The seed multiplication project is currently in its early stage, in subsequent years farmers will be included through community and individual participatory methods. The study will continue to gain better understanding of what farmers' selection criteria are.

ACKNOWLEDGEMENTS

We would like to thank J. Mkhari, T. Shilajoe, R. Ramugondo, G. Donaldson from the Limpopo Department of Agriculture for their support in executing the trials; the farmers from different villages for their collaboration in allocating plots for the trials and participating in evaluating the new varieties. The earlier stage of the research was financed by Sorghum Forum, while the currently ongoing projects are funded by the ARC and the Department of Agriculture.

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