Pigeonpea has a ready market, and a high market value, in Tanzania. It can contribute significantly to maintaining and improving soil fertility, as well as improving household nutrition and income. However, medium-duration varieties adapted to the semi-arid areas have not yet been clearly identified and released, and sorghum/pigeonpea intercropping systems have received little attention. Current work focuses on identifying appropriate varieties and cropping systems.

On-farm participatory research was initiated in the 1999/2000 cropping season. It is being implemented by scientists from the Department of Research and Development, in collaboration with extension staff. Due to a late start to the rainy season, and limited planting opportunities, the program got off to a somewhat shaky start. Nonetheless, the trials have been implemented, and work is under way.

In **Zimbabwe,** technologies selected for on-farm research included: manage-ment and utilization of FYM, combina-tions of FYM and inorganic nitrogen, legume rotations (cowpea, groundnut, bambaranut), and the use of modified tied ridges for water conservation. The use of dead-level contours and infiltration pits may be added as additional water management options.

The work was initiated, in a limited way, in the 1998/99 season and considerably expanded in 1999/2000. It is being implemented by SMIP and ICRISAT, in collaboration with several partners—the Department of Research and Specialist Services (DR&SS), AGRITEX (extension), TSBF (Tropical Soil Biology and Fertility), DFID (Department for International Development, UK), and the Intermediate Technology Development Group (ITDG). Due to unusually high rainfall in western Zimbabwe, the trials have been very productive this year. The response from farmers involved in the technology evaluation has been very positive.

Conclusions

The activities planned for IR 1.2 have been largely implemented on schedule, and work is progressing well. Publication of some of the outputs has been unfortunately delayed, but these should become available in due course.

The future

In Tanzania, there appears to be considerable potential for improving soil fertility and farm incomes by including appropriate pigeonpea varieties in semi-arid production systems. Both farmers and institutional partners are very enthusiastic about the possibilities. Since market-acceptable medium-duration varieties are available for on-farm testing, it is hoped this work can progress rapidly.

In Zimbabwe, farmers have responded positively to technologies for the management and use of FYM. In the higher-rainfall areas, the combination of organic and inorganic fertilizer is also popular. Tests have shown that improved water management systems are practical under smallholder conditions. Plans are currently being made with DR&SS and AGRITEX to test methods of stimulating broad adoption of the most popular tech-nology options in the coming season.

Performance of the Sorghum Variety Macia in Multiple Environments in Tanzania

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Introduction

Sorghum is grown in six out of seven zones in Tanzania. It is produced mainly for home consumption and is a key factor in household food security, particularly in marginal areas with low rainfall and poor soil fertility. Collaboration between the SADC/ICRISAT Sorghum and Millet Improvement Program (SMIP) and the National Sorghum and Millet Improvement Program (NSMIP) was initiated in the early 1980s and has been instrumental in the development, selection, and release of improved varieties. This article summarizes information about the development and testing of the recently released sorghum variety Macia (SDS 3220), including comparisons with two released varieties, Pato (SDS 2293-6) and Tegemeo (2KX 17/B/I); and an improved, Zimbabwe release SV 1.

On-station and on-farm trials

SDS 3220 was developed at SMIP's Matopos Research Station in Zimbabwe through mass selection in the F_4 generation from M91057 (pedigree [GPR 148 x E35-1] x CS 3541) introduced from ICRISAT-Patancheru, India.

SDS 3220 was found promising, and then tested in preliminary and advanced SMIP trials, which further confirmed its potential. It was then evaluated in regional collaborative trials between 1988/89 and 1990/91, and subsequently in on-station multi-locational national variety trials for three seasons: 1991/92 (7 sites), 92/93 (5 sites), and 93/94 (2 sites). The test sites covered almost all the important sorghum-producing regions in Tanzania.

This was followed by on-farm, farmer-managed trials conducted for three seasons in two drought-prone districts in northern Tanzania—Same district in 1994/95 and 95/96, and Mwanga district in 97/98. Several improved sorghum lines were evaluated for agronomic as well as grain characteristics.

Results from on-station and on-farm trials

All data obtained from randomized and replicated variety trials in which SDS 3220 (Macia) was included as a test entry, were analyzed for location and year/season effects using the ANOVA method.

Data from on-station trials were pooled across locations (Table 1). Significant differences were observed among entries in the 1991/92 season, with SV 1 giving the highest yield of 3.6 t ha^{-1}. Grain yields of Macia were not significantly different from those of SV 1 and Pato. The entries did not differ significantly in 92/93 and 93/94. The latter season was very good, with high mean yields (Table 1). Generally, Macia was shorter in stature and flowered earlier than the other entries. Farmers prefer short-statured varieties as this makes bird-scaring easier. The earliness allows the variety to escape terminal drought.

Table 1. Performance of sorghum lines in on-station trials, Tanzania, 1991/92 to 1993/94. Data pooled across 14 locations

Entry	Days to 50% flowering	Plant height (cm)	Grain yield (t ha^{-1}) 91/92	92/93	93/94
Macia	65	129.7	3.1	1.5	4.6
Pato	69	175.3	3.3	1.6	4.4
Tegemeo	67	119.5	1.9	1.2	4.2
SV 1	68	152.3	3.6	1.4	3.9
Trial mean [1]	67	147.4	3.0	1.4	3.7
LSD 0.01			0.6	ns	ns
CV (%)			25.1	na	na

1. Includes all entries tested in that year's trial, na = data not available, ns = not significantly different.

Similar observations on plant height and earliness were made from on-farm trials (Table 2). However, grain yield data from on-farm trials were not conclusive. In the 95/96 season, Pato yields were significantly higher than those of SV 1, but not different from Macia and Tegemeo. In 97/98, there were no significant yield differences between entries, but yields were generally high (>4.0 t ha^{-1}), indicating a good season and the high yield potentials of the improved varieties.

Table 2. Performance of sorghum lines in on-farm trials, Same and Mwanga districts, northern Tanzania [1].

Entry	Days to 50% flowering	Plant height (cm)	Grain yield (t ha^{-1}) 94/95	95/96	97/98
Macia	64	131	na	1.50	4.16
SV 1	70	153	2.76	1.35	4.03
Pato	68	173	2.27	1.99	4.26
Tegemeo	67	na	2.03	1.92	na
Trial mean	68	152	2.38	1.69	4.15
LSD 0.01			ns	0.58	ns
CV (%)			11.6	22.3	10.0

na = data not available, ns = not significantly different
1. Same district in 1994/95 and 95/96, Mwanga district in 97/98.

Grain quality characteristics

Laboratory tests were carried out at the SMIP food technology facilities in Matopos to complement the field trials, and provide data on grain quality and thus on possible end uses of the varieties (e.g. in the food processing and malting industries). This information is valuable for the testing and selection program. Macia, Pato, and Tegemeo, which were then being tested on-farm in Tanzania, were analyzed for a total of 15 physical and physico-chemical traits (Tahle 3).

Macia has a thin pericarp (similar to Pato), whiter grains (75.3 Agtron reading versus 74.5 for Pato), and a white pearly endosperm. This indicates that Macia is a superior food type cultivar that is likely to meet farmers' preferences. Macia also has a higher SDU value (Sorghum Diastatic Units), indicating its suitability for malting.

Table 3. Grain quality evaluation of sorghum cultivars from Tanzania

Characteristic	Cultivars		
	Macia	Pato	Tegemeo
Grain color	White	Cream/ yellow white mottled	Creamy white
Pericarp	Thin	Thin	Thick
Testa	Absent	Absent	Absent
Endosperm color	White	White	White
Endosperm texture	Pearly	Inter-mediate	Pearly
Size fractions (%)			
Large	0.26	80.54	46.45
Medium	99.27	19.44	53.33
Small	0.38	0.00	0.17
100-kernel mass (g)	1.68	3.56	2. 18
Grain hardness (visual)	3.6	3.4	3.4
Milling yield (%)	81.60	87.00	83.60
Dehulling loss (%)	15.20	7.23	11.05
Floaters (%)	22	23	15
Water absorption (%)	14.30	4.0	8.2
Tannin content (= %CE)	0.00	0.00	0.00
Dry Agtron reading	75.3	74.5	76.0
Wet Agtron reading	56.1	53.2	56.5
SDU	42.60	28.76	20.12

Size fractions: Large = >2.6 mm, Medium = 1.7-2.6 mm, Small = <1.7 mm
Visual hardness rated on 1-5 scale: 1 = very soft, 5 = very hard.

Processing and utilization traits: farmer evaluation

In Oct 1997, Pato and Macia were evaluated for processing and utilization traits by 26 farmers (22 women, 4 men) from Kwakoa-Mwanga district in northern Tanzania. The farmers evaluated grain size and color, processing and cooking quality (Table 4).

The palatability, taste, and acceptability of food prepared from these two varieties was further evaluated by 81 women and 67 men who filled in a questionnaire after sampling the food. Macia was reported to have the acceptable white, large grains that produced white flour. The traditional foods like *makande.* porridge (*uji*), and stiff porridge (*ugali*) were of acceptable taste and appearance. Both sets of evaluations thus indicate that Macia, like Pato, will be readily accepted by farmers.

Table 4. Farmers' rating (26 farmers) of sorghum variety characteristics, 1997, Kwakoa-Mwanga district, northern Tanzania

	SV 1	Pato	Macia
Grain yield	3	4	5
Large grain size	3	5	4
Earliness	3	3	5
Disease resistance	2	2	2
Pest resistance	2	2	2
Stem strength	2	2	3
Large head size	2	3	5
Plant height (convenience for bird scaring)	2	3	5
Ease of dehulling	3	3	3
Flour color	3	3	3
Palatability/cooking quality	3	3	3
Storage pest resistance	2	2	2

Scored on a 1-5 scale, where 1= poor and 5 = excellent.

Conclusions

Macia is an early-maturing sorghum variety that was released in Tanzania in Dec 1999, targeted at semi-arid areas with a 3-4 month growing period. The variety has a number of useful characteristics—short plant height that is convenient for bird scaring, large head size, high yield, low dehulling losses, and good eating quality. Macia also has a staygreen characteristic and the residues are therefore suitable for feeding farm livestock. The recommended agronomic practices for Macia are similar to those for Tegemeo and Pato.

Variety Development and Seed Systems for Sorghum and Millets in Zimbabwe

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Introduction

The purpose of applied plant breeding is to develop better varieties. But the benefits of an improved variety cannot be realized until enough seed has been produced to allow the variety to be grown on a commercial scale over the