

received stiff sorghum porridge (*ugali*) made from dehulled and unde-hulled sorghum grain. These samples were served as regular meals.

Almost 98% of the students found the sorghum acceptable as a replacement to maize in breakfast and lunch meals. These students rated the overall acceptability of the *uji* made from dehulled sorghum meal approximately equal to the version made from unde-hulled grain. But if offered a choice, most would select the breakfast porridge made from dehulled grain, because of the whiter color of this product.

If the sorghum is to be made into *ugali*, as that is commonly eaten for lunch, the survey results suggest this grain be dehulled. There is a strong and statistically significant preference for the dehulled sorghum flour, that is said to be smoother and whiter than the product made from unde-hulled flour.

SMIP's recent market surveys indicate that in favorable rainfall years, sorghum can readily be purchased on the local market for such school-feeding programs. More importantly, the introduction of this product would significantly stimulate domestic sorghum production. And such a program would encourage farmers to invest in adopting better varieties and management technologies.

The development of the market for sorghum would reduce incentives to grow maize in drought-prone regions. If a consistent market for sorghum is created, this will also benefit industry. More competitive sorghum purchases will reduce grain assembly and transport costs. Sorghum will be more readily available to millers and the animal feeds industry at favorable prices.

If Tanzania experiences drought, it would be easy to replace the domestic grain supply with imports of sorghum grain. In 1992 the United States provided sorghum to Zimbabwe for use in food aid programs. This grain was marginally cheaper than maize and just as acceptable to consumers. African sorghum exporters include the Republic of South Africa and the Sudan. Alternatively, the school feeding program could readily shift back to 100% maize, at least until domestic sorghum supplies recover.

SMIP is now encouraging the WFP to substitute at least 10% of the maize currently destined for Tanzania's school-feeding program with sorghum. It is hoped this will increase to 50% substitution in the sorghum-growing regions of the country within the next few years.

Adoption of Improved Sorghum and Pearl Millet Varieties in Tanzania

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Introduction

Sorghum [*Sorghum bicolor* (L.) Moench] and pearl millets [*Pennisetum glaucum* (L.) R. Br.] are important cereals for food security in the central high plateau comprising Singida and Dodoma regions of Tanzania, and come second to maize (*Zea mays* L.) in the Western (Tabora, Shinyanga, and Mwanza), and Southern (Mtwara, Lindi, and Ruvuma) Zones (Anonymous 1998). In Dodoma, Singida, Shinyanga, Mwanza, and Mara, sorghum and millets account for most of the national area under sorghum cultivation, while Dodoma, Singida, Shinyanga, and Tabora account for a large proportion of the national area under pearl millets. The area under millets includes both pearl millet and finger millet. The latter is grown mostly in Rukwa, Mara, and Kilimanjaro, and accounts for approximately one-third of the total millet hectareage.

The importance of sorghum and millets in the food basket of the Tanzanian population has led to considerable technological development, particularly of improved varieties that will provide a solid foundation for increasing farm-level productivity and incomes. A number of institutions such as the Food and Agriculture Organization of the United Nations (FAO), realizing the importance of quality seed of improved varieties, have from time to time provided farmers with seed through relief programs. Private seed companies have not fully engaged in the commercial aspects of developing seed of open-pollinated varieties or seed of small and coarse grains like sorghum and pearl millet. To ensure sustainable availability of quality seed of improved varieties of these crops, SMIP worked closely with both public and private institutions to develop alternative seed systems strategies in three SADC countries including Tanzania, and measured the impact of this intervention.

Improved varieties

Under the terms of the impact-monitoring plan for SMIP Phase IV, a baseline estimate must be established for adoption of improved varieties in each of four pilot countries. In Tanzania, the baseline established in the

early 1990s suggested that the level of adoption of new sorghum and pearl millet varieties was as low as 5%. Since then, two new sorghums (Pato in 1995 and Macia in 1999) and two pearl millets (Okoka and Shibe in 1994) have been released. These new varieties supplement other sorghums released previously (Tegemeo in 1986, Serena, Seredo, and Lulu in the late 1960s and early 1970s) and pearl millet Serere 17 in the early 1970s. Recent efforts to multiply and promote these improved varieties are known to have resulted in a significant increase in adoption, but the actual level of adoption has not been officially documented. Therefore, an adoption survey was deemed a necessary part of the impact-monitoring plan of the SMIP Phase IV program, that would indicate:

- Increased levels of adoption for improved sorghum and millet varieties from 7-20% in the three target countries Tanzania, Zimbabwe, and Mozambique from 1997/8 to 2002/3.
- Increase in area sown to new sorghum varieties from 64 thousand ha in 1997/8 to 260 thousand ha, and pearl millet from 37 thousand ha in 1997/8 to 118 thousand ha by 2002/3.

This would imply promotion of adoption of new sorghum varieties by 520 thousand farmers and of pearl millet varieties by 235 thousand farmers in the three target countries.

Survey methodology

A formal survey was conducted to assess the level of adoption and acceptance of the new improved sorghum and pearl millet varieties. The survey also evaluated

household strategies for seed supply, and the degree to which farmers are replacing traditional varieties of sorghum and pearl millet. Information was derived from nine regions of Tanzania (Arusha, Dodoma, Lindi, Mara, Mtwara, Mwanza, Shinyanga, Singida, and Tabora). Districts were selected according to the importance of the crops in terms of hectareage, production, and consumption. Two districts were selected from each region, except in Tabora and Arusha, where only one district from each was chosen. Villages and respondents were selected at random, and gender was taken into consideration. The 16 most important districts for the production of sorghum and pearl millet were covered. A minimum of 8 respondents was interviewed from two villages in each district, totaling 16 respondents per district. The exception was Kondoa District in Dodoma, where 24 farmers were interviewed because of the differential distribution of sorghum and pearl millet areas in the district, and Kwimba, Misungwi, and Bunda, where 17 farmers were interviewed in each district. The national survey therefore involved a total of 267 respondents. The varieties Tegemeo, Pato, Macia, Serena, and Seredo were targeted for sorghum adoption, and Serere 17, Okoka, and Shibe for pearl millet adoption.

Results

The survey revealed that the proportion of farmers who are aware of the new improved sorghum varieties ranges from about 16% in Lindi (Southern Tanzania) to as high as 80% in Dodoma (Central Tanzania). Those with experience in growing these varieties also ranged from as low as 6% (Lindi) to as high as 62% in Dodoma (Table 1).

Table 1. Proportion (%) of farmers aware of new sorghum varieties and experienced in growing them, Tanzania, 2001

Region	Farmers				Number of respondents
	Aware		Experienced		
	Improved	Local	Improved	Local	
Dodoma	79.5	20.5	61.5	38.5	40
Singida	60.0	40.0	38.1	61.9	32
Tabora	60.0	40.0	35.0	65.0	16
Shinyanga	63.1	36.9	45.0	55.0	32
Mwanza	50.5	49.5	42.0	58.0	50
Mara	45.6	54.5	47.1	53.0	17
Lindi	15.7	84.4	6.3	93.7	32
Mtwara	28.1	71.9	20.3	79.7	32
Arusha	36.0	64.0	29.2	70.8	16
Weighted mean ¹	56.8	43.2	42.3	57.7	267

1. Weighted against the proportion of sorghum area within the region

Table 2. Mean area sown to improved sorghum varieties, based on 2001 adoption survey study, Tanzania

Region/area (’000 ha)	Dodoma	Singida	Shinyanga	Mwanza	Other major	Other minor	Total	Improved (%)
Reference area	97	60	121	73	158	165	674	
Improved	46	18	50	37	53	40	244	36
Local	51	42	71	36	105	125	430	

The survey results were weighted against the national hectareage sown to sorghum, and revealed that improved sorghum varieties currently occupy approximately 36% of the area under sorghum (Table 2).

Similarly, the proportion of farmers who are aware of the existence of the new improved pearl millet varieties, ranges from a low of just 2% in the Lake Zone (Mwanza) to a high of 44% in the Central Zone (Dodoma). The proportion of farmers experienced in growing the varieties ranges from 0% (Mwanza) to 33% (Dodoma) (Table 3).

The survey results were weighted against the national hectareage, and showed that the improved pearl millet varieties now occupy approximately 27% of the total area sown to pearl millet. It has taken more than 6 years to reach these levels of adoption, from the time the last releases were made in 1994 for the pearl millet varieties Okoa and Shibe, and in 1995 for the sorghum variety

Pato. As a result of the combined functioning seed systems in the Central Zone, and the national drought relief efforts, Macia, the most recent release, is rapidly becoming known to farmers. The survey further revealed that a majority of farmers in Tanzania have learned about the new improved varieties through the Extension Service (over 70% for the variety Pato), whereas about 22% learned of this variety from other farmers.

Contribution toward achieving SMIP impact indicators

The major SMIP impact indicator seeks a regional increase in adoption levels to 20%, from base values of 7%, set in 1998. The progress made in Tanzania so far guarantees that the project impact indicators will be met. These adoption levels (36% adoption for sorghum and 27% for pearl millet) will contribute significantly towards meeting the target impact indicators.

Table 3. Proportion (%) of farmers aware of new pearl millet varieties and experienced in growing them, Tanzania, 2001

Region	Farmers				Number of respondents
	Aware		Experienced		
	Improved	Local	Improved	Local	
Dodoma	43.8	56.3	32.5	67.5	40
Singida	42.2	57.8	26.6	73.5	32
Tabora	-	-	-	-	16
Shinyanga	18.8	81.2	14.1	86.0	32
Mwanza	2.0	98.0	-	-	50
Mara	-	-	-	-	16
Lindi	-	-	-	-	33
Mtwara	-	-	-	-	32
Arusha	-	-	-	-	16
Weighted mean	29.7	52.2	21.1	55.9	267