

Evaluation of Crop Performance and Farmer Preference for Pearl Millet Varieties in Tanzania

MAN
24/95

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Abstract

This study was carried out to select an improved pearl millet variety acceptable to the farming community of Tanzania, after comparison with farmers' local land-race varieties (LLVs). Twenty-one farmers from three districts participated. Improved varieties TSPM 91018 and TSPM 91001, which had been used in national on-station trials for more than three seasons and were found to be promising, were established in the farmers' fields in three districts in the 1993/94 season. The farmers' LLV and Serere 17, an improved released variety, were included in the Singida district trial for additional comparison.

The variety TSPM 91018 was selected by farmers because of its earliness in maturity, long heads, large grain size and high yield. This variety was superior overall to the farmers' LLV and the improved released variety Serere 17. Across villages in the three districts TSPM 91018 produced 2.31 t ha⁻¹ of grain, 43% more than the farmers' LLV (1.62 t ha⁻¹). In Dodoma district, where both the farmers' LLV and Serere 17 were included, the new variety yielded 28% and 48% more respectively. This variety matures about 2 weeks earlier than the farmers' LLV, which gives it an advantage of escaping drought in seasons characterized by the early termination of rains—a normal occurrence in the central plateau of Tanzania.

Introduction

The Tanzania national agricultural research program and SADC/ICRISAT/SMIP have participated in a joint project to improve pearl millet varieties for Tanzania since

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Letayo, E.A., Saadan, H.M., Mndolwa, S.I., Gupta, S.C., and Monyo, E.S. 1996. Evaluation of crop performance and farmer preference for pearl millet varieties in Tanzania. Pages 65-70 in Drought-tolerant crops for southern Africa: proceedings of the SADC/ICRISAT Regional Sorghum and Pearl Millet Workshop, 25-29 Jul 1994, Gaborone, Botswana (Leuschner, K., and Manthe, C.S., eds.). Patancheru 502 324, Andhra Pradesh, India: International Crops Research Institute for the Semi-Arid Tropics.

1989. Through this project several high-yielding varieties have been developed and tested in several research stations throughout the country.

Pearl millet is a major crop, particularly in the central part of Tanzania, comprising Dodoma, Singida, and Shinyanga regions. The crop covers about half of the land under cereal cultivation in the three regions and, apart from sorghum, it is a crop on which farmers depend for their food. The average annual rainfall in these areas is about 600 mm. The farmers have been growing this crop for a long time and the most common varieties are still their local landraces. It is a crop of high value in the community and it is used for food, particularly in the preparation of both thin and stiff porridge, as well as a source of cash.

The local landrace varieties (LLVs) take a long time to mature and, as a result of the small amount of rainfall in this part of the country, in most years the plants are unable to fill the grain due to early termination of the rains. So it is desirable to obtain a variety that matures earlier than farmers' LLVs. Earlier, Serere 17 was bred to serve this purpose. But it was observed to mature too early, i.e., its maturity coincided with the annual migration of quelea birds in the pearl millet zone. As a result this variety suffered considerable damage from bird attack, and is no longer popular in the farming community.

Essentially, an improved variety is needed that is earlier than the farmers' LLVs, to escape terminal drought which is often experienced by these cultivars, but with slightly later maturity than Serere 17, in order to avoid maturing when quelea birds migrate.

Since superiority of a new variety over that of the farmers' LLVs must be established in on-farm conditions, the Tanzania national sorghum and millets program began on-farm research in Dodoma and Singida regions, which are the extension target areas for the crop. On-farm research gave farmers a chance to grow new pearl millet varieties in their own environments and an opportunity to select the variety of their choice.

Materials and Methods

Farmers were selected from five different villages in three districts to represent the farmers in the target area, so that new varieties could subsequently be recommended for adoption with the assistance of extension personnel. The villages involved in the trials were Iloilo and Chanhumba in Dodoma rural district, Ntondo and Unyanga in Singida rural district, and Tulya in Iramba district.

In general most of the villages had sandy loam and sandy clay loam soils. Dry seeding is normally done in Dodoma in November while, in Singida, seed is normally sown in January after the land has been tilled with an oxen-drawn plow. These trials were sown in Dec 1993 in Dodoma district and the rains came early in Jan 1994. In Singida and Iramba districts sowing was done from early January to early February.

In all villages seeds were sown at a spacing of 80×30 cm ($41\ 667$ plants ha^{-1}). Most farmers in Dodoma did not use any fertilizers or manure, whereas most farmers in Singida and Iramba applied farmyard manure just before sowing at a rate of 10 t ha^{-1}

(250 g hole⁻¹). The number of weedings was variable; while most farmers in Dodoma weeded twice, those in Singida did up to three weedings before the crop flowered, and in Iramba weeding was done twice.

In all three districts no disease or pest control program was undertaken because field pests and diseases were not a major problem in the 1993/94 season. As during the previous grain harvest, the major problem encountered was storage pests, and follow-up studies are planned.

Field data were collected by the extension personnel and, because data on the number of days to flowering and the number of days to maturity were not recorded at all locations, this information is not presented in the tables. The data collected were from a sample area of 45 m² and included the following parameters:

1. Number of hills: determined by counting the number of hills from the sample areas.
2. Head count: the number of heads harvested from a sample area.
3. Head weight: determined by weighing the dried heads from the sample area.
4. Grain yield: after threshing the grain was collected and weighed in grams per plot.
5. Farmer preference: i.e., which variety was most preferred, followed by the second choice.

Results and Discussion

In Dodoma district TSPM 91018 produced the highest grain yield (1.44 t ha⁻¹) and was significantly superior to all other varieties in respect of grain production (Table 1). This variety had a yield advantage of about 29% over the farmers' LLV. This variety also had significantly higher threshing percentage as compared with the farmers' LLV and Serere 17. TSPM 91001 had the highest plant population, whereas Serere 17 produced the highest number of heads per plot.

Table 1. Performance data of pearl millet on-farm verification trial entries averaged over a total of eight unreplicated sites in two villages, Dodoma rural district, Tanzania, 1993/94 season.

| Variety | Plant count (ha ⁻¹) | Head count (ha ⁻¹) | Threshing (%) | Grain yield (t ha ⁻¹) |
|--------------|------------------------------------|-----------------------------------|------------------|--------------------------------------|
| TSPM 91018 | 25703 | 76094 | 67.9 | 1.44 |
| TSPM 91001 | 29609 | 76796 | 61.6 | 1.13 |
| Farmers' LLV | 27656 | 50625 | 58.8 | 1.12 |
| Serere 17 | 27344 | 92813 | 60.0 | 0.97 |
| Mean | 27578 | 74082 | 62.1 | 1.17 |
| SE | ±985 | ±5291 | ±2.8 | ±0.10 |
| CV (%) | 10.1 | 20.2 | 12.9 | 24.2 |

Table 2. Performance data of pearl millet on-farm verification trial entries averaged over a total of nine unreplicated sites in two villages, Singida rural district, Tanzania, 1993/94 season.

| Variety | Plant count (ha ⁻¹) | Head count (ha ⁻¹) | Threshing (%) | Grain yield (t ha ⁻¹) |
|--------------|------------------------------------|-----------------------------------|------------------|--------------------------------------|
| TSPM 91018 | 37500 | 100089 | 59.6 | 2.90 |
| TSPM 91001 | 36736 | 97917 | 60.5 | 2.40 |
| Farmers' LLV | 31000 | 84125 | 47.5 | 1.98 |
| Mean | 35625 | 95357 | 57.1 | 2.46 |
| SE | ±3336 | ±4002 | ±4.2 | ±0.14 |
| CV (%) | 28.1 | 12.6 | 6.2 | 16.9 |

In Singida district, TSPM 91018 gave significantly higher grain yield as compared with TSPM 91001 and the farmers' LLV (Table 2). It had yield advantage of about 46% over the farmers' LLV, and 16% over TSPM 91001 (Table 2). Serere 17 was not included in this trial. Both TSPM 91018 and TSPM 91001 were superior to the farmers' LLV in respect of head count per hectare and threshing percentage.

In Iramba district TSPM 91018 also produced significantly higher grain yield as compared with other varieties (Table 3). There were no significant differences among varieties for other traits.

Table 3. Performance data of pearl millet on-farm verification trial entries averaged over a total of four unreplicated sites in one village, Iramba district, Tanzania, 1993/94 season.

| Variety | Plant count (ha ⁻¹) | Head count (ha ⁻¹) | Threshing (%) | Grain yield (t ha ⁻¹) |
|--------------|------------------------------------|-----------------------------------|------------------|--------------------------------------|
| TSPM 91018 | 25469 | 48281 | 73.0 | 3.01 |
| Farmers' LLV | 32188 | 58125 | 76.7 | 2.18 |
| TSMP 91001 | 25313 | 47656 | 71.0 | 2.05 |
| Mean | 27656 | 51354 | 73.5 | 2.41 |
| SE | ±2724 | ±6229 | ±4.2 | ±0.28 |
| CV (%) | 19.7 | 24.3 | 11.3 | 23.3 |

Based on the mean over all the sites across three districts, TSPM 91018 produced the highest grain yield (2.31 t ha⁻¹) followed by TSPM 91001 (1.85 t ha⁻¹) (Table 4). TSPM 91018 had 43% yield advantage over the farmers' LLV and 25% over TSPM 91001. TSPM 91018 had a higher threshing percentage, and a greater number of heads per plot as compared with the farmers' LLV.

Although data on days to flowering were not collected in all villages, in those villages where they were taken Serere 17 was the earliest to flower (42 days after sowing), followed by TSPM 91018 (47 days) and TSPM 91001 (55 days), while the

Table 4. Performance data of pearl millet on-farm verification trial entries averaged over 21 unreplicated sites across five villages of three districts: Dodoma rural, Singida rural, and Iramba, Tanzania, 1993/94 season.

| Variety | Plant count (ha ⁻¹) | Head count (ha ⁻¹) | Threshing (%) | Grain yield (t ha ⁻¹) |
|--------------|------------------------------------|-----------------------------------|------------------|--------------------------------------|
| TSPM 91018 | 30000 | 79079 | 65.9 | 2.31 |
| TSPM 91001 | 31845 | 80297 | 62.9 | 1.85 |
| Serere 17 | 27344 | 92812 | 60.0 | 1.62 |
| Farmers' LLV | 29705 | 62242 | 59.7 | 1.62 |
| Mean | 30192 | 76759 | 62.5 | 1.82 |
| SE | ±1290 | ±3017 | ±1.6 | ±0.08 |
| CV (%) | 19.6 | 18.0 | 11.5 | 21.2 |

farmers' LLV took 64 days. Because it matures 30–35 days earlier than the farmers' LLV, Serere 17 is seriously attacked by birds. It was also observed that the farmers' LLV suffers from terminal drought.

Farmers' Preference

Throughout the growing season, farmers observed the performance of varieties in on-farm trials.

Just after emergence, 70% of the farmers selected TSPM 91018 as their first choice, particularly on the basis of seedling vigor, while the remaining farmers selected their LLV as the first choice.

On the basis of plant vigor (before heading), the first choice was TSPM 91018, followed by the farmers' LLV, TSPM 91001, and Serere 17.

After noting the days to flowering, all farmers selected TSPM 91018 as their first choice, followed by TSPM 91001, their LLV, and Serere 17. The reasons given for choosing TSPM 91018 are that it flowered earlier than their LLV and the heads were very long.

The fourth evaluation was done when all varieties had matured. The farmers' first choice was still TSPM 91018. Reasons for this choice were that it was earlier in flowering and matured in 79 days, while their LLV took more than 100 days to mature. They also cited long heads and larger grain size as added advantages over the LLVs.

Since Serere 17 is no longer popular in this area for the reasons already noted, it is desirable to obtain a variety that matures later than Serere 17 but earlier than the farmers' LLV. TSPM 91018 matures 15 days after Serere 17 but earlier than the farmers' LLVs. This variety was also superior in yield to all the varieties that were evaluated on farmers' fields, including the farmers' LLVs used in all the locations.

Conclusion

TSPM 91018 was observed to possess the desirable characters of earliness and high grain yield. In addition, it was the farmers' first choice in all the villages where the trials were conducted. This variety also fits well into the short rainy season of the central Tanzania zone. Due to its proven superiority in both yield and acceptability by farmers, this variety will be recommended to the variety release committee for prerelease in Nov 1994, for possible release in Oct 1995. During the 1994/95 season information will be collected from more villages in more districts throughout Tanzania to make a stronger case for release.