Farmers’ perceptions of constraints to sorghum production, and *Striga* control practices, in semi-arid areas of Tanzania

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Introduction

• Sorghum is widely grown in arid and semi-arid parts of sub-Saharan Africa (SSA).

• In SSA sorghum productivity is low: biotic and abiotic stresses, and socio-economic constraints.
Introduction

• Both *Striga hermonthica* (Del.) Benth and *S. asiatica* (L.) Kuntze] occur in Tanzania, and cause yield losses of 30 -90% in sorghum, and other cereals

• Cultural, chemical and host resistance measures have not been adopted in Tanzania, and *Striga* infested fields are simply abandoned

*S. asiatica*  
*S. hermonthica*
Parts of Africa affected by *Striga*

Sorghum fields infested by *Striga*
• Understanding farmers’ production constraints and perceptions of *Striga* management is essential for demand-led sorghum breeding

**Research Objective**
To assess constraints affecting sorghum production and farmers’ approaches of *Striga* management in the semi-arid regions of Tanzania, as a basis for breeding for *Striga* resistance
Materials and methods

Description of study sites and sampling

• Three districts (Igunga, Kishapu and Meatu), all situated in the semi-arid areas of western Tanzania

• Six wards: Mbutu and Isakamaliwa (from Igunga District), Mwataga and Kishapu (from Kishapu District), Mamshali and Mwagwila (from Meatu District)

• Six villages were selected each with 20 farmers

• A total of 120 farmers participated in individual interviews
Striga distribution map within the boundaries of Tanzania (MacOpiyo et al. 2009), and location of the three study districts, indicated by a thick, black line
Focus group discussions (FGDs)

• FGDs were held in each village
• Each focus group composed of eight representative farmers, local leaders, and key informants
• A total of 48 farmers participated in the FGDs across the three districts
Materials and Methods

• Data sources

Face-to-face interviews, observations made through transect walks across selected villages, and discussions with focus groups.
Materials and Methods

• Data source and data analysis

Semi-structured questionnaire: farmers’ preferences, perceived production constraints, levels of *Striga* infestation and control practices

Farmers` preferred traits in sorghum varieties were described and ranked using a pair-wise matrix technique

Data analyzed using the Statistical Package for Social Scientists (SPSS) computer software
Results

*Crop production*

The majority of the farmers allocated most of their land to sorghum, followed by cotton, and maize.

Different crops grown in 2013/2014 cropping season
Results

Perceived constraints to sorghum production:
Drought, low soil fertility, *Striga* infestation, storage pests, damage by birds, lack of improved varieties, lack of production inputs and diseases

75% to 85% of the respondents ranked *Striga* infestation as a highly important constraint

The two *Striga* species were identified as the most abundant parasitic weeds
# Major constraints to sorghum production

<table>
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<th>Severity</th>
<th>District</th>
<th>Mean</th>
<th>Df</th>
<th>Chi-Square</th>
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</table>

HS = high severity, MS = moderate severity and LS = low severity, Df = degrees of freedom
Striga infestation and control strategies:

- Hand weeding, crop rotation, fallowing, intercropping, and organic manure application were some of the farmer recognized control measures, BUT they were hard to apply consistently.

- Most interviewed farmers (80%) had little knowledge of the internationally recommended Striga management practices.
  - No knowledge on these technologies
  - No extension service providing detailed information about these control options

- Adoption of Striga resistant varieties has been slow:
  - The absence of farmers` preferred traits
  - No organized seed system to deliver the new varieties
  - Loss of Striga resistance: Macia, Serena, Wahi, Pato, and Tegemeo

There is a need to develop and distribute locally adapted sorghum varieties with resistance to Striga AND farmer preferred traits.
Farmers’ ranking of the traits of preference in sorghum varieties

- In all districts, resistance to *Striga* was rated as the No. 1 trait of preference.

- Farmers preferred sorghum varieties that were:
  - early maturing - to escape drought
  - tolerant to *Striga* infestations
  - bird repellent

- Differences existed in the ranks between the districts.
### Farmers’ traits of preference (%) for sorghum varieties

<table>
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<tr>
<th>Traits</th>
<th>District</th>
<th>Mean</th>
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<td>Igunga</td>
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<tr>
<td><strong>Striga resistance</strong></td>
<td>45.0</td>
<td>42.5</td>
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<td><strong>Earliness</strong></td>
<td>17.5</td>
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<td><strong>Drought tolerance</strong></td>
<td>12.5</td>
<td>17.5</td>
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<td><strong>Resistance to bird attack</strong></td>
<td>11.0</td>
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<td><strong>Pest and disease resistance</strong></td>
<td>4.5</td>
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<td><strong>Grain yield</strong></td>
<td>6.0</td>
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<td><strong>Grain quality</strong></td>
<td>3.5</td>
<td>2.5</td>
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</tbody>
</table>
Conclusions

- **Sorghum** was the most valuable cereal crop in the semi-arid regions of Tanzania.

- **Striga infestation** was the major biotic constraint limiting sorghum production.

- **Factors limiting Striga management**: herbicides (unavailability and unaffordability), delayed hand weeding, lack of *Striga* resistant and farmers` preferred varieties.

- **Sorghum breeding program required**: develop sorghum varieties for *Striga* resistance that include farmer preferred traits in locally adapted varieties.
Breeding for farmers-preferred, *Striga* resistant and FOS compatible sorghum genotypes

1. *Sorghum bicolor*

Superior Sorghum Lines:
- *Striga* Resistance:
  - low stimulants
  - reduced metabolites
  - mechanical
- Compatibility with FOS suppress *Striga*

Germination stimulants: strigolactones

Tritrophic Interaction

2. *Striga hermonthica* or *S. asiatica*

BioControl of *Striga*
- Direct – FOS attacks germinating plants
- Indirect – FOS degrades strigolactones

3. *Fusarium oxysporum* f.sp. *strigae*
Dr Mrema with candidate sorghum varieties developed for *Striga* resistance and compatibility with FOS biocontrol, at Tumbi Agricultural Research Institute, Tabora Region, Tanzania
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