Integrated Management of Striga hermonthica in Maize in the Nigerian Savannas

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Introduction
Introduction

- Maize is the most important staple food crop for over 300 million people in SSA.

- Africa produces approximately 52 million tons annually from about 29 million ha.

- Over 95% of maize produced in SSA is grown by small to medium scale farmers for subsistence needs.

- Nigeria is one of the highest maize producers in SSA (7.5 million tons of grain from 5 million hectares annually).
Introduction

- One of the main constraints to the production of maize in Nigeria are parasitic weeds (*Striga hermonthica*).
- Maize yield losses due to *Striga* can be as high as 80%.
- In Nigeria, these losses cause widespread food insecurity and malnutrition and threaten the livelihood of rural farmers.
Striga on maize
Percentage of fields infested by *Striga* species in northeast Nigeria

<table>
<thead>
<tr>
<th>Ecological zone</th>
<th>Sorghum</th>
<th>Maize ¹</th>
<th>Rice ²</th>
<th>Millet ³</th>
<th>Cowpea ⁴</th>
<th>Fallow ³</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudan savanna</td>
<td>100</td>
<td>96</td>
<td>-</td>
<td>100</td>
<td>71</td>
<td>45</td>
<td>82.4</td>
</tr>
<tr>
<td>Northern Guinea</td>
<td>96</td>
<td>87</td>
<td>61</td>
<td>-</td>
<td>95</td>
<td>48</td>
<td>77.4</td>
</tr>
<tr>
<td>Southern Guinea</td>
<td>93</td>
<td>56</td>
<td>58</td>
<td>-</td>
<td>78</td>
<td>37</td>
<td>64.4</td>
</tr>
<tr>
<td>Mean</td>
<td>96.3</td>
<td>79.6</td>
<td>59.5</td>
<td>100</td>
<td>81.3</td>
<td>43.3</td>
<td>74.7</td>
</tr>
</tbody>
</table>

Associated Striga species:
Striga on various Crops

- Striga effect on sorghum
- Striga effect on rice
- Striga effect on maize
- Striga effect on cowpea
Range of Striga-management options developed and tested

- Resistant varieties
- Complimentary crop management practices (trap crops in rotation, push-pull, fertilizer application)
- IR-Maize
Putting research into use

- Development of strong partnerships
- The use of participatory approaches
- Strengthening of community based organisations
- Production for the market
- Gender mainstreaming
- Use of research knowledge and proven technologies for innovation
Form coalition of partners and hold workshops to set-up IPs

- Research: IITA, IAR, UniMaid, BUK
- Extension: BOSADP, Agric Dept. Biu, Damboa, Hawul, Kwaya
- NGOs: WOFAN, CDEV.
- Input dealers: Jubaili, Africa Agro, KASAIDA, community input dealers
- Banks: Nigeria Agricultural Bank
- Policy makers: Ministry Agric, LG Chairmen and councillors from the four LGAs
- Agro-processors: Grand Cereals Comp., Jos, Modern Universal Foods, Kano
- Seed companies: Premier Seed, Seed Project Co., Jirkur Seed Cooparative
- Farmers organisations
Use of PREA approach to provide targeted interventions along the value chain

- Community and livelihood analysis to identify problems, opportunities and discuss solutions among stakeholders
- Social mobilization
- Action planning
- Testing promising technologies (on-station and on-farm)
- Sharing experience (mid-season evaluation)
- Self-evaluation
Learning Together Through Participatory Extension Approaches

PEA Learning Cycle

- Social mobilisation
  - Entering community
  - Building trust
  - Feedback to community
  - Identifying local organisations
  - Raising awareness
- Experimentation while implementing action
  - Identifying needs & problems
  - Prioritising needs & problems
- Action planning
  - Searching for solutions
  - Mandating local institutions
- Self-evaluation
  - Planning for next learning cycle
- Sharing experience
  - Mid-season evaluation
  - Process monitoring & review
- Social!
Community and livelihood analysis to define entry points

- Community analysis carried out in the targeted communities to identify constraints and define entry points
Community and livelihood analysis to define entry points

Constraints
• Poor soil fertility
• Parasitic weed infestation
• Drought
• Crop pests and diseases
• Poor crop management
• Dysfunctional markets
• Poor access to information
• Post-harvest losses
• Ineffective policies
Community and livelihood analysis to define entry points

Possible agreed solutions

- Foster interaction among stakeholders to find and share information on constraints and solutions
- Crop diversification to improve soil fertility and control Striga
- Cereal-legume rotation to improve soil fertility and control Striga
- Deployment of Striga-resistant crop varieties
- Use of organic/inorganic mineral nutrient sources
- Try biological control options using fungi
- Link farmers to market
Social Mobilization to engage identified community groups

- CBOs engaged in each community to experiment new innovations to control Striga
- CBOs nominated 1 or 2 lead farmers to demonstrate a selected technology
- CBOs selected key farmers to produce seeds in community-based seed schemes
PROSAB’s development approach

- **On-station trials** – breeding, plant screening, etc

- **Mother trials (PROSAB)**
  - On-farm research – variety trials, management practices

- **Farmer Groups**
  - Lead farmer trials, local seed production,
  - Farmer testing and learning, adoption/adaptation
  - Input and output marketing

- **Scaling out**
  - Farmer-to-farmer extension
  - Further farmer testing, adoption, adaptation

**Knowledge**

- **Partnerships**
- **PREA**
- **Strong CBOs**
- **Gender**

**No of households involved**

- **Pre 2004**
- **2004-5**
- **2006-7**
- **2007-8**

**Time**

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Effect of maize varieties and N fertilization on grain yield, *Striga* emergence and damage score
Effect of N fertilization on *Striga* Infestation of maize genotypes

<table>
<thead>
<tr>
<th>Location</th>
<th>Early-maturing</th>
<th>Late-maturing</th>
<th>N rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No of <em>Striga</em>/plot</td>
<td>Grain yield (kg/ha)</td>
<td>No of <em>Striga</em>/plot</td>
</tr>
<tr>
<td>Sabongari</td>
<td>74.9</td>
<td>2021.9</td>
<td>79.6</td>
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<tr>
<td>Wandali</td>
<td>64.3</td>
<td>3128.1</td>
<td>137.5</td>
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<tr>
<td><strong>N rates</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>87.5</td>
<td>1277.3</td>
<td>122.7</td>
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<tr>
<td>30</td>
<td>76.6</td>
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<td>132.6</td>
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<tr>
<td>60</td>
<td>75.2</td>
<td>3128.3</td>
<td>106.4</td>
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<tr>
<td>120</td>
<td>39.1</td>
<td>3725.1</td>
<td>72.5</td>
</tr>
<tr>
<td>SED (Location)</td>
<td>8.9</td>
<td>102.7</td>
<td>12.2</td>
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<tr>
<td>SED (Nitrogen)</td>
<td>15.3</td>
<td>205.6</td>
<td>21.9</td>
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</table>
Nitrogen and cultivar effect on grain yield of maize under natural infestation with *Striga*.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Nitrogen levels (kg ha(^{-1}))</th>
<th>Grain yield kg ha(^{-1})</th>
<th>Mean</th>
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<tr>
<td>8331-1-1</td>
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<tr>
<td>9022-13STR</td>
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<td>1396.0 2594.2 2653.2 4667.3</td>
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<tr>
<td>ACR 97 TZL COMP1-W</td>
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<tr>
<td>IWDC2 SYN F2</td>
<td>0 30 60 120</td>
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<tr>
<td>TZB-SR</td>
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<td>828.8 2114.0 1853.1 3105.6</td>
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<tr>
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<tr>
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S E D L x N 187.32**

S E D L x V 280.98**

S E D L x N x V 561.96
Cereal-legume rotation
On-farm performance of maize in rotation systems (NGS and SGS)

<table>
<thead>
<tr>
<th>Ecological zone</th>
<th>Crop history</th>
<th>Yield (kg/ha)</th>
<th>Striga/ha</th>
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<tbody>
<tr>
<td>NGS</td>
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<td>208493</td>
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<td>S.E.</td>
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Mean grain yield of maize varieties following cowpea on farmers’ field (Sudan Savanna)

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Striga ha(^{-1})</th>
<th>Grain yield ha(^{-1})</th>
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</thead>
<tbody>
<tr>
<td>Cowpea</td>
<td>2000SYN-STR</td>
<td>0</td>
<td>3177</td>
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<tr>
<td>Cowpea</td>
<td>2004SYN-STRTZE</td>
<td>17515</td>
<td>3510</td>
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<tr>
<td>Cowpea</td>
<td>99TZEE-Y-STR</td>
<td>5515</td>
<td>2864</td>
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<td>Cowpea</td>
<td>99EVDTSTR-TZE</td>
<td>1667</td>
<td>3046</td>
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<td>FC</td>
<td>FC</td>
<td>32192</td>
<td>1871</td>
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<tr>
<td>Mean</td>
<td></td>
<td>11378</td>
<td>2966</td>
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</table>
Mean grain yield of maize varieties following groundnut on farmers’ field

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Striga ha(^{-1})</th>
<th>Grain yield ha(^{-1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groundnut</td>
<td>2000SYNEE</td>
<td>6566</td>
<td>3014</td>
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<td>Groundnut</td>
<td>2004SYNST-TZE</td>
<td>4007</td>
<td>2593</td>
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<td>Groundnut</td>
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<td>Groundnut</td>
<td>99EVDSTSTR-TZE</td>
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<td>3493</td>
</tr>
<tr>
<td>FC</td>
<td>FC</td>
<td>32182</td>
<td>1534</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>11031</td>
<td>2757</td>
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</tbody>
</table>
## Mean grain yield of maize varieties following soybean on farmers’ field

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Striga $\text{ha}^{-1}$</th>
<th>Grain yield $\text{ha}^{-1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybean</td>
<td>2000SYN</td>
<td>3112</td>
<td>3375</td>
</tr>
<tr>
<td>Soybean</td>
<td>2004SYNSTR-TZE</td>
<td>8415</td>
<td>2891</td>
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<td>Soybean</td>
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<td>1313</td>
<td>1875</td>
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<tr>
<td>Soybean</td>
<td>99EVDTSTR-TZE</td>
<td>3022</td>
<td>4022</td>
</tr>
<tr>
<td>FC</td>
<td>FC</td>
<td>20357</td>
<td>1724</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td>7244</td>
<td>2777</td>
</tr>
</tbody>
</table>
Build and strengthen capacity of Stakeholders
Organized mid-season evaluation and mega field days

- Organized mid-season evaluations across communities to establish advantages and disadvantages of technologies
- Organized mega field days to scale-out and up project activities
- .
Adoption – Formal Survey

Maize: 89% SS, 73% NGS, 55% SGS
Soybean: 68% SS, 77% NGS, 55% SGS
Cowpeas: 16% SS, 42% NGS, 42% SGS
Groundnuts: 39% SS, 39% NGS, 39% SGS
Rotation: 38% SS, 44% NGS, 38% SGS
Covering fertiliser: 89% SS, 39% NGS, 39% SGS
Close spacing: 74% SS, 60% NGS, 55% SGS
Spraying: 83% SS, 83% NGS, 33% SGS
Adoption (PASS – 2008) – Transect work and focus group discussion

2009

- 84% for maize
- 63% for soybeans
- 61% for rice
- 28% for cowpea
- 25% for groundnuts
- 8% for sorghum
- 93% for legume-based rotation
- 83% for use of herbicides/pesticides
- 68% for strip control through weeding
- 53% for closer spacing
- 50% for buying fertilizer
- 47% for soybean utilization

76% for soybean
Thank you