Background

• Land degradation in the form of soil erosion and declining soil quality is a serious challenge to agricultural productivity and economic growth in Ethiopia (Mulugeta et al., 2005).

• Tigray, the northern-most region of the country, suffers from extreme land degradation as steep slopes have been cultivated for many centuries and are subject to serious soil erosion (Wolde et al., 2007).

• Soil erosion due to high tillage frequency and other soil management problems has seriously affected over 25% of the Ethiopian highlands (Kruger et al., 1996).

• Such detrimental effect of soil erosion and water stress can be improved by management options like conservation agriculture practices, including permanent beds and other traditional practices.

Study location and experimental plots

• Experimental plots located Tigray region, N.Ethiopia 13º14’N and 39º32’E at an altitude of 1960 m.a.s.l (Fig. 2).

• Average weather data (1972-2006): Annual P = 504 mm (unimodal); Annual ET₀ = 1540 mm; T = 8-27.5°C; RH = 40–70 %

• Slope: 3 %; soil: Typic Casultert

• Experimental layout (B1= Block 1; B2=Block 2; T1 = Treatment 1; T2 = Treatment 2; T3 = Treatment 3)

• The whole experimental field is isolated from the top by 1.2 m wide and 0.5 m deep trench for the determination of sediment concentration

• Plot size= 19.1 * 5.5 m

• The sizes of the trenches were 1.5 m wide, 4.5 m long and about 1m deep.

• Study location and experimental plots (contd.)

• It was estimated by measuring the depth of the collected runoff in the trenches using a Trime-FM3-Tube-probe (TDR)

• Runoff volume was measured at 0800 after each storm that caused erosion.

• Runoff and soil loss were not significantly different among treatments on the first rainfall event that caused runoff.

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Results

• The traditional conservation practice Terwah (TERW) can be considered as first step towards conservation agricultural practice

• The traditional tillage practice (TRAD) had significantly lower overall soil loss than TRAD (Fig.8 & 9)

• TERW and TRAD had significantly higher runoff than PB especially at high rainfall periods (Fig.7)

• Soil loss was significantly lower in TERW and PB compared to TRAD especially during the end of rainy season (Fig.7)

• PB had significantly lower overall runoff compared to TRAD. Both PB and TERW had significantly lower overall soil loss than TRAD (Fig.8 & 9)

Table: Agronomic parameter; Tef yield, biomass, plant height, seed dry matter at first weeding and harvest index for the different treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Tef yield (kg ha⁻¹)</th>
<th>Weed dry matter (kg ha⁻¹)</th>
<th>Tef biomass (kg ha⁻¹)</th>
<th>Plant height at maturity (cm)</th>
<th>Harvest index</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRAD</td>
<td>1173 (50) a</td>
<td>6.7 (0.18) a</td>
<td>44 (2.5) a</td>
<td>0.18 (0.007) b</td>
<td></td>
</tr>
<tr>
<td>TERW</td>
<td>925 (99) b</td>
<td>4.5 (0.64) b</td>
<td>39 (3.5) b</td>
<td>0.21 (0.007) a</td>
<td></td>
</tr>
<tr>
<td>PB</td>
<td>678 (73) c</td>
<td>3.0 (0.69) b</td>
<td>31 (1.7) b</td>
<td>0.22 (0.004) a</td>
<td></td>
</tr>
</tbody>
</table>

Values in bracket are standard error. Values in column connected with the same letter are not significantly different.

• Weed (Cynodon dactylon) dry matter was significantly lower in TRAD → could not be controlled by hand weeding

Conclusion

• Permanent Beds (PB) showed lowest runoff and soil loss

• The traditional conservation practice Terwah (TERW) can be considered as first step towards conservation agricultural practice

• Highest yields were observed for the traditional tillage practice (TRAD) because of better control of weeds (Cynodon dactylon)

• Follow-up of appropriate use and dosing of herbicide (Glyphosate) is of utmost importance