

Conservation Agriculture (CA) is believed to improve soil nutrient and water status, soil structure, and enhances soil biodiversity. Maintenance of surface cover makes sense on smallholder cropping systems where input and labor efficiency is necessary to maintain profits. However, relevance of some CA benefits on smallholder farms have remained unclear and difficult to explain. This is probably because there is very little or inadequate empirical data to support such practices.



Figure 1: A good maize crop under conservation agriculture

Objectives

The aim of the study was to evaluate the effect of various tillage practices and residue retention/soil cover on the status of soil water, ammonium-N and labor on smallholder farms in western Kenya.

Materials and Methods

In a CA trial at KALRO Kakamega soil samples were collected at 0-10 cm, 10-30 cm, 30-60 cm and 60-90 cm from plots treated with 0 t residue + 75 kg N, 2 t residue + 75 kg N 4 t residue + 75 kg N and 8 t residue + 75 kg N ha⁻¹. The samples were collected one week after topdressing the maize with calcium ammonium nitrate fertilizer and analyzed for ammonium-N, and soil water content. In related on farm field trials labor costs for implementing different tillage practices (zero-tillage, ridges and conventional tillage) were collected and analyzed.

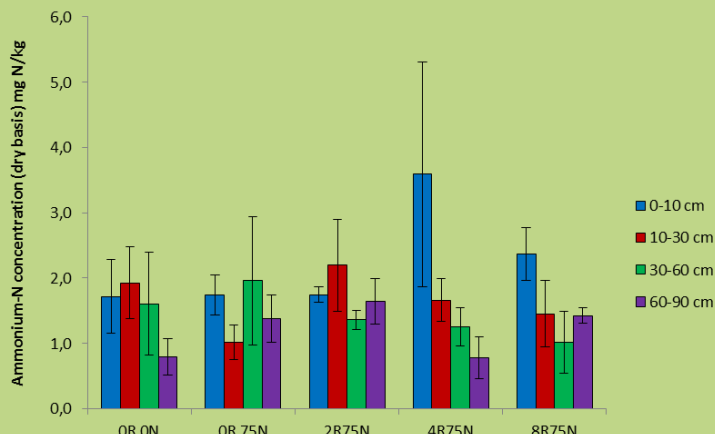


Figure 2: Ammonium-N concentration under different residue rates at different soil depths

Results

4 t of residue + 75 kg N gave the highest amount of ammonium-N recovery at top soil layer. Low levels of ammonium-N were recovered in all the soil layers sampled from the zero residue plots (Fig. 2).

0 t of residue gave highest soil water content beginning depths 20 cm to 100 cm compared to residue treatments (Fig. 3).

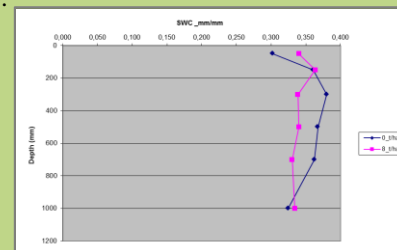


Figure 3: Soil Water Content

In all the four seasons of tillage experimentation, conventional tillage was the most expensive (Fig. 4).

Discussion and Conclusion

High recovery rate of ammonium-N due use of 4 t/ha of residue significantly improved the availability of applied nitrogen within the plant rooting zone thus increasing the nitrogen use efficiency (NUE). Reasons for the low recovery of N in the control remain unclear.

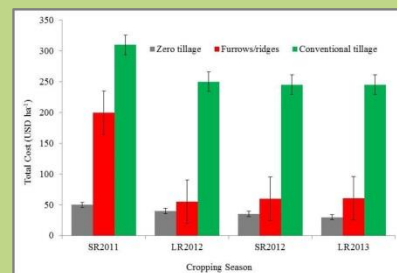


Figure 4: Labour costs (USD) for various tillage practices

Soil water content reduced significantly along the soil profile in the plot treated with 8 t residue compared to control. This signifies increased water utilization by the plants under CA practice. As reported in previous works, this experiment confirms that CA practices reduce labor cost by between 10-30% in both, the zero and furrow tillage compared to conventional tillage. Consistent use of cover crops (Figure 5) resulted in enhanced crop vigor and yields (Fig. 1), signifying improved soil health.



Figure 5: Cover crop on a conservation agriculture field