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Why is legume integration important in conservation agriculture cropping systems? Lessons regarding maize direct-mulch based cropping systems (DMC) cultivated on nitrogen rich soil in Ivory Coast.

Many results show that legume cover-crops play diverse agroecological roles for the sustainability of cereal based cropping systems and is important in providing nitrogen (N) supply for the subsequent cereal. Few studies have been conducted on the effects of conventional vs. conservation agriculture conversion in areas where soils are rich in top-soil organic status and entire soil physical properties which are cultivated by small-farms for annual cash products like maize as in Africa, Asia and South or Central America.

An agricultural experiment was carried out from 1995 to 1999 in the semi-deciduous area of Ivory Coast (Western Africa) with a randomized block design comparing 9 treatments on large elementary plots ($216m^2$) with four replications. For this study we focus only on 2 specific treatments to determine whether decomposition process could meet N supply needs for maize crops without any N fertilizer input. We compared N supplies in direct mulch based cropping systems (DMC) with 6 month maize cropping alternating with 6 fallow month, with the native *Chromolaena odorata* (Cho) and the introduced legume *Pueraria phaseoloides* (Pue). The two cover-crops were grown as live mulch. Phosphorus fertilizer only was applied on maize each year, 60 kg/ha the first year and 30 kg/ha after.

The Cho DMC treatment acted as a control and we focused this study in the 4th and 5th cropping years when significant maize-grain yield differences were recorded in favour at the Pue DMC treatment, respectively 5.6 against 4.6, and 5.4 against 3.5 t/ha.

N maize above-ground immobilizations were respectively for Cho DMC and Pue DMC, 123.5 and 152.7 kg N /ha in 1998 (significant) and 84.7 and 137.0 kg/ha in 1999 (significant).

In 1998, soil surface N stocks were high and not significantly different for both treatments respectively at the first 10 cm of soil, 2580 kg N/ha (+/-90) for Cho DMC and 2300 kg/ha (+/-80) for Pue DMC.

N cover crop immobilizations were respectively for Cho DMC and Pue DMC, 76.5 and 70.9 kg N /ha in 1998 (non significant) and 85.5 and 142.0 kg/ha in 1999 (significant).

Mean of $\delta^{15}N$ natural abundance values of the first 10 cm of soil at the beginning of the experiment (1995) were +8.83 (+/-0.52). Means of $\delta^{15}N$ Cho and Pue above-ground biomass were significantly different, respectively + 6.34 (+/-0.28) and +3.28 (+/-0.38). We estimated the % of N immobilization in above-ground Pue biomass coming from the atmosphere at 62.9 and 56.4%, respectively soil and Cho as reference. Means of $\delta^{15}N$ of the leaf near the maize ear were significantly different each year, +8.07 (+/-0.30) for Cho DMC and +6.50 (+/-0.44) for Pue DMC in 1998 and, +8.16 (+/-0.08) for Cho DMC and +4.86 (0.30) for Pue DMC in 1999. We estimated amounts of N coming from the legume cover for N maize above-ground immobilizations, 39.9% in 1998 and 80.4% in 1999 with Cho as reference.

We concluded that despite very high N soil stocks the N cover crop supply from the direct litter cover crop and via new soil organic matter mineralization represented a large N supply for subsequent maize crops. Thus we hypothesized that in DMC and in conservation agriculture systems the largest amount of soil N was not available for the crops because in the absence of soil tillage, it is protected within the soil aggregates. Legumes would therefore, play with continuous minimum tillage cropping systems, a major role in providing significant amount N supply for cereals.