Changes in Some Chemical Properties of an Oxisol and Summer Crops Yields as Affected by Tillage and Cover Crops in Southwestern Parana, Brazil. *

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In Brazil, since colonization started, the lack of adequate global planning in natural resources in all different regions as well as the use of land without taking into consideration its 'agricultural aptitude have led to misuse and exploitation of land. The State of Parana, located in the Southern part of the country (22° 29' 30" and 26° 42' 59" of south latitude and between 48° 02' 24" and 54°37' 38" of longitude west of Greenwich), is one of the most important agricultural regions, representing only 2.4% of total agricultural exports. In this State approximately 6.5 million hectares are cultivated with summer crops such as soybeans, maize, beans, cotton, upland rice, wheat, sugar-cane, cassava, etc. Approximately half of this area remains in fallow during the season. This situation associated with heavy rainfall increases soil losses. Soil erosion has become one of the most serious problems in agriculture production. In Parana, average soil losses of 10 to 40 t of fertile soil ha^{-1} were observed when traditional soil tillage systems were used. The severity of erosion in many areas means land had been irreversibly lost. There is evidence which shows when nutrients removed by harvesting are not replaced by mineral weathering and organic inputs, such systems became unsustainable.

A field experiment was established in 1986 on clayey Oxisols, to evaluate the effects of winter cover crops on summer crops (maize and soybean). Treatments combined winter cover crops, including blue lupins *(Lupinus augustifolius* L.), hairy vetch *(Vicia villosa* Roth), black oat *(Avena strigosa* Schreb), corn spurrey *(Spergula arvensis* L.), oilseed radish *(Raphanus sativus* L.), winter wheat *(Triticum aestivum* L.), and fallow, two nitrogen levels (0 and 90 kg N ha") in maize plots, and two tillage systems, conventional (one disc plough and 2 disc harrowings) and no-tillage, every year before crop planting. The treatments were laid out using a split-plot design in three blocks with three replications. Cover crops were grown during the winter time and controlled at the flowering stage by the application of weed-killerherbicide (spergula and fallow) or by cutting with a knife roller (lupins, hairy vetch, black oats and oilseed radish), and wheat grain was harvested. The vegetal mass of dead materials was left on top of the soil as mulch under the no-tillage system or incorporated under conventional tillage. Summer crops, maize and soybean, were sown at the beginning of the summer season. The shoot plant tissues of different cover crops and fallow were collected during the flowering period in 1994; after harvest, the wheat straw was collected. All samples were dried at 60°C, ground and sieved (0.2 mm) for chemical analysis. The soil samples were collected in November 1994 (0-5, 5-15 cm) in each sub-sub plot. The soil samples were sieved (2mm) and then ground by mortar & pestle to pass a 0.2mm sieve for chemical analysis (N,P,K^{+},Ca^{+}-, $Mg^{++},C,AL^{3+}H^{+}$). The summer crops grain yields were evaluated each year. Dry matter accumulated for different cover crops presented significant and strong differences among species in tissue element concentration. The different cover crops used showed a significant increase in the organic carbon level in the soil for both depths (0-5 and 5-15 cm) and also increased levels of some soil nutrients. There is a trend to improve organic carbon levels in no-tillage when cultivated with winter cover crops. The crop residues and also tillage regime caused significant alteration and redistribution of nutrients within the soil profile. The better no-tillage system promoted higher maize and soybean yield. The use of some legumes (blue lupin and hairy vetch) in no-tillage. allowed an economy of 90 Kg N ha-1 fertilizer when compared with fallow in the conventional system.

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