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DYNAMICS OF ORGANIC MATTER FRACTIONS IN TWO CALIFORNIA SOILS THROUGH THREE COTTON CYCLES

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Abstract

This study represents the first analysis of organic matter fractions as influenced by time, depth, N input and soil texture. A long-term cotton nitrogen (N) study provided the opportunity to follow the fate of soil-applied ^{15}N-fertilizer through three cropping cycles. The objective of this effort was to quantify the different soil organic matter (SOM) fractions and changes that occurred during the course of three cotton crops. The study was conducted in the San Joaquin Valley, CA on two different soil types. The soils were a Panoche clay loam (fine-loamy, mixed (calcareous), thermic Typic Torriorthent) and a Wasco sandy loam (course-loamy, mixed, nonacid, thermic Typic Torriorthent). Acala cotton (cv. Maxxa) was planted in each year of this three-year study. Designated ^{15}N-microplots were established in the low and medium N rates (56 and 168 kg N ha^{-1}, respectively) of the replicated field trials. After establishment in 1998, each season's cotton biomass remaining after harvest was shredded and incorporated in to the soil (approx. 20 cm). Post harvest soil samples were collected from each ^{15}N-microplot in two depth increments (0 - 30 cm and 30 - 60 cm). Humic and fulvic acids were obtained by the acid/alkali extraction method described by Stevenson (1994). Light fractions were determined from a sodium iodide solution extraction. Standard analysis of SOM was performed by the UC DANR Analytical Labatory using the Walkely-Black and the Loss on Ignition (LOI) methods.

The total SOM found in the surface 30 cm of the Panoche (cl) increased slightly from the 1998 sampling to 1999 then remained constant through the 2000 season. The Wasco (sl) showed a relatively minor change in total SOM over the three years. The total SOM of the 30-60 cm depth tended to increase slightly for the clay loam soil while decreasing in the sandy loam soil. Nitrogen treatments had no significant effect on the amount of SOM over the three-year period of this study. There were specific differences in the amounts of humic and fulvic acids found in the two soils. The humic acid fraction represented more than 50% of the total organic matter of the Panoche (cl) while for the Wasco (sl) most of the total was recovered in the fulvic acid fraction. Similar differences were observed for the unextractable (R1) fraction. The clay loam soil had nearly twice the amount of total organic matter in the R1 fraction as the sandy loam soil. Surprisingly, the total organic matter determined by Loss on Ignition (LOI) was significantly higher than determinations using the Walkley-Black method. Values of total organic matter (%) determined by LOI were similar to values derived by the acid/alkali extraction method.

The two soil types have distinctly different amounts of soil organic matter fractions. Our next step will be to determine the % fertilizer ^{15}N applied in 1998 found in these organic matter pools. This information will be used to compare the mineralization/immobilization of applied N for these soils. This will provide a greater understanding of the nutrient cycling of different soil types. Knowing the general makeup of soil organic matter may provide better information on how to manage nutrient inputs to optimize crop utilization and prevent nutrient losses.

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