Input Level and Crop Diversity Effects on Nitrate-N and Extractable P, Aggregation, and Organic C and N in Soil after Sixth Year in the Second Six-Year Rotation Cycle

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The amount of nitrate-N in the 0-90 cm soil was greatest at ORG input under DAG diversity or at HIGH input under LOW diversity, with the lowest nitrate-N at all inputs under DAP diversity. In few instances, ORG input had greater nitrate-N than RED or HIGH input, most likely due to lack of P in soil for crop growth. The nitrate-N in various soil depths suggested some downward movement of nitrate-N when LOW or DAG cropping diversity was compared to DAP diversity at HIGH input. Nitrate-N in soil in different cropping diversities varied with crop species and input level. In LOW cropping diversity, nitrate-N in soil was greatest after GM/F1 at ORG input, GM/F2 at RED input and GM/F1 at HIGH input, and was lowest after wheat2 or wheat3 at ORG input, after canola at RED input, and wheat3 at HIGH input level. In DAG cropping diversity, nitrate-N in soil was greatest after GM/F1 at ORG input, and after wheat at RED and HIGH inputs, and was lowest after barley at ORG input, after spring rye at RED input, and after canola at HIGH input. In DAP cropping diversity, nitrate-N in soil was greatest after hay2 and was usually lowest after alfalfa at all input levels. Extractable P in soil was higher (but small increase) under HIGH or RED inputs than ORG input in the 0-15 cm (also 15-30 cm) layer. There was no effect of cropping diversity on extractable P in soil. Low inherent P levels in soil were considered responsible for lack of differences between the diversities. Extractable P in soil was low in the surface and extremely low in the subsoil layers, indicating that at this site there may have little potential for bringing P from sub-soil to the surface by using taproot crops. This also suggests that if surface and sub-soil are low in available P or other nutrients, it may not be possible to sustain high crop yields under organic farming systems without using external nutrient sources. Proportion of fine aggregates (< 1.3 mm – erodible soil fraction) in 0-5 cm soil was greater with LOW diversity and HIGH input, and lowest with DAG diversity and RED input. The opposite was generally true for large aggregates (> 12.7 mm). Mass of LFOM, LFOC and LFON in 0-15 cm soil was greater at RED input than ORG and HIGH inputs and also greater under DAG and DAP diversity than LOW diversity. In conclusion, the findings suggest that soil quality can be improved and nutrient accumulation in the soil profile can be minimized by using reducing or elimination of tillage and proper fertilizer input under diversified cropping systems.