SEASONAL SOIL MICROBIAL DYNAMICS AS INFLUENCED BY SOIL TYPE AND NITROGEN FERTILIZATION

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Abstract

Since most of the N assimilated by plants is derived from inorganic-N sources, mineralization plays a critical role in controlling the amounts of N available to plants. In order to further efficient N use and to prevent ground water pollution with nitrate it is necessary to adjust N fertilization rates according to the N mineralization potential of a soil. Soil microbial biomass, although usually a small part of the total organic matter, plays a critical role in the nutrient dynamics of a particular soil type. Microbial transformations of N provide nitrate and ammonium to plants while immobilization of nitrate and ammonium by microbes is an important step in soil organic matter accumulation. The objectives of this study were to examine the effects of soil type and depth, and N fertilization on soil microbial respiration and biomass C at intervals throughout the cotton growing season. Soil samples were taken at two locations in the Central Valley of CA, from a Wasco sandy loam (Typic Torriorthent) and a Panoche clay loam (Typic Haplocambid) throughout the 1999 growing season. Samples were collected out of 50 and 150 lb N $acre^{-1}$ (56 and 168 kg N ha^{-1}) fertilization treatments on six different sampling dates. Triplicate soil samples were collected from the planting bed of four replications of each N treatment from 0 - 10 cm and 11 - 20 cm depth and combined by depth. Carbon mineralization was determined by measuring CO_2 evolution from these samples under controlled incubation at 25°C. Microbial biomass C was determined using the chloroform fumigation incubation method. In both soil types microbial biomass C and the rate of C mineralization varied considerably across sampling dates. However, even though the two soil types differ considerably in particle size distribution, the amounts of microbial biomass C and the rates of CO_2-C evolution varied within the same range. Even though the moisture content was always higher in the lower soil samples, differences in microbial biomass C and C mineralization between the two soil depths were often not significant and did not show a clear pattern across sampling dates. Temperature conditions before soil sampling may have affected the patterns in microbial biomass C and C mineralization in interaction with the soil moisture content. The variability of microbial biomass C and C mineralization observed between soil sampling dates indicates how strongly microbial communities and biomass are influenced by a variety of factors (i.e. soil temperature and moisture, management practices, plant growth, etc.). Since N mineralization is microbially driven it is important to understand the factors influencing microbial populations and activities. This will allow for the adjustment of management practices according to environmental conditions and soil type and hopefully improve N use efficiency and reduce any negative environmental impact.

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