Influence of Lime and Crop Rotation on Soil Nitrogen, Dry Matter Production and Microbial Biomass; a Field Trial, Merredin, WA

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Nitrogen (N) fertilisers are applied to the soil to meet crop N demands. A large proportion of Western Australian (WA) cropping soils are acidic, decreasing access to plant available nutrients. Application of lime is generally the most effective means of ameliorating increasing soil acidity. Meanwhile, legumes are grown rotationally with cereals to increase plant-available soil N levels. We used a field experiment at Merredin, WA (Latitude -31.483347; Longitude 118.219093) to measure the influence of historic lime application and crop rotation on soil N availability and microbial biomass carbon (MBC). The field experiment included randomised lime treatments (- lime, + lime) surface applied at 3.5 t ha^{-1} 2008 and a further 3 t ha^{-1} in 2012 to the same plots. In 2018, the trial areas were sown to different plant species in a split plot design with *Ornithopus compressus* cv. Yellow Serradella and *Triticum sativum* cv. Sceptre being used as the primary species comparison in this study. In 2019, the site was sown to wheat (*Triticum sativum* cv. Sceptre). We hypothesised that increasing soil pH through incorporating lime into soil and rotating crop would increase soil N and MBC, and as a result increase N supply to the crop. Six subplots (2.2 X 1.85 m) were marked in the middle of main plots (20 X 2.4 m) leaving 1 m at both end, and 0.8 m gap between subplots. Four of the six subplots fertilised by liquid urea at 40 kg N ha^{-1} and the control receiving 0 kg N ha^{-1}. Isotopically labelled (^{15}N Atom 5%) urea was applied to the remaining subplot to quantify the fertiliser derived N in plants and grain at harvest. Every fortnightly, *in-situ* inorganic N was measured (0-10 cm) prior to sowing and, then fortnightly in fertilised and unfertilised subplots. Additional deep profile soil samples (0 to 60 cm, in 10 cm increments) were collected before sowing, at terminal spikelet, flowering and will be collected at maturity. At terminal spikelet and flowering, both lime and legume were significantly increased MBC and above ground dry matter production ($p < 0.05$). However, there were no any combined interaction was observed ($p > 0.05$). Initial mineral N results indicated that possible NH_4^+-N nitrification in limed plots where NH_4^+-N was lower than nil-limed plots ($p < 0.05$). In contrast, NO_3^--N was higher in limed plots than nil-limed plots ($p < 0.05$). At harvest, fertilizer derived N in plants and grain will be determined.