Crop rotation effects on a soil in summer rainfall Australia

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Early cropping practices on the rich basaltic soils of the Northern Tablelands of New South Wales were exploitative with continuous cultivation of maize and oats being common. A yield decline was observed and in 1921 a rotation experiment was established at the Agricultural Research and Advisory Station, Glen Innes, with the objective of developing crop rotations which would both maintain soil fertility and produce economic yields.

Treatment rotations were as follows: (i) maize/spring oats; (ii) maize/spring oats/red clover (iii) maize/maize/spring oats; (iv) maize/maize/spring oats/red clover; (v) maize/spring oats/autumn oats; (vi) maize/spring oats/autumn oats/red clover; (vii) maize/spring oats/red clover/autumn oats. Crop production trends indicated that as the proportion of a rotation under legume ley increased the yields of maize grain and oats hay could be maintained for longer and at a higher level although as maize frequency increased this effect was reduced. The presence of autumn oats was also beneficial to maintenance of maize and oat yields even in the absence of a legume ley (1). The project described here will evaluate the effect of the different rotations on those chemical, physical and biological properties of the soil associated with crop production.

MATERIALS AND METHODS

The rotation experiment is situated on a prairie soil and receives a mean annual rainfall of 847 mm with 64% falling between 1st of October and 31st March.

Two sets of measurements will be used in the assessment of soil chemical fertility. One set will evaluate the effect of the previous 72 years of rotation treatments on chemical parameters associated with soil fertility. The other set will study mineral N dynamics by periodic sampling to quantify N accumulation under leys and fallows and N utilisation by maize and oat crops. The program of measurement of soil physical and hydrological properties will evaluate whether the rotation treatments have led to any differences in water infiltration rates and soil water holding capacity and to assess whether there is any difference in the ability of plant roots to grow in and extract water from the soil. The biological activity of the soil will be assessed using the Cotton Strip Assay (CSA). The CSA measures the rate of rotting of a strip of pure cellulose cloth which has been buried in the soil. The load required to break the fibres of the strip indicates the extent of rotting and therefore the level of soil microbial activity. This project will make a substantial contribution to our understanding of the association between key soil parameters and crop production sustainability.

ACKNOWLEDGMENTS

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REFERENCES

1. Norton, M.R., Murison, R., Holford, I.C.R. and Robinson, G.G. 1995. Aust. J. Exp. Agric. 35, (in press).