

Nitrogen build up in medic pastures: wheat in comparison with other rotations in dry Mediterranean zones

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Introduction

The rate of increase in soil nitrogen (N) under cereal-legume rotations is a major determinant of future increase in crop yield and of sustainable production of cereals and by-products for animal feeding. The results are presented of six annual soil samplings from an ongoing experiment which started in 1985/86 in Tel Hadya, north-west Syria. The experiment compared medic pasture/wheat rotations with four alternative forms of land use (wheat/lentil, wheat/vetch, wheat/fallow and wheat/water melon).

Material and methods

The investigation was carried out at the International Centre for Agricultural Research in the Dry Areas (ICARDA) Research Station of Tel Hadya, 30 km south of Aleppo, Syria. The soils are calcareous heavy Luvisols (Terra Rossa). Soil pH ranges between 8.0 and 8.1. The soil is low in organic matter (1.0%) and average available phosphorus at 0 to 20 cm soil depth is 5.0 mg/kg. The climate is Mediterranean with an annual rainfall of 320 mm

occurring mainly between November and May, December to March being the wettest period. Medic (*Medicago* spp.) at three grazing rates (low, medium and high; 4, 7 or 10 sheep per ha), lentil, vetch, fallow and water melon were rotated with wheat. Each treatment consisted of a 2-year cycle, and both phases of the cycle were planted on separate plots in the first and subsequent year. The design was a randomized block, with three replicates. Vetch was hand harvested; all top growth was cut and removed until years 4 and 5 when the crop was grazed. Lentils were hand harvested (i.e. plants were uprooted) except for grazing of a poor crop in year 4. Water melon failed to produce a crop in year 4 and was not planted in year 5 because of low rainfall. Eighty-four soil samples were taken at 0 to 20 cm depth in October every year, before the sowing started. Soil samples were analysed for N by the Kjeldahl method (Bremner, 1965).

Results

Vetch forage and medic pasture rotations with wheat gave rates of soil N increase of the order of 31 mg/ha

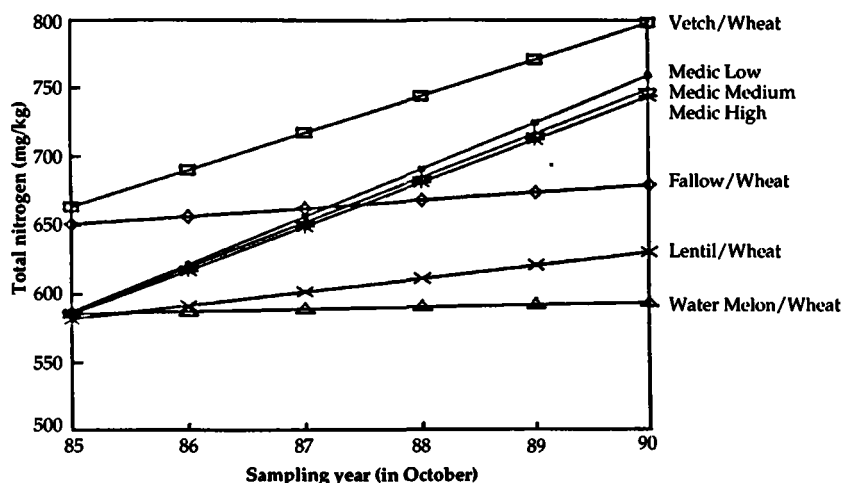


Figure 1 Changes in total soil nitrogen content under different types of land use over a period of 6 years.

per year, roughly equivalent to 69 kg/ha annually. Vetch and medic were superior to lentil, fallow and water melon in their ability to increase soil N (Figure 1). For lentil, fallow and water melon respectively, soil N accumulation rates were 10, 6 and 2 mg/kg per year (equivalent to 22, 13 and 3 kg/ha per year). The low rate of accumulation under lentil, despite the plant's ability to fix atmospheric N, was probably related to the hand harvesting method in which the larger roots were removed from the plot. N under the grazed medic pasture was practically unaffected by stocking rate.

Discussion

The research clearly illustrates the relatively constant annual rates of soil N increase under differing land-use systems on low-N soils and the potential for increasing soil fertility under legume cereal-livestock farming systems in the dry Mediterranean area.

References

- Bremner, J. M. 1965. Total Nitrogen. In: *Methods of Soil Analysis, Part 2, Agronomy* (ed. C. A. Black *et al.*) 9: 1149-1178. American Society of Agronomy, Madison, WI.