

Improving N use and performance of arable crops on organic arable farms using an expert group approach

Funder: DEFRA
Collaborators: ADAS, IOR-Elm Farm Research Centre, University of Nottingham
Start Date & Duration: 1999-2002

Overall Aim

To improve the performance of arable organic cropping systems by identifying acceptable changes in practice which increase the availability of nitrogen for crop uptake and decrease losses of nitrogen to the environment. These aims will ensure that organic agriculture will be able to continue to maintain soil fertility, reduce pollution and ensure that foodstuff of high nutritional quality and sufficient quantity will be produced.

Objectives

1. To select, up to ten, arable organic farms that were appropriate for case studies and to quantitatively estimate nitrogen availability and nitrogen losses for representative rotations being used on these farms.
2. To identify aspects of these rotations for which N use and crop performance could be improved, to quantitatively estimate the degree of improvement in gross margins and N losses, and to develop these changes into a form which is acceptable to the farmers concerned.
3. To summarise for the wider organic community the data and concepts that prove necessary to convince these farmers of the benefits of making the changes, and to transfer these data and concepts to consultants specialising in advising the organic farming community, and to their clients.

Main Findings

- Of the 9 case studies, 7 had a positive N balance, 6 had a positive P balance and 3 had a positive K balance. The degree to which a particular nutrient was in surplus or deficit appeared to be independent of the balance of the other nutrients within the rotation.
- The ratio of N inputs supplied in the form of biological fixation : manure : atmospheric deposition was approximately 40:40:20 for stocked systems and 70:0:30 for stockless systems. This emphasises the importance of the N supplied by atmospheric deposition.
- Averaged over the whole rotation, the N input for each crop which exported produce from the field, e.g. cereals, grain legumes and silage, ranged from 150 to 300 kg N ha⁻¹. This is similar to the amounts of N supplied to non-leguminous crops in conventional systems
- 30-40% of the N fixed by legumes, deposited from the atmosphere or inputted in the form of manures is leached.
- The majority of manure is applied to the ley phase of the rotation.
- Supplementary P fertilizer and additional feed for non-ruminant livestock caused the surplus P balances. Stockless systems without fertilizer had a large P deficit and stocked systems which relied on recycling manure alone had a small P deficit.

- Only rotations with a large manure return or brought in feed had a positive or neutral K balance. This is likely to be reduced if K leaching from manure had been estimated. The sustainability of the rotations in K deficit will depend on the ability of the soil to supply K by weathering of soil mineral reserves.
- Bought-in manures and feeds on organic farms must be from other organic farms. So stockless farms e.g. Terrington, export nutrients to livestock-based farms. There will be a net loss of K and P from organic farms as a whole, and there is a need for available and cost-effective supplies of these nutrients. Project OF0114 deals with this issue.
- The budgets calculated for these case studies indicate that there is no reason why organic rotations should be inherently unsustainable with regard to N, P or K. The rotations show a wide range of nutrient balances and the differences arise from the contrasting rotations, varied interactions with on-farm livestock and use of supplementary nutrients. There is therefore scope for individual organic farms to increase the efficiency with which they use nutrients within the rotation to minimise losses to the environment.
- Simple rotational budgets, as used in the case studies, are one tool to enable an increased understanding of nutrient flows at a rotational level by organic farmers and their advisors.

Transfer activities and outputs

- A poster was presented to the IFOAM 2000 Conference in Basle: *P M Berry, L Philipps & R Sylvester-Bradley*. An expert group approach to improving nitrogen use and performance of arable crops on organic farms in the UK.
- Meetings were held with case study farmers and their advisors as part of the project.
- Presentations were made at meetings of the Society for Chemical Industry Agriculture Group, and the Nutrients in Organic Agriculture Group
- Results were published in the Elm Farm Research Centre Bulletin.