

LONG TERM EXPERIMENT - THE IMPROVEMENT OF SOIL CONDITION

This was the fourth year of this long term experiment to examine the value of short term leys and soil conditioners on soil structure and yield of arable crops.

PHASE III TREATMENT SEQUENCE 2nd YEAR
CROP WINTER WHEAT

METHOD

The sugar beet crop was harvested on 9 October 1974 and the sugar beet tops removed by the topping unit. On 10 October 63 kg/ha P₂O₅ and K₂O were applied and ploughed in on 14 October. Maris Huntsman winter wheat was drilled on 27 October. A good uniform plant establishment was obtained but during the extremely wet winter and spring waterlogging occurred in the tractor wheelings associated with seedbed preparation and drilling. This was much less marked on the FWL treatment where early plant growth and tillering were improved.

On 23 April 1975 nitrogen was applied at 100 kg/ha. The crop was harvested on 15 August, no lodging or shedding occurred.

RESULTS

| Treatment | Grain Yield t/ha | Grain Nitrogen % |
|-------------|---------------------|---------------------|
| A1) Control | 5.08 | 1.75 |
| A2) Control | 5.50 | 1.74 |
| A FYM | 5.40 | 1.87 |
| A FWL | 7.01 | 1.67 |
| *A 1yr ley | 5.52 | 1.64 |

*Treatment not applied until 1976 equivalent to control in 1975

A large increase in grain yield of 1.64 t/ha was obtained from the heavy dressing of FWL applied two years previously. FYM had no effect on grain yield but tended to increase grain nitrogen content.

PHASE II TREATMENT SEQUENCE 3rd YEAR
CROP SPRING BARLEY

METHOD

This phase was ploughed on 7 October 1974 following the previous crop of winter wheat. On 27 February 1975 fertilizer was applied at 100N, 63P₂O₅ and 63 K₂O kg/ha. Maris Mink spring barley was drilled on 4 March into poor soil conditions following the extremely wet winter. A good uniform plant establishment was obtained but early vigour and tillering was improved on the FWL treatment.

The crop was harvested on 11 August, no lodging or loss of heads occurred.

RESULTS

| Treatment | Grain Yield t/ha | Grain Nitrogen % |
|-------------|---------------------|---------------------|
| A1) Control | 4.39 | 1.60 |
| A2) Control | 4.54 | 1.56 |
| A FYM | 4.84 | 1.61 |
| A FWL | 5.72 | 1.60 |

A large increase in grain yield of 1.25 t/ha was obtained from the heavy dressing of FWL applied three years previously. FYM increased yield by 0.37 t/ha. There was no difference in the nitrogen content of the grain.

PHASE I TEST SEQUENCE 1st YEAR
CROP SUGAR BEET

A comprehensive analysis of soil physical measurements were recorded but the analysis of the results and their relationship to sugar yield has not yet been completed. Unchecked plant populations and root yields are given in the table of results.

| Treatment | Plant Population 9 June thousands/ha | Root Yield t/ha |
|-------------|---|--------------------|
| A1) Control | 63.3 | 35.0 |
| A2) Control | 64.2 | 36.0 |
| A FYM | 61.5 | 35.4 |
| A FWL | 64.5 | 39.4 |
| A 1yr ley | 62.3 | 40.3 |
| * 3yr ley | 48.4 | 34.2 |

*3 yr ley plots preferentially attacked by Skylarks

The sugar beet crop was grown at six nitrogen levels. Response curves have to be fitted to this data and comparisons made between rotations at optimum nitrogen fertilizer level.

CROP 3YR LEY PERENNIAL RYEGRASS
 1YR LEY ITALIAN RYEGRASS

METHOD

The 1 year ley plots in Phase II were established with R v P Italian ryegrass on 24 October 1974 with 50, 50 and 75 kg/ha of N, P₂O₅ and K₂O respectively.

On 28 March 1975 125, 38 and 75 kg/ha of N, P₂O₅ and K₂O respectively were applied for the first cut both to the 3 year ley and 1 year ley treatments. The same rate of fertilizer was given for each of the subsequent cuts. Only two harvest cuts were

taken as at the third harvest the crop consisted only of sparse stemmy material due to the lack of rainfall.

RESULTS

| Date of Harvest | DM t/ha | MAD fibre % | CP % | DM t/ha | MAD fibre % | CP % |
|-----------------|-------------------------------|----------------|---------|-------------------------|----------------|---------|
| | <u>Phase II 3rd year ley</u> | | | <u>Phase II 1yr IRG</u> | | |
| 1st cut 29 May | 3.38 | 26.2 | 14.8 | 4.17 | 23.2 | 10.5 |
| 2nd cut 21 July | 1.96 | 32.0 | 17.6 | 4.42 | 38.4 | 10.8 |
| Total | 5.34 | | | 8.59 | | |
| | <u>Phase III 2nd year ley</u> | | | <u>Phase I</u> | | |
| 1st cut 29 May | 4.37 | 25.5 | 14.6 | Test Sequence | | |
| 2nd cut 21 July | 2.11 | 31.3 | 19.0 | | | |
| Total | 6.48 | | | | | |

The first harvest produced only a moderate yield but the herbage was of good quality. The highest yield at the first cut was produced by the 2nd year PRG ley. The crude protein content of the 1 year IRG ley was rather low at both harvests.

The second cut of the 1 year IRG ley consisted of very poor quality stemmy material but gave much the highest yield. A third harvest was not possible because of prolonged drought conditions and little grass growth. In general the yield of dry matter for 1975 was little over half that of the previous year.

SOIL ANALYSIS PHASE II

Soil samples at 0-15 and 15-30 cm depths were taken from each plot at the start of each phase and again at the end of the three years treatment sequence. The changes at 0-30 cm depth over the treatment sequence are summarised in the following table of results.

| Treatment | pH | Pppm | Kppm | Mg ppm | OM % |
|---|-----|------|------|--------|------|
| Phase II 1972. At start of treatment sequence | | | | | |
| A1) Control | 7.4 | 24 | 71 | 42 | 2.00 |
| A2) Control | 7.6 | 22 | 74 | 40 | 1.95 |
| A FYM | 7.5 | 23 | 74 | 40 | 2.08 |
| A FWL | 7.5 | 23 | 74 | 41 | 2.03 |
| a 1yr ley | 7.5 | 18 | 80 | 42 | 2.03 |
| 3 yr ley | 7.2 | 18 | 76 | 42 | 1.95 |
| Phase II 1975. At end of treatment sequence | | | | | |
| A1) Control | 7.0 | 29 | 101 | 51 | 1.98 |
| A2) Control | 7.3 | 28 | 88 | 46 | 2.05 |
| A FYM | 7.2 | 26 | 95 | 48 | 2.08 |
| A FWL | 7.7 | 41 | 94 | 72 | 2.10 |
| A 1yr ley | 7.0 | 26 | 123 | 47 | 1.98 |
| 3yr ley | 6.3 | 30 | 123 | 51 | 2.05 |

| | Differences after 3 yrs treatment cropping | | | | |
|-------------|--|----|----|----|-------|
| Δ1) Control | -0.4 | 5 | 30 | 9 | -0.02 |
| Δ2) Control | -0.3 | 6 | 14 | 6 | 0.10 |
| Δ FYM | -0.3 | 3 | 21 | 8 | 0.00 |
| Δ FWL | 0.2 | 18 | 20 | 31 | 0.07 |
| Δ 1yr ley | -0.5 | 8 | 43 | 5 | -0.05 |
| 3 yr ley | -0.9 | 12 | 47 | 9 | 0.10 |

The soil analysis made in 1972 before treatments were applied demonstrate the uniformity of the site against which changes during the treatment sequence can be measured. The P and K contribution from the FYM application was corrected by reducing the levels of inorganic fertilizer applied. Similarly the application of P and K to the ley treatments was calculated to compensate for the offtake of these nutrients in the herbage. The objective was for all treatments to enter the test crop sequence with similar and adequate levels of soil P and K reserves. The FWL treatment was excepted from this principle as the plant nutrients contained in the 125 t/ha application were too large to allow correction by withholding inorganic fertilizer to the treatment crops.

The effect of the FWL three years after application can be clearly seen as an increase in soil pH, P and Mg levels. The allowances made for plant nutrient contributions from FYM have proved satisfactory as the effect on soil reserves was similar to the control treatments. The 1 year and 3 year leys, however, have increased soil P and particularly soil K reserves more rapidly than the other treatments. This is in direct contrast to the situation on Phase I reported last year. It may be that soil reserves have increased merely because these nutrients were not removed from the soil by the third harvest as there was no herbage growth due to drought conditions.

In common with the results of Phase I, Phase II also shows change in soil organic matter levels between treatments.

R.W. Clare
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