

SUGAR BEET

LONG TERM EXPERIMENT - THE IMPROVEMENT OF SOIL CONDITION NAS 200 ML 74

This was the third 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 1st YEAR

CROP - SUGAR BEET

METHOD

All main plots were soil sampled on 7 September 1973 at 0-6 and 6-12in. depth for routine analysis, particle size distribution and plastic and liquid limits.

On 7 September 20-25 ton per acre of FYM was applied with an average dry matter content of 23.5% and contained 2.04%N, 1.15%P₂O₅, 5.69%K₂O and 0.72%Mg in the dry matter. Factory waste lime (SBL) was applied on 7 September at 55 ton per acre at an average dry matter content of 50.0% and containing 0.43%N, 1.23%P₂O₅, 0.05%K₂O and 0.42%Mg in the dry matter, with a total neutralising value of 46.8.

3 cwt per acre of agricultural salt was given on 25 September 1972. 120 units N, 80 P₂O₅ and 150 K₂O was applied on 4 April to all but the FYM treatment which received 90 units N only as the FYM was calculated to supply 30 units N, 80 P₂O₅ and 150 K₂O.

Monotri pelleted seed was drilled at 6in. spacing on 10 April and harvested on 30 September 1974 to allow the timely drilling of winter wheat.

RESULTS

The rather late drilling into very dry soil followed by very dry weather resulted in seedlings emerging over a protracted period and a low final plant population. The FYM and factory waste lime treatments appeared to improve seedling establishment since at harvest 4,500 more plants per acre were recorded

Treatment	Final Population '000/acre	Root Yield ton/acre	Sugar %	Sugar Yield cwt/acre
A1) control	19.0	11.22	13.75	31.0
A2) control	21.8	12.68	14.15	36.0
A FYM	24.5	12.64	14.80	37.0
A SBL	24.8	13.92	14.58	40.6
*A 1yr ley	19.7	11.30	14.36	32.5

* Treatment not applied until 1973.

The increase in sugar content was closely correlated with plant population. However, the interpretation of the sugar yield results are complicated by a trend in yield levels across the replicates. Nevertheless the large dressing of factory waste lime appeared to increase sugar yield as did the application of FYM.

PHASE II TREATMENT SEQUENCE 2nd year

CROP-WINTER WHEAT

METHOD

On 6 November the sugar beet tops were ploughed in and on 12 November 50 units P_2O_5 and 50 units K_2O per acre were applied. Winter wheat (Maris Huntsman) was drilled on 12 November. On 10 April 80 units per acre of nitrogen was applied as a top dressing to all plots. The crop was harvested on 22 August, no lodging or shedding occurred.

RESULTS

Treatment	Grain Yield cwt/acre	Grain Nitrogen %
A1) control	55.3	2.18
A2) control	54.1	2.07
A FYM	58.7	2.26
A SBL	56.5	2.12
*A lyr ley	54.7	2.13

*Treatment not applied until 1975 equivalent to control in 1973

FYM gave an increase in yield of 4 cwt per acre and factory waste lime 2 cwt per acre compared with the untreated plots. Little difference in the nitrogen content of the grain was recorded although the FYM treated plots tended to produce grain of the highest nitrogen content.

PHASE I TREATMENT SEQUENCE 3rd YEAR

CROP- SPRING BARLEY

METHOD

The experimental site was ploughed in the autumn following the previous crop of winter wheat. On 21 March 1974 fertilizer was applied at 80N, 50 P_2O_5 and 50 K_2O units per acre. Spring barley (Maris Mink) was drilled on 23 March and harvested on 15 August 1974. No lodging or loss of heads occurred.

Treatment	Grain Yield cwt per acre	Grain Nitrogen %
A1) control	44.2	2.05
A2) control	44.2	2.02
A FYM	44.7	2.07
A SBL	46.7	2.12

There was little difference in yield between treatments. The use of factory waste lime showed a yield improvement of 2.5 cwt per acre but FYM failed to give any yield benefit. Grain from the factory waste lime treatment tended to have a higher grain nitrogen content.

CROP 3YR LEY PERENNIAL RYEGRASS
1YR LEY ITALIAN RYEGRASS

METHOD

The 3 year ley plots in Phase III were established by sowing a 1:1 mixture of Barlena and S101 perennial ryegrass on 5 October 1973 with 3 cwt per acre of a 13:13:20 compound fertilizer. Similarly the 1 year ley plots in Phase I were established with RVP Italian ryegrass.

On 6 March 1974 100 units N, 30 P₂O₅ and 60 K₂O were applied for the first cut to both the 3 year ley and 1 year ley plots. The same rate of fertilizer was given for each of the subsequent cuts.

RESULTS

Date of Harvest	DM cwt/acre	MAD fibre %	CP %	DM cwt/acre	MAD fibre %	CP %
	<u>Phase I 3rd year ley</u>			<u>Phase I 1 year IRG</u>		
1st cut 3 June	52.9	28.8	10.5	58.0	26.6	9.5
2nd cut 23 July	24.7	29.3	19.5	34.0	33.0	14.7
3rd cut 9 Sept	22.9	29.3	18.8	11.0	32.1	21.4
Total	100.5			103.0		
	<u>Phase II 2nd year ley</u>			<u>Phase III 1st year ley</u>		
1st cut 3 June	47.9	27.4	11.7	46.6	26.5	13.6
2nd cut 23 July	29.2	28.7	19.1	32.2	31.7	16.7
3rd cut 9 Sept	20.9	29.4	20.1	24.0	29.1	21.4
Total	98.0			102.8		

The first cut produced a high yield of good quality herbage although the crude protein content was rather low from the 1 year ley. Subsequent harvests from the 1 year ley consisted of rather stemmy material and at the 3rd cut the yield was poor.

SOIL ANALYSIS PHASE I

Soil samples at 0-6 and 6-12in. 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 0-12in. depth over the treatment sequence are summarised in the following table of results.

Treatment	pH	P ppm	K ppm	Mg ppm	OM%
Phase I 1971. At start of treatment sequence					
A1) control	7.5	28	79	37	1.97
A2) control	7.6	37	83	37	2.13
A FYM	7.7	33	76	39	2.07
A SBL	7.5	30	75	37	2.07
A 1yr ley	7.5	32	74	37	2.10
3yr ley	7.7	35	77	35	1.90
Phase I 1974 At end of treatment sequence					
A1) control	7.3	33	103	45	1.90
A2) control	7.3	35	119	44	1.90
A FYM	7.5	34	111	48	1.95
A SBL	7.9	41	107	72	1.90
A 1yr ley	6.9	31	111	39	1.95
3yr ley	7.3	23	91	39	1.95
Differences after 3yrs treatment cropping					
A1) control	-0.2	5	24	8	-0.07
A2) control	-0.3	-2	36	7	-0.23
A FYM	-0.2	1	35	9	-0.12
A SBL	0.4	11	32	35	-0.17
A 1yr ley	-0.6	-1	37	2	-0.15
3yr ley	-0.4	-12	14	4	0.05

The soil analysis made in 1971 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 factory waste lime treatment was excepted from this principle as the plant nutrients contained in the 56 ton per acre application were too large to allow correction by withholding inorganic fertilizer to the treatment crops.

The effect of the factory waste lime 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 and the 1 year ley. The 3 year ley, however, has depleted soil P reserves and increased the soil K less rapidly than other treatments. Consequently the P and K applications to the 3 year ley are under review. Additional monitoring is also proposed by annual soil analysis.

Little change in soil organic matter levels have been detected between treatments.