

THE IMPROVEMENT OF SOIL CONDITION BY ROTATION, ORGANIC MANURING AND LIME APPLICATION (NAS 200 ML 77)

The sandy/loam <sup>clay</sup> at Morley is typical of a large area of South Norfolk and Suffolk. It is an unstable soil with an organic matter content of only 1.5-1.9% and is therefore very easily compacted to the detriment of the sugar beet crop. Earlier work has demonstrated the short term virtues of keeping seedbed cultivations for beet to a minimum to avoid compaction, but it was felt that possible means of achieving a more permanent improvement in stability should also be investigated, so a new trial was devised to do this.

Heavy applications of Farm Yard Manure (FYM) or Factory Waste Line (FWL) were used as soil conditioning materials and these are compared with a one year ley and a three year ley.

As well as records of crop yields, intensive physical examination of the soil is undertaken to determine changes in soil shear strength and aggregate stability.

The total cropping rotation is of six years, the first three being treatment years and the remaining three are a sequence of test crops. The treatment cropping is either a 3 yr ley or arable cropping with sugar beet, and two cereals. Soil conditioning treatments are applied as follows:-

- a) 50 t/ha FYM applied to the beet in both the treatment and test sequences
- b) 125 t/ha FWL applied to the treatment sequence only
- c) The second cereal is replaced by a one year ley

The treatment sequence is followed by test crops of sugar beet, spring barley and potatoes.

In order to give experience in a number of seasons with each crop, two blocks of the experiment (a phase) were started in each of three successive years. This report therefore includes one year's results for each of the three phases, and in 1977 this represented two blocks growing each of the test crops.

Having been cropped for three years under a series of treatment crops, the sugar beet on phase III was the first of the test crops to be grown on that phase. This represented the fourth year of trial on phase III. 500 kg/ha Kieserite, 380 kg/ha Betrox and 700 kg/ha of 0-14-28 NPK compound were applied during October 1976 to all plots except the Arable + FYM treatment. The application of 50 t/ha of FYM was made to the Arable + FYM plots at the same time and incorporated by two passes with a spring tined cultivator. The whole of phase III was ploughed on 11 January 1977. The compound fertilizer was calculated to supply similar quantities of phosphorus and potassium to that supplied by the FYM.

A seedbed was prepared on 17 March by two passes with a dutch harrow, but drilling was not possible until 5 April. Nomo was drilled at 3.75 cm spacing and band sprayed with Pyranin (3.1 kg/ha - product). The crop was hand singled on 31 May and 1 June.

Although little boron deficiency was recognised in this crop, there was a marked tendency for the Factory Waste Line (FWL) treated plants to have very pale leaves. The response to nitrogen in leaf colour and growth was also much less evident on the FWL plots than on the other treatments. It is planned to take leaf samples during the 1978 season to try to identify the cause of this poor growth.

At harvest on 6-7 December it was found that root growth had been less affected than top growth and sugar yields were not affected to any great extent by the soil conditioning treatment. All yields were quite good, with no soil treatment giving a significant improvement over the

Sugar yield tonne/hectare

Soil Treatment	Nitrogen Level kg/ha						Mean
	0	38	75	113	151	188	
Arable(control)	8.04	8.61	8.97	8.67	9.02	8.63	8.66
Arable + FYM	8.35	8.99	9.25	8.63	8.84	8.70	8.79
Arable + FWL	8.05	8.19	8.63	8.81	8.60	8.44	8.45
Arable + 1 yr ley	8.40	8.96	8.55	8.30	8.62	8.61	8.57
3 yr ley	7.97	8.84	8.51	8.28	8.71	8.28	8.43
Mean	8.16	8.72	8.78	8.54	8.76	8.53	

arable control. Although yields were somewhat variable, there were tendencies for the ley and FYM treatments to reach their peak sugar yields at 38 or 75 kg/ha of nitrogen, while the highest yield on the arable control plots was achieved at 151 kg/ha of nitrogen. The mean response to nitrogen showed that on average there was nothing to be gained in sugar yield by exceeding 75 kg/ha of nitrogen. April-July 1977 was a period of low rainfall and good soil conditions, so that no benefits were recorded following the use of the soil conditioning treatments.

YEAR 2 of Test Sequence (Phase II)

CROP SPRING BARLEY

This phase was ploughed on 12 January following the lifting of the previous sugar beet crop. On 13 March 300 kg/ha of 0-20-20 compound was applied, the area was spring tine cultivated once and drilled with Maris Mink spring barley. The four nitrogen levels were applied on 20 April, after crop establishment. Plant counts taken on 20 April showed a good establishment of 250-300 plants/m<sup>2</sup>.

Grain yield tonne/hectare

Soil Treatment	Nitrogen Level kg/ha				Mean
	38	75	113	151	
Arable(control)	5.14	6.13	6.45	6.53	6.06
Arable+FYM	5.63	6.40	6.69	6.73	6.36
Arable+FWL	5.56	6.31	6.65	6.80	6.33
Arable+1 yr ley	5.58	6.53	6.56	6.84	6.27
3 yr ley	5.82	6.31	6.57	6.61	6.33
Mean	5.55	6.34	6.58	6.70	

The barley grew well and responded to very high levels of nitrogen application. All treatments were still responding at the highest level tested (151 kg/ha). There was no evidence of adverse effects from factory waste line at any level of nitrogen and all conditioning treatments gave a slight improvement over the control yield.

YEAR 3 of Test Sequence (Phase I)

CROP POTATOES

Potatoes are the final crop of the test sequence and were grown on phase 1 for the first time in this trial. Pentland Crown potatoes were planted on 5 April, following the application of 1250 kg/ha of 0-14-28 compound fertilizer on 21 March.. The six levels of nitrogen were applied on 4 April and incorporated by spring tine harrowing on 4 and 5 April. The ridges were pulled down and re-ridged on 11 May. Weed control was by Bronox (4.7 kg/ha product) applied on 15 May.

Although temperatures were lower than in 1976, rainfall was similarly lacking and growth throughout the season was only modest. The poor colour of the plots treated with factory waste line was observed in the same way as it was recorded on the beet crop. There appeared to be no response in haulm growth to nitrogen on the FWL plots, but considerable response on the other soil treatments. As shown in the yield results, none of the soil treatments showed a marked response to nitrogen, but yields tended to be highest from 160-240 kg/ha. Overall yields were increased slightly by the FYM treatment but the other treatments gave no effect or a reduction. It is hoped that leaf analysis in 1978 will shed some light on these unexpected results.

Yield of Ware Potatoes tonne/hectare

Soil Treatment	Nitrogen Level kg/ha						Mean
	80	120	160	200	240	280	
Arable(control)	30.9	32.0	33.8	31.9	34.8	29.9	32.2
Arable+FYM	33.1	37.8	33.3	34.6	35.0	36.0	35.0
Arable+FWL	27.5	27.5	28.3	26.3	25.9	27.9	27.2
Arable + 1 yr ley	30.9	31.5	37.1	36.3	34.4	29.4	33.3
3 yr ley	30.5	30.1	30.1	30.3	32.9	30.9	30.9
Mean	30.6	31.8	32.5	31.9	32.6	30.8	

In addition, samples from all treatments were sliced and assessed for internal bruising. No differences were found even at the high levels of nitrogen tested. Although no assessments were made, the produce of the FWL plots was compared with the others and no increase in common scab was observed.

Conclusions

Some problems with boron deficiency on FWL plots were recorded in 1976, and in 1977 unexplained lack of vigour was observed. Although the pH on the FWL plots has risen to around 8.0 there are the first occasions that any deleterious affects have been recorded and may be associated with the unusually dry conditions. Manganese deficiency is a possibility but the barley did not suffer and no symptoms were observed in spite of detailed examination during the growing season. In other seasons, particularly in wet and difficult situations, very considerable yield benefits have been recorded. The reason for recent poor results must be determined if possible.

In order to try to obtain the benefits without the disadvantages, one spare set of plots are being treated at a lower rate (62½ t/ha) of FWL in the next treatment sequence. This has started with the beet crop being grown on phase I in 1978. Considerable numbers of soil physical measurements have been made and these will shortly be available for the whole of the first rotation.