

CONFIDENTIAL*

THE IMPROVEMENT OF SOIL CONDITION BY ROTATION,
ORGANIC MANURING AND LIME APPLICATION - 1978

NAS 200 ML

2nd year test crop - Phase III
3rd year test crop - Phase II

SUMMARY

In the second year of the test crop sequence, the organic soil conditioning treatments, 1 or 3 year leys and FYM, gave the highest mean yield of grain from a spring barley crop. Following these treatments, the barley responded only up to 113 kg/ha nitrogen, while the barley following the untreated arable and the arable plus factory waste lime treatments responded to 151 kg/ha nitrogen.

In the third year of the test crop sequence the ware yield of potatoes was again affected by the Factory Waste Lime treatment which tended to reduce yields. The highest yields were produced after FYM or the 3 year ley.

The sandy clay loam soil 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. In this trial, heavy applications of Farm Yard Manure (FYM) or Factory Waste Lime (FWL) have been used as soil conditioning materials and these are compared with a one year ley and a three year ley.

METHOD

The experiment consists of a number of soil conditioning treatments applied to a sequence of cropping over an initial three year period followed by a further three years of test crops to monitor the effects of the treatments in terms of soil condition and crop yield.

In order to gain experience in a number of seasons with each crop, two replicates of the experiment (a phase) were started in each of three successive years, commencing in 1972. The actual cropping sequence is as follows:

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Treatment crops - Sugar beet
 (or 3 year ley) Winter wheat
 Spring barley or 1 yr ley

Test crops - Sugar beet
 Spring barley
 Potatoes

Soil conditioning treatments have been applied as follows:

FYM - applied at 50 t/ha to the beet in both treatment and test sequences

FWL - applied at 125 t/ha to the beet in the original treatment sequence only. Residual effects will be tested in a second rotation sequence.

(N.B. An additional FWL treatment at 62.5 t/ha has been applied to a spare untreated plot at the start of the second rotation).

In 1978 Phase I was growing sugar beet as the first treatment crop at the start of a second rotation sequence. Phase II was in potatoes, the last of the original test crops, while Phase III was in spring barley test crop.

RESULTS

Year 1 of treatment sequence (Phase I) - sugar beet

Farmyard manure was re-applied to the appropriate FYM treatment plots @ 50 t/ha in the autumn of 1977 before being ploughed down. No further Factory Waste Lime was applied to the plots which had previously received 125 t/ha of this material at the start of the experiment in 1971, the effects of the original dressing will continue to be assessed in subsequent test crops. However, Factory Waste Lime was applied @ 62.5 t/ha to a set of spare previously all-arable plots and ploughed down during the autumn of 1977. Yields of sugar ranged from 7.82 to 8.19 t/ha, with FYM giving the highest yields. Factory Waste Lime did not appear to affect crop establishment or growth.

Year 2 of test sequence (Phase III) - spring barley

Grain yield at 85% d.m. (t/ha)

Soil treatment	Nitrogen level (kg/ha)				Mean
	38	75	113	151	
Arable (control)	4.55	5.17	5.36	5.40	5.12
Arable + FYM	5.12	5.42	5.48	5.37	5.35
Arable + FWL	4.81	4.93	5.62	5.63	5.25
Arable + 1 yr ley	5.08	5.48	5.62	5.43	5.40
3 yr ley	5.53	5.46	5.73	5.55	5.57
Mean	4.94	5.27	5.53	5.46	

The barley did not appear to show any marked differences in growth due to soil conditioning treatment. Grain yield at harvest, however, did produce interesting differences in response to nitrogen. The FYM and 1 and 3 year ley treatments gave a generally low response to increasing nitrogen with a maximum yield at 113 kg N/ha. The arable control and FWL treatments gave a sharper response and their highest yield was given at the highest nitrogen level tested (151 kg N/ha). All applied treatments gave a higher maximum and overall yield than the untreated arable control.

Year 3 of test sequence (Phase II) - potatoes

Crop growth on this, the final crop of the test sequence, appeared generally satisfactory throughout the season, with no obvious effect from the Factory Waste Lime treatment, which had caused Boron deficiency in sugar beet in 1976 and lack of vigour in potatoes in 1977. Increasing nitrogen level resulted in typically darker and more vigorous haulm growth on all treatments.

Yield of ware potatoes 40-80 mm (t/ha)

Soil treatment	Nitrogen level (kg/ha)						Mean
	80	120	160	200	240	280	
Arable(control)	38.5	39.0	40.5	40.0	37.0	37.2	38.7
Arable + FYM	40.5	39.3	41.3	39.5	38.0	42.9	40.2
Arable + FWL	35.8	38.0	36.7	36.0	36.2	35.7	36.4
Arable + 1 yr ley	36.4	38.1	34.9	36.7	38.7	37.3	37.4
3 yr ley	41.7	41.3	39.9	40.7	37.5	44.6	40.9
Mean	38.6	39.1	39.0	38.8	37.4	39.5	

Ware yields were largely unaffected by nitrogen level although individual soil condition treatments produced somewhat variable results. Overall, the lowest yields were produced by the Factory Waste Lime treated plots, an effect consistent with the 1977 results. Laboratory analysis of samples of potato leaves from all treatments showed that although boron levels were similar, the Factory Waste Lime plots gave lower levels of manganese than the other treatments (156 mg/kg dry matter for FWL plots compared with 222 mg/kg dry matter for the arable control plots). This suggests that lack of availability of manganese may be involved in the sometimes deleterious effects of heavy dressing of Factory Waste Lime.

The highest yields tended to follow the use of FYM or a 3 year ley.