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Poultry Manure

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presence and absence of dung. In the further experiments containing minerals (superphosphate and potash salt), the responses to minerals were slightly decreased by the addition of dung.

TABLE XIV

Kale (tons per acre)

	Woburn 1932 Sulphate of ammonia : cwt. N				Woburn 1936 Sulphate of ammonia	
	None	0.2	0.4	0.8	0.4 cwt. N	0.8 cwt. N
No dung	13.29	17.76	19.67	24.36	10.14	13.67
Dung	19.19	21.24	23.67	28.74	13.14	15.49
Standard errors	±0.713				±0.357	

With kale, the responses to sulphate of ammonia were smaller in presence of dung in both experiments, though not significantly so.

TABLE XV

Residual effects of Dung on the Succeeding crop (cwt. per acre)

Dung applied to	Amount of dung	Succeeding crop	Mean yield	Increase for dung	
Potatoes	1916	10	Wheat grain	11.9	+2.4
Potatoes	1920	15	Wheat grain	17.8	+3.6
Potatoes	1936	15	Spring oats grain	20.2	+2.7
Kale	1932	15	Barley total produce	95.1	+12.2
Kale	1936	15	Barley grain	12.0	+2.2
Barley	1921	14	Clover 1921 green weight	9.2	+6.7
			Clover 1922 hay	45.5	+8.2
			Clover 1923 hay	13.0	+2.3

The residual effects are striking. Dung applied to potatoes or kale increased the succeeding cereal crops by over 2 cwt. grain per acre in every case. In an experiment in which dung was applied to barley, clover sown under the barley continued to benefit from the dung for at least three seasons, the green weights being doubled by the dung in the first season.

POULTRY MANURE

The consignments of dried poultry manure for the 1933-36 experiments were obtained from Suffolk, but for the 1937 experiments the supply was from Hampshire : the percentages of nitrogen, phosphoric acid and potash were very similar :—

		Percentage in dried manure					
		Nitrogen	P ₂ O ₅	K ₂ O	Ash	Dry matter	
1936	Suffolk	3.90	3.53	1.70	35.3	88.7
1937	Hampshire	3.75	3.43	1.76	22.2	85.1

In the first three years in which the manures were applied the poultry manure was distinctly inferior to the sulphate of ammonia. The direct effect of poultry manure, based on 29 experiments, only amounted to 64 per cent. of the direct effect of sulphate of ammonia.

In 1936 the figure was 71 per cent. as the mean of 14 experiments; 8 cwt. dried poultry manure has thus about the same value as 1 cwt. sulphate of ammonia.

The percentage increases in yield over the plots without nitrogen in 1937 are shown in Table XVI.

TABLE XVI
Comparison of Direct Effects

Crop	Percentage Increase over no Nitrogen		
	Sulphate of ammonia	Poultry manure	Difference poultry manure as against sulphate of ammonia
Potatoes	+58	+36	-22
Runner beans	+11	+7	-4
Kale	+76	+29	-47
Kale	+81	+27	-54
Early potatoes	+47	+75	+28
Mean	+55	+35	-20
Mean of 14 First Year experiments 1936	+35	+25	-10
Mean of 29 First Year experiments, 1933-35	+25	+16	-9

The residual effects of poultry manure were small and not statistically significant, but their existence could be inferred from the fact that the marked superiority of sulphate of ammonia over poultry manure in the year of application was reduced and in several experiments reversed when the dressings were repeated year after year.

In three out of seven cumulative experiments in 1937, the advantage is with poultry manure, whereas in the first year effects only one out of five experiments went in this direction. Nevertheless poultry manure has not done so well in the cumulative experiments of 1937 as in those of 1936, when 6 out of 7 trials showed an advantage of poultry manure over sulphate of ammonia. This result may be due in part to the excessive leaching that the land suffered during the winter of 1936-7.

The 1937 results are shown in Table XVII.

TABLE XVII
Cumulative Effects

Crop	Percentage Increase over no Nitrogen		
	Sulphate of ammonia	Poultry manure	Difference poultry manure as against sulphate of ammonia
Potatoes	+18	+9	-9
Cabbages	+23	+55	+32
Swedes, tops	+19	+8	-11
Potatoes	+128	+65	-63
Potatoes	+23	+37	+14
Potatoes	+36	+27	-9
Cabbages	+13	+23	+10
Mean	+37	+32	-5

Reviewing the whole of the experiments it appears that poultry manure is not uniformly better than sulphate of ammonia in the cumulative series, but it approaches sulphate of ammonia closer than in the series testing first year effects. Kale appears to be a particularly unsuitable crop for poultry manure, while the only two cabbage crops grown in 1937 showed a significant superiority of poultry manure over sulphate of ammonia.

ARABLE CROPS

SUGAR BEET

Each year since 1933 the Rothamsted staff has co-operated with what has now become the Committee on Research and Education of the Sugar Commission in carrying out experiments on the manuring and cultivation of sugar beet at Rothamsted, Woburn and on a number of representative sugar beet growers' farms.

During the first three years 1933, 1934 and 1935, the responses to fertilizers were comparatively small. The summers were hot and dry, and apparently provided little opportunity for the phosphate and potash to exert their full effects. Nitrogen was the only fertilizer to justify itself in the average in these years, and the single dose of potash came next in order of effectiveness. In 1936, however, there were good responses to all nutrients and especially to phosphate; the results provided us with our first favourable opportunity for relating field responses to chemical analysis of the soils. In 1937 the responses to nitrogen and phosphate were less than in 1936, but the results from potash were the best so far recorded.

The mean increase to the three nutrients in terms of sugar per acre are shown in Table XVIII.

TABLE XVIII

*Mean Responses to Nutrients in Single and Double Dressings. 1933-1937
Sugar (cwt. per acre)*

Year	No. of expts.	Mean yield of roots tons p. a.	Mean yield of sugar	Sulphate of ammonia		Superphosphate		Muriate of potash	
				2 cwt.	4 cwt.	3 cwt.	6 cwt.	1½ cwt.	2½ cwt.
1933	13	11.5	37.5	+0.4	—	+0.3	—	+0.8	—
1934	15	13.5	47.6	+1.8	+3.0	+0.4	+1.0	+1.4	+0.4
1935	23	9.5	32.4	+1.8	+2.7	+0.1	+0.4	+0.8	+0.9
1936	26	10.4	36.6	+5.5	+7.7	+1.9	+3.0	+1.2	+1.9
1937	30	11.6	40.3	+3.8	+5.2	+1.5	+1.9	+1.5	+2.8

The quantity of sugar per acre required at January 1938 prices to pay for the expenditure on fertilizers is as follows:—

cwt.		Cwt. per acre
2	Sulphate of ammonia ..	1.4
4	” ” ..	2.7
3	Superphosphate ” ..	1.1
6	” ” ..	2.1
1½	Muriate of potash ..	1.0
2½	” ” ..	1.9

So far as the experiments have at present gone the fertilizer results may be summarised as follows:—