

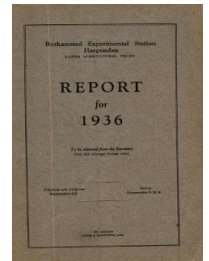
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# Rothamsted Report for 1936

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### Rothamsted Research

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## WHEAT

Effect of sulphate of ammonia applied at five different times  
RW—Great Knott, 1936

Plan and yields in lb., grain above, straw below

|    |       |       |       |       |       |       |    |
|----|-------|-------|-------|-------|-------|-------|----|
| 1  | 3     | 5     | 1     | 2     | 0     | 4     | 6  |
|    | 76.9  | 72.1  | 81.6  | 80.3  | 78.7  | 75.9  |    |
|    | 129.6 | 116.2 | 113.6 | 133.7 | 96.0  | 117.1 |    |
|    | 5     | 4     | 0     | 1     | 3     | 2     |    |
|    | 86.3  | 82.1  | 84.0  | 91.1  | 88.8  | 89.2  |    |
|    | 120.7 | 117.6 | 106.2 | 126.4 | 139.4 | 140.8 |    |
| W  | 2     | 1     | 3     | 0     | 4     | 5     |    |
| ↑  | 75.2  | 84.6  | 77.9  | 86.3  | 77.5  | 84.3  |    |
|    | 134.6 | 110.9 | 141.1 | 121.4 | 123.8 | 126.7 |    |
|    | 4     | 0     | 5     | 3     | 2     | 1     |    |
|    | 82.0  | 85.4  | 90.1  | 83.8  | 84.5  | 96.4  |    |
|    | 127.0 | 117.8 | 129.6 | 146.0 | 148.5 | 139.8 |    |
|    | 1     | 3     | 2     | 4     | 5     | 0     |    |
|    | 87.8  | 76.6  | 85.9  | 84.2  | 86.0  | 88.3  |    |
|    | 120.2 | 146.4 | 156.8 | 136.8 | 135.2 | 119.7 |    |
|    | 0     | 2     | 4     | 5     | 1     | 3     |    |
| 31 | 91.9  | 77.2  | 94.5  | 99.1  | 95.2  | 89.3  | 36 |
|    | 125.1 | 148.0 | 139.0 | 138.4 | 148.3 | 150.2 |    |

SYSTEM OF REPLICATION : 6×6 Latin square.

AREA OF EACH PLOT : 1/40 acre (53.0 lks. × 47.2 lks.).

TREATMENTS : No sulphate of ammonia (0) and sulphate of ammonia at the rate of 0.4 cwt. N per acre applied on Oct. 28 (1), Jan. 20 (2), Mar. 16 (3), Apr. 27 (4) and May 25 (5).

CULTIVATIONS, ETC. : Ploughed on various dates during Sept. Harrowed : Oct. 28 and April 16. Drilled : Oct. 28. Harvested : Aug. 18. Variety : Victor. Previous crop : Beans.

STANDARD ERRORS PER PLOT : Grain : 1.22 cwt. per acre or 4.02% ; Straw : 1.94 cwt. per acre or 4.18%.

## Summary of Result : cwt. per acre

|                   | No N | Dates of application of sulphate of ammonia<br>(0.4 cwt. N per acre) |         |         |         |        | Mean of<br>all N | Standard<br>error |
|-------------------|------|----------------------------------------------------------------------|---------|---------|---------|--------|------------------|-------------------|
|                   |      | Oct. 28                                                              | Jan. 20 | Mar. 16 | Apr. 27 | May 25 |                  |                   |
| GRAIN             |      |                                                                      |         |         |         |        |                  |                   |
| (±0.498)          | 30.6 | 31.9                                                                 | 29.3    | 29.4    | 29.5    | 30.8   | 30.2             | ±0.223            |
| Incr. .. (±0.704) |      | +1.3                                                                 | -1.3    | -1.2    | -1.1    | +0.2   | -0.4             | ±0.546            |
| STRAW             |      |                                                                      |         |         |         |        |                  |                   |
| (±0.792)          | 40.8 | 45.2                                                                 | 51.3    | 50.8    | 45.3    | 45.6   | 47.6             | ±0.354            |
| Incr. .. (±1.12)  |      | +4.4                                                                 | +10.5   | +10.0   | +4.5    | +4.8   | +6.8             | ±0.868            |

## Conclusions

On the average of all times of application, sulphate of ammonia had little effect on the yield of grain, and gave a significant increase in straw. There were, however, significant differences in the yields obtained with the different times of application, the earliest dressing (Oct. 28) producing an increase in the yield of grain which was not quite significant, and the next three times of application (Jan. 20, Mar. 16, and April 27) producing a depression in the yield of grain.

The straw yields at first increased to a maximum and then decreased with later application.

**Effect of fallow and of one-year leys of clover, ryegrass and clover and ryegrass, cut once and followed by bastard fallow or green manure crops of mustard or vetches, or cut twice.**

|     |     | Grain Straw |      | Grain Straw |   |      |      | Grain Straw |    | Grain Straw |   |      |      |   |      |      |    |
|-----|-----|-------------|------|-------------|---|------|------|-------------|----|-------------|---|------|------|---|------|------|----|
| 133 | OM  | N           | 18.6 | 48.9        | O | 11.6 | 31.2 | 101         | 69 | CR2         | O | 19.5 | 42.9 | N | 22.1 | 46.9 | 37 |
|     | C2  | O           | 18.9 | 43.8        | N | 15.1 | 47.9 |             |    | CR1         | N | 17.7 | 45.8 | O | 17.6 | 36.9 |    |
|     | O2  | N           | 17.9 | 44.6        | O | 8.7  | 29.8 |             |    | O1          | O | 14.7 | 34.4 | N | 23.2 | 46.8 |    |
|     | R1  | O           | 8.8  | 29.2        | N | 12.1 | 39.4 |             |    | CM          | N | 11.6 | 46.9 | O | 15.2 | 34.3 |    |
|     | OV  | O           | 15.1 | 39.2        | N | 16.8 | 49.4 |             |    | CV          | O | 7.5  | 33.2 | N | 13.6 | 38.4 |    |
|     | RV  | O           | 11.3 | 37.2        | N | 10.7 | 41.8 |             |    | CRM         | O | 12.4 | 37.1 | N | 14.8 | 39.2 |    |
|     | CRM | O           | 12.8 | 38.2        | N | 12.2 | 47.0 |             |    | R1          | N | 14.2 | 40.0 | O | 14.5 | 27.7 |    |
|     | CR2 | O           | 13.4 | 35.4        | N | 14.8 | 47.4 |             |    | OV          | O | 15.1 | 37.6 | N | 18.8 | 55.0 |    |
|     | RM  | O           | 13.2 | 30.3        | N | 12.0 | 43.0 |             |    | O2          | O | 13.8 | 38.1 | N | 21.2 | 49.3 |    |
|     | O1  | O           | 23.1 | 46.7        | N | 22.8 | 55.7 |             |    | OM          | O | 16.1 | 39.2 | N | 21.5 | 47.8 |    |
|     | R2  | N           | 16.3 | 41.4        | O | 12.4 | 28.5 |             |    | C1          | O | 12.4 | 42.2 | N | 16.4 | 43.8 |    |
|     | CR1 | O           | 14.0 | 37.9        | N | 13.4 | 46.6 |             |    | CRV         | N | 11.6 | 44.9 | O | 9.0  | 31.0 |    |
|     | CV  | N           | 11.0 | 63.5        | O | 9.0  | 40.2 |             |    | R2          | O | 11.8 | 30.2 | N | 13.0 | 31.0 |    |
|     | CRV | N           | 10.8 | 56.4        | O | 6.7  | 35.0 |             |    | C2          | O | 20.6 | 47.1 | N | 21.0 | 49.2 |    |
|     | CM  | N           | 10.7 | 51.8        | O | 10.6 | 39.4 |             |    | RV          | N | 11.8 | 42.4 | O | 8.9  | 33.4 |    |
|     | C1  | N           | 13.5 | 57.0        | O | 10.5 | 37.8 |             |    | RM          | O | 5.5  | 27.5 | N | 14.8 | 40.4 |    |
|     |     |             |      |             |   |      |      |             |    |             |   |      |      |   |      |      |    |
|     | R1  | O           | 9.9  | 29.5        | N | 11.8 | 41.0 |             |    | O2          | O | 12.9 | 43.0 | N | 20.4 | 55.6 |    |
|     | OM  | O           | 14.2 | 37.3        | N | 17.4 | 51.6 |             |    | CR1         | N | 8.3  | 34.0 | O | 9.0  | 31.7 |    |
|     | CM  | N           | 14.4 | 49.1        | O | 9.6  | 35.4 |             |    | OV          | O | 14.3 | 45.7 | N | 19.0 | 53.0 |    |
|     | C2  | O           | 21.1 | 46.0        | N | 18.6 | 45.9 |             |    | R1          | N | 7.4  | 28.8 | O | 9.1  | 22.0 |    |
|     | C1  | O           | 17.1 | 44.8        | N | 16.0 | 49.2 |             |    | OM          | N | 21.0 | 50.8 | O | 14.5 | 35.5 |    |
|     | CRV | O           | 13.0 | 40.8        | N | 12.9 | 49.1 |             |    | R2          | N | 17.3 | 42.4 | O | 9.2  | 23.8 |    |
|     | RM  | O           | 19.2 | 41.0        | N | 15.2 | 45.0 |             |    | RV          | O | 7.8  | 28.2 | N | 6.9  | 30.4 |    |
|     | CR1 | O           | 18.2 | 40.3        | N | 17.6 | 47.9 |             |    | C1          | O | 12.7 | 36.6 | N | 13.9 | 41.8 |    |
|     | O2  | N           | 24.4 | 51.4        | O | 18.5 | 38.2 |             |    | CRV         | O | 8.3  | 37.7 | N | 9.1  | 45.9 |    |
|     | O1  | N           | 26.1 | 56.6        | O | 17.2 | 36.3 |             |    | CV          | O | 10.8 | 44.7 | N | 12.3 | 46.7 |    |
|     | CV  | O           | 15.5 | 40.8        | N | 12.0 | 47.5 |             |    | CR2         | N | 19.4 | 39.8 | O | 17.1 |      |    |

SYSTEM OF REPLICATION ; 4 randomised blocks of 16 plots each, the plots being split for sulphate of ammonia at the rate of 0.3 cwt. N per acre applied as a top dressing to the wheat.

AREA OF EACH SUB-PLOT ; 0.0099 acre (46.8 lks.  $\times$  21.2 lks.)

TREATMENTS : 4  $\times$  4 factorial design.

No ley (O), broad red clover (C), ryegrass (R), ryegrass and clover (CR). Vetches sown after 1st cut. (V), mustard sown after 1st cut (M), 1 cut taken, followed by summer fallow (1), 2 cuts taken (2).

BASAL MANURING ; Nil.

CULTIVATIONS, ETC. ; Ploughed ; Sept. 28-30. Harrowed ; Oct. 19 and 28. Drilled ; Oct. 28.

Sulphate of ammonia applied ; March 28. Harrowed and rolled ; May 5. Harvested ; Aug. 24 and 25. Variety ; Victor. Previous crop ; Ley.

STANDARD ERRORS : Grain : Per whole plot : 2.07 cwt. per acre or 15.7% ; per sub plot : 1.96 cwt. per acre or 14.9%. Straw : per whole plot : 3.62 cwt. per acre or 9.87% ; per sub plot : 3.68 cwt. per acre or 10.0%.

### Green manure crops : Nitrogen added lb. per acre.

|         |    |    | Fallow | Clover | Ryegrass | Clover and ryegrass | Mean |
|---------|----|----|--------|--------|----------|---------------------|------|
| Mustard | .. | .. | 11.8   | 13.0   | 10.9     | 11.7                | 11.9 |
| Vetches | .. | .. | 9.2    | 12.8   | 12.2     | 13.0                | 11.8 |

|                                                       |    |    | No nitrogen |        | Nitrogen |        |         |         |
|-------------------------------------------------------|----|----|-------------|--------|----------|--------|---------|---------|
|                                                       |    |    | 1 cut       | 2 cuts | 1 cut    | 2 cuts | Mustard | Vetches |
| GRAIN ; cwt. per acre ( $\pm 1.04^1$ , $\pm 1.39^2$ ) |    |    |             |        |          |        |         |         |
| Fallow                                                | .. | .. | 15.0        | 12.7   | 13.9     | 20.2   | 17.7    | 16.7    |
| Clover                                                | .. | .. | 11.8        | 18.2   | 11.0     | 9.6    | 13.4    | 15.3    |
| Ryegrass                                              | .. | .. | 9.5         | 10.6   | 11.7     | 8.8    | 10.2    | 14.2    |
| Clover and ryegrass                                   | .. | .. | 13.2        | 15.0   | 10.4     | 8.3    | 12.8    | 16.7    |
| STRAW ; cwt. per acre ( $\pm 1.81^1$ , $\pm 2.60^2$ ) |    |    |             |        |          |        |         |         |
| Fallow                                                | .. | .. | 35.4        | 32.2   | 34.9     | 46.4   | 44.8    | 47.7    |
| Clover                                                | .. | .. | 36.3        | 39.3   | 31.7     | 35.7   | 43.2    | 39.7    |
| Ryegrass                                              | .. | .. | 24.4        | 25.4   | 28.1     | 28.1   | 33.6    | 33.6    |
| Clover and ryegrass                                   | .. | .. | 33.0        | 32.5   | 28.6     | 32.5   | 39.2    | 39.6    |

(<sup>1</sup>)For comparisons involving the mean of nitrogen and no nitrogen.

(<sup>2</sup>)For comparisons involving the difference of nitrogen and no nitrogen.

|             | Fallow | Clover | Ryegrass             | Clover and ryegrass | Mean | Standard errors | Fallow | Mustard | Vetches |
|-------------|--------|--------|----------------------|---------------------|------|-----------------|--------|---------|---------|
| No nitrogen | 14.1   | 12.6   | GRAIN; cwt. per acre |                     | 12.2 |                 | 12.4   | 11.4    | 10.2    |
| Nitrogen    | 18.7   | 12.8   | 10.2                 | 11.7                | 14.2 |                 | 14.2   | 14.1    | 11.8    |
| Mean        | 16.4   | 12.7   | 11.0                 | 12.4                | 13.2 | $\pm 0.518$     | 13.3   | 12.8    | 11.0    |
| Increase    |        | -3.7   | -5.4                 | -4.0                |      | $\pm 0.732$     |        | -0.5    | -2.3    |
| Difference  | +4.6   | +0.2   | +1.7                 | +1.5                | +2.0 | $\pm 0.693$     | +1.8   | +2.7    | +1.6    |
| Increase    |        | -4.4   | -2.9                 | -3.1                |      | $\pm 0.980$     |        | +0.9    | -0.2    |
| No nitrogen | 34.5   | 35.8   | STRAW; cwt. per acre |                     | 32.1 |                 | 32.3   | 30.2    | 32.8    |
| Nitrogen    | 46.4   | 42.8   | 26.5                 | 31.6                | 41.2 |                 | 40.6   | 41.7    | 42.8    |
| Mean        | 40.4   | 39.3   | 30.8                 | 36.1                | 36.6 | $\pm 0.905$     | 36.4   | 36.0    | 37.8    |
| Increase    |        | -1.1   | -9.6                 | -4.3                |      | $\pm 1.28$      |        | -0.4    | +1.4    |
| Difference  | +11.9  | +7.0   | +8.7                 | +9.0                | +9.1 | $\pm 1.30$      | +8.3   | +11.5   | +10.0   |
| Increase    |        | -4.9   | -3.2                 | -2.9                |      | $\pm 1.84$      |        | +3.2    | +1.7    |

### Conclusions

All three leys produced large reductions in the yield of grain compared with fallow, the reduction being significantly greater for ryegrass than for clover or with the clover and ryegrass mixture. The yields of grain were in all cases substantially better where two cuts of the leys were taken than with only one cut. In fact, where no nitrogen was applied to the wheat, the yields with two cuts of clover or the clover and ryegrass mixture were as good as with fallow.

The yields of grain following mustard were slightly but not significantly below those following the bastard fallow. The yields following vetches were significantly lower than those following mustard.

The response in grain to sulphate of ammonia was significantly greater after fallow than after any of the leys, the response following clover being negligible.

The effects on straw were in general similar to those on grain, except that vetches did not depress the yields of straw.

## BARLEY

Soil fumigation experiment. Residual effect of chlorpicrin, chlordinitrobenzene, "seekay" and "cymag," as controls of wireworm infestation.

RB—Pastures, 1936  
Plan and yields in lb.

Grain, straw, plant number (four metre rows) (April 23) and number of wireworms (total of four samples) in descending order

|        |                                       |                                      |                                      |                                      |                                      |    |
|--------|---------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|----|
| 31     | <b>P</b><br>29.0<br>48.0<br>124<br>3  | <b>O</b><br>27.8<br>54.4<br>120<br>2 | <b>N</b><br>32.1<br>82.4<br>118<br>5 | <b>K</b><br>36.0<br>66.0<br>217<br>1 | <b>M</b><br>45.6<br>89.9<br>153<br>4 | 35 |
| 36     | <b>M</b><br>35.1<br>68.4<br>196<br>6  | <b>K</b><br>41.3<br>69.7<br>187<br>0 | <b>O</b><br>33.1<br>53.2<br>148<br>6 | <b>N</b><br>43.6<br>78.4<br>148<br>4 | <b>P</b><br>42.2<br>64.8<br>152<br>4 |    |
| S<br>↑ | <b>O</b><br>36.9<br>59.1<br>161<br>4  | <b>M</b><br>36.0<br>60.0<br>208<br>9 | <b>K</b><br>31.6<br>58.6<br>151<br>1 | <b>P</b><br>38.9<br>54.6<br>177<br>6 | <b>N</b><br>41.2<br>81.8<br>151<br>5 |    |
|        | <b>N</b><br>39.3<br>77.2<br>150<br>17 | <b>P</b><br>36.6<br>60.4<br>166<br>8 | <b>M</b><br>34.5<br>62.0<br>152<br>8 | <b>O</b><br>40.3<br>65.0<br>177<br>9 | <b>K</b><br>37.6<br>55.2<br>179<br>0 |    |
| 51     | <b>K</b><br>35.8<br>60.7<br>212<br>4  | <b>N</b><br>41.1<br>71.6<br>180<br>4 | <b>P</b><br>38.1<br>64.2<br>182<br>2 | <b>M</b><br>32.5<br>55.0<br>166<br>4 | <b>O</b><br>30.7<br>55.3<br>95<br>8  | 55 |

Note.—In the field the plots lay in one line, 36 being next to 35, etc.

SYSTEM OF REPLICATION : 5 × 5 Latin square.

AREA OF EACH PLOT ; 1/60 acre (60.6 lks. × 27.5 lks.).

TREATMENTS : No fumigant (O), chlordinitrobenzene (N) and chlorpicrin (P) at the rate of 2.0 cwt. per acre, "cymag" (M) at the rate of 7.5 cwt. per acre and "seekay" (K) at the rate of 5.0 cwt. per acre applied in 1935. (See 1935 Report, p. 188).

BASAL MANURING ; Nil.

CULTIVATIONS, ETC. ; Ploughed on various dates during February. Springtime harrowed ; March 18. Rolled, Harrowed and Drilled ; March 20. Rolled ; May 2. Harvested ; Aug. 21 and 22. Variety ; Plumage Archer. Previous crop ; Sugar beet.

Sampling for wireworms ; Date ; June 19-July 2. Two random samples per half plot were taken, each sample consisting of 6 ins. × 6 ins. × 5 ins. (deep) of soil.

STANDARD ERRORS PER PLOT ; Grain ; 2.45 cwt. per acre or 12.5%. Straw ; 4.74 cwt. per acre or 13.7%. Plant number : 174.8 thousands per acre or 16.2%.

### Summary of Results

|                                          | No<br>fumigant | Chlordini-<br>troben-<br>zene | Chlor-<br>picrin | "Cymag" | "Seekay" | Mean   | Standard<br>error |
|------------------------------------------|----------------|-------------------------------|------------------|---------|----------|--------|-------------------|
| GRAIN ; cwt. per acre                    | 18.1           | 21.1                          | 19.8             | 19.7    | 19.5     | 19.6   | ±1.10             |
| STRAW ; cwt. per acre                    | 30.8           | 41.9                          | 31.3             | 35.9    | 33.2     | 34.6   | ±2.12             |
| PLANT NUMBER ;<br>thousands per acre     | 930.7          | 991.8                         | 1063.5           | 1161.7  | 1256.0   | 1080.7 | ±78.2             |
| NO. OF WIRE-<br>WORMS per square<br>yard | 52             | 63                            | 41               | 56      | 11       | 45     |                   |

### Conclusions

"Seekay" applied in 1935 produced a significant decrease in the number of wireworms in June 1936. This was reflected in a significant increase in plant number, but the corresponding increase in grain was not significant, the grain yields being moderately good even in the absence of any fumigation. The somewhat higher yields of grain and straw given by chlordinitrobenzene may be attributed to an effect of nitrogen.

The other fumigants had apparently no residual effects on wireworms.

## SPRING OATS

Soil fumigation experiment. Residual effect of "cymag," carbon disulphide jelly, chlordinitrobenzene and "seekay." Effect of sulphate of ammonia.

RO—Pastures, 1936

Plan and yields, total produce in grams above, weeds in lb. centre, 3rd cyst count below\*

|    |       |     |       |     |       |       |       |       |    |
|----|-------|-----|-------|-----|-------|-------|-------|-------|----|
| 1  | O     | 2CK | 1N    | 1CM | 2CM   | 2S    | 2CK   | O     | 40 |
|    | 79    | 938 | 106   | 275 | 281   | 4,033 | 2,461 | 105   |    |
|    | 88    | Nil | 128   | 181 | 291   | 230   | 57    | 215   |    |
|    | 248   | 232 | 272   | 206 | 160   | 114   | 114   | 266   |    |
|    | 1S    | O   | 1A    | 2CM | 1CK   | 1N    | 1CM   | 1A    |    |
|    | 4,844 | 63  | 171   | 256 | 1,238 | 105   | 1,068 | 962   |    |
|    | 57    | 206 | 198   | 192 | 53    | 247   | 199   | 192   |    |
|    | 154   | 150 | 274   | 264 | 180   | 198   | 106   | 188   |    |
|    | 2S    | 1CK | 2A    | 2N  | O     | 2A    | 2N    | 1S    |    |
|    | 1,888 | 621 | 210   | 387 | 65    | 188   | 140   | 2,692 |    |
| S  | 197   | 61  | 253   | 284 | 203   | 274   | 250   | 214   | ↑  |
|    | 229   | 273 | 275   | 212 | 102   | 82    | 120   | 88    |    |
|    | 1CK   | 1A  | 1S    | 2CK | 2CK   | 2A    | 1CK   | 1CM   |    |
|    | 885   | 385 | 868   | 616 | 338   | 550   | 495   | 555   |    |
|    | 25    | 147 | 94    | 9   | 32    | 245   | 48    | 191   |    |
|    | 242   | 358 | 252   | 222 | 160   | 262   | 196   | 230   |    |
|    | 2A    | 2N  | 2S    | 1N  | 1A    | 2N    | 2S    | O     |    |
|    | 1,047 | 30  | 1,518 | 205 | 105   | 735   | 3,021 | 809   |    |
|    | 197   | 184 | 137   | 144 | 196   | 201   | 110   | 156   |    |
|    | 412   | 353 | 258   | 322 | 100   | 116   | 56    | 68    |    |
| 21 | 2CM   | O   | 1CM   | O   | 1S    | 1N    | O     | 2CM   | 36 |
|    | 1,425 | 165 | 358   | 285 | 1,608 | 1,679 | 315   | 1,203 |    |
|    | 187   | 147 | 166   | 127 | 121   | 135   | 148   | 204   |    |
|    | 204   | 276 | 224   | 174 | 88    | 52    | 116   | 102   |    |

The positions of the blocks in the field were slightly different from those shown above.

\*Number of cysts per 400 grams of soil.

AREA OF EACH PLOT; 1/80 acre (30 lks. × 41.7 lks.).

TREATMENTS; No fumigant (O), single (1) and double (2) dressings of "cymag" (CM), carbon disulphide jelly (S), chlordinitrobenzene (N) and "seekay" (CK), at the following rates of application per acre for the single dressing; 1CM, 7.5 cwt.; 1S, 24.3 cwt.; 1N, 2.0 cwt. and 1CK, 5.0 cwt., applied in 1935.

Sulphate of ammonia (A) at the rate of 0.4 cwt. and 0.8 cwt. N per acre. Applied in 1936.

BASAL MANURING; Nil.

CULTIVATIONS, ETC.; Ploughed; Aug. 27-29 and Feb. 10-March 13. Spring-time harrowed; March 19. Rolled, harrowed, sulphate of ammonia applied and drilled; March 20. Harrowed; May 8. Rolled; May 9. Harvested; Aug. 7. Variety; Marvellous. Previous crop; Oats. (See 1935 Report, p.176).

SPECIAL NOTES; The entire produce was weighed, Oats plus weeds. Weight of oats was determined by sampling a strip 30 lks. × 1 yd. Third cyst count; Dec. 1 and 2. Two random samples of about 50 grms. of soil were taken per half plot.

STANDARD ERRORS PER PLOT; Weeds; 22.4 cwt. per acre or 19.8%. 3rd cyst count: sampling error 32.3 or 16.6%; experimental error 59.9 or 30.7%.

## Summary of Results

|                                 | TOTAL PRODUCE ; cwt. per acre <sup>2</sup> |                                    |                |                 |                                  | WEEDS ; cwt. per acre<br>( $\pm 11.2$ . Means : $\pm 7.92$ ) |                                    |                    |                 |                                  |
|---------------------------------|--------------------------------------------|------------------------------------|----------------|-----------------|----------------------------------|--------------------------------------------------------------|------------------------------------|--------------------|-----------------|----------------------------------|
|                                 | Chlor-<br>dinitro-<br>ben-<br>zene         | Carbon<br>disul-<br>phide<br>jelly | " Cy-<br>mag " | " See-<br>kay " | Sul-<br>phate<br>of am-<br>monia | Chlor-<br>dinitro-<br>ben-<br>zene                           | Carbon<br>disul-<br>phide<br>jelly | " Cy-<br>mag "     | " See-<br>kay " | Sul-<br>phate<br>of am-<br>monia |
| None ..                         | ..                                         | ..                                 | 3.4            | ..              | ..                               | ..                                                           | ..                                 | 115.2 <sup>1</sup> | ..              | ..                               |
| Single ..                       | 7.6                                        | 36.2                               | 8.2            | 11.7            | 5.5                              | 116.8                                                        | 87.0                               | 131.5              | 33.4            | 130.8                            |
| Double ..                       | 4.7                                        | 37.8                               | 11.4           | 15.7            | 7.2                              | 164.1                                                        | 120.4                              | 156.2              | 17.5            | 173.1                            |
| Mean of single<br>and double .. | 6.2                                        | 37.0                               | 9.8            | 13.7            | 6.4                              | 140.4                                                        | 103.7                              | 143.8              | 25.4            | 152.0                            |

Standard error ; <sup>(1)</sup>  $\pm 7.92$ .<sup>(2)</sup> No single standard error is applicable to this table.

|                                             | Third cyst count ( $\pm 30.0$ )    |                               |                  |            |                           |
|---------------------------------------------|------------------------------------|-------------------------------|------------------|------------|---------------------------|
|                                             | Chlor-<br>dinitro-<br>ben-<br>zene | Carbon<br>disulphide<br>jelly | " Cymag "        | " Seekay " | Sulphate<br>of<br>ammonia |
| None ..                                     | ..                                 | ..                            | 175 <sup>1</sup> | ..         | ..                        |
| Single ..                                   | 211                                | 146                           | 192              | 223        | 230                       |
| Double ..                                   | 202                                | 164                           | 182              | 182        | 258                       |
| Mean of single<br>and double ( $\pm 21.2$ ) | 206                                | 155                           | 187              | 202        | 244                       |

Standard error : <sup>(1)</sup>  $\pm 21.2$ .

## Conclusions

The effects of the fumigants applied in 1935 on the numbers of cysts in December 1936 were not significant.

The yields of oats were negligible except on the plots which had been fumigated with carbon disulphide jelly. In particular, the application of sulphate of ammonia in 1936 failed to produce a reasonable crop.

" Seekay " produced a large reduction in weeds.

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**POTATOES****Effect of Dung, ploughed in in December or applied in the bouts, of Straw and of Sulphate of Ammonia**

RP—Gt. Harpenden, 1936

Total produce in lb. above, percentage ware below

|    |         |         |         |         |         |         |         |         |    |
|----|---------|---------|---------|---------|---------|---------|---------|---------|----|
| 1  | — St N  | DL — —  | — St —  | DL St — | DE — —  | DE St — | DE — N  | DL St — | 8  |
|    | 206     | 366     | 165     | 344     | 317     | 291     | 352     | 397     |    |
|    | 58.8    | 74.8    | 58.1    | 75.2    | 77.0    | 75.5    | 73.0    | 78.1    |    |
|    | — — N   | DE St N | DL St N | DE — —  | — — —   | DL — —  | — St —  | DE St N |    |
|    | 249     | 302     | 543     | 200     | 234     | 373     | 169     | 320     |    |
|    | 68.0    | 71.4    | 65.1    | 64.6    | 72.1    | 81.2    | 56.0    | 66.1    |    |
| W  | — — —   | DL — N  | DE St — | DE — N  | DL — N  | — St N  | DL St N | — — N   |    |
| ↑  | 182     | 417     | 266     | 201     | 426     | 322     | 391     | 291     |    |
|    | 60.1    | 80.4    | 69.3    | 62.8    | 81.6    | 77.6    | 75.6    | 71.8    |    |
|    | — — —   | DE St N | — St —  | — — N   | DE — —  | — St N  | — St —  | DE — N  |    |
|    | 245     | 370     | 246     | 299     | 342     | 335     | 190     | 335     |    |
|    | 72.5    | 78.9    | 72.0    | 75.9    | 80.0    | 78.5    | 60.7    | 73.0    |    |
|    | — St N  | DE — N  | DL St N | DL St — | DL St N | DL — —  | DL St — | DL — N  |    |
|    | 238     | 342     | 458     | 408     | 458     | 372     | 277     | 356     |    |
|    | 66.9    | 77.2    | 83.0    | 80.8    | 81.8    | 77.0    | 71.3    | 77.5    |    |
|    | DE St — | DE — —  | DL — —  | DL — N  | DE St — | DE St N | — — N   | — — —   |    |
| 41 | 230     | 314     | 389     | 336     | 339     | 369     | 322     | 254     |    |
|    | 67.6    | 75.8    | 80.8    | 75.5    | 77.5    | 77.7    | 77.7    | 78.1    | 48 |

SYSTEM OF REPLICATION: 4 randomised blocks of 12 plots each.

AREA OF EACH PLOT (after rejecting edge bouts): 1/48 acre. Plots actually 1/40 acre (45.5 lks. × 54.9 lks.)

TREATMENTS: 3 × 2 × 2 factorial design.

Dung: None, 15 tons per acre ploughed in in December (DE), or stored and applied in the bouts (DL).

Straw: None, 40 cwt. per acre (chaffed), ploughed in in December, except when applied with DL, for which straw and dung were mixed and stored (St).

Sulphate of ammonia: None, 0.4 cwt. N per acre applied in the bouts (N).

BASAL MANURING: 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre as superphosphate, and 1 cwt. K<sub>2</sub>O per acre as sulphate of potash applied in the bouts.

CULTIVATIONS, ETC.: Applied dung and chaff: Dec. 10. Ploughed: Dec. 19-21. Springtime harrowed: April 7-10. Horse harrowed: April 15. Bouted: April 16-17. Applied stored dung and artificials: April 17-18. Potatoes planted: April 21-22. Harrowed ridges: April 24. Re-ridged: May 5. Grubbed: May 28-June 12. Earthed up: July 1. Sprayed: July 21. Lifted: Sept. 29-Oct. 1. Variety: Ally. Previous crop: Wheat.

SPECIAL NOTE: Potatoes passed through a 1½ inch riddle to determine the percentage ware.

STANDARD ERRORS PER PLOT: Total produce: 1.00 tons per acre or 15.0%; Percentage ware: 4.87.

**Summary of Results: Yields of separate treatments**

|                                               |    |          | No<br>Dung | Dung<br>ploughed in in the bouts |      |
|-----------------------------------------------|----|----------|------------|----------------------------------|------|
| TOTAL PRODUCE : tons per acre ( $\pm 0.500$ ) |    |          |            |                                  |      |
| No sulph. amm...                              | .. | No straw | 4.83       | 6.19                             | 7.92 |
|                                               |    | Straw    | 4.06       | 5.94                             | 7.53 |
| Sulph. amm.                                   | .. | No straw | 6.13       | 6.49                             | 8.10 |
|                                               |    | Straw    | 5.81       | 7.19                             | 9.77 |
| PERCENTAGE WARE : ( $\pm 2.44$ )              |    |          |            |                                  |      |
| No sulph. amm...                              | .. | No straw | 70.7       | 74.4                             | 78.4 |
|                                               |    | Straw    | 61.7       | 72.5                             | 76.4 |
| Sulph. amm.                                   | .. | No straw | 73.4       | 71.5                             | 78.8 |
|                                               |    | Straw    | 70.4       | 73.5                             | 76.4 |

**Effect of time of application of dung**

|                                                                    | No sulph. amm. |       | Sulph. amm. |       | Mean  |
|--------------------------------------------------------------------|----------------|-------|-------------|-------|-------|
|                                                                    | No straw       | Straw | No straw    | Straw |       |
| TOTAL PRODUCE : tons per acre ( $\pm 0.707$ . Mean : $\pm 0.354$ ) |                |       |             |       |       |
| Dung in the bouts minus<br>dung ploughed in .. ..                  | +1.73          | +1.59 | +1.61       | +2.58 | +1.88 |
| PERCENTAGE WARE : ( $\pm 3.45$ . Mean : $\pm 1.72$ )               |                |       |             |       |       |
| Dung in the bouts minus<br>dung ploughed in .. ..                  | +4.0           | +3.9  | +7.3        | +2.9  | +4.5  |

**Effect of Straw**

| Response to Straw                             |    |    | No<br>Dung | Dung<br>ploughed in in the bouts |       |
|-----------------------------------------------|----|----|------------|----------------------------------|-------|
| TOTAL PRODUCE : tons per acre ( $\pm 0.707$ ) |    |    |            |                                  |       |
| No sulph. amm.                                | .. | .. | -0.77      | -0.25                            | -0.39 |
| Sulph. amm.                                   | .. | .. | -0.32      | +0.70                            | +1.67 |
| PERCENTAGE WARE : ( $\pm 3.45$ )              |    |    |            |                                  |       |
| No sulph. amm.                                | .. | .. | -9.0       | -1.9                             | -2.0  |
| Sulph. amm.                                   | .. | .. | -3.0       | +2.0                             | -2.4  |

**Effect of sulphate of ammonia**

| Response to<br>sulphate of ammonia                                 |    |    | No<br>dung | Dung<br>ploughed in in the bouts |       | Mean  |
|--------------------------------------------------------------------|----|----|------------|----------------------------------|-------|-------|
| TOTAL PRODUCE : tons per acre ( $\pm 0.707$ . Mean : $\pm 0.408$ ) |    |    |            |                                  |       |       |
| No straw..                                                         | .. | .. | +1.30      | +0.30                            | +0.18 | +0.59 |
| Straw                                                              | .. | .. | +1.75      | +1.25                            | +2.24 | +1.75 |
| PERCENTAGE WARE : ( $\pm 3.45$ . Mean : $\pm 1.99$ )               |    |    |            |                                  |       |       |
| No straw..                                                         | .. | .. | +2.7       | -2.9                             | +0.4  | +0.1  |
| Straw                                                              | .. | .. | +8.7       | +1.0                             | 0.0   | +3.2  |

**Conclusions**

Dung applied in the bouts gave 1.9 tons per acre more than dung ploughed in, the mean responses being 1.2 tons per acre to dung ploughed in and 3.1 tons per acre to dung applied in the bouts.

Straw gave slight but not significant decreases in yield, except in the presence of both dung and sulphate of ammonia, in which case it gave a significant increase of 1.2 tons per acre.

Sulphate of ammonia produced a significant increase of 1.2 tons per acre. The increase was somewhat greater in the presence of straw than in its absence, particularly where dung was present.

Dung produced a significant increase in percentage ware. Sulphate of ammonia gave a significant increase in the absence of dung, but no increase in its presence, the interaction between sulphate of ammonia and dung being almost significant. The depression due to straw was not significant.

## SUGAR BEET

Effect of muriate of potash and agricultural salt, ploughed in in Autumn or harrowed in in Spring, and of dung.

RS—Great Harpenden, 1936

Plan and yields in lb.

Roots (dirty), tops, sugar percentage and plant number in descending order

|    |          |          |          |          |          |          |    |
|----|----------|----------|----------|----------|----------|----------|----|
| 1  | — K A —  | — — S —  | NA K S D | NA K A D | NA K S — | — — A —  | 6  |
|    | 670      | 674      | 733      | 728      | 646      | 600      |    |
|    | 584      | 616      | 760      | 629      | 500      | 462      |    |
|    | 17.42    | 17.68    | 17.86    | 17.71    | 18.49    | 17.57    |    |
|    | 503      | 484      | 500      | 517      | 505      | 498      |    |
|    | — — A —  | NA — A — | — K A D  | — K S D  | NA K A — | NA — S — |    |
|    | 677      | 730      | 755      | 725      | 701      | 641      |    |
|    | 584      | 634      | 744      | 704      | 550      | 534      |    |
|    | 17.77    | 18.26    | 17.60    | 17.31    | 17.77    | 17.83    |    |
|    | 465      | 478      | 474      | 523      | 523      | 510      |    |
|    | — K S —  | NA K A — | NA — A D | — — A D  | NA — A — | — K S —  |    |
|    | 604      | 697      | 790      | 788      | 747      | 648      |    |
|    | 480      | 570      | 682      | 658      | 480      | 462      |    |
|    | 18.58    | 17.22    | 18.20    | 17.51    | 18.32    | 17.80    |    |
|    | 537      | 536      | 538      | 541      | 531      | 497      |    |
| NE | NA K S — | NA — S — | — — S D  | NA — S D | — K A —  | — — S —  |    |
|    | 583      | 618      | 770      | 774      | 670      | 634      |    |
|    | 448      | 484      | 645      | 724      | 507      | 507      |    |
|    | 18.81    | 17.31    | 18.32    | 18.18    | 18.12    | 18.26    |    |
|    | 522      | 526      | 529      | 521      | 509      | 506      |    |
|    | — K S D  | — — S D  | NA K S — | — K A —  | NA K S D | — K A D  |    |
|    | 703      | 664      | 689      | 662      | 747      | 686      |    |
|    | 554      | 556      | 502      | 508      | 689      | 666      |    |
|    | 18.26    | 17.98    | 18.24    | 18.40    | 18.04    | 17.70    |    |
|    | 519      | 515      | 540      | 528      | 517      | 509      |    |
|    | — — A D  | NA — A D | NA — S — | — — A —  | NA K A D | NA — S D |    |
|    | 721      | 799      | 722      | 649      | 774      | 730      |    |
|    | 590      | 609      | 550      | 456      | 638      | 735      |    |
|    | 17.76    | 17.92    | 18.20    | 18.09    | 17.82    | 17.92    |    |
|    | 518      | 541      | 526      | 532      | 543      | 502      |    |
|    | NA — S D | — K A D  | — — S —  | — K S —  | — — S D  | — — A D  |    |
|    | 804      | 758      | 666      | 659      | 751      | 752      |    |
|    | 711      | 649      | 518      | 501      | 563      | 700      |    |
|    | 18.40    | 18.03    | 17.88    | 18.46    | 17.76    | 17.52    |    |
|    | 470      | 521      | 520      | 520      | 535      | 483      |    |
|    | NA K S D | NA K A D | NA — A — | NA K A — | NA — A D | — K S D  |    |
|    | 812      | 798      | 743      | 716      | 812      | 738      |    |
|    | 675      | 565      | 490      | 436      | 580      | 623      |    |
| 43 | 18.19    | 18.14    | 18.03    | 18.19    | 17.99    | 18.00    | 48 |
|    | 563      | 580      | 580      | 580      | 560      | 551      |    |

SYSTEM OF REPLICATION : 6 randomised blocks of 8 plots each.

AREA OF EACH PLOT (after rejecting edge rows) : 0.01851 acre. Plots actually : 1/45 acre (73.3 lks. × 30.3 lks.).

TREATMENTS : 2<sup>4</sup> factorial design.

Muriate of potash : None, 1.0 cwt. K<sub>2</sub>O per acre (K).

Agricultural salt : None, 5 cwt. per acre (NA).

Minerals ploughed in, in Autumn (A). Harrowed in, in Spring (S).

Dung : None, 10 tons per acre ploughed in, in Autumn (D).

BASAL MANURING : Sulphate of ammonia at the rate of 0.6 cwt. N per acre, superphosphate at the rate of 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre.

CULTIVATIONS, ETC. : Dung applied : Dec. 9. Autumn artificials applied : Dec. 10. Ploughed : Dec. 19. Spring-time harrowed : April 7. Rolled and harrowed : April 27. Spring artificials applied : May 1. Harrowed, rolled and drilled : May 1. Harrowed and rolled : May 2. Horse hoed : June 15. Singled : June 16 and 17. Hand hoed : Aug. 13. Lifted : Nov. 19-26. Variety : Kleinwanzleben. Previous crop : Wheat.

STANDARD ERRORS PER PLOT: Total sugar: 2.86 cwt. per acre or 5.36%. Tops: 1.09 tons per acre or 7.74%. Mean dirt tare : 0.138.

**Responses to fertilisers**

MEAN YIELDS: Total sugar: 53.3 cwt.; Roots (washed): 14.84 tons; Tops: 14.08 tons; Sugar percentage: 17.98; Plant number: 28.2 thousands.

|                                                               | Mean response | Differential responses |         |        |         |           |         |
|---------------------------------------------------------------|---------------|------------------------|---------|--------|---------|-----------|---------|
|                                                               |               | Dung                   |         | Salt   |         | Mur. pot. |         |
|                                                               |               | Absent                 | Present | Absent | Present | Absent    | Present |
| TOTAL SUGAR: cwt. per acre ( $\pm 1.17$ . Means $\pm 0.825$ ) |               |                        |         |        |         |           |         |
| Salt ..                                                       | +3.7          | +3.1                   | +4.2    | —      | —       | +4.4      | +3.0    |
| Mur. pot.                                                     | -1.1          | -1.0                   | -1.2    | -0.4   | -1.8    | —         | —       |
| ROOTS (washed): tons per acre                                 |               |                        |         |        |         |           |         |
| Salt ..                                                       | +0.90         | +0.81                  | +0.99   | —      | —       | +1.04     | +0.76   |
| Mur. pot.                                                     | -0.32         | -0.39                  | -0.25   | -0.18  | -0.46   | —         | —       |
| TOPS: tons per acre ( $\pm 0.445$ . Means: $\pm 0.314$ )      |               |                        |         |        |         |           |         |
| Salt ..                                                       | +0.34         | -0.01                  | +0.70   | —      | —       | +0.72     | -0.04   |
| Mur. pot.                                                     | -0.12         | -0.54                  | +0.29   | +0.26  | -0.50   | —         | —       |
| SUGAR PERCENTAGE                                              |               |                        |         |        |         |           |         |
| Salt ..                                                       | +0.13         | +0.05                  | +0.22   | —      | —       | +0.20     | +0.06   |
| Mur. pot.                                                     | +0.06         | +0.19                  | -0.07   | +0.13  | -0.01   | —         | —       |
| PLANT NUMBER: thousands per acre                              |               |                        |         |        |         |           |         |
| Salt ..                                                       | +0.9          | +1.2                   | +0.6    | —      | —       | +0.7      | +1.0    |
| Mur. pot.                                                     | +0.5          | +0.6                   | +0.3    | +0.3   | +0.6    | —         | —       |

**Effects of time of application of minerals**

| Minerals applied                  | None                                        | Salt               | Mur. pot.          | Salt<br>mur. pot.  | No<br>dung         | Dung               | Mean               | Increase           |
|-----------------------------------|---------------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| TOTAL SUGAR : cwt. per acre       |                                             |                    |                    |                    |                    |                    |                    |                    |
| Autumn .. ..                      | 51.7 <sup>1</sup>                           | 57.9 <sup>2</sup>  | 52.7 <sup>2</sup>  | 54.8 <sup>2</sup>  | 53.1 <sup>3</sup>  | 57.1 <sup>3</sup>  | 55.1 <sup>4</sup>  |                    |
| Spring .. ..                      |                                             | 54.2 <sup>2</sup>  | 49.9 <sup>2</sup>  | 53.8 <sup>2</sup>  | 48.7 <sup>3</sup>  | 56.6 <sup>3</sup>  | 52.6 <sup>4</sup>  | -2.5 <sup>3</sup>  |
| Standard errors ..                | (1)±0.825, (2)±1.17, (3)±0.953, (4)±0.674.  |                    |                    |                    |                    |                    |                    |                    |
| ROOTS (washed) : tons per acre    |                                             |                    |                    |                    |                    |                    |                    |                    |
| Autumn .. ..                      | 14.48                                       | 15.98              | 14.76              | 15.40              | 14.79              | 15.97              | 15.38              |                    |
| Spring .. ..                      |                                             | 15.06              | 13.84              | 14.72              | 13.37              | 15.71              | 14.54              | -0.84              |
| TOPS : tons per acre              |                                             |                    |                    |                    |                    |                    |                    |                    |
| Autumn .. ..                      | 13.78 <sup>1</sup>                          | 13.97 <sup>2</sup> | 14.70 <sup>2</sup> | 13.62 <sup>2</sup> | 12.76 <sup>3</sup> | 15.44 <sup>3</sup> | 14.10 <sup>4</sup> |                    |
| Spring .. ..                      |                                             | 15.03 <sup>2</sup> | 13.36 <sup>2</sup> | 14.37 <sup>2</sup> | 11.96 <sup>3</sup> | 16.55 <sup>3</sup> | 14.25 <sup>4</sup> | +0.15 <sup>3</sup> |
| Standard errors ..                | (1)±0.314, (2)±0.445, (3)±0.363, (4)±0.257. |                    |                    |                    |                    |                    |                    |                    |
| SUGAR PERCENTAGE                  |                                             |                    |                    |                    |                    |                    |                    |                    |
| Autumn .. ..                      | 17.84                                       | 18.12              | 17.88              | 17.81              | 17.97              | 17.90              | 17.94              |                    |
| Spring .. ..                      |                                             | 17.98              | 18.07              | 18.27              | 18.19              | 18.02              | 18.11              | +0.17              |
| PLANT NUMBER : thousands per acre |                                             |                    |                    |                    |                    |                    |                    |                    |
| Autumn .. ..                      | 27.6                                        | 29.0               | 27.4               | 29.5               | 28.6               | 28.7               | 28.6               |                    |
| Spring .. ..                      |                                             | 27.5               | 28.4               | 28.3               | 28.1               | 28.0               | 28.1               | -0.5               |

**Conclusions**

Salt produced a significant increase in sugar per acre, while muriate of potash gave a decrease which was not significant.

The autumn application of salt gave somewhat higher yields than the spring application, but the difference was hardly significant.

Salt and muriate of potash had little effect on tops.

Dung applied to whole blocks gave an increase of 5.7 cwt. sugar per acre and 3.30 tons tops per acre.

## SUGAR BEET

Effect of sowing date, of sulphate of ammonia and of superphosphate and  
muriate of potash broadcast or drilled with the seed

RS—Great Harpenden, 1936  
Plan and yields in lb.

|    |        | Roots |       | Tops  |       | Sugar |  |  |  | Roots  |       | Tops  |       | Sugar |       |  |     |
|----|--------|-------|-------|-------|-------|-------|--|--|--|--------|-------|-------|-------|-------|-------|--|-----|
|    |        | Sugar | Man-  | Sugar | Man-  | per   |  |  |  |        | Sugar | Man-  | Sugar | Man-  | per   |  |     |
|    |        | beet  | golds | beet  | golds | cent. |  |  |  |        | beet  | golds | beet  | golds | cent. |  |     |
| 49 | 2 Db — | 73.5  |       | 58.0  |       | 18.49 |  |  |  | 2 — N  | 101.5 |       | 54.5  |       | 18.61 |  |     |
|    | 3 Db N | 122.7 | 9.0   | 101.0 | 0.5   | 17.42 |  |  |  | 1 P N  | 142.0 |       | 75.0  |       | 18.91 |  | 85  |
|    | 3 Bs — | 93.3  |       | 71.5  |       | 17.77 |  |  |  | 1 Bp — | 95.4  | 4.0   | 49.5  | 0.5   | 18.75 |  |     |
|    | 1 Bs — | 135.7 |       | 81.5  |       | 18.15 |  |  |  | 1 Bs N | 159.9 | 9.5   | 91.5  | 0.5   | 18.52 |  |     |
|    | 3 — N  | 115.2 | 4.5   | 96.0  | 0.5   | 17.80 |  |  |  | 3 P N  | 149.1 |       | 113.0 |       | 18.46 |  |     |
|    | 2 Bp — | 81.2  | 3.0   | 54.5  | 0.5   | 17.83 |  |  |  | 2 Db N | 104.8 |       | 69.0  |       | 18.61 |  |     |
|    | 1 Bp N | 139.0 |       | 113.0 |       | 18.20 |  |  |  | 2 Bp N | 121.0 |       | 83.5  |       | 18.64 |  |     |
|    | 3 P —  | 85.7  |       | 66.0  |       | 18.29 |  |  |  | 2 P —  | 108.9 |       | 70.0  |       | 18.46 |  |     |
|    | 2 — —  | 88.1  |       | 60.5  |       | 18.03 |  |  |  | 3 Db — | 88.5  | 6.5   | 58.0  | 0.5   | 18.87 |  |     |
|    | 1 Da — | 44.1  | 98.0  | 23.0  | 6.0   | 18.32 |  |  |  | 1 Da N | 112.8 | 26.0  | 58.0  | 1.0   | 18.61 |  |     |
|    | 2 P N  | 138.1 |       | 103.0 |       | 17.74 |  |  |  | 2 Da — | 92.2  | 12.5  | 66.0  | 0.5   | 18.44 |  |     |
|    | 3 Da — | 79.0  | 12.0  | 67.5  | 1.0   | 18.06 |  |  |  | 3 Bs N | 124.3 | 7.0   | 99.0  | 0.5   | 17.94 |  |     |
|    | 2 Bs N | 155.7 |       | 144.0 |       | 17.31 |  |  |  | 3 — —  | 109.0 |       | 85.5  |       | 17.12 |  |     |
|    | 1 P —  | 132.5 | 6.0   | 94.5  | 0.5   | 17.14 |  |  |  | 3 Bp — | 94.6  |       | 84.0  |       | 17.22 |  |     |
|    | 1 Db N | 161.8 | 58.0  | 126.5 | 3.5   | 17.34 |  |  |  | 3 Da N | 122.8 | 15.5  | 121.0 | 2.5   | 17.34 |  |     |
|    | 3 Bp N | 127.9 | 5.5   | 126.5 | 0.5   | 16.79 |  |  |  | 2 Bs — | 138.0 |       | 112.5 |       | 17.57 |  |     |
|    | 2 Da N | 156.4 | 11.5  | 147.0 | 1.0   | 17.28 |  |  |  | 1 — —  | 101.7 |       | 63.0  |       | 17.05 |  |     |
|    | 1 — N  | 153.5 |       | 108.0 |       | 17.31 |  |  |  | 1 Db — | 93.0  | 7.0   | 61.5  | 1.5   | 16.88 |  |     |
|    |        |       |       |       |       |       |  |  |  |        |       |       |       |       |       |  |     |
|    | 3 Da — | 101.0 |       | 108.5 |       | 17.05 |  |  |  | 2 Bp — | 119.6 |       | 87.5  |       | 17.57 |  |     |
|    | 3 Bp — | 88.7  |       | 93.0  |       | 17.14 |  |  |  | 2 P —  | 117.9 |       | 83.0  |       | 18.32 |  |     |
|    | 2 Bs — | 97.2  |       | 85.0  |       | 17.16 |  |  |  | 2 Bs N | 157.2 |       | 115.5 |       | 17.68 |  |     |
|    | 1 Da — | 51.2  | 118.0 | 38.5  | 14.0  | 16.99 |  |  |  | 3 Db — | 92.0  | 7.0   | 78.5  | 1.5   | 17.74 |  |     |
|    | 3 — N  | 93.8  |       | 103.5 |       | 17.16 |  |  |  | 1 — —  | 119.5 |       | 66.0  |       | 17.48 |  |     |
|    | 3 Db N | 125.6 | 11.0  | 126.0 | 0.5   | 17.11 |  |  |  | 1 Bp N | 168.2 |       | 115.5 |       | 17.74 |  |     |
|    | 1 P —  | 130.0 |       | 101.0 |       | 17.34 |  |  |  | 3 Bs — | 90.0  |       | 79.0  |       | 17.94 |  |     |
|    | 1 Bs N | 166.3 |       | 130.5 |       | 17.37 |  |  |  | 3 Da N | 143.9 | 4.0   | 140.0 | 0.5   | 17.40 |  |     |
|    | 3 P —  | 91.7  | 8.0   | 81.5  | 0.5   | 17.28 |  |  |  | 1 Bs — | 129.7 |       | 81.5  |       | 17.77 |  |     |
|    | 1 Db N | 128.0 | 12.0  | 89.0  | 0.5   | 17.60 |  |  |  | 2 Da — | 91.0  | 4.0   | 73.5  | 0.5   | 18.03 |  |     |
|    | 1 Bp — | 98.7  |       | 68.5  |       | 17.34 |  |  |  | 2 — N  | 141.0 | 4.5   | 104.0 | 0.5   | 17.58 |  |     |
|    | 2 — —  | 99.5  |       | 76.5  |       | 17.11 |  |  |  | 1 Da N | 136.0 | 54.5  | 84.5  | 3.0   | 17.80 |  |     |
|    | 1 — N  | 182.4 |       | 146.0 |       | 17.25 |  |  |  | 3 — —  | 87.9  |       | 69.5  |       | 17.60 |  |     |
|    | 2 Db — | 123.8 | 4.5   | 113.5 | 0.5   | 16.76 |  |  |  | 1 P N  | 176.3 |       | 110.5 |       | 17.97 |  |     |
|    | 2 Da N | 116.9 | 7.5   | 112.0 | 0.5   | 17.05 |  |  |  | 3 P N  | 133.8 | 6.0   | 120.0 | 1.0   | 17.63 |  |     |
|    | 3 Bs N | 149.0 |       | 135.5 |       | 16.47 |  |  |  | 3 Bp N | 120.4 | 8.5   | 114.5 | 1.5   | 17.37 |  |     |
|    | 2 Bp N | 140.0 |       | 102.0 |       | 16.96 |  |  |  | 2 Db N | 134.6 | 8.0   | 119.0 | 1.0   | 17.40 |  |     |
| 84 | 2 P N  | 146.1 |       | 67.5  |       | 16.30 |  |  |  | 1 Db — | 81.1  | 7.5   | 52.0  | 1.0   | 17.48 |  | 120 |

SYSTEM OF REPLICATION ; 4 randomised blocks of 18 plots each. Certain interactions partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge-rows) ; 1/190 acre. Plots actually 1/95 (94.8 lks.  $\times$  11.1 lks.).

TREATMENTS ; 6  $\times$  3  $\times$  2 factorial design.

Sowing dates ; April 23 (1), May 8 (2), May 26 (3).

Minerals ; None (—), ploughed in (P), broadcast immediately after ploughing (Bp), broadcast at sowing (Bs), drilled below seed (Db), drilled above seed (Da), at the rate of 0.5 cwt.  $P_2O_5$  per acre as superphosphate and 1.0 cwt.  $K_2O$  per acre as muriate of potash.

Sulphate of ammonia ; None (—), 0.6 cwt. N per acre drilled where minerals are drilled, otherwise broadcast (N).

BASAL MANURING ; Nil.

CULTIVATIONS, ETC. ; Minerals applied (P) ; March 21 . Ploughed ; March 27-April 1. Minerals applied (Bp) ; April 3. Spring-time harrowed ; April 7 and 8. Rolled ; April 8. Harrowed ; April 20 and 23. Rolled ; April 23. Minerals applied ; (Bs, Db, Da) ; April 23. Harrowed and rolled ; April 24. Rolled ; May 8. Minerals applied (Bs, Db, Da) ; May 8. Harrowed ; May 8. Harrowed and rolled ; May 26. Minerals applied (Bs, Db, Da) ; May 26. Horse hoed 1st sowing ; May 28. Singled 1st sowing ; June 11. Horse hoed 2nd sowing ; June 12. Singled 2nd sowing ; June 17. Horse hoed 3rd sowing ; June 23. Singled 3rd sowing and hand hoed 1st and 2nd sowings ; July 4. Horse and hand hoed all sowings ; Aug. 8 and 12. Lifted ; Nov. 27-Dec. 3. Variety ; Kleinwanzleben E. Previous crop ; Wheat.

SPECIAL NOTE ; The seed drill used had not been properly cleaned before the experiment and unfortunately contained mangolds seeds, which grew along with the sugar beet on certain plots. The results have been combined by assuming that a sugar beet root weighs one half a mangolds root and that sugar beet tops weigh 2.5 times mangolds tops. The individual weights of sugar beet and mangolds are, however, given in all cases. It will be noticed that the mistake severely affected a few treatments only.

STANDARD ERROR PER PLOT : Roots (Sugar beet +  $\frac{1}{2}$  Mangolds) : 1.39 tons per acre or 13.4% ;  
Tops (Sugar beet +  $\frac{5}{2}$  Mangolds) : 1.52 tons per acre or 19.4%.

### Conclusions

Later sowing produced a significant decrease in the yield of roots and a significant increase in the yield of tops. The sugar percentage was also slightly lower with the later sowings, so that the yield of sugar per acre dropped by 4.7 cwt. per acre from the first to the second sowing and by a further 2.6 cwt. per acre from the second sowing to the third.

Sulphate of ammonia produced large increases in the yields of roots and tops. Sulphate of ammonia had little effect on the average on sugar percentage and gave an average increase in sugar per acre of 11.6 cwt. or 32 per cent. of the mean yield.

The average response to minerals was not significant in roots, tops or sugar percentage.

## Main effects and interactions of sowings with fertilisers

|                       | Sugar beet     |                |                | Mangolds       |                |                             | Sugar beet + $\frac{1}{2}$ Mangolds |                |                | Mean Increase             |
|-----------------------|----------------|----------------|----------------|----------------|----------------|-----------------------------|-------------------------------------|----------------|----------------|---------------------------|
|                       | S <sub>1</sub> | S <sub>2</sub> | S <sub>3</sub> | S <sub>1</sub> | S <sub>2</sub> | S <sub>3</sub>              | S <sub>1</sub>                      | S <sub>2</sub> | S <sub>3</sub> |                           |
| ROOTS ; tons per acre |                |                |                |                |                |                             |                                     |                |                |                           |
| N <sub>0</sub>        | 8.57           | 8.70           | 7.79           | 1.70           | 0.17           | 0.24                        | 9.42 <sup>1</sup>                   | 8.78           | 7.91           | 8.70 <sup>2</sup>         |
| N <sub>1</sub>        | 12.91          | 11.40          | 10.80          | 1.13           | 0.22           | 0.50                        | 13.48                               | 11.51          | 11.05          | 12.01 + 3.31 <sup>3</sup> |
| O                     | 11.81          | 9.12           | 8.61           | 0.00           | 0.10           | 0.10                        | 11.81 <sup>4</sup>                  | 9.17           | 8.66           | 9.88 <sup>1</sup>         |
| P                     | 12.32          | 10.84          | 9.76           | 0.13           | 0.00           | 0.30                        | 12.38                               | 10.84          | 9.91           | 11.04 + 1.16 <sup>5</sup> |
| Bp                    | 10.63          | 9.79           | 9.15           | 0.08           | 0.06           | 0.30                        | 10.67                               | 9.82           | 9.30           | 9.93 + 0.05               |
| Bs                    | 12.55          | 11.62          | 9.68           | 0.20           | 0.00           | 0.15                        | 12.65                               | 11.62          | 9.76           | 11.34 + 1.46              |
| Db                    | 9.84           | 9.26           | 9.09           | 1.79           | 0.27           | 0.71                        | 10.74                               | 9.40           | 9.44           | 9.86 - 0.02               |
| Da                    | 7.30           | 9.68           | 9.47           | 6.29           | 0.75           | 0.67                        | 10.44                               | 10.06          | 9.80           | 10.10 + 0.22              |
| Mean                  |                |                |                |                |                |                             | 11.45 <sup>6</sup>                  | 10.15          | 9.48           | 10.36                     |
| Incr'se               |                |                |                |                |                |                             | -1.30 <sup>1</sup>                  | -1.97          |                |                           |
| TOPS ; tons per acre  |                |                |                |                |                |                             |                                     |                |                |                           |
| N <sub>0</sub>        | 5.52           | 6.65           | 6.66           | 0.17           | 0.01           | 0.02                        | 5.94 <sup>7</sup>                   | 6.67           | 6.71           | 6.44 <sup>8</sup>         |
| N <sub>1</sub>        | 8.82           | 8.63           | 9.87           | 0.06           | 0.02           | 0.06                        | 8.97                                | 8.68           | 10.02          | 9.22 + 2.78 <sup>9</sup>  |
| O                     | 8.12           | 6.27           | 7.52           | 0.00           | 0.01           | 0.01                        | 8.12 <sup>10</sup>                  | 6.29           | 7.54           | 7.32 <sup>7</sup>         |
| P                     | 8.08           | 6.86           | 8.07           | 0.01           | 0.00           | 0.03                        | 8.10                                | 6.86           | 8.15           | 7.70 + 0.38 <sup>11</sup> |
| Bp                    | 7.35           | 6.94           | 8.86           | 0.01           | 0.01           | 0.04                        | 7.37                                | 6.96           | 8.96           | 7.76 + 0.44               |
| Bs                    | 8.16           | 9.69           | 8.16           | 0.01           | 0.00           | 0.01                        | 8.18                                | 9.69           | 8.18           | 8.68 + 1.36               |
| Db                    | 6.98           | 7.62           | 7.71           | 0.14           | 0.03           | 0.06                        | 7.33                                | 7.70           | 7.86           | 7.63 + 0.31               |
| Da                    | 4.33           | 8.45           | 9.27           | 0.51           | 0.05           | 0.08                        | 5.61                                | 8.57           | 9.47           | 7.88 + 0.56               |
| Mean                  |                |                |                |                |                |                             | 7.45 <sup>12</sup>                  | 7.68           | 8.36           | 7.83                      |
| Incr'se               |                |                |                |                |                |                             | +0.23 <sup>7</sup>                  | +0.91          |                |                           |
| SUGAR PERCENTAGE      |                |                |                |                |                |                             |                                     |                |                |                           |
|                       | S <sub>1</sub> | S <sub>2</sub> | S <sub>3</sub> | Mean           | Increase       | TOTAL SUGAR ; cwt. per acre |                                     |                |                |                           |
|                       |                |                |                |                |                | S <sub>1</sub>              | S <sub>2</sub>                      | S <sub>3</sub> | Mean           | Increase                  |
| N <sub>0</sub>        | 17.56          | 17.81          | 17.67          | 17.68          |                | 33.1                        | 31.3                                | 28.0           | 30.8           |                           |
| N <sub>1</sub>        | 17.88          | 17.60          | 17.41          | 17.63          | -0.05          | 48.2                        | 40.5                                | 38.5           | 42.4           | +11.6                     |
| O                     | 17.27          | 17.83          | 17.42          | 17.51          |                | 40.8                        | 32.7                                | 30.2           | 34.6           |                           |
| P                     | 17.84          | 17.70          | 17.92          | 17.82          | +0.31          | 44.2                        | 38.4                                | 35.5           | 39.4           | +4.8                      |
| Bp                    | 18.01          | 17.75          | 17.13          | 17.63          | +0.12          | 38.4                        | 34.9                                | 31.9           | 35.1           | +0.5                      |
| Bs                    | 17.95          | 17.43          | 17.53          | 17.64          | +0.13          | 45.4                        | 40.5                                | 34.2           | 40.0           | +5.4                      |
| Db                    | 17.32          | 17.82          | 17.78          | 17.64          | +0.13          | 37.2                        | 33.5                                | 33.6           | 34.8           | +0.2                      |
| Da                    | 17.93          | 17.70          | 17.46          | 17.70          | +0.19          | 37.4                        | 35.6                                | 34.2           | 35.7           | +1.1                      |
| Mean                  | 17.72          | 17.70          | 17.54          | 17.66          |                | 40.6                        | 35.9                                | 33.3           | 36.6           |                           |
| Increase              |                | -0.02          | -0.18          |                |                |                             | -4.7                                | -7.3           |                |                           |

Standard errors: (1)  $\pm 0.401$ , (2)  $\pm 0.232$ , (3)  $\pm 0.328$ , (4)  $\pm 0.695$ , (5)  $\pm 0.567$ , (6)  $\pm 0.284$ , (7)  $\pm 0.439$ , (8)  $\pm 0.253$ , (9)  $\pm 0.358$ , (10)  $\pm 0.760$ , (11)  $\pm 0.621$ , (12)  $\pm 0.310$ .

## MANGOLDS

Effect of sulphate of ammonia, superphosphate, muriate of potash, agricultural salt and dung

RM—GREAT HARPENDEN—1936

Plan and yields in lb., roots above, tops centre, plant number below

|    |                                                                                                              |      |      |      |                                                                                                              |      |      |      |    |
|----|--------------------------------------------------------------------------------------------------------------|------|------|------|--------------------------------------------------------------------------------------------------------------|------|------|------|----|
| 1  | - PK - D - - - N <sub>A</sub> D S - K - - - SPKN <sub>A</sub> D                                              |      |      |      | - - - - D - PKN <sub>A</sub> D - - K - - S - - N <sub>A</sub> D                                              |      |      |      | 8  |
|    | 844                                                                                                          | 1104 | 1156 | 1508 | 1248                                                                                                         | 1100 | 784  | 1376 |    |
|    | 126                                                                                                          | 157  | 139  | 196  | 120                                                                                                          | 136  | 95   | 152  |    |
|    | 444                                                                                                          | 461  | 471  | 446  | 484                                                                                                          | 448  | 479  | 478  |    |
| NE | SP - N <sub>A</sub> - - - KN <sub>A</sub> - S - - - D - P - - -                                              |      |      |      | SPK - D S - KN <sub>A</sub> - SP - - - - P - N <sub>A</sub> -                                                |      |      |      | 8  |
|    | 1312                                                                                                         | 1000 | 1176 | 888  | 1356                                                                                                         | 1376 | 1008 | 964  |    |
|    | 168                                                                                                          | 150  | 146  | 123  | 158                                                                                                          | 171  | 122  | 130  |    |
|    | 466                                                                                                          | 472  | 492  | 504  | 478                                                                                                          | 461  | 493  | 472  |    |
| ↑  | - - K - D SP - - D - P - N <sub>A</sub> D - PKN <sub>A</sub> -                                               |      |      |      | S - K - D SPKN <sub>A</sub> - - - KN <sub>A</sub> D SP - N <sub>A</sub> D                                    |      |      |      | 8  |
|    | 896                                                                                                          | 1284 | 996  | 860  | 1328                                                                                                         | 1292 | 1008 | 1324 |    |
|    | 148                                                                                                          | 174  | 146  | 132  | 180                                                                                                          | 167  | 138  | 176  |    |
|    | 460                                                                                                          | 490  | 469  | 451  | 487                                                                                                          | 458  | 462  | 471  |    |
| 25 | S - - N <sub>A</sub> - SPK - - - - - S - KN <sub>A</sub> D - P - - D - PK - - - - N <sub>A</sub> - S - - - - |      |      |      | S - - N <sub>A</sub> - SPK - - - - - S - KN <sub>A</sub> D - P - - D - PK - - - - N <sub>A</sub> - S - - - - |      |      |      | 32 |
|    | 1184                                                                                                         | 984  | 740  | 1468 | 1008                                                                                                         | 692  | 780  | 1108 |    |
|    | 156                                                                                                          | 148  | 110  | 211  | 144                                                                                                          | 110  | 126  | 124  |    |
|    | 439                                                                                                          | 474  | 507  | 448  | 447                                                                                                          | 470  | 492  | 487  |    |

SYSTEM OF REPLICATION : 4 randomised blocks of 8 plots each. Certain high order interactions are partially confounded with block differences.

AREA OF EACH PLOT (after rejecting edge rows) : 0.02322 acre. Plots actually. 1/45 acre (48.8 lks. × 45.5 lks.)

TREATMENTS : 2<sup>5</sup> factorial design.

Sulphate of ammonia : None, 0.6 cwt. N per acre (S).

Superphosphate : None, 0.5 cwt. P<sub>2</sub>O<sub>5</sub> per acre (P).

Muriate of Potash : None, 1.0 cwt. K<sub>2</sub>O per acre (K).

Agricultural Salt : None, 5 cwt. per acre (N<sub>A</sub>).

Dung : None, 10 tons per acre (D).

BASAL MANURING : Nil.

CULTIVATIONS, ETC. : Dung applied : Dec. 11. Ploughed : Dec. 17-19. Spring-time harrowed :

April 7. Artificials applied : May 5. Harrowed : May 5. Rolled : May 5. Drilled :

May 5. Horse hoed : June 12, Aug. 12 and 13. Singled : July 2 and 3. Lifted :

Nov. 18 and 19. Variety : Yellow Globe. Previous crop : Wheat.

STANDARD ERROR PER PLOT : Roots : 1.91 tons per acre or 7.50%

### Responses to fertilisers

MEAN YIELD: Roots: 25.50 tons; Tops, 3.40 tons; Plant number: 21.2 thousands.

|                                                           | Mean response | Differential responses |         |        |         |        |         |                   |         |
|-----------------------------------------------------------|---------------|------------------------|---------|--------|---------|--------|---------|-------------------|---------|
|                                                           |               | Sulphate of ammonia    |         | Dung   |         | Salt   |         | Muriate of potash |         |
|                                                           |               | Absent                 | Present | Absent | Present | Absent | Present | Absent            | Present |
| ROOTS: tons per acre ( $\pm 0.955$ , Means: $\pm 0.675$ ) |               |                        |         |        |         |        |         |                   |         |
| Sulphate of ammonia                                       | +7.73         | —                      | —       | +7.87  | +7.59   | +6.68  | +8.79   | +5.93             | +9.53   |
| Dung .. .. .                                              | +4.20         | +4.34                  | +4.06   | —      | —       | +5.17  | +3.24   | +4.45             | +3.96   |
| Salt .. .. .                                              | +3.12         | +2.07                  | +4.18   | +4.09  | +2.16   | —      | —       | +1.68             | +4.56   |
| Muriate of potash ..                                      | +0.22         | -1.58                  | +2.02   | +0.46  | -0.02   | -1.22  | +1.66   | —                 | —       |
| Superphosphate ..                                         | -0.45         | -0.60                  | -0.30   | -0.37  | -0.53   | -1.08  | +0.17   | +0.20             | -1.10   |
| TOPS: tons per acre.                                      |               |                        |         |        |         |        |         |                   |         |
| Sulphate of ammonia                                       | +0.72         | —                      | —       | +0.64  | +0.80   | +0.62  | +0.83   | +0.47             | +0.98   |
| Dung .. .. .                                              | +0.50         | +0.42                  | +0.58   | —      | —       | +0.66  | +0.33   | +0.46             | +0.54   |
| Salt .. .. .                                              | +0.50         | +0.40                  | +0.60   | +0.66  | +0.33   | —      | —       | +0.43             | +0.57   |
| Muriate of potash ..                                      | +0.19         | -0.06                  | +0.44   | +0.14  | +0.23   | +0.12  | +0.26   | —                 | —       |
| Superphosphate ..                                         | +0.05         | +0.01                  | +0.08   | +0.08  | +0.02   | +0.12  | -0.02   | +0.27             | -0.18   |
| PLANT NUMBER: thousands per acre                          |               |                        |         |        |         |        |         |                   |         |
| Sulphate of ammonia                                       | 0.0           | —                      | —       | -0.6   | +0.6    | +0.4   | -0.3    | -0.1              | +0.2    |
| Dung .. .. .                                              | -0.4          | -1.0                   | +0.2    | —      | —       | -0.6   | -0.1    | -0.4              | -0.3    |
| Salt .. .. .                                              | -0.8          | -0.4                   | -1.1    | -1.0   | -0.5    | —      | —       | -0.9              | -0.7    |
| Muriate of potash ..                                      | -0.7          | -0.8                   | -0.5    | -0.7   | -0.5    | -0.8   | -0.6    | —                 | —       |
| Superphosphate ..                                         | -0.3          | -0.6                   | +0.1    | -0.1   | -0.4    | -0.4   | -0.2    | -0.2              | -0.4    |

### Conclusions

Sulphate of ammonia, dung and salt produced significant increases in the yield of roots. The average response in roots to muriate of potash was small and not significant, but the responses to sulphate of ammonia and salt were increased by the presence of muriate of potash, the increase being significant for sulphate of ammonia and almost so for salt. The results for tops were similar to those for roots. Superphosphate had little effect on roots or tops.

## BEANS

## Effect of dung, nitro-chalk, superphosphate and muriate of potash

RE—Gt. Harpenden, 1936

Plan and yields in lb., grain above, straw below

|    |      |       |       |      |       |       |       |       |    |
|----|------|-------|-------|------|-------|-------|-------|-------|----|
| 28 | P    | K     | D     | NPK  | NPK   | D     | P     | DNK   | 35 |
|    | 45.1 | 55.0  | 53.1  | 36.2 | 43.1  | 42.2  | 38.8  | 34.2  |    |
|    | 78.4 | 83.0  | 89.9  | 87.0 | 95.2  | 96.3  | 81.0  | 101.6 |    |
| N  | DNK  | DNP   | DPK   | N    | N     | DNP   | K     | DPK   |    |
|    | 41.0 | 48.4  | 54.8  | 41.7 | 46.9  | 52.2  | 50.2  | 44.5  |    |
|    | 87.8 | 90.8  | 81.2  | 79.0 | 78.1  | 99.8  | 91.0  | 98.2  |    |
| ↑  | DP   | NK    | DK    | PK   | NK    | DP    | O     | NP    |    |
|    | 50.1 | 44.5  | 42.6  | 51.4 | 42.9  | 52.4  | 57.0  | 39.2  |    |
|    | 86.9 | 101.2 | 84.4  | 80.1 | 89.4  | 98.8  | 73.0  | 96.0  |    |
| 52 | DNPK | O     | DN    | NP   | PK    | DK    | DNPK  | DN    | 59 |
|    | 44.1 | 57.5  | 41.3  | 49.7 | 55.8  | 51.9  | 54.0  | 42.5  |    |
|    | 94.2 | 87.5  | 102.2 | 87.3 | 114.0 | 110.8 | 116.8 | 110.0 |    |

SYSTEM OF REPLICATION : 4 randomised blocks of 8 plots each. Certain interactions confounded with block differences.

AREA OF EACH PLOT : 1/40 acre. (54.5 lks. by 45.9 lks.)

TREATMENTS : 2<sup>4</sup> factorial design.

Dung : none, 10 tons per acre (D).

Nitrochalk : none, 0.4 cwt. N per acre (N).

Superphosphate : none, 0.6 cwt. P<sub>2</sub>O<sub>5</sub> per acre (P).

Muriate of potash : none, 1.0 cwt. K<sub>2</sub>O per acre (K).

SPECIAL NOTE : The two right hand blocks failed and were redrilled in the spring with spring beans.

CULTIVATIONS, ETC. : Plots, 32-35, 40-43, 48-51, 56-59. Applied dung and artificials : Oct. 11. Ploughed : Oct. 14-16. Harrowed : Oct. 18. Drilled : Oct. 21. Crop failed. Springtime harrowed : March 16. Harrowed, redrilled and harrowed in : March 19. Horse hoed : May 7 and 29.

Plots, 28-31, 36-39, 44-47, 52-55. Applied dung and artificials : Oct. 11. Ploughed : Oct. 14-16. Harrowed : Oct. 18. Drilled : Oct. 21. Harrowed : March 24. Hand hoed : April 24-27 and June 9. Horse hoed : May 29. All plots harvested : Aug. 24. Previous crop : Wheat.

STANDARD ERROR PER PLOT : Grain : 1.72 cwt. per acre or 10.3%.

## Responses to fertilisers

Mean yields : GRAIN, 16.8 cwt ; STRAW, 32.9 cwt.

|                                                              | Mean response | Differential responses |         |             |         |                |         |           |         |
|--------------------------------------------------------------|---------------|------------------------|---------|-------------|---------|----------------|---------|-----------|---------|
|                                                              |               | Dung                   |         | Nitro-chalk |         | Superphosphate |         | Mur. pot. |         |
|                                                              |               | Absent                 | Present | Absent      | Present | Absent         | Present | Absent    | Present |
| GRAIN : cwt. per acre ( $\pm 0.860$ . Means : $\pm 0.608$ ). |               |                        |         |             |         |                |         |           |         |
| Dung .. ..                                                   | -0.1          | —                      | —       | -0.8        | +0.6    | -2.1           | +1.8    | +0.3      | -0.5    |
| Nitro-chalk ..                                               | -2.2          | -3.0                   | -1.5    | —           | —       | -3.3           | -1.2    | -1.5      | -3.0    |
| Superphosphate ..                                            | +0.3          | -1.6                   | +2.3    | -0.7        | +1.4    | —              | —       | -0.3      | +1.0    |
| Mur. pot. ..                                                 | -0.3          | +0.1                   | -0.7    | +0.4        | -1.0    | -0.9           | +0.4    | —         | —       |
| STRAW : cwt. per acre                                        |               |                        |         |             |         |                |         |           |         |
| Dung .. ..                                                   | +3.3          | —                      | —       | +2.6        | +4.0    | +4.5           | +2.1    | +5.1      | +1.5    |
| Nitro-chalk ..                                               | +1.8          | +1.0                   | +2.6    | —           | —       | +1.5           | +2.1    | +2.2      | +1.4    |
| Superphosphate ..                                            | +0.5          | +1.6                   | -0.7    | +0.2        | +0.8    | —              | —       | +0.2      | +0.8    |
| Mur. pot. ..                                                 | +1.8          | +3.6                   | 0.0     | +2.2        | +1.4    | +1.5           | +2.1    | —         | —       |

## Conclusions

The average effects of dung, superphosphate and muriate of potash on the yield of grain were negligible, while nitrochalk produced a significant depression in grain. The interaction between the effects of dung and superphosphate was statistically significant, but in view of absence of any apparent average effects of either dung or superphosphate no weight can be attached to it.

Dung produced a significant increase in the straw yields.

## KALE

## Effect of sulphate of ammonia, poultry manure, soot and rape dust

RK—FOSTER'S, 1936 (3rd year)

Plan and yields in lb.

|         |                       |                       |                       |                       |                       |                       |                        |                        |    |
|---------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|------------------------|----|
| 1       | R <sub>1</sub><br>800 | N <sub>0</sub><br>650 | M <sub>0</sub><br>629 | M <sub>1</sub><br>792 | M <sub>2</sub><br>724 | R <sub>1</sub><br>683 | R <sub>2</sub><br>767  | N <sub>1</sub><br>836  | 8  |
|         | S <sub>0</sub><br>741 | S <sub>1</sub><br>822 | N <sub>1</sub><br>883 | M <sub>2</sub><br>875 | S <sub>2</sub><br>796 | M <sub>1</sub><br>622 | M <sub>0</sub><br>592  | N <sub>0</sub><br>715  |    |
| SW<br>↑ | R <sub>2</sub><br>969 | S <sub>2</sub><br>927 | R <sub>0</sub><br>742 | N <sub>2</sub><br>975 | R <sub>0</sub><br>764 | S <sub>0</sub><br>729 | N <sub>2</sub><br>782  | S <sub>1</sub><br>848  |    |
|         | R <sub>2</sub><br>958 | N <sub>0</sub><br>798 | M <sub>1</sub><br>763 | S <sub>1</sub><br>814 | R <sub>2</sub><br>874 | R <sub>0</sub><br>691 | R <sub>1</sub><br>728  | M <sub>1</sub><br>856  |    |
|         | N <sub>2</sub><br>868 | M <sub>0</sub><br>746 | M <sub>2</sub><br>876 | S <sub>2</sub><br>918 | M <sub>2</sub><br>785 | N <sub>0</sub><br>776 | N <sub>1</sub><br>828  | S <sub>0</sub><br>756* |    |
| 41      | R <sub>1</sub><br>720 | S <sub>0</sub><br>792 | R <sub>0</sub><br>737 | N <sub>1</sub><br>776 | S <sub>2</sub><br>784 | N <sub>2</sub><br>930 | S <sub>1</sub><br>830* | M <sub>0</sub><br>657* | 48 |

\* Estimated.

SYSTEM OF REPLICATION: 4 randomised blocks of 12 plots each.

AREA OF EACH PLOT: 0.028926 acre (10 yds. × 14 yds.)

TREATMENTS, 1936: No nitrogen (N<sub>0</sub>), sulphate of ammonia (N) half applied in seed bed and remainder as a top dressing, poultry manure (M), soot (S) and rape dust (R), applied in seed-bed at the rate of 0.4 cwt. N per acre (N<sub>1</sub>) or 0.8 cwt. N per acre (N<sub>2</sub>). Plots receiving treatment O in 1936 had treatment 2 in 1935 and *vice versa*. Plots receiving treatment 1 had this in both years. For N<sub>0</sub>, S<sub>0</sub>, M<sub>0</sub>, and R, (see plan) the fertilizer symbols refer to the 1935 treatment.

BASAL MANURING: All plots were made up to 1.0 cwt. P<sub>2</sub>O<sub>5</sub> per acre and 1.0 cwt. K<sub>2</sub>O per acre, using superphosphate and muriate of potash (an allowance being made for the P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O contained in the organic manures).

CULTIVATIONS, ETC. Ploughed: March 7, 23-26. Springtime harrowed: April 15. Applied manures (sulphate of ammonia at half-rate): May 2. Harrowed and rolled, before and after seed sown: May 4. Seed resown: May 26. Harrowed and rolled: May 26. Dusted with Derris powder: June 12 and 17. Hand-hoed: July 9. Horse-hoed: July 22. Applied second half of sulphate of ammonia: July 27. Harvested: Dec. 22-Feb. 2. Variety: Thousand head. Previous crop: Brussels Sprouts. (See 1935 Report, p.191).

SPECIAL NOTE: Kale harvested at weekly intervals as food for stock.

STANDARD ERROR PER PLOT: 0.925 tons per acre or 7.59%.

Summary of Results: tons per acre ( $\pm 0.462$ )

| Nitrogen, cwt. per acre |      |      | Sulph.<br>amm. | Poultry<br>manure | Soot  | Rape<br>dust | Mean<br>( $\pm 0.231$ ) |
|-------------------------|------|------|----------------|-------------------|-------|--------------|-------------------------|
| 1934                    | 1935 | 1936 |                |                   |       |              |                         |
| 0.0                     | 0.8  | 0.0  | 11.34          | 10.13             | 11.64 | 11.32        | 11.11                   |
| 0.4                     | 0.4  | 0.4  | 12.83          | 11.71             | 12.79 | 11.31        | 12.16                   |
| 0.8                     | 0.0  | 0.8  | 13.71          | 12.58             | 13.21 | 13.76        | 13.32                   |
| Mean ( $\pm 0.267$ )    |      |      | 12.63          | 11.47             | 12.55 | 12.13        | 12.20                   |

## Conclusions

There was a significant response to the 1936 application of nitrogen. Poultry manure gave lower yields than soot or sulphate of ammonia with all three types of dressing, the average differences being significant. Rape dust occupied an intermediate position.