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ROTHAMSTED  
RESEARCH

## Report for 1931

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## Rothamsted Farm Report

### Rothamsted Research

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Per cent. of Yield.

	Pota- toes.	Sugar Beet. Roots.	Beet. Tops.	Swedes. Roots.	Swedes. Tops.	Barley. Grain.	Barley. Straw	Hay
<i>Latin Squares</i> —								
Average 1927-1930	5.2	6.4	6.7	—	—	7.8	8.3	8.5
1931 ..	6.6	5.3	8.4	5.6	5.6	—	—	7.7
<i>Randomised Blocks</i> —								
Average 1927-1930	9.0	7.4	8.2	—	—	—	—	—
1931 ..	10.2	5.8	10.3	—	—	—	—	10.9

## FARM DIRECTOR'S REPORT, 1931

*Weather.* The general character of the weather is shown by the graph of deviations from average values (p. 62). The features of the year October, 1930—September, 1931 were the wet November and December, the mild winter and the cool, moist summer with a wet harvest. The mean temperatures for June, October and November were respectively 1°F., 2.1°F. and 0.3°F. above the 52 year average, but for all the other months it was under the average, the total deficit for the year being 7.1°F. The only really hot weather occurred between June 20th and July 10th.

There was very little frost apart from a fortnight of quite sharp weather at the end of February and beginning of March. This, along with occasional night frosts during the winter, brought the ploughed land to a good powdery tilth by the spring.

Every month from April to September experienced fewer hours of sunshine than the 38 year mean, the deficit totalling altogether 191.6 hours. October had 28 hours and March 38.7 hours above the mean.

5.1 inches of rain in November made the autumn very wet, but luckily this did not affect any of the farm work. July and August together had 2.1 inches rainfall above the 78 years average, but it was not the amount that made the bad harvest so much as the numerous small showers. The total for the year was 29.9 inches, being 1.15 inches above the mean.

Although the past season was wet and cool, yet October, 1930, and March, 1931, were unusually dry. In October, only 1.24 inches fell, against the average of 3.11 inches, and the drainage through 60 inches of bare soil was 0.211 inches as against the average of 1.63 inches for that month. In March the total rainfall was 0.09 inches, and measurable rain fell on two days only. The rainfall was the lowest shown in our 78 years records for March, except for March, 1929 (0.065 ins.), the lowest recorded figure for any month being 0.063 ins. in December, 1864.

*Cropping, 1930-1932.* (For dates, yield and other information, see pp. 109-114.)

Rye was sown in Long Hoos, Sections I, II and III, in September, 1930. This was fed off to sheep in March, 1931, and again in May. Sections I and III (old division) had previously been dunged just before sowing at the rate of 14 tons per acre. Section II had carried mustard folded off with sheep in August, 1930

Dung was carted out to Little Hoos in September, 1930, at the

same rate ; this was the first application of dung since the termination in 1921 of the old experiments on residual values. Several good crops had been grown without dung. Forage and wheat were later sown in this field.

Beans were sown in Great Knott after wheat, on October 2nd, and proved successful, apart from some thin places due to damage by pigeons. Before harvest the plants were 6 feet high in many places. The lower portion of this field is still rather infertile, however, and the crop was distinctly lighter there.

All of the 1930 sugar beet and potatoes were out of the way before October, thus enabling the following crops to be sown early. Broadbalk was sown on October 16th. All the sowing was completed under favourable conditions, although rather later than in 1929 ; the ground was fairly moist, and not dusty as it had been for the preceding crops.

The kale in Pastures was used between the middle of December and the end of February, 1931 ; some was carted off to stock, the rest folded.

This folding caused some puddling ; nevertheless, the field after ploughing worked down to quite a favourable tilth. On part of the land Marvellous oats were sown ; the crop, however, was disappointing and much inferior to the mixture of barley with beans. Mayweed—usually, like iron grass (*Polygonium aviculare*), bad in this field—spread rapidly where the plant was thin. Another part of the land carried the 1931 experimental potatoes grown without dung ; the yields were amongst the heaviest obtained here. The old kale stems caused no difficulty in ploughing or sowing corn, but somewhat hindered the preparation of the potato ground.

Part of the Great Harpenden seeds ley was ploughed up in September and sown with Grey winter oats ; on the remainder sheep were fed during the winter, the land was ploughed in January, with narrow, well set-up furrows, and crumbled to an ideal tilth for spring oats after some frosts. Just after sowing, a sharp spell of frost occurred ; during this period crows attacked the seed, yet the crop was considerably heavier than the winter oats. Wireworm and crows both affected the spring oat experiment carried out on this area.\*

One year seeds in Fosters yielded heavily, estimated at over 2 tons hay per acre. The crop, however, was used for stack silage because of the very showery weather. To it was added the produce from our rotation and forage experiments, making a total of about 100 tons of green matter. The final product was sweet, dark brown silage, much relished by stock. The waste round the outsides was smaller than anticipated ; it was roughly estimated at about 10 per cent. The outside material was carted to out-wintered cattle and the small amount they did not eat was tramped into the ground as

\* The mean yields of the spring varieties were in cwt. per acre.

	Grain.	Straw.
Marvellous .. ..	19.6	24.6
Golden Rain II. .. ..	18.7	27.0
Victory .. ..	17.4	27.5

It is doubtful whether any of these differences are significant as the plots were not adequately replicated or randomised (p. 144)

manure. Analyses showed, however, that in spite of the good appearance, the material contained much less protein than is usually found in farm crops.

Per cent. in sample as received.

	Protein	Fat	Soluble Carbo-hydrates	Fibre	Ash	Water
Silage from one year's seeds mixture .. .. .	1.22	1.24	23.0	13.9	3.95	56.7
Silage from general forage mixture	1.22	0.96	16.2	10.7	2.52	68.4

Per cent. in Dry Matter

Silage from one year's seeds mixture .. .. .	2.82	2.86	53.1	32.1	9.12	—
Silage from general forage mixture .. .. .	3.87	3.04	51.3	33.8	7.99	—

Oats and wheat (cut green) contain 6 to 7 per cent. of protein in the dry matter, while leguminous crops contain 17 to 20 per cent.

All the oats in Great Harpenden, winter and spring, were undersown in April, 1931, with 20 lb. Western Wolths Ryegrass and 5 lb. trefoil per acre. This is to be utilised for feeding sheep on during the winter, then it will be dunged and sown with kale.

Laid corn was a less serious problem than in the previous harvest. The winter oats were worst, but the power-binder proved of great value in dealing with them. The Little Hoos wheat experiments were badly laid and had to be scythed, while several of the Broadbalk plots were also bad.

The weather seriously hindered the harvest, particularly from the plots. Threshing took a long time, and much of the produce had to be carted into the shelter of the Dutch Barn. By the end of harvest we were a full fortnight later with our general farm work than in previous years. Luckily a very fine spell of weather during October and part of November allowed us to catch up again.

After the ewes and lambs had used the Long Hoos rye (p. 57) it was ploughed up. Sections II and III were sown on May 7th, 1931, with linseed, which yielded 10 cwt. grain per acre. It is difficult to cut with the horse binder, but easy to manage with the power-binder. Section I was sown with kale on June 13th. It came well and did not suffer from the flea-beetle. Despite this and the excellent growing season, the final yield of 16-18 tons per acre was disappointing considering the autumn dung, manuring by sheep, and 2 cwt. sulphate of ammonia per acre; in 1930 the yield had been 4 or 5 tons per acre higher.

Barnfield mangolds were sown on April 15th-17th. The seed went in deeply on a dusty tilth and germination was slow and uneven. They were therefore re-sown on May 26th, and gave a splendid plant and a splendid crop. A few swedes sown as a safeguard with the mangolds developed even better; their superior size compared with neighbouring mangolds was striking. In the dry autumn the crop was carted in ideal conditions, the land being much less cut up with the carting than usual. It was all ploughed, after applying dung to the proper plots, in this good condition. For two years now we have tried two different spacings on each of the plots. It was hoped that with narrower drills the foliage would more quickly

grow over and check weeds ; instead, the low yielding plots where this effect was most desired, gave smaller plants than with wide spacing, thus defeating the object of the narrower drills.

In Agdell the wheat on the fallow half was very poor. On Plot 1C and on the top half of 3M the germination was very poor indeed. The seedlings appeared to be drowned by the rain before they were properly established.

Two observations in the Hoos Field Rotation were noteworthy. After the hay crop, the residual effect of all the manures, including dung and straw plus artificials on the following wheat was very slight. After the swede crop, however, the residual effect of straw plus artificials, which had greatly increased the yield of swede tops, was obviously greater than the direct effect of straw plus artificials applied direct to the barley, despite the very heavy dressing of nitrogen given ; the one plot was laid, the other was not to any extent.

On the other hand the direct effect of straw plus artificials on the hay crop was greater than the residual effect, and indeed exceeded the effect of any other treatment.

The forage experiment in Little Hoos gave high yields. The best plots could not well have been heavier, being about 6 feet high and almost lodging when cut green. The wheat mixtures seemed superior to the oats, the oats growing very slowly in the early summer ; it was therefore surprising to find that the oat mixtures were the heavier after all. The half plots left till harvest were very badly laid and suffered from birds.

In July another forage experiment was started. Its aim was to explore the possibilities of producing early and later green crops so as to extend the operating season of a machine for drying green crops, which would deal chiefly with lucerne and grass in the main part of the season. The weather between July and November was more than usually favourable to growth, nevertheless the maximum autumn yield was only 7 tons of green matter per acre, no more than the much cheaper temporary grass growing nearby which, however, would have been more difficult to cut at that time of year. The experiment is continuing to the late spring of 1932.

*Control of Black bent (Alopecurus agrestis)*, at present the worst weed on the arable land at Rothamsted. It is much worse in autumn sown crops—cereals and beans—than in those sown in spring. Several methods of reduction are being tried :

(1) Rye is grown as the winter cereal ; this is folded by sheep in spring and then ploughed under in April or May ; the *Alopecurus* seed can thus germinate, but the resulting plants can produce no fresh seed. Rye, however, has some drawbacks. It is more costly than certain other spring foods, and in 1931 it appeared to handicap the succeeding kale crop. This is being followed up experimentally.

(2) Spring oats are grown instead of winter oats. If this proved successful the sheep feed would be supplied by cheap one-year seeds mixtures or rape kale instead of green rye.

*Grass.* This was a most favourable season for grassland. Pastures continued green and in active growth throughout, although the start was slow, and for a fortnight at the beginning of July growth almost ceased. Sawyers I and III received 1 cwt. per acre nitrate of soda early in February to encourage an early spring bite ; the result,

however, was very disappointing, there being very little early growth at all. Later on, however, this field provided excellent keep for the ewes and lambs. It was then shut up for only 6 weeks and gave a 30 cwt. crop of hay. Despite the nitrate and the haymaking, the Wild White clover formed a thick carpet in the aftermath.

All the other grass showed steady improvement under the favourable conditions and gave a splendid aftermath for the lambs and for flushing the ewes.

*Live Stock.* The chief development has been with sheep. Three investigations have been started :

(1) A study of the suitability of half-bred ewes, bred at Rothamssted by using a Scotch half-bred ram on the best of our commercial Scotch half-bred ewes. An attempt will be made to breed from some of the ewe-lambs.

(2) Comparison of a first-cross between a Cheviot ewe and a Dorset Horn ram with the Scotch half-bred. Six ewe hoggs of this Dorset Horn cross have been purchased from the Earl of Elgin ; these are, as far as is known, the only ones at present in the country. If they are as satisfactory as the half-bred, and in addition can take the ram over a wider period of time, they may become attractive commercially. The Dorset Horn is also being tried on the Scotch half-bred ewe, although this is a second cross.

(3) Examination of the possibilities of breeding from ewe lambs. Many farmers do this successfully, but the average type of ewe lamb which we have purchased during the past two years has been too young and small, and the result has been unsatisfactory. We are now trying bigger and more expensive half-bred ewe lambs at Woburn with results which, at present, are more promising.

In October, 1930, the flock consisted of 98 half-bred ewes, 97 gimmers and ewe lambs and 300 lambs. All the ewes were put to the Suffolk ram. Lambing began on March 10th and extended till April 14th ; the number of lambs on May 30th was 187, consisting of 2 triplets, 62 doubles and 57 singles.

*Cattle.* In October, 1930, the stock consisted of four in-calf Shorthorn heifers and 23 cross-bred Angus stores. During the year polled black calves were purchased locally from dairy farmers (Polled Angus bull and Shorthorn cow), and two more heifers ; there were born also six calves. The four heifers during their lactation period reared 35 calves between them.

This method gives us well-reared animals in sufficient number to stock our grass land adequately, and at less cost than the purchase of store cattle in spring. It is capable of considerable development, and we hope that the services of a recorder may become available so as to help in working out the various problems connected therewith.

*Pigs.* In October, 1930, the herd consisted of 21 Wessex Saddle-back sows, one large white boar and one Wessex boar ; no fresh sows have been purchased, but 8 have been brought into the herd from our own litters. By far the greatest number of the pigs have been crosses, sold as stores soon after weaning (some 12 weeks old) or for pork when about five months old and weighing from 80 to 110 lb. dead weight.

*Buildings.* The building developments outlined in the previous Report have now been completed, although the equipment, both mechanical and electrical, is not yet complete, through lack of funds.

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*Implements.* The following firms have lent us implements in addition to those mentioned in the 1930 Report :

Austin Motor Co. (tractor).

Miller Wheels, Ltd. (Patent Tractor Wheels).

R. A. Lister & Co. (power-driven sheep-shearing machine).

We have also been indebted to Messrs. Massey-Harris, Ltd., for the loan for a few weeks of a four-wheel-drive tractor, tractor-plough and cultivator.

*Staff.* C. Frith left us in July, 1931, and went as assistant to a farmer in Cambridgeshire, who is adapting his system to mechanisation. J. R. Moffat came in December, 1931, as voluntary assistant, and is occupied with our sheep investigations and with our various farm records.

### METEOROLOGICAL OBSERVATIONS

Meteorological observations have been systematically made at Rothamsted for many years ; these records are being used in the Statistical Department in interpreting crop records. The Station has co-operated in the Agricultural Meteorological Scheme since its inauguration by the Ministry of Agriculture in 1926, and possesses all the equipment required of a Crop-Weather Station. The observations taken under this scheme include :

OBSERVATIONS TAKEN ONCE DAILY : 9 a.m. G.M.T.

*Temperatures*—maximum and minimum (screen), solar maximum, grass minimum.

*Rain* (inches) and *Sunshine* (hours and minutes by Campbell-Stokes recorder) during the previous 24 hours.

OBSERVATIONS TAKEN THRICE DAILY : 9 a.m., 3 p.m., and 9 p.m. G.M.T.

*Temperatures*—wet and dry bulb (screen), 4 inches and 8 inches under bare soil.

*Wind*—direction and force (continuously recording anemobiograph).

*Weather*—(Beaufort letters).

*Visibility.*

These, together with notes and observations of crop growth are used in drawing up the weekly statement for the purpose of the Crop Weather Report of the Ministry of Agriculture.

Additional data are collected under the following heads :

**RADIATION.**—A Callendar Radiation Recorder (on loan from the Imperial College of Science) gives a continuous record of the radiant energy falling on a receiver situated on the roof of the laboratory. The records are compared with those for South Kensington, and are also used in plant physiological studies in the Station.

**RAINFALL AND DRAINAGE.**—The rain falling on one thousandth of an acre is collected in the big gauge erected by Lawes in 1871. Samples of the water are analysed in order to ascertain its nutrient value.

**EVAPORATION.**—The amount of water that evaporates in 24 hours from a porous porcelain candle dipping into a bottle of water is measured daily by the loss in weight. This measurement has been found to give a good general indication of the "drying power" of the atmosphere during rainless periods which, being controlled