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ROTHAMSTED RESEARCH

Report for 1970 - Part1

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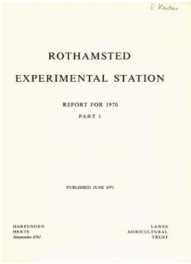
ROTHAMSTED
EXPERIMENTAL STATION
REPORT FOR 1970
PART 1

The Farms : Rothamsted

J. R. Moffatt

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THE FARMS

J. R. MOFFATT

ROTHAMSTED

Except for a frustrating spring which caused most crops to start late, the year was an easy one for field work but some crop yields were disappointing. Grass for silage was cut late but excellent silage and hay was made in a dry and sunny June. The summer was fine; each of the six months May–October had less than average rain, which made field work easy but caused spring cereals and beans to give small yields of grain and straw. Sugar beet seemed little affected by the drought; potatoes showed some effect and were improved by irrigation. The irrigation equipment worked almost continuously from early June to the end of July, mainly on potatoes and grass but also on some barley and beans. Corn harvest was early and, with little drying needed, was finished before the end of August.

In a remarkably mild spell during September and October the potatoes and sugar beet were lifted, weed grasses on arable fields were checked, and winter wheat was sown. By the end of October field work, except for ploughing, was finished. After germinating unevenly, the winter wheat improved during the mild and wet November when rain fell on 23 days.

The effect of weather on crops

The early part of January was cold with two falls of snow but the rest of the month was mainly mild and wet, rain falling on 23 days. In February 20 wet days gave above-average rain but the mean air temperature was below average. About 12 in. of snow fell on 4 March and persisted for a week, and rain fell on 21 days. The mean air temperature was 4·8°F below average. The ground was very wet and land work impossible.

Work on grassland started in mid-March and on arable land a few days later, but after three days was stopped by rain and snow. Rain fell on 21 days in April giving a total of over 3 in., and there were 17 ground frosts. Even when the ground was fit to carry a tractor the soil underneath was very wet and tractor passes were kept to the minimum. Cereal drilling did not finish until the end of April and the early-sown barley was several inches tall before the last was sown.

Potato planting started in the last week of April in poor conditions. A hot, dry spell at the end of April dried the ground rapidly and planting finished on 9 May; sugar beet was also drilled. May was dry with thundery showers and less than 1 in. of rain. Temperature fluctuated widely but the mean was 3·2°F above average. Strong winds delayed the spraying of cereals and potatoes with herbicides but grass grew rapidly.

The mean temperature for June was 3·6°F above average and hours of sunshine were 59 above average. Rain fell on seven days giving a total of 0·92 in., 1·29 in. below average. Silage and hay were cut simultaneously early in the month and conditions were good for both crops. Spring cereals looked well but grew slowly; winter wheat looked promising The bean plants were small and needed moisture. Potatoes grew slowly and irrigating started towards the end of June. On two areas sown to swedes few seeds germinated because of the dry soil.

In July fine, hot and sunny days alternated with dull, cool ones. Rain fell on 18 days but the mean was 0·5 in. below average, and there was one ground frost. Cereals ripened slowly and the expectation of a very early harvest did not materialise. Potatoes, grass

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and some beans were irrigated, most areas twice. Beans stopped growing and the leaves began to turn yellow and grass became scarce, but potatoes grew well.

Cereal harvest started on 11 August, was interrupted by rain but finished on 29 August, about a week earlier than usual; the grain needed little drying. Rain and mean temperature were about average.

September was exceptionally fine and warm although there was heavy rain on two days. The miserable bean crop was harvested early in the month. Potatoes were all lifted by 9 October in excellent conditions. The warm, dry weather continued through October, which had only 0·9 in. of rain, 2 in. below average, and the air temperature was 2°F above average; there were 12 ground frosts. The ground was very dry and although most areas ploughed nicely some were too hard. Most of the cereal stubbles were cultivated or sprayed with paraquat. Winter wheat was drilled in rather dry seedbeds and sugar beet was lifted and clamped. Some late silage was taken and autumn PK fertilisers were applied to grassland.

Rain fell on 23 days in November and gave 6·3 in., more than twice the average; the mean temperature was 2·7°F above average. Some ground was ploughed before it became too wet. December had average rain and 22 ground frosts; ploughing finished before Christmas. Almost immediately there was a spell of hard frost and a fall of about 2 in. of snow which persisted until the end of the year.

Field experiments

There were 4548 full-scale plots, 765 more than in 1969, and yields were taken from 4048. There were also 440 large plots managed by departments and 1257 microplots, making a total of 6245.

Autumn-sown experiments had a bad start for although they were drilled in good time the forced seedbeds were very dry. On Broadbalk the 1969 wheat and bean stubbles were cleaned by a rotavator, and after ploughing the ground had to be rotavated again to get a seedbed. Wheat germinated slowly and unevenly and by mid-December on some plots only 37% of the ground had a full plant and some seed rotted. Replanting was considered but was not needed as the crop improved by the end of December. 'Prebane' was used to control blackgrass on all except Section 8 which is not sprayed. The crop grew satisfactorily and there was no lodging but yields generally were less than in 1969. Wild oats were so few that the time spent in walking through the crop to pull them is not a true reflection of the weed infestation. Horsetails are one of the worst weeds and were prevalent on all sections.

The tick beans were drilled late, germinated quickly but then grew slowly. Mechanical cultivations controlled weeds growing between the rows but those in the rows, especially knotgrass (*Polygonum aviculare*), spread rapidly and competed with the crop for moisture. Yields were very poor.

Potatoes grew reasonably well but yielded slightly less than in 1969. Weeds, other than horsetails and thistles, were satisfactorily controlled by the linuron/paraquat spray.

The wheat stubbles of the 'O' Section (under continuous wheat) were sprayed with paraquat to weaken couch grass. The field was ploughed in September, disc harrowed twice and wheat drilled on 9 October. Germination was rather patchy but the plant had evened out by the end of November.

On Great Hoos the 1969 barley and bean stubbles were sprayed with paraquat and ploughed in November. In spring the soil was wet and, to lessen consolidation, the seedbed was made with one pass of a spring-tined cultivator fitted with a crumbler. The variety was changed from Maris Badger to Julia and treated with 'Murganic/RPB'

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against loose-smut. The few wild oats were hand pulled. Yields were slightly less than in 1969 but were satisfactory on plots given enough nitrogen. Beans were less weedy than on Broadbalk and yielded more. Weeds in the King Edward potatoes were satisfactorily controlled by a linuron spray; potato yields were small. The whole field was sprayed in autumn with paraquat.

The 1969 Exhaustion Land stubble was sprayed with paraquat to check couch grass. The variety Julia replaced Maris Badger, and the seed was dressed against loose smut. The mean yield was 7 cwt/acre less than in 1969.

The wheat and fallow experiment had a satisfactory plant but yielded less than in 1969.

Barnfield, in the third year of its revised cropping, grew Kolibri spring wheat and Julia barley. They were sown late but grew well and plants showed big responses to nitrogen. The wheat was badly damaged by birds during ripening and yields were small. Barley yielded less than in 1968, itself a year of small yields.

Beans were grown for the fourth successive year on Series 'O'. The two FYM strips were sprayed with paraquat in autumn 1969 to control weeds. Beans were drilled on 20 April. In 1969 the plots were split to compare simazine *v* mechanical cultivations for weed control. This year the simazine halves were split again, with simazine applied to one quarter, to compare the effects of residues from 1969 simazine with fresh simazine. The residues slightly lessened the yield of plots other than the two given FYM. The fresh simazine lessened the yield of all plots except the one given FYM and fertilisers. All plots were affected by drought and stem-eelworm, and yields were poor. The whole field was sprayed with paraquat during September and ploughed during October.

In the Ley–Arable experiment in Highfield and Fosters, the early-sown winter wheat germinated slowly and unevenly, and in early December the proportion of ground with a full plant ranged between 30 and 90%. It recovered well and produced good crops in both fields with no lodging.

Potatoes, planted late, grew well. In Fosters the youngest leaves were attacked by aphids in July, which probably lessened the yield and may be partly responsible for the difference in yield between the two fields. In Highfield yields exceeded those of 1969 but in Fosters they were smaller.

On the Cultivation–Weedkiller experiment the wheat germinated slowly and unevenly and the average yield (45 cwt/acre) was 12 cwt less than in 1969. The different primary cultivations had no effect on yield. Barley yields were 4–7 cwt/acre less than in 1969 and the ploughed plots gave more yield than the rotavated or tined plots. The mean yield of 14 tons/acre of potatoes was slightly better than in 1969 and was slightly more with the tine cultivations than with the other primary cultivations. Weeds were satisfactorily controlled by herbicides and mechanical treatments. The beans, drilled on 21 March, were very stunted, and yields were very small, but more on the ploughed plots than on the tined or rotavated plots. Mechanical operations did not control weeds in the rows and these soon covered the ground; simazine failed to control weeds but did not affect yield. All plots were sprayed with paraquat after harvest.

In winter wheat variety trials Maris Beacon yielded a little more than Joss Cambier, which yielded 6 cwt more than Cappelle. The mean yield of all varieties was 46·7 cwt/acre on a soil largely free from take-all and eyespot, and 27·0 cwt on a soil where they followed other cereal crops. Corresponding figures for 1969 were 62·8 and 45·5 cwt.

In a spring wheat variety trial the mean yield was 22·8 cwt/acre, 14 cwt less than in a similar experiment in 1969. Rothwell Sprite yielded most, perhaps because it was sown more thickly. The seedsman's figure for germination was accepted and a correction made to give the same weight of viable seed, but later tests showed a better germination.

Julia is the standard barley variety for experiments though Zephyr is still sown in

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some. All the seed used on experiments was treated with 'Murganic/RPB'. In a variety trial, where there was little mildew, Julia slightly outyielded Zephyr and Sultan. The mean yield of 32·8 cwt/acre was 17 cwt less than with the same varieties in 1969. There was less straw than usual, in some experiments less than half as much as in similar experiments in 1969.

The small yields of 11–15 cwt/acre from spring beans reflected late drilling, wet seedbeds, prolonged drought and virus disease. The early but light infestation of aphids was controlled by spraying with 'Metasystox', which increased yields by about 3 cwt/acre, as did 'Thimet' granules. Rows spaced 5 in. apart gave 2 cwt/acre more than rows 21 in. apart.

Potato experiments were all planted later than usual but despite the drought yielded reasonably. Weeds were satisfactorily controlled by a linuron/paraquat spray except that many fat hen (*Chenopodium album*) and thistle plants survived and were hand pulled. Preventive sprayings were given against blight (*Phytophthora infestans*) and aphids. Yields generally were 1–2 tons less than in 1969; in two experiments King Edward outyielded Pentland Crown.

Cropping

Of the 653 acres farmed, 453 were under arable crops or fallow, 87 under short-term leys or lucerne and 113 under permanent grass. The main crops were wheat (114 acres), barley (210 acres), beans (54 acres), potatoes (29 acres) and sugar beet (5 acres). Thirty-eight acres were fallowed.

Wild oats are becoming fewer and are no longer a serious problem. Eighteen acres of the worst-infested ground were treated with 'Avadex BW' to avoid hand pulling, and all cereals were inspected and rogued.

The fallows and half-fallows to control twitch grasses were worked many times during the summer, mainly by a rotary cultivator, with occasional deep-tine cultivations. The dry summer restricted the growth of grass weeds in cereals and, after harvest, the weakened plants were brought to the surface by cultivations or rotavating, or were sprayed with paraquat. These areas were the last to be ploughed.

Much of the farm is worked on a 7-year rotation of two cereals, a 'break' crop, two cereals and two 'break' crops, so as to give a choice of sites with different probabilities of attack by soil-borne pathogens. Several fields are outside the rotation, as they are kept acid or deficient in phosphorus or potash to provide sites for fertiliser experiments; most of these are under long-term leys or fallow, but some grow cereals.

Cereal diseases and pests. Loose smut (*Ustilago nuda*) was rare; an early and light attack of mildew (*Erysiphe graminis*) did not develop into a severe attack. There was more brown rust (*Puccinia hordei*) than usual on barley. Ergot (*Claviceps purpurea*), so common in 1969, was not observed. Eyespot (*Cercosporella herpotrichoides*) was fairly widespread on winter wheat but had little effect on the yield of the resistant varieties grown; spring-sown crops were not attacked. Take-all (*Ophiobolus graminis*) was common and affected the yields of some crops but the dry summer checked its spread.

Wheat Bulb fly (*Leptohylemyia coarctata*) were present in large numbers on one area of winter wheat, but the crop grew away from the attack and yielded over 45 cwt/acre; elsewhere damage was negligible. Counts made in October showed unusually many eggs after potatoes, even where ground cover had been good. Stem eelworm (*Ditylenchus dipsaci*) occurred mainly where bean crops have been infected in the past. On some areas the infestations were widespread and caused considerable loss of crop. Bean aphids (*Aphis fabae*) were few early in the season but increased later.

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Crops

Wheat. Most of the seedbeds in autumn 1969 had to be forced by disc harrows, rolls or rotavators as the ground was hard. The wheat drilled in October germinated unevenly and slowly, in contrast to wheat drilled after rain fell in November, which germinated quickly and evenly. Joss Cambier (50 acres) and Cappelle (30 acres) were the main varieties. Top dressings of nitrogen were delayed by bad weather and were not all given until early May. The crop looked well throughout the summer and promised to be the crop of the year but yields were well below average; there was no lodging. The 30 acres of Kolibri spring wheat averaged about 26 cwt/acre, 17 cwt less than in 1969.

Barley. Julia (105 acres) and Zephyr (101 acres) were the main varieties, with some Midas grown for seed. Most areas were drilled late in rather poor seedbeds. The barley grew well in May but slowly in the dry summer; the straw was short and the crops rather thin, and there was no lodging. The best field yield was 34 cwt/acre, and yields were about 10 cwt smaller than in 1969; the grain was of good quality.

Oats. A small acreage of Manod oats, drilled very late, was attacked by frit fly, and yielded poorly.

Beans. Maris Bead spring tick was the main variety, but Tarvin was grown in some experiments. Drilling started late and did not finish until 20 April. On most areas weeds were controlled by simazine but dinoseb acetate was used on some. Early growth was good but the drought soon slowed growth and the crops were stunted; some areas were badly attacked by stem-eelworm and by broad bean stain virus. A spray against black aphids did not prevent a late attack, but it did little damage. The crop started to turn yellow in July. Yields of 11–15 cwt/acre were about half those of 1969, in itself a poor year.

Potatoes. King Edward was the main variety with small areas of Majestic and Pentland Dell. In future Pentland Dell will be replaced by Pentland Crown. Rothamsted-grown seed was used for ware crops and all were chitted. Stock Seed from Northern Ireland was grown to provide seed for 1971; all varieties were given an 'H' certificate.

Planting started about four weeks later than usual but in fine weather finished only one week later. On most areas weeds were controlled by a linuron/paraquat spray but paraquat was omitted where a large proportion of the plants had emerged. After a slow start the crop grew well. Two preventive sprayings were given against blight (*Phytophthora infestans*). Some areas had many aphids (mainly *Macrosiphum euphorbiae*) which damaged the young foliage so 'Metasystox' was included in the first spray against blight. The non-experimental potatoes were given about 4¼ in. of water in two applications in June and July, and they grew vigorously. Lifting started in mid-September and continued without interruption until it finished on 7 October. Yields ranged widely but the tubers were of excellent size and shape, and fairly free from blemish.

The seed crop was not irrigated. The haulm was burnt off in August and they were lifted early in September.

Sugar beet. Drilling was about two weeks late but the crop germinated and grew well. Weeds were controlled by 'Betanal' supplemented by two inter-row hoeings. There was some damage by mangold fly (*Pegomyia betae*) and non-experimental areas were sprayed with 'Metasystox' to control this and virus yellows. The plants grew well despite the

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drought, and irrigation did not increase yield of roots. The average yield was 18·8 tons/acre of washed beet and the average sugar percentage was 18·7. The crop was lifted mechanically from dry ground and the dirt tare was small.

Swedes and turnips. Swedes failed to germinate in the dry soil and were replaced by white turnips, which germinated unevenly and after singling were attacked by fungus (*Phoma*). One area was completely destroyed and on another the yield was very small.

Grass. A high-nitrogen compound fertiliser was given in March, and most fields received 'Nitro-Chalk' at 3 cwt/acre in June. Cold weather in April retarded growth which became rapid in May. Silage-making was delayed until early June to increase bulk. The grass was so dry that there was no need to wilt and there was no seepage. Hay was made at the same time and several fields yielded more than 2 tons/acre.

In July grass became scarce and 20 cattle were sent to Woburn for grazing. Nitrogen and irrigation later produced more than sufficient grass and a second hay crop was taken from one field early in August. Some late silage was made in October.

Cattle

In November and December 1969, 58 cattle were brought into covered yards and fed on hay, silage, brock potatoes and home-grown concentrates. One hundred and twenty-six young cattle were bought in late summer of 1969, of which 90 were out-wintered on a similar ration without concentrates. They maintained their live weight and 63 were sold fat during the summer and autumn. Altogether 113 cattle were fattened during the year.

One hundred and nine yearling Hereford-Cross bullocks were bought in autumn 1970 and all except 27 are out-wintering and feeding on hay, silage, potatoes and barley straw. More potatoes than usual are being fed as stockfeed potatoes are cheap and plentiful.

All bought cattle were dosed against liver fluke, and young stock was treated in autumn with an organo-phosphorus insecticide against warble fly.

Buildings and equipment

A timber-framed barn was built to give more space for silage and greater safety when rolling it.

Two direct-recording balances (100 kg and 20 kg) were installed. They were used to weigh the produce of the cereal plots and, after riddling, the various grades of potatoes from experimental plots. The weights, or other numbers, are punched on tape, which is fed into a teleprinter so that the figures can be inspected and the number of recordings counted before disposing of the produce. This is moved to and from the balances on pallets by a hand-operated pallet-truck.

Fertilisers are now delivered, stored and reloaded for transport to the fields on pallets handled by a fork-lift truck.

A combine harvester, with a compressed air cleaning device, was bought for work on plots.

Staff

G. F. Cole, who has given the Station exceptionally loyal service since he was first appointed as an assistant to the Field Superintendent in 1929, retired from the post of Assistant Farm Manager, which he has filled since 1943.

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