ROTHAMSTED RESEARCH

Rothamsted Experimental Station Guide

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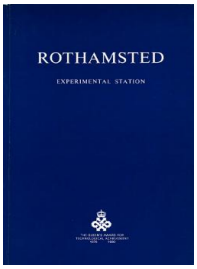

The Farm

Rothamsted Research

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various depths down to 4 ft (1·2 m), at the tips of growing grass (grass minimum) and at screen height in the air (maximum, minimum, dry bulb and wet bulb).

Table 1 gives average weather at Rothamsted for the 10 years 1970–79. Some values for 1976 are included to illustrate an extreme deviation from the long-term pattern. A summary of the weather records for both Rothamsted and Woburn is given in the *Rothamsted Report for 1979*, Part 2.

THE FARM

The Rothamsted Home Farm of 100 hectares came under the management of Sir John Lawes in 1834. In 1843, and after, he assigned part of it to the field experiments on wheat, barley and grass now known as the Classical experiments. Although some land was sometimes in other occupation, Lawes always retained control of the experimental fields, which in his day were worked from farm buildings near the Manor House. These Classical Fields were made over on a 99 years' lease to the Lawes Agricultural Trust on its foundation in 1889, and have since been bought. More land has been acquired from the original home farm, and the adjoining Scout Farm, Redbourn, was bought in 1965. Today the estate, including woodlands, totals 330 ha of which 262 ha are farmed.

Classical experiments, long-term rotation experiments and crop-sequence experiments occupy the same sites every year. There are about 800 Classical plots which occupy about 16 ha. Rotation, crop-sequence and annual experiments total about 3000 large plots. In addition about 1600 plots are used for microplot experiments. One and a quarter hectares near the Laboratory, known as the Garden Plots, and approx. 9 ha on the farm, are used for small-plot experiments which cannot conveniently be done by farm equipment.

Organisation and staffing

The Working Party for Field Experiments plans the programme of field experiments. Detailed instructions are drawn up by the Field Experiments Section and passed to the Head of Farms. The Head of Farms, aided by two assistants at Rothamsted and a bailiff at Woburn, is responsible for the field work in connection with experiments and all matters relating to the farms. A team of recorders, responsible to the Head of Farms, is responsible for marking out the experiments, supervising all field operations on experimental plots, and recording yields. The Field Experiments Section maintains liaison between farm staff and the research workers. The Statistics Department analyses results of the experiments which are published each year.

The Farm staff consists of five tractor drivers, one general worker, a stockman/tractor driver, a mechanic and a building maintenance worker. The regular staff is supplemented by casual labour for potato picking and roguing wild oats in cereals.

Cropping

Of the 262 ha farmed, about 190 ha are under arable cropping. Much of the farm is worked on a 7-year rotation of two cereals, one break crop, two cereals, two break crops, to provide a choice of sites for cereals with different probabilities of attack by soil-borne pathogens. Several fields outside the rotation are not given P, K or lime. This is to provide sites

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where responses to applied P and K will be great, and where effects and interactions of soil pH can be measured. Some of this land is under grass and the rest is either fallowed or sown to wheat or oats, as it is now too acid to grow acceptable crops of barley or roots.

There are about 40 ha of permanent grass, some being low-lying river meadow and some unploughable because of trees. A number of experiments are sited on permanent grass, and a reserve is kept for future experiments.

Notes on crops

Wheat. The Rothamsted soil is well suited to wheat and about 50 ha are grown. Flanders is the standard variety on most experiments largely due to its good all-round disease resistance and proven reliability. However it is outyielded by new varieties and is being replaced by Hustler, Avalon and Brigand.

Wheat is generally grown as the first cereal after a break but some is grown after previous wheats for experimental requirements.

Black Grass (*Alopecurus myosuroides*) and Annual Meadow Grass (*Poa annua*) are a problem on some sites and chlortoluron ('Dicurane') is used in the autumn or isoproturon ('Hytane') in spring.

These chemicals are also effective against broad leaved weeds, often saving application of a hormone herbicide. Wild oats are, in most fields, few enough to allow hand roguing. Where there are too many for roguing, difenzoquat ('Avenge') has given excellent control.

Barley. About 90 ha are grown each year, about one-third autumn sown. The standard winter variety is Igri but other varieties are grown to meet experimental needs. Georgie has been the standard spring variety but is being replaced by Triumph. Seed of both winter- and spring-sown crops is usually treated with ethirimol ('Milstem') to control mildew (*Erysiphe graminis*) and crops may be sprayed with fungicides later in the growing season as necessary.

Early drilling of spring crops is an advantage particularly on the lighter land where seedbeds can dry out rapidly.

Beans. Beans (*Vicia faba*) are a useful break crop in the rotation as their husbandry requires no specialist machinery other than that used for cereals and herbicides, either simazine alone or as a mixture with trietazine, gives good weed control.

Most beans are spring sown as aphids can be controlled. Pirimicarb ('Aphox') is now used which is much less harmful to bees than demeton-S-methyl ('Metasystox') and more reliable than granules such as phorate ('Thimet').

Spring beans gave poor yields in 1970 and 1971 due to virus diseases and drought in 1975 and 1976 caused poor crops. Parts of the farm are infested with stem eelworm (*Ditylenchus dipsaci*) and this limits the frequency with which beans can be grown.

Some winter beans are grown as chocolate spot (*Botrytis* spp.) can usually be kept under adequate control with benomyl ('Benlate') repeated if necessary. There is a growing interest in the crop for experimental needs.

Potatoes. The area is restricted to about 12 ha each year by the scarcity of labour for lifting. Part of the area is planted with Foundation Stock,

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usually from the progeny of VTSC crops, to provide seed for the following year. This area is grown in isolation from other potato crops, and virus vectors, mainly aphids, are controlled by an application of a granular systemic insecticide at planting, and later by foliar sprays of insecticide, usually applied with a fungicide spray against blight (*Phytophthora infestans*). Strains of aphids resistant to demeton-S-methyl ('Metasystox'), the foliar-applied insecticide normally used, were found in 1976, and pirimicarb ('Aphox') has been used since.

All seed tubers are chitted in a temperature-controlled store and experiments are planted by a manually-fed 2-row machine or by hand. Non-experimental and seed crops are planted by automatic planter. Some fields are low in magnesium and a 10–10–15 fertiliser* containing 4.5% Mg is broadcast at 1900 kg ha^{-1} before planting, and the ground then levelled with a heavy spring-tine cultivator. Seedbeds are prepared by spike rotavator or rotary harrow.

An inter-row cultivator is used after planting and a further earthing up will be given in the season by a rotary ridger.

Weeds are controlled chemically by a pre-emergence spray of linuron, but paraquat may be added if weeds have emerged before spraying. All potatoes are sprayed regularly against blight and haulm is destroyed about a fortnight before lifting using a haulm pulverizer followed by spraying with sulphuric acid.

Lifting is normally by 2-row elevator lifter followed by hand picking. Transport to store is in 250 kg boxes. The stony soil is not really suitable for mechanical harvesting but a single-row harvester may be used if casual labour is short.

Potatoes are stored in an insulated building with provision for ventilation from a central duct with A-shaped on-floor laterals.

Potatoes are usually followed by winter wheat. Seedbeds are prepared by surface cultivation as ploughing buries the ground-keepers and encourages survival.

Oats. About 20 ha are grown as a 'break' in the rotation as they do not suffer from take-all (*Gaeumannomyces graminis*). Mostly winter oats are grown as they are usually ready before the spring barleys and this helps spread harvest as well as leaving the land clear for autumn-sown crops in reasonable time.

Only varieties resistant to stem eelworm such as Peniarth are grown.

Most autumn-sown crops are sprayed before emergence with methabenzthiazuron ('Tribunil') to control annual grasses.

Sugar beet. The area of sugar beet grown is usually less than 0·5 ha and is grown in experiments only, as the autumn workload of potato lifting and drilling of winter cereals takes up all available labour.

Grass. There are about 65 ha grassland most of which is permanent or leys left down as long as they remain productive. One- or 2-year leys are sown to provide sites for fertiliser work which require a more uniform sward than that provided by older grass and short leys are sometimes used as a break from cereals.

* 10–10–15 and similar sets of figures indicate the percentages of N, P_2O_5 and K_2O respectively in the compound fertiliser.

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Most of the grass is grazed by cattle and the surplus cut for hay or silage. Except for the first cut on Park Grass all produce of grass experiments and the associated surrounds are ensiled. After weighing the samples all the remainder is direct cut using an additive. Usually three cuts a year are taken.

Irrigation

Water for irrigation is drawn by a submersible pump from a borehole 90 m deep into a 10^6 litre (1000 m^3) reservoir, lined with a butyl sheet. Water from the reservoir is pumped into 130 mm underground mains, fitted with hydrants. Much of the farm can be reached by 100 mm diameter portable aluminium surface pipes, connected to a convenient hydrant. Portable sprinklers can apply 25 mm of water in 4 hours to a maximum area of 0·8 ha at a time. As abstraction is limited to 27 000 m^3 experiments testing irrigation, and all potatoes, have priority for water supplies, and in recent dry years there has been little available for grassland.

On experimental plots, overhead oscillating spray lines are used to obtain a more uniform watering than the sprinklers, but are unsuitable for windy conditions, and there is growing interest in trickle irrigation for this purpose.

Livestock

Cattle. About 120 Hereford-cross steers are fattened each year. Yearlings are usually bought during autumn or winter, weighing about 300 kg. On arrival they are treated against lung intestinal worms and liver fluke (*Fasciola hepatica*). A systemic insecticide is used to kill warble fly larvae (*Hypoderma bovis* and *H. lineatum*). They are outwintered in sheltered fields with access to cover, and fed a ration of home-produced foods: silage, hay, barley straw and chat potatoes. Some of these cattle are finished on grass during the following year. Any not sold fat by late autumn are yarded and fattened on the above ration, supplemented by a home-grown concentrate based on cereals and beans.

Machinery

Because of experimental demands, a wide range of machinery is needed and it is not possible to use large units effectively. The farm is worked with eight light and medium tractors. Ploughing is still the chief primary cultivation for spring-sown crops and is done with reversible ploughs to eliminate ridges and furrows which complicate the siting of plots. After potatoes and beans, and on some stubbles where there is no trash to bury, a chisel plough or heavy spring-tine cultivator is used.

In preparing seedbeds the aim is to avoid excessive soil compaction. Operations are kept to a minimum by using, where necessary, rotary harrows which can produce a seedbed in a single pass in difficult conditions. However, in the spring when there has been natural weathering a spring-tine cultivator will normally produce a suitable seedbed for cereals and beans.

Small cereal and bean plots are harvested with a combine harvester built for plot work and fitted with a compressed air cleaning device. Most large plots are harvested by 3 m cut machines, which also handle the non-experimental areas.

Much straw is baled and carted to avoid uneven residues on long-term experiments and to provide litter and food for stock. Where straw is burnt it is usually spread first.

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For harvesting grass plots, a forage harvester has been adapted so that herbage is delivered into a box, from which it can be raked and weighed. Grass is cut for hay with a flail mower to speed drying.

An increasing part of the field work of a number of departments involves spraying; a high clearance tractor, with row-crop wheels, is used to meet this demand on bean and potato crops.

Buildings

The first of the cottages and farm buildings were built in 1913, but most have since been adapted for new purposes and new ones added. There is an insulated potato chitting store with refrigeration equipment and fluorescent strip lighting, and an insulated potato store with air ducting which allows ventilation and cooling of stored potatoes. The grain plant has a bin storage capacity of about 700 tonnes. The bins are fitted with ventilated floors which permit in-bin drying, cooling and self emptying. An oil-fired 4 tonnes per hour continuous-flow drier is available if the moisture content of grain is greater than can be dried by cold air ventilation. An in-sack platform drier is used to dry small experimental batches of grain, beans, oilseeds, etc. There is a well-equipped farm workshop.

There is yard space for about 90 cattle, a covered silage clamp and barns sufficient to hold up to 400 tonnes of hay and straw.

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