ROTHAMSTED RESEARCH

Report for 1962

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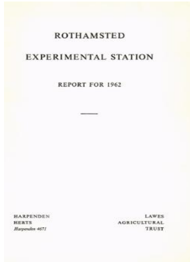
ROTHAMSTED
EXPERIMENTAL STATION
REPORT FOR 1962

Broom's Barn Experimental Station

Rothamsted Research

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BROOM'S BARN EXPERIMENTAL STATION

R. HULL

The staff transferred from Dunholme Field Station to Broom's Barn as the new buildings were finished, and Dunholme laboratory was closed on 19 May.

In the company of over 200 distinguished guests of the Lawes Agricultural Trust Committee and the Sugar Beet Research and Education Committee, the Minister of Agriculture, Fisheries and Food, the Rt. Hon. Christopher Soames, C.B.E., M.P., opened Broom's Barn Experimental Station on 27 July 1962. The new laboratories, tarehouse and glasshouses have since been brought into full operation.

Experiments were laid down on the farm crops and the usual programme of field experiments and surveys in all sugar beet growing areas was organised with the invaluable help of the British Sugar Corporation's Agricultural staff.

In July, P. B. H. Tinker was appointed as chemist. R. Hull attended the Summer Congress of the International Institute of Sugar Beet Research in Holland in June.

Incidence of aphids and virus diseases. The sequence of five years (1957–61) in which green aphids were plentiful and early on sugar beet was broken in 1962. Not until the middle of July did the average infestation reach one aphid per ten plants, an infestation reached in most previous years by the end of May. In 1962 green aphids were noticeably concentrated on the occasional groups of plants with yellows. Aphids were few on sugar beet in the previous wet, stormy autumn and the cold winter killed those outdoors. No aphids were found in early spring on wild beet on the east coast and few on weeds anywhere.

Although few aphids were trapped in beet fields in 1962 (only one-ninth the number trapped in 1961 on equivalent traps), *Myzus persicae* (Sulz.) were actually more numerous than in the previous year. They were active too late to spread virus extensively in the root crop, but they provided an unusual hazard for the steckling beds. The relationship between the time when aphids fly and virus spread is shown by results from the Shotley peninsula (Suffolk) in 1961 and 1962. In 1961, 50 *M. persicae* were trapped, 39 of them in May and June, and at the end of August unsprayed sugar-beet plots had 25% plants with yellows. In 1962, 57 *M. persicae* were trapped, but only one in May and June, and yellows incidence in unsprayed plots at the end of August was only 0·7%.

Yellows appeared late in most crops, and the incidence at the end of August (2·9%) was the smallest since records started in 1946. During October the disease became more prevalent, showing randomly distributed, round patches of yellowed plants, particularly in late-sown crops.

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In some of the coastal areas of Essex and Suffolk the disease became prevalent during August and severely stunted crops.

The scarcity of green aphids on beet in May and June meant that few spray warnings were issued. Growers in parts of the Ipswich and Felsted factory areas were advised to spray in early June, and some in Allscott, King's Lynn and Nottingham areas in late June. Some growers sprayed without a warning; in all, 81,000 acres were sprayed once and 12,000 twice.

Trials in each factory area, 101 in all, tested the efficiency of the spray warning scheme. Large plots were: (1) sprayed with demeton-methyl early, about 2 weeks before a spray warning was probable; (2) sprayed when the warning was issued, or two weeks after the early spray; (3) sprayed late, 2 weeks after the previous spray; or (4) left unsprayed. The average incidence of yellows at the end of September was: unsprayed 5·7%, early sprayed 4·9%, "warning" spray 3·6% and late spray 3·4%. Only 15 trials showed any consistent control of yellows. At the end of September these had, on average, 19·3% yellows on unsprayed, 13·2% on early, 8·6% on "warning" and 9·3% on late-sprayed plots. Only four trials in East Anglia and three in southern England had more than 20% infected plants on untreated plots in September. The "warning" spray increased yield of roots in these four trials by 4 cwt/acre, and the early and late sprays by less. Sugar, Na and K percentages were not affected by spraying. Clearly yellows did not appreciably affect yield in 1962 and the few spray warnings issued were not justified.

Aphids on sugar beet. During May, June and July 1961, 278 samples of aphids were collected from sugar beet in all English beet-growing areas. Of these 12% contained alate *M. persicae*, 25% *Macrosiphum solanifolii*, (Ashm.), 37% *Aphis fabae* Scop., 8% *Aulacorthum solani* (Kalt.) and 41% other species (21 different genera). The corresponding figures for adult apterae were 54, 22, 40, 5 and 4%. Corresponding figures for alate aphids in 178 samples collected in the same way during June, July and August 1962 were 11, 13, 12, 0 and 19% (11 different genera), and for adult apterae 43, 10, 16, 1 and 3%.

Subdividing the 1961 samples into those collected in May (84), June (110) and July (84), the following changes during the three-month period become apparent. Alatae: the proportion of samples containing *A. fabae* increased month by month, *M. persicae* decreased, *M. solanifolii* was most numerous in June, *A. solani*, *Myzus ascalonicus*, Donc., *Cavariella aegopodii* (Scop.) decreased greatly and other species slightly. Immature aphids and adult apterae (these give a measure of the species ability to colonise and develop on sugar beet): *A. fabae* and *M. persicae* were by far the most numerous, immature *M. solanifolii* were common, especially early in the season, but wingless adults were less common. All other species decreased in number as the season progressed. In 1962, 178 samples were collected, 68 in June, 93 in July and 17 in August. The proportion of samples containing alate *A. fabae* and *M. solanifolii* increased month by month, but *M. persicae* decreased in August. The proportion of samples containing nymphs or adults of the above three species increased month

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by month. The commonest other species were *Metopolophium dirhodum* (Walk.) and *Drepanosiphum platanoides* (Schrank); *M. ascalonicus* and *C. aegopodii* did not occur in the 1962 samples. (Dunning and Heathcote)

M. persicae and the clamp aphid *Rhopalosiphoninus staphyleae* subsp. *tulipaellus* (Theo.) feed satisfactorily on the rootlets of infected mangolds, but do not become infective, presumably because the virus is too dilute in the roots. Both aphid species acquire the virus by feeding on the young etiolated shoots.

Beet seedlings growing in pots were infected with sugar-beet yellows virus when at the two-leaf stage by three aphid species: those infected by *A. fabae* suffered less loss of yield than those infected by *M. persicae* but more than those infected by *R. staphyleae*. However, the differences were not significant, and symptoms shown by different plants ranged from mild to severe, regardless of the species of the vector. A month after infection, the plants had 12% less dry matter in their tops and 41% less in the roots than uninfected plants.

Neither *R. staphyleae* nor *R. latysiphon* (Davidson) transmitted sugar-beet mosaic virus.

The crop of an aphid that has fed on Chenopodiaceous plants is unusually extended by the accumulation of polysaccharides. This effect persists through the moult and was shown by *M. persicae* that had flown for 4 hours.

Work on the transmission of viruses in relation to the behaviour and physiology of alate aphids is described on p. 163. (Heathcote)

Aphid predators and parasites. Insect predators and parasites were unimportant in keeping the beet aphid population at its unusually low level during 1962, but parasitic fungi attacked many aphids in autumn. In September fungi were common on both black and green aphids at Broom's Barn and elsewhere. Diseased specimens of *M. persicae* and *A. fabae* from beet, and several species of aphid from other plants had four *Entomophthora* spp., distinguished on conidial size and shape: *E. planchoniana* Cornu. on *Macrosiphum rosae* (L.), *Macrosiphum* sp., *A. fabae*, *M. persicae*, *Microlophium evansii* (Theob.), *Cavariella pastinacae* L., and *D. platanoides*; *E. aphidis* Hoff. on *A. fabae*, *M. persicae*, and *Capitophorus hippophaes* (Wlk.); *E. fresenii* (Nowakowski) on *A. fabae*; and *Entomophthora* sp. Petch. (probably *thaxteriana*) on *M. persicae* and *M. solanifolii*.

The distribution of these species was determined on 86 aphid samples, of which 64 were *A. fabae* collected from Suffolk, Norfolk, Cambridgeshire, Lincolnshire and Yorkshire. Omitting samples that had only one or two spores of an *Entomophthora* sp., *E. aphidis* was found in 57 samples, *E. planchoniana* in 35, *E. fresenii* in 20 and *Entomophthora* sp. (probably *thaxteriana*) in 2. *E. fresenii* was commonly associated with *E. aphidis*. It occurred alone in only two samples and in only one with *E. planchoniana* but without *E. aphidis*.

E. aphidis was the dominant species in north Suffolk and Norfolk, and *E. planchoniana* in Yorkshire, north and central Lincolnshire and near Bury St. Edmunds. Both were common in the fens. (Byford)

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Mangold clamps. Of 2,778 farms in beet-growing areas 1,469 grew mangolds, red beet or fodder beet, and 497 still had mangold clamps in late April. Ninety-nine clamps contained aphids; of 43 clamps examined, 15 contained *M. persicae*, 4 *M. ascalonicus*, 40 *R. staphyleae* and 2 *R. latysiphon*. Farms had many fewer clamps than in 1961, and the aphid infestations were much smaller; the clamps were being used up more rapidly than usual. In 99% of the clamps the mangolds were topped at least partially, but only 34% of the clamps contained mangolds topped correctly for late keeping. The survey is being continued for a further year.

Collaborative work with Imperial College Field Station continued on the control of aphids in mangold clamps by methyl-bromide fumigation, especially on varietal susceptibilities to damage, bromine residues in the mangolds after fumigation, clamp fumigation technique and the practicability of commercial fumigation.

Two varieties of Cannell's mangolds grown at Broom's Barn, Yellow Globe "QQ" (5·5% sugar content and 10% dry matter) and Kirsche's Ideal (7·7% and 12%) and one variety of fodder beet, Hunsballe XI (12·4% and 16·8%) were put into a clamp in early December and in early March subdivided into four small clamps, each containing an equal mixture of the three varieties. Three of these clamps were fumigated with methyl bromide on 10 April for equal periods of time, but with three gas concentrations. One month after treatment, the largest dose had killed all sprouts and rootlets and the flesh showed slight decay and superficial mould; the intermediate dose damaged the sprouts, but the rootlets and flesh were only little harmed, and the smallest dose, which was the one found necessary in previous trials to control aphids effectively, caused only very slight damage to the sprouts. Hunsballe fodder beet was damaged least and "QQ" mangold most of the three varieties used. Two months after treatment there was still no damage following the smallest dose.

In three clamps of 11,000, 7,000 and 3,000 cu ft the rate the gas entered did not affect the uniformity of its distribution, whereas the time required to air the clamp after fumigation depended on the density of mangolds and cover and the amount of wind, and ranged from a few minutes to an hour or more.

Messrs. Fisons Farmwork Ltd. were employed to fumigate clamps in an area of 100 sq miles immediately south of Cambridge. Of 50 clamps reported in the area by fieldmen of the British Sugar Corporation in February, 15 were unsuitable for fumigation because they were against hedges, walls or stacks, and the mangolds in 15 others were used by the end of March. The other 20 clamps were fumigated between 19 March and 13 April at an intended CTP (concentration of gas in oz/1,000 cu ft $\times$ time in hours) of 100, the least needed to control aphids. At least 3 hours' fumigation were needed to give reasonably uniform gas concentrations. High winds prevented clamp sheeting on two days, but no other difficulties were encountered. Eleven of the clamps contained aphids and, periodical samples from them, and from small control clamps made from unfumigated mangolds, showed that fumigation controlled aphids in all but one clamp. In some clamps the sprouts were scorched, but the mangolds themselves were not damaged. (Dunning)

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Insecticides on the root crop. The effect on yellows incidence of insecticidal sprays used to control pests such as mangold fly, flea beetle and pigmy beetle was again tested in the same districts as in 1961. Spraying in the four trials ranged from 14 May to 6 June, nearly 3 weeks later, on average, than in 1961. Only at Ipswich was a spray warning given for the area, and then not until 6 weeks after the trial there had been sprayed. Yellows was rare in two of the trials, but its incidence increased in September at Ipswich and Bury St. Edmunds. The average incidence of yellows was unaffected by treatments, in contrast to 1961; the difference can be attributed to the very late aphid infestation in 1962. Similarly, yellows incidence (5–11% at the end of September) was unaffected by different insecticides applied in late June on trials at Felsted and Cambridge.

Menazon seed treatment at 5 and 10% by weight of product containing 80% of active ingredient (a.i.) and 5% menazon granules combine-drilled at 1 and 2 lb/acre were tested with two seed varieties, Sharpe's E (both natural and 8–10/64th in. rubbed and graded, gravity separated seed) and Hilleshog Polyploid (natural). Five replications of single 45-ft rows were drilled on 25 April in a randomised block layout. The insecticide did not damage the tops or roots of the beet. Increasing doses of menazon regularly increased the plant populations from rubbed Sharpe's E seed, and the largest dose (menazon granules at 2 lb a.i./acre) increased sugar yield by 40%. Plant populations and yields from natural Sharpes E were also increased, though less, whereas those from Hilleshog were unaffected, probably reflecting the fungistatic property of menazon.

The effect of menazon, used as a seed dressing, on early aphid infestation and yellows infection was studied at eight sites in East Anglia. Sharpe's E seed, 7–11/64th in. rubbed and graded, EMP-steeped and BHC-dusted, was treated with 5% by weight of an 80% menazon seed-dressing formulation. At seven of the eight sites the heavy menazon-dressing resulted in a slightly higher seeding rate than for the untreated or BHC-treated seed. The number of seedlings produced per oz of seed sown was nowhere affected significantly by the treatment, which also had no effect on final plant population or yellows incidence. Only at Ipswich did green aphids become numerous by the end of July, but yellows incidence was only 7% at the end of August, and this was more than at any other site.

Trials at Broom's Barn and Sprowston compared demeton-methyl spray with disulfoton and menazon granules: (1) drilled in the row with the seed or broadcast on the seedbed prior to drilling; (2) placed 2·5 in. deep and 3–4·5 in. to one side of the young plants at the time of steerage hoeing; and (3) applied as a top dressing to the foliage at the time of the first demeton-methyl spray. Menazon seed treatment was also included at Broom's Barn. No spray warning was issued by the British Sugar Corporation in either area, and aphids were few until August. At this late date, the plots from seed treated with menazon had only two-thirds as many green apterae as the control, plots with granules applied at the time of drilling had less than half as many and plots with granules applied later had only a quarter to one-twentieth as many. Disulfoton granules always controlled green apterae slightly better than did the equivalent menazon treatment; disulfoton was less effective when placed to one side of the

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growing plant, whereas menazon seemed more effective applied in this way than when broadcast on the seedbed or on the foliage. Black aphids were patchily distributed at both trials, and treatment effects were inconsistent.

At Broom's Barn disulfoton granules applied at drilling or to the leaves and the two July sprays of demeton-methyl decreased yellows infection measured as infected-plant-weeks to mid-October from 148 to 15; other spray and granule treatments 30–75 and menazon seed treatment to 45. At Sprowston all treatments decreased yellows incidence, but this was so small that comparisons of individual treatment effects are valueless. At Broom's Barn all treatments except menazon on the seed increased sugar yield, demeton-methyl spray treatments giving the greatest increase of 11%. All the menazon granule treatments outyielded the equivalent disulfoton treatments, even though, on average, they controlled aphids and yellows less effectively.

In a further trial at Broom's Barn menazon and phorate were compared as a 5% granule top-dressing applied in bands to the foliage at 24 oz a.i./acre and as sprays at a high (H) rate, equivalent to the granule application, and at a low (L) rate, a normal commercial rate. Treatments were applied on 13 July to $\frac{1}{65}$-acre plots replicated four times, and aphids were counted on 9 and 23 August. Relative control of green and black apterae were: menazon H spray > (menazon granules = phorate granules) > phorate H spray > (menazon L spray = phorate L spray). Menazon L spray did not affect the incidence of yellows, but all other treatments decreased it by between 45% (phorate L spray) and 82% (phorate granules). (Dunning and Winder)

A Latin-square trial at Harpenden compared a seedbed application on 10 April of disulfoton granules (2 lb a.i./acre) with a single spray of demeton-methyl or of menazon (applied at the standard rate) on 6 July. Aphids, predators and parasites were too few to show any differences between the effect of the insecticides. By mid-October untreated plots had only 6·5% yellows, and there was no significant difference between treatments. (Heathcote)

Insecticides on stecklings. Three trials tested seven insecticide treatments for the protection of summer-sown stecklings. The treatments and a control were replicated three times in randomised blocks. The sites, sowing dates, seed rates per 25-ft row (all Sharpe's E natural seed) and plot sizes were: Broom's Barn 3 August, 6·5 g, $\frac{1}{180}$ acre; Melton Mowbray 2 August, 10·8 g, $\frac{1}{22}$ acre; Sleaford 15–16 August, 3·5 g, $\frac{1}{11}$ acre. Treatments applied at drilling were: (1) menazon seed dressing at 2·5% or 5% by weight of 80% product, and (2) 5% menazon granules in the rows with the seed at the equivalent of approximately 1 lb a.i./acre (21-in. rows); respectively at the three sites, 0·26 and 0·46, 0·22 and 0·45, 0·14 and 0·45 g a.i./25 ft of row (25-ft row at 21-in. spacing equals approximately $\frac{1}{1000}$ acre). Both treatments controlled apterous aphid infestation very effectively for 3–4 weeks after sowing (i.e., until the second pair of true leaves were 1 in. long) and then partially until early October, when aphid populations decreased naturally on the control plots. The granule

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treatment at drilling controlled aphids better than the seed treatment at all three sites during September. One of the two plots with each of these treatments also received 5% disulfoton granules, as a top-dressing in a band over the plants, to give approximately 1 lb a.i./acre (at the three sites respectively 0·46, 0·46 and 0·57 g/25 ft of row). This further treatment was applied when the control of aphids given by the treatments at drilling appeared to be diminishing, but aphid populations then declined naturally and differences in subsequent infestation between the single and double treatments remained small.

The demeton-methyl spray (7 oz a.i./acre) and 5% disulfoton granule top-dressing (0·46 g/25 ft of row) were applied as soon as practicable after the plants emerged, but even so, some aphids had infested them. The effect of the spray did not persist long, and another was applied 2 weeks after the first; the effect of disulfoton granules persisted longer, and with the natural decline of aphid populations a second top-dressing gave little extra benefit. In the 8 weeks after drilling, i.e., approximately to the end of September, two foliage sprays of demeton-methyl decreased apterous green and black aphid populations respectively by 77% and 70%, menazon seed dressing by 81% and 73%, menazon granules with seed by 88% and 84% and disulfoton top-dressing on foliage by 73% and 82%.

When yellows incidence was assessed during the first 2 weeks of November it was 57% on the untreated plots at Broom's Barn, 32% at Melton Mowbray and 14% at Sleaford. It was decreased by amounts ranging from more than two-thirds by menazon granules drilled with the seed to a half by one top-dressing with disulfoton granules. Yellows incidence in the seed crop will be assessed again. (Dunning and Winder)

Yellows tolerant varieties. Varieties selected for tolerance to yellows were again tested on sprayed and unsprayed plots, but yellows did not spread to them, so the yields of the varieties have been determined only when relatively free from yellows. Of the older tolerant varieties tested at Broom's Barn in co-operation with the National Institute of Agricultural Botany, A7S/2 yielded 10% more sugar than the commercial varieties; others equalled them or gave slightly smaller yields. In a trial of new inbred varieties none of 29 tested equalled the average yield of the commercial varieties. Most of the reciprocal crosses between 10 of the older selected varieties greatly outyielded commercial varieties, but two yielded less, whether as male or female parent. (Hull and Glenister)

Seed crops. The average yellows incidence of 0·9% in sugar-beet seed crops was the smallest since 1952, but in mangold seed crops it was 6·8%. Sugar-beet seed crops raised under a mustard cover-crop and grown-on *in situ* had up to 32·5% of plants with downy mildew and averaged 8·3%. In 1961 and 1962 stecklings raised adjacent to a root or seed crop and grown-on *in situ* gave seed crops with an average of 10·4% plants with downy mildew, compared with 2·7% at distances up to 400 yd and 1·3% at distances more than 400 yd.

Although yellows was less prevalent in the root crop up to the end of September than previously recorded, it was carried into many sugar-beet and mangold steckling beds by the abundant aphids during August and

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September. Of 137 sugar-beet steckling beds, 12 had more than 1% yellows, as did 89 out of 139 mangold and red-beet steckling beds. Ten sugar-beet steckling beds had a substantial incidence of downy mildew. The average yellows infection of 0·46% for sugar-beet and 3·7% for mangold and red-beet stecklings, and the proportion of mangold steckling beds with more than 1% yellows, were similar to 1957, when yellows was very prevalent in the root crop. More sugar-beet steckling beds exceeded 1% yellows in 1962 than in 1957, no doubt because of the new use of summer-sown mustard cover-crops. Thirty-four steckling beds with mustard cover averaged 0·99% yellows and 0·72% downy mildew, compared with averages of 0·07% yellows and 0·07% downy mildew in 59 steckling beds sown under cereal cover-crops. (Byford)

Downy mildew. Stecklings at Dunholme and at Clenchwarton were sprayed with solutions of either 5 or 10% copper sulphate at 100 gal/acre to test whether mildewed plants could be killed while healthy ones survived. Plants sprayed on 15 November 1961 at Dunholme were severely scorched; 36 and 22% of plants sprayed with 5 and 10% solution respectively survived, but some surviving plants had mildew. At Clenchwarton, sprayed on 14 December 1961, many of the plants were killed. In another trial at Clenchwarton four sprays between 9 December and 28 April of either maneb, zineb, "Perenox", fentin acetate or "PP645" had no influence on downy mildew in the seed crop, which increased from 4% infected plants on 20 March to 11% on 26 April and 32% on 13 June.

At Broom's Barn stecklings sprayed six times with fentin acetate or maneb at approximately 10-day intervals, beginning immediately after brairding, had 8 and 7% downy mildew respectively 3 weeks after the last spray, compared with 25% in unsprayed plots.

In root crops at Stradbroke, Suffolk, and Friday Bridge, Cambs., where downy mildew was spreading rapidly from adjacent severely infected seed crops, maneb, zineb, "Perenox", "PP645" and fentin acetate, sprayed three times at approximately fortnightly intervals, all decreased mildew incidence slightly, maneb, the most effective material, from 17 to 11% at Friday Bridge and from 15 to 13% at Stradbroke.

Plants infected with downy mildew in root crops at Broom's Barn, Friday Bridge and Stradbroke, were marked at regular intervals. Plants infected in June yielded only 29% as much sugar as healthy plants; as time of infection was delayed, yields correspondingly increased. The greatest depression in sugar percentage, 2·8%, was in plants infected in July. Roots in which downy mildew had decreased sugar content had most nitrogen content and were the worst for juice purity.

At Broom's Barn half of the roots infected with downy mildew between 3 September and 10 December were frosted, but none of 56 healthy roots. (Byford)

Ramularia leaf spot. Ramularia leaf spot did not develop until November in Cornwall, where this disease is usually prevalent. Four Irish varieties selected for resistance, kindly supplied by Mr. B. Crombie of the Irish Agricultural Institute at Thurles, yielded less weight of roots and

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sugar per acre, but had a higher sugar percentage than Sharpe's E when harvested at the end of October. Ramularia leaf spot developed rapidly during November on all varieties except OFG 228/2, which retained its foliage satisfactorily, as in 1961. At the end of November this variety had increased its sugar content from 17·0 to 17·6%, whereas all others had not changed, but Sharpe's E still gave the greatest yield. Evidently only when the disease develops early, as in 1961, do these resistant varieties outyield Sharpe's E.

In the south of Cornwall the long-term average minimum soil temperature throughout the winter is above that in East Anglia during early April. To determine whether sugar beet could be grown from autumn sowings, 23 varieties with high bolting resistance were sown on 14 September, 26 September and 10 October at St. Erth, near Hayle, by Mr. C. E. Loweth of the British Sugar Corporation. They grew throughout the winter (which was exceptionally cold for that area), and by February the plants had an average of 11, 8 and 7 leaves for the three sowings respectively. Some varieties got downy mildew. In April plants began to bolt; by July only occasional plants among the American and English varieties had not bolted, but 70% of Klein A.A. and 85% of Hilleshog L 3014 had not. A few plants of these and other varieties did not bolt by October and gave large roots. (Hull)

Seed treatment. In four replicated field trials EMP applied at 1% vol/wt by the "Mist-O-Matic" machine gave 43% more seedlings per oz of seed sown and 6·7% more plants in the final stand than untreated seed; the increases from EMP steep, "Agrosan" dust and 5% vol/wt "Mist-O-Matic"-applied EMP were 32, 20 and 27% in seedlings and 4·2, 4·6 and 2·8% in final plants. In one trial that was thinned only by machine, 1% "Mist-O-Matic"-applied EMP gave 16·0% more plants in the final stand and a significantly higher yield than untreated seed. (Byford)

Control of *Pleospora betae* Bjorling. In 1960, 4 lb of 50% griseofulvin in 100 gal/acre of water was sprayed on sugar-beet seed plants at Dunholme, either 4 weeks, 2 weeks or 1 day before cutting. Incidence of *Pleospora betae* was very small (5·5% of seed clusters infected) and was not affected by spraying; germination was increased by all the sprays, but most by that given 1 day before cutting.

In 1961 griseofulvin sprays were applied either 2 weeks or 2 days before cutting a seed crop at Dunholme. Samples from each plot were tested for germination at the Official Seed Testing Station, and for *P. betae* at Broom's Barn. The treatments had a small effect on germination, two sprays giving 82% compared with 78% unsprayed, but they diminished the incidence of *P. betae* from 38 to 17% by one spray and to 12% by two. (Byford)

Sugar-beet Manuring

This report gives the results of trials made in 1961 in co-operation with the British Sugar Corporation; few results of the 1962 trials are yet known.

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NPKNa with dung trials. A new series of five factorial experiments tested 0·6 or 1·2 cwt/acre N as ammonium sulphate, 0·3 and 1·0 cwt/acre P_2O_5 as triple superphosphate, 0·5 and 2·4 cwt/acre K_2O as potassium chloride and 0 and 1·6 cwt/acre Na as agricultural salt (0 and 4 cwt/acre). A basal dressing of 12 tons/acre of dung was applied.

As would be expected, with widely different rates of application and in the presence of dung, the smaller dressings of P and K were the most economic; indeed, the larger dressing of P depressed yields slightly. Increasing the amount of N gave increased yield without salt, but decreased it with salt.

NK salt trials. The treatments used in this series were given in the previous report. The 13 trials gave the same positive N × Na and negative K × Na interactions as reported last year. On the average potassium was not needed with salt, but in several experiments the largest dressing of K was worth while even with salt.

The only nutrient to affect juice purity was nitrogen, which depressed it from 93·7% at the N_1 to 93·2% at the N_2 level. Salt increased both Na and K in the beet, and potassium increased K and decreased Na.

Straight versus compound fertiliser trials. A small experiment of 8 plots was attached to each NK salt experiment. The treatments were 10 cwt/acre of a commercial compound fertiliser and 2 cwt/acre salt, or the equivalent nutrients as straight fertiliser. The mean yield of sugar was 2·9 cwt/acre more with straight than with compound fertiliser, and the straight fertilisers gave the largest yield in 12 out of 13 trials. No reason for this can be given at present.

Nitrogen top-dressing trials. The design of these trials was as given in the 1961 report. The conclusion was again that the total amount of nitrogen is far more important than its time of application. The maximum sugar yield was obtained with 1·5 cwt/acre N. The increase in plant population obtained by splitting the largest nitrogen dressing in 1960 was reversed in 1961 and, on average, top-dressing had no effect on plant population.

Placement trials. Three trials compared nil and autumn and spring applications of 3 cwt/acre salt, 0 and 2 cwt/acre "Nitro-Chalk" as top-dressing and placement or broadcasting of 6 cwt/acre compound fertiliser. Salt in the seedbed gave a greater yield than salt applied in the autumn, and broadcast fertiliser gave 1·1 cwt/acre more sugar than placed fertiliser. In two similar trials in 1960 broadcasting gave 1·4 cwt/acre more sugar than placing the fertiliser.

Magnesium trials. The incidence of magnesium deficiency appears to be increasing in sugar beet, and a series of experiments was started in 1961 which included as treatments magnesium, ammonium, potassium and sodium sulphate. A rather small average response of 1·8 cwt/acre sugar was obtained to magnesium sulphate, but the results of the individual experiments differed greatly. The response was lessened by any of the

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other fertilisers, despite the fact that sodium salts can intensify magnesium-deficiency symptoms. (Tinker and Last)

Broom's Barn Farm

The 31 acres of winter wheat (var: Cappelle) averaged 43 cwt/acre. On the light soil of Black House growth was strong throughout the winter and spring; a basic dressing of 1½ cwt/acre of 6: 15: 15 compound fertiliser was drilled with the seed, and the yields of plots receiving 1¼, 2½, 3¾ and 5 cwt/acre of sulphate of ammonia on 15 March were 43·7, 51·0, 51·5 and 53·0 cwt/acre respectively. On the stronger soil of Little Lane, after a clover ley, a dressing of 2½ cwt/acre basic fertiliser was given and the crop grew slower; the same sulphate of ammonia top-dressings as on Black House gave no yield response. Spraying with barban and CMPP kept both crops free from wild oats and broad-leaved weeds.

Rika barley averaged 27 cwt/acre from 48 acres. The average was lowered by the crops on Marl Pit and Flint Ridge, which lacked moisture in July. On Marl Pit, F. V. Widdowson determined the yields, from plots receiving 0, 35 and 70 units of N/acre, in the form of either ammonium sulphate, urea or sodium nitrate, as 16·2, 20·0 and 19·8 cwt/acre of grain. Spraying with herbicides kept both crops reasonably free from weeds.

The S.53 meadow fescue on White Patch was slow to establish, but became a full stand, and yielded about 2¼ cwt/acre of seed. Seven acres contaminated with Italian ryegrass were cut for silage. The aftermath was fed to cattle in the yard.

Red clover on Dunholme was attacked during the winter by wood pigeons, and clover rot occurred patchily, although the field has not been cropped with clover for many years. The produce made 3½ tons/acre of silage, and oats and tares on Bull Rush made 6 tons/acre of silage. After this crop was cut in June the land was cultivated 14 in. deep, ploughed, worked to a fine tilth and levelled, then fallowed. In turn, each field will have this treatment, which is helping to eliminate weeds and improve uniformity and tilth.

The sugar beet lacked moisture during July. It responded quickly to 2 in. of water given when the irrigation plant was completed at the end of the month. August rainfall was adequate for the crop. In the October samplings of a growth-rate experiment on Hackthorn, P. J. Goodman measured a yield of 15·8 tons/acre of roots at 22·6% (dry weight) for the 23 March sowing, which had 10% of bolters, and 15·0 tons/acre of roots at 22·7% (dry weight) for the 13 April sowing, 0·5% bolters. The mean yield of sugar beet from the farm calculated from deliveries to the factory was 12·9 tons/acre, with a mean sugar content of 16·5%. This is considerably less than yields determined on the experimental plots by hand lifting, which averaged 16·5 tons/acre at 16·5% sugar.

The 39 head of stock fed through the winter in the yard were sold between March and May, weighing 8·17 cwt on average. They made about 40 tons of manure, which has been spread on Bull Rush. Twenty Friesian and 38 Hereford-cross bullocks are being fed with silage and barley in 1962–63.

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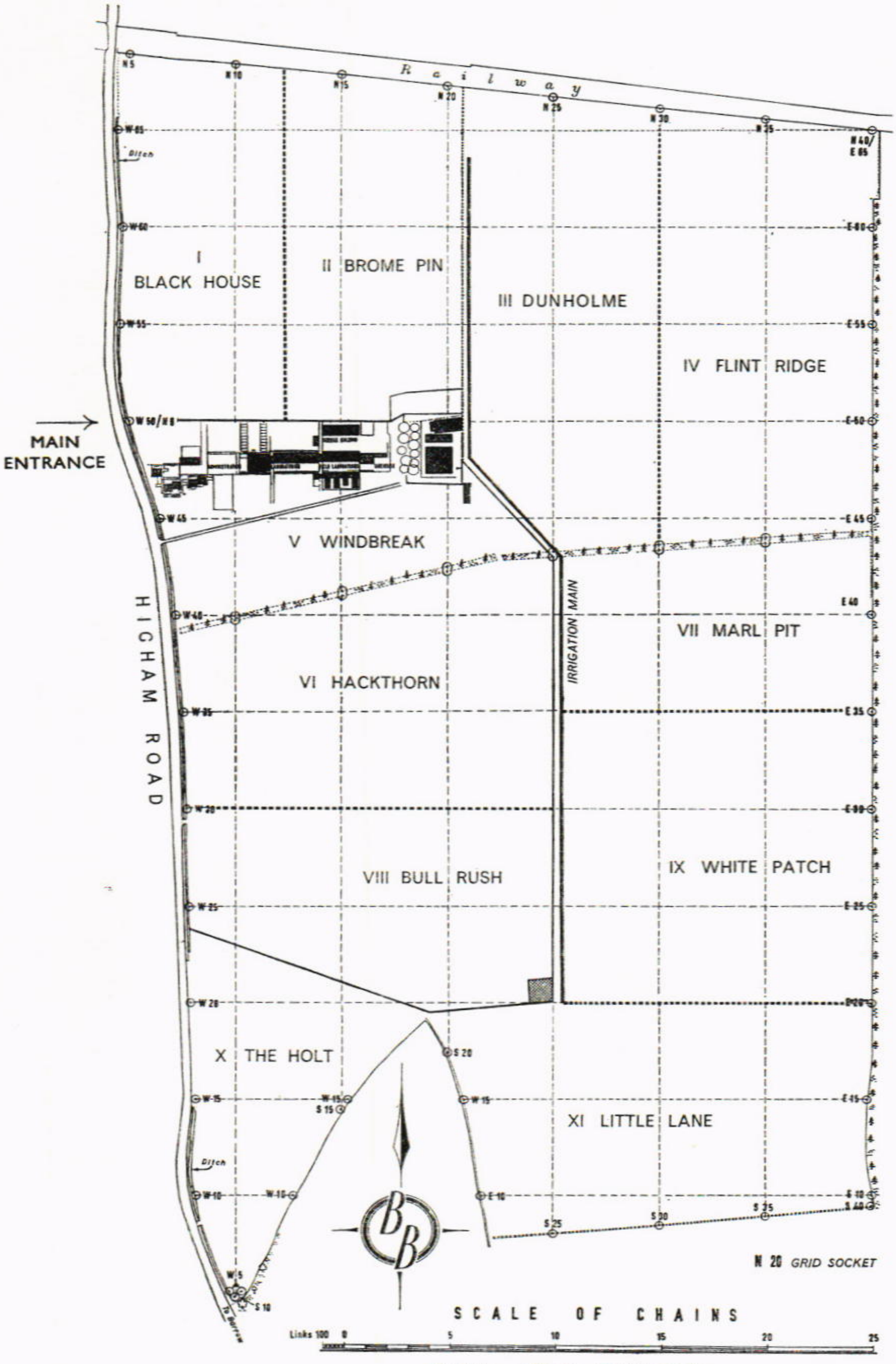
BROOM'S BARN FARM



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In the autumn 21 acres were sown with winter wheat and 22 acres with S.22 ryegrass. All except 25 acres of land under sugar beet had been ploughed by the end of the year.

The harvesting of sugar-beet experimental plots was delayed because the tarehouse was not ready for use until late October, and a few plots were still not lifted at the end of the year.

On experimental plots on Brome Pin Mr. G. W. Cussans obtained good control of weeds in sugar beet with some of the pre- and post-emergence herbicides tested. The treatments did not affect yield, which averaged 18½ tons/acre of roots and 62 cwt/acre of sugar. "Murbetex" pre-emergence band spray controlled weeds well on 5 acres of sugar beet on Hackthorn.

Two experiments tested treatments intended to overcome soil-structure difficulties experienced in the previous year on the Stretham series. Subsoiling at 20 in. had no effect on the yield of winter wheat or barley, but increased sugar beet root yield by 1·03 ton/acre and sugar yield by 2·9 cwt/acre. Plot variation was large because the cereal harvest was delayed and the sugar beet was damaged by pheasants and hares. In the other experiment 10 and 40 cwt/acre of gypsum applied to the ploughed land in the spring did not affect the yield of sugar beet whether the land was rolled heavily after the seed was sown, or whatever amount of fertiliser was given.

To lessen the risk of beet-eelworm populations building up, the sugar-beet contract now prohibits sowing of sugar beet on land that carried a cruciferous crop in the previous year. The most likely alternative to white mustard, fodder radish, was tested in co-operation with the National Agricultural Advisory Service on eelworm-infested fen. In co-operation with the National Institute of Agricultural Botany several possible alternative crops were tested at Broom's Barn for their speed of establishment, density of cover and production of dry matter. They were sown at the end of June on fallowed land. The cruciferous crops established earliest and produced most harvestable dry matter. Turnips produced 158, fodder radish 114, sunflower 71, buckwheat 70 and white mustard 63 cwt/acre of dry matter. The grasses and grain crops were damaged by birds and hares and became weedy. The leguminous crops were slow to establish, but eventually gave a good stand. They were damaged by pests and gave little harvestable yield (14–26 cwt/acre of dry matter).

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