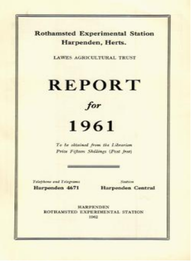

Report for 1961

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Dunholme Field Station

R. Hull

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DUNHOLME FIELD STATION

R. HULL

S. N. Adams left to become Soil Chemist at the Hobart, Tasmania, Station of the Commonwealth Scientific and Industrial Research Organisation. He contributed to the 24th Congress of the International Institute of Sugar Beet Research in Brussels in February and R. Hull to the joint meeting of the same organisation with the American Society of Sugar-beet Technologists in London in May.

Experimental work at Dunholme ended with the completion of the field experiments in December. Dunholme Field Station will close in 1962 and the staff and equipment transfer to new laboratories at Broom's Barn Farm, Higham, near Bury St. Edmunds. This move and the resulting staff changes restricted experimental work this year. Field experiments were continued on the same subjects as last year, and the British Sugar Corporation gave invaluable help with them and with surveys of diseases and pests.

Broom's Barn Farm

After delay and difficulties from wet weather and mud during the winter, Tilbury Construction Co. Ltd. completed the roads, services and farm buildings in June, when Kerridge & Co. Ltd. immediately started work on the laboratories and houses, due for completion in May 1962. By the end of 1961 the six houses were finished and three were occupied. Most of the laboratory buildings were roofed and internal work was progressing rapidly.

The 280-foot-deep borehole did not yield enough water for irrigation, so on the recommendation of the Geological Survey it was deepened to 390 feet. Pumping at 11,500 gallons/hour for 12-hour periods on three consecutive days in July dropped the water level from 117 to 174 feet, where it remained constant. This yield of water will irrigate 2 acres at a time.

The land was divided into ten fields of 10–23 acres, mostly rectangular, and an area near the buildings was reserved for small plots. The outfall from the roadside drainage ditch proved inadequate, and water often spilled over the land at the north end of the farm, so it was led into a large soak-away. After the wet and mild winter, tilth was poor, especially where the soil had been compacted and puddled when harvesting sugar beet. The spring-sown wheat and barley in these fields was patchy, with the bad patches apparently caused by anaerobic conditions about 6 inches below the soil surface. Autumn-ploughed land ran and set; it grew weeds profusely and was ploughed again in spring.

The crop rotation was designed to clean the land from perennial and annual weeds, especially wild oats. Each field will be cropped in turn with oats and tares, cut for silage in June, and then fallowed and worked. Twenty-two acres were sown with S.53 meadow fescue for seed, and other fields will have red clover or seeds mixtures in rotation with wheat, barley and sugar beet. In 1961, 30 acres of barley yielded 16–18 cwt./acre of grain, 17½ acres of spring wheat yielded 20–24 cwt./acre, 16 acres of oats yielded 16 cwt./acre. The spring-sown beans failed because of weeds and bird depredations. Twenty-nine acres of sugar beet yielded 14·2 tons/acre of roots at an average sugar content of 15·7%.

In the autumn 35 acres were sown with winter wheat, and most of the land was ploughed by the end of the year.

An experiment was started in August to assess the effect of subsoiling on various crops. Other long-term experiments will begin when the land has been cleaned and levelled. This year's sugar-beet experiments tested the use of insecticides for controlling yellows, yellows-tolerant varieties, chemical weed control, seed inoculation with *Azotobacter* and the effect of sowing date and nitrogen on growth throughout the season.

Incidence of aphids and virus diseases

Myzus persicae again lived during the winter of 1960/61 on wild beet on the Suffolk coast. Beet mosaic spread from wild beet to mangolds and sugar beet on the Shotley peninsula; there was no evidence that yellows did. Mosaic was more prevalent in beet crops throughout eastern England than for many years.

Green aphids infested sugar beet early in May. Cold winds and frost in May restricted their increase temporarily, especially in Norfolk and south Lincolnshire, and elsewhere they were patchily distributed. Infestations reached an average for the country of 1 per plant by 20 June, and then increased to an average of 3 per plant (20 per plant in Ipswich and Spalding factory areas) by 8 July when counts ceased. The most heavily infested areas were the west Midlands, Isle of Ely, Suffolk, Essex and south Lincolnshire. This early infestation led to yellows showing early and threatened another severe attack of the disease, the fifth in consecutive years. *Aphis fabae* infestations were light and late.

Spray warnings were sent to growers by some factories in the second week of May, about 2 weeks earlier than in 1960, and by the end of June nearly all growers had been advised to spray, some twice or three times. About 329,000 of the 410,000 acres of sugar beet were sprayed with systemic insecticide, and of this sprayed acreage 113,000 was sprayed twice and 15,000 three times. 52,000 acres were first sprayed in May, 215,000 in June and 62,000 in July; some growers delayed spraying after receiving the spray-warning because black aphids were few, and they still do not appreciate the significance of the less obvious and generally fewer green aphids.

Mean incidence of yellows in 143 sample fields at the end of June, July, August and September was 0·7, 10·4, 21·2 and 25·1. This is a slower rate of development of yellows than given by comparable aphid infestations in 1949 and 1957. With no spraying in 1949 and late spraying in 1957, the September incidence of yellows was 50–60%.

The crop started early and grew rapidly until mid-summer, but soil temperatures in summer were too low for maximum growth. Nevertheless, the country's final yield of 14·5 tons/acre of roots at 15·4% sugar content has been exceeded only in 1960.

Aphids on sugar beet

During May and early June 1960, ninety-one samples of aphids were collected from sugar beet in all English beet growing areas. Fifteen per cent of samples contained alate *Myzus persicae*, 40% *Macrosiphum euphorbiae*, 34% *Aphis fabae*, 9% *Aulacorthum solanii* and 29% other species. The corresponding figures for apterae were 19, 10, 5, 1 and 2%. *Myzus ascalonicus*, the commonest species in samples from weeds, was not found in these samples from sugar beet.

In the glasshouse, apterous *Hyperomyzus lactucae* L., *Megoura viciae* (Buckt.), *Microlophium evansi* (Theob.) and *Myzus* (*Sciamyzus*) *cymbalariae* Stroyan failed to transmit sugar-beet mosaic virus; *Acyrthosiphon pisum* (Harris) did transmit but inefficiently. *M. persicae* and *Myzus ascalonicus* Donc. (from *Stellaria media*) were equally efficient vectors of yellows, *Macrosiphum euphorbiae* (Thos.) (= *M. solanifolii* Ashm.) from potato was less efficient than *M. persicae*, and *M. cymbalariae* from Chinese cabbage much less. Alate and apterous *A. fabae* infected fewer plants with yellows than alate or apterous *M. persicae* under the same conditions, but plants inoculated with yellows (" N " strain) by 1, 3 or 5 *M. persicae* or *A. fabae* had equally severe symptoms.

Coccinellid predators were active in March on spindle colonised with *A. fabae*. Insecticide treatment did not prevent coccinellids from recolonising sugar beet at Broom's Barn once aphid numbers had increased again, and the coccinellid population in August was estimated to be 57,000 adults/acre on the commercial crop sprayed twice with demeton-methyl. Although coccinellids were fewer at Rothamsted, they kept the aphid population in check. (Dunning and Heathcote.)

Mangold clamps

The field staff of the British Sugar Corporation surveyed the incidence of aphids in mangold clamps in beet-growing areas at the beginning of April and of May 1948–57. Over this 10-year period the average number of clamps per square mile ranged from 1 to 2·1 in April and 0·4 to 0·9 in May, with 5–53% and 11–62% of clamps infested with aphids in April and May respectively. A similar survey over 855 square miles in late April 1961 covered 2,750 farms; of these, 1,482 grew mangolds, red beet or fodder beet, and 962 still had clamps, of which 443 were aphid-infested. The aphids on shoot samples from 123 infested clamps were identified in the laboratory; 63% of the samples contained *Myzus persicae*, 2% *M. ascalonicus*, 3% *Macrosiphum euphorbiae*, 9% *Aulacorthum solanii*, 96% *Rhopalosiphoninus staphyleae* and 17% *R. latysiphon*.

Collaborative work with Imperial College Field Station and the Plant Pathology Laboratory of the Ministry of Agriculture continued on the control of aphids in mangold clamps by methyl bromide fumigation. Two clamps near Lincoln had a 3-inch diameter perforated ventilating pipe along the centre of the base and fine-bore polythene sampling tubes built in during clamping. One clamp was of normal triangular cross-section, 6 × 10 × 45 feet covered with straw, alongside an identical control clamp; the other was a cube

$8 \times 13 \times 25$ feet enclosed in straw-bale walls. In early March these clamps were fumigated to find the rate gas injected along the ridge was distributed through the clamp, and the rate it dispersed after the polythene covering sheet was removed. Feeding the gas mixed with air into the clamps from a mist blower gave very uneven distribution. The clamps aired very rapidly after removing the sheet, and the built-in ventilation pipes were unnecessary. The approximate total CTP'S (concentration of gas in oz./1,000 cu. ft. $\times$ time in hours) resulting from three fumigations in each clamp were 117 and 52 respectively, and they did not damage the mangolds or sprouts.

Four aphid-infested clamps in Cambridgeshire and West Suffolk were fumigated between 18 and 21 April. Their volumes were 2,000, 3,600, 3,700 and 8,000 cu. ft., and their dimensions, covering material, mangold variety, condition and temperature differed. The target CTP was 100, and means of 118, 103, 100 and 69 were achieved. Aphids were all killed in the first three clamps, but reinfested two of them by mid-June. One of these was heating (15–24° C.) when fumigated, and partly collapsed a week later. The inlet pipes were too short to cover the large top of the fourth clamp, dimension $6 \times 30 \times 48$ feet, and the gas was unevenly distributed; one corner reached a CTP of only 26, and some aphids survived there. (Dunning.)

Tolerant varieties

Varieties selected for tolerance to yellows at Dunholme, the Plant Breeding Institute, Cambridge, and by Dr. S. Ellerton of Bush-Johnson were compared with four commercial varieties on sprayed and unsprayed plots at Broom's Barn. Mean yellows incidence on the sprayed plots in August was 35% and on the unsprayed 55%; mean root yields were 19·0 and 17·7 tons/acre; mean % sugar 16·5 and 16·0; mean sugar yield 62·8 and 56·8 cwt./acre. Reselections from the Dunholme tolerant varieties A7S/2, M9S/6, N4S/1 and Q1S/1 outyielded the commercial varieties on both the sprayed and unsprayed plots, on average by 11, 19, 7 and 19% respectively. Multiplications of the varieties 93/1, 103/233, 20/30, which did well in 1959, again outyielded the commercial varieties by 6, 7 and 9% on average, but varieties 337/45, 45/694 and 11/21 gave 99, 102 and 92% of the yield of the commercial varieties. Varieties 337/6S, 337/8S and 5/430 outyielded the commercial ones by 7, 10 and 8% respectively. The five PBI varieties also outyielded the commercial ones by 14, 11, 7, 2 and 5% and two of the five Bush-Johnson varieties did so by 13%. Most of these best-yielding varieties outyielded the commercial ones on both the sprayed and unsprayed plots. (Hull and Glenister.)

Insecticides

Four field trials tested the effect on yellows incidence of insecticide sprays normally used to control pests such as mangold fly, flea beetle and pigmy beetle. The spray in early May was, on average, 3 weeks before the local spray warnings, and 5 weeks before the farmer sprayed the field, including the trial area, with whatever systemic insecticide he favoured. The insecticides, oz./acre of active ingredient, and mean percentage decrease of yellows incidence as infected-plant-weeks were: DDT (16) 1·3%, demeton-methyl (7) 23·7%, dieldrin (6) 12·0% and dimethoate (1·2) 14·7%; trichlorphon (6) gave 9·5% increase. Either killing predators of aphids or disturbing the first few viruliferous aphids may be the reason for trichlorphon increasing yellows incidence; all other insecticides decreased yellows on average, but only demeton-methyl did so at all four sites. Dimethoate and demeton-methyl had unexpectedly large effects considering the very few aphids found at the time of spraying.

Five field trials made in co-operation with the British Sugar Corporation tested the effect on yellows incidence of commercial and experimental aphicides applied at the time of the local spray warning. Of thirteen materials tested only five were used at all sites. At the three sites examined after spraying, all insecticides controlled black aphids and all except fluoroacetamide controlled green aphids. The incidence of yellows on the control plots was: 87% at Holbeach (18 August), 87% at Cambridge (26 August), 17% at Sleaford (16 August), 24% at King's Lynn (25 August), 64% at Saffron Walden (2 August). At all sites most materials greatly decreased yellows incidence; exceptions were dimethoate (10% decrease at King's Lynn) and fluoroacetamide (decreases of 8·5% at Holbeach, 6% at Sleaford, 1% at Saffron Walden and an increase of 8% at King's Lynn).

The percentage decrease of yellows incidence expressed as infected-plant-week totals were: demeton-methyl 50%, dimethoate 36%, fluoroacetamide 16%, menazon 41% and phosphamidon 52%. Comparing these results with those of previous years shows that some materials behave differently in different seasons. Formulation changes of menazon and fluoroacetamide may be responsible. Bulking the results of 2 trials in 1959, 4 in 1960 and 5 in 1961, the decreases they gave in yellows incidence were: demeton-methyl 35%, dimethoate 27%, fluoroacetamide 16%, menazon 31% and phosphamidon 31%.

Except for phosphamidon and "Disyston" at King's Lynn, all insecticides increased sugar yield; the greatest increase at each site was: Holbeach—phosphamidon 27%; Cambridge—dimethoate 27%; King's Lynn—demeton-methyl 9%; Saffron Walden—demeton-methyl 17%. Yields were not determined at Sleaford.

At Gleadthorpe Experimental Husbandry Farm, Notts., 9 plants with yellows were transplanted into the centres of plots of beet $\frac{1}{36}$ acre in area, and each of the plants was infested with 20 apterous *M. persicae* 8 days before the plots were sprayed with various insecticides. It was intended to measure spread of yellows from the infectors, but this was prevented by a heavy natural infestation of green and black aphids. Nevertheless, plots differed greatly in losses from aphid attack and yellows; yields in cwt. sugar/acre from plots treated with insecticides were: demeton-methyl 47, dimethoate 47, fluoroacetamide 39, menazon 48, DDT 32, indopol polybutene 30, "Disyston" 54; unsprayed plots containing infectors yielded 28 and without infectors 42 cwt./acre.

Granular formulations of aphicides were compared with demeton-methyl sprays in the field. Trials at Broom's Barn and Sprowston tested early, and early + late sprays of demeton-methyl, seedbed applications of " Disyston " and menazon granules, and foliage top-dressings of " Disyston ". Seedbed application of " Disyston " on 23 March, worked-in before drilling on 10 April, controlled aphids in late May, but only halved the population in mid-June. All treatments except menazon decreased yellows incidence considerably; a seed bed dressing of " Disyston " followed by an application to the foliage in late May was best.

A trial on limestone soil at Dunholme tested " Disyston " granules side-placed into the soil with a " Gandy " granule applicator fitted with special coulters, either at the time of drilling or of steerage hoeing. These treatments were compared with a demeton-methyl spray and with " Disyston " granules applied to the foliage by the " Gandy " mounted on the steerage hoe, so that the plants retained some of the granules and the remainder fell on the soil in a 4-inch band. At 32 oz./acre (active ingredient) " Disyston ", side-placed at drilling on 15 April, gave poorer aphid and yellows control, but increased yield more than the 6-oz. rate. The " Disyston " foliar top-dressing (16 oz./acre) and the demeton-methyl spray (7 oz./acre), applied on 6 and 7 June, respectively, rapidly controlled aphids. The top dressing affected aphids for longer, decreased yellows more and increased sugar yield considerably more than did the spray. " Disyston " granules side-placed into the soil at the same rate and time acted more slowly, but gave the most persistent aphicidal action and decreased yellows and increased sugar yield nearly as much as the demeton-methyl spray.

" Disyston " and menazon granule formulations of various sizes and concentrations were applied as top dressings at 16 oz. active ingredient/acre, and compared with a demeton-methyl spray. All treatments except menazon controlled black and green aphids within 4 days. The large-sized 5% " Disyston " granules (formulation 4909a) controlled aphids and yellows less well and increased yield less than the normal-sized 5% granules (formulation 4909). Menazon 5% granules gave better aphid control than 0·5%, but decreased yellows and increased yield less; 10% " Disyston " was superior to the 5% and 2·5% formulations in controlling aphids and yellows, but increased yield less. The granules of higher concentration could not be applied as uniformly as those of lower concentration.

The efficacy of granules applied to the foliage may depend on the high dose given, and effect of varying dose was tested at Broom's Barn. Sprays were applied on 26 May in a 7-inch band over the row at 2 oz. a.i./acre and at 24 oz. a.i./acre, to compare exactly with the dose of insecticide in the granule treatments. The granules were applied at 24 oz. a.i./acre to the foliage and adjacent soil in a band of the same width, on 28 May. All treatments, except phorate spray at the 2-oz. rate, controlled green aphids well; phorate and dimethoate sprays and granules gave excellent control at the 24-oz. rate. Menazon granules at 12 oz. controlled green aphids better than the spray at 2 oz., but less well than at 24 oz. Yellows control paralleled the aphid control, although phorate granules at 24 oz. a.i./acre were slightly better than the spray at the same rate. Each insecticide as a spray at the 24-oz. rate gave slightly better sugar yield than the granule formulation; the plants, which had seven leaves, were still rather small for retaining granules. (Dunning and Winder.)

At Broom's Barn the time of spraying with demeton-methyl (7 oz. a.i./acre) was compared with foliar top dressing with phorate granules applied at a rate of 13·7 lb./acre (22 oz. a.i.) with a " Horstine Farmery " granule applicator. The granules increased yield by 2½ ton of roots/acre, the two demeton-methyl sprays increased yield by 2 tons, and a single spray by about 1 ton/acre. At harvest all insecticide-treated plots had about 90% of plants with yellows and untreated plots 97%, but during July percentage infection was twice as great in the untreated plots.

The Harpenden trial compared untreated plots with those sprayed with demeton-methyl at the time of the spray warning, plots receiving seedbed application of granular " Disyston " (2 lb. a.i./acre), and others receiving top dressings of granular " Disyston " (1½ lb. a.i.). Aphids were few, even on the untreated plots. All treatments decreased yellows incidence by 10%. The top dressing of " Disyston " decreased yellows slightly less than either soil-applied " Disyston " or the spray of demeton-methyl—possibly because of the drought at the time of application, which prevented insecticide from being absorbed by the beet plants.

At Broom's Barn and Harpenden first infections were with sugar-beet mild yellows virus, and although sugar-beet yellows virus came later, it was less prevalent than the less-virulent one. (Heathcote.)

In seven trials in 1961 a foliar top dressing of " Disyston " granules, at an average rate of 22 oz. a.i./acre, decreased yellows incidence by 51%, compared with 30% by a standard demeton-methyl spray.

Seed crops

Seed crops had few plants with yellows in 1961; the mean incidence in sugar beet and mangolds was 2·9% and 7%, and the highest in individual crops 15% and 34%, respectively. Downy mildew was prevalent, particularly in crops raised under mustard cover, whether transplanted or grown-on *in situ*; up to 19·2% of plants were infected. A few plants with silvering disease were found in three mangold seed crops in South Lincolnshire and Essex.

Yellows was rare in sugar-beet stecklings in the autumn of 1961. Only one bed had more than 1% of plants with yellows and the average for those certified for planting was 0·14%. Twenty-six of 120 mangold steckling beds had more than 1% yellows; average yellows incidence in the remainder was 0·25%.

Spread of downy mildew from seed crops to nearby root crops has recently caused serious damage and, as the disease is usually more prevalent in seed-growing areas than elsewhere, special measures were taken against it in steckling beds this year. The average incidence in open beds, beds raised under mustard cover and those under cereal cover was 0·54%, 0·27% and 0·005%, respectively. Beds with the most infections were either destroyed or plants from them were transplanted in the autumn, so that those with mildew will die during the winter and the disease will not spread as it does with undisturbed plants close together. (Byford.)

Downy mildew

Although fungicidal sprays sometimes decrease downy mildew in root crops and stecklings, their effects are inconsistent. At Dunholme three sprays with maneb, the first shortly after brairding, gave 4% of sugar beet with downy mildew in late August compared with 14% of unsprayed plants, 5% for "Perenox" and 7% for triphenyltin acetate, "Dithane" and "PP645". All sprayed plots gave a slightly greater yield of roots of higher sugar percentage than unsprayed. In a similar experiment at Pointon, Lincs., 2·7% of unsprayed plants had mildew in late July, whereas those sprayed with "Dithane", triphenyltin acetate, "Perenox" and "PP645" had 0·2, 0·5, 1·1 and 0·9% of plants with mildew respectively.

At Oundle, Northants., one, two or three sprays with triphenyltin acetate on sugar beet, the first applied after the mildew had appeared, decreased incidence in late July to 23, 20 and 17% respectively, compared with 37% in unsprayed plots. The crop later suffered from drought. The sprays increased sugar yield by 7·4, 11·9 and 10·8% respectively compared with unsprayed plots; the sprays increased sugar by 0·8%. The root juice purities for the unsprayed and once-sprayed plants were 85% and 83% and for the twice and three times sprayed 87% and 88%—effects very important for extracting sugar in the factories.

The same fungicides and "Strepospray" gave poor control of mildew when sprayed at 15- or 30-day intervals on August-sown stecklings at Dunholme.

The spread of the disease to a root crop surrounded by infected second-year plants, and its effect on yield of roots, was studied at Dunholme. Plants were marked as they developed downy mildew and their yield determined in November (Table 1).

TABLE 1

Effect of downy mildew on sugar beet

Date infected	% of plants infected	Average root weight (g.)	Sugar (%)	Sugar per root (g.)	Sugar per root as % healthy
May... ...	7·0	262	15·6	40	31
June ...	14·8	224	13·9	31	24
July ...	5·4	462	13·5	62	49
August ...	5·2	614	14·5	89	70
September/ October ...	4·0	812	16·8	136	107
Healthy ...	—	754	16·9	127	100

Plants infected in June had smaller roots and sugar percentage than those infected in May. Plants infected in July and August also had a lower sugar percentage but larger roots. Plants infected late in the season were slightly heavier, on average, than healthy roots, and their sugar percentage the same. Only 8% of plants which contracted mildew in May had mildewed leaves in June, but 42% of those that apparently recovered developed mildew later.

Half the plants infected in June recovered by July, but 41% of these developed mildew later. This re-infection or redevelopment of the disease had little additional effect on yield. Plants infected in June, July or August which soon recovered weighed less than those which showed symptoms over a longer period. Most infected plants survived to harvest, but of those infected in May, June and July respectively 9·7, 2·8 and 1·3% died. Some of the survivors were very severely stunted; the roots of some plants infected in May and June weighed less than 25 g. in November. (Byford.)

Ramularia leaf spot

During the wet summer of 1960 Ramularia leaf spot defoliated some sugar-beet crops in Devon and Cornwall by August. Although the trouble does not usually develop so early, it occurs most years. Experiments done in co-operation with Mr. C. E. Loweth of the British Sugar Corporation tested the effect of fungicide sprays and of different varieties on the incidence of the disease.

Triphenyltin acetate and zineb sprays in July, August and September gave better control than "Perenox", maneb or "PP645". A spray with copper oxychloride at the end of July had no effect on the incidence of the disease on 23 October, but mid-August and early September sprays considerably decreased its incidence.

Mr. B. Crombie of the Irish Agricultural Institute, at Thurles, kindly supplied seed of four varieties of sugar beet selected for resistance to Ramularia leaf spot in Ireland, where the disease is prevalent. On 23 October varieties 191A and 185 had leaf spot, but much less than Sharpes E. Variety 155/1 had very little leaf spot, and variety OFG 228/1 had none, but considerable rust. The Irish varieties were outstandingly green and vigorous compared with the brown, drab appearance of Sharpes E. They gave yields of 65–86 cwt./acre of sugar, compared with 66 for Sharpes E and 81 for Sharpes E sprayed with fungicide. Their sugar content was 16·2–16·8%, compared with 15·2% for Sharpes E and 15·7% for Sharpes E sprayed. These preliminary results indicate that considerable benefit might result in crops in the south-west from spraying with fungicide and choosing appropriate varieties. (Hull.)

Seed treatment

All the gravity-separated, rubbed seed graded to $\frac{8}{64}$–$\frac{10}{64}$ inch supplied by the British Sugar Corporation to growers in 1961 was disinfected with ethyl mercury phosphate (EMP) steep treatment. It gave good brairds, which several fieldmen reported free from black leg. Machinery to treat the seed was specially designed to protect the operators. Of the total of 1,726 tons of seed supplied to growers, 847 tons of natural and 536 tons of rubbed seed graded to $\frac{7}{64}$–$\frac{11}{64}$ inch had a combined fungicide/insecticide dust treatment. 343 tons of rubbed seed graded to $\frac{8}{64}$–$\frac{10}{64}$ inch had the EMP steep treatment and was then dusted with insecticide. In 1962 the rubbed seed of all grades will have the EMP steep treatment.

In eighteen field trials the most effective seed treatment was EMP solution applied at 5% volume to weight in the "Mist-O-

Matic " machine followed by drying; this gave 28% more seedlings than untreated seed. "Agrosol" increased stands by 24% and "Panogen" by 23%. EMP steep, "Mist-O-Matic" fungicide, "Agrosan" dust and EMP applied in the "Mist-O-Matic" machine at 1% v.w. increased stands by 20, 20, 19 and 11% respectively. BHC dust applied to commercial EMP-steeped seed had no effect on seedling stand, but dieldrin applied as dust, liquid or mist, and heptachlor dust, gave less seedlings than seed treated with fungicide only, while heptachlor liquid applied to EMP-steeped seed gave less seedlings than the untreated control.

In 3 years' trials "Panogen" and "Agrosol" proved, on average, slightly superior to dust treatments. Liquid insecticide treatments sometimes depress seedling emergency. (Byford and Dunning.)

At Dunholme EMP steep increased seedling emergence in the field by 59%, and "Agrosol" and phenyl mercury acetate used as steep increased it by 49% and 40%, respectively. Five short-wet treatments with volatile compounds increased seedling emergence by 43–55%, and "Agrosan" dust increased emergence by 31%. EMP solution applied as a spray at 1% v.w. of liquid was more effective than 6%, when neither batch of seed was dried before sowing. "Agrosol", applied after the seed had been soaked in water for 20 minutes and dried, gave fewer seedlings than when applied to unsoaked seed in eleven out of thirteen seed samples. The increase in emergence in two samples was small and, on average, the water-soak decreased field emergence by 10%. (Byford.)

Two replicated field trials tested nine insecticide treatments on EMP-steeped seed at sites with wireworm populations of 150,000 and 400,000/acre. Seed rates were 4·3 and 4·1 lb./acre of $\frac{8}{64}$–$\frac{16}{64}$-inch seed respectively. Heptachlor liquid and dieldrin mist treatments decreased seedling emergence. (Dunning.)

Sugar-beet Manuring

This report gives the more important results of a series of field trials done in co-operation with the field staff of the British Sugar Corporation in 1960; the results of the 1961 experiments are not yet known.

NPK-dung trials

Nine 3^3 factorial experiments tested 0·6, 1·2 and 1·8 cwt. N/acre as ammonium sulphate; 0, 0·5 and 1·0 cwt. P_2O_5/acre as superphosphate, and 0·8, 1·6 and 2·4 cwt. K_2O/acre as muriate of potash both with and without dung.

Without dung, 0·6 and 1·2 cwt. N/acre were equally profitable, phosphate was uneconomic and the best potash dressing was 1·6 cwt. K_2O/acre. As in previous years, the highest rate of nitrogen depressed sugar yield. With dung, 0·6 cwt. N/acre was the best dressing, phosphate was uneconomic and 0·8 and 1·6 cwt. K_2O/acre were equally profitable. Dung gave a higher sugar yield than any combination of mineral fertiliser on a light soil in Nottinghamshire. These trials ended in 1960.

NK–salt trials

This series of experiments was designed to measure the response curve of sugar beet to salt and the nitrogen–salt and potash–salt interactions; eight experiments tested all combinations of:

(*a*) 0·6 and 1·2 cwt. N/acre as ammonium sulphate;
(*b*) 0, 2 and 4 cwt. agricultural salt/acre;
(*c*) 0, 1·2 and 2·4 cwt. K_2O/acre as muriate of potash.

TABLE 2

The effect of salt on the response of sugar beet to nitrogen and potash. Mean of eight experiments in 1960

	Sugar yield (cwt./acre)				
	Cwt. N/acre		Cwt. K_2O/acre		
	0·6	*1·2*	*0·0*	*1·2*	*2·4*
Without salt	57·7	58·5	56·6	58·0	59·6
With 4 cwt. salt/acre ...	60·3	62·9	63·2	60·8	60·8

Table 2 shows that salt increases response to nitrogen but decreases response to potash. Without salt, 1·2 cwt. N gave only 0·8 cwt. sugar/acre more than did 0·6 cwt. N/acre. With 4 cwt./acre of salt, the difference was increased to 2·6 cwt. sugar/acre. By contrast, a response of 3·0 cwt. sugar/acre to 2·4 cwt. K_2O/acre without salt changed to a depression of 2·4 cwt. sugar/acre with 4 cwt. salt/acre.

Top-dressing trials

This series of nine experiments measured the effect of delaying some nitrogen until singling time. Treatments giving 0·6, 0·9, 1·2, 1·5 and 1·8 cwt. N/acre as sulphate of ammonia were compared with plots receiving the same total amount of nitrogen but partly as either 0·3 or 0·6 cwt. N/acre as " Nitro-Chalk " at singling time.

The total amount of nitrogen given and not the time of application was important for yield of sugar and tops. 1·8 cwt. N/acre applied to the seedbed depressed plant population, and a higher plant population was obtained by splitting such a heavy dressing. In spite of this, the split dressing did not give more sugar. (Adams.)