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Report for 1960

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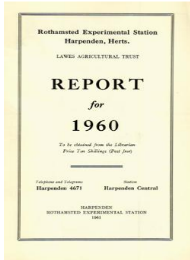
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Dunholme Field Station

R. Hull

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DUNHOLME FIELD STATION

R. HULL

In October M. Glenister replaced E. W. Dunham, who left in August, and P. J. Last was appointed in November. The impending move of the Station to Suffolk has created difficulties in keeping and recruiting assistants.

S. N. Adams, R. A. Dunning and R. Hull contributed to the 23rd Congress of the International Institute of Sugar-Beet Research in Brussels in February. R. Hull also attended the meeting of the Virus Committee in Holland in January, and the Summer Congress in Vienna in June. R. A. Dunning gave a paper at the 11th International Congress of Entomology in Vienna. At the invitation of the Irish Agricultural Institute, R. Hull visited Eire in October to advise measures to control sugar-beet yellows.

The weather at Dunholme was representative of the main sugar-beet growing areas, extremely dry until the end of June and extremely wet afterwards. Only 3½ inches of rain fell in the 4 months March–June. July–December produced 20·3 inches, with only 43 days without rain, of which only five were in October and November. Everywhere, corn and root harvest was delayed and difficult. Sugar beet was harvested from mud in December, and much remained in the ground at the end of the year. The spring and summer weather suited sugar beet, which covered the rows with foliage in June and grew vigorously throughout the autumn. The early drought affected the crop only on the poorest land. Yields of over 20 tons/acre were common, and the national average yield 17·38 tons/acre is considerably greater than in any previous year.

The British Sugar Corporation gave invaluable help with 100 field experiments in commercial sugar-beet root and seed crops and in mangold crops, as well as with regular surveys of diseases, aphids and other pests.

Broom's Barn Farm

Until C. J. Hingston was appointed Farm Bailiff in March, Mr. E. J. Cousins, agriculturist of the Bury St. Edmunds Sugar Factory, kindly organised the farming activities, and the British Sugar Corporation staff also helped with sowing and mechanically thinning the sugar beet. The first objective of the farming programme is to get the land into a satisfactory state for field experiments. By early April 140 acres were sown with barley, 23 acres with oats and clover, and 20 acres with sugar beet. All the cereals were freed from broad-leaved weeds with chemical weed-killers, but all crops were infested with wild oats, which grew densely in places. Two areas, amounting to about 35 acres, were infested with couch-grass and were treated with dalapon in the autumn. Corn harvest started at the end of July, but was not finished until 13 September, and the delay resulted in loss of much grain. The average yield was 1 ton/acre. An excellent stand of clover was established under the oats.

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The sugar beet was grown with a minimum of hand labour. Lifting started on 12 October, but was continually delayed by the weather, and was not completed at the end of the year. The average yield was 13½ tons/acre, with an average sugar percentage of 15·5.

The Ministry of Agriculture Survey Section kindly surveyed the farm and fixed the sites for sockets to mark grid lines which divide the land into 5-chain squares. Surface soil samples from each 1-chain square, and sub-soil samples from each 5-chain square have been stored for reference purposes. Eleven acres (The Holt) were underdrained.

Contractors started the civil-engineering work in August, but work has been continually delayed by rain and mud. A 10-inch bore-hole, lined for 127 feet, has been sunk 282 feet into the chalk, and yielded water at 120–130 feet. The sewage line and works, roads and the irrigation main are being laid, and should be complete early in 1961. Plans for the buildings will be ready for tenders early in 1961.

Incidence of sugar-beet yellows

The fine autumn of 1959 and the mild winter resulted in large populations of *Myzus persicae* and *Aphis fabae* on spring hosts. The heavy infestations of aphids in 1959 had spread yellows virus widely by the end of the year, so in March the sugar-beet crop seemed to be threatened with an early attack of yellows. Green aphids started to infest sugar beet in mid-May, about the same time as last year, but developed slower, because of attack by predators and parasites which had built up on last year's aphid infestations. An average infestation of one green aphid per plant for the country's sugar beet was reached by 9 July, compared with 13 June last year, and then the infestation remained about the same or decreased. The black-aphid infestation paralleled the green, and never damaged the crop appreciably. Spray warnings were sent to growers by some sugar factories in the third week of May, and by mid-July most growers in the south and east had been advised to spray. Growers in some areas had spray warnings up to mid-July, and a few growers were advised to spray a second time. Of the total crop of 413,000 acres, 221,000 were sprayed, of which 51,000 acres had a second or third spray.

In September sprayed fields in the eastern counties were generally relatively green compared with the unsprayed ones, in which 80–100% of plants had yellows. In some areas spraying apparently failed to decrease yellows incidence satisfactorily, although it controlled the apterous aphids on the crop; the reason for this is not established, but it is possibly because winged aphids, many of which must have been infective, were active over a long period.

Yellows was more prevalent than usual in the south, west and north of England and in Scotland, but less prevalent than usual in East Anglia, where most crops were sprayed. For instance, at the end of September mean incidence of plants with yellows in sample fields in north Lincolnshire was 60%, and in Norfolk and Suffolk 20–27%—a reversal of the usual situation. Mean incidence in all sample fields at the end of August was 16·5%—about the same as the previous 2 years—resulting in a calculated loss of sugar yield of

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about 7%. Before the crop was sprayed, about 50% of plants in the sample fields had yellows in years when the weather favoured spread of the disease, as it did in 1960. (Hull.)

Two field experiments with systemic insecticides checked the timing of the spray warning. A single application at the recommended time increased root yield by 2½ tons/acre at Rothamsted, and at Broom's Barn.

At Rothamsted spraying 1 week before the recommended time increased root yield by 1 ton/acre; the local destruction of predators at the time of infestation by aphids did not affect the resulting aphid population. Predators, particularly Coccinellids, were exceptionally abundant, and they almost freed plants from aphids in mid-June. All plots were eventually recolonised by aphids. The incidence of yellows reached 60% in unsprayed plots.

At Broom's Barn a second application 2 weeks after the first was economically worth while. Unsprayed plots yielded 36·6 cwt./acre of sugar, those sprayed early 46·8 cwt., those sprayed late 49·3 cwt. and those sprayed on both occasions 52·3 cwt. The aphid population was larger than at Rothamsted, and eventually all plants had yellows. Predators invaded sprayed crops as soon as they were recolonised by aphids. (Heathcote.)

Sources of viruliferous aphids

Aphids were numerous on mangold foliage in the autumn of 1959 and in clamps in the spring of 1960. Spraying growing mangolds in the autumn with demeton-methyl killed most of the aphids, but did not ensure that the clamps were free from aphids in the spring. Fewer of the roots in the clamps made from sprayed mangolds had aphids than in the 21 corresponding clamps made from unsprayed mangolds, and the infestation was lighter. The method is not reliable enough, however, to recommend to growers. In these clamps the closer the mangolds were topped, the lighter was the aphid infestation in the spring.

In April and May aphid-infested mangold clamps were fumigated with methyl bromide in collaboration with Dr. Page and Dr. Lubatti of Imperial College Field Station. Preliminary laboratory trials at Imperial College showed that both *Myzus persicae* and *Rhopalosiphoninus staphyleae* are readily killed by low doses of methyl bromide, e.g., a CTP (concentration of gas in oz./1,000 cu. ft. × time in hours) of not more than 30, and that mangolds are not harmed by CTP's below about 200. Two clamps in the Lincoln area, and two in the Cambridge area, varying in size from 600 to 2,000 cu. ft., were fumigated under $\frac{10}{1000}$-inch polythene sheeting, and an 8,000-cu. ft. clamp near Cambridge was fumigated (under rubberised-canvas sheets with rolled joints) for periods of 2–17 hours with the quantity of methyl bromide adjusted to give an average CTP of about 100. All clamps were nearly freed from aphids by the fumigation.

Aphids were found in 44 of 101 samples of weeds from beet-growing areas examined between late March and early May. The weeds were of many species, but mainly *Stellaria media*, *Senecio vulgaris*, *Malva* spp. and *Plantago* spp. *Myzus ascalonicus* was recorded 22 times, *M. persicae* 10, *Macrosiphum* spp. 14, *Aulacorthum* spp. 9 and other species 6. None of the beet plants to which many

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of these aphids were transferred developed severe yellows; a few developed a mild or transient yellowing.

This is the third year in which aphids found on field weeds in the spring have infected occasional sugar-beet test plants with mild yellows, but none with severe; in contrast, most aphids from mangold clamps, stecklings and beet debris give severe yellows. (Dunning.)

A few *M. persicae* and *M. euphorbiae* were found on the innermost leaves of wild beet at three sites on the Suffolk coast during March, and are presumed to have overwintered there. Coccinellids were common and kept the aphids under control, and virus spread from this source was not obvious. (Heathcote.)

Tolerant varieties

Varieties selected for ability to tolerate yellows were tested at Dunholme, Sprowston and Ipswich, in experiments which depended on natural incidence of yellows. At Sprowston, and in other experiments arranged in co-operation with the National Institute of Agricultural Botany and the Plant Breeding Institute at Cambridge and Walton-on-the-Naze, varieties were compared on demeton-methyl sprayed and unsprayed plots. This year the experimental varieties seldom exceeded or equalled the yield of commercial varieties, in contrast to the results in the dry year 1959, when yellows was early and aphids prevalent. At Sprowston the commercial varieties outyielded all except variety Bu. 6 on the sprayed plots and all except 59/6/3, Sh. 8A and Sh. 5 on the unsprayed plots, where yellows was prevalent but late. At Ipswich, yellows incidence varied from 20 to 70% in September on different varieties, but only 59/6/5 and 59/6/6 outyielded the commercial varieties.

At Dunholme, where yellows incidence was low but downy mildew prevalent, the commercial varieties equalled or exceeded the yield of the inbreds and out-pollinated varieties. All plants of some inbred lines (e.g., 59/4/3) had downy mildew, and some plants were killed by it, whereas other lines had few infected plants.

Varieties which resulted from interpollinating plants selected from hybrid varieties consistently outyielded Sharpes E and Bush E; the hybrids had been produced by crossing two tolerant lines. Yellows incidence was about 60% on the commercial and about half this on the more tolerant experimental varieties. Those with varieties 6 and 8 as the seed-bearing parents in the first hybrid exceeded the sugar yield of the commercial varieties by 11% and 10% respectively.

The growth of the tolerant hybrid Q1S/1 × A7S/1 (Q) was again compared with that of Sharpes E, both in the field and in the glasshouse. In the field, Sharpes E had more leaf area and retained it longer than Q and exceeded the sugar yield of Q by 10%. Yellows immediately decreased the leaf area of Sharpes E more than Q, and the difference persisted through much of the summer. With yellows, Q outyielded Sharpes by 45%. In the glasshouse Q produced a greater weight of leaf than Sharpes at first, but after 11 weeks Sharpes had more than Q whether infected or not. The effect of yellows on yield of dry matter in leaves, petioles and roots was apparent 27 days after infection (6 weeks after sowing). After 16½

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weeks the percentage dry matter in the roots of Q, healthy and infected, was 20%; in Sharpes 22% and 19% respectively. Sharpes had more dry matter in the roots than Q when healthy, but when infected, Q outyielded Sharpes. When infected Q gave 80% of the yield when healthy, and infected Sharpes gave only 36% of its yield when healthy. (Hull.)

Insecticides

Five field trials tested various insecticides for control of aphids and yellows. At Cambridge all insecticides decreased aphid numbers on the 3rd day after spraying, but "Phosdrin" increased the number of apterous green aphids per plant on the 7th day, and both demeton-methyl and "Phosdrin" did so on the 14th day. On unsprayed plots 61% of plants had yellows by the end of August, but none of the insecticides decreased yellows incidence (infected-plant-weeks) significantly, and "Phosdrin" gave a significant increase at one count (10 August). On unsprayed plots at Spalding 34% of the plants had yellows at the end of August; spraying with malathion increased yellows incidence by 19%, and all other insecticides decreased it only slightly. At Peterborough all insecticides appreciably increased the low yellows incidence when applied once, but, when applied twice, phosphamidon and menazon gave decreases. At Dunholme all insecticides decreased aphid numbers on the 2nd and 6th days after spraying, but on the 19th day only demeton-methyl, dimethoate and menazon did so. Subsequent yellows incidence was relatively high (51% at end of August), and was decreased by all insecticides except fluoroacetamide; all increased yield. All insecticides decreased the low virus incidence at Waddington near Lincoln.

The average decrease in yellows incidence given by a single spray in all five trials was: demeton-methyl 23%, dimethoate 15%, fluoroacetamide 7%, menazon 21%. Phosphamidon was used in four trials and increased yellows incidence by 3% on average, compared with decreases of 11% by demeton-methyl, 2% by dimethoate, 10% by fluoroacetamide and 13·5% by menazon.

In the glasshouse, demeton-methyl and "Phosdrin" sprayed on to colonies of *Aphis fabae* on sugar beet gave 95% kill or better within 3 hours; dimethoate and fluoroacetamide within 22 hours; menazon took over 48 hours. When higher dosages of the same materials were watered over the soil surface, demeton-methyl and "Phosdrin" killed the aphids slower than when sprayed, menazon was slower initially but finally quicker, and dimethoate was quicker throughout. "Disyston" granules (average size 1·25 mm.), sprinkled on to the foliage and soil surface, killed some aphids rapidly, but took 48 hours to kill all; the same dose worked into the soil surface had no effect for 8 hours and took 72 hours to kill all. Persistence of the treatments was checked by reinfesting the plants with *A. fabae* 4 and 8 days after treatment. All the materials except "Phosdrin" were still active on both days.

Three field trials tested various combinations of "Disyston" seed treatments, broadcast or "in-the-row" soil applications and top-dressings to the foliage with granules, and demeton-methyl sprays. Seed dressing (1·6 oz. a.i./acre) and admixture of granules

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(12·8 oz. a.i./acre) with seed decreased seedling emergence but not final plant numbers, and decreased yellows incidence. On average, a single spray with demeton methyl decreased yellows incidence (infected-plant-weeks) by 51%, and a single application of granular "Disyston" at 32 oz. a.i./acre, as a top dressing on the foliage after singling, decreased it by 62%. Two of the trials tested a second spray and a second top dressing which decreased yellows incidence by 62% and 82% respectively.

The relative phytotoxicity of two sizes of 5% "Disyston" granules (average 1·25 and 3·0 mm. diameter) and 5% phorate granules (0·75 mm.) were compared by drilling three rates of each material mixed with 8 lb. rubbed seed and also with 16 lb./acre of natural seed. The phorate and small-sized "Disyston" granules were more injurious than the large-sized "Disyston", giving more cotyledon tip-scorch, smaller seedlings and fewer plants. The plants recovered rapidly in June, and no treatment gave fangy roots at harvest.

In the steckling cover-crop experiment described below, part of each main plot was treated with demeton-methyl (standard spraying rate on 18 August, 23 September and 16 November) or with "Disyston" (April sowings—granules at 3 lb. a.i./acre top-dressed along the rows on 12 August after cover-crops harvested; July sowings—2·5% by weight of 50% seed dressing plus granules at 3 lb. a.i./acre worked into the seedbed on 22 July). During late summer and autumn of 1959, black and green aphids were fewest given "Disyston". In May 1960 numbers of apterous green aphids per plant were: control 12·7, "Disyston" 8·1 and demeton methyl 2·5. The yellows incidence in June was the same with both insecticides and only a little lower than on the control plots. (Dunning and Winder.)

Sugar-beet mosaic virus

Rigid particles, about 730 mμ long, were identified in the sap of beet plants with mosaic, confirming observations in Germany. Attempts to prepare an antiserum by injecting rabbits with concentrated preparations of mosaic virus failed. (Heathcote.)

Seed crops

Yellows was prevalent in seed crops in 1960. Occasional crops surveyed by the National Agricultural Advisory Service and British Sugar Corporation steckling inspectors in June had up to 50% of plants with yellows, and the average for 82 sugar-beet seed crops was 7·3%; mangold seed crops had up to 80% of infected plants with a mean of 18% for 52 crops. This relatively high incidence of yellows had not been detected in the steckling beds the previous autumn. In two-thirds of the sugar-beet seed crops the percentage of plants showing yellows increased more than 20 times between October and June, and 90% of mangold seed crops did so. The stecklings which were stunted by the drought of 1959 failed to show symptoms when infected, and possibly the disease spread later in the autumn and more extensively in the spring than usual.

The proportion of sugar-beet stecklings raised under cover-crops increased from 37% in 1951 to 88% of the 1,046 acres in 1960. At first only cereal cover-crops were used and the stecklings were sown

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in April, but in 1960 37% of the cover-crop acreage was sown in July under mustard.

These crops call for different certification methods and present different disease-control problems than open beds or beds in spring-sown cover-crops; for instance, some are still covered with mustard 6 feet high in October, and downy mildew spreads in the stecklings during the winter and spring. This is a signal example of how changing agricultural practices present new research problems. Eleven sugar-beet steckling beds for the 1961 seed crop were destroyed because they had more than 1% of plants with yellows, and the average infection in the remaining 113 was 0·19%. Thirty beds of mangold stecklings had more than 1% yellows; average yellows incidence in the remaining 162 beds was 0·30%. (Byford and Dunham.)

Stecklings sown in April 1959 and others sown in July were grown-on *in situ* at Dunholme to produce seed in 1960. The table summarises the observations made on them:

Cover crop	Number of aphids/100 plants: Mean of several counts in autumn 1959		Number of aphids/100 plants: May 2–5 1960	% of plants with yellows		Seed yield
	Black	Green	Green	3 Nov. 1959	13 June 1960	lb./plot
April barley ...	5	10	30	—	23·5	34
April mustard	0	10	70	—	16·9	53
July mustard...	11	61	570	9·0	23·5	23
July linseed ...	7	27	1,190	4·5	21·6	33
July open bed	8	47	4,170	8·4	20·8	25

In the July sowings the cover-crops competed with the stecklings for moisture in the persistent drought, and the steckling population was decreased, especially by mustard. During the late summer and autumn aphids on the July-sown stecklings, especially under mustard cover, were more numerous than on the April sowings. The lowest virus incidence and highest seed yield followed April sowing under mustard cover. Transplanting in February from the April-sown mustard and barley cover plots and from the July-sown open bed decreased green aphids to one-tenth in early May. The effect of insecticides is reported in the work on insecticides. (Dunning and Winder.)

Seed treatment

As a result of good harvest weather, seed used in 1960 was of unusually high germination, was only lightly infected with *Pleospora betae* and few seedlings had black leg. For the first time in five seasons field trials in the 18 factory areas did not show ethyl mercury phosphate (EMP) steep to be a better seed treatment than a commercial organo-mercury dust fungicide. Both increased seedling stand by 17%. "Panogen", "Agrosol" and "Mist-O-Matic" fungicide increased stands by 5%, 9% and 7% respectively. Dieldrin dusted on to EMP-steeped seed gave slightly more seedlings per ounce of seed sown than EMP-steep alone; heptachlor dust, heptachlor liquid, γ-BHC dust and dieldrin mist gave slightly less,

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and " Astex " significantly less. Commercial organo-mercury dusts containing γ-BHC or heptachlor gave slightly fewer seedlings per ounce than a dust containing fungicide only. The liquid combined-dressings " Ceresol " and " Mist-O-Matic " were only slightly inferior to the comparable fungicide, but " Panogen " + " Astex " gave 6% fewer seedlings than the untreated control.

In 1961 EMP-steep will be used commercially in Britain on all rubbed and graded, gravity-separated seed. (Byford and Dunning.)

In four field experiments near Lincoln " Agrosol " steep and " Agrosol " applied in a mixing drum gave seedling emergence comparable to that from EMP-steep, all giving 26% more seedlings than untreated seed; " Agrosol " applied as a spray gave only 19% more seedlings. " Agrosan " gave 20% more seedlings than untreated seed, and EMP applied as a spray in 6% or 1% volume/weight of water gave 20% and 21% more respectively.

In the field at Dunholme, both 1958 seed with high *Pleospora* infection and 1959 seed, when steeped in water before being treated with " Agrosan ", " Panogen " or " Agrosol ", gave fewer seedlings than seed that had not been steeped before treatment. Six further samples of seed with different amounts of *P. betae* infection gave a similar result with " Agrosol ".

Seed treated with " Agrosol ", " Panogen " or EMP at normal and higher doses had its germination greatly decreased after storage in polythene bags when the seed was moist, but not when stored in muslin bags; the inhibition zones produced on stemphylium–agar sheets were also much smaller. Both effects were much less pronounced with the relatively non-volatile dust dressing " Ceresan ". With EMP, the effect developed after only 2 weeks storage, and became more pronounced with increased moisture and mercury content. Treated seed dried before storage to its original moisture content germinated satisfactorily and gave inhibition zones of normal size.

Inhibition zone size in stemphylium–agar plate assays was affected by pH of the agar, by spore concentration and temperature of incubation, but not by depth of agar, or by sucrose content of the medium. (Byford.)

Two field trials at Dunholme on limestone and clayey loam tested the effects of excessive dosage of insecticide seed dressings on diploid (var. Sharpe's Klein E) and polyploid (vars. Sharpe's Polybeet and Hilleshog Polyploid) natural seed. Materials used were 30% γ-BHC and 40% heptachlor at normal (12 oz./cwt.) $2n$, $4n$ and $8n$ rates, and 40% dieldrin and 80% menazon at normal (9 oz./cwt.) $2n$, $4n$ and $8n$ rates. Leaf injury was detected in the polyploid varieties at the normal rate of γ-BHC, and was significant at $2n$ and above in all varieties, more so in the polyploid, especially Hilleshog, than in diploid varieties. Plant populations were decreased progressively by $2n$ and higher doses of γ-BHC, and loss of plants continued until the end of June. At harvest only γ-BHC at the $8n$ rate increased fanginess of roots. Pitting of the root at the original site of the seed was obvious at the $2n$ rate of γ-BHC and severe at higher rates, especially with Hilleshog Polyploid. Dieldrin, heptachlor and menazon, even at the $8n$ rate, produced no apparent injury throughout the season. (Dunning.)

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Downy Mildew

Organo-tin fungicide sprayed on August-sown stecklings at 10-day intervals, starting immediately after brairding, decreased downy mildew incidence in early October from 23 to 2%. When sprayed at 30-day intervals 6·8% of plants had mildew. For "Dithane" sprays at 10- and 30-day intervals the percentage of infected plants was 6·8% and 16·7% respectively; for "Perenox", 13·2% and 12·2%.

After 7 days at 10° and 75% relative humidity, spores germinated when incubated in water at 10°, but not after 24 hours at 30°, and 100% or 90% R.H. (Byford.)

Herbicidal sprays

Various hormone weed-killers distorted and stunted sugar beet when sprayed on them at a tenth of the concentration used for spraying cereals. Sugar-beet sprayed at the end of May showed more severe symptoms than those sprayed at the beginning of May. Two-months-old sugar beet sprayed on 20 May with 2 : 4-D at a concentration of 1 : 20,000 showed typical severe injury for a week. After that the plants recovered and eventually looked greener and more vigorous than the unsprayed ones, although the leaves were narrow and their venation abnormal. In November the sprayed plots yielded only 1½% less weight of roots with 0·2% lower sugar content than the unsprayed. Hormone spray injury occurred in numerous sugar-beet fields as a result of drift from cereal spraying or from using contaminated machines for spraying sugar beet. In some fields the injury could not be explained in these ways, because it occurred in well-defined patches irregularly distributed in large fields. In each such field the previous cereal crop had been sprayed, and apparently the chemical had persisted in the soil. The distribution of the patches suggested excessive doses where spray machines had been cleared or refilled. (Dunham.)

Sugar-Beet Manuring

This report gives the more important results of a series of field trials conducted in co-operation with the field staff of the British Sugar Corporation in 1959; the results of the 1960 experiments are not yet known. A series of nitrogen top-dressing trials started in 1959 is being continued; most of the trials fell on unresponsive sites in 1959. The growth analysis of sugar beet receiving different levels of nitrogen fertiliser continued.

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, the most profitable average dressings were 0·6 cwt. N, 0·5 cwt. P_2O_5 and 2·4 cwt. K_2O/acre. Higher rates of nitrogen depressed sugar yield. The responses to potash were higher than in previous years. With dung, 0·6 cwt. N/acre was still the

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most profitable dressing, but there was no gain from applying more than 0·8 cwt. K_2O/acre. A surprising result was that 1·0 cwt. P_2O_5/acre could be justified in the presence of dung. Dung gave a higher sugar yield than any combination of mineral fertiliser on heavy soils at Bury and Ipswich.

The average response to nitrogen was small. Although the summer drought may have affected response, the response was not high even on two irrigated fields.

NKSalt trials

In this series of experiments 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 1

The effect of salt on the response of sugar beet to nitrogen and potash. Mean of eight experiments in 1959

	Sugar yield (cwt./acre)				
	Cwt. N/acre		Cwt. K_2O/acre		
	0·6	1·2	0·0	1·2	2·4
Without salt	55·4	53·9	52·2	52·7	59·0
With 4 cwt. salt/acre ...	59·1	60·0	57·6	61·1	59·9

Table 1 shows that salt appreciably affects the response to nitrogen and potash. When no salt was applied, 0·6 cwt. N and 2·4 cwt. K_2O/acre were the most profitable dressings, as in the NPK dung series. By contrast, in the presence of 4 cwt. salt/acre, 1·2 cwt. N/acre could be justified, and there was no gain from exceeding 1·2 cwt. K_2O/acre. These results suggest that the NPK dung series is not a reliable guide to manuring in the presence of salt. For this reason, the NPK–dung trials were ended in 1960.

Ploughing-down of P and K trials

Ten experiments compared a spring application of 1·0 cwt. P_2O_5/acre as superphosphate and 1·5 cwt. K_2O/acre as muriate of potash, with the same fertiliser applied in the previous autumn and ploughed in.

Ploughing-down of P and K in the autumn is less effective than the spring application, lowering yield on average by 4·0 cwt./acre sugar. The results do not support the idea that ploughing-down might be effective in a dry summer, for even in 1959 ploughing-down was as inefficient as in the two previous wet summers. The spring fertilisers were applied on the rough ploughing, and the seed-bed cultivations would mix them in the top few inches of soil. It seems that this makes the fertiliser available to beet even in a dry season.

In 1958 the spring application was thought to be better than the autumn, because at some sites plants on plots which received seedbed fertiliser made a quicker start. To investigate this possibility, a

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starter treatment of 0·3 cwt. P_2O_5 + 0·5 cwt. K_2O/acre broadcast on the seedbed in addition to the other fertilisers was tested in 1959. With this starter dose, autumn- and spring-applied PK gave similar sugar yields.

These experiments have ended. In all 3 years fertiliser applied in spring gave a bigger yield than ploughed-down in the autumn, and there is no reason to advise farmers to change their current practice. (Adams.)

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