REPORT

(ABRIDGED)

TO THE

ANNUAL GENERAL MEETING

29th JULY 1954

BY THE

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CONTENTS

OCCASIONAL PAPERS

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ADMINISTRATION

Membership

At 31st March 1954 the total membership was 515, comprising 188 life and 327 annual members. Seven new members were elected during the year, while 25 members died or resigned.

Obituary

Through the death of Mr J. F. McGill the Society lost the services of one of its Trustees. Mr McGill was a founder member of the Society and throughout its early life, by serving on Committees, he gave strong support and encouragement to its development. The Directors wish to record their appreciation of the valuable service he rendered to the Society for many years.

Staff

Miss Shona Binnie, S.D.H., was appointed on 1st December 1953 to give technical assistance to the sections dealing with Root Crops and Herbage Plants.

Miss T. M. R. McGhee, B.Sc., N.D.D., left the Society's service to be married.

Mr Donald Skinner was awarded the Royal Highland and Agricultural Society's Silver Medal and Certificate for 30 years' satisfactory service in agriculture.

Seafield

It is expected that the new station at Seafield will be ready for occupation in October 1954. The programme of work on the main laboratory block and outbuildings is well advanced, although some difficulty has been experienced in commencing work on houses for field workers. A suitable site has been finally agreed and permission has been given by the Midlothian County Council for work on the houses to begin.

Experimental Centres

Peeblesshire

Stocks of virus-free potatoes—
at West Loch, Eddleston.

Inverness-shire

Oat material for selection—
on Corriebrough Estate, Tomatin.

Argyll

on Melfort Estate, Kilmelford.

MULTIPLICATION AND MARKETING OF PLANT BREEDING STATION PRODUCTS

In accordance with the Agency arrangements set out in the 1952 Annual Report, elite stocks of Plant Breeding Station products have been handed over for further multiplication and marketing to official Agents as follows:—

Oats	Bell	Messrs Macfarlan, Shearer & Co., Greenock.
	Albyn Donside, Craigs Afterlea	Scottish Agricultural Industries, Ltd., 35 Charlotte Street, Leith.
	Early Miller	Mr George Clapperton, Sheriffhall Mains, Dalkeith.
Beans	Albyn Tick	Messrs Roughead & Park, Ltd., Haddington.
Grasses	Scotia Cocksfoot, Scotia Timothy	Messrs David Bell, Ltd., 15 Coburg Street, Leith.
Potatoes	Pentland Ace	Messrs W. J. Campbell & Miller, Ltd., 2 Charlotte Square, Edinburgh.
	Craigs Alliance	Messrs J. C. Dougal, Ltd., Auchterarder.

The Directors have decided it is impracticable to require Agents handling Station varieties to give priority in distribution to members of the Society and have accordingly cancelled this provision in Agents' agreements. Intimations regarding new Plant Breeding Station productions will appear in the Society's Annual Reports, and members wishing stocks are requested to take advantage of such advance information and to make early application to the Agents.

CERTIFICATION OF "SCOTIA" STRAINS OF GRASSES

Since the multiplication of stock-seed is exclusively in the hands of the Society's Agent, stock-seed certificates may only be issued for the Agent's crops.

A certificate will also be issued in respect of seed crops sown with stock-seed. Crops entered for certification will be field-inspected on behalf of the Society by the National Institute of Agricultural Botany, Cambridge. Forms of application for inspection of seed crops may be had from the Secretary, Scottish Plant Breeding Station, Craigs House, Corstorphine, Edinburgh 12, and completed forms should be returned as early in the season as possible, but, in any case, not later than 30th April. Samples of the cleaned seed from field-recommended crops should be sent to the Secretary, Scottish Plant Breeding Station, Craigs House, Corstorphine, Edinburgh 12, who will arrange to have them tested by the Seed Testing Station, Corstorphine, Edinburgh. A charge will be made for field inspection and seed testing.

Pre-inspection of Fields.—The greatest importance is laid on the adequate isolation of fields and their freedom from weeds. A seed field should not adjoin fields in which other strains of the same species will be allowed to come into head; at least two hundred yards should separate the seed crops from such fields. Whenever possible fields should be inspected before ploughing.

Pre-inspection of fields by the National Institute of Agricultural Botany can be arranged either through the Scottish Plant Breeding Station or direct with the National Institute of Agricultural Botany.

RESEARCH PROGRAMME

Cereals

Oats.

The main development in the Cereals Section during the period covered by this Report has been the establishment of the Oat Selection Centres in Argyll and Inverness-shire in the spring of 1953 to which reference was made in the 1953 Annual Report, and the completion of the first season's work at these Centres.

Breeding material from both Centres was harvested in good condition and during the winter months all selections were examined qualitatively and quantitatively and the most promising have been continued in 1954. As a result of the first year's experience in the conduct of the Selection Centres, modifications to sowing rate and technique have been made in the planning of the 1954 work.

In both areas the arrangements made for the harvesting of material by the staff of the Cereals Section, in co-operation with the Advisory Services of the West and North of Scotland Agricultural Colleges, worked satisfactorily and all the material harvested from both replicated trials and selection plots was brought back to the Plant Breeding Station for examination.

In the West early-ripening material had been badly stripped by birds as it approached maturity, resulting in a considerable loss of information. Nevertheless, a number of varieties and selections showed considerable promise under redland conditions and these have been included, together with much new material, at the 1954 centre. Because of the prevalence of flocks of sparrows in the West, arrangements have been made to net the area of the plots at this Centre from the time of commencement of earing to harvest. No such difficulty was experienced in the North, and while it may be necessary in the future to provide for netting against small birds, it is proposed for 1954 to grow the plots in the open field as was done the previous year.

Thanks to the continued interest in these projects by members of the College Extension Services, similar facilities have again been obtained in Argyll and Inverness-shire, both Centres being sited much nearer to Oban and Inverness, respectively, than in

1953 to facilitate periodic inspection during the growing season by the College officers concerned.

The varieties which appeared the most promising have again been included in replicated trials at their respective Centres, although it must be borne in mind that the 1953 season was so exceptional that the performances observed may not be typical of the varieties in a normal season.

The indebtedness of the Cereals Section to Mr J. A. Billmeir of Melfort Estate, Kilmelford, Argyll, and to his Manager, Mr Hugh Sinclair, must be recorded for the facilities granted to the Station in respect of the Argyll Selection Centre for 1954. The Section is similarly indebted to Mr P. Matthews of Corriebrough Estate, Tomatin, Inverness, and to his Manager, Mr John Fraser, for the facilities in the Inverness area.

In addition to the work carried out at the Centres mentioned above, sister lines of all breeding material grown there were maintained, harvested and examined at the Plant Breeding Station in order that loss due to unforeseen causes, such as bird damage, might be made good and information obtained on the relative performances of the lines in different environments. This policy has been continued in 1954.

The replicated trial carried out at the Plant Breeding Station in 1953, to examine the response of certain selections to two levels of nitrogen, was not completely satisfactory in that the weather at harvest time made the plots difficult to secure in good order and resulted in a large experimental error. The over-all effect of nitrogen was marked, but no reliable assessment of differential response of selections to the treatment was possible. An extended form of this trial has been laid out in 1954.

During the period under review the Cereals Committee of the Department of Agriculture for Scotland has assumed from the Field Trials Committee the responsibility for the co-ordination of regional trials, on a field scale, of new oat varieties. Ten of the Station-bred varieties classified according to their probable area of usefulness as far as this can be judged from available reports, and which have shown some promise in College trials in recent years, have been submitted to the Department's Committee for final test.

Approximately 1 cwt. of seed of each has been handed over to the Department's Committee for the current year's trials, and multiplication plots of these varieties are being maintained

at the Station for as long as they continue to be represented in the official trials.

Material was sent to the National Institute of Agricultural Botany for inclusion in a replicated trial at Seale Hayne in Devon and at the conclusion of the trial a very comprehensive report covering the entire growing period was received. This report contains much valuable data which will be useful when considering the behaviour of the varieties under different environmental conditions and it is unfortunate that some of the plots were badly damaged by birds, making yield records unreliable.

Attention has again been paid, in the year under review, to the problems of the alkaline soil areas in the Orkneys and some of the Western Isles and bulk lots of seed of hybrids produced for these areas were sent out to the County Organisers in Tiree, Uist and Orkney for trial and selection. The hybrid 0532 (*Avena byzantina* × *Quality*) continued to receive favourable reports and fixed selections from it are being multiplied at the Plant Breeding Station for comparative trials in the alkaline soil areas.

Interspecific hybridisation of oats has continued, and a few seeds have been obtained from the F_2 generation of the cross between the duplicated hybrid (6n) (*Avena barbata* × *A. strigosa*) and *A. sativa*, and also from the cross between a duplicated (4n) plant of *A. strigosa* and *A. abyssinica*.

The Agency scheme for the marketing of oat varieties produced at the Plant Breeding Station has completed its first season, and during the year the staff of the Section advised growers of some of the crops on problems of roguing and maintenance of varietal purity. Elite stocks of Early Miller, Albyn Donside and Craigs Afterlea were grown at Braehead Farm, Barnton, Midlothian, in 1953, and in spite of very difficult harvest weather were secured in satisfactory order. The variety Bell was grown at the Plant Breeding Station. The produce of these elite plots has been distributed to the Agents for multiplication and marketing.

Herbage Plants and Genecology

In some districts of Scotland ploughing and re-seeding may be sound policy as a means of increasing the output from hill-land, but by far the greater proportion of the hill acreage of

Scotland does not lend itself to this method of improvement and, accordingly, it is the natural vegetation itself that must be the subject of any intended improvement. In comparison with the amount of attention that has been given to the grasses of arable land, hill species have been virtually ignored, yet a detailed knowledge of the components of natural vegetation would seem to be an essential preliminary to its improvement. As far as the vegetation is concerned, ecology has done much to make it possible to predict the gross effects of treatments, but it should be remembered that ecology deals with species and seldom with units of lower rank: the new science of genecology can supplement ecology by providing information about populations within species. Broadly speaking, genecology is the study of hereditary structure and dynamics of biological populations; it is concerned with the evolutionary processes which produce the pattern of variation exhibited by plants and animals as well as with the recording and classification of the patterns themselves.

The genecological analyses of the fine-leaved fescues of Britain have been continued during the past year. Sheep's fescue has been found to comprise several chromosome races and the geographical distributions of these are being traced. In the case of Red fescue the hexaploid is the commonest type, but an octoploid form has been collected from several extremely dry habitats, for example, sand dunes, stone walls and the driest type of heath. The maritime octoploid, when grown at the Plant Breeding Station, is very similar to Station-grown material of the maritime species *Festuca juncifolia* and their relationship is being investigated. During 1953 crosses were made between different races and species of fine-leaved fescues and a number of hybrids have been raised. The ease with which the interspecific cross *Festuca rubra-Lolium perenne* can be made suggests that this cross may occur where the two species grow together in nature. Annual species are not commonly found in hill vegetation but the annual Eyebright has been given some attention in order to find out whether the selective influence of environment can be distinguished more rapidly than with perennials. Eyebright is semi-parasitic but seems to show little host specialisation, and the same species can grow on many different hosts. The semi-parasitic nature of this plant may make it possible to separate the selective effects of soil differences from those of other environmental factors.

Another aspect of environmental selection has been examined in replicated trials of hill grasses grown under uniform environmental conditions at Corstorphine. Seed was collected in the first place from four commonly occurring grass species on three different aspects of the Pentland Hills. Some difficulty was experienced in establishing all the plants under garden conditions but it was possible to make observations and measurements and the results proved to be of some interest. A scrutiny of the figures for plant size was particularly interesting in that it made plain that for one aspect the greatest expression of size in one species was not necessarily associated with the greatest expression of size in another. It is proposed to extend this work as it is felt that a knowledge of racial relationships within hill-land plant communities is of no less importance than information concerning their floristic composition. The proximity of Seafield to the Pentland Hills will make it possible to carry out a more detailed investigation of hill-land problems under natural conditions.

The planting of trees for the purpose of giving shelter to stock is becoming increasingly recognised as part of the hill-land improvement process, but the beneficial effect of trees upon pasture is not so widely appreciated. In this connection an observation by Dr Fenton that "much of the good grassland and growth that occur today where the plough has never been is due to the good start from the birch woods." This superiority of the grassland within hill birch woods and also of that derived from former birch woods suggests the importance of planting deciduous trees of which the birch is particularly suited to hill-land. At the Station a preliminary genecological survey of the diploid and tetraploid birches of Britain is now in progress and this work might well be extended to include a study of the components of vegetations associated with birch.

Several populations of cocksfoot from the Mediterranean area have been grown and observed at Corstorphine for two years, and are interesting on account of their autumn activity, some plants continuing growth late into the autumn. The individual plants are generally rather small narrow-leaved and those counted have a chromosome number of $2n=28$, but some relatively broad-leaved plants which happened to survive the first winter at Corstorphine were selected and pairs of similar type were crossed. Further examination of these populations must be delayed until after the removal to Seafield.

The progenies of several crosses between plants of Ayrshire perennial ryegrass which show little or no autumn shooting were examined throughout the season and the best plants have been selected with a view to further breeding. Two complete progenies and several individual plants in other progenies showed very marked freedom from autumn shooting. A new elite stock of Scotia cocksfoot is being multiplied and it is hoped to preserve the palatability for which this strain is noted and to increase its yielding capacity. An asexual strain of smooth-stalked meadow grass of Oregon origin has been tested in replicated trials and could be multiplied if there were to be a market for it.

A replicated trial of 42 populations of Scotch timothy from Stirlingshire and the Carse of Gowrie was laid out at the request of the Grassland Committee of the Scottish Agricultural Improvement Council in order to study the amount and nature of the variation which occurred within the timothys of these two areas. The samples were obtained with the help of Mr I. V. Hunt of the West of Scotland Agricultural College and of Messrs James Gray & Co., Ltd., Stirling. Controls include Finnish, Swedish and Scotia timothy. The trial established itself well and it was possible to make preliminary measurements by the autumn of 1953, but a detailed analysis will have to await the results of the current year.

The pending removal to Seafield has necessitated some curtailment in the grass breeding programme, but steps are being taken to have the facilities at Seafield available by next summer.

Potatoes

The Registration Trials in 1953 contained eleven of the Society's seedlings of which six were in the 1st-Year, three in the 2nd-Year and two in the 3rd-Year tests. All these selections were resistant to the races of blight occurring in Scotland and some were field immune from one or more of the viruses A, X and Y. The Committee recommended that one seedling in the 3rd-Year Trial should be given a further test in 1954 and that one in the 1st-Year Trial should proceed to the 2nd-Year test in 1954.

During 1953 inoculation tests on tobacco revealed that a strain of virus Y was present in certain stocks of seedlings.

This virus, which is very mild in effect and cannot readily be recognised in potatoes by ordinary inspection, is sufficiently uncommon to warrant extreme measures being taken to prevent its further spread. This entails the destruction of all unessential stocks of tubers and the testing, by sap inoculation on tobacco, of all material to be grown in 1954 that might have been exposed to infection. As a result of these precautions, no seedlings were submitted for inclusion in the Registration Trials or in other such tests outwith the Station.

Trials for the assessment of field resistance to the leaf-roll and Y viruses contained over seven hundred seedlings in various stages of test. In the trials of thirty-six advanced seedlings the spread of both viruses in 1952 was slightly above average, and in the final assessments twenty-one seedlings were found to be more resistant to leaf roll and six more resistant to virus Y than the commercial varieties with which they were compared. One seedling showed no infection with virus Y and is judged to be field immune from this virus. It was, however, partially infected with severe mosaic disease caused, as later studies showed, by an unusual and hitherto unrecorded strain of virus A. Laboratory tests for the detection of hypersensitive, field immune, responses to A, X and Y viruses were applied to over three hundred advanced seedlings in the course of selection.

Thirty-two strains of virus X were checked for homogeneity and classified into groups on the basis of the responses evoked when they were sap- and graft-inoculated to a series of potato test varieties of the constitution NxNb, Nxnb, nxNb and nxnb. It was found that a large proportion of strains recovered from American varieties are of the primitive type which cause lethal necrosis in the presence of either Nx or Nb. Only one strain of this type has so far been recovered from British material. Several new strains of the B type were found, one of which apparently occurred by mutation from a primitive strain. Serological examination of several selected strains indicated that the primitive strains lacked antigenic groups commonly present in the two more advanced groups of strains. An examination of thermal inactivation among the strains has been initiated with results which indicate differences in this character within each of the three major strain categories.

The three commercial stocks of the variety Majestic, referred to in previous Reports, were again sampled to determine their content of virus X. Increases over the previous year were

recorded in each stock and from the data obtained over the three year period of examination it is concluded (*a*) that in a stock grown in isolation and with minimum disturbance the rate of increase from a low initial virus content is of the order of two-fold annually; (*b*) that roguing of visibly infected plants has a selective effect favouring the spread of milder variants of the virus but has little effect on total virus content of the stock as a whole; and (*c*) that infiltration of virus X from adjacent infected stocks takes place rapidly in normal agricultural practice and is probably the most usual cause of rapid increases in X-content.

Further investigations were made in relation to potato stunt disease. The causative virus appears to be rapidly inactivated *in vitro* and only negative results have been obtained in attempts to prepare an antiserum and examine the physical properties of the virus. The results of electron microscope examinations of infected plant sap were also negative. The disease in potatoes has been compared over a range of British and American varieties with the unmottled curly dwarf and spindle tuber diseases. The latter two diseases resembled each other closely on all varieties and varied only in degree within a variety whereas stunt differed from both in several major characteristics.

A virus, at present unidentified but probably the S virus of Dutch investigations, has been detected by serological methods in a wide range of potato stocks. Work is in progress to estimate the distribution and significance of this virus.

The investigations relating to field immunity from blight have provided further evidence of the instability of the fungus and shown that the four genes so far identified in *S. demissum* are insufficient to guarantee permanent freedom from the disease. Among the many isolates of the fungus obtained from countries overseas, two of them, originating in Canada, proved to be new and to fall into place in the scheme for the classification of sixteen strains previously formulated. The two new races, together with the thirteen already known, bring the total number to fifteen, leaving only one in the hypothetical category. One of the Canadian races, viz. (1234), is capable of attacking plants carrying the four genes $R_1R_2R_3$ and R_4. Tests have revealed, however, that this race is incapable of causing disease in many forms of *S. demissum* and consequently it is clear that additional genes must be present in the species.

Meanwhile it will be unnecessary to go back to wild plants in search of these genes because several seedlings which were retained from the earlier breeding work have proved to be hypersensitive to this and to all other known races. Stocks of true seed, both hybrid and selfed, are available for the continuation of the experiments.

As supplementary to the investigations relating to field immunity from blight the breeding of field resistant varieties was continued. Field resistance, although providing only partial protection against the disease, has the advantage of giving similar protection against all the specialised races that have appeared in the search for hypersensitive varieties. No doubt the ultimate aim will be the combination in maximum degree of both forms of resistance, but it seems probable that if field immunity from the common race were combined with a high degree of field resistance, any specialised races that might arise would have little chance of attaining serious proportions in such a crop. Breeding experiments with this end in view are in progress.

Breeding for resistance to the potato root eelworm has made steady progress and the eelworm plot at Boghall was planted to capacity with hybrid seedlings. Of the four *S. andigenum* families, obtained as seed from Cambridge in 1952, one (ADG 1673) has shown most promise by maintaining the highest level of resistance in crosses with commercial varieties in 1953. Resistance in this material proved to be dominant and plants cyst-free at maturity occurred in such proportion as to suggest the segregation of a major gene controlling resistance. Many of the resistant hybrids, particularly those of earlier maturity, showed considerable improvement in habit of growth and yielding capacity as compared with the wild parent. Plants of this type were employed as parents in backcrossing to commercial varieties and the seed so obtained will provide the bulk of the material available for selection in 1954. A few of the backcross progenies which appear to be particularly promising are being grown in eelworm infested soil under glass in order to facilitate the selection of resistant segregates and also to maintain them in virus-free condition in case some may be of economic value. In due course cuttings from them will be established in healthy soil out of doors for the purpose of assessing economic qualities under field conditions and providing plants for further breeding purposes. By this method

it will be possible to identify resistant segregates and to use them for crossing within the same season.

One interesting fact concerning the mechanism of eelworm resistance in *S. andigenum* came to light in 1953. Evidence has accumulated to show that resistant seedlings can stimulate emergences of the larvæ from the cysts, and that the invading larvæ are subsequently inhibited in the root at various stages of development prior to cyst formation. Examination of roots from a number of cyst-free plants grown at Boghall revealed the presence of larvæ in every case. These resisters, though falling short of commercial potato standards, would appear to be endowed with ideal trap-cropping qualities. The problem for the immediate future is to improve the commercial qualities of the material whilst maintaining the same degree of eelworm resistance.

Root Crops and Other Brassicas

Swedes

The swede material at present under examination has been derived from crosses between Station strains. These strains had each in their time attained a certain degree of merit but were deficient in some aspect. Some had been derived from plants found in commercial crops, but most had been selected from intervarietal crosses. In both cases, however, self-fertilisation for a few generations had apparently fixed the heredity so that selection had little or no further effect. In the present series attempts are being made to retard or avert the onset of this homozygosity. Greater use is being made of mass-seedings in isolation plots, and numerous lines are being taken with a view to recombining the best. Trials were laid out for four purposes, viz. routine tests with the strain AFT, tests on a few likely lines for winter hardiness, assessment of the relative value of groups of lines, and assessment of individual lines within groups.

Strain AFT.—The Station purple-top strain AFT or Ds 32 continues to show winter hardiness comparable with the Aberdeen type of hardy purple-top swede, and to yield as well as the best control in yield trials at Corstorphine. The National Institute of Agricultural Botany has kindly multiplied some

stock seed to obtain several hundredweights, with a view to testing the strain in their regional trials. Samples of this English-grown seed and of a recent stock seed were included in four trials at Corstorphine in 1953. It has always been understood that a large-scale seeding in the South would impart greater vigour to the progeny than could be expected from locally grown stock seed, but the reverse appeared to be the case in this instance. In three of the trials the English seed gave low plant stands, while the stock seed which had been produced at Roslin had very full stands. The effects of this disparity have been eliminated as far as possible by covariance corrections for plant numbers, but it will be seen from the Table that when the dry matter yield for the English sample of AFT is taken as 100, the stock seed of AFT yields about 5 per cent more. The comparison of the two samples with the early type control, Victory, is probably affected by the dates on which the trials were tested and lifted, for trials 53/1 and 53/3, in which Victory did well, were taken early while the other two were left till late in the season.

Trial No.	53/1	53/2	53/3	53/4
AFT—English seed .	100	100	100	100
AFT—Stock seed .	107	105	105	104
Victory—Early type .	104	99	102	93
Champion—maincrop .	98	95	102	93
Aberdeen—late type .	79	70	81	66

Some field tests were made with the AFT strain on farms in East Lothian and Fife. The appearance of the crop was not impressive, though better on high ground near Humbie than when grown alongside Victory in the North Berwick district. In one field conditions had caused a general lengthening of the neck, and AFT had developed longer necks than the other varieties present.

Winter hardiness.—A small trial was carried out to compare a few strains for productivity in October, while parts of each plot were left growing for a test of resistance to frost in February. The latter test was not very critical this year because, although the necks appeared much damaged, the roots were still mostly

sound. The two samples of AFT were at least as sound as the Aberdeenshire type. A line of ANI showed good resistance, high dry matter 12.5 per cent, and very poor yield. In these respects it was similar to other lines of this cross previously tested. The other two lines under test were from a cross, ANX, between Wilhelmsburger and the Station strain AFS. From the good yields and low dry matter percentages, these would appear to be early types, though their roots had not been seriously damaged by the frosts.

Breeding Groups.—Ten lines, which had been mass-multiplied to yield adequate quantities of seed, were sown out in a trial with the usual three controls. The dry matter percentages were very low all round, the highest being AFT with 9.9 per cent and the lowest Victory with 8.7 per cent. Eight of the lines outyielded the best control for yield of dry matter, viz. two samples of AFT discussed in a separate section; three lines of AMU, a purple globe obtained by crossing the old strain ABJ with Danish Bangholm; two lines of APL, a comparatively recent cross between strains ACF and ADC; and one of the AMN lines which were under test in Trial 53/1. The failures were APNca, from a cross between Strain ABJ and Dreadnought, and ANM–V, a supposed clubroot resistant line, from Excelsior × Stirling Castle.

Selection within Groups.—Attempts are being made to select an early purple-top strain from the descendants of a cross named AMN, whose parents were the Station strains ACF × ABJ. Yield trials had been carried out on two previous generations, and most of the eighteen lines in the present Trial, 53/1, had been selected from units which had passed a test. If the mean value of dry matter for the trial is taken as 100, the Victory control would have 107 and Dreadnought, another early variety, 103. Six of the AMN lines lay between these values and another six between 102 and 99. The present series of AMN seems to be yielding as well as, though no better than, a good early variety. Some of the selections had been self-fertilised in bags, while others were seeded together in isolation plots, and pairs of progenies were compared in the trial. There was no apparent tendency for either method of propagation to be more vigorous than the other, but the closely related pairs seemed to have rather similar yields of dry matter and to be alike in having relatively large roots, or high dry matter.

In a second trial, 53/2, there were lines from six different

crossings. The best, apart from AFT, was another early type, APN, derived from Strain ABJ × Dreadnought. Two closely related lines of this headed the list on account of large yields of roots, while a third line was also well above average. On the other hand, the attempt to select a late strain from a cross ANM, between Excelsior × Stirling Castle, gave very poor results and only one of eight lines was above average. Crops of this type have seldom had a chance at Corstorphine, as has been shown by the repeated failure of Aberdeen late hardy types used as controls in the post-War trials, although seed from several sources has been used.

Clubroot resistance.—Tests of swede strains were continued both in the field plot and in boxes of infected soil. Such resistance as there is in swedes appears to be confined to late hardy, globular types, and as has been mentioned above, it is this type which grows so poorly at Corstorphine that the lines tend to be discarded for appearance alone. The strains, which have been of good appearance, have usually failed in clubroot tests.

Kales

Leafy forms of *Brassica* are being sought, which might either improve the efficiency of crops such as kales or rape, or extend the periods of the year when green fodder could be obtained.

Marrow-Stem Kale types.—For some of its uses, the marrow-stem kale could be replaced advantageously by a form which had more leafage and less stem. One of the Station strains of marrow-stem kale, M. 34, has good leafage and a short stem but lacks vigour. In looking for unrelated marrow-stem material with which to cross it, the so-called "Hybrid Kale" from New Zealand was also found to have a high ratio of leaf to stem, though the stems were by no means short. Plants selected from these two sources were seeded together in pairs in isolation plots so that intercrossing could take place. Some progenies were grown in 1953 as unthinned sowings and as spaced transplants, and observations were made on both, though only the transplant trial could be tested for weight of leaf and stem. In this trial, when cut in October, a commercial marrow-stem control strain was found to yield only three-quarters as much leaf as stem, while the progenies had twice or thrice as much. On the other hand this control outyielded all the progenies in

gross weight, because of its enormous stems, which weighed on the average twice as much as the stems of the progenies. In most cases, however, the yield of leaf was considerably in favour of the progenies, the best of which will be propagated from selected plants. A combination of large yield of leafage with a very short stem was not obtained. The mean stem lengths of the progenies differed greatly and though none was as tall as the control, there were no good dwarf types, for those with the shortest stems had obviously feeble constitutions and were not worth keeping. Later in the winter some more plants of each strain were weighed. By that time there had been loss of leafage all round, but the same relationships were found.

Leafy Brassica Hybrids.—A series of hybridisations has been made with thousand-headed kale as one parent and kohl rabi, broccoli, or curly kale as the other, and also the combination kohl rabi × curly kale. Some of the hybrid progenies were sown in a seed-bed and transplanted into an observation plot, with the object of seeing which combinations were likely to be useful before testing the whole series. During the summer, in July and August, the hybrids of thousand-headed kale × kohl rabi looked most leafy and vigorous, especially when the Station line T5 had been a parent, but later in the autumn the thousand-headed kale × broccoli were much the largest. These hybrids shot to flower in the autumn when derived from a plant of Veitch's Self-Protecting broccoli, but remained in the vegetative phase when the parent was Strain 9 : 3, a spring maturing type of broccoli. The hybrids in which curly kale had been incorporated were slow growing and lacked leafage. Selections of good plants were taken from the best of the hybrids for propagation. During 1953 further crossings were made within the material, so that more comprehensive trials will be possible at a later date.

Older Hybrid Kales.—Second hybrid generations of some crossings made in 1950 were observed in a small trial of spaced transplants. When the first generation hybrids were compared in 1951 it was found that those which had the thousand-headed kale line T5 and/or the thousand-headed kale × broccoli, AMK as parents gave good performances, though these old strains had become mediocre in vigour. Here again the cross ARW, descended from T5 × AMK, had a gross yield equal to the thousand-headed kale control strains, with slightly more leafage. T25, a hybrid of T5 × another thousand-headed plant,

was not so good, however, and two crosses with perpetual kale ancestry were definitely poor.

Kales from Jugoslavia.—Seven samples of seed were sent from Jugoslavia by Professor Tåvcar. They arrived rather late, but were sown on 1st May and transplanted to an observation plot in June. Two of the samples were described as *Brassica oleracea* var. *cauliflora*, and the others as var. *acephala*, and they had been gathered from various places near Dubrovnik and Makarska. They were certainly not heading, but contained mixtures of types, few of which would have appeared attractive to British farmers. A few selections were made, and it is hoped to make some hybridisations.

Sugar Beet

The sugar beet research programme is mainly concerned with the problem of the elimination of bolting from crops in the northern parts of the beet-growing area. It was undertaken at the request of the Sugar Beet Research and Education Committee of Great Britain, and was co-ordinated with the work of the Cambridge Plant Breeding Institute.

Assessment of KLT Families.—The largest operation of 1953 consisted of the testing of forty-nine new lines bred at Cambridge for resistance to bolting. The trial at this Station was sown on 11th March, and conditions were favourable for severe bolting as was seen when the standard control, Klein E, had 20 per cent of bolters by early August and 34 per cent on 3rd October. In contrast only four of the Cambridge lines had more than 10 per cent of bolters in October, and twenty-one lines had less than 3 per cent. Bolting was very slight in the trial at Cambridge, and the tops were small there. It was possible at Corstorphine, however, to observe the foliage in a well-developed state and free from Virus Yellows. The main yield trial was held at Cambridge, but check tests of yield and sugar content were taken at Corstorphine and the washed roots were examined for shape and fangs. Finally, when the information had been pooled, plants were selected from certain lines and sent to Cambridge for propagation.

Assessment of KNB Families.—For the last few years, certain Cambridge families of sugar beet, or derivatives propagated at Corstorphine, have been under test for resistance to

bolting and also for their yielding capacity. As the Cambridge Institute have now decided which of these older families are best suited for combination in a strain, this phase of the work is nearing completion. In 1953 there were seven polycross samples, *i.e.* seed from mother plants of seven families which had been interplanted in order to favour cross pollination. There were also samples of seed of four of these families, which had been propagated in isolation. Three experimental combinations and a triploid had been sent from Cambridge for test, and a standard control, Klein E, was included. As usual the seed was sown out in two adjoining trials, the first of which was sown on 23rd–24th March, and the second on 17th–20th April. Practically no bolting occurred in the April sown trial, but in the March sowing the control had 31 per cent of bolters by mid-September. The new experimental units from Cambridge showed little bolting, but some of the families which had been propagated in Scotland had considerable numbers of late bolters, up to 19 per cent in one case. These lines had received only one light treatment, and that several generations ago. The different families showed different reactions to bolting, and where there were both polycross and line samples there was considerable similarity in performance. This was also seen when tests of yield and sugar content were carried out on both trials. The individual results are of little interest except to the breeder, but in general it may be said that the April sowing of the control set a high standard, which was attained by several of the March sowings and by two or three April sowings. The early sowings tended to have greater root weight and lower percentage of sugar than the late and their tops were much heavier.

Station Lines.—Eighteen lines derived from selections made by the Station were sown out in a trial on 3rd April. The standard control Klein E had 5 per cent bolters on 10th August, and about 10 per cent by mid-September. One of the so-called "Logie" families had been light treated at Cambridge, and five lines and a bulk sample all showed less than one per cent of bolting. Eleven samples of Scotscraig ranged from 0.4 to 10.9 per cent. These have not yet received light treatment, but it is hoped to commence treatments after the move to the new Station. A sample of Klein AA, which was included in this trial, had only 1.2 per cent of bolters by mid-September.

Plot tests were not carried out on this trial and instead some

of the lines were rejected for fanged roots, while the others were selected, first by appearance and then by weight and soluble solids content, to obtain roots for propagation. The Logie light-treated family had the best root shapes as well as freedom from bolting, several lines were kept, and a composite group of the fifty best roots from all the lines was sent for seeding at Cambridge.

Interaction of Sowing Date and Strain.—The second of a series of trials designed to compare the behaviour of a standard variety with that of a non-bolting strain, when sown on different dates in the spring, was carried out in 1953. As in 1952, the standard variety was Sharpe's Klein E, and the non-bolting strain a Cambridge family, KNB 178, a good line but not a composite strain ready for the market. The sowing dates were also close to those of 1952, 9th March, 2nd April and 20th–21st April. Bolting was observed every week from June to mid-September.

BOLTING IN TWO STRAINS SOWN ON THREE DATES

Sowing Date	March 9		April 2		April 20–21	
Strain	Klein E	KNB 178	Klein E	KNB 178	Klein E	KNB 178
Percentage of Bolters on—						
June 12, 1953	1.3	0.0	0.0	0.0	0.0	0.0
,, 17	4.3	0.0	0.0	0.0	0.0	0.0
,, 26	11.5	0.0	0.3	0.0	0.0	0.0
July 3	14.7	0.1	1.5	0.1	0.1	0.0
,, 10	18.8	0.1	1.7	0.1	0.1	0.0
,, 16	23.1	0.3	3.6	0.1	0.2	0.0
,, 22	26.4	0.5	4.3	0.1	0.2	0.0
,, 29	28.2	0.9	5.2	0.1	0.3	0.1
August 5	31.8	2.0	6.3	0.1	0.3	0.1
,, 12	34.9	3.0	7.6	0.3	0.5	0.1
,, 19	37.3	3.8	8.4	0.4	0.7	0.1
,, 26	38.7	4.3	9.8	0.4	0.7	0.1
September 2	40.1	5.1	9.8	0.4	0.7	0.1
,, 9	43.3	6.3	11.0	0.5	0.8	0.1
,, 16	47.0	7.7	11.9	0.6	0.9	0.1
September 17, 1952	30.6	2.3	2.6	0.3	1.7	0.0

It will be seen from the Table that Klein E, when sown on 9th March, started bolting in June and that the proportion of bolted plants increases evenly by weekly increments till 47 per cent of the crop had bolted in mid-September. The corresponding sowing in 1952 had started bolting rather later, increased slightly less quickly and reached only 30.6 per cent by mid-September, as is shown at the foot of the Table. Bolting was more severe than in 1952, for the second sowing of Klein E, on 2nd April, had nearly 12 per cent compared with less than 3, and the KNB 178 was also somewhat affected in its March sowing, but its efficiency in resisting bolting is striking.

The sugar content and yield were determined for every plot, and as the plant stands were not too erratic this year, it was possible to compare the three sowings. The early-April sowing gave the largest roots and the most sugar per root, the March sowing following closely and the mid-April being lower in value. On the other hand some adjustments are needed for the losses due to bolting. The early-April sowing of Klein E was probably the best crop of the six even allowing for the trouble caused by its 12 per cent of bolters and the actual loss of perhaps half of them. On the other hand if the numbers of bolters in the March sowing are taken into account the Klein E crop was definitely lower yielding than KNB 178, which was not unduly affected by bolting. It should be noted, however, that conditions may be very much more severe in other districts. For instance, a member sowed two resistant strains of sugar beet in an exposed field on the coast of Angus a few days before the first sowing of this trial, and each bolted about 30 per cent and had many useless roots. Unfortunately no seed of a normal strain was sown at that time as a control.

Propagation.—Groups of plants were seeded in isolation plots in the Lothians. Some plots failed, but on the whole the crops were harvested in better condition than in the previous two years. Seed of the progenies of some single plants showed good germination, but there was a lot of poor samples. A group of plants was seeded at Cambridge by the Plant Breeding Institute, which has also kindly accepted six groups for seeding in the present season, in addition to thirteen groups selected at Corstorphine from the KLT trial described above.

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APPENDIX

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Publications

BLACK, W., C. MASTENBROEK, W. R. MILLS, L. C. PETERSON. "A proposal for an international nomenclature of races of *Phytophthora infestans* and of genes controlling immunity in *Solanum demissum* derivatives." *Euphytica*, 2 (1953): 173–178.

The differential host series employed by the four authors were exchanged and the reactions of the races isolated or employed in the different countries were ascertained. The results obtained made it possible to standardise the designation of the races of the blight fungus and of the genes for immunity derived from *Solanum demissum*. For both purposes the nomenclature of Black was chosen.

BLACK, W. "Late blight resistance work in Scotland." *American Potato Journal*. (In Press.)

GREGOR, J. W., and PATRICIA J. WATSON. "Some observations and reflections concerning the patterns of intraspecific differentiation." *New Phytologist*. 53, No. 2, 1954.

Populations of *Lolium perenne* illustrate some of the practical difficulties of recording the environmental tolerances of species in terms of discrete ecotypes. It is suggested that as subjectively defined groupings are often involved and as a single population may be classified in a number of different ways, no one classification, but rather a number of different classifications united by the use of a common root term, is likely to provide a system of recording that is sufficiently flexible to cope with the ever-increasing variety of genecological information.

OCCASIONAL PAPERS

Swede Trials at Corstorphine (1924-1954)

By V. McM. Davey

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Trials of one sort or another were laid out with swedes nearly every year at Corstorphine since about 1924, when the first Director, Professor M. Drummond, and F. W. Sansome arranged observation trials with numerous samples of named varieties or strains. The three Scottish Agricultural Colleges co-operated in this investigation by carrying out yield trials at several centres, and also by examining methods of analysis. At Craigs House, however, a study was made of the morphological differences to be found both *between* and *within* strains. Typical and atypical specimens were selected and in due course propagated by bag isolation to supply seed of self-fertilised progenies. For the next few years first the progenies and then inbred lines derived from them, were studied and compared with samples of the variety to try to decide how far the original differences had been due to heredity and how much they owed to environmental modifications. Further selections were made from commercial strains, mostly plants of ideal appearance and large size, but curiosities and rogues were also kept and propagated. From the behaviour of their descendants the original plants might be placed in four classes:—

1. Hereditarily similar to types commonly occurring in the variety.
2. Similar to the variety except for some noticeable character.
3. A true swede, but of distinctly different form.
4. Not a true swede.

The first class was the commonest, and where the plant had been taken as typical, or merely for its large size, this was to be expected. The size of the storage organ or "root" is controlled mainly by its environment, and hereditary differences can only be detected by comparing populations. The shape of the "root" is also subject to great modification, and plants selected for abnormal shapes generally had progenies fluctuating within the range of the variety. On the other hand, the pattern and habit of the foliage showed hereditary variations, for the

selected plants nearly always bred true for some characteristic foliage type while the parent variety contained a mixture of such types. In the second class, the most common condition was a genotype recessive for one of the few major genes. Plants with bronze-top skin colour lack a major gene giving completely purple skin, but possess some factors which cause or intensify a purple mottling. Though rarely found in some old, established varieties of purple-top swede, bronze-tops may constitute as much as 5 per cent of the crop in a new or poorly selected strain. In some kinds of swede, however, the skin colour is regarded as unimportant, *e.g.* both purple and green may occur in various proportions in some varieties of the hardy, late Aberdeenshire type and also in Scandinavian strains derived from Bangholm purple-top × Wilhelmsburger green-top combinations. A collection of bronze- and green-top lines was examined and it was found that most of them differed from their variety only in that one respect, but a few were obviously of a different type. As might be expected, a proportion of the purple-top plants selected proved to have been heterozygous because their progenies segregated for skin colour. In the third class there were the plants of distinct type occasionally found in a crop, whose descendants also exhibited the atypical characters. An admixture of seed must have occurred at some stage, and sometimes the variety of the rogue could be named. It was this type of variate which created chief interest in the early years, for it was then thought to be a chance recombination of the varietal genes, and that by inbreeding from a suitable selection a new strain could be obtained. The best and most distinctive line developed in this way at the station was finally identified as synonymous with a Dutch type which must have been mixed into the parent variety at one time, but not in subsequent years, and this opens the question of the nature of a variety.

The Variety.—Various combinations of colour, shape and maturity give a number of recognisable *types* of swede. Possibly some of these types were originally varieties in the sense that they were products of a breeder, but for a long time they have been propagated and selected by many seed growers till there are now a number of "varieties" of similar appearance bearing different names or alternatively a number of seedsmen's strains bearing one varietal name, *e.g.* "Best-of-All." If a breeder controls a variety for a long period, a stable product can be

maintained, but this is achieved by selecting according to some strict standard, and in other hands the type might change. When a number of seedsmen's strains of "Best-of-All" were compared in a trial in 1926, the modal shape varied from oval in a strain sold in England to flat-globe in one for the Aberdeenshire market. In any crop, however, shape and size may fluctuate greatly, leaf characters may vary considerably, but skin colour will usually be constant except in so far as it may be intensified by exposure to sunlight. There are few if any major gene alleles within a variety, but there are probably numerous polygenes giving quantitative differences in storage efficiency of the "root," resistance to clubroot and tendency for the "neck" or stem to elongate during the first year. The proportion of self-fertilised and intercrossed seed may vary with the insect population, but selfs seem to be common. Occasionally a variety of distinct appearance comes on to the market, perhaps to start yet another group synonym.

A fourth class was listed above in which the plants were not true swedes. The most common "rogue" of the swede crop is swedelike rape. It is commonly grown broadcast on arable land, and may be present as seed in the soil, when it can be mistaken for a vigorous swede seedling. Rape seed may also be mixed with that of swede and escape detection. Many rogue plants were sent to the Station for identification, and specimens were often seeded to give self-fertilised progenies which were compared with samples of rape grown as spaced plants as for swedes. When cultivated in this way Dwarf rape forms a dark green rosette of leaves but does not bolt, so that it is less noticeable in a swede crop than Giant rape which has also dark green leaves but develops a long stem and may flower. Occasionally hybrid swede × rape plants have been sent in, and at least one case of second generation segregations has been noted.

Yield trials.—Statisticians have devised many new forms of yield trial during the past thirty years, and a number of these have been adopted for the swedes, though often after some time lag. At first alternating plots with a standard control and systematic lay-outs were still in vogue, but randomised block and latin square designs were the general practice between the Wars. This meant that very few lines or progenies could be compared efficiently in one trial, because the size of the blocks became too large. After the War a lattice-square lay-out which permitted twenty-five treatments to be compared in only

three replications made a great change in the scope of operations, while other recent designs were tried where seed was more plentiful.

The supply of seed from single plants, and the plant stand of the trial were ever-present difficulties. The progeny of a single, bagged plant might amount to 60 g. of seed, but in most years there were relatively few plants which yielded more than 28 g. In farm practice an ounce of seed will sow one hundred yards of drill, and by hand sowing, thinly, it can be made to cover two hundred yards, *i.e.* four plots could be sown which when singled would have a maximum stand of 200 plants each. Gaps are liable to occur with such thin sowing, especially if the condition of the seed is imperfect. It is true that the seed could be made to go further and the stand improved by placing in dibble holes, but swedes grown this way are deep seated and have quite different shapes from those obtained by the common practice of "dropping" the seedling by hoeing the earth from its roots. The condition of the seed from self-fertilised plants varies very much because the swede plant is prone to sudden death when the storage root collapses. A good sound root should survive till the seed is fully developed and ripe, but rotting may occur earlier, so that the seed, though viable, is only partly filled and imperfectly ripened. This is more common after a season when the crops had large roots and low dry matter percentages. Thus the progenies might be handicapped by the condition of their seed, which should not be counted against them, but sometimes also by susceptibility to dry-rot, which certainly was a hereditary defect. Unless it had been kept for long, the commercial seed used for controls was in better condition than the progenies, because it had been grown in a more suitable climate and carefully dressed. In trials the plant stands of the controls were among the least affected by gaps, unless the seed was too old.

The effects of differing plant numbers were obvious, but for some years there was no remedy. Then covariance methods became available, and during the first two years of the War the data of all the earlier trials were examined and re-worked. It was not possible to publish the results at that time, and after the War they were of little interest, but the summarised conclusions might be given here :—

> "The number of plants per plot in small yield trials of swede is very erratic, because of deaths which may be due to weather, pests or diseases, and which may occur at any period of the growing season.

Plant numbers might be expected to vary at random, but there are also differences between treatments (*i.e.* strains). Treatment variances for plant numbers were significantly greater than random in eleven out of twenty-five trials; old or badly matured seed and the incidence of dry-rot were recognisable causes of treatment differences. Swedes adjacent to gaps have heavier 'root' than average, so that plant numbers may influence the relative values of treatments. Covariance provided a means of studying the influence of differences in plant numbers on estimates of (1) dry-matter percentage, (2) root weight, and (3) dry-matter content of the bulk, the conclusions being as follows:—

(1) Plant numbers had no appreciable effect on dry matter percentage. The covariance corrections were insignificant and the correlation coefficients varied from +0.5 to −0.2 in 16 trials.

(2) Plant numbers influenced the 'root'-weight inversely. The correlation ranged from −0.8 to −0.5 in 22 trials but was absent in three others. Considerable improvement in the precision of the trial was often obtained, and the relative values of strains were sometimes considerably altered by the covariance adjustments.

(3) Plant numbers influenced dry-matter content in the same way, and to the same extent, as they affected the root weight. Correlations ranged from −0.75 to −0.5 in 13 trials and were absent in the three mentioned above. Improvements in precision and alteration in relative values of treatments were obtained in some trials but not in others."

It seems only prudent to ascertain the effect of plant numbers in each trial and to adjust the treatment values when necessary, but it must be admitted that this greatly adds to the labour of computation which is already very considerable in lattice and other complex designs. There is also the question of what characters should be tested. Yield of dry matter is an economic criterion which is carefully studied on the Continent but practically disregarded in this country. Whether it is expressed as the yield of the average root, or per acre is immaterial since the adjustments for negative and positive correlations respectively should bring the treatment values into the same order of merit. Yield of roots per acre interests the farmer, but average root weight may give a better picture to the breeder who is concerned to distinguish maturity types. Dry matter percentage indicates the quality of the root and in conjunction with root weight helps to determine the type. The inverse correlation between percentage of dry matter and weight is strong, but not complete. In individual plants of a crop it was

seldom found to be more than —0.5. Early maturing varieties like Victory have very heavy yields of root and low percentages of dry matter, while maincrop and late sorts have high percentages and smaller crops; this may be seen in Table II.

Dry Matter Percentage.—The most striking feature about the Corstorphine trials was the number of years in which the swede crops showed low percentages of dry matter. Ten per cent is usually regarded as low for a swede, but in two years since the War, 1945 and 1949, not only the early Victory but Champion and Aberdeen were also below this value (Table I.). In such seasons there was very little range between early and late types, but in years such as 1951, when high percentages were obtained, the strain differences were much more distinct. Table I. gives the dry matter percentages of the three control varieties which have been used in all trials since the War. In the 1927–1939 series of trials the controls were chosen for kinship

TABLE I. Dry Matter Percentage in Swede Types

Type Variety		Early Victory	Maincrop Champion	Aberdeen late (Several)
Year and Trial No.				
1945	1	8.6	9.2	9.2
,,	WR	8.7	9.6	9.5
1946	WR	10.1	10.7	11.1
1947	WR	10.4	11.6	11.3
1948	1	10.2	10.7	10.7
,,	WR	9.8	10.3	9.7
1949	1	8.7	9.3	8.2
,,	2	8.6	9.5	9.5
1950	2	9.8	10.5	10.2
,,	WR	10.5	11.5	11.7
1951	1	12.1	12.5	13.4
,,	4	11.6	12.7	12.8
,,	2	11.0	11.3	12.2
1952	1	10.7	11.9	12.6
,,	2	9.6	10.8	10.9
1953	1	9.7	10.5	10.7
,,	2	8.7	9.6	9.1
,,	4	8.7	9.5	9.2
,,	WR	9.4	10.5	10.5

with the experimental material, and the seasonal differences are complicated by those of strain. From Table I. it will be seen that Victory had a lower percentage of dry matter than the corresponding samples of Champion maincrop and Aberdeenshire late. Nevertheless in different seasons Victory gave percentage values ranging from 8.6 to 12.1, while Champion varied from 9.2 to 12.7, and the Aberdeenshire late types varied still more. Some of the trials were tested before the late types were mature, but when percentages were high they might be over 13 per cent.

In Table II. the weights per root and yields of dry matter per root are given for a few of the trials. The example for 1949 was in very bad condition when tested and the roots subsequently decomposed with a soft rot. At the other extreme the 1950

TABLE II. Composition of Roots in Different Years

Year and Variety		Dry matter percentage	Mean root weight in lb.	Mean dry matter per root in lb.
1945	Victory	8.7	2.8	0.24
	Champion	9.6	2.4	0.22
	Aberdeen	9.5	1.8	0.17
1946	Victory	10.1	2.7	0.28
	Champion	10.7	2.4	0.25
	Aberdeen	11.1	2.2	0.24
1947	Victory	10.4	3.0	0.31
	Champion	11.6	2.5	0.29
	Aberdeen	11.3	2.2	0.25
1948	Victory	9.8	3.6	0.36
	Champion	10.3	3.1	0.32
	Aberdeen	9.7	2.6	0.25
1949	Victory	8.7	2.4	0.21
	Champion	9.3	1.9	0.18
	Aberdeen	8.2	1.4	0.12
1950	Victory	10.5	3.7	0.38
	Champion	11.5	3.0	0.34
	Aberdeen	11.72	2.9	0.34

trial had good percentage of dry matter and large roots. In all the examples shown here, and in all the trials where they have been sown together, Victory outyielded the other two for weight of root, and this superiority has nearly always been sufficient to give Victory the highest yield of dry matter also. Corstorphine is a district where soft, early types grow well. Besides Victory a white-fleshed, green-top variety gave enormous yields of soft roots, and the more promising Station strains have mostly tended to be large and relatively low in dry matter percentage.

On the other hand certain types very seldom yield well at Corstorphine. The purple-globe "Best-of-All" is one, but the hardy, late Aberdeenshire types are notoriously bad. Records of trials held elsewhere and inspection of the crops at Craibstone show what good yields can be obtained. The seed used as the "Aberdeen" control was obtained from different seedsmen and bore different varietal names, but always the yield was poor. In trials left growing till February as a test of winter hardiness, the Aberdeenshire type had a greater proportion of sound roots than Victory and was usually sounder than Champion, though in some of these trials the winter was too mild to afford a proper test.

The significance of the failure of Aberdeenshire types as controls at Corstorphine is that selections made for high percentage of dry matter and possible resistance to clubroot were usually rejected because of their poor yields and unattractive looking roots. It is very desirable to test new strains under different environments to assess their value.

Selection for Dry Matter.—Individual plants of a population were selected for weight and dry matter percentage as indicated by a core bored through the root. The practice was discontinued mainly because of the poor seed yields from the damaged roots. Though there was a considerable number of plants with small roots and low dry matter percentage, probably due to immaturity, there were comparatively few with both large roots and high dry matter. Such plants were selected, and most of them had progenies which were either slightly above average in percentage and lower in yield, or *vice versa*. One or other of the high values shown by the parent plant had been entirely due to modification. It seemed preferable, therefore, to make the first test on the progenies of plants selected from commercial crops, or after the early years of the

work, from F_2 populations of inter-varietal crossings. This was done in replicated yield trials if possible, but some idea of type could be obtained from a single plot.

Trials and Breeding Methods.—At the beginning of this paper mention has been made of lines bred by the selection and self-fertilisation of single plants originating from plants of a commercial variety. Yield trials were first used to compare these lines with one another and with a sample of the parental variety. The results were reviewed in 1936, and it was found that about a third of the lines tested were definitely worse than their variety, a third nearly equal to it, and a third giving slightly better values but barely significant. It was considered that if a stock had become mixed or contained some undesirable characters, it might be made more uniform by breeding from some typical plants and throwing together the lines that proved satisfactory. There seemed little chance of obtaining a new variety, the best of the Station lines being traced to some other variety than that in which it occurred.

The second stage of the work was to compare lines derived from crosses between different types of swede. All possible combinations were made, and some of them, *e.g.* Purple-top × Green-top, gave lines of very poor appearance. Other combinations had better hybrids, and after a large number had been examined in trials and observation plots, some dozen were chosen and intensively studied during the War period. Self-fertilisation by isolation in bags was the only practical means of propagation at that time, and the lines became inbred after about four generations both for the qualities under consideration and also for faults such as splitting or neckiness, which could no longer be eliminated by selection. It was concluded also that the inbreeding had put the strains at a disadvantage when compared with the commercial variety, which seems to derive vigour from its somewhat heterogeneous nature and partial cross fertilisation. One inbred line, however, still compares well for yield of dry matter with the commercial controls.

The last stage of the trials at Corstorphine has consisted of attempts to breed strains which do not become too inbred. Crosses were made between the older established lines, and numerous lines of similar phenotype were selected. These were tested in the bigger trials which were then available, and propagated sometimes by selfing, sometimes by seeding plants

from several similar lines in an isolation plot, and occasionally by hand-crossing pairs of lines. The three commercial varieties mentioned above were used as controls in every trial, and some of the lines have yielded quite well in comparison. It is mainly soft, heavy-yielding types which have shown to advantage at Corstorphine, and it will be of interest to see whether other types are favoured when the Station moves to its new premises at Seafield at an elevation some 300 feet higher.

THE SCOTTISH PLANT BREEDING STATION

An Historical Review

By R. J. L. GALLIE

Scottish Plant Breeding Station, Seafield, Roslin, Midlothian

In recent years developments in agricultural research have shown the increased importance placed upon it by the Government. Since the last War large sums of money have been spent on a programme of expansion in this field. In the agricultural research service, through training grants, studentships and fellowships, young men and women are being provided with greater opportunities for extending their knowledge and improving their prospects of promotion to the highest posts. By means of substantial Government grants new research stations have been set up and long established ones expanded. Of the latter the Scottish Plant Breeding Station is a prominent example, for this year the Station will move from Craigs House, Corstorphine, to new and extensive premises at Seafield, Midlothian, on the estate of the Edinburgh Centre of Rural Economy. While this departure to larger and more up-to-date laboratories has been made possible only by Government aid, it is fitting and perhaps of value to look back to the establishment of the Station and to recount its subsequent development, for the origins of the Scottish Society for Research in Plant Breeding stemmed largely from the initiative of business men and practical farmers in Scotland. Since, however, the results of scientific investigations carried out by the Society have been published in its Annual Reports and elsewhere what follows is a brief account of its foundation and development viewed only from an administrative aspect. It may also serve as a valediction to the home of the Scottish Plant Breeding Station for so many years, Craigs House, Corstorphine.

Background

The value to agriculture of breeding new and improved plants had been recognised long before the advent of the 1914–18 War, but the paralytic condition of agriculture in the preceding decades, brought about by economic forces over which the industry had no control, was not conducive to new ventures in plant research. Government policy had favoured the consumer so that foreign imports depressed the price of

home-grown foods. The consequence was that never before 1914 had the recorded arable area of Britain been so small. From 1871–75 the average arable acreage of England, Wales and Scotland combined was 18,242,204, while the corresponding acreage in 1914 was 14,293,741. For Scotland alone the decrease was 180,355 acres. At the beginning of the century plant breeding abroad, however, had received a great impetus from the re-discovery of the Mendelian theory of inheritance and it appeared from reports of work in progress at research stations abroad, particularly from the Swedish station at Svälof and from Denmark, that Britain must give more attention to agricultural education and research. In 1916 the Government appointed an Agricultural Policy Sub-Committee of the Committee for Post-War Reconstruction, with the following terms of reference: "Having regard to the need of increasing home-grown food supplies in the interest of national security, to examine and report upon methods of such increase." Although appointed to advise the Government on the peace-time development of agriculture, the Committee—commonly known as the Selbourne Committee—found it impossible not to relate its task to the effect of home production of food in wartime for it is then any weakness of policy would endanger national security. A Parliamentary paper of 1916, for example, vividly revealed the contrast between German and British agriculture. The paper stated that:—

"On each hundred acres of cultivated land

1. The British farmer feeds from 45 to 50 persons;
   the German farmer feeds from 70 to 75 persons.
2. The British farmer grows 15 tons of corn;
   the German farmer grows 33 tons of corn.
3. The British farmer grows 11 tons of potatoes;
   the German farmer grows 55 tons of potatoes.
4. The British farmer produces 4 tons of meat;
   the German farmer produces 4½ tons of meat.
5. The British farmer produces 17½ tons of milk;
   the German farmer produces 28 tons of milk.
6. The British farmer produces a negligible quantity of sugar;
   the German farmer produces 2¾ tons of sugar."

And this under agricultural conditions not less favourable to the British farmer. The drift away from arable agriculture which had gone on over the years in Britain was obvious.

Lord Selbourne, Chairman of the Committee, informed a conference in Edinburgh in 1917 that the United Kingdom fell lamentably short in making proper provision for agricultural research and education. He said that in the year before the War the United Kingdom did not spend more than £300,000 on agricultural education. In the same year Canada spent a million pounds; France spent over a million, and Russia spent £600,000. Expenditure in the U.S.A. ran into several millions. The main object of the Selbourne Committee, however, appeared to be to break in the post-war years the cycle of vexatious lean years in agriculture which had drained away farm workers from the industry, impoverished farmers and produced a kind of pastoral agriculture which had so gravely imperilled the country. In the minds of agriculturists, however, the hope was nourished that the "consumer first" policy of pre-war Governments would be reversed in the post-war era and that such a change would induce a re-vitalised rural economy. It seems, however, that it was the appalling disparity between German and British agricultural output that stirred administrators and agriculturists alike.

Foundation

In Scotland an address by Dr Russell, Director of Rothamsted Experimental Station, to the Highland and Agricultural Society in 1917 stimulated the interest of those present in the need for more research work in Scotland. Moreover, productions of the Swedish Station at Svälof were becoming increasingly known and appreciated by farmers. In 1917 the Directors of the Highland and Agricultural Society appointed a delegation to meet the Secretary of the Board of Agriculture for Scotland "to discuss the desirability of setting up some authority (*a*) to decide what are and what are not new varieties of plants and also to grant certificates for such as, after careful trial, are recognised as new and improved varieties; and (*b*) to encourage the selecting and raising of new varieties." The delegation was led by the late Mr James Elder, Athelstaneford, Drem, and the late Dr Charles Douglas, C.B., Auchlochan, Lesmahagow. It was agreed by the Board of Agriculture for Scotland to proceed at once with the first of these projects and in the spring of 1918 a Government Plant Registration Station was set up. The second objective was deemed not immediately

practicable and the establishment of a research station was therefore deferred. But not for long, for in 1918 discussions again took place with the Board which resulted in the Highland and Agricultural Society convening a conference in the same year with the object of establishing a Plant Breeding Station in Scotland. Representatives from the Scottish Chamber of Agriculture, the National Farmers' Union of Scotland and the Scottish Seed Trade Association attended, and the chair was taken by the Secretary for Scotland, the Rt. Hon. Robert Munro, K.C., M.P. The need for setting up a research station was unanimously recognised; motions to establish and finance one were made without debate. In his address to the Meeting the Chairman intimated that from public funds the Government was prepared to subscribe to the inaugural fund one pound for each pound contributed by the public up to a reasonable limit. Some apprehension appears to have existed in the minds of those present about the degree of control the Government might wish to exercise over the new organisation, for Dr R. B. Greig (later Sir Robert B. Greig) said "he wished to be allowed to remove what appeared to him to be a misapprehension as to the question of controlling a station such as was proposed. Dr Douglas and Mr Shields would bear him out when he said that there had not been any suggestion that the station should be controlled by the Board of Agriculture. It was far more important that it should be a national institution such as had been described by Dr Douglas, than an annexe of the Board of Agriculture. This was much more a national business than a departmental one. It was of national importance, in order to produce what was required for the benefit of the people as well as for the benefit of the farmer, but it was of first importance that the farmer in Scotland should have a personal and definite link and deep interest in the proposal. Of course, he must modify the statement that the Board desired to have no control of this institution, because if the Board gave a proportion of the funds it was entitled to representation in proportion to these funds; but that was the only way in which there should be any kind of control by the Board of Agriculture, which was sufficiently weighted with burdens just now, and was glad to be relieved of some of them." It is interesting to note that one seed merchant present, who had intended to make it a condition of his substantial donation that the station should be in the hands of business men in the agricultural industry, waived this

condition after receiving Dr Greig's assurance. In the light of later developments it is perhaps worthy of mention that the approved Government policy in relation to the new station was that it should be self-governing and by means of Government assistance should not be allowed to depend upon the accidents of annual subscriptions, for to do otherwise was likely to influence the research programme unduly towards producing immediate results. It was felt too that if the post of Director were to attract a man of the highest scientific attainment he should not be tied by subscribers who might wish to see tangible results year after year, but should have freedom to go into the most fundamental research.

Arising from the conference in 1918 a Committee was formed for the purpose of raising finance. It consisted of the following members:—

10 from the Highland and Agricultural Society
10 from the Scottish Chamber of Agriculture
10 from the National Farmers' Union of Scotland
10 from the Scottish Seed Trade Association
1 from the West of Scotland Potato Trade Association
1 from the Edinburgh and East of Scotland Potato Trade Association
1 from the Perth and District Potato Trade Association
1 from the Corn Millers' Association
1 from the West of Scotland Wholesale Ryegrass Machiners' Association
1 from the National Association of Corn and Agriculture Merchants.

By 1920 the Committee was able to report that £21,000 had been received from firms, associations and persons and shortly afterwards the fund was closed at £22,500. As promised, the Government from the Agricultural Development Fund subscribed a similar amount, bringing the initial fund up to £45,000. There followed the formal steps of giving the new organisation a name and drawing up rules. The name chosen was the Scottish Society for Research in Plant Breeding and as such the new organisation became registered in 1921 as a specially authorised Society under the Friendly Societies Act, 1896. The Directors held their first meeting on 6th September 1920, and the first office-bearers elected were:—

Trustees:

The Rt. Hon. ROBT. MUNRO, K.C., M.P., Secretary for Scotland.

CHARLES DOUGLAS, C.B., D.Sc., Auchlochan, Lesmahagow, *Chairman.*

James Elder, Athelstaneford Mains, Drem, *Vice-Chairman.*

David Bell, 15 Coburg Street, Leith.

J. F. McGill, 69 Kyle Street, Ayr.

Directors :

D. L. Bowe (Messrs J. H. Bowe & Sons), Dunbar.

Sir James Campbell, LL.D., 14 Douglas Crescent, Edinburgh.

Sir Isaac Connell, S.S.C., 18 Duke Street, Edinburgh.

William Cuthbertson, V.M.H. (Messrs Dobbie & Co.), Edinburgh.

J. Inglis Davidson, Saughton Mains, Corstorphine, Edinburgh.

J. W. Drummond (Messrs W. Drummond & Sons, Ltd.), Stirling.

George A. Ferguson, Surradale, Elgin.

David Ferrie of Parbroath, Cupar, Fife.

Lord Forteviot, Dupplin Castle, Perth.

A. B. Fulton (Messrs Jas. Fulton, Jun.), 118 Queen Street, Glasgow.

James Gardner, South Hillington, Cardonald.

Sir Archibald Buchan Hepburn of Smeaton, Bt., 21 Lansdowne Crescent, Edinburgh.

J. H. Milne Home, Irvine House, Canonbie.

W. W. Hope, The Knowes, Prestonkirk.

John McCaig of Belmont, Stranraer.

J. T. McLaren, The Leuchold, Dalmeny.

A. T. McRobert (Aberdeen Lime Co.), Aberdeen.

George G. Mercer, Southfield, Dalkeith.

Principal W. G. R. Paterson, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow.

G. B. Shields, Dolphingstone, Tranent.

Sir David Wilson of Carbeth, Bt., Killearn.

Nominated by the Board of Agriculture for Scotland :

Sir Robert B. Greig, M.C., LL.D.

T. Anderson, M.A., B.Sc.

A. McCallum, M.A., LL.B.

James Wood, O.B.E., M.A., B.Sc.

Mr John Stirton, Secretary of the Highland and Agricultural Society, assumed the additional responsibility of Secretary to the new Society.

To supervise the affairs of the Society in more detail, the Directors appointed three Standing Committees. These were:—

Research . . .	To prepare plans and reports of: Research, selection of seeds and plants, and special points in manuring.
Finance . . .	To deal with resources, expenditure, investments, estimates and accounts.
Management . .	To take charge of staff, cultivations, and all matters affecting the land, buildings, equipment, &c.

The Research Committee had sub-committees for dealing with individual crop programmes.

Such an arrangement for control matched the situation for many years, but eventually, in 1951, the Research Committee was disbanded in favour of four Standing Committees for "crop" research, one for each section of the work.

According to the rules, the objects of the Society were to promote agriculture, arboriculture or horticulture, and its operations in carrying out these objects were to be exclusively scientific and limited to experimental and other research for the improvement of plants and crops in Scotland and investigating conditions affecting their production.

While the Plant Breeding Station was to function as an independent research station it appears the sponsors intended it should operate in conjunction with the Government Registration and Seed Testing Station. The Plant Breeding Station was to produce, the Registration Station to evaluate new plant varieties. As matters developed, the two Stations became neighbours at East Craigs, Corstorphine, for in 1920 the Society purchased the mansion-house of Craigs House along with thirty acres of land, and later the Board of Agriculture for Scotland erected extensive modern premises on adjacent land. The Director of the Plant Registration and Seed Testing Station became a Government nominated member of the Society's Board of Directors, and because of the close proximity of the Stations there developed between them a valuable and harmonious association.

Operation

The Society began operations at Corstorphine with a staff of two scientists, Mr Montagu Drummond, B.A., F.L.S., as Director of Research, and an assistant. Four years later Mr Drummond resigned to take the Chair of Botany at Glasgow University. The post was filled by his Assistant, Mr William Robb, N.D.A., F.R.S.E., who had some years previously been associated with the renowned plant breeder, Dr Wilson of St Andrews. With the assistance of the Board of Agriculture for Scotland a comprehensive collection of foreign oats and barleys was obtained, which, along with a unique collection of potatoes raised by Dr Wilson and presented to the Society, provided material for the first programme. Specialisation at that early stage in the life of the new station was naturally impracticable, but a beginning was made which embraced collecting and classifying suitable material, isolating strains and comparing their relative merits. The work was divided into four sections—cereals, herbage plants, potatoes and roots.

In 1929 the Empire Marketing Board, in response to an application, made a grant which enabled the Society to engage in investigations into virus diseases of potatoes and which led to the establishment of sub-stations at Huntly, Aberdeenshire, and Kirknewton, Midlothian, and to the erection later of new laboratories and greenhouses at Craigs House. Three more members of staff were recruited. Income to maintain the work was also granted by the Empire Marketing Board and when in 1934 the Board was dissolved, the investigations continued supported by funds administered by the Department of Agriculture for Scotland.

The founders had envisaged that the work of the Plant Breeding Station would have a practical aspect, plant production, and also be concerned with long-term investigations more philosophical in character. It was their hope that financial considerations would not unduly influence the programme towards one or the other but that the Director would enjoy wide scope in which to pursue his researches. How much influence financial limitations had upon the course of the programme it is difficult to say, but it seems these existed to a marked extent when compared with present-day expenditure, for, excluding work on virus diseases of potatoes, the programme was largely concerned with producing new varieties of plants.

The Society had to depend upon four main sources of income,

namely, Government aid, income from capital investments, the sale of produce, and subscriptions from members. In the first year the total income from these sources amounted to £3,500; ten years later it was £3,700, of which the Government provided about a third. In 1923 there were 172 members, of whom 90 were life members, while in 1933 annual members numbered 216 and life members 127, in spite of appeals for new subscribers. Sales of produce in 1923 brought in £178 and in 1933 £280, a valuable increase, but dependence on increased sales could not continue indefinitely if the exclusively scientific nature of the Society's operations as defined in its constitution were to be preserved. Nevertheless, it was only natural to consider improving the Society's income either by utilising a larger acreage for commercial seed production or by schemes of marketing. Income from investments was virtually static, but notwithstanding the many difficulties, the programme at the Station was pursued. The hopes of the Secretary for Scotland and those who sponsored the Scottish Plant Breeding Station that it should develop unfettered by financial restrictions remained largely unfulfilled until the late 1930's. In 1934 a change was introduced in the Government system of allocating grants which held promise of an expanded programme of research. By 1943 the Society's income was about £6,898, of which the Government provided £5,400. This proportion increased steadily in the ensuing years until to-day, through the Department of Agriculture for Scotland, the Government provides almost 90 per cent of the Society's total income, amounting to approximately £29,000.

Once Government aid had placed the Society's finances on a satisfactory footing it was inevitable that attention should turn again towards the question of marketing new seed products of the Society. But how this could best be done in a way not at variance with the rules of the Society required long and careful thought, for by its rules the Society's activities had to be exclusively scientific. The multiplication and marketing of seed raised many problems. To multiply seed on a large scale would clearly divert the attention of members of staff towards crop inspection and away from their scientific investigations. Further, marketing seed would entail the purchase of expensive cleaning machinery and the employment of staff experienced in trading.

After many discussions it seemed to the Directors the

matter could best be dealt with in two stages: the first to be covered by a scheme operable immediately, and the second by a scheme requiring time to consider and develop which would be introduced at some time in the future. The second scheme would replace the first and would become a permanent feature of the Society's operations. An arrangement was eventually introduced under the intermediate stage which provided for the limited production of elite seed grown and inspected by the Society. This seed was offered to members at a fixed price, but to facilitate the disposal to non-members, Seed Merchant members were invited to sell the Society's productions, for which they received a suitable discount, a comparable discount being offered to Grower Members. In return for these concessions members were bound to give a guarantee that their purchase was for use on their own farms only and so far as Merchants were concerned they had to sell at a fixed price. As the Society was originated to help Agriculture it was agreed to offer its elite productions at a price not exceeding 100 per cent above the market price of commercial seed of the same variety of crop. In this way new seeds would not become the subject of speculation and inflated prices.

The second and permanent arrangement which envisaged the establishment of a Seed Growers' Organisation or Commercial Company was never launched. It proposed that the Society would undertake to market through an Association or Company all productions of new varieties of plants and reselections of these, and to keep the Company supplied with suitable quantities of pedigree seed. The scheme followed generally the lines of the relationship existing between the Society's counterpart in Sweden, the Swedish Seed Association, Svälof, and the General Swedish Seed Company, whereby the latter received and marketed new plant productions, recompensing the Plant Breeding Station as well as shareholders from trading profits. After close examination this scheme was rejected as unsuitable to Scottish conditions. The temporary arrangement which was thus left to function indefinitely was not regarded as a satisfactory solution to the problem, for, since it did not allow large-scale production of pure seed, further multiplication and distribution of the seed was much restricted. Nevertheless, no alternative presented itself until 1952 when an "agency" scheme was devised and launched experimentally. This scheme, still in operation, provides for

the appointment of official agents who are members of the seed trade and preferably members of the Society. It was decided that the Plant Breeding Station will multiply limited quantities of seed bred by the Station under close inspection, designating the produce elite seed. Agents will be the sole recipients of such seed and be bound to multiply it further under conditions and obligations set out in their appointment. The terms of these appointments differ with each crop variety and are designed to ensure that seed ultimately reaching the market will be of high quality and that each variety will be widely distributed. The following agents were appointed:—

Oats	BELL	Messrs Macfarlan, Shearer & Co., Greenock.
	ALBYN DONSIDE, CRAIGS AFTERLEA	Scottish Agricultural Industries, Ltd., 35 Charlotte Street, Leith.
	EARLY MILLER	Mr George Clapperton, Sheriffhall Mains, Dalkeith.
Beans	ALBYN TICK	Messrs Roughead & Park, Ltd., Haddington.
Grasses	SCOTIA COCKSFOOT, SCOTIA TIMOTHY	Messrs David Bell, Ltd., 15 Coburg Street, Leith.
Potatoes	PENTLAND ACE	Messrs W. J. Campbell & Miller, Ltd., 2 Charlotte Square, Edinburgh.
	CRAIGS ALLIANCE	Messrs J. C. Dougal, Ltd., Auchterarder.

Accompanying a scheme for marketing it was essential to have a scheme of certification for grasses. Such a scheme for "Scotia" strains of grasses was introduced in 1952 and has since been operated in collaboration with the National Institute of Agricultural Botany. Briefly, the scheme provides for the issue of certificates by the Society certifying the authenticity and standard of crops of "Scotia" strains of Cocksfoot and Timothy grasses grown from seed purchased from the Society. Inspection of crops in England are carried out on behalf of the Society by officers of the National Institute of Agricultural Botany and the National Agricultural Advisory Service, and fields in Scotland by the Society's staff. Since the agent handling grasses becomes, under the agency arrangement, the sole recipient of elite seed and since the production of stock seed is thus the responsibility of the agent, the Certification

Craigs House, Corstorphine

Seafield, Lothianburn

Scheme was modified to allow the issue of certificates covering the multiplication of seed for commercial purposes other than reproduction. Certificates guaranteeing suitability for stock seed multiplication are issued only for the agent's crops grown from elite seed.

In conjunction with its annual application for financial aid the Society submits a report on the work of the Station and proposals concerning future research to the Department of Agriculture for Scotland. As a result the Society's programme is co-ordinated with the work of other research stations by the Agricultural Research Council and is integrated into the national scheme of work. Through representation on the Scottish Agricultural Advisory and Scottish Agricultural Improvement Councils of the Department of Agriculture for Scotland the Society is able to relate its work to the needs of Scottish Agriculture. The Society is also represented on the recently established National Herbage Seed Certification Authority, whose headquarters are at the National Institute of Agricultural Botany, Cambridge.

There are also close ties with the Agricultural Colleges. Although no constitutional link exists between the Society and the three Scottish Agricultural Colleges one or more of the Colleges has been represented on the Society's Board of Directors for many years—a similar connection with the University of Edinburgh has also been maintained—providing useful opportunities for co-operation. The wide range of soil and climatic conditions in Scotland necessitates field trials in different areas to ascertain how new varieties of plants respond to the particular conditions of different areas and how they compare with the usual varieties. In arranging these trials the staffs of the Colleges collaborate with the staff of the Plant Breeding Station and help to bring local crop improvement problems more prominently to the notice of the Society. For example, on the advice and with the help of officers of the North and West Colleges the Society has recently established two oat selection and trial centres, one in Inverness-shire and another in Argyll. Initial selections are made under these two environments and trials of the most promising lines are continued.

Throughout its history, despite times of financial stringency, the Society has endeavoured to adhere closely to its objectives, though with greater Government support now being given long-

term research is likely to receive more encouragement than hitherto. When at a recent Conference on Scientific Education the President of the Federation of British Industries said, "Industry will pay the price of Leadership; Industry must invest in Research," he was laying upon research responsibility for leadership. But while research has acquired this new and meaningful significance it should perhaps not be overlooked that food production has reached its present level by the practical co-ordination of all sections of the agricultural industry including research, and it was a realisation of this and the fact that plant breeding research seemed to have been largely left out of the picture in Scotland that thirty-four years ago the Scottish Society for Reseach in Plant Breeding was founded and the Scottish Plant Breeding Station established.

As already mentioned the Society is planning to leave Craigs House in the autumn of 1954. About four-fifths of the cost of erecting and equipping the laboratories and extensive greenhouses at the new Station, valued at approximately £130,000, is being borne by the Government and a little more than a fifth by the Society from invested funds. This will virtually liquidate the funds subscribed publicly to found the Society.

The erection of these new buildings reflects the importance agriculture has acquired after the Second World War, an importance which never fully materialised or at least did not long persist in the years following the First World War. Since the Society started operations the number of scientific staff has increased from two to fourteen. A staff of four are engaged in administration and clerical duties and there are two laboratory and thirteen field workers. The Station is under the direction of J. W. Gregor, Ph.D., D.Sc., F.L.S., who joined the staff in 1925 and succeeded Mr William Robb on his retiral in 1950.

The varied interests of agriculture are still fully represented on the Directorate of the Society, and the Directors, with better facilities, larger staff and an expanded programme, will have greater responsibilities than ever before. In the Chairman, Sir John H. Milne Home, D.L., J.P., Elibank, Walkerburn, there exists a link with the early days of the Society (he was a committee member of the Highland and Agricultural Society when the Plant Breeding Station was established and served on the first Board of Directors), and it is fitting that under his guidance the Society will begin a new chapter in its history at

the Edinburgh Centre of Rural Economy. For its Vice-Chairman the Society has Sir James Denby Roberts, Bt., Strathallan Castle, Auchterarder, a practical farmer of wide experience and with a close interest in research. The Directors are elected at the Annual General Meetings of the Society by the members and still retain their constitutional powers to guide the operations of the Society even although the research programme and maintenance expenditure requires the ultimate approval of the Department of Agriculture for Scotland. This arrangement works satisfactorily. The Directors and the Government negotiate in the closest harmony, for the Society, with a membership of 515, much of it long standing, facilitates a fusion of interest between the Agricultural Industry and the Government, with advantage to the nation.

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