1930

SCOTTISH SOCIETY FOR RESEARCH IN PLANT-BREEDING.

REPORT.

THE Directors of the Scottish Society for Research in Plant-Breeding have much pleasure in again submitting the Annual Report—the ninth—to the Members of the Society.

The work which the Society is undertaking at the Plant-Breeding Station is progressing and extending as rapidly as possible. A more rapid expansion of the work, or the undertaking of new investigations, much as these might be desired, is conditioned largely by the Society's income, which, in the present state of agriculture, it has been found very difficult to augment by additional contributions from agricultural sources.

During the last year further results have been obtained confirming those of previous years, and indicating that a number of plants raised at the Station, as a result of experimentation, merit further trial and multiplication on a larger scale. If the results of the trials are again satisfactory, certain of the oats and grasses that are being multiplied may soon be ready to put out as commercial varieties. Two varieties of oats, three varieties of grasses, and three varieties of potatoes are being grown for the above-mentioned purpose. These facts are merely mentioned here to emphasise the practical side of the experimental work. An account of the research work carried out at the Plant-Breeding Station, Craigs House, Corstorphine, during the year 1929 is given in the report by the Director of Research which appears on pages 15 to 39 hereof.

Research into Virus Disease of Potatoes. Empire Marketing Board Scheme.

Reference was made in the Report last year to the fact that the Society had obtained, through the Department of Agriculture for Scotland, a grant from the Empire Marketing Board to enable the Society to undertake research work on virus disease of potatoes. The various buildings which are required in connection with this scheme are now almost ready for occupation. Some difficulty has been experienced in obtaining suitable candidates for the post of Chief Assistant, and on that account an appointment to this post has not yet been made. The two Junior Assistants allowed under the scheme have been appointed and have taken up their duties. In accordance with the approved scheme of work, a Sub-Station has been instituted in the North of Scotland, at Gibston Farm, Huntly, Aberdeenshire. Additions have also been made to the premises at the Society's Sub-Station at Ainville, Kirknewton, Mid-Lothian, for dealing with certain aspects of the virus disease investigation. Work at the two Sub-Stations is now in progress, and it is hoped that work will also be in progress at Craigs House at an early date.

Financial.

The audited accounts for the year, excluding those coming under the grant from the Empire Marketing Board or the Dr Wilson Memorial Account, reveal very little difference in the state of the Society's funds as compared with those of the previous year. The grant obtained from the Development Commission, through the Department of Agriculture for Scotland, for the year 1928-29 amounted to £1094, 17s. 1d. The amount received as annual subscriptions has, up to the present, remained almost stationary, but the amounts received as Life Membership subscriptions fluctuate from year to year, and consequently it is difficult beforehand to arrange the

expenditure accordingly. In many Societies Life Membership subscriptions are regarded as capital income, but the Department of Agriculture for Scotland have intimated that Life Members' subscriptions to this Society should rank as ordinary income for purposes of calculating the amount of grant to be paid from Government sources to the Society. The effect of this method may be indicated by stating that one Life Membership subscription was received in the year ended 31st March 1929. This increased the ordinary income, taken into account in reckoning the grant, by £20, but by regarding the sum as ordinary income the result, in effect, was that the Society obtained no benefit from the Life Membership subscription of £20; it actually reduced the grant by £18.

The items of income and expenditure are, on the whole, not widely different from those of last year. The salaries of several of the assistants have increased according to scale, and this accounts for the increased expenditure under this head.

"Dr Wilson" Memorial Fund.

This fund now amounts to £261, 5s. Since the end of the financial year, however, arrangements have been made to make an award from the fund.

This award, which will be made at the Annual General Meeting, is as follows:—

Mr William Runcieman, Castleton, King Edward, for his work in introducing the improved variety of Potato Oat known as "Castleton." (An account of this work appears on pp. 40 to 42 hereof.)

Membership.

The Society comprises 100 life members and 98 annual members (22 at the 10s. rate and 76 at the £1 rate). Three life members and fifteen annual members were enrolled during the year; three members died and two members resigned. A list of members appears on pages 43 to 47 hereof.

Donors of £20 or over (including donations to the Preliminary Fund) are entitled to become life members of the Society without further payment. Donors of £10 or over may become members of the Society by payment of an annual subscription of 10s., and others by payment of an annual subscription of £1.

In order that the membership list may be kept up to date, changes of addresses should be intimated to the Secretary.

Election of Directors.

In accordance with the rules of the Society, the six senior Directors retire at this time. Their names are as follows :—

James Hislop Elder, B.Sc., Athelstaneford Mains, Drem.
Thomas Hogg (Messrs Alex. Cross Seed Co., Ltd.), 21 Hope Street, Glasgow.
Major James Keith, Pitmedden, Udny.
Captain A. R. M'Dougal, Blythe, Lauder.
Professor Ernest Shearer, Agricultural Department, The University, Edinburgh.
Professor William Wright Smith, Inverleith House, Arboretum Road, Edinburgh.

To fill the vacancies thus created, the Directors recommend the election of the following :—

D. L. Bowe (Messrs J. H. Bowe & Sons), Dunbar.
John Chisholm, Ladysbridge, Banff.
John E. B. Cowper, Gogar House, Corstorphine.
J. H. Milne Home, Irvine House, Canonbie.
William Kay, 19 South St David Street, Edinburgh.
J. P. Ross Taylor, Mungoswalls, Duns.

JOHN STIRTON,
Secretary.

[Abstract of Accounts

ABSTRACT OF ACCOUNTS.

For year ended 31st March 1930.

INCOME.

Interests Received			£1,663 0 11
Recoverable Income Tax			232 12 5
			£1,895 13 4
Sale of Produce and Stock on Hand			239 3 8
Rents Received			13 10 0
Subscriptions—			
Annual	£80 10 0		
Life	15 0 0		
		95 10 0	
Note.—Annual Subscriptions amounting to £16 are in arrear.			
Donations under £10		9 1 6	
Income Ranking for Grant			£2,252 18 6
Donations £10 or over		10 0 0	
Total Ordinary Income			£2,262 18 6
Grant from the Department of Agriculture for Scotland for the year 1929-30		1,275 0 0	
			£3,537 18 6
Funds at 1st April 1929	£44,172 11 8½		
Less—Estimated Grant on Expenditure for year 1928-29 not allowed	90 7 7		
		44,082 4 1½	
			£47,620 2 7½

EXPENDITURE.

Salaries—			
Officers (including Ainville Sub-Station)			£1,859 17 8
Secretary and Office			210 0 0
			£2,069 17 8
Labour			623 16 7
National Health and Unemployment Insurances			18 7 9
Seeds and Roots			14 9 5
Manures			120 12 0
Sundry Working Expenses, including renewals of Implements and Tools			140 0 4½
Laboratory Expenses			20 15 3
Library Expenses			38 19 0
Rates and Insurances			38 3 3
Office Expenses			82 0 2½
Heating, Lighting, and Cleaning			34 9 2
Travelling Expenses			44 8 8
Property Repairs and Upkeep			57 3 2
Locality Trials			38 8 8
Ainville Sub-Station Expenses			67 0 9½
Expenditure Ranking for Grant			£3,408 11 11½
Depreciation on Implements, Tools, Furniture, &c.			57 0 10
Total Expenditure			£3,465 12 9½
Funds at 31st March 1930, per Balance-sheet			44,154 9 10
			£47,620 2 7½

BALANCE-SHEET.

As at 31st March 1930.

LIABILITIES.

I. Accounts Outstanding	£179	17 0
II. Funds at 31st March 1930	44,154	9 10
	£44,334	6 10

DR WILSON MEMORIAL FUND.

Value at 31st March 1930.			
£205 10 0	Funds at 31st March 1930, consisting of—		
	£200 5 per cent War Stock, 1929-47—value at date of transfer	£176	5 0
	Sum in Bank on Deposit Receipt	70	0 0
	Sum in Bank on Current Account	15	0 0
		£261	5 0

SHEET.

March 1930.

ASSETS.

I. Houses and Lands			£7,813 16 4
II. Implements and Tools			671 14 11
III. Laboratory Apparatus			147 1 6
IV. Office Fittings			83 10 8
V. Stocks on Hand			113 19 3
VI. Accounts Outstanding			75 4 10
VII. Income Tax Recoverable			232 12 5
VIII. Investments at Cost :—			
Value at 31st March 1930.			
£14,385 0 0	1. £14,000 5 per cent War Stock, 1929-47	£12,390 0 0	
12,845 0 0	2. £14,000 4 per cent Funding Stock, 1960-90	10,045 0 0	
13,255 18 9	3. £16,900 3½ per cent Conversion Stock	11,140 3 6	
800 0 0	4. £800 Edinburgh Corporation Loan	800 0 0	
£41,285 18 9			34,375 3 6
IX. Equipment at Ainville Sub-Station			183 7 6
X. Cash Balances—			
In Bank—			
On Current Account		£126 16 1	
On Deposit Receipt		500 0 0	
On Hand		10 19 10	
			637 15 11
			£44,334 6 10

MEMORIAL FUND.

Funds at 1st April 1929	£251 5 0
Interest for year	10 0 0
	£261 5 0

VIRUS DISEASE RESEARCH SCHEME

ABSTRACT OF

For the Year ended

INCOME.

Grant from Empire Marketing Board	£2543 0 0
	£2543 0 0

BALANCE

As at 31st

LIABILITIES.

I. Accounts Outstanding	£13 5 0
II. Funds at 31st March 1930	2284 12 0
	£2297 17 0

EDINBURGH, 13*th May* 1930.—The undersigned, having had access to all the Accounts, and verified the same with the Accounts and Vouchers relating thereto, now

16 ALVA STREET.

(EMPIRE MARKETING BOARD).

ACCOUNTS.

31st March 1930.

EXPENDITURE.

Maintenance—		
Huntly		£71 18 5½
Craigs House		36 9 6½
Salary		150 0 0
		£258 8 0
Capital Expenditure—		
Huntly	£656 4 9	
Craigs House	1362 5 3	
Ainville	268 0 2	
	£2286 10 2	
Funds at 31st March 1930		2284 12 0
		£2543 0 0

SHEET.

March 1930.

ASSETS.

I. Buildings, &c.—		
Huntly		£656 4 9
Craigs House		1362 5 3
Ainville		268 0 2
		£2286 10 2
II. Cash in Bank		11 6 10
		£2297 17 0

Books and Accounts of the Society, and having examined the foregoing Statement of signs the same as found to be correct, duly vouched, and in accordance with law.

W. SLATER BROWN, C.A., *Public Auditor.*

ANALYSIS OF MEMBERS

As at 31st March 1930.

Aberdeen	6	Lanark	14
Argyll	3	Linlithgow	3
Ayr	15	Mid-Lothian	34
Banff	2	Moray	1
Berwick	14	Nairn	..
Bute	..	Orkney	2
Caithness	1	Peebles	3
Clackmannan	..	Perth	14
Dumbarton	2	Renfrew	5
Dumfries	9	Ross and Cromarty	6
East Lothian	27	Roxburgh	4
Fife	11	Selkirk	1
Forfar	8	Stirling	2
Inverness	..	Sutherland	..
Kincardine	1	Wigtown	2
Kinross	..	England	2
Kirkcudbright	6		198

ESTABLISHMENT FOR 1929-30.

BOARD OF DIRECTORS.

Trustees.

THE RIGHT HON. WILLIAM ADAMSON, M.P., Secretary of State for Scotland.
JAMES ELDER, Athelstaneford Mains, Drem.
DAVID BELL, 15 Coburg Street, Leith.
JOHN FINLAYSON M'GILL, 69 Kyle Street, Ayr.

Ordinary Directors.

1927.

JAMES HISLOP ELDER, B.Sc., Athelstaneford Mains, Drem.
THOMAS HOGG (Messrs Alex. Cross Seed Co., Ltd.), 21 Hope Street, Glasgow.
Major JAMES KEITH, Pitmedden, Udny.
Captain A. R. M'DOUGAL, Blythe, Lauder.
Professor ERNEST SHEARER, Agriculture Department, The University, Edinburgh.
Professor WILLIAM WRIGHT SMITH, Inverleith House, Arboretum Road, Edinburgh.

1928.

JAMES W. DRUMMOND (Messrs W. Drummond & Sons, Ltd.), Stirling.
CHARLES E. GREGOR, Innerwick, East Lothian.
WILLIAM LOW of Balmakewan, Laurencekirk.
J. T. M'LAREN, 7 Park Place, Stirling.
ROBERT MILLER, Ferrygate, North Berwick.
JAMES PATON, Kirkness, Glencraig, Fife.

1929.

W. J. CAMPBELL, 61 Fountainhall Road, Edinburgh.
WILLIAM CUTHBERTSON (Messrs Dobbie & Co., Ltd.), Edinburgh.
Sir JAMES INGLIS DAVIDSON, Saughton Mains, Corstorphine.
IAN C. MENZIES, W.S., 22 Rutland Street, Edinburgh.
GEORGE G. MERCER, Southfield, Dalkeith.
G. BERTRAM SHIELDS, Rosebery Farm, Gorebridge.

Directors Co-opted.

D. L. BOWE (Messrs J. H. Bowe & Sons), Dunbar.
Professor MONTAGU DRUMMOND, Botany Department, University, Glasgow.
J. H. MILNE HOME, Irvine House, Canonbie.

Directors nominated by the Board of Agriculture.

Sir ROBERT B. GREIG, M.C., LL.D.,
J. M. CAIE, M.A., B.L., B.Sc.,
T. ANDERSON, M.A., B.Sc.,
ALEXANDER M'CALLUM, M.A., LL.B.,
} York Buildings, Queen Street, Edinburgh.

Chairman of Directors—JAMES ELDER, Athelstaneford Mains, Drem.
Vice-Chairman—DAVID BELL, 15 Coburg Street, Leith.
Director of Research—WILLIAM ROBB, N.D.A., Craigs House, Corstorphine.
Chief Assistant—JAMES W. GREGOR, Ph.D., F.L.S., Craigs House, Corstorphine.
Assistant—V. E. M'M. DAVEY, B.Sc., Ph.D., Craigs House, Corstorphine.
Assistant, Potato-Breeding Sub-Station—WILLIAM BLACK, B.Sc., Ainville Farm, Kirknewton.
Assistants under Virus Disease Scheme—GEORGE COCKERHAM, B.Sc., Gibston, Huntly, and ALAN M'BAIN, B.Sc. Ainville, Kirknewton.
Temporary Junior Assistant—J. M. S. LANG, B.S.A., Craigs House, Corstorphine.
Secretary—JOHN STIRTON, 8 Eglinton Crescent, Edinburgh.

COMMITTEES.

RESEARCH.

G. Bertram Shields, *Convener.*
T. Anderson.
W. J. Campbell.
William Cuthbertson.
J. W. Drummond.
Professor M. Drummond.
James H. Elder, B.Sc.
Charles E. Gregor.
Sir Robert B. Greig.
Thomas Hogg.
J. H. Milne Home.
Major James Keith.
William Low.
Capt. A. R. M'Dougal.
J. F. M'Gill.
George G. Mercer.
James Paton.
Professor Ernest Shearer.
Professor W. Wright Smith.
James Elder, *Chairman, ex officio.*
David Bell, *Vice-Chairman, ex officio.*

MANAGEMENT.

David Bell, *Convener.*
D. L. Bowe.
J. M. Caie.
Sir J. Inglis Davidson.
Charles E. Gregor.
J. H. Milne Home.
Major James Keith.
J. T. M'Laren.
George G. Mercer.
Robert Miller.
Professor Ernest Shearer.
G. Bertram Shields.
James Elder, *Chairman, ex officio.*

FINANCE.

J. H. Milne Home, *Convener.*
Thomas Hogg.
William Low.
Alex. M'Callum.
Ian C. Menzies.
Robert Miller.
G. Bertram Shields.
James Elder, *Chairman, ex officio.*
David Bell, *Vice-Chairman, ex officio.*

REPORT

BY

DIRECTOR OF RESEARCH.

I. Research Programme.

"The aim of the Society is to establish a thoroughly equipped Station, and to promote the discovery and the creation of such new and improved races of the leading crop plants as are best suited to Scottish conditions.

"The methods employed at the Station to obtain improved types of plants are, in the main :—

"(*a*) Collection and classification of suitable living material.

"(*b*) Isolation of pedigree strains (pure lines).

"(*c*) Hybridisation of pedigree strains, varieties, and species.

"(*d*) Comparative trial of varieties, pedigree strains, &c."

The crop plants on which breeding experiments are being carried out are chiefly Oats, Potatoes, Herbage Plants (Perennial Ryegrass, Cocksfoot, Timothy, and Plantain), and Swedes. A review of the work done and the results obtained during the past year follows.

A. Cereals.

The hybridisation of oat varieties and strains was continued, and many selections of hybrid plants were made for the purpose of obtaining :—

(*a*) Improved varieties in which stiff straw, high grain yield,

and early maturity would be combined in as high a degree as possible.

(*b*) Further data as regards inheritance of grain colour and other characters in oats.

A large number of hybrid grains were sown singly in breeding-plots, and a representative collection of apparently fixed strains was sown at about the usual field rate in trial plots and multiplication plots. The plots ranged in size from a centgener row to a one-fifth acre field plot. A collection of named varieties was also sown.

The breeding plots, as in previous years, consisted of hybrid selections in various stages ranging from the second to the seventh generation.

From various second-generation progenies promising early-ripening stiff-strawed plants have been selected for further comparison. Some of the selections are from a cross between one of the strains of the promising stiff-strawed but rather late-ripening series (obtained by crossing Castleton Potato with Beseler's Prolific), and an early-ripening plant from a cross between Victory and Black Mesdag.

An early-ripening strain, produced from Victory × Black Mesdag, has been back-crossed with Victory to produce, if possible, a heavier grain-yielding type, or an earlier-ripening form of Victory.

Among the hybrids that are beyond the second-generation stage, a wide range of types has been found in those of which Bathurst is one of the parents. Bathurst is an Australian oat which ripens very early. A few early-ripening, white-grained types from this cross have been selected; some of these are promising, but they are not yet fixed. Several series of hybrids from Orion have been carefully studied, and single plants have been selected to secure, if possible, early-ripening but stiffer-strawed, heavier grain-yielding types than Orion. Many selections have been retained from the following crosses: Castleton Potato × Orion, Orion × Yielder, Sandy × Orion, and Beseler's Prolific × Orion. In the last-mentioned cross some very attractive white-grained types have been picked out, but the straw in several of these may be rather weak if the plants are grown in rich soil.

The hybrid strains, which were apparently fixed in 1929,

included selections from the following crosses: Victory × Black Mesdag—an early-ripening type; Beseler's Prolific × Orion—early-ripening, heavy grain-yielding type; Sandy × Orion—stiff-strawed, free-tillering, medium-early types, and also a few long-strawed types; Potato × Record—short, stiff-strawed types; Hybrid selection (Beseler's Prolific × Eighty Day) × Orion—early-ripening, white-grained types; Dala × Yielder—early-ripening, stiff-strawed types; Potato × Victory—heavy-yielding Potato types.

Eleven hybrid selections and six named varieties were grown for comparison and multiplication in the first-year small multiplication plots. The most outstanding among these are two selections from a cross between Beardless Probsteier and Leader. These two are medium early-ripening, large-grained types, which seem to be productive and to have stiff straw. There is also one promising strain from a cross between Golden Rain and Castleton Potato. A few selections from Tam Finlay crosses appear to be worthy of further trial. Various selections from crosses between Sandy and Storm King, and Sandy and Triumph have not come up to the desired standard. Here the grain was not attractive and the yield was low, also the straw was inclined to be brittle and too easily broken.

Field Trials.—These trials, as in the previous two years, were made on replicated plots, each plot being $\frac{1}{440}$ acre. The plots were arranged in four blocks, and each selection occurred once in each block. The selections were arranged at random within the blocks, the only restriction being that any variety should not occur more than once in any row of plots from north to south, or more than once in any row of plots from east to west. This method of preliminary trial has been found suitable to the conditions at the Station. By careful sowing of the grain and by careful cultivation and harvesting of the plots, results showing a tolerably small experimental error have been obtained. In addition to providing a means of obtaining reliable estimates of the yield of grain from the varieties under trial, these plots permit of reasonably accurate comparisons being made between new varieties and standard named varieties as regards date of maturity, strength of straw, and other characteristics. Thirty varieties were grown in these $\frac{1}{440}$ acre comparative trial plots, the standard named varieties grown being Victory,

Sandy, and Potato. The yields of grain in these trials are shown in Table I. (page 26).

A statistical analysis was made of the data obtained for yield by Mr J. M. S. Lang, Junior Assistant, who, in addition to assisting in the work with herbage plants and potatoes, had charge of the oat trial-plots. The standard error in the trials was estimated at 0.42 lb. On the basis of this standard error, the first seven varieties in the table have given a significantly higher yield of grain than Victory. There is no significant difference in the yields of grain in the next fourteen varieties, but the last nine varieties have given a significantly lower yield of grain than Victory. It falls to be noted that the plots were threshed out of the stook as soon as the grain was dry enough to store in sacks, and consequently the yields may be slightly higher than they would have been had it been practicable to stack the grain for a time before threshing. The period between the dates of cutting and of threshing of the different varieties varied, but the bulk of the selections were threshed within fourteen days of cutting. As the grain could not readily be graded, the small grain was included in the total yield of each variety. The comparisons of grain yield, however, should not be seriously affected by these modifications of agricultural practice.

It will be noted that many of the selections from Castleton Potato and Beseler's Prolific have given a high yield of grain. As might be expected, the very early-ripening types and some of the Sandy types have given relatively low yields of grain. Where figures are available, the relative yields of grain in 1928 and 1929, taking Potato as 100, are also shown in the Table. The relative positions of most of the selections are fairly well maintained.

"Locality" Oat Trials, 1929.

Trials of new selections were again carried out in different districts in Scotland. The majority of the trials were carried out under arrangements made with the Agricultural Colleges in Scotland. Ten selections were included in the trials, and in each case the grain had to be returned to the Society unless other arrangements were agreed to. Reference is made in

the undernoted summary to the more important results of the trials.

Variety Aa 600 : Golden Rain × Leader.—This variety was selected as a white-grained type of Golden Rain, and has been tested during the last three years. The yield of grain is about the same as that of Potato. This selection, however, has shown no outstanding characteristics in any of the different trials to suggest that further trials should be made.

Variety Aa 604 : Sandy × Leader.—An early-ripening type selected for comparison with Sandy and Potato. The report on this variety in the trial in the north of Scotland area states: "Superior to Potato in regard to ripeness of straw and head. Straw is of a type suitable for the district."

In a trial in the south-west of Scotland this variety gave a moderate yield of grain and a good crop of straw, but a comparison here with Potato or Sandy was not available. This variety has been tested in different districts during the last two years, and its early-ripening characteristic, together with the quality of the straw produced, have been brought out as points in its favour.

Variety Aa 605 : Sandy × Leader.—Selected for comparison with Sandy or Potato. This selection is a few days later in ripening than Aa 604, but it has generally given a higher yield of grain.

The best report on this variety in 1929 is from Caithness. In 1928 a very favourable report was received from Orkney, but a trial again in that district in 1929 could not be arranged. The Country Organiser for Caithness has reported on this selection as follows: "Earlier than Potato and Sandy. Ripened more uniformly and a finer quality of straw than Golden Rain and Plentiful in the same field. This variety compared very favourably with Potato, Sandy, Golden Rain, and Plentiful grown in the same field, and the yield of 20 cwt. 70 lb. per acre is considered very satisfactory in this district. The bushel weight of dressed grain was 40 lb., as compared with 38½ lb. from Plentiful on the adjacent plots."

In the trial in Ayrshire this variety grew satisfactorily, and ripened earlier than the Potato oat. The yield of grain, however, was lower than that of Potato, but this was accounted for to a considerable extent by damage from birds, as this variety was among the earliest ripening ones in the trial.

In the trial in Lanarkshire the yield of grain was only slightly lower than that of Potato. The crop ripened early, however, and there was no lodging.

The report from the trial in Dumfriesshire indicates that this variety had grown satisfactorily there. It had rather more grain than Aa 604, and the grain seemed to be of better quality. The straw was also noted as being of good quality for fodder.

Variety Aa 609: Sandy × Record.—This is a large-grained type selected for trial in districts where Sandy or Potato oats are grown. In most of the trials it has given a good yield of grain, but the straw is rather weak, and on this account it is not proposed to test this variety further.

Variety Aa 621: Potato × (Sandy × Golden Rain).—Selected for comparison with Potato. At the Plant-Breeding Station this selection appeared to be a free-tillering leafy form, producing a fine sample of grain of the Potato type. In most of the trials, however, it has given a low yield of grain, and it does not seem to surpass Potato in any characteristic. The most favourable report on this selection is from West Aberdeenshire, where a trial was made at an elevation of about 1000 feet. In this trial the report states: "The oat stood quite well, while there was a tendency to lodge on the part of Sandy and Gordon in the later stages. It looked quite a nice crop in the field." This selection ripened two days later than Yielder and three days earlier than Gordon.

Variety Aa 612: Castleton Potato × Beseler's Prolific.—Selected on account of its short stiff straw and high grain yield. (See illustrations on page 21, inserted with the permission of the Director of the Seed-Testing Station, Corstorphine.) This variety has been tested for two years, and on fertile soils it has given a good yield of grain, but in late districts it does not ripen quite early enough. Its date of maturity at the Plant-Breeding Station in 1928 was about the same as that of Victory, but in 1929 it ripened several days later.

In the trials at Boghall Experimental Farm it gave a yield of 28 cwt. of grain as compared with 32 cwt. of grain per acre from Victory (the experimental error being estimated at about 5 per cent). It was specially noted in the report for its stiff straw, and it was the stiffest-strawed variety of

FIG. 1.

Plot of Aa 612 oats being cut by machine at the Seed-Testing and Plant-Registration Station, Corstorphine, 1929.

FIG. 2.

Plot of Victory oats in the foreground, lodged, and immediately behind, plot of Aa 612 oats, not lodged, at Seed-Testing and Plant-Registration Station, Corstorphine, 1929.

FIG. 3.

Bolting in Normal Swedes.

Left-hand Row—Progeny of a short-necked plant. Necks 2 or 3 inches in length.

Right-hand Row—Progeny of a bolted plant selected from the same crop. Necks range from 5 inches to about 3 feet (*i.e.*, fully bolted). The bolting tendency was thus partly hereditary.

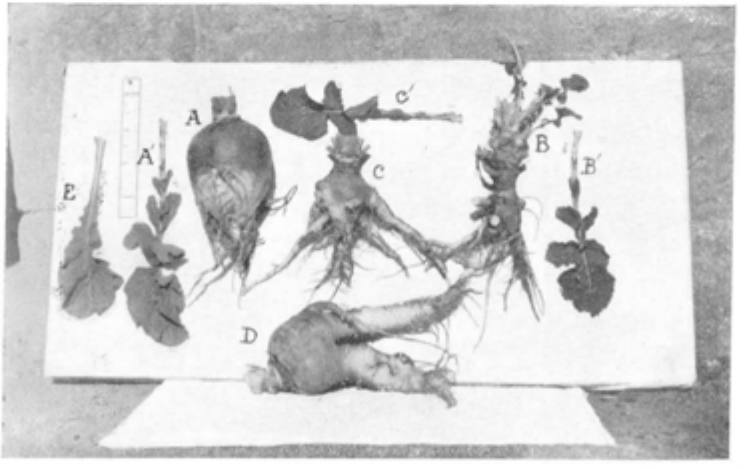

FIG. 4.

Swede × Winter Swede-like Rape.

A. Swede of parent strain. A^1. Leaf of same.
B. Swede-like Rape. B^1. Do.
C. Hybrid (note small bulb). C^1. Do.
D. Mis-shapen swede for comparison with hybrid.
E. An uncommon form of swede leaf.

the six varieties in the trial. The five other varieties in the trial were Victory, Sovereign, Echo, Star, and Silver.

In the trial at The Heugh, North Berwick, where the previous crop had been sugar-beet, a very heavy crop was produced. This variety stood better than any of the other three new selections in the trial-plots; it also stood better than Record, the variety which was grown in the remainder of the field. The yield of grain was estimated at about 40 cwt. per acre. (The yield of grain from Record, in the same field, averaged 37.5 cwt. per acre.)

In the trial in Dumfriesshire this variety was grown on an exceptionally rich plot of ground. The plants tillered very freely, and the straw grew to a length of over 5 feet. Under these conditions lodging took place while the crop was still green. Another variety of oats in the remainder of the field was also very badly lodged.

In a trial near Dreghorn, in Ayrshire, this variety was tested against Yielder, which appears to be the favourite oat variety in that locality. It produced less grain than Yielder. Aa 612 gave at the rate of 29 cwt. of grain and Yielder at the rate of 33 cwt. of grain per acre. Aa 612 was considered to be too late in ripening for this district.

In a trial at Craibstone, Aberdeen, this variety produced a fine plump sample of grain, and gave a yield at the rate of 34.2 cwt. per acre. It was practically equal to Victory, which gave a yield of 34.5 cwt. per acre, and which occupied the second highest position in the oat variety trials there.

A trial and multiplication plot of about 1⅓ acres of Aa 612 was grown by Mr James Elder, Athelstaneford Mains, Drem, and a satisfactory standing crop was obtained. The yield of grain worked out at about 30 cwt. per acre. The produce of this plot was returned to the Plant-Breeding Station to be threshed there by the small "self-cleaning" thresher in order that the seed would be kept as free as possible from admixture as the grain was to be reserved for seed.

From the results of the various trials both at the Plant-Breeding Station and elsewhere it would appear that this variety possesses very stiff straw, and that it is best adapted to fertile soils in districts where crops ripen moderately early.

Variety Aa 615: Castleton Potato × Beseler's Prolific.—This variety is similar in many of its characteristics to Aa 612.

It is a short, stiff-strawed type, possibly slightly shorter in the straw than Aa 612. It was tested on highly fertile soil at Ferrygate, East Lothian, by Mr Robert Miller. Forty-two lb. of seed were sown on a plot $\frac{1}{8}$ of an acre in area, and the yield of grain obtained was 6 cwt. 101 lb. This is equivalent to about 41 cwt. per acre.

Varieties Aa 616, 617, 620: *Castleton Potato* × *Beseler's Prolific*.—These are longer but slightly weaker-strawed selections than Aa 612 and Aa 615, although all are from one crossed grain obtained in 1919. The yields of grain from these three varieties at the Plant-Breeding Station have been considerably higher, and their dates of maturity slightly earlier than Aa 612 and Aa 615.

In the trial at Pittendreich, Elgin, Aa 616 was tried against Victory and Potato. Aa 616 produced about 21½ cwt. of grain per acre, Victory about 21 cwt. per acre, and Potato about 15¾ cwt. per acre. Aa 616 and Victory ripened about the same time (9th September) and Potato ripened a little later.

Aa 617 was included in the trials at Quithelhead, Durris, Kincardineshire, at an approximate elevation of 400 feet. It produced about 29¼ cwt. of dressed grain per acre; Victory, 30 cwt. per acre; Potato, 24 cwt. per acre.

Aa 616, 617, 620 were also included in the trials at The Heugh, North Berwick. All three varieties became lodged practically to the same extent as the variety Record which was grown alongside. They all produced heavy yields of grain, the lowest yield being at the rate of nearly 37 cwt. per acre. This is the first year in which these three varieties have been tested at other centres in addition to the Plant-Breeding Station. On account of their high yield of grain at the Station and elsewhere, it is proposed to continue the trials of Aa 617 and Aa 620. As Aa 616 has the weakest straw, it is not proposed to carry out further trials with it.

Trials at the Seed-Testing and Plant-Registration Station.

The ten selections referred to in the "Locality Trials" were also included in the above-mentioned trials. The reports on them will be received later.

Large Multiplication Plots of New Varieties.

The Cereals Sub-Committee have agreed that two varieties should be grown in quantity in 1930, with a view to their being put on the market at an early date, should that course be decided on by the Society. About 10 acres of the stiff-strawed variety Aa 612, and about 1½ acres of Aa 605 have therefore been sown.

Wheat and Barley.

Small plots of a few named varieties of wheats and barleys were grown for observation. A few wheat crosses have been made by Mr J. M. S. Lang, Temporary Junior Assistant, for the purpose of studying the second generation progenies in 1930. A stiff-strawed barley plant selected from a crop of Plumage Archer was sent to the Station by Mr G. Bertram Shields, Rosebery Farm, Gorebridge, two years ago. This seems a promising selection, and a small multiplication plot of it was grown in 1929.

[Table I.

TABLE I.

Oat Trials, Plant-Breeding Station, Corstorphine, 1929—$\frac{1}{440}$-Acre Plots.

(Four plots of each Variety.)

Varieties arranged in Order of Yield.

Name or Reference No.	Parentage of Unnamed Selections.	Mean Yield.	Relative yields when Potato = 100.		Remarks.
			1929.	1928.	
		lb.			
Aa 620 . .	Castleton Potato × Beseler's Prolific	11.53	134	145	—
,, 635 . .	,,	11.44	133	143	—
,, 634 . .	,,	11.32	131	137	—
Sovereign Aa 522	—	11.25	131	—	—
Aa 617 . .	Castleton Potato × Beseler's Prolific	11.07	129	134	—
Aa 638 . .	,,	11.00	128	—	—
,, 640 . .	,,	11.00	128	148	—
,, 616 . .	,,	10.69	124	141	Rather weak straw
,, 618 . .	,,	10.69	124	129	—
,, 637 . .	,,	10.53	122	—	—
,, 639 . .	,,	10.13	118	—	—
,, 631 . .	Potato × Victory	9.84	114	—	—
,, 612 . .	Castleton Potato × Beseler's Prolific	9.75	113	121	Short, stiff-straw type
Silver Aa 521 .	—	9.66	112	—	—
Aa 612 . .	Castleton Potato × Beseler's Prolific	9.64	112	117	Duplicate selection
,, 623 . .	Sandy × Record	9.58	111	125	—
Victory Aa 30 .	—	9.47	110	122	—
Aa 615 . .	Castleton Potato × Beseler's Prolific	9.21	107	—	Short, stiff-straw type
,, 609 . .	Sandy × Record	9.11	106	110	Weak straw
,, 614 . .	,,	8.94	104	134	—
Potato Aa 10 .	—	8.60	100	100	—
Aa 600 . .	Golden Rain × Leader	8.05	94	97	—
Potato Aa 523 .	—	8.00	93	—	Potato selection
Aa 604 . .	Sandy × Leader	7.74	90	96	Early-ripening variety
,, 605 . .	,,	7.48	87	90	,,
Sandy Aa 2 .	—	7.35	86	84	—
Aa 621 . .	Potato × No. 9 (3)	7.08	82	110	—
Melø̀j Aa 518 .	—	6.58	77	—	Very early-ripening variety
Nidar Aa 516 .	—	6.05	70	—	,,
Aa 627 . .	Sandy × Victory	5.88	68	—	—

Standard error = 0.42 lb.

B. Potatoes.

Assistants in Charge—
J. W. Gregor, Ph.D. (Plant-Breeding Station).
William Black, B.Sc. (Ainville Sub-Station).

The potato-breeding investigations were, as in previous years, conducted at two centres. Comparisons of yields of tubers, and of resistance to disease of the more promising seedlings, were made chiefly at Corstorphine, but seeding, raising of seedlings, and comparison of botanical characters of the seedlings were made mainly at the Sub-Station at Ainville. A detailed account of genetical experiments carried out during the last four years is given in an article by Mr William Black in the 'Journal of Genetics,' Vol. 22, No. 1, 1930. The work at Ainville has shown that it is advisable to use only healthy plants as parents in order to obtain a larger proportion of healthy seedlings. Breeding from obviously unhealthy plants has frequently produced a progeny in which there was a high proportion of unhealthy plants.

The suitability of the Sub-Station for the potato-breeding work has been shown by the fact that almost all the apparently healthy varieties obtained a few years ago still retain their healthy appearance. It would seem, however, that early maturing varieties do not flower as freely at Ainville as they do in some other districts, but, in general, the late-ripening varieties flower as freely and set seed quite as readily there as they do at Corstorphine.

Selfing.—The experiments designed for the purpose of studying the effects of selfing potato plants through a series of generations were successfully continued. Some of the plants have now reached the fourth-selfed generation, and various progenies are breeding true for certain individual characters such as flower colour, tuber colour, and tuber shape. The degree of uniformity within the different selfed progenies varies to a considerable extent, since the rate of progress towards a pure-breeding type depends upon the hereditary constitution of the plants selected as parents. It has been found in practically all instances that the proportion of flower-producing and self-fertile plants tends to increase with each successive selfed generation, and consequently the difficulty arising through self-sterility decreases accordingly. The selfed plants were vigorous and healthy, and so far there

has been no definite evidence of loss of vigour through self-fertilisation.

First-year Seedlings.—A total of 2954 seeds were sown and an average germination of 77.0 per cent was obtained. On account of the limited area of land available, however, the number of seedling plants had to be reduced to 1884. The majority of the seedlings—over 1000—were from hybrid berries obtained by crossing the following varieties: Bishop and Flourball, Bishop and 120(42) (a Great Scot seedling), Majestic and 121(4) (a Witchhill seedling), Champion and Flourball, Epicure and Flourball, Kerr's Pink and 966(*b*)(4) (Bishop seedling), Kerr's Pink and 120(45) (a Great Scot seedling), Ally and Flourball, King Edward and Flourball, Abundance and 120(56) (a Great Scot seedling), Edzell Blue and Flourball, and 94(93) and 120(3) (both Great Scot seedlings).

The seedlings, in general, were exceptionally vigorous and healthy, and many promising types were obtained. Yields were good, various individual plants producing over 8 lb. of tubers. The highest yield amongst the hybrid seedlings was 8 lb. 4 oz., obtained from King Edward × Flourball. This yield, however, was exceeded by a selfed seedling in the third (F3) generation arising from Langworthy, with a yield of 8 lb. 12 oz. Over 700 selfed seedlings were raised chiefly for the purpose of obtaining further data in connection with the inbreeding experiments.

Second-year Seedlings.—Seedlings in the second year numbered 693, of which 354 were grown for experimental purposes only. The remainder consisted of a selection of possible economic types from various hybrids. Many promising seedlings, some of which are "earlies," were contained in this group, and, in general, the tuber yields were high. A hybrid seedling from Abundance × Shamrock produced 9 lb. of tubers. Crosses between Abundance and Majestic, Abundance and Shamrock, Abundance and 121(6) (a Witchhill seedling), British Queen and Flourball, Epicure and Flourball, Kerr's Pink and Flourball, Kerr's Pink and 39(15), King Edward and 39(15), and Up-to-Date and 98(23) (an Up-to-Date seedling) produced promising seedlings.

Third- and Fourth-year Seedlings.—A few of these were grown for further observation and comparison. About one-sixth of them were selfed seedlings, and these also

gave indications of meriting further trial as economic types.

Virus Diseases.—No further examples of virus diseases were found amongst the older seedlings. A few of the second-year seedlings, previously suspected, showed symptoms of virus disease and they were consequently discarded. The usual small proportion of weak and degenerate types was found amongst the first-year seedlings, but, in addition, there appeared in one progeny a large percentage of apparently unhealthy, weakly, dwarf plants. Many of the dwarf plants that occurred were malformed.

Trials: Craigs House.—Throughout the season potatoes grew well and suffered little from disease of any kind. The number of selections grown in the area in the field containing experimental varieties was increased to 330. The field trials included the testing of selections of economic importance in 3-, 6-, 12-, and 24-tuber plots, the size of the plots depending on the quantity of tubers available, and on the relative agricultural importance of the selection. In addition to the field trials, the most outstanding selections were also tested in highly fertilised ground in plots of 5 tubers each. The varieties Great Scot and Kerr's Pink were again used as controls, and these were planted at intervals throughout all the trials.

As a result of these and other trials three varieties are to be included in the 1930 First-Year Registration Trials conducted by the Department of Agriculture for Scotland. Certain data with reference to these selections are given in Table II., page 30.

Seedlings in the Trials carried out by the Department of Agriculture for Scotland.—Trials of the most promising seedlings were carried out both at East Craigs and Philpstoun.

Five varieties from the Plant-Breeding Station were included in the First-Year Registration Trials, 1929. All appeared to be perfectly healthy and were very vigorous. Three of these varieties have been recommended for inclusion in the Second-Year Registration Trials, 1930. Data with reference to these varieties are given in Table III., page 31.

Of the five heaviest-yielding varieties in the 1929 First-Year Registration Trials carried out by the Department of Agriculture for Scotland, four were supplied by the Scottish

Society for Research in Plant-Breeding, No. 96(33) heading the list.

Cooking Quality.—Comparisons of the cooking quality of the seedlings included in the Registration Trials have been made at various times, and these seedlings have been found to reach a high standard of quality. All were floury in texture, and had a good flavour when boiled. In culinary quality they compared favourably with Kerr's Pink. Nos. 94(105) and 96(43) were considered superior to 96(33).

Wart Disease Tests.—As in previous years, seedlings were submitted to the Department of Agriculture for Scotland for inclusion in their Wart Disease Trials. The numbers tested were greater than in previous years.

TABLE II.

RESULTS OF TRIAL IN 1929 OF VARIETIES TO BE INCLUDED IN THE FIRST-YEAR REGISTRATION TRIALS OF THE DEPARTMENT OF AGRICULTURE FOR SCOTLAND, 1930.

(Two standard named Varieties are included in the Table for comparison.)

Variety.	Shape.	Maturity.	Average yield per plant.	
			Craigs House.	Ainville.
			lb.	lb.
93(53) . . .	Oval	Early main crop	4.6	3.7
96(35) . . .	Oval	Main crop .	5.1	4.9
Great Scot . .	Round	Early main crop	4.3	2.8
96(130) . .	Oval	Late . .	5.5	4.2
Kerr's Pink . .	Round	Late . .	5.0	3.4

TABLE III.

RESULTS OF TRIAL IN 1929 OF VARIETIES RECOMMENDED FOR INCLUSION IN SECOND-YEAR REGISTRATION TRIALS, DEPARTMENT OF AGRICULTURE FOR SCOTLAND.

(Two standard named Varieties are included in the Table for comparison.)

Variety.	Shape.	Maturity.	Average yield per plant.					
			Craigs House.					Ainville Sub-Station.
			1927, Field.	1928, Field.	Demonstration Plot, 1928.	1929, Field.	Demonstration Plot, 1929.	1929, Field,
			lb.	lb	lb.	lb.	lb.	lb.
94(105)	Oval	Main crop	3.5	2.3	6.0	5.3	8.9	4.5
96(33) .	Round	Late .	4.2	2.8	6.8	4.3	6.5	4.1
96(43) .	,,	,,	4.0	2.4	4.6	5.0	6.8	3.6
Great Scot	,,	Early main crop	2.2	2.0	5.9	4.3	5.6	2.8
Kerr's Pink	,,	Late .	1.8	1.8	5.6	5.0	7.6	3.4

C. HERBAGE PLANTS.

Assistant in Charge—J. W. GREGOR, Ph.D.

The experiments with herbage plants have been continued in accordance with the scheme outlined in previous Reports.

A considerable part of the work during the last few years has been directed to the examination of different types of Timothy. From the data obtained it is apparent that the species Timothy (Phleum pratense), in Britain, contains at least two groups: Group I., a large-growing cultivated type; and Group II., a "wild" type. These two groups have so far proved to be inter-sterile.

Group I., "American" type.—The term "American" is here applied to a type which was constantly found in agri-

cultural samples from America and Europe. This type has a wide distribution in Britain, but it would be difficult to determine whether it existed in this country previous to the introduction of seed from America.

The group is characterised by the development of comparatively few tillers, even in the second summer of growth. The fertile stems are strong, and "haplocorms" (*i.e.*, the swollen part near the base of the stem), consisting of one, two, or very occasionally three swollen internodes, are usually developed. Haplocorms, however, may not be present on all stems of a plant. In the haplocorm and culm there are approximately seven elongated internodes. The tillers rarely arise from nodes (joints) other than those of or below the haplocorm, or the node immediately above this region. The leaves are generally long and broad. This type is seldom, if ever, common in old closely-grazed pastures.

Group II., "Wild" type.—This is a multi-tillering comparatively low-growing group. The erect forms in culture seldom exceed 2 feet 6 inches in height, while, under similar conditions, the corresponding type in Group I. may attain a height of 4 feet 6 inches. The fertile stems are slender and haplocorms are often poorly developed, while in some plants they are completely absent. The number of elongated internodes per stem is similar to that for Group I. In prostrate or decumbent forms rooting tillers may arise from nodes up to, and including, the fourth; in a few rare instances rooting tillers were observed at the fifth node (the node immediately above the first elongated internode was counted as the first). This group is also distinguishable from Group I. by the smaller size of its seeds. Matured seeds were collected in the greenhouse from several erect plants of both groups, and the number per gram was counted; 1433 seeds of Group I. were equivalent in weight to 2273 seeds of Group II. Leaf length and leaf breadth are variable. In general, it may be said that this group is better suited to grazing conditions.

A cytological examination of material representing both groups has been made by Dr F. W. Sansome, John Innes Horticultural Institution, Merton, London, and his results confirm the fitness of the above classification, since Group I. plants have 42 chromosomes (2n) and Group II. has 14 (2n). This study of inter-sterile groups within the Linnean species Phleum pratense is of economic and scientific interest.

Growth Forms within the Species P. pratense.—For purposes of classification, four growth-form types—viz., prostrate, decumbent, ascending, and erect may be distinguished. There is, however, no sharp line of demarcation between any one form and the next in the series. With the exception of the prostrate form, which has not yet been found in Group I., both groups possess corresponding growth forms. As previously mentioned, the two groups usually occupy different habitats, but even within a group a relationship exists between the types found in a particular habitat and the environmental conditions of the habitat. It appears that in nature the types which are unsuited to the prevailing conditions of their habitat are gradually eliminated, and those that survive frequently bear at least some external resemblance to each other. A detailed account of this work has been accepted for publication in the 'Journal of Genetics.'

In connection with this study of wild populations, the Sea Plantain (Plantago maritima) has proved to be a serviceable plant for the examination and comparison of habitat types, and on that account it has been utilised in some of the investigations in preference to the grasses, since there are certain circumstances which make the species particularly suitable for a research of this nature—viz.: (1) a continuous coastal and a localised inland distribution in the British Isles; (2) cross-fertilisation as the normal means of sexual reproduction, in many cases obligatory owing to the low degree of self-fertility; (3) characters which can be measured with some degree of accuracy. A preliminary paper dealing with the work with Plantago maritima has been published in the 'Journal of Genetics,' Volume 22, No. 1, 1930. The possible value of the sea plantain as an agricultural plant is still being investigated.

The work on wild populations, so far as it has gone, at least indicates the probable economic value of the growth-forms which occur within a species; low growth-habit may tentatively be considered as a character of plants suited for grazing. Further, the study of growth types has established the presence of two apparently inter-sterile groups within the species Phleum pratense. The grouping is of considerable agricultural importance, firstly, because the two groups in general seem to suit different purposes (Group I. for haying and Group II. for grazing), and secondly, they can be seeded

in the same field without the risk of crossing taking place between the two groups.

Relative Hardiness of Grass Varieties.—In a previous Report mention was made of an attempt to raise "hardy" types of Timothy by crossing common Timothy (P. pratense) and Alpine Timothy (P. alpinum). The hybrids obtained from this cross in 1927 were almost completely sterile. As a result of further work on this problem it has been possible to obtain a third generation of considerable size, but it would be inadvisable at this stage in the investigations to predict the agricultural importance of this study until more experimental work has been carried out.

Multiplication of Strains.—Three strains of pasture grasses are now in their second year of multiplication; these include (1) Group II., Timothy; (2) a grazing type of Perennial Ryegrass; and (3) a broad-leaved type of Cocksfoot of intermediate height. It is expected that sufficient seed of these grasses should be available at the end of the season in 1930 for further multiplication.

Pedigree Cultures.—A number of strains of Perennial Ryegrass, Cocksfoot, and Timothy were grown from seed obtained by crossing selected plants under controlled conditions. Comparisons of the seedlings were made with a view to making further selections of grazing types.

D. Root Crops.

(*Swedes and Turnips.*)

Assistant in Charge—V. E. M'M. Davey, B.Sc., Ph.D.

The purpose of the experiments with Swedes is, in the first case, to examine various methods of selecting and comparing individual bulbs with a view to obtaining ultimately improved strains or varieties.

Pedigree Breeding.—About 150 strains of Swedes were sown out in small plots, with certain commercial varieties as controls, while larger plots of most of these were sown in various groupings for the purpose of comparative trials. Observations were made periodically on all the strains during the season, and in the autumn representative selections were made for propagation. The "Roots" Sub-Committee in-

spected the trials in October, and it was decided that one hybrid strain should be mass-multiplied for further observation. A pedigree strain, which had been tested in the yield trial, was also chosen for mass-multiplication.

Controlled Seeding.—About 210 strains of seed were harvested, including 160 samples from self-fertilised plants representing pedigree lines or new types, and forty-four from artificial hybridisations made for the purpose of obtaining recombinations of characters and for the investigation of certain problems bearing on heredity. Three samples, each consisting of one lb. or more, were obtained from mass-multiplications of promising lines for purposes of yield trial in the field.

Analysis of Hereditary Characters.—The investigations concerning the manner of inheritance of various characters such as yield, dry-matter percentage, shape of bulb, colour of skin and flesh, type of foliage, and resistance to finger-and-toe disease were continued. Further information was obtained on problems relating to bolting:—

(1) The tendency in normal swedes.

(2) The occurrence of the bulbless bolter.

(1) When in 1927 some varieties known to be of the type which are coarse in the "neck" were grown under weather conditions causing slight bolting, it was noted that the majority of the plants had necks from ten to fifteen inches in length, but that about 1 per cent were fully bolted, while another 1 per cent had very much shorter necks than the main type. Plants of extreme types were selected in pairs out of three of these varieties and self-fertilised. The progenies were sown early in April 1929. At the end of the season the progenies of the short-necked plants were all short-necked, while the progenies of the long-necked selections had long necks, and in some cases they had fully bolted (see Fig. 3, page 22). When a coarse-necked variety is grown under conditions causing slight bolting, it would appear that the short-necked plants occasionally found in it might be worth selecting, if it is desired to produce a particular strain of the variety less coarse in the neck.

(2) Bulbless bolters have been bred at the Station and appear to be some form of swede-like rape (as has been stated

by H. A. Lafferty in the 'Journal of the Irish Free State Department of Agriculture,' Volume XXVII., No. 1, 1929). Some of the bulbless bolters were completely annual, while others had stems of ten inches in length at the end of the season. The samples of winter rape so far examined have had much shorter stems, but other strains are under examination. Hybrid half-bulbed bolters are also sometimes found, and a plant of this nature, which showed the purple skin of the swede and the white flesh and lemon flower of the bulbless bolter (or rape), was observed. When selfed the progeny of this hybrid plant segregated showing types with white or yellow flesh, lemon or buff flowers, and purple or bronze skin. Thus the parent characters hidden in the (F_1) hybrid plant reappeared in the (F_2) second generation. The bulbs were of all sizes, more or less woody, and with fanged roots. The bulbless bolter was found to cross readily with the swede when plants of each were grown close together. Experimental crosses between swede and rape were made for comparison with the hybrid bulbless bolter (see Fig. 4, page 22).

Yield Trials.—Six small yield trials were carried out during 1929. In two cases a number of pedigree lines bred from a named variety were tested for yield only, and were compared with a sample of the parent variety. By this means duplicates and lines of inferior cropping power could be discarded.

The other four yield trials constituted the second stage in the scheme in which this Station and the Edinburgh and East of Scotland College of Agriculture have been collaborating since 1927, to test a method of selecting parent roots. In that year about 300 plants were tested singly for weight, total dry matter, and soluble solids. (Soluble solids are supposed to be the digestible part of the dry matter.) Extreme types were selected and self-fertilised, and their progenies were grown in yield trials in 1929 with controls, and tested for the same characters. The results obtained from the material analysed by the Station have been examined and the following observations have been made :—

1. Selection of plants from a commercial crop resulted in lines showing hereditary differences, but selection from a pedigree line gave strains similar to one another, showing that the pedigree line was more or less true-breeding.

2. Selection of seven good plants from the commercial

variety gave six strains as good as, or better than, the parental variety.

3. Local environmental differences such as differences in soil, moisture, manuring, or the spacing of the roots in the drill, greatly influence the weight and composition of individual plants. Deviations arising entirely from these causes are not inherited, so that in yield trials the progenies do not show parental characters of this nature.

Bulb-to-bulb analyses were carried out on two F_2 (second hybrid) generations in order to select extreme types. Populations of F_1 hybrids and parent strains were compared in bulk in order to determine whether there was extra vigour in the hybrid.

II. Publications, Lectures, and Official Visits by Staff, for the Year ended 31st March 1930.

PUBLICATIONS (P) AND LECTURES (L).

Director of Research :—

"Plant-Breeding," New Monkland Agricultural Discussion Society, 22nd October 1929. (L)

"Plant-Breeding: Selection as a means of Plant Improvement," Wireless Talk, 28th November 1929. (L)

"The Work of a Plant-Breeding Station," Royal Philosophical Society of Glasgow, 12th February 1930 (L)

Chief Assistant J. W. Gregor, Ph.D. :—

"Some Aspects of the Breeding and Selection of Pasture Plants," Scottish Conference of County Organisers, July 1929. (L)

"Plant-Breeding: The Composition of Plant Populations." Wireless Talk, December 1929. (L)

"Growth Forms within the Sea Plantain (Plantago maritima)," Botanical Society of Edinburgh, January 1930. (L)

VISITS.

Director of Research :—

The Royal Agricultural High School, Berlin.
The Genetics Institute, Dahlem, Berlin.
The Agricultural High School and Plant-Breeding Grounds, Halle.

Chief Assistant J. W. Gregor, Ph.D. :—

The Royal Botanic Gardens, Kew.
The John Innes Horticultural Institution, Merton, Surrey.

III. Demonstrations.

An increased number of demonstrations on the work at the Station were given by members of the staff to various groups of agricultural and other interested parties who visited the Plant-Breeding Station throughout the year.

IV. Acknowledgments.

Grateful acknowledgment is made to the undernoted departments, institutes, firms, and individuals for gifts of samples or other material for experiment :—

Allan, C., Esq., North of Scotland College of Agriculture, Aberdeen.
Allison, A. Y., Esq., North Gyle, Corstorphine.
Anderson, Thomas, Esq., Director of the Seed-Testing Station, Corstorphine.
Bell, David, Esq., J.P., 15 Coburg Street, Leith.
Drummond, J. W., Esq., of Messrs Drummond & Sons, Stirling.
Drummond, Professor Montagu, The University, Glasgow.
Edinburgh and East of Scotland College of Agriculture.
Findlay, William M., Esq., Marischal College, Aberdeen.
Goff, Dr, Institüt für Acker-und Pflanzenbau, Dahlem, Berlin.

Harvey, William, Esq., Nonington, near Dover.
Home, J. H. Milne, Esq., Irvine House, Canonbie.
Institute for Applied Botany, 44 Herzen Street, Leningrad, U.S.S.R.
Knappe, P. T., Esq., Latvia.
Leissner, G. Nilsson, Esq., Ph.D., Svalof, Sweden.
M'Laren, J. T., Esq., 7 Park Place, Stirling.
Miln, G., Esq., of Messrs Gartons, Ltd., Warrington.
Murphy, Paul A., Esq., Ph.D., Albert Agricultural College, Glasnevin, Ireland.
Smith, The Executors of the late Charles, Corstorphine.
Stewart, James C., Esq., 13 South St Andrew Street, Edinburgh.
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The Ministry of Agriculture and Fisheries, London.
Wilson, A. S. B., Esq., Boghall Experimental Farm, Milton Bridge, Mid-Lothian.

Thanks are also due to the Director of the Seed-Testing and Plant-Registration Station, Corstorphine, for carrying out laboratory tests on potato seedlings for susceptibility to wart disease; to members of the staffs of the three Scottish Agricultural Colleges who arranged and supervised the trials of certain of the Society's new varieties of oats; and to Messrs Ian W. Tervet and C. D. S. Swamy, who kindly gave their services as honorary members of the staff for a part of the year.

WILLIAM ROBB,
Director of Research.

THE ORIGIN OF THE "CASTLETON" POTATO OAT.

The stock of Potato Oats known as "Castleton" was raised from seeds which were selected individually as being of outstanding excellence. This method of oat improvement was suggested by work done by my father about the middle of last century. From picked seeds he produced a Potato Oat which had at least a local reputation for goodness. It was grown on this farm as a field crop until about the last decade of the century, when, owing to the stock having somehow become degenerate, the growing of it was discontinued.

The Potato Oats from which "Castleton" was developed came here as a First Prize exhibit bought at a seed grain show. These oats had been grown here as a field crop for some years previous to my setting to work, towards the end of 1908, to extract from them what was intended to be the foundation of an improved stock.

The start was made by putting some 20 bushels from bulk through a rotary screen. By doing this a quantity of less than one bushel was retained as containing the biggest and best seeds, and the necessity for working on useless bulk was to some extent avoided. The picking out of best type seeds then became my chief spare time interest during the following winter months. The grain was placed, a handful at a time, on a sheet of white paper on a table, spread by using an instrument made for the purpose, and seeds of particularly good type picked out and kept apart. This was done sometimes by daylight, but more often by lamplight. Only seeds of the very best Potato Oat type were passed as good, and everything considered good in lamplight was reviewed

in daylight. Seeds to pass had to be full-bodied, so far as could be judged thin in the husk, smooth-skinned and free from awn, and of good white colour. Quality alone was aimed at. Quantity was considered to be of very little importance. By the end of February 1909, I had about two thousand seeds, weighing probably about three and one-third ounces, as a result of my work.

A plot of land about fifteen feet in length and of the same width was prepared. To give good scope for crop development, and consequent big grain increase for work done, the seeds were planted in rows with 4 inches between the seeds in the row, and 4 inches between the rows. This work was much expedited by the use of an implement which marked out in the soil 15 holes at a time in a straight line, at intervals of 4 inches, and with a uniform depth of 1¼ inches. Grown on garden soil, it was a great crop, about seven feet high, with most plants sending up three or more stems to the full height, with many shorter secondaries in addition. To ensure its standing erect until ripe, it was strung and cross-strung with tight lines of binder twine. The grain yield was about thirty pounds, and the type of seed showed great improvement over that of the stock from which the seeds were picked. This was encouraging, and with a view to greater ultimate improvement I selected seeds from the produce of this plot of 1909 as carefully as in the previous year. This time I had little difficulty in getting three times the former quantity of seeds, this being as much as I cared to plant. These were grown in 1910 in the same way as in the previous year. From the produce of the crop of 1910 I made a further selection of seeds, which were grown in 1911 in the same way as before. My object in this repetition of selection from the produce of selection was to ensure that only best type seeds were retained to lay the surest foundation I could think of for a new oat stock. By far the greatest improvement was in the produce of selection No. 1, as compared with the parent stock. Considerable improvement was apparent in the produce of No. 2 over that of No. 1; but there was very little difference between the produce of selections No. 3 and No. 2.

Although the new oat stock, grown as a field crop, had been exhibited at shows as "Castleton Improved" Potato Oats previous to 1914, it was not distributed as seed to growers until No. 3 selection came to sufficient bulk to be offered for

sale in that year. Now known as "Castleton" Potato Oats, it is raised, as I have described, from a triple mass selection of seeds. The process of selection had no direct reference to yield per acre, earliness of ripening, or weather resistance of crop, although in the plot crops plants of undesirable type were cast out without scruple. It was carried out in the belief that seeds of good and uniform type would produce a crop practically in every way superior to the stock from which they were selected.

When I began this selection work about the end of November 1908, I had no idea of doing it more than once. By various methods, however, and mostly with the plant rather than the seed as the unit, oat selection followed by crop trial has been to me an interesting hobby ever since.

WILLIAM RUNCIEMAN.

CASTLETON,
KING EDWARD.

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