

SCOTTISH SOCIETY FOR RESEARCH IN  
PLANT-BREEDING.

REPORT.

---

IN submitting the eighth Annual Report to the Members of the Scottish Society for Research in Plant-Breeding, the Directors have pleasure in again drawing attention to the importance of the research work that is being successfully undertaken at the Scottish Plant-Breeding Station, and to the steady progress that is being made. It is of special interest from the practical side to note that there are already indications of the work carried out in previous years with oats and grasses, yielding at an early date results of direct value to the farmer.

The research work carried out at the Station during the past year is reviewed by the Director of Research on pages 13 to 34. The Report describes the scope of the work and some of the results that have been obtained, but Members will no doubt find the Report of added interest if they can arrange to visit the Plant-Breeding Station and see the plants that are being grown.

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

Scotland is an important source of seed potatoes. Large quantities are sent to England, and smaller quantities to other countries. It is most desirable, therefore, that the

potato crops in Scotland should be as free as possible from all kinds of disease, and particularly from virus disease. This disease is prevalent in many crops, and it is most important that every effort should be made to inquire into the causes and the prevention of the disease under Scottish conditions.

An application was made by the Society, through the Board of Agriculture for Scotland, to the Empire Marketing Board for a grant to enable the Society to undertake research work on virus disease of potatoes. This application was favourably considered, and intimation has been received that the Empire Marketing Board has agreed to provide a capital sum not exceeding £4450 towards the cost of buildings and equipment, and also to give a maintenance grant not exceeding an average of £1430 per annum for five years.

Plans and specifications for the necessary buildings for the research work have been prepared by Mr A. G. Ingham, Chief Surveyor to the Department of Agriculture for Scotland, and the Directors desire to express their appreciation of the care and attention which he has given to the work. Estimates for certain of the buildings have now been accepted, and the erection of the new buildings and the appointment of assistants will proceed forthwith.

### **Financial.**

The audited accounts for the year ended 31st March 1929 show an increase of about £243 in the Society's funds. This increase is accounted for as a result of including as assets recoverable income tax, and the estimated balance of the grant to be received on the year's working. Such items were not included as assets in previous years' accounts.

A few slight alterations in the grouping of several items in

the Abstract of Accounts have been made this year in order to show more clearly the various items that are taken into consideration in calculating the grant to be obtained from Government sources. The basis on which the grants from the Development Commission are now received by the Society, through the Department of Agriculture for Scotland, was revised by the Treasury a year ago, and the method of calculating the grant was described in last year's Annual Report. An instalment of £1050 towards the grant for maintenance expenditure for the year ended 31st March 1929 was received towards the end of that year. It is estimated that the total amount of grant obtainable for the year will be £1185, 4s. 8d. This figure is based on the assumption that about £3398, 15s. will rank as the amount of maintenance expenditure for the year ended 31st March 1929, and it is therefore expected that a further sum of £135, 4s. 8d. will be received. This figure has been reckoned as income for the year to which it applies, in order that the results of the year's working may be more clearly defined.

The amounts received or spent in the various accounts vary, in most cases, very slightly from those of the previous year. On the income side of the Abstract of Accounts there is a slight increase in the amounts received as subscriptions and donations, but the net amount of the income is practically the same as in 1928. The increase—about £18—in the amount received as donations is due chiefly to the response made to the Society's appeal for additional funds.

On the expenditure side of the Accounts the total expenditure ranking for grant is only slightly higher than the corresponding amount of the previous year. The increase in the amount for officers' salaries is due to several of the Assistants being on a salary scale, and also to the fact that the amount

of the salary of the Assistant at the Sub-Station at Ainville is included along with the other officers' salaries instead of being included, as in previous years, in the expenses of Ainville Sub-Station. The expenditure incurred at Ainville is included along with that at the Plant-Breeding Station for purposes of calculating the grant to be received from Government sources.

### **"Dr Wilson" Memorial Fund.**

This fund now amounts to £251, 5s., showing an increase of £10 for the year. No further offer of prizes from the fund has been made since 1927.

### **Membership.**

The Society consists of 99 life members and 86 annual members (22 at the 10s. rate and 64 at the £1 rate). Two life members and seven annual members were enrolled during the year; six members died, two members resigned, and the names of two members, whose subscriptions were in arrears, were deleted from the roll. A list of members appears on pages 37 to 40 hereof.

Donors of £20 or over (including donations to the Preliminary Fund) are, on application, entitled to become life members 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 :—

- D. L. BOWE (Messrs J. H. Bowe & Sons), Dunbar.  
 Professor MONTAGU DRUMMOND, Botany Department, University, Glasgow.  
 JOHN GIBB, Gladstone, Bishopton.  
 J. H. MILNE HOME, Irvine House, Canonbie.  
 WILLIAM INGLIS (Messrs John Inglis & Sons, Ltd.), Granton House, Edinburgh.  
 Principal W. G. R. PATERSON, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow.

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

- 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, J.P., Southfield, Dalkeith.  
 G. BERTRAM SHIELDS, Rosebery Farm, Gorebridge.

JOHN STIRTON,  
*Secretary.*

[ABSTRACT OF ACCOUNTS

## ABSTRACT OF

For year ended

### INCOME.

Interests . . . . .		£1,634 12 0
Add: Recoverable Income Tax . . . . .		232 2 0
		£1,866 14 0
Sale of Produce and Stock on Hand . . . . .		279 9 11
Rents . . . . .		15 0 0
	Income Ranking for Grant . . . . .	£2,161 3 11
Subscriptions—		
Annual . . . . .	£72 10 0	
Life . . . . .	20 0 0	
		£92 10 0
<i>Note.</i> —Annual Subscriptions amounting to £8, 10s. are in arrear.		
Donations . . . . .	36 2 7	
Income Tax Recovered . . . . .	231 10 3	
		360 2 10
	Total Ordinary Income . . . . .	£2,521 6 9
Grant from the Department of Agriculture for Scotland—		
On Account of year ended 31st March 1929 . . . . .	£1,050 0 0	
Estimated Balance receivable for year ended 31st March 1929 . . . . .	135 4 8	
		1,185 4 8
<i>Note.</i> —Balance of Grant for Year ended 31st March 1928, estimated at £31, 13s. 6d., is still outstanding.		
	Total Income . . . . .	£3,706 11 5
Funds at 1st April 1928— . . . . .		43,929 2 8
		£47,635 14 1

## ACCOUNTS.

31st March 1929.

### EXPENDITURE.

Salaries—		
Officers, including Ainville Sub-Station . . . . .		£1,813 1 2
Secretary and Office . . . . .		207 0 0
		£2,020 1 2
Labour . . . . .		615 15 7
National Health and Unemployment Insurances . . . . .		16 13 2
Seeds and Roots . . . . .		17 7 3
Manures . . . . .		164 3 2
Sundry Working Expenses, including renewals of Implements and Tools . . . . .		126 8 10
Laboratory Expenses . . . . .		39 10 8
Library Expenses . . . . .		38 13 9
Rates, Taxes, and Insurances (excluding recoverable Income Tax) . . . . .		40 13 4
Office Expenses . . . . .		74 19 8½
Heating, Lighting, and Cleaning . . . . .		35 15 7
Travelling Expenses . . . . .		44 19 9
Property Repairs and Upkeep . . . . .		71 15 6
Locality Trials . . . . .		10 15 11
Ainville Sub-Station Expenses (excluding Salary) . . . . .		81 1 8
	Expenditure Ranking for Grant . . . . .	£3,398 15 0½
Depreciation on Implements, Tools, Furniture, &c. . . . .		64 7 4
	Total Expenditure . . . . .	£3,463 2 4½
Funds at 31st March 1929, per Balance-sheet . . . . .		44,172 11 8½
		£47,635 14 1

## BALANCE-

As at 31st

## LIABILITIES.

I. Accounts Outstanding . . . . .	£160 18 11
II. Funds at 31st March 1929 . . . . .	44,172 11 8½

---

£44,333 10 7½

DR WILSON

Funds at 31st March 1929 . . . . .	£251 5 0
------------------------------------	----------

---

£251 5 0

EDINBURGH, 10th May 1929.—The undersigned, having had access to all the Accounts, and verified the same with the Accounts and Vouchers relating thereto, now  
16 ALVA STREET.

## SHEET.

March 1929.

## ASSETS.

I. Houses and Lands . . . . .	£7,851 19 0
II. Implements and Tools . . . . .	716 13 0
III. Laboratory Apparatus . . . . .	154 16 3
IV. Office Fittings . . . . .	87 18 8
V. Stocks on Hand . . . . .	102 2 0
VI. Accounts Outstanding, including balance of 1928-29 Grant . . . . .	173 16 11
VII. Income Tax Recoverable . . . . .	232 2 0

## VIII. Investments at Cost :—

Value at 31st March 1929.			
£14,297 10 0	1. £14,000 5 per cent War Stock, 1929-47 . . . . .	£12,390 0 0	
12,188 15 0	2. £14,000 4 per cent Funding Stock, 1960-90 . . . . .	10,045 0 0	
12,949 12 6	3. £16,900 3½ per cent Conversion Stock . . . . .	11,140 3 6	
300 0 0	4. £300 Edinburgh Corporation Loan . . . . .	300 0 0	
£39,735 17 6			33,875 3 6
	IX. Equipment at Ainville Sub-Station . . . . .		183 7 6
	X. Cash Balances—		
	In Bank—		
	On Current Account . . . . .	£94 9 7	
	On Deposit Receipt . . . . .	831 10 3	
	On Hand . . . . .	29 11 11½	
			955 11 9½
			£44,333 10 7½

## MEMORIAL FUND.

Value at 31st March 1929.		
£204 5 0	£200 5 per cent War Stock, 1929-47—valued at date of transfer	£176 5 0
	Interest to date . . . . .	75 0 0
		£251 5 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.

31st March 1929.

**ANALYSIS OF MEMBERS.**

Aberdeen . . . . . 6	Lanark. . . . . 14
Argyll . . . . . 3	Linlithgow . . . . . 4
Ayr . . . . . 14	Mid-Lothian . . . . . 29
Banff . . . . . 1	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 . . . . . 23	Roxburgh . . . . . 3
Fife . . . . . 10	Selkirk . . . . . 1
Forfar . . . . . 7	Stirling . . . . . 2
Inverness . . . . . ..	Sutherland . . . . . ..
Kincardine . . . . . 1	Wigtown . . . . . 1
Kinross . . . . . ..	England . . . . . 2
Kirkcudbright . . . . . 7	
	<u>185</u>



## ESTABLISHMENT FOR 1928-29.

## BOARD OF DIRECTORS.

*Trustees.*

THE RIGHT HON. SIR JOHN GILMOUR, Bart., D.S.O., M.P., Secretary of State for Scotland.

JAMES ELDER, Athelstaneford Mains, Drem.

DAVID BELL, J.P., 15 Coburg Street, Leith.

JOHN FINLAYSON M'GILL, 69 Kyle Street, Ayr.

*Ordinary Directors.*

## 1926.

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

Professor MONTAGU DRUMMOND, Botany Department, University, Glasgow.

JOHN GIBB, Gladstone, Bishopton.

J. H. MILNE HOME, Irvine House, Canonbie.

WILLIAM INGLIS (Messrs John Inglis & Sons, Ltd.), Granton House, Edinburgh.

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

## 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, Udry.

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, The Leuchold, Dalmeny.

ROBERT MILLER, Ferrygate, North Berwick.

JAMES PATON, Kirkness, Glencaig, Fife.

*Directors Co-opted.*

WILLIAM CUTHBERTSON (Messrs Dobbie & Co., Ltd.), Edinburgh.

Sir JAMES INGLIS DAVIDSON, Saughton Mains, Corstorphine.

G. BERTRAM SHIELDS, Rosebery Farm, Gorebridge.

*Directors nominated by the Board of Agriculture.*

Sir ROBERT B. GREIG, M.C., LL.D.,

JAMES WOOD, O.B.E., M.A., 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, J.P., 15 Coburg Street, Leith.

*Director of Research*—WILLIAM ROBB, N.D.A., Craigs House, Corstorphine.

*Chief Assistant*—JAMES W. GREGOR, Ph.D., Craigs House, Corstorphine.

*Assistant*—V. E. M'M. DAVEY, B.Sc., Craigs House, Corstorphine.

*Assistant, Potato-Breeding Sub-Station*—WILLIAM BLACK, B.Sc., Ainville Farm, Kirknewton.

*Secretary*—JOHN STIRTON, 3 George IV. Bridge, Edinburgh.

## COMMITTEES.

---

### RESEARCH.

G. Bertram Shields, *Convener*.  
 T. Anderson.  
 William Cuthbertson.  
 J. W. Drummond.  
 Professor M. Drummond.  
 James H. Elder, B.Sc.  
 John Gibb.  
 Charles E. Gregor.  
 Sir Robert B. Greig.  
 Thomas Hogg.

Major James Keith.  
 William Low.  
 Capt. A. R. M'Dougal.  
 J. F. M'Gill.  
 Principal W. G. R. Paterson.  
 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.  
 Sir J. Inglis Davidson.  
 Charles E. Gregor.  
 J. H. Milne Home.  
 William Inglis.  
 Major James Keith.

J. T. M'Laren.  
 Robert Miller.  
 Professor Ernest Shearer.  
 G. Bertram Shields.  
 James Wood.  
 James Elder, *Chairman, ex officio*.

### FINANCE.

J. H. Milne Home, *Convener*.  
 Thomas Hogg.  
 William Low.  
 Alex. M'Callum.

Robert Miller.  
 G. Bertram Shields.  
 James Elder, *Chairman, ex officio*.  
 David Bell, *Vice-Chairman, ex officio*.

# R E P O R T

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 work at the Station is directed chiefly towards practical ends ; it should be noted, however, that a certain amount of attention has to be given to problems not of immediate practical importance.

“ 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. CEREALS.

#### *Oats.*

The experiments with oats have been continued as in the previous years. The purpose of this work, as heretofore, is to produce improved varieties, some of which should possess

stiff straw and give a high yield of grain, while others should be characterised by early maturity and by adaptability to varying conditions prevailing in late districts in Scotland. Further progress was made with this work during the year, and a few explanatory notes are here given concerning the details of the various experiments and investigations that are being carried out.

*Hybridisation.*—As a means of attaining the objects in view, further hybridisations of plants possessing certain desirable characteristics were made. A few early-ripening varieties, such as Orion, Black Mesdag, and Bathurst, were again successfully used as parents, and a sufficiently large number of hybrid grains was secured.

*Pedigree Cultures.*—The most important of the hybrid grains obtained in the previous year were sown. Each of the plants arising from the hybrid grain, although grown in a pot, produced as much grain as should give a fairly large second generation of plants. As previously indicated, it is important to have a large number of second generation plants, because in some hybrids 200 of these are too few to give all the possible hybrid types a chance of appearing. From the different generations ranging from the second to the seventh, about 600 hybrid unfixed selections were grown in breeding-plots for comparison and further selection. The individual plants of five families of second-generation hybrids (over 1000 plants in all) have been compared and classified, and further data concerning the inheritance of certain botanical characters were obtained. From progenies in generations beyond the second many promising selections, and a few chiefly of botanical interest, have been retained for further experimentation. A considerable number of diverse and promising plant types has been obtained from the following hybrids—Orion  $\times$  Sandy, Orion  $\times$  Beseler's Prolific, and they are now in the fourth generation. Among the Orion  $\times$  Sandy hybrids there are some very vigorous and tall plants. In some families these types appeared to be fixed as regards length of straw and colour of grain, but the ripening period of individual plants varied. Although the straw was abnormally long, several of these long-strawed selections possessed fairly stiff straw, which, despite its length, showed little tendency to lodge. In making selections from the hybrid, preference has been given to white-grained plants. The other hybrid—Orion

× Beseler's Prolific—has produced a progeny of plants which showed a marked contrast in strength of straw to the other Orion × Sandy hybrid. In the Beseler's Prolific cross all the plants had much shorter and weaker straw, the straw being very like that of Orion. In several plants of this hybrid the grain is white and attractive, and a few early-ripening white-grained plants have been selected for further trial and comparison.

Several promising strains which now appear to be breeding true to type have been marked for initial multiplication. These strains have been obtained from the following combinations: Beardless Probsteier × Leader, Victory × Black Mesdag, Sandy × Victory, Potato × Victory, Record × Tam Finlay, Sandy × Storm King. It may be of interest to state that in several progenies of Victory hybrids the re-occurrence of the Victory type has not been observed. A characteristic of the Victory oat is that many of the spikelets are three-grained. The capacity to do this is no doubt an inherited one, but at the same time its expression is influenced by environmental conditions. The effects of environment on the expression of the hereditary factor or factors for three-graining have been emphasised by Professor H. Raum.<sup>1</sup> In all the hybrid progenies from Victory, with Glebe, Potato, and Sandy there were few plants bearing any considerable proportion of three-grained spikelets. Plants bearing a larger or smaller proportion of three-grained spikelets have been selected, but these have invariably produced plants in which the capacity to produce three-grained spikelets was not nearly so great as in the parent—Victory.

Of the hybrid selections in the first stages of multiplication, 17 were tested in rod-row plots against control varieties. As a result of this preliminary test several selections have been retained for further trials in larger plots in 1929. Other 20 hybrid selections were tested in small field-plots against Potato, Sandy, and Victory varieties, and also multiplied in separate plots. Fourteen of these selections were replicated four times in the Yield Trial Plots. The four trial plots and one multiplication plot of each selection absorbed all the available grain. A statistical analysis of the grain yields of the selections was made according to methods described by

<sup>1</sup> Zeitschrift f. Pflanzenzuchtung, Band XIII., Heft 4.

Engledow and Yule.<sup>1</sup> In Table I. data are given with reference to the control varieties and the more promising hybrid selections. The varieties are arranged in the table in order of yield of grain. The yields of grain within the sets of four plots were tolerably uniform.

TABLE I.

OAT TRIALS, 1928— $\frac{1}{4}$ -ACRE PLOTS.

VARIETIES ARRANGED IN ORDER OF YIELD.

Name or Reference Number.	Parentage.	Growing Period.	Yield of Grain. Mean of four $\frac{1}{4}$ -acre plots. lbs.	Remarks.
		Days.		
72 (22) G (6) A	Castleton Potato × Beseler's Prolific	162	10.5	Stiff-strawed type
72 (22) G (4) E	"	161	10.3	"
72 (22) G (6) B	"	163	10.2	"
72 (22) G (4) A	"	158	10.0	"
72 (22) G (4) H	"	162	9.7	"
72 (22) G (4) B	"	159	9.5	"
72 (22) G (4) C	"	159	9.2	"
Victory Aa 30	—	155	8.7	—
Aa 612	Castleton Potato × Beseler's Prolific	158	8.6	Stiff-strawed type
72 (22) G (1) A	"	158	8.3	"
Aa 609	Sandy × Record	158	7.8	—
108 (10) B (4)	Potato × No. 9 (3)	154	7.8	—
Potato Aa 10	—	154	7.1	—
Aa 600	Golden Rain × Leader	153	6.9	—
Aa 604	Sandy × Leader	153	6.8	—
Aa 605	"	153	6.4	—
Sandy Aa 2	—	154	6.0	—

Standard Error=0.55 lbs.

<sup>1</sup> 'The Principles and Practice of Yield Trials,' 1926.

From the results of the analysis, it may be said that under the conditions prevailing at the Station in 1928 the first four varieties in Table I. have given a significantly higher yield of grain than Victory, and the first ten varieties have given a significantly higher yield of grain than Potato. Two of the Sandy types and Sandy have given the lowest yields.

The Castleton Potato  $\times$  Beseler's Prolific hybrid selections are all stiff-strawed types, which may be best adapted to medium-early and to fertile soils where lodging is liable to occur. Some of these selections are distinctly short-strawed types. The Sandy hybrid selections are mainly for comparison with that variety and with the Potato oat. The Golden Rain  $\times$  Leader selection might be worth further trial on soils where the Golden Rain variety has given satisfactory results. The grain of this hybrid selection is not quite so yellow as that of Golden Rain, and on that account might be preferred to Golden Rain if it is equally suitable otherwise.

*Locality Trials, 1928.*—Arrangements were made with each of the three Agricultural Colleges in Scotland to have several new hybrid selections tested in the respective areas served by the Colleges. Seven selections in all were included in the trials.

#### SUMMARY OF REPORTS ON THE LOCALITY TRIALS.

*Variety Aa 600: Golden Rain  $\times$  Leader.*—This selection was tested in four centres on a wide variety of soils. At one centre where this variety was tested the field lay at an elevation of 850 feet, and the yield of grain was only three bushels less than that produced by Crown, and it was considered that the straw was of slightly better quality than Crown. From results received from other trial centres, it would appear that this variety should be tested again in 1929.

*Variety Aa 604: Sandy  $\times$  Leader.*—This selection was grown in various places in the north, east, and west of Scotland. The most favourable reports this year have been received from Dumfriesshire. On one farm it is reported as follows: "Grows a fair amount of straw, is fairly good grain, and seems like an oat that would be suitable for sowing on fields that were bad for lodging. It also seems to be a fairly good yielder of grain." In another trial the report states: "This variety (604) showed great promise; the straw was fine and of good

quality. It stood very well." In the Registration Trials, Department of Agriculture for Scotland, this variety has been recommended for further trial in 1929.

*Variety Aa 605: Sandy × Leader.*—This selection was also tested in the north, east, and west of Scotland, generally alongside the variety Aa 604. This variety did very well in Aberdeenshire in 1927, but on the same farm in 1928 the crop was exceedingly thin, having been thinned out very severely after braiding. The best reports this year have been received from Dumfriesshire. A farmer there reports on it as follows: "Aa 605 is what I would consider a first-class oat. It grows beautiful straw, though not too much of it, though rather more than No. 2 plot (*i.e.*, Aa 604). It seems to stand well, and the grain is excellent. It seems also to have the faculty of retaining its colour, as it got practically three weeks in the stook of the worst harvest weather on record." The Castleton Potato grown alongside was badly lodged. In the Registration Trials this variety has also been recommended for further trial in 1929. At Boghall Experimental Farm this variety is reported to have been "slightly better than Potato."

*Variety Aa 608: Sandy × Daubeny.*—This selection is a Sandy type, which, at the Plant-Breeding Station, ripens earlier than Sandy, but it does not ripen any earlier than Sandy in the North of Scotland. The yield of grain was also rather low, and it does not seem that this variety is worth further trial.

*Variety Aa 612: Castleton Potato × Beseler's Prolific.*—This is one of the stiff-strawed selections which has given very good results at the Plant-Breeding Station both as regards yield of grain and strength of straw. It was tested at five different centres. At Boghall Experimental Farm it was reported that this variety was "just about as good as Victory." On the trial at a high-lying farm in Lanarkshire, it is reported that "this variety is satisfactory in yield of grain, threshing out about three bushels less per acre than 'Crown.'" The report from the trial in Kincardineshire, which was carried out on a rather cold clayey field lying at an elevation of 550 feet, states that this selection was estimated to have produced 20 cwt. of dressed grain per acre in comparison with Castleton Potato, 26½ cwt.; Victory, 29¼ cwt. The date of ripening of the hybrid was rather late, the crop was still green on the



13th October when it was cut. It is probable this selection is better suited to medium-early and fertile soils where lodging is liable to occur. In the Registration Trials in 1928 this variety was tested against several other varieties, including Victory, and it gave the highest grain yield. It has been recommended for further trial in 1929.

*Variety Aa 614: Sandy × Record.*—This variety was tested only at Boghall Experimental Farm, where it gave a strong healthy braird, and a moderately thick crop, but the straw was rather weak. The estimated yield of grain per acre was 23 cwt.

## B. POTATOES.

### *Assistants in Charge—*

J. W. GREGOR, Ph.D. (Plant-Breeding Station).

WILLIAM BLACK, B.Sc. (Ainville Sub-Station).

The objects of the experiments with potatoes remain the same, and further investigations have been carried out concerning in the main (a) the heredity of several characters, (b) the effects of selfing on the production of relatively pure-breeding parent varieties, (c) the maintenance of healthy stocks of seedlings, (d) the relative merits of various pairs of varieties as parents for producing new immune varieties, and (e) the relative agronomic value of the more promising types of seedlings that are raised in the experiments.

As in previous years, the work is being conducted at two centres. Comparisons of yields of tubers and of resistance to disease of the more promising seedlings are made chiefly at the Plant-Breeding Station, Corstorphine, but all the other investigations are made at the Sub-Station at Ainville.

*Heredity.*—The desirability of using only healthy stocks as parent varieties is becoming apparent. There has been a distinct fall in the percentage of unhealthy and degenerate seedlings in the offspring of apparently healthy varieties. The parent stocks are being maintained in a healthy condition, and are being increased by the addition of a few other desirable varieties. Several unnamed varieties, selected on account of their comparatively high standard of excellence in some particular respect and their capacity to produce viable pollen, are maintained as pollen parents. The older selections

of unnamed varieties have now been considerably reduced in numbers, their places as parent plants having been taken by more recently raised and promising seedlings. Only healthy plants were used for breeding, and the usual precautions were taken to prevent accidental cross-pollination. Berries were obtained from many of the self- and cross-pollinated flowers. Particular attention was paid to the selfing of a number of seedlings for the inbreeding investigations. It was hoped to obtain a large number of berries from early-ripening varieties, but the scarcity or absence of flowers on these varieties was a limiting factor. Among the crosses from which good seed was obtained, the following may be mentioned: Abundance  $\times$  120(56), Ally  $\times$  Flourball, and Majestic  $\times$  121(4). The series No. 120 was derived from Great Scot, and No. 121 from Witchhill.

Twenty-one families of seedlings consisting of 1475 plants were raised. Fifteen of these families, containing between 50 and 200 seedling plants each, were grown as a whole to obtain data regarding the heredity of various characteristics of the potato. From the data obtained it was found that in the cross—Kerr's Pink  $\times$  Flourball, where both parents have coloured tubers—the progeny, when lifted, consisted of 50 per cent white-tubered plants. After exposure to light for a few days, however, the tubers from several plants acquired a certain amount of pigment in the skin, thus increasing the proportion of coloured tuber plants. These plants in which the colour developed later appear really to be coloured varieties in which the pigment does not develop in the absence of light.

*Selfing.*—The experiments designed for the purpose of studying the effects of selfing potato plants through a series of generations were successfully continued. Eight families of seedlings comprising 725 plants were grown for this purpose. They were chiefly seedlings in the third selfed generation. Within each family the plants displayed a marked degree of similarity with respect to certain botanical characters. There are as yet no families perfectly uniform in type for all the chief morphological characters, but there are indications that a comparatively high degree of uniformity in certain families may soon be reached. In some of the inbred families a high degree of self-fertility is now evident. Self-fertile plants of different types will be valuable for genetical experiments, even if they are not directly of economic importance.

*Crossing.*—A certain amount of breeding was carried out on a more or less empirical basis, mainly to find out how several pairs of varieties perform as parents for the production of varieties immune from Wart Disease, and possessing characters of economic value. These seedlings were compared, and those possessing undesirable characteristics were discarded. The remainder were retained for further trials. Some of the best seedlings were produced from the following crosses: Great Scot  $\times$  Bell, Kerr's Pink  $\times$  Bell, Up-to-date  $\times$  Flourball, British Queen  $\times$  993(a)(4), and Great Scot  $\times$  993(a)(4). Many otherwise promising seedlings were discarded on account of their being susceptible to Wart Disease.

It was noted that a few pairs of varieties when hybridised produced progenies in which all the plants were obviously worthless as economic types. It is possible that in these combinations something of greater value might be secured if a large number of seedlings could be obtained. When only a comparatively small number of seeds are obtained in a crossed berry, some of the possible hereditary combinations may not have a chance of appearing. For instance, in a progeny consisting of 50 plants derived from Epicure  $\times$  Garnet Chili, not one was found of sufficient merit to justify further trial. The parents themselves possess certain desirable qualities, but apparently the combination of characters in the first generation plants at any rate is unfavourable. Different and more favourable combinations, however, might be formed in the second generation plants. It is in this connection that self-fertility becomes most important, because if the first generation plants are self-fertile, a second generation ( $F_2$ ) may readily be obtained. For example, if all the first generation plants of the above-mentioned hybrid were late-ripening types, and were also male sterile, there would be little chance of back-crossing with a variety like Epicure for the purpose of obtaining the early-ripening characteristic in the second generation. Early ripening is, of course, a characteristic that we are particularly anxious to obtain in certain new varieties.

*Virus Diseases.*—The amount of virus diseases that appeared throughout the year was negligible, and this confirms the observations made in previous years. A small percentage of abnormal plants was found among the first-year seedlings before the healthy and normal plants had reached the stage for planting-out in the open. It seems probable that those

abnormal and weak plants were hereditary variations. It is not without significance that so far as one could judge by eye, unhealthy plants were absent in those families of seedlings produced wholly from the apparently healthy named varieties introduced recently for breeding purposes from Craibstone, Aberdeen. Families of seedlings produced from varieties other than those from the North of Scotland invariably showed a proportion of unhealthy plants.

A few unhealthy plants were found among the second-year seedlings, but they had not been raised from the North of Scotland varieties. In these it is probable that the disease was insufficiently developed in the first year to be observed. In some of them as first-year seedlings the presence of virus disease was doubtful.

No disease was observed in any of the third-year seedlings.

*First-year Seedlings.*—In all, 1475 seedlings were raised, consisting of 725 from selfed berries and 750 from hybrid berries. The latter were produced from crossing the following varieties: Abundance  $\times$  Majestic, Abundance  $\times$  Shamrock, British Queen  $\times$  Flourball, Epicure  $\times$  Flourball, Kerr's Pink  $\times$  Flourball, Kerr's Pink  $\times$  39(15), King Edward  $\times$  39(15), Up-to-date  $\times$  98(23) (an Up-to-date  $\times$  Majestic seedling), and Witchhill  $\times$  121(5) (a Witchhill  $\times$  Immune Ashleaf seedling). Many vigorous and promising types of seedlings were produced, comparatively few "degenerate" plants being in evidence. Several of the parent plants possessed coloured tubers, and, as expected, a considerable proportion of the seedling tubers were also coloured. As there is little demand for coloured tubers, the range of seedlings for selection was therefore further restricted.

*Second and Third-year Seedlings.*—The seedlings in their second year of existence were reduced to a total of 420 selections at planting time after the results of the trials for immunity to wart disease had been taken into consideration. All the varieties susceptible to wart disease were discarded except a few which have been kept for experimentation.

The seedlings in their third year at Ainville numbered 150. In accordance with the usual practice of maintaining at Ainville a small healthy stock of each individual selection which is being tested at Craigs House, two plants of each of these were grown. In addition, however, it was considered advisable to multiply in greater quantity the best of the third-year

selections in order to have a sufficient number of tubers, if necessary, for subsequent registration and other trials. Over 100 selections, varying in quantity from 6 to 24 tubers, were planted for this purpose. The conditions of cultivation were similar to those which might be given to an ordinary commercial crop. In general, the selections grew well and remained healthy. A little damage was done by early frosts, and this reduced the yield of tubers. The results showed that some of the seedlings merit further trial on a larger scale, and that they compare favourably with the named varieties grown in the field. There was very little loss on account of blight.

*Registration Trials, &c.*—Five seedlings have been submitted to the Department of Agriculture for Scotland for inclusion in the Registration Trials.

For the preliminary small-scale trials carried out by the Department of Agriculture for Scotland 50 single-tuber samples have been submitted.

*Wart Disease Trials.*—As in previous years, seedlings were submitted to the Department of Agriculture for Scotland for inclusion in these trials. Single tuber samples were also submitted from the 1928 crop. In certain families of seedlings a tuber from each plant was submitted for trial to obtain a count of the proportion of susceptible plants that occurred.

*Comparative Trials of Selected Seedlings.*—These trials are mainly made at the Plant-Breeding Station, Corstorphine. While a seedling is being tested at Corstorphine a small duplicate stock of the same selection is, of course, grown at the Sub-Station at Ainville to provide healthy seed, if required for the future. Botanical notes were taken throughout the growing season and comparisons of over 300 selections were made with reference to characters of economic importance. Freedom from disease was one of the features of the trials, but it must, however, be mentioned that an early frost cut down the haulms at an exceptionally early date, and thus prevented the full development of late blight in the foliage. This disease did occur in a few selections, and, when present, it attacked those selections which had in previous years proved to be the more susceptible.

The Trial results indicate that 15 selections were outstanding, in respect of their cropping powers and habit of growth, and compared very favourably with their controls (Kerr's Pink and Great Scot). In Table II. the yields of five of the

most promising selections, as well as their controls, are given. These five selections have been sent to the Department of Agriculture for Scotland for inclusion in the Registration Trials.

The parents of the No. 93 and the No. 94 selections are Great Scot and Bell, and for the No. 96 series Kerr's Pink and Bell. The cooking quality of all the five seedlings was good. Kerr's Pink was used for comparison of cooking quality, and it is denoted in the Table by "VG" (= very good). When the quality of the seedling is slightly inferior or slightly superior to Kerr's Pink "VG -" and "VG +" are employed respectively.

It is worthy of note that during the period these selections have been in culture at Craigs House no definite symptoms of either Mosaic or Leaf Roll have been observed.

[TABLE II.

TABLE II.

RESULTS OF YIELD TRIALS (CRAIGS HOUSE) OF SELECTIONS ENTERED FOR REGISTRATION TRIALS (1929).

Station No.	Maturity.	Shape of Tuber.	Cooking Quality.	Garden Trial, 1928.		Field Trial, 1927.		Field Trial, 1928.		Garden Trial, 1928. Order of Yield.	Field Trial, 1927. Order of Yield.	Field Trial, 1928. Order of Yield.
				Average Yield per Plant—lbs.	Ratio— Small.*	Average Yield per Plant—lbs.	Ratio— Small.*	Average Yield per Plant—lbs.	Ratio— Small.*			
93 (110)	Late main crop	Oval	VG -	—	—	—	—	2.3	1.7	—	—	96 (33)
94 (72)	"	Full oval	VG -	5.8	6.5	4.0	9.0	2.6	3.4	96 (33)	96 (33)	94 (72)
94 (105)	Late	Round oval	VG +	6.0	5.2	3.5	8.6	2.3	2.0	94 (105)	94 (72)	96 (43)
96 (33)	"	Round	VG -	6.8	10.6	4.2	8.8	2.8	4.3	Great Scot	96 (43)	93 (110)
96 (43)	"	Round oval	VG +	4.6	2.6	4.0	9.2	2.4	1.4	94 (72)	94 (105)	94 (105)
Great Scot				5.9	5.7	2.2	6.2	2.0	2.0	Kerr's Pink	Great Scot	Great Scot
Kerr's Pink			VG	5.6	5.7	1.8	7.4	1.8	1.7	96 (43)	Kerr's Pink	Kerr's Pink

\* Small (seed and chats) = 1.

## C. HERBAGE PLANTS.

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

Steady progress is being made in the efforts to understand more fully the characteristics of the various grass varieties which constitute a pasture, and special attention is being paid to the study of competition within a species, as distinct from competition between different species. The results of this work on the pollination of Perennial and Italian Ryegrass have now been published ('Transactions' of the Royal Society of Edinburgh, Volume LV., Part III., No. 30, 1928).

As indicated in the Report for 1928, one of the main lines of research being undertaken in connection with pasture plants at the Plant Breeding Station is the study of the relation between environment and the genetic constitution of the forms found growing wild.

*The Relationship between the Plant and its Environment.*—Plants frequently assume distinct habits of growth when subjected to the influence of extreme conditions of environment, and in these circumstances a whole species-population may appear almost homogeneous, yet when some or all of the extreme conditions are removed, as in experimental culture, the population may exhibit a considerable range of types. If the effects of different conditions were more fully understood, the information gained would be of great value to the plant-breeder in his endeavour to isolate the types suited to certain agricultural conditions. Grazing, no doubt, stimulates tiller production even in plants of essentially the "haying" variety, but it should not be assumed that any grass plant is capable, under the conditions of extremely close grazing, of developing the required habit of growth essential for survival in a pasture. Although in pastures some plants of the "haying" type—Perennial Ryegrass, for example—become slightly modified in form in response to the effects of the environmental conditions, there are others of certain species, including *L. perenne*, which, in a pasture, undergo no modification because their normal growth form is well adapted to pasture conditions. The modified forms tend to resemble the naturally occurring pasture ones, but modification does not proceed to the extent of making them exactly similar. These unmodified forms are hereditary; they are what we believe to be the



best pasture forms, and it is reasonable to assume that the study of these will amply repay investigation.

As an example of the superiority of the hereditary pasture type under experimental plot conditions, the following account of an experiment made last year may be of interest :—

Two plants of perennial ryegrass, of equal vigour when grown separately, were chosen ; one represented the hereditarily low-growing pasture type, while the other was of the upright "haying" type. They were also distinguished by a minor botanical difference which aided subsequent identification. Eighty-five equal-sized pieces of each plant were interplanted in a small plot during the first week of May. The plot was cut closely once a week thereafter until the middle of July, after which time cutting was limited to every second week till 2nd October, at which date the plants were lifted and examined. It was then found that all the eighty-five pieces of the pasture plant were present and vigorous, whereas ten pieces of the "haying" type had died and the remainder were much weakened. Fig. 1, p. 29, illustrates the result clearly. In the photograph the background is made up of the pasture form ; all that remained of the hay type is seen in the middle foreground.

A similar result was obtained when an extremely tall cultivated form of Timothy was grown along with a low-growing pasture form (Fig. 2), p. 29.

*Pedigree Cultures.*—A considerable amount of time last year was devoted to the study of Timothy varieties. Here, as in Perennial Ryegrass and Cocksfoot, great variation of type occurs ranging from the low-growing to the upright form (Fig. 2). Selection within various lines was continued with satisfactory results. As in previous years the crossing of promising forms was carried out under strict control. The cultivated form of Timothy (*i.e.*, tall growing) is rarely, if ever, abundant in old heavily grazed pastures, therefore other forms of the species received most attention last season. A low-growing pasture strain is now in the second year of vegetative multiplication preparatory to its being multiplied by seed.

Last year the Perennial Ryegrass trial plots proved to be a source of interest to visitors to the Station. Plots of a low-growing pasture strain, now being multiplied, were seen alongside plots of a strain of cultivated Ayrshire Perennial Rye-

grass. There was no doubt that the plots containing the pasture strain made decidedly the superior pasturage; practically no bare spaces occurred between the plants, as was the case in the cultivated ryegrass plots.

*Experiments with Sea Plantain* (*Plantago maritima*).—As mentioned in last year's report, steps are being taken to investigate the possibility of finding some edible plant which might be introduced into a seeds mixture to prevent the grazing stock from "scouring" when there is excess of wild white clover in the pasture. As a result of observations made, both in the wild and at the Plant-Breeding Station, different forms of sea plantain (Fig. 3) are now being intensively studied. Collections of material have been made from many coastal and inland localities in Scotland, and an examination of the types, with a view to selecting the forms best adapted to pasture conditions, is in progress. 15 lb. of seed were saved last year from plants growing in the experimental garden at the Plant-Breeding Station. This seed will be utilised for a field trial in 1929, which should afford some indication of the value of the species and of its behaviour under cultivated pasture conditions.

#### D. ROOT CROPS.

(*Swedens and Turnips*.)

*Assistant in Charge*—V. E. M<sup>c</sup>M. DAVEY, B.Sc.

The experiments with root crops refer mainly to methods of breeding and of selecting parent roots of Swedes.

*Pedigree Breeding*.—About 180 strains of Swedes were sown out in small plots with commercial controls, while larger plots of most of these were sown in various groupings, for the purpose of comparative trials. Observations were made on all the strains at times during the season, and numerous selections were made for propagation. The Roots Sub-Committee inspected the trials in the autumn, and it was decided that three strains should be mass-multiplied to provide seed for small field trials.

*Controlled Seeding*.—About 120 Swedes were seeded, each being individually isolated. 43 of these had been selected on the basis of dry-matter content, soluble solids, and weight, out of 300 cored roots, half of which, it will be recalled, were

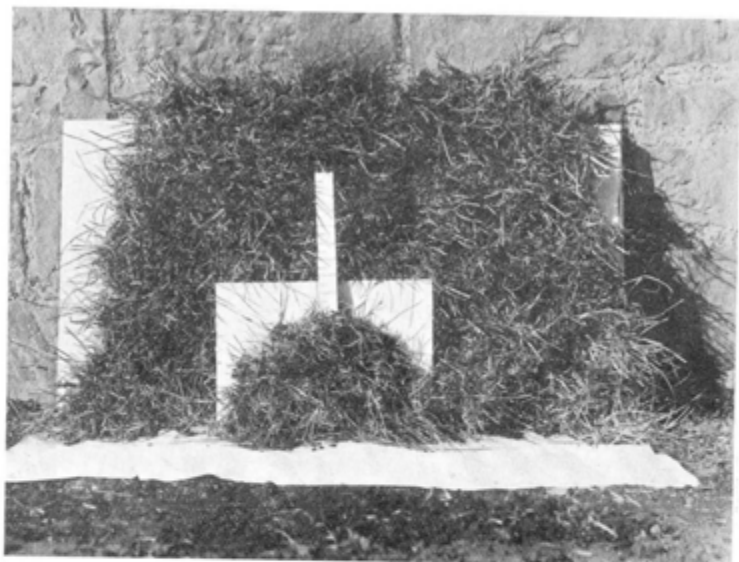


FIG. 1.

The effect of competition between varieties of the same species  
(perennial ryegrass).



FIG. 2.

Two forms of timothy (*Phleum pratense*), photographed in August.

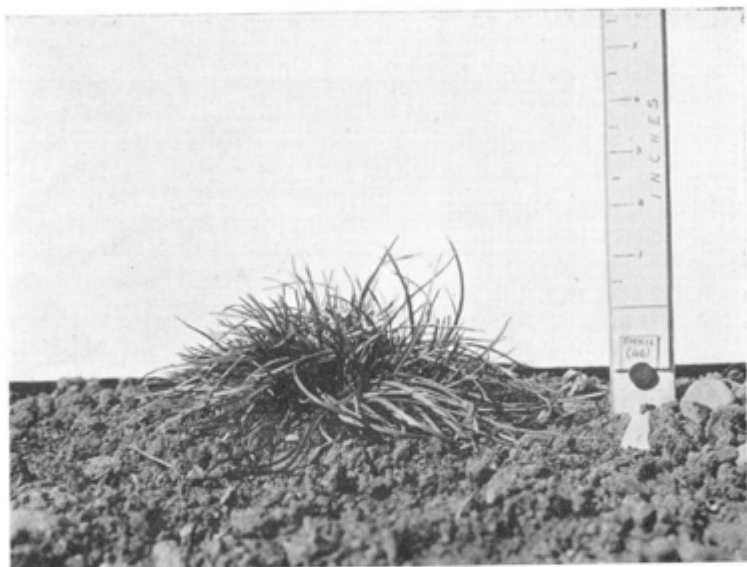


FIG. 3.  
The sea plantain (*Plantago maritima*), photographed in April.



FIG. 4.  
Self-fertilisation of swedes (ripening stage).

analysed by the Edinburgh College of Agriculture. The seed obtained from these will be grown as material for the second part of the co-operative College trials in 1929. The remainder of the selfed plants represented various stages in pedigree breeding. 18 hand crosses were made for the investigation of certain problems.

*Analysis of Hereditary Characters.*—The investigations concerning the mode of inheritance of shape of bulb, colour of skin and flesh, type of foliage, dry-matter content, resistance to finger-and-toe disease, tendency to bolt, &c., are being continued.

This year some notes were obtained on the subject of flesh-colour inheritance. Work on the Continent had shown that when white and yellow-fleshed roots, either swede or turnip, are crossed, the first generation hybrids are all white. A series of such crosses made at this Station have confirmed the results obtained on the Continent. It also appeared that there are two, or perhaps three, pairs of factors each controlling flesh colour. In 1925 a cross was made at the Station between a yellow-flesh swede and a white-flesh swede (not of the variety used in the above-mentioned Continental experiments). The first hybrid ( $F_1$ ) generation were all white-fleshed. In 1928 a large plot of the next ( $F_2$ ) generation was grown, and the flesh colours, along with other characters, carefully noted during lifting. The score was 3621 white, 246 yellow-fleshed; this is very close to a ratio of 15:1. On this ratio the theoretical numbers expected of each type are 3625:242. From this result it is inferred that the white-flesh parent is different from the yellow-flesh parent in possessing two pairs of factors of which one of either pair could give white flesh, and that only in the total absence of both factors for white colour would yellow flesh show. The probability is that yellow has only one chance of occurring in sixteen times. Suitable back-crosses confirmed this.

Another white-flesh swede has been found in a crop of swedes of the Superlative type. The occurrence of this white-flesh swede was probably due to outside pollination, the plant being heterozygous. In this case only one set of factors was involved, larger proportions of yellow plants appeared in its progeny and in back crosses.

It may be concluded, then, that when white and yellow-fleshed varieties are crossed either one plant in four or one

in sixteen will be yellow-fleshed in the second hybrid generation.

*Species Hybridisation.*—A number of hybrid populations were grown. These consisted of white and yellow turnips in different combinations. In connection with this work attention is drawn to the late Dr Wilson's paper on this subject in the 'Transactions' of the Highland and Agricultural Society, 1911. Hybrids between swedes and turnips were large plants with leaves of swede colour, but deeply divided like turnip, and slightly hairy beneath. In colour, if one parent was red the hybrid was likewise red. The green which underlies the skin of the swede was always present. If either or both parents were white-fleshed, all the hybrid plants were white-fleshed. While if both parents were yellow, the hybrids were all yellow. Necks were short, and swellings or nodules disfigured the otherwise good roots.

*Comparison of Pedigree Cultures.*—Special attention was paid to the non-purple varieties and strains, a large number of which were planted together. Bronze tops and occasionally green tops occurred in many purple-top varieties to the extent of 0 — 5 per cent. The majority of these appear to be different from their variety types only in one or two respects, and this, taken in conjunction with the fact that selfed purple-top plants occasionally segregate, giving 25 per cent bronze, seems to show that the difference is due principally to one factor, which decides the colour of the neck and to some extent the skin. A few "rogues," however, show several points of difference from the varieties in which they are found, and, in some cases at least, their occurrence is due to admixture of seed. In 1926, twenty of these "off-types" were collected, and their progenies nearly all bred true for colour.

Bronze colour is much modified by weather and soil conditions, but there are distinct types, which may become true breeding. Two plants, one light and one dark bronze, were selected from a bronze variety in 1921, and their self-fertilised descendants have ever since retained the distinctive difference.

*Best-of-All Trial.*—In 1926 various samples of Best-of-All from various sources were grown, together with some varieties thought to be "synonyms."

In that year it was noted that the Best-of-All strains varied in colour in different directions from a fairly distinct main

type, and covered a considerably wide range. All the strains contained a few bronze-tops. There was also great variability in shape. The other varieties under examination also exhibited ranges of colour overlapping Best-of-All, but, with one exception, their main colour types (about 80 per cent) were not the same as that of the Best-of-All strains. Nineteen roots were selected as being distinctive in colour and shape. The following colours appeared to breed true: (1) very dark purple; (2) scurfy purple; (3) clear purple; (4) light red-purple with red neck; (5) bronze; and (6) very scurfy green. Of the various shapes some bred true for one shape only. Some gave a small range of shapes, some gave wide ranges, and in one or two progenies the parent shape did not occur.

*Yield Trials.*—Four mass-multiplied strains were ready for trial, two of them having been sown out in 1927, but destroyed by a drought. With their commercial varieties, these were laid out in a yield trial with five plots of each. Measured areas in each plot were weighed, and from the data obtained the average yields and bulb weights were calculated. No dry-matter estimations were made in this trial. One of the multiplied strains showed promise.

*Disease Resistance.*—In the Drive Plot, which is kept heavily infected with finger- and -toe disease, the progenies of resistant roots were tried out. Infection was severe. The three strains that were least damaged and contained most clean roots were the descendants of those that were the most resistant in 1926.

*Dry-matter, &c., Analyses.*—The Edinburgh College of Agriculture made no analyses as their material was at the seeding stage in 1928. Five lots of fifty roots were tested by coring, for dry-matter content, and were also weighed. The most distinctive roots from these were selected, and in some cases further analyses were made on the whole root, leaving the neck for seed production.

Certain other bulk samples and single roots were analysed, a different method of sugar estimation being tried. A considerable part of the winter work was devoted to making investigations on a large line yield trial, in which forty-six bulk samples were tested for dry-matter content, nineteen for sugar, and forty-seven plots were weighed. An extract from the results is included in Table III. of this report.

TABLE III.

## LARGE LINE YIELD TRIAL, 1928.

*Extract of the Results.*

*Material.*—Three pedigree strains, Da 440, 441, and 442, originating in a commercial purple-top swede variety self-fertilised and selected for three generations, were compared in replicate plots with a sample of the parent variety, Da 234.

Da 440 and Da 441 were progenies of sister roots. The similarity between them may indicate the effect of inbreeding. Da 442 was unrelated to the other lines, except that the great-grandparents of all were plants in the same commercial sample.

Control Da 234, Commercial Variety, showing Average Yields.	If the yields of the control be expressed as 100, the corre- sponding yields of the other strains proportionally are :—		
	Da 440.	Da 441.	Da 442.
Yield per acre . . . . 20 tons	114	114	98
Dry-matter content . . 12·8%	96	96	108
Dry-matter per acre . . 51 cwt.	109	110	106
Average weight per bulb 2½ lb.	111	111	91
Sugar content . . . . 7·6%	103	100	114
Sugar per acre . . . . 30 cwt.	117	114	116



## II. Publications, Lectures, and Official Visits by Staff.

### PUBLICATIONS (P) AND LECTURES (L).

Director of Research :—

- “Inbreeding as a Means of Plant Improvement,” the Glasgow University Society of Agricultural Science, November 1928. (L)
- “Some Potato-Breeding Problems,” the ‘Scottish Journal of Agriculture,’ Vol. XII., No. 1, January 1929. (P)
- “Plant-Breeding: some Aspects of Work with Crop Plants,” Wireless Talk, January 1929. (L)

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

- “Pollination and Seed Production in the Ryegrasses (*Lolium perenne* and *Lolium italicum*),” ‘Transactions’ of the Royal Society of Edinburgh, Vol. LV., Part 3, No. 30, 1928. (P)
- “Some Observations on the Breeding of Pasture Plants,” Wireless Talk, January 1929. (L)

Assistant V. E. M'M. Davey, B.Sc. :—

- “Bolting in Root Crops,” Botanical Society of Edinburgh, April 1928. (L)

### VISIT.

Assistant V. E. M'M. Davey, B.Sc. :—

- The John Innes Horticulture Institute, Merton, Surrey. (Attending short summer course on Genetics.)

## III. Demonstrations.

Demonstrations regarding the work at the Station were given by members of the staff to various groups of agriculturists 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 :—

- Thomas Anderson, Esq., M.A., B.Sc., East Craigs, Corstorphine.  
 The Animal Breeding Research Department, Edinburgh.  
 Messrs David Bell, Ltd., Leith.  
 The Central Experiment Farms, Ottawa, Canada.  
 Messrs Alex. Cross Seed Co., Ltd., 21 Hope Street, Glasgow  
 (per Thomas Hogg, Esq.).  
 Messrs W. Dods & Son, Haddington (per James Elder, Esq.).  
 Messrs W. Drummond & Sons, Stirling.  
 The Edinburgh and East of Scotland College of Agriculture.  
 The Imperial Department of Agriculture, Pusa, India.  
 J. M. Kennedy, Esq., Lerwick, Shetland.  
 P. T. Knappe, Esq., Latvia.  
 Messrs M'Gill & Smith (per J. F. M'Gill, Esq.), Ayr.  
 M. Ødelien, Esq., Oslo, Norway.  
 Charles Smith, Esq., Corstorphine.  
 A. S. B. Wilson, Esq., B.Sc., Boghall Experimental Farm, Milton Bridge, Midlothian.  
 A. Robertson Wilson, Esq., M.A., M.D., 23 Hoseside Road, Wallasey, Cheshire.

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 new varieties of oats, and to Miss Eleanor Marshall, Glasgow, who kindly gave her services as an honorary member of the staff for a part of the year.

WILLIAM ROBB,  
*Director of Research.*

## LIST OF MEMBERS as at 31st March 1929.

- 
- Allison, James, Carlowrie, Kirkliston.  
 Allison, William, Almond Hill, Kirkliston.  
 Arnot, David, Mains, Edzell.  
 Baird, Major W. A., Lennoxlove, Haddington.  
 Ballantyne, Sir Henry, Monkkrigg, Haddington.  
 Barclay, George, Thornhill, Johnstone.  
 Barrie, Walter, Sundhope, Selkirk.  
 Bell, David, J.P. (David Bell, Ltd.), 15 Coburg Street, Leith.  
 Berwick, R. W., Ardross, Elie.  
 Black, George, Penston, Macmerry, Haddington.  
 Blair, T., Hoprig Mains, Macmerry, Haddington.  
 Biggar, J. M. R. (T. Biggar & Sons), Dalbeattie.  
 Bone, Jack, Monktonhill, Monkton, Ayr.  
 Bowe, D. L. (J. H. Bowe & Sons), Dunbar.  
 Bristowe, Sydney C., Craig, Balmaclellan.  
 Brough, John (Johnson & Darlings, Ltd.), Governor's Yard,  
 Berwick-on-Tweed.  
 Brown, James, Merryton, Hamilton.  
 Brown, Joseph, High Merryton, Larkhall.  
 Brownlie, W., Mossgiel, Mauchline.  
 Buccleuch and Queensberry, Duke of, Dalkeith House, Dalkeith.  
 Buttar, Thomas A., Corston, Cuppar Angus.  
 Butter, Colonel Charles A. J., of Faskally, Cluniemore, Pitlochry.  
 Calderwood, William, Clachan Farm, Rosneath.  
 Campbell, Sir Archibald S. L., of Succoth, Bart., Garscube,  
 Glasgow.  
 Campbell, J. Arthur, Arduaine, Argyll.  
 Campbell, James A., Craigie House, Ayr.  
 Campbell, W. J., 61 Fountainhall Road, Edinburgh.  
 Carmichael, Robert (R. Carmichael & Son), 91 High Street,  
 Coldstream.  
 Caverhill, William, Crichness, Duns.  
 Charlton, James (J. Charlton & Sons), 32 Bank Street, Dumfries.  
 Clarkson, Alexander, Skirling Mill, Biggar.  
 Connell, Sir Isaac, S.S.C., 18 Duke Street, Edinburgh.  
 Corbett, Hon. T. G. P., Rowallan, Kilmarnock.  
 Corrie, Thos., South Park, Borgue.  
 Cowan, Alex., Valleyfield, Penicuik.  
 Cowper, H. S., Montrose.  
 Cowper, John E. B., Gogar House, Corstorphine.  
 Craig, Edward J., Burn, Thornhill.  
 Crawford, Hugh W. B., Forneth, Castle Douglas.  
 Crawford, Robert, Drumbeg, Turnberry.  
 Crichton, Jas. B., of Luthrie Bank, Cupar.  
 Cruickshank, James, Kilmarnock Arms Hotel, Cruden Bay.  
 Currie, William, Greenhill, Deskford, Cullen.

- Cuthbertson, William (Dobbie & Co., Ltd), Edinburgh.  
 Davidson, Sir James Inglis, Saughton Mains, Corstorphine.  
 Davidson, Sir Leyburn F. W., Huntly Lodge, Huntly.  
 Deans, John H., Pitcoy, Dunbar.  
 Drummond, James W. (W. Drummond & Sons, Ltd.), Stirling.  
 Drummond, Professor Montagu, Botany Department, The University, Glasgow.  
 Dudgeon, G. E., Kildalloig, Campbeltown.  
 Duncan, John, Castlehill, Maybole.  
 Duncan, J. Bryce, Newlands, Dumfries.  
 Duncan, William Watson (Drummond Bros.), Central Station Buildings, Leith.  
 Duthie, Edwin C. (Ben Reid & Co.), 72 Guild Street, Aberdeen.  
 Elder, James, Athelstaneford Mains, Drem.  
 Elder, James H., Athelstaneford Mains, Drem.  
 Falgate, W. R., East Pinkerton, Dunbar.  
 Findlay, Sir John R., of Aberlour, Bart., K.B.E., 3 Rothesay Terrace, Edinburgh.  
 Fleming, William, Meinfoot, Ecclefechan.  
 Forrest, Robert Jack, Preston, Duns.  
 Forteviot, Rt. Hon. Lord, Dupplin Castle, Perth.  
 Garden, W. J. (R. Garden, Ltd.), 18 Bridge Street, Kirkwall.  
 Gardner, James, South Hillington, Cardonald, Glasgow.  
 Garvie, R., Hillocks of Gourdie, Blairgowrie.  
 Gibb, John, Gladstone Farm, Bishopton.  
 Gibson, Walter H., Campdown, Drem.  
 Gill, William Hope, Tomich, Invergordon.  
 Gilmour, The Right Hon. Sir John, Bart., Montrave, Leven.  
 Gordon, Alexander P., Bindal, Portmahomack.  
 Gray, James, 74 Osborne Street, Glasgow.  
 Gregor, Charles E., Innerwick, East Lothian.  
 Gregor, David Clunie, Innerwick, East Lothian.  
 Greig, Sir Robert B., Department of Agriculture for Scotland, Edinburgh.  
 Hannah, John M., Girvan Mains, Girvan.  
 Hay, Major J., Belton, Dunbar.  
 Henderson, John, Annandale Estate Office, Moffat.  
 Herbertson, Robert H., Fans, Earlston.  
 Hogg, Thomas (A. Cross Seed Co., Ltd.), 21 Hope Street, Glasgow.  
 Hogg, William, Birkenside, Earlston.  
 Home, J. H. Milne, Irvine House, Canonbie.  
 Hope, Colonel Charles, Cowdenknowes, Earlston.  
 Hope, William W., Linton Lodge, Prestonkirk.  
 Houldsworth, Lieut.-Colonel W. T. R., of Kirkbride, Maybole.  
 Howie, Robert, Drumfork Farm, Helensburgh.  
 Hunter-Weston, Sir Aylmer, Hunterston, West Kilbride.  
 Hunter, A. N. (Austin & M'Aslan), 95 Mitchell Street, Glasgow.  
 Hunter, James Adam, Inchmartine, Inchture.  
 Hunter, Thomas, 24 Brewery Street, Dumfries.  
 Hutchison, A. (R. Hutchison & Co.), Kirkcaldy.  
 Inglis, Wm. (J. Inglis & Sons), Leith.  
 Irvine, Charles, sen. (C. Irvine & Sons), 1 Market Place, Jedburgh.

- Jack, Archibald, Hermiston, Currie.  
 Keith, Major James, Pitmedden, Udney.  
 Kerr, A. R. (Forage Supply Co., Ltd.), Springfield Mills, Leith.  
 Kerr, T. B. B., 63 Queen Street, Glasgow.  
 Law, Andrew, Bankrugg, Gifford.  
 Laird, W. P. (Laird & Sinclair, Ltd.), 18 High Street, Dundee.  
 Leitch, James Mackessack, Carden and Inchstelly, Alves, Forres.  
 Lennox, James, Redhills, Crieff.  
 Linlithgow, The Marquess of, Hopetoun House, South Queensferry.  
 Logan, David, Ferney Castle, Reston.  
 Low, William, of Balmakewan, Laurencekirk.  
 Lowrie, James, Blegbie, Humber.  
 Lyburn, R., 8-10 Germiston Street, Glasgow.  
 M'Alister, A. W., Potato Merchant, Dumfries.  
 M'Arthur, A. (J. & A. M'Arthur), 204 Hunter Street, Glasgow.  
 M'Corquodale, A. C., Meddat, Kildary.  
 M'Dougal, Captain Arthur Robert, Blythe, Lauder.  
 M'Gill, John F. (M'Gill & Smith, Ltd.), Ayr.  
 M'Kean, John M., Dalhousie, Bonnyrigg.  
 Mackie, Maitland, North Ythsie, Tarves.  
 M'Laren, J. T., The Leuchold, Dalmeny.  
 MacLennan, George, 34 North Bridge, Edinburgh.  
 M'Millan, Nigel, Knowe, Kirkconnel.  
 M'Nab, J. B., Newtonmill, Brechin.  
 M'Queen, James, Crofts, Dalbeattie.  
 Marshall, H. B., Rachan, Broughton.  
 Mather, Charters J. (Laing & Mather), Kelso.  
 Mather, Matthew, Silverknowes, Davidson's Mains.  
 Menzies, Ian C., W.S., 22 Rutland Street, Edinburgh.  
 Mercer, George G., Southfield, Dalkeith.  
 Miller, Hugh, West Fortune, Drem.  
 Miller, Jas. W., Lochhead Farm, East Wemyss.  
 Miller, Robert, Ferrygate, Dirleton.  
 Montgomerie, A. W., Lessnessock, Ochiltree.  
 Montgomery, Andrew Mitchell, Netherhall, Castle Douglas.  
 Morrison, John A., West Fenton, Drem.  
 Motherwell, Andrew (A. Motherwell, Ltd.), Gorbals, Glasgow.  
 Munro, James, Crook, Bilbster, Wick.  
 Murdoch, Alexander, East Hallside, Hallside, Glasgow.  
 Murray, James C. (Lothian Coal Co.), Newbattle Collieries, Newton-  
 grange.  
 Murray, T. P. D., Dryburgh, Dundee.  
 Novar, Right Hon. Viscount, of Raith and Novar, K.T., Raith,  
 Kirkcaldy.  
 Park, T. B. (Roughhead & Park), Haddington.  
 Paterson, Principal William G. R., West of Scotland Agricultural  
 College, Glasgow.  
 Paton, James, Kirkness, Glencraig.  
 Pattullo, Kenneth D., Langlogie, Meigle.  
 Pollok, Mrs Gladys, Ronachan, Clachan.  
 Powrie, James (Powrie Bros.), Potato Merchant, 19 Hospital  
 Street, Perth.

- Rae, W. A., Douglasfield, Murthly, Perth.  
 Ramsay, Charles, High Drummore, Drummore.  
 Rattray, Colonel P. Burn Clerk, C.B.E., Craighall Rattray,  
 Blairgowrie.  
 Reid, A. T., Auchterarder House, Auchterarder.  
 Reid, W. J., Bridge of Dun, Montrose.  
 Robertson, A., 125 Willowbrae Road, Edinburgh.  
 Robertson, Peter D., of Castlecraig, Nigg.  
 Robertson, Wilson Mathieson, Saughton Mains, Corstorphine.  
 Rodger, Andrew, Kellie Castle Farm, Pittenweem.  
 Sanderson, Charles William, Birnieknowes, Cocksburnspath.  
 Sansome, Frank W., Ph.D., John Innes Horticultural Institute,  
 Merton, Surrey.  
 Scarlett, James W., Sweethope, Inveresk, Musselburgh.  
 Scott, D., Newton, East Wemyss.  
 Shearer, A. (Macfarlane, Shearer & Co.), Greenock.  
 Shearer, Professor Ernest, The University, Edinburgh.  
 Shields, G. Bertram, Rosebery Farm, Gorebridge.  
 Simpson, Major J., Glencarse.  
 Simpson, W. J., Castlemains, Dirleton.  
 Smith, Mrs Ida F., Whitechester, Duns.  
 Smith, Professor William Wright, Inverleith House, Arboretum  
 Road, Edinburgh.  
 Stevenson, Allan, Parkhill, Tarbolton.  
 Stewart, Sir Hugh Shaw, Bart., Ardgowan, Inverkip.  
 Stirling, Hugh B., Darlingfield, Gordon.  
 Stirling, Captain John, of Fairburn, Muir of Ord.  
 Stodart, Charles, Leaston, Humble.  
 Stodart, Colonel Thomas, C.I.E., I.M.S., Kingston, North Berwick.  
 Strang, Gavin, Moneydie, Redgorton.  
 Tait, Charle William (J. & W. Tait), Kirkwall.  
 Taylor, J. P. Ross, Mungoswalls, Duns.  
 Thom, A. S. (T. Imrie & Sons), Ayr.  
 Thomson, Moffat S., of Lambden, Greenlaw.  
 Thomson, John (Thomson Bros.), 106 Taylor Street, Glasgow.  
 Thomson, T. (J. Donaldson & Co.), 24 St Giles Street, Edinburgh.  
 Thorburn, M. G., Glenormiston, Innerleithen.  
 Tullis, R., Strathenny, Leslie.  
 Turnbull, Phipps O., Smeaton, Dalkeith.  
 Usher, Sir Robert, Bart., Wells, Hawick.  
 Wallace, Falconer L., of Candacraig and Balcairn, Strathdon.  
 Wallace, Sir Matthew G., Terreglestown, Dumfries.  
 Watson, Professor J. A. S., School of Rural Economy, Oxford.  
 Willison, Douglas, Acharn, Killin.  
 Wilson, Sir David, of Carbeth, Bart., Killearn.  
 Wilson, Emma, Lady, Kippen House, Dunning.  
 Wyllie, J. G. C. (Dan Wyllie & Co.), 197 High Street, Ayr.  
 Younger, H. G. (W. Younger & Co. Ltd.), Abbey Breweries,  
 Edinburgh.  
 Young, James G., Cadboll, Fearn.

PRINTED BY WILLIAM BLACKWOOD & SONS LTD.