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SCOTTISH PLANT BREEDING STATION
PENTLANDFIELD
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MIDLOTHIAN.

SPBS Rept. By Directors 6 [1927]
7 [1928]
8 [1929]
9 [1930]
10 [1931]

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SCOTTISH SOCIETY FOR RESEARCH IN
PLANT-BREEDING.

REPORT.

IN submitting the sixth Annual Report to the Members of the Scottish Society for Research in Plant-Breeding, the Directors are pleased to record that the work of the Society continues to progress and develop.

The virus diseases, leaf-roll and mosaic, have hindered research work in potato-breeding, but it is hoped that the experiments which are now being carried on at the Sub-Station at Ainville may lead to further progress being made in the study of some of the problems relating to this work.

New strains of oats and grasses are now approaching a stage where extended trials will be necessary prior to deciding as to their being multiplied and marketed.

An account of the research work carried out at the Plant-Breeding Station at Craigs House, Corstorphine, and at the Sub-Station at Ainville, Kirknewton, for the year ended 31st March 1927 is given in the Report by the Director of Research, which appears on pages 13-29 hereof.

Financial.

The audited accounts for the year ended 31st March 1927 show a decrease of about £264 in the Society's funds, as compared with the funds a year ago. It will be noted, however, that the grant from the Development Commissioners, £498, 18s. 8d., received through the Board of Agriculture during the year under review, is based on the expenditure for the year ended 31st March 1926, in which year there was a considerable reduction in ordinary expenditure on account of rearrangements made in the Staff. As against the decrease in funds for the year under review, it will be remembered that for the year ended 31st March 1926, the funds of the Society showed an increase of over £700. The grant to be obtained on the year's working should, after certain adjustments have been made by the Board of Agriculture for Scotland, make up almost the total amount of the deficiency between ordinary income and ordinary expenditure. The ordinary income of the Society is almost identical with that of the previous year. Ordinary expenditure, not including that for the Ainville Sub-Station, shows a slight increase, the greater part of which increase is accounted for by the rearrangements made in the Staff.

A sum of £453, 13s. 11d. was incurred as capital expenditure, but, with the exception of the item for manures, this sum does not rank in calculating the amount of grant to be obtained for the year. The amount for manures will be carried forward, and will appear, as before, as an item in next year's ordinary expenditure. The capital expenditure includes the purchase of a tractor, a tractor plough, a cultivator, a disc harrow, a specially constructed portable threshing machine, and a small wooden shed.

The chief fixed assets in the Balance-sheet remain approximately at the previous year's figures.

"Dr Wilson" Memorial Fund.

This fund now amounts to £231, 5s., showing an increase of £10 for the year. A scheme for the award of prizes of twenty guineas each, out of the proceeds of the fund, has now been drawn up and approved by the Directors.

The fund originated through the efforts of a Committee, which raised a sum of nearly £200 to found a prize in commemoration of the work in Plant-Breeding of the late Dr John Wilson of St Andrews. The prize will be awarded for work done in Scotland, without support from public funds, in producing a seed or plant which the Directors consider to be of value to agriculture in Scotland. The first award will be made, it is hoped, towards the end of the current year, and further awards will be made from time to time as the income from the fund will permit.

Membership.

The Society consists of 100 life members and 89 annual members (21 at the 10s. rate and 68 at the £1 rate). Ten annual members were enrolled during the year, 2 members died, 5 members resigned, and 4 members in arrears with subscriptions were removed from the membership list.

Donors of £20 or over (including donations to the Preliminary Fund) are 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.

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 CRUICKSHANK, Kilmarnock Arms, Cruden Bay.

JAMES W. DRUMMOND (Messrs W. Drummond & Sons, Ltd.), Stirling.

Professor J. A. SCOTT WATSON, Agriculture Department, University, Oxford.

A. W. M'ALISTER, Seedsman, Dumfries.

J. T. M'LAREN, The Leuchold, Dalmeny.

ROBERT MILLER, Ferrygate, North Berwick.

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

JAMES HISLOP ELDER, B.Sc., Athelstaneford Mains, Drem.

THOMAS HOGG (Messrs Alex. Cross & Sons), 19 Hope Street, Glasgow.

Major JAMES KEITH, Pitmedden, Udney.

Captain A. R. M'DOUGAL, Blythe, Lauder.

Professor ERNEST SHEARER, Agriculture Department, The University, Edinburgh.

Professor WILLIAM WRIGHT SMITH, Inverleith House, Arboretum Road, Edinburgh.

JOHN STIRTON,

Secretary.

[ABSTRACT OF ACCOUNTS

ABSTRACT OF

For year ended

INCOME.

Subscriptions—	
Annual	£74 0 0
<i>Note.</i> —Annual Subscriptions amounting to £11, 10s. are in arrear.	
Donations	41 12 3
Interests	1,881 10 0
Rents	15 0 0
Income Tax Recovered	240 4 8
Sale of Produce and Stock on Hand	253 6 2½
Total Ordinary Income	£2,505 13 1½
Grant from Board of Agriculture—for year ended 31st March 1926	498 18 8
Grant from Board of Agriculture for Ainville Sub-Station (outstanding)	250 0 0
Investments Realised—part Edinburgh Corporation loan <u>£200 0 0</u>	
Total Extraordinary Income	£748 18 8
Total Income	£3,254 11 9½
Funds at 1st April 1926—	43,547 13 8

£46,802 5 5½

ACCOUNTS.

31st March 1927.

EXPENDITURE.

Salaries—	
Officers	£1,306 2 8
Secretary and Office	225 16 8
	<u>£1,531 19 4</u>
Labour	664 6 4½
National Health and Unemployment Insurances	16 9 7
Seeds and Roots	8 10 9
Manures	127 11 10
Working Expenses, including renewals of Implements and Tools	210 2 10
Laboratory Expenses	62 14 3
Library Expenses	32 4 0
Rates, Taxes, and Insurances	276 5 8
Office Expenses	93 14 8
Heating, Lighting, and Cleaning	33 15 8
Travelling Expenses	43 15 1
Property Repairs	57 4 4
Depreciation on Implements, Tools, Furniture, &c.	71 14 3
Locality Trials of Oats	31 14 0
Ainville Sub-Station Expenses including Salary	256 10 11
Total Ordinary Expenditure	£3,518 13 6½
Capital Expenditure—	
Houses and Lands	£38 2 8
Implements and Tools	346 17 11
Manures for Crop 1927	68 13 4
Total Capital Expenditure	<u>£453 13 11</u>
Funds at 31st March 1927, per Balance-sheet	43,283 11 11

£46,802 5 5½

BALANCE-**As at 31st****LIABILITIES.**

I. Accounts Outstanding	£676 3 0
II. Funds at 31st March 1927	43,283 11 11

£43,959 14 11**DR WILSON**

Funds at 31st March 1927	£231 5 0
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£231 5 0

EDINBURGH, 18th May 1927.—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 1927.****ASSETS.**

I. House and Lands (at Cost)	£7,851 19 0
II. Implements and Tools	819 2 4
III. Laboratory Apparatus	171 12 7
IV. Office Fittings	97 8 6
V. Stocks on Hand	307 14 9½
VI. Accounts Outstanding, including Grant from Board of Agriculture for Ainville Sub-Station	442 13 2

VII. Investments at Cost:—

Value at 31st March 1927.		
£14,253 15 0	1. £14,000 5 per cent War Stock, 1929-47	£12,390 0 0
12,057 10 0	2. £14,000 4 per cent Funding Stock, 1960-90	10,045 0 0
12,685 11 3	3. £16,900 3½ per cent Conversion Stock	11,140 3 6
300 0 0	4. £300 Edinburgh Corporation Loan	300 0 0
<u>£39,296 16 3</u>		<u>33,875 3 6</u>

VIII. Equipment at Ainville Sub-Station	183 7 6
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IX. Cash Balances—

In Bank—	
On Current Account	£186 6 2
On Hand	24 7 4½
	<u>210 13 6½</u>

£43,959 14 11**MEMORIAL FUND.**

Value at 31st March 1927.	
£203 12 6	£200 5 per cent War Stock, 1929-47—valued at date of transfer
	Interest to date
	£176 5 0
	55 0 0
	<u>£231 5 0</u>

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 1927.

ANALYSIS OF MEMBERS.

Aberdeen	4	Lanark.	16
Argyll	3	Linlithgow	3
Ayr	18	Mid-Lothian	25
Banff	1	Moray	1
Berwick	12	Nairn . . . . .	..
Bute . . . . .	..	Orkney	2
Caithness	1	Peebles	4
Clackmannan . . . . .	..	Perth	13
Dumbarton	3	Renfrew	6
Dumfries	9	Ross and Cromarty	6
East Lothian	27	Roxburgh	4
Fife	10	Stirling	2
Forfar	7	Sutherland	1
Inverness	Wigtown	1
Kincardine	1	England	1
Kinross	2		
Kirkcudbright	6		
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ESTABLISHMENT FOR 1926-27.

BOARD OF DIRECTORS.

Trustees.

- THE RIGHT HON. SIR JOHN GILMOUR, Bart., D.S.O., M.P., Secretary for Scotland.
 THE RIGHT HON. VISCOUNT NOVAR OF RAITH AND NOVAR, K.T., P.C., G.C.M.G., Raith, Kirkcaldy.
 JAMES ELDER, Athelstaneford Mains, Drem.
 DAVID BELL, 15 Coburg Street, Leith.
 JOHN FINLAYSON M'GILL, 69 Kyle Street, Ayr.

Ordinary Directors.

1924.

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 JAMES W. DRUMMOND (Messrs W. Drummond & Sons, Ltd.), Stirling.
 Professor J. A. SCOTT WATSON, Agriculture Department, University, Oxford.
 A. W. M'ALISTER, Seedsman, Dumfries.
 J. T. M'LAREN, The Leuchold, Dalmeny.
 ROBERT MILLER, Ferrygate, North Berwick.

1925.

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 Sir J. INGLIS DAVIDSON, Saughton Mains, Corstorphine.
 J. M. HANNAH, Girvan Mains, Girvan.

- GEORGE G. MERCER, J.P., Southfield, Dalkeith.
 G. B. SHIELDS, Dolphingstone, Tranent.
 Sir DAVID WILSON of Carbeth, Bart., D.Sc., Killearn.

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.

Directors Co-opted.

- JAMES HISLOP ELDER, B.Sc., Athelstaneford Mains, Drem.
 THOMAS HOGG (Messrs Alex. Cross & Sons), 19 Hope Street, Glasgow.
 Captain A. R. M'DOUGAL, Blythe, Lauder.

Directors nominated by the Board of Agriculture.

- | | |
|-----------------------------------|---|
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Edinburgh. |
| JAMES WOOD, O.B.E., M.A., B.Sc., | |
| T. ANDERSON, M.A., B.Sc., | |
| ALEXANDER M'CALLUM, M.A., LL.B., | |

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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., 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.
 James Cruickshank.
 William Cuthbertson.
 J. W. Drummond.
 Professor M. Drummond.
 James H. Elder, B.Sc.
 John Gibb.
 Sir Robert B. Greig.
 John M. Hannah.

Thomas Hogg.
 A. W. M'Alister.
 Capt. A. R. M'Dougal.
 J. F. M'Gill.
 Principal W. G. R. Paterson.
 Professor J. A. S. Watson.
 Sir David Wilson, Bart.
 James Elder, *Chairman, ex officio*.
 David Bell, *Vice-Chairman, ex officio*.

MANAGEMENT.

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 D. L. Bowe.
 James Cruickshank.
 Sir J. Inglis Davidson.
 J. H. Milne Home.
 William Inglis.
 J. T. M'Laren.

G. G. Mercer.
 Robert Miller.
 G. Bertram Shields.
 Professor J. A. S. Watson.
 James Wood.
 James Elder, *Chairman, ex officio*.

FINANCE.

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 David Bell.
 John M. Hannah.
 Thomas Hogg.
 Alex. M'Callum.
 G. G. Mercer.

Viscount Novar, K.T., P.C., G.C.M.G.
 G. Bertram Shields.
 Sir David Wilson, Bart.
 James Elder, *Chairman, ex officio*.
 David Bell, *Vice-Chairman, ex officio*.

R E P O R T

BY

DIRECTOR OF RESEARCH.

I. Research Programme—General Outline.

“ 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, but 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, and Timothy), and Swedes.

The experiments with potatoes are now being carried out at two different centres. The seedlings are being raised at the Sub-Station at Ainville, Kirknewton, with the object of maintaining stocks of potatoes in a healthier condition than

has been found possible at the Plant-Breeding Station, Corstorphine. The field-trials of the seedlings raised at the Sub-Station will be made at the Plant-Breeding Station, but duplicate stocks of the seedlings will, as far as possible, be retained at the Sub-Station. As the raising of seedlings commenced at the Sub-Station only in 1926, it is as yet impossible to say whether the objects aimed at in raising the seedlings at the Sub-Station will be fully realised.

On account of the infection with virus diseases, the seedling stocks of potatoes at the Plant-Breeding Station have been greatly reduced.

A certain amount of the detail that has generally been included in previous Reports concerning the year's work has, on this occasion, been curtailed or omitted altogether. Material for publication is gradually being collected, and, as it is mainly of scientific interest, it might more appropriately appear in scientific papers, which may be published elsewhere from time to time.

II. Research Programme—Details for 1926.

A. CEREALS.

Oats.—The collection of named varieties of oats is being made as representative as possible, and an additional number of varieties were grown in 1926, the total being 187. (It is not suggested that all the varieties are distinct.) As far as possible each variety is grown every year from the grain from one plant selected the previous year. A list of the named varieties grown is given in Table I.

Pure lines of a few standard named varieties were multiplied on a small scale to maintain pure stocks for comparison with hybrid selections.

TABLE I. OATS—COLLECTION OF NAMED VARIETIES.

* = Pure Lines.

Name of Variety.	Station Number.	Name of Variety.	Station Number.
Abundance	Aa 393*	Clemrothery	Aa 459
Algerian	" 62*	Comewell	" 59*
" Red	" 94	Cropwell	" 463
" Black	" 95	Crown	" 29*
" Grey	" 96	Culberson	" 70
" 	" 448	Dala.	" 22*
Alaska	" 443	Daubeny	" 23*
" G.	" 455	1000 Dollar.	" 25*
Argentine 2	" 449	Dun	" 384*
" 3	" 450	Early Champion	" 53*
" 6	" 451	" Hamilton	" 12*
Ascot	" 33*	" Siberian	" 368*
" 	" 44*	Echo	" 405
Aurora	" 50*	Eighty Day	" 21*
Banner	" 38*	Flanders Yellow	" 457
" Ottawa	" 444	Fortuna.	" 407
" 44 M.C.	" 456	Fulghum	" 52*
Bathurst 12	" 432	Garris	" 104*
" 16	" 439	Gartons 1935	" 464
Barbachlaw	" 460	Giant Yellow	" 61*
Beardless Propsteier	" 31*	Glebe	" 17*
Bell	" 76*	Glen Innes 8	" 438
Beseler's Prolific	" 27*	" "	" 433
" "	" 32*	Golden Rain	" 65*
" "	" 387	Gordon	" 378*
Big Four	" 383*	" 	" 379
" "	" 389	" 	" 385*
Black Engelbrecht	" 467	Grange	" 18*
" Mesdag	" 77*	Guyra	" 434
" Mogul	" 89*	Hamilton	" 20*
" Tartarian	" 93*	Hardy Winter	" 74*
Blainslie	" 8*	Hedehavre (White)	" 19
Californie	" 49*	" (Tawny)	" 72
Captain	" 48*	Hero (close)	" 40
Castleton Potato	" 11*	Huskless	" 1
" Sandy	" 381*	Hutchison	" 73*
Ceirch-du-Bach	" 468	Idamine	" 386

TABLE I.—*continued.*

Name of Variety.	Station Number.	Name of Variety.	Station Number.
Iowar	Aa 58*	Potato	Aa 401*
Joanette Hybrid	" 75*	"	" 402*
Kent Berlie	" 13*	Prolific Pfeffelbacker	" 43
Kherson	" 63*	Radnorshire Sprig	" 469
King	" 446	Record	" 24*
Kinness	" 26*	"	" 41*
Lachlan	" 43I	Red Oat	" 66*
Land Oat	" 46I	Red Rustproof	" 67*
Land Sort	" 462	Richland	" 51*
Leader	" 47*	Ruakuras	" 406
Liberty	" 412	Sandy	" 2*
Ligowo	" 28*	"	" 3*
Lincoln	" 377*	"	" 107*
"	" 377	"	" 403
"	" 394	Scots Berlie	" 15
Mansholts III.	" 101	" "	" 16*
Marvellous	" 454	Sir Douglas Haig	" 90*
Mortgage Lifter	" 453	Sixty Day	" 60*
Mulga	" 430	Sparrowbill	" 56*
Myrtle A.	" 91	Stable King	" 392
" B.	" 92	Storm King	" 45*
Naesgaard	" 64	Sunrise	" 436
Naked × Polish	" 37I	Superb	" 452
"	" 409	Supreme (Selected)	" 88*
New Sandy	" 41I	Swedish Select	" 35*
Nordfinsk	" 466	" "	" 39I
Nova Oat	" 470	Tam Finlay	" 7*
O.A.C.	" 51I	" "	" 382*
O.A.C. 72	" 447	Tersets Potato	" 410*
1327	" 473	Trifolium	" 103*
Odal	" 36	Triumph	" 46*
"	" 37	Triumphal	" 388*
"	" 408	Tyrone Tawny	" 7I
Orion	" 442	Victory	" 30*
Ostend's Glory	" 57*	Waverley	" 9*
Potato	" 10*	Wexford Tawny	" 68
"	" 296*	White Horse	" 34*
"	" 397*	" "	" 395
"	" 400*	" Odal	" 465

TABLE I.—*continued.*

Name of Variety.	Station Number.	Name of Variety.	Station Number.
White Russian . . .	Aa 54*	<i>A. orientalis tartarica</i>	Aa 423
" " . . .	" 55*	<i>A. sativa</i>	" 471
" " . . .	" 404	<i>A. " aurea</i>	" 413
Wide Awake	" 440	<i>A. " "</i>	" 426
" "	" 441	<i>A. " brunnea</i>	" 416
Wilga	" 437	<i>A. " Krausei</i>	" 472
Winter Turf	" 69*	<i>A. " montana</i>	" 427
Wisconsin	" 390	<i>A. " mutica</i>	" 415
Yielder	" 42*	<i>A. " "</i>	" 474
Yellow Poland	" 45 ⁸	<i>A. " praegravis</i>	" 428
		<i>A. " trisperma</i>	" 417
<i>A. brevis</i>	" F1	<i>A. sterilis</i> × Golden	
<i>A. " "</i>	" F2	Rain	" 429
<i>A. nuda</i>	" C1	<i>A. strigosa</i>	" B1
<i>A. " "</i>	" C2	<i>A. " "</i>	" B2
<i>A. orientalis</i>	" 422	<i>A. " "</i>	" B3
<i>A. orientalis obtusata</i>		<i>A. " glabrescens</i>	" B4
<i>alba</i>	" 424	<i>A. " orcadensis</i>	" B5
<i>A. orientalis pugnax</i>	" 425	<i>A. " pilosa</i>	" B6

Breeding has been continued to obtain varieties possessing one or more of the following characteristics: viz., stiff straw, early-ripening period, high grain-yield, free tillering capacity, and adaptability to various conditions. This breeding work has now reached a stage at which a considerable number of selections from hybrids are now available for small-scale multiplication and trial. Each selection was derived from a single plant, which was noted as apparently possessing one or more of the desired characteristics indicated above.

It will, of course, be obvious that it is impracticable to multiply all the initial individual selections to a stage where comparisons can be made on replicate plots on a comparatively large scale. It was therefore necessary to effect a compromise and to devise a method of making approximate comparisons of selections in the earliest stages when they were in small quantities. In these preliminary trials certain

characteristics, such as period of ripening and strength or stiffness of straw, can be approximately determined, and at any rate more accurately than in breeding plots where the plants are grown much more widely spaced than under ordinary conditions of cultivation. During the last few years various methods of making preliminary comparisons of selections in small quantities suitable to the various conditions at the Plant-Breeding Station have been tried, with the object of assisting in eliminating as early as possible the less desirable selections. Of the methods tried, that which it is proposed to pursue meanwhile is indicated in outline as follows:—

In the first year comparative trials will be carried out in rows 5 feet long, the rows being replicated as often as possible, and an equal number of grains sown in each row at approximately the normal field rate of seeding. In the second year the comparative trials will be carried out in rows about 16 feet long in replicate. In the third year the trials will be carried out in plots about 11 square yards, $\frac{1}{4}\frac{1}{4}\frac{1}{6}$ -acre; as many replications as possible will again be made. The less promising selections will be eliminated from the trials from year to year. In 1926 a few selected strains had reached the $\frac{1}{4}\frac{1}{4}\frac{1}{6}$ -acre plot stage. A scheme is being prepared for larger-scale trials being carried out in different districts in Scotland, in order to obtain further information regarding the merits or demerits of any new and promising selection before it is marked for large-scale multiplication.

The selections from the unfixed hybrids were grown in breeding plots for observation as in previous years. The numbers of hybrid grains sown individually were: from first generation plants, over 2100; from second generation plants, over 4300; from third, fourth, fifth, sixth, and seventh generation plants, over 5300. From three different hybrids twenty-five selections were grown in duplicate for observation and comparison in rod-row plots. As they were derivatives of either Sandy or the Potato variety, a "pure line" of Potato was grown for comparison with the selections. Precautions were taken to ensure as far as possible that the treatment of the plots was uniform throughout. It was found necessary to protect the plots from birds, and this was effectually accomplished by the use of nets erected over the growing crop. The amount of variation in yield between the duplicate rows in many of the selections was compara-

tively small, and where this condition obtained, rather more reliance could be put on the relative accuracy of the grain-yielding capacities of the selections. In future years it is hoped to have sufficient grain available to allow of these trial plots being arranged at least in triplicate.

In the $\frac{1}{4}$ -acre trial plots of new strains, two from a Sandy hybrid compared favourably with the Sandy parent, and were marked for further trial and multiplication.

Further trials of the Glebe oat were carried out in different districts in Scotland in 1926, and on a larger scale than in 1925—a total area of about 47 acres being grown. The seed for these trials was supplied direct from the Plant-Breeding Station. Contracts were made with various farmers to grow the grain for the Society. Acknowledgment is made of the assistance rendered by various members of the staffs of each of the three Agricultural Colleges in Scotland in making arrangements with the growers of eight 5-acre plots, and for assisting in sending in reports regarding the trials. A summarised report of the Glebe oat trials is given in Table II. As in the previous year's trials, the yield of grain varied considerably from district to district, the highest yield of grain in 1926 being obtained in Dumfriesshire.

In both years the yield of grain from the trials in Fife has been surprisingly low in comparison with that obtained in other districts. On clay land in Ayrshire, for example, a yield of 27 cwt. per acre has been obtained from 2 acres. It would therefore seem that Glebe is less suited to the conditions prevailing in Fife than in Ayrshire and in certain other districts in the West of Scotland.

[TABLE II.]

TABLE II. GLEBE OAT TRIALS, 1926.

County.	Elevation of Trial Plot.	Type of Soil.	Average Yield of Dressed Grain per acre.	Days to mature.	Remarks. (Extracted from Reports received.)
Dumfries. . .	ft. 60	Medium loam	cwt. 30	149	The yield has proved to be far beyond our estimate. The crop stood very well, and the straw is of very fine quality. Crop free from lodging.
Kirkcudbright	200	Medium loam	..	149	This variety has done very well against Potato, particularly as regards lodging, which was very bad among Potato in this district this season.
Ayr	300	Heavy clay	24	141	The Glebe oats grown here have proved to stand up a little better than the Potato oats, but the straw is a bit coarser and harder and shorter in length. Crop free from lodging.
Ayr	300	Stiff clay	27	153	Better than Potato.
Berwick . .	400	Medium loam	23	161	Yield of grain almost equal with Victory. Mostly standing — some lodged.
Fife . . . .	..	..	15.2	..	No remarks made.
Fife	200	Medium loam	15	147	Crop free from lodging. Inferior to Victory.

TABLE II.—*continued.*

County.	Elevation of Trial Plot.	Type of Soil.	Average Yield of Dressed Grain per acre.	Days to mature.	Remarks. (Extracted from Reports received.)
East Lothian	ft. 80- 100	Light loam	cwt. 27	161	Very heavy crop. Lodged after severe storm. Yield similar to Victory.
East Lothian	500	Medium loam	24	155	The straw is of excellent quality. Victory yielded 3 cwt. per acre of grain more than Glebe. Crop free from lodging.
Kincardine .	300	Light gravelly loam	20	167	It was estimated by a number of farmers that a similar crop of Potato oats might yield 15 cwt. per acre, and Victory 16-18 cwt. per acre. Crop free from lodging.
Caithness .	110	Clay loam	12.3	143	In comparison with Sandy and Gordon, Glebe gave the stronger braird. Crop free from lodging. Grain severely damaged by rain after crop was cut.

After the results of the trials had been considered by the Board of Directors of the Society, it was decided by the Directors to send out a leaflet regarding the Glebe oats to the members of the Society. This leaflet was sent out in February last, and the grain, as threshed from the trial plots, was offered to the members at £2 per quarter of 3 cwt. In response to the intimation in the leaflet, about 14½ tons of grain were disposed of for seed.

B. POTATOES (*Ainville Sub-Station*).

Assistant in Charge—WILLIAM BLACK, B.Sc.

The potato-breeding work at Ainville has, for its primary object, the production of seedlings free from the "degeneration" diseases in order to provide a stock of healthy plants for comparative trials, and to provide parent plants for pedigree breeding. With a limited area—1 acre is at present available—extensive trial and multiplication plots are impossible, and the work is therefore confined, on the one hand, to breeding and raising seedlings with a view to the propagation of a healthy reserve stock of the more promising types, and, on the other, to the study of the inheritance of various characteristics of importance in raising new varieties.

Of the potato seeds sown in 1926, some were taken from the remainder of the "Wilson" collection, but most of them had been secured at the Plant-Breeding Station. The seeds were from twenty-eight different berries, produced by various crossed or selfed plants. The seed sown gave altogether over 2500 seedlings. While all the seedlings from three berries were ultimately planted out for further observation and comparison, only selected plants from the other berries were planted out, thereby entailing a substantial reduction in numbers. All unpromising and unhealthy types were discarded when observed, leaving about 1400 seedlings to be planted out in the open. A few plants affected with either mosaic or leaf-roll were noted while the seedlings were growing under glass, the first symptoms showing when the plants were about four weeks old. In other plants, however, symptoms of virus disease were not recognisable until considerably later. Towards the end of the season no further development of virus diseases appeared. No aphides (greenfly) were observed on the potato plants either under glass or in the open at Ainville during the whole of the season, and if absence of greenfly on the potatoes continues, this may be a helpful condition. Throughout the growing period descriptive notes were taken on the characteristics of the plants, and all unhealthy specimens weeded out when observed. On lifting the tubers in the autumn a further selection was made in certain progenies, the unpromising types being discarded. At lifting time and later during the

winter the essential characteristics of the underground parts were noted and compared. About 550 selections were deemed fit for further trial.

Immunity Trials.—As in previous years, various selections were sent to the Board of Agriculture for Scotland to be included in their Wart Disease Trials.

Virus Diseases.—During the summer some observations were made in connection with virus diseases. Plants showing symptoms of such diseases were discarded when noted, in order to minimise the possibility of spreading infection. It was noted that symptoms of leaf-roll appeared within a month of the date of germination in certain plants, while other plants remained to all appearances perfectly healthy until they were considerably older. The progenies of apparently healthy plants, however, were not affected to any great extent. Of the progeny of one hybrid from a badly affected leaf-roll plant, about 40 per cent of the seedlings were affected with leaf-roll. The remaining 60 per cent were apparently healthy, but symptoms of the disease may be revealed in the coming season. In the early stages of growth this series seemed healthy, but shortly after mid-season the 40 per cent of unhealthy plants had been recognised. Outside infection seems improbable, as no disease was found in plants of other hybrids growing in close proximity to the infected plants. The inference is that the disease had been transmitted through the seed.

Blight (*Phytophthora infestans*) made its appearance late in the season. Wide differences in the amount of infection were noted, not only between whole progenies but also between the individuals in any particular progeny. Some plants were almost entirely destroyed by its ravages, while others remained unaffected, but, as a rule, plants showing signs of early ripening suffered to the greatest extent.

Hybridisation of a number of immune varieties was successfully carried out during the summer. Varieties of all types of maturity were used, but a special effort was concentrated on obtaining healthy seed from the earlier-maturing varieties. For the purpose of continuing the investigations regarding inbreeding, several varieties were selfed.

In connection with the inbreeding experiments, ten progenies of seedlings from selfed parents were raised in 1926, and a further number will be aimed at in 1927.

Apparently healthy samples of twenty-three named varieties have been obtained, with the object of using them at Ainville as parents for selfing and for hybridising.

During the year a study was made of the whole series of seedlings (over 130) from one hybrid berry in order to ascertain whether much fluctuation occurred in the shape and colour of the tubers of seedlings in the second year from the berry as compared with the parent tuber in the first year.

B. POTATOES (*Plant-Breeding Station*).

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

The experiments at the Plant-Breeding Station during the year consisted mainly in the further testing of the selected seedlings which had been raised in previous years, and an area of about $1\frac{1}{2}$ acres was required for this work. Only a few seedlings were raised, and these were mainly for observation regarding the occurrence of virus diseases.

Over two hundred selections, one or more years from the berry, were grown in plots of various sizes according to the variety and the amount of tubers available. As in previous years, the virus diseases, leaf-roll and mosaic, were evident, particularly in many of those selections which were two or more years from the seed. Of the two common virus diseases, leaf-roll and mosaic, mosaic was the more prevalent. In many selections affected with mosaic disease, the yield of tubers had not been reduced in so large a degree as in most plants affected with leaf-roll.

Throughout the growing season notes were made regarding the foliage characteristics and vigour of each selection. At the time of lifting, the total yield of tubers, together with the proportion of "ware," "seed," and "small," were determined.

A large number of selections have been discarded; these consisted to a large extent of selections seriously affected with leaf-roll and mosaic. Amongst the earlier-ripening selections, ordinary blight caused much damage, and a number of selections were discarded on account of their apparent susceptibility to that disease.

Several promising seedlings, one year from the berry, have been retained for further trial. A few tubers from apparently

healthy plants of certain selections were lifted early in the season, and some of these have been retained for growing in a healthier environment than at Corstorphine, with the object of maintaining healthy stocks of these varieties.

Further crossing and selfing of various varieties were carried out, and seed was obtained in a number of the crossed and selfed plants.

C. HERBAGE PLANTS.

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

Visits have been made by Dr J. W. Gregor to various parts of the country, and, as a result, further samples of grasses from wild populations have been added to the collection at the Station. A few samples of grass seeds have been obtained, in exchange, from various European Institutions for trial and comparison.

Breeding.—The breeding experiments were carried out on the same principles as already described in former reports. Certain of the clones of grasses when hybridised with certain other clones with which they are cross-fertile, are breeding relatively uniform as regards certain essential characteristics. These strains have now reached a stage of multiplication in which methods are being tried to seed pairs of clones known to breed fairly uniform progeny in comparative isolation. It is desired to obtain sufficient seed as soon as possible from those clones which, when interbred, produce uniform progeny, in order to have the seed sown as a constituent of a seeds mixture in a pasture. It is difficult to estimate the relative economic value of any new strains which have been selected empirically until they have been tried under the conditions normally occurring in field pastures.

An experiment designed with the object of comparing new strains of grasses in small plots approximating more closely to conditions prevailing in a temporary pasture than in the breeding plots was laid down in the spring of 1926. Oats were used as a nurse crop, and wild white clover was sown along with the perennial ryegrass. Ordinary commercial perennial ryegrass, with wild white clover also, was sown in the control plots.

Perennial Ryegrass.—In the autumn of 1926, thirty-five

lots of seed of perennial ryegrass obtained under conditions of controlled pollination were sown. 1500 seedlings were raised, and 1300 of these have been planted out in the experimental field for observation and study. Several of these populations as a whole have the characters of the wild "pasture type" of perennial ryegrass, and as seedlings they exhibited a degree of uniformity sufficient to warrant their being multiplied in the near future.

Cocksfoot.—Several plants of cocksfoot selected from wild populations were self-pollinated. The amount of seed obtained varied considerably in different plants. No controlled cross-pollinations were made in 1926. The selfed seed which was obtained was sown early in 1927, and the seedling plants have been planted out for observation and comparison.

Of the various populations raised from seed in 1926, none has proved sufficiently uniform in type to be multiplied. The results of the breeding work, however, indicate that steady progress is being made towards obtaining uniform pasture strains of this grass also.

Timothy.—The majority of the cultivated strains have produced a progeny consisting more or less of the "hay" type of plant as distinct from the "pasture" type. The experiments in crossing the cultivated form of Timothy with Alpine Timothy are being continued.

The investigations in connection with the occurrence of self-sterility in grasses have been continued.

The results of the two years' experiment in seeding two inter-fertile clones of perennial ryegrass at an elevation of about 1000 feet on the Lammermuir Hills have shown that it is impracticable to obtain seed in sufficient quantity there. Only a very small quantity of seed was produced, and it has been decided that the experiment there should be brought to a conclusion.

Miscellaneous.—A few plants of Kikuyu grass, an important grass in Kenya Colony, were received from J. A. Campbell, Esq., of Arduaine, Argyll, for trial. The plants were grown in pots after they were received. During the winter, while still in pots, they were kept in a greenhouse, but the effects of a short spell of frost killed them.

A quantity of seed of Kikuyu grass was also received from W. Lyon Watt, Esq., Kenya Colony, for trial. The seeds received were sown in the spring of 1926 under glass, and the

resulting plants were grown outside in plots during the summer. They grew luxuriantly, and covered the plot, spreading rapidly by means of long succulent stolons produced above ground, which rooted freely. An indication of the spreading capacity of this grass may be obtained when it is stated that the twelve plants planted in the spring in a square plot, about 2 feet 6 inches apart, had completely covered the whole area of the plot by the end of the summer. Judging by the wealth of herbage produced, this grass seemed promising, but unfortunately, however, the first short period of frost in the autumn completely killed every plant. The climatic conditions in Scotland in the winter would therefore seem to be unfavourable for the growth of Kikuyu grass.

D. "ROOT" CROPS.

Assistant in Charge—V. E. M^cM. DAVEY, B.Sc.

The policy pursued has been in accordance with that outlined in previous Reports. Attention has been concentrated chiefly on swedes, but in addition, a few small-scale experiments have been made with sugar-beet.

Pedigree Breeding.—About thirty-four strains of swedes with controls of commercial varieties were sown out in short drills (rod-rows), replicated in various parts of the experimental breeding plots. Two of these were hybrids (F₁) of flesh-colour crosses; the remainder were "selfed" lines, most of them being descendants of "roots" selected from the large Variety Trial of 1922. Observations were made on all the strains throughout the season, and numerous selections made for seeding. The Roots Sub-Committee inspected the trials in the autumn of 1926, and it was decided that two strains were worthy of trial on a small field scale. These two strains are to be multiplied in natural isolation. Thanks are again due to Mr J. T. M'Laren, Dalmeny, and Mr C. Smith, Corstorphine, for giving facilities for this multiplication at Dalmeny and Cramond Island respectively. The season was favourable, the plots over all were fairly uniform, and satisfactory crops were obtained. "Turnip fly" attacks were more severe than usual; but rapid growth in the first "rough leaf" stage saved the crop from permanent injury.

Controlled Seeding.—About sixty-two swedes and three turnips were seeded in isolation during 1926, the desired amount of self-fertilised seed being obtained. A few hand crosses were attempted. Two mass multiplications were made in natural isolation, plenty of seed being obtained. With sugar-beet some preliminary experiments were commenced to ascertain whether seed will set readily in this climate, and whether self-sterility is absolute. Sugar-beet "bolters" were available for this investigation, and were also used.

Hybridisation.—(a) Bulb colour in turnips. A cross was made between Lincolnshire Red Globe and a white-skinned rogue occurring in that stock in 1923. The hybrid (F_1) roots grown in 1924 were red. These roots were seeded in natural isolation in 1925 by courtesy of Mr George G. Mercer, Southfield, Dalkeith. In 1926 a large number of the bulbs of the second hybrid (F_2) generation were grown at the Station and some at Glasgow University, and a detailed study of the progeny was made.

(b) One of the White \times Yellow-flesh hybrid (F_1) strains is to be multiplied to obtain abundant seed for the F_2 generation when segregation in the flesh-colour of the bulbs is likely to occur. A number of the bulbs have been sent to the Ainville Sub-Station to be seeded there.

Yield Trial.—Seed from lines that had been multiplied was available for the first time in 1926. A replicated Yield Trial was laid down consisting mainly of five such strains, and the commercial varieties from which they had originally been selected. Relative crop and dry-matter yields were estimated, and some sugar estimations were also made.

Disease Resistance Trial.—A few strains of swedes were again grown in an isolated plot, which is kept highly infected with the organism causing Finger-and-Toe disease. Under these conditions of infection no strain as a whole has yet completely resisted the disease, but some individual bulbs have apparently done so. The chief feature in 1926 was the inclusion of two strains which had been obtained by "selfing" bulbs which apparently had been resistant to the disease. These strains withstood damage by the disease relatively well. Commercial varieties of reputed or unknown resisting powers and some pedigree lines were also tried. Results were markedly different; several strains succumbed entirely. Selections of

apparently uninfected bulbs from the most resistant strains have been made, and these will be "selfed" in order to study the effects of further inbreeding.

"Best-of-All" Synonym Trial.—Some seven samples of "Best-of-All" from various growers, and five named varieties believed to be very similar to "Best-of-All," were sown out in large strip-plots of four drills each. Botanical observations were made throughout the season, and weighings of the crop were made in the autumn. Selections of roots of different shapes and colours have been made with the object of selfing each root and studying the progenies. On comparing the notes made, it would seem that there are differences in type in the "Best-of-All" variety as grown in various parts of Britain. 1 per cent to 5 per cent Bronze-Tops occurred in every "Best-of-All" strain. The colour of Purple-Tops showed a considerable range; shape of bulbs also varied or fluctuated considerably, and occurred in different proportions in the different strains. These differences, in some cases, probably may be correlated with characteristics suitable to local conditions.

Miscellaneous.—Studies of the inheritance of various characters in swedes—*e.g.*, "splitting," "fanged roots," "coarse and multiple necks"—have been continued.

III. Publications, Lectures, and Official Visits by Staff.

PUBLICATIONS (P) AND LECTURES (L).

Chief Assistant J. W. Gregor, Ph.D., and F. W. Sansome, B.Sc., Ph.D., Glasgow University :—

"Experiments on the Genetics of Wild Populations: Part I., Grasses," 'Journal of Genetics,' Vol. XVII., No. 3, 1927. (P)

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

"The Influence of Environment on the Formation of Definite Habitat Types"—Edinburgh Meeting of the Society for Experimental Biology, July 1926. (L)

VISITS.

Director :—

- Swedish Plant-Breeding Station, Svalof, Sweden.
 Royal Agricultural Society's High School Experiment
 Ground, Copenhagen, Denmark.
 Agricultural Experiment Station, Lyngby, Denmark.
 Agricultural Experiment Station, Tystofte, Denmark.
 Plant-Breeding Station, Taastrup, Denmark.
 Experimental Farm, Kollekolle, Denmark, in June 1926.
 Scottish Agricultural Research Council Conference in
 Aberdeen in July 1926.
 Meeting of the Research Council, Bristol, July 1926.
 Experiment Station, Long Ashton, Bristol, July 1926.

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

- Scottish Agricultural Research Council Conference in
 Aberdeen in July 1926.
 Oxford Meeting of the British Association, September
 1926.
 Plant-Breeding Station, Cambridge, September 1926.
 National Institute of Agricultural Botany, Cambridge,
 September 1926.
 Plant-Breeding Station, Aberystwyth, September 1926.
 The International Institute of Agriculture, Rome, Feb-
 ruary 1927.

IV. 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.

V. Acknowledgments.

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- Dr Å. Åkerman, Sveriges Utsadesforening, Svalof, Sweden.
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Seed Testing Station, Corstorphine.
- Messrs Wm. Dods & Son, Seedsmen, Haddington.
- Dominion of Canada Department of Agriculture.
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- Wm. M. Findlay, Esq., Marischal College, Aberdeen.
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- J. T. M'Laren, Esq., The Leuchold, Dalmeny.
- National Institute of Agricultural Botany (per S. F. Armstrong, Esq.), Huntingdon Road, Cambridge.
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- Royal Danish Agricultural Society, Copenhagen.
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- C. Smith, Esq., Corstorphine.
- Professor Wm. Wright Smith, Royal Botanic Garden, Edinburgh.
- Welsh Plant-Breeding Station (per Professor R. G. Stapledon and T. J. Jenkin, Esq., M.Sc.), Aberystwyth.

WILLIAM ROBB,
Director of Research.

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