

SCOTTISH SOCIETY FOR RESEARCH  
IN PLANT-BREEDING

REPORT

BY THE

DIRECTORS

TO THE

ANNUAL GENERAL MEETING

28th July 1949



1949

SCOTTISH SOCIETY FOR RESEARCH IN  
PLANT-BREEDING.

REPORT.

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THE Directors of the Scottish Society for Research in Plant-Breeding have pleasure in submitting the Twenty-eighth Annual Report to members of the Society.

The provision of adequate facilities for the expansion of the Society's research programme continues to receive attention. It is expected that land for experiments will be available to the Society as soon as the necessary buildings are erected and equipped at the Edinburgh Centre of Rural Economy, Bush and Dryden Estates. In view of the possibility of subsidence, through mining, in some of the fields at Dryden Farm the Society has been advised that buildings of a really permanent nature should not be erected there. It has been proposed, therefore, that the main offices, laboratories, and glasshouses should be built in a field near Bush House, where an area of about 7 acres of land has been allotted to the Society. Locating the offices and laboratories there will be in conformity with the plans for the general layout of buildings on the estate. Only part of this area will be required for buildings; the remainder of the ground will be utilised for small experimental and demonstration plots. It is intended to conduct the main plant-breeding field experiments at Dryden Mains, which is regarded as the most suitable part of the estate for the growing and seeding of a wide range of crop plants for plant-breeding purposes. Sketch plans of a group of new buildings have been prepared by the Chief Engineer and Architect, Department of Agriculture for Scotland, and these have been considered in detail with a view to their being submitted to the Edinburgh Centre of Rural Economy for approval. Building materials still seem to be in short supply,

and some delay is sure to occur before new buildings are ready for occupation.

An account of the work at the Plant-Breeding Station, Corstorphine, at the Sub-Station, Boghall, and at Dundonnell, is given in the Report by the Director of Research on pages 15 to 45.

The Directors wish to draw attention to two of the Society's new varieties of crop plants which have been recently named—" Craigs Afterlea " oat and " Craigs Alliance " potato. Descriptive notes of these varieties are given on pages 15 and 26 respectively of this Report.

The potato varieties " Craigs Royal " and " Craigs Snow-White," registered by the Department of Agriculture for Scotland early last year, were grown under contract, for seed, in Aberdeenshire in 1948. A Stock-Seed Certificate was granted by the Department of Agriculture for Scotland in respect of the crop of each variety. It was decided that these varieties should now be introduced into commerce, and, as customary, members of the Society were given the first opportunity to purchase seed of these in lots of not less than one ton of each. In response to a circular letter to all members, applications were received for 38 tons of " Craigs Royal " and 51 tons of " Craigs Snow-White," quantities much in excess of the amounts available. Allocations were therefore made by ballot, and 18 members each received one ton of " Craigs Royal " and 6 members each received one ton of " Craigs Snow-White," these quantities included all the seed available for disposal this year. Applicants who received seed tubers all readily agreed to grow their crops under the same conditions of isolation as presently prevail for Stock Seed and to enter their crop for Stock-Seed Inspection, season 1949-50.

The Directors wish again to express their thanks to Messrs David Bell, Ltd., Leith, for their valued assistance in cleaning, storing, and despatching bulk quantities of cereal and grass seeds for the Society.

#### Staff.

Additional help was required for the experiments being undertaken on sugar beet breeding, and Mr F. J. W. England,

B.Sc., was appointed on a temporary basis to assist with this work as from 1st September 1948.

Miss Patricia J. Watson, who is working on herbage and grassland problems at the Station, was awarded the Degree of Ph.D. in January last by the University of Glasgow for a thesis entitled, "The Ecotypic Differentiation of Populations: Altitudinal Distribution of Variation in *Festuca*."

Dr William Black was granted leave of absence to attend the Eighth International Congress of Genetics in Stockholm, 7th to 14th July 1948, and he was awarded a Travelling Fellowship by the Agricultural Research Council to cover his travelling and maintenance expenses. During the Congress, facilities were provided for members to visit various agricultural experiment stations in Sweden, and Dr Black availed himself of these opportunities.

Leave was granted to Dr J. C. Haigh to attend the Fifth International Congress of Comparative Pathology at Istanbul, 13th to 20th May 1949, and to Dr J. W. Gregor to attend the Fifth International Grassland Congress at Noordwijk, Holland, 22nd June to 2nd July 1949.

Mr John Stirton, who has acted as Secretary of the Society since its inception in 1921, decided to retire from office at 30th June 1949, and his resignation has been accepted with regret. Mr Stirton took a most active part in the preliminary proceedings when the proposal to set up a Plant-Breeding Station in Scotland was being successfully advocated towards the end of the 1914-18 world war, by farmers, seedsmen, and others interested in the improvement of agricultural crop plants, and that since then he has taken a keen interest in all the Society's activities. The Directors wish to place on record their appreciation of the invaluable help he has given the Society.

In view of the expansion of the Society's work the appointment of a full-time Secretary was considered, but it was decided that in the meantime the post should continue to be held on a part-time basis. Mr R. M. Lemmon, B.L., Secretary of The Royal Highland and Agricultural Society, was offered the position of Secretary and Treasurer, on a temporary basis, and he has agreed to accept office as from 1st July 1949.

### Financial.

The accounts as audited at 31st March 1949 show that the Society's funds stand at £46,091 as compared with £45,942 at 31st March 1948, an increase of £149.

The Society's ordinary income in 1948-49 was £653 more than in 1947-48, ordinary sales being approximately £97 more than last year. The increased income resulted largely from the marketing of the two new varieties of potato—"Craigs Royal" and "Craigs Snow-White"—which contributed £550, 4s. 6d. The amount of grant received from the Department of Agriculture for Scotland was £16,147, 10s. 3d., an increase of £3210, 10s. 3d. over that of the previous year.

Capital income (*i.e.*, income not taken into account in reckoning the amount of grant provided by the Department of Agriculture for Scotland) for the year amounted to £284, 12s. 8d., of which sum £190 represented life-membership subscriptions.

The total ordinary expenditure amounted to £18,405, and this figure shows a rise of £2827 over that of the previous year. The main increases are for salaries, superannuation contribution, renewals of implements and tools, property repairs, Boghall Sub-Station (property repairs), and the Society's share of the expenses of the Edinburgh Centre of Rural Economy.

The balance of grant in the Society's hands at 31st March 1949 amounted to £1658, 2s. 3d. Increased income from sales, the amount of which was not known until near the end of the financial year, had the effect of increasing the unexpended balance of grant at the end of the year. The figure representing the unexpended balance may be subject to adjustment later by the Department of Agriculture for Scotland, but it is not anticipated that there will be any material alteration.

The expenditure on Sugar Beet Investigations which were started in 1948 is shown separately. This expenditure was met by a grant received from the Sugar Beet Research and Education Committee, Ministry of Agriculture and Fisheries.

On the assets side of the balance-sheet, items VIII. to XI. represent liquid assets amounting to £37,745, 8s. 9d. The

investments in item X. are valued at cost price, and at market value on 31st March 1949 show an appreciation of £14,854, 13s. 6d.

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

This fund now amounts to £420, 16s. 8d. No payments were made from the fund during the year.

#### **Membership.**

The Directors have to report that in the past year seven members died and four members resigned. They are pleased to record, however, that 116 new members were elected during the year, that large number being almost entirely due to the efforts of the Vice-Chairman, Mr W. J. Campbell. Nineteen of the new members paid life subscriptions. At 31st March the membership numbered 478, and consisted of 186 life members and 292 annual members (15 at the 5s. rate and 277 at the 10s. rate of subscription). A list of members appears on pages 46 to 62 hereof.

Donors of £10 and over are entitled to become life members without further payment. Donors of £5 may become members of the Society by payment of an annual subscription of 5s., and others by payment of an annual subscription of 10s.

The attention of members is again drawn to the intimation received from the Agricultural Research Council that the Scottish Society for Research in Plant-Breeding has been approved as a Research Association for the purposes of Section 27 of the Finance Act, 1944. "Payments by an agriculturist to an approved institution engaged on agricultural or horticultural research will rank as an expense in his accounts for the purpose of income tax even if intended as a contribution towards a definite capital project to be carried out by the research organisation."

### Election of Directors.

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

W. J. CAMPBELL, Sibster, Hermitage Drive, Edinburgh.  
 ROBERT HOWIE, B.Sc., Grange, Kirkcaldy.  
 Captain IAN S. ROBERTSON, Linkwood, Elgin.  
 ROBERT L. SCARLETT, O.B.E., Sweethope, Musselburgh.  
 WILLIAM SMITH, M.B.E., M.A., B.Sc., 10 South Castle Street,  
 Edinburgh.  
 WILLIAM J. WRIGHT, The Heugh, North Berwick.

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

Major R. F. BREBNER, C.B.E., The Leuchold, Dalmeny House,  
 Edinburgh.  
 GEORGE G. MERCER, C.B.E., Southfield, Dalkeith.  
 JAMES B. MILLER, Easter Ferrygate, North Berwick.  
 A. GORDON PORTER, West Scryne, Carnoustie.  
 Sir JAMES DENBY ROBERTS, Bt., Strathallan Castle, Auchterarder.  
 JOHN STIRTON, O.B.E., Pinkiepens House, Musselburgh.

R. M. LEMMON,  
*Secretary.*

**List of Varieties of Crop Plants raised or selected  
by the Society and introduced into Commerce.**

		Date of Registration.
<i>Oats</i> —		
Elder	} Registered by the Department of Agriculture for Scotland as new varieties.	1930
Bell		1932
Early Miller		1934
<i>Wheat</i> —		
Scottish Iron III.		
<i>Barley</i> —		
Craigs Triumph.		
<i>Potatoes</i> —		
The Alness	} Registered by the Department of Agriculture for Scotland as new varieties.	1934
Craigs Defiance		1939
Craigs Royal		1948
Craigs Snow- White		1948
<i>Grasses</i> —		
"Scotia" Cocksfoot, Ref. No. Cc 196.		
"Scotia" Timothy, Ref. No. Cb 224.		

**SEEDS FOR DISPOSAL.**

It is expected that limited quantities of elite stocks of seed of Early Miller and Bell oats, Craigs Triumph barley, "Scotia" cocksfoot, and tubers of "Craigs Royal" and "Craigs Snow-White" potatoes, will be available for disposal in January 1950.

**IT IS SUGGESTED THAT MEMBERS WHO WISH TO OBTAIN ANY OF THESE SEEDS OR TUBERS SHOULD MAKE PROVISIONAL INTIMATION OF THEIR REQUIREMENTS AS SOON AS POSSIBLE TO THE DIRECTOR OF RESEARCH.**

It is sometimes impracticable to circularise all members of the Society regarding seeds for disposal, and it is hoped that this suggestion will be noted by interested members.



## ABSTRACT OF

For the year ended

<i>INCOME.</i>	
Interest Received	£1,090 8 2
Recoverable Income Tax	488 7 9
	£1,578 15 11
Director's Rent and Rates	92 15 0
Sales—	
Ordinary, including Stocks on Hand	£1,022 6 4
Extraordinary—	
"Early Miller" Oats Account	£29 4 11
"Scotia" Cocksfoot Account	51 4 1
"Craigs Royal" and "Craigs Snow-White" Account	550 4 6
	630 13 6
Subscriptions—Annual	1,652 19 10
Note.—Annual Subscriptions amounting to £9, 5s. are in arrear.	100 10 0
Donations—Sums under £10	11 2 6
	Total Ordinary Income
	£3,436 3 3
Grant received from Department of Agriculture for Scotland for the year 1948-49	16,147 10 3
Capital Income—	
Life Membership Subscriptions	£190 0 0
Interest on Donations and Life Membership Subscriptions (£3154, 9s. at 3 per cent, less Income Tax)	£64 16 11
Recoverable Income Tax	29 15 9
	94 12 8
	284 12 8
	Total Income
	£19,868 6 2
Balances at 1st April 1948—	
Funds in Hand	£45,942 17 9
Department of Agriculture for Scotland Maintenance Grant	479 12 8
	46,422 10 5
	£66,290 16 7
<b>BUILDINGS AND EQUIPMENT</b>	
Balance at 1st April 1948	£188 1 6
Interest	0 19 1
	£189 0 7
<b>SUGAR BEET</b>	
Grant received from the Sugar Beet Research and Education Committee	£450 0 0
Balance due to Society	77 9 10
	£527 9 10

## ACCOUNTS.

31st March 1949.

<i>EXPENDITURE.</i>	
Salaries—	
Officers, including Sub-Station	£9,014 3 6
Secretary and Office	634 16 8
	£9,649 0 2
Superannuation Contribution	924 11 5
Auditor's Fee	26 5 0
Labour, including Sub-Station	2,579 11 6
National Insurance	184 4 6
Seeds and Roots	11 7 2
Manures	138 0 6
Sundry Working Expenses	559 6 7
Renewals of Implements	597 7 3
Laboratory Expenses	50 13 2
Library Expenses	63 8 7
Rates and Insurances	111 13 9
Printing, Telephone, Postages, and Office Supplies	333 13 3
Heating, Lighting, and Cleaning	360 5 6
Travelling Expenses	421 15 8
Property Repairs	395 10 11
Regional Trials	58 11 11
Grassland Experimental Area, Dundonnell	225 7 5
Boghall Sub-Station Maintenance Expenses	535 19 5
Edinburgh Centre of Rural Economy (Share of Expenses)	1,178 10 3
	Total Ordinary Expenditure
	£18,405 3 11
Depreciation on Temporary Buildings, Tools, &c.	135 19 7
	Total Expenditure
	£18,541 3 6
Balances at 31st March 1949—	
Funds in Hand per Balance-sheet	£46,091 10 10
Department of Agriculture for Scotland Maintenance Grant	1,658 2 3
	47,749 13 1
	£66,290 16 7
<b>—FIRE DAMAGE.</b>	
Expenditure on Restorations	£42 16 6
Sum on Deposit Receipt	146 4 1
	£189 0 7
<b>INVESTIGATIONS.</b>	
Salary and Superannuation Contribution (Part-time)	£192 10 0
Wages, National Insurance, and sundry Working Expenses	274 16 3
Equipment	60 3 7
	£527 9 10

## BALANCE-

As at 31st

## LIABILITIES.

I. Accounts Outstanding, due by Society . . . . .	£516 18 1
II. Subscriptions paid in advance . . . . .	15 10 0
III. Department of Agriculture for Scotland: Balance of Maintenance Grant	1,658 2 3
IV. Funds at 31st March 1949 . . . . .	46,091 10 10

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£48,282 1 2

## DR WILSON MEMORIAL

Value at 31st March 1949—	Funds at 31st March 1949—	
£209 0 0	£200 3½ per cent War Stock . . . . .	£176 5 0
	Sum in Savings Bank . . . . .	244 11 8
		<hr/> £420 16 8

EDINBURGH, 10th May 1949.—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 1949.

## ASSETS.

I. Houses and Lands, at Cost, less Depreciation . . . . .	£8,067 14 3
II. Virus Scheme Buildings, &c., at Cost, less Depreciation—	
Craigs House . . . . .	£1,683 15 7
Boghall Sub-Station . . . . .	299 2 0
	<hr/> 1,982 17 7
III. Greenhouses, Huts, Frames, and Equipment at Sub-Station, at Cost, less Depreciation . . . . .	121 15 9
IV. Implements and Tools, at Cost, less Depreciation	£187 12 11
Additions during year . . . . .	597 7 3
	<hr/> £785 0 2
Less Charged to Renewals . . . . .	597 7 3
	<hr/> 187 12 11
V. Laboratory Apparatus, at Cost, less Depreciation . . . . .	55 9 11
VI. Office Furniture and Fittings . . . . .	53 11 0
VII. Stocks on Hand, as valued by Directors . . . . .	67 11 0
VIII. Accounts Outstanding, due to Society . . . . .	969 16 6
IX. Income Tax Recoverable . . . . .	518 3 6
X. Investments, at Cost :—	

Value at 31st March 1949.		
£14,765 17 0	1. £14,130, os. 9d. 3½ per cent War Stock . . . . .	£12,530 0 0
15,890 0 0	2. £14,000 4 per cent Funding Stock, 1960-90 . . . . .	10,045 0 0
17,914 0 0	3. £16,900 3½ per cent Conversion Stock . . . . .	11,140 3 6
£48,569 17 0		<hr/> 33,715 3 6

XI. Cash Balances—	
In Bank on Current Account . . . . .	£995 12 5
In Savings Bank . . . . .	1,343 16 3
On Dollar Draft . . . . .	160 16 11
On Hand . . . . .	41 19 8
	<hr/> 2,542 5 3
	<hr/> £48,282 1 2

## FUND ACCOUNT.

Funds at 1st April 1948 . . . . .	£408 0 5
Interest for year . . . . .	12 16 3
	<hr/> £420 16 8

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.

[ROBERT MACDONALD, C.A., Approved Auditor.

## DISTRIBUTION OF MEMBERSHIP

As at 31st March 1949.

Aberdeen . . . . .	16	Linlithgow . . . . .	21
Angus . . . . .	32	Midlothian . . . . .	93
Argyll . . . . .	4	Moray . . . . .	8
Ayr . . . . .	19	Nairn . . . . .	—
Banff . . . . .	1	Orkney . . . . .	3
Berwick . . . . .	33	Peebles . . . . .	6
Bute . . . . .	1	Perth . . . . .	20
Caithness . . . . .	5	Renfrew . . . . .	4
Clackmannan . . . . .	1	Ross and Cromarty . . . . .	11
Dumbarton . . . . .	4	Roxburgh . . . . .	11
Dumfries . . . . .	11	Selkirk . . . . .	—
East Lothian . . . . .	65	Stirling . . . . .	6
Fife . . . . .	25	Sutherland . . . . .	2
Inverness . . . . .	2	Wigtown . . . . .	5
Kincardine . . . . .	2	England . . . . .	24
Kinross . . . . .	3	Abroad . . . . .	6
Kirkcudbright . . . . .	3		
Lanark . . . . .	31		
			<hr/> 478

## ESTABLISHMENT FOR 1948-49.

## BOARD OF DIRECTORS.

*Trustees.*

H.M. SECRETARY OF STATE FOR SCOTLAND, Scottish Office,  
St Andrew's House, Edinburgh.  
JOHN FINLAYSON M'GILL, Kyle Street, Ayr.  
SIR JOHN H. MILNE HOME, Elibank, Walkerburn.  
ALEXANDER M'CALLUM, O.B.E., M.A., LL.B., 78 Craiglea Drive, Edinr.

*Ordinary Directors.*

## 1946.

W. J. CAMPBELL, Sibster, Hermitage Drive, Edinburgh 10.  
ROBERT HOWIE, B.Sc., The Grange, Kirkealdy.  
Captain IAN S. ROBERTSON, Linkwood, Elgin.  
ROBERT L. SCARLETT, O.B.E., Sweethope, Musselburgh.  
WILLIAM SMITH, M.B.E., M.A., B.Sc., 10 Castle Street, Edinburgh.  
WILLIAM J. WRIGHT, The Heugh, North Berwick.

## 1947.

WILLIAM ALLISON, Almond Hill, Kirkliston.  
HOWARD U. CUNNINGHAM, C.B.E. (Scottish Agricultural Industries, Ltd.), 39 Palmerston Place, Edinburgh 12.  
Principal JOHN KIRKWOOD, O.B.E., B.Sc. (Agric.), West of Scotland Agricultural College, 6 Blythswood Square, Glasgow, C.2.

IAN C. MENZIES, O.B.E., W.S., 22 Rutland Street, Edinburgh.  
Professor Sir WILLIAM WRIGHT SMITH, F.R.S., Inverleith House, Edinburgh.  
Professor STEPHEN J. WATSON, M.Sc., D.Sc., Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh 8.

## 1948.

DAVID BELL, 15 Coburg Street, Leith.  
JAMES H. ELDER, B.Sc., Cregganore, North Berwick.  
WM. HUGH HAMILTON, W.S., Cairns, Kirknewton.  
ALEXANDER D. C. MAIN, B.Sc., Windyedge, Perth.  
FRED. MILLS (Roughhead & Park, Ltd.), Haddington.  
ANDREW M. RIDDEL (W. Drummond & Sons, Ltd.), Stirling.

*Directors Co-opted.*

Major R. F. BREBNER, C.B.E., The Leuchold, Dalmeny House, Edinburgh.  
GEORGE G. MERCER, C.B.E., Southfield, Dalkeith.  
JAMES B. MILLER, Easter Ferrygate, North Berwick.

*Directors nominated by the Department of Agriculture for Scotland.*

Sir PATRICK R. LAIRD, C.B., St Andrew's House, Edinburgh 1.  
J. M. CAIE, C.B., LL.D., M.A., B.L., B.Sc., 2 Cobden Road, Edinburgh 9.  
ALEXANDER M'CALLUM, O.B.E., M.A., LL.B., 78 Craiglea Drive, Edinr. 10.  
T. P. M'INTOSH, B.Sc. (Agric.), Ph.D., East Craigs, Corstorphine, Edinr. 12.

*Chairman of Directors*—Sir JOHN H. MILNE HOME, Elibank, Walkerburn.  
*Vice-Chairman*—W. J. CAMPBELL, Sibster, Hermitage Drive, Edinburgh 10.  
*Director of Research*—WILLIAM ROBB, N.D.A., F.R.S.E., Craigs House, Corstorphine.  
*Chief Assistant*—JAMES W. GREGOR, Ph.D., D.Sc., F.I.L.S., Craigs House, Corstorphine.  
*Assistants*—V. M'M. DAVEY, B.Sc., Ph.D., DONALD CAMERON, B.Sc., PATRICIA J. WATSON, M.A., Ph.D., and F. J. W. ENGLAND, B.Sc., Craigs House, Corstorphine.  
*Assistants, Potato-Breeding Sub-Station*—WILLIAM BLACK, B.Sc., Ph.D., F.R.S.E., and J. C. HAIGH, B.Sc., Ph.D., A.R.C.S., Boghall.  
*Assistants, Virus Disease Scheme*—GEORGE COCKERHAM, B.Sc., Ph.D., and T. M. R. M'GHEE, B.Sc., N.D.D., Craigs House, Corstorphine.  
*Secretary*—JOHN STIRTON, O.B.E., 8 Eglinton Crescent, Edinburgh 12.

## COMMITTEES.

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### RESEARCH.

Fred Mills, *Convener*.  
 William Allison.  
 David Bell.  
 Major R. F. Brebner.  
 J. M. Caie.  
 W. J. Campbell.  
 Howard U. Cunningham.  
 James H. Elder.  
 W. H. Hamilton.  
 Sir John H. Milne Home.  
 Robert Howie.  
 Principal John Kirkwood.  
 Sir Patrick R. Laird.  
 Alexander M'Callum.

J. F. M'Gill.  
 T. P. M'Intosh.  
 A. D. C. Main.  
 Ian C. Menzies.  
 George G. Mercer.  
 James B. Miller.  
 A. M. Riddell.  
 Captain Ian S. Robertson.  
 Robert L. Scarlett.  
 William Smith.  
 Professor Sir William Wright Smith.  
 Professor S. J. Watson  
 William J. Wright.

### MANAGEMENT.

William Allison, *Convener*.  
 David Bell.  
 Major R. F. Brebner.  
 J. M. Caie.  
 Sir John H. Milne Home.  
 Robert Howie.  
 Alexander M'Callum.  
 T. P. M'Intosh.  
 A. D. C. Main.

Ian C. Menzies.  
 George G. Mercer.  
 James B. Miller.  
 Fred Mills.  
 A. M. Riddell.  
 William Smith.  
 Professor S. J. Watson.  
 William J. Wright.

### FINANCE.

Alexander M'Callum, *Convener*.  
 William Allison.  
 J. M. Caie.  
 W. J. Campbell.  
 Howard U. Cunningham.  
 W. H. Hamilton.  
 Sir John H. Milne Home.  
 Principal John Kirkwood.

Sir Patrick R. Laird.  
 Ian C. Menzies.  
 George G. Mercer.  
 Fred Mills.  
 Captain Ian S. Robertson.  
 Robert L. Scarlett.  
 Professor Sir William Wright Smith.  
 William J. Wright.

# R E P O R T

BY

DIRECTOR OF RESEARCH

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## I. Research Programme.

### GRAIN CROPS.

WILLIAM ROBB, *Director of Research.*

DONALD CAMERON, B.Sc.

#### *Oats.*

After considering reports of field trials—carried out over several years in different districts—of the Society's unnamed hybrid oat Ref. No. *Aa* 708 and receiving requests for seed of this variety, the Board of Directors of the Society have decided that this oat should now be known as "Craigs Afterlea." Bred from (Castleton Potato  $\times$  Yelder)  $\times$  Elder, this new variety's most outstanding characteristic is resistance to lodging. It ripens early, has white grain of medium size and comparatively short straw. It is expected that this new oat will prove to be particularly suitable for growing on soils of high fertility. Trials at Craibstone Experimental Farm, Aberdeen, indicate that where an oat crop is to follow pasture in which there has been an ample amount of white clover, this variety merits consideration. It is not recommended for soils of average fertility or for those which are light or dry. "Craigs Afterlea" has not yet been put into commerce, but about 5 acres are being grown for seed in 1949 with a view

to putting the variety on the market as soon as a sufficient quantity of grain is available, probably in 1950 or 1951. In the past it has been customary to put the Society's new oat varieties into commerce only after they had been approved for registration by the Department of Agriculture for Scotland under their Cereal Registration Scheme. This scheme, however, has been in abeyance for a number of years, and consequently "Craigs Afterlea" could not be submitted for registration.

Several unnamed hybrid selections were again included in trials in different parts of Scotland and also at a few centres in England, in co-operation with the Agricultural Colleges in Scotland and the National Institute of Agricultural Botany in England. These selections comprise some which have shown considerable resistance to lodging, and others which were early ripening and are intended for upland districts. The results of the trials were variable, and it was difficult to draw definite conclusions. It is not hard to obtain early-ripening varieties with a good type of straw, but, frequently, it would seem that as the growing period is shortened the yield of grain tends to be reduced. One of the oat-breeding objectives is to produce a variety in which early ripening is combined with a capacity to give a high yield of grain and a sufficient degree of hardiness or adaptability for upland conditions.

On acid soils and on some of the more upland areas, particularly in Aberdeenshire, the selection Ref. No. *Aa* 676 (Castleton Potato  $\times$  Yelder) has continued to give promising results. When this variety has been grown on land of medium to high fertility the yield of grain has been lower than that of the standard varieties. The yield of straw, however, has usually been high, and this characteristic may be useful where a high value is placed on straw for fodder. Another early-ripening selection, Ref. No. *Aa* 714 (Marvellous  $\times$  Orion), which has larger grain than *Aa* 676, has given promising results in an upland area in Inverness-shire, and more trials have been laid down this year.

A new group of hybrid selections developed in recent years has been added to the number which are undergoing initial field trials at the Plant-Breeding Station, Corstorphine. Some of the older selections have been discarded for various reasons, such as low yield, susceptibility to lodging, or other undesirable

features. Forty-five hybrid selections were included in replicated small plot trials—the varieties Star, Onward, and Yelder being used as standards for comparison. In addition to obtaining data on grain yield, length of straw and period of ripening, some additional characteristics of the grain have been determined by estimating the 1000 grain weight, the percentage kernel, and the proportion of small grain within samples which have received an average amount of cleaning. Data obtained from these trials are shown in Table I.

Of the eleven highest grain-yielding varieties, three unnamed selections, AG, L, and AI, show considerable promise; all are early and above average in standing power; AG and AI are of average height, and L is short-strawed. L was also promising in 1946 trials. The varieties A, S, and R are high grain-yielding, later in ripening than average, and of average standing power and height. F is a late, high grain-yielding variety of average height and standing power. J is later than the average in ripening and of average height and below average standing power. Y is a late variety with short straw of average standing power. In the trial, Onward was one of the latest ripening varieties; Yelder was about nine days earlier; and both are of average height and standing power.

The hybrid selection derived from Quality  $\times$  *Avena byzantina* was again included in a field trial on alkaline soil in Tiree and favourable results were again obtained in 1948. This selection shows promise of being well suited for growing on alkaline soils, and a larger trial will be carried out in Tiree in 1949. Grain has also been supplied for a small-scale trial in the Hebrides.

Eight acres of Early Miller oats and two acres of Bell oats were grown for seed in order to meet the demands for elite stocks of these varieties.

An increased number of unfixed hybrid oats were grown for comparison and selection.

The attempt to synthesise a fertile hexaploid by colchicine treatment of the hybrid—*Avena barbata*  $\times$  *Avena strigosa*—has not so far been successful, but the experiment will be repeated in 1949.

A large population of plants of *A. strigosa* and *A. brevis* derived from seed treated with colchicine in 1947 was grown in 1948 and a number of abnormal plants selected. Among them, two of *A. strigosa* were found to have grain larger than



TABLE I.  
OAT VARIETIES ARRANGED IN ORDER OF YIELD OF DRESSED GRAIN.

Identification letter	Name of Variety or Station No., if allocated, of Hybrid Selection	Days to Mature	Average Plant Height in Inches	Estimated Yield of Dressed Grain per acre in cwt.	Percentage Weight of Dressed Grain over 0.095-in. sieves	1000-Grain Weights of Grain over 0.095-in. sieves in grammes	Percentage Kernel in the Grain over 0.095-in. sieves
AG		144	49	33.4	79.9	44.320	72.2
L	<i>Aa 720</i>	141	44	32.8	82.9	45.334	70.6
AI		140	50	31.2	76.9	43.468	74.2
AW	Onward	157	49	31.2	89.9	41.472	71.3
S		152	50	30.6	66.0	45.071	74.2
F		158	48	30.6	66.1	39.559	73.4
J		150	50	30.5	63.0	40.721	73.6
R		153	51	30.5	75.2	45.949	74.5
Y		158	44	30.4	80.6	37.009	73.2
A	<i>Aa 698</i>	150	48	30.3	88.3	44.415	71.8
AV	Yielder	148	48	30.2	81.4	41.743	74.7
V	<i>Aa 716</i>	147	50	29.5	74.2	42.184	74.2
Q		150	47	28.9	85.2	45.235	70.5
AP		148	49	28.9	76.2	42.458	71.6
D		141	54	28.6	85.2	46.813	73.6
AH		146	49	28.5	73.9	46.037	72.7
AU		156	50	28.5	88.8	40.941	74.7
AX		155	46	28.2	88.4	42.774	75.1
H	Star	149	48	28.2	58.1	39.419	71.0
AQ		146	50	28.1	79.8	44.755	74.2
C		140	50	28.0	86.0	47.228	69.9
AR		142	48	27.8	74.0	41.155	74.8
N		144	47	27.8	92.0	39.658	72.8
I	<i>Aa 719</i>	151	47	27.3	67.0	38.595	72.0
AT	Craigs Afterlea	140	44	27.0	89.9	41.433	69.8
G	<i>Aa 718</i>	145	44	26.7	55.1	38.999	71.1

OAT VARIETIES ARRANGED IN ORDER OF YIELD OF DRESSED GRAIN—*cont'd.*

Identification letter	Name of Variety or Station No., if allocated, of Hybrid Selection	Days to Mature	Average Plant Height in Inches	Estimated Yield of Dressed Grain per acre in cwt.	Percentage Weight of Dressed Grain over 0.095-in. sieves	1000-Grain Weights of Grain over 0.095-in. sieves in grammes	Percentage Kernel in the Grain over 0.095-in. sieves
AA		143	59	26.6	88.0	46.208	71.7
AD		144	45	26.6	87.6	42.583	73.3
W	<i>Aa 717</i> .	146	53	26.4	79.5	44.660	72.5
AO		154	52	26.4	87.6	45.646	73.9
T		151	47	26.1	63.9	43.808	73.7
AS	<i>Aa 676</i> .	142	45	25.9	78.2	38.565	69.9
B	<i>Aa 713</i> .	148	49	25.7	86.0	40.053	72.1
P		142	46	25.2	85.9	42.573	72.2
M		147	48	24.7	80.5	43.786	72.3
AL		145	49	24.7	80.9	44.682	71.9
AK		154	49	24.6	76.9	40.178	72.8
X		154	48	24.6	94.7	40.446	74.0
AB		149	47	24.2	79.6	39.548	76.0
AE*		140	47	24.0	79.5	44.557	74.2
AN		149	49	24.0	84.7	46.154	73.7
U	<i>Aa 722</i> .	156	52	22.4	50.0	38.487	76.6
O		145	47	21.9	88.0	41.795	72.9
E		141	50	21.7	89.6	47.613	75.3
K	<i>Aa 714</i> .	153	54	21.5	54.4	42.472	73.9
AM		154	51	21.5	89.6	45.999	74.2
AC		152	45	21.0	62.9	36.922	75.9
AF		145	47	20.4	81.6	42.276	74.2
Difference for Significance at 5 per cent level .		4	4	4.3			

the normal size, and these will be examined cytologically in 1949.

The notes of botanical characters of named oat varieties which had been taken in previous years were used in assembling the critical descriptions of those varieties included in the Department of Agriculture for Scotland Trial Oat Inspection Scheme in 1948. In connection with this scheme a number of farms in Angus, Fife, and the Lothians were visited by Mr Cameron, who gained thereby useful experience of cultural conditions in these areas, and who was able to some extent to make observations on the constancy, in the commercial crops, of those botanical characters which had been recorded on pot-grown, pure-line material. It is hoped to make further observations along these lines in 1949.

Samples of Star oats were received from Mr J. R. Dale, Auldham, North Berwick, and from Professor Å. Åkerman, Svalöf, on which a preliminary investigation of techniques necessary for the inclusion of resistance to leaf spot (*Helminthosporium Avenae*) in the breeding work of the Station has been begun.

### *Barley.*

The seed of six first-generation barley hybrids grown in 1948 was sown immediately after harvest. Seedlings showing relatively low dormancy were selected and grown over winter in a glasshouse, and the seed from them will be sown for further selection.

A further series of crosses between barleys of high and low dormancy was made in 1948, and the first-generation hybrids were sown in the spring of 1949.

Samples of seed of a few barley varieties selected from Scots Common barley were again submitted to Dr L. R. Bishop, Brewers' Research Association, London, who kindly agreed to test them for germinative energy shortly after they had been harvested. The results obtained from 1948 crops were in close agreement with those obtained from the previous year's crop. The selection B7(4) showed a relatively high percentage of germinative energy—*i.e.*, less dormancy—as compared with the germinative energy of Plumage Archer and Spratt Archer.

About 2 acres of Craigs Triumph barley were grown at the Plant-Breeding Station and all the grain was used for seed.

#### *Wheat.*

The reference collections of named varieties of winter wheat and spring wheat were again grown.

#### *Beans.*

As in previous years some 250 plants of the Field Bean, *Vicia faba* L., were "bagged" during the flowering period to prevent natural intercrossing. Observations made during the growing period on flower and stem colour, and on the characters of the beans when ripe, indicate that the majority of the Station's older lines are now true breeding, and the most attractive of them are being multiplied in spatial isolation.

Seven true-breeding lines of which sufficient quantities of seed were available have been included in a small replicated trial on which their relative yields, stature, and maturity periods will be assessed.

The seed from six distinctive lines, sown at intervals in a crop of winter wheat to determine the degree of spatial isolation required by small groups of plants to prevent natural intercrossing, has been sown for observation in 1949, and an estimate of the minimum distance necessary between lines will be made as a guide to future multiplication policy.

Selections from second-generation populations grown in 1948 were made, and the most promising types have been sown for inbreeding in 1949 and subsequent years.

#### POTATOES.

*(Breeding—Boghall Sub-Station.)*

WILLIAM BLACK, B.Sc., Ph.D., F.R.S.E.  
J. C. HAIGH, B.Sc., Ph.D., A.R.C.S.

Potato-breeding problems are concerned mainly with the aggregation of disease-resistant properties which have been found in certain members of the potato family, both cultivated and wild, and the combining of as many of them as possible

with the best features of popular commercial varieties. In view of the many factors involved in the inheritance of morphological characters, as well as disease-resistant qualities, very large numbers of seedlings require to be grown and tested in order to obtain the full range of recombinations desired for selection purposes.

The investigations concerning resistance to blight and the inter-relationships of blight strains have been continued. In 1948 the routine tests were made with strains B and C and a few supplementary tests with strain A. In addition, comparative tests of a range of seedling types were carried out with ten German strains provided by Dr K. O. Müller. A new strain of greater virulence has been discovered on some of the Society's seedlings when grown in East Africa.

A further new strain, apparently a mutant of the East African strain, was isolated early in 1949. Preliminary tests indicate that it has a wider range of host plants—*i.e.*, it attacks not only the lines susceptible to the East African strain, but also a number which are resistant to it. Both the East African strain and its mutant differ only quantitatively from strain B; they are, however, qualitatively different from strain C. It has been found that certain breeding lines are resistant to all these strains, and some promising selections have been made from them. It has now become increasingly difficult to maintain all the different blight strains.

On account of the mutability of the fungus the problem of resistance to blight has greatly increased in complexity. In the past the production of new resistant selections has invariably been followed sooner or later by the appearance of new strains of *Phytophthora* capable of attacking them. Should this continue indefinitely the prospects of attaining permanent freedom from blight in a variety are remote. Nevertheless, while these biotypes may flourish under laboratory conditions they need not necessarily persist in the field. If their survival value under ordinary conditions was as great as that of the common strain, then a greater number of them ought to be present in commercial crops. Such evidence has not been forthcoming. It is possible therefore that some of the biotypes which have been isolated may be of academic interest rather than of practical importance.

On account of the practical value of field immunity from the mosaic viruses, particularly A, X and Y, hybridisations

have been made in order to combine these qualities with blight resistance. Field immunity from viruses A and X is readily available in certain commercial varieties and un-named seedlings, and no difficulty has been experienced in obtaining the desired combination of these disease-resistant qualities.

Likewise several seedlings which are hypersensitive to virus Y have been used for crossing purposes and the hypersensitive character has been transmitted to a proportion of the progeny. Some of these plants have been bred from wild species, while others have been made available through the generous co-operation of Dr E. M. Hutton, Australia. The tests for reaction to the mosaic viruses were carried out by the Potato Virus Disease Section.

The breeding of leaf-roll resistant types is more difficult to achieve, since no form of leaf-roll immunity is known and no convenient laboratory test for resistance is available. Nevertheless, leaf-roll resistant varieties, including a number of German origin, have been used for crossing purposes, and the selections which have been made from the progenies are being exposed to natural infection in the field.

The possibility of breeding for resistance to blackleg is still being explored. The work has so far been confined to the greenhouse and laboratory; considerable difficulty has been experienced in finding a satisfactory test for resistance and the problem is not yet solved. The claim has been made by Russian workers that immunity from blackleg is to be found in *S. acaule* and its hybrids with *S. tuberosum*; laboratory tests have not confirmed this claim, nor do they indicate the existence of immunity in any of the score of exotic species and hybrids so far tested. It may however be possible to find a degree of resistance that will justify breeding work, and tests are being continued.

A small observation plot was planted in 1948 to test the reactions of some exotic species to the attack of the potato-root eelworm (*Heterodera rostochiensis* Wollenweber); land known to be infested was provided on the farm for this purpose. Both before and after the trial estimates of the number of eelworms present in the soil were kindly made by Mr I. D. West, Entomology Department of the College of Agriculture, Edinburgh, and these indicated that while there were no significant differences between the density of the eelworm

population in the soil beneath the roots of the wild species and the commercial variety used as control, there was a significantly lower percentage viability of the cysts in the neighbourhood of some of the South American species. This result agrees with published reports on eelworm resistance, which suggest that while eelworm immunity may not be found in the South American species a considerable degree of resistance is possible. The test is being repeated during the coming year on a slightly larger scale, and an effort is being made, with the co-operation of the farm staff, to build up a high infestation of eelworm in the trial plot, which it is hoped will serve as a testing ground for assessing the resistance of any breeding material.

A valuable collection of German breeding material, supplied in 1948 through the co-operation of Dr K. O. Müller, was grown at Boghall for observation and utilisation in the breeding experiments. It contains types resistant to most of the common potato diseases and pests as well as various high-yielding named varieties and seedling selections.

The investigation into the nature and cause of bolting in potatoes was continued in co-operation with the John Innes Horticultural Institution. Investigations dealing with the utilisation of wild species of potato in breeding experiments and with the nature and inheritance of incompatibility in diploid species have also been continued.

In connection with the above investigations fully 19,000 new seedlings were raised in 1948. With the exception of about 900, all were bred for resistance to blight, in combination with resistance to other diseases. A total of 5016 seedlings were planted in the field as material for the selection of potential economic types.

The number of second-year seedlings planted out in 4-tuber plots in 1948 was 774. Most of them were resistant to at least two strains of blight, but resistance to all the fourteen available strains was found to be a feature of several breeding lines. Fully 200 seedling varieties were selected for further trial in 1949.

Third-year and older seedlings numbering 173 were grown in trial and multiplication plots at Boghall. A few of these selections proved resistant to all fourteen strains of blight as well as field-immune from viruses A and X. Trial plots of some of the more advanced selections were also grown at Craigs House. Fifty-four selections were retained, some for

further trial as economic types and others for breeding and experimental purposes only. Ten of them were selected for inclusion in official trials in 1949.

*Trials.*—Some notes on the seedlings included in official trials in 1948 are listed in Table II.

TABLE II.

Reference Number	Maturity	Resistant to blight strains	Field-immune from viruses	TRIALS		
				D.O.A.S. Year	M.O.A.F. Year	L.D.G.M. Year
Craigs Royal .	2nd E.	—	A, X.	+	+	2nd
827a(185)	} 1st E.	—	A, B.	3rd	—	—
Craigs Alliance						
833b(98)	E.M.	A, C.	A, B, C, X.	+	+	3rd
834c(29)	2nd E.	A, C.	A, B, C, X.	3rd	+	2nd
931a(3)	E.M.	A, C.	B.	2nd	—	—
1081a(2)	2nd E.	A, C.	C.	2nd	1st	—
1092a(4)	E.M.	A, C.	B.	2nd	+	—
1266a(3)	M.	A, C.	A, B.	2nd	1st	—
1085(6)	M.	A, C.	—	1st	2nd	—
1321c(5)	M.	A, B.	A, B, C, X.	—	2nd	—
1095b(22)	E.M.	A, C.	A.	1st	1st	—
1253a(12)	2nd E.	A, B, C.	A, X.	1st	—	—
1256b(13)	E.M.	A, B, C.	B.	—	1st	—
1256c(7)	1st E.	A, B, C.	A, B, X.	1st	—	—
1433b(14)	M.	A, B, C.	A.	1st	—	—
1435(3)	2nd E.	A, B, C.	A, C.	1st	—	—
1436(5)	M.	A, B, C.	—	—	1st	—
1439a(4)	M.	A, B, C.	A, B, C, X.	1st	—	—

*Key to contractions:—*

M = Maincrop.

E.M. = Early maincrop.

1st E. = 1st Early.

2nd E. = 2nd Early.

+ = Trials completed.

L.D.G.M. = Lord Derby Gold Medal Trials.

M.O.A.F. = Ministry of Agriculture and Fisheries Trials.

D.O.A.S. = Department of Agriculture for Scotland Trials.

The registration trials conducted by the Department of Agriculture for Scotland contained thirteen varieties. Seven of these were included in the first-year test, and the Committee recommended that six of them should be continued for further trial in 1949. The second-year test contained four of the Society's seedlings, one of which was recommended for further trial in 1949. Of the two seedlings included in the third-year test, one of them, 834c(29), gave inconclusive results



and was recommended for a further year's trial. The other, 827a(185), was recommended for registration and has since been named Craigs Alliance. The official description of Craigs Alliance is as follows:—

*Maturity.*—First early.

*Tuber.*—Oval, slightly flat; skin white; on exposure colouring red-purple at eyes and lenticels at rose end; flesh white; eyes shallow, sprouts pink.

*Foliage type.*—Home Guard.

*Foliage.*—Low to medium height, open; stems fairly numerous and slightly bronzed, sometimes assuming a zigzag appearance; nodes green and swollen; wing small and straight; leaf long and open, drooping; mid-rib green; leaflet of average size, slightly upwards-folded with wavy light-green margin, glossy, lobes uneven, terminal rounded; secondary leaflets fairly numerous, small-pointed.

*Flower.*—White and infrequent; buds usually drop.

This variety, which was bred from Craigs Defiance  $\times$  The Alness, matures as early as Arran Pilot, forming attractive white, oval tubers. On the evidence of the trials at the Plant-Breeding Station its cropping capacity is greater than that of Arran Pilot and its cooking quality superior. It is field-immune from viruses A and B.

The trials conducted by the Ministry of Agriculture and Fisheries at the School of Agriculture, Loughborough, contained seven of the Society's seedlings, five in the first-year and two in the second-year test. In addition, small samples of twenty seedlings were submitted for preliminary test. Selections have again been forwarded for inclusion in the 1949 trials.

The Lord Derby Gold Medal trials in 1948 contained three of the Society's seedlings—viz., Craigs Royal, 834c(29), and 833b(98). No final decision was reached by the Committee regarding Craigs Royal, and an invitation was issued to submit it again in 1949. In the case of 834c(29) and 833b(98) the Committee did not consider that these seedlings showed sufficient promise to justify an award.

Multiplication crops of Craigs Royal, Craigs Snow-White, and the two unnamed seedlings 833b(98) and 834c(29) were

grown under contract in Aberdeenshire by Mr A. Milne, Netherton of Mounie, Oldmeldrum. Craigs Royal and Craigs Snow-White were inspected by the Department of Agriculture for Scotland and awarded Stock Seed Certificates. From these stocks 18 tons of Craigs Royal and 6 tons of Craigs Snow-White were sold in 1-ton lots to members of the Society. The amounts of seed applied for exceeded the quantities available and allocation was made by ballot. The stock of 833*b*(98) amounting to 3 tons was sold to the Department of Agriculture, Dar-es-Salaam, for trial under general cultivation in Tanganyika Territory.

Arrangements have been made to grow in 1949 in Aberdeenshire approximately 4 acres Craigs Royal, 2 acres Craigs Snow-White,  $\frac{3}{4}$ -acre 834*c*(29),  $\frac{1}{2}$ -acre 1092*a*(4), and  $\frac{1}{2}$ -acre Craigs Alliance.

Preliminary regional field trials of Craigs Royal were conducted at seven centres in 1948, each centre being supplied with 15 cwt. seed tubers. Epicure was the control variety. Since the seed tubers of Craigs Royal could not be treated in the same manner as those of Epicure, the trials were regarded as preparatory to comparative trials in 1949 when treatments would be similar. Reports of the 1948 trials were not entirely consistent, but indicated that Craigs Royal tended to bulk slightly later than Epicure, although it ultimately gave a higher yield of saleable ware. The trials will be continued in 1949.

Similar regional trials, conducted at four centres, have been arranged for Craigs Alliance with Arran Pilot as the control variety. In addition, smaller quantities have been forwarded to five centres in England under the auspices of the National Agricultural Advisory Service.

The multiplication of virus-free stocks of the more promising seedlings has been continued at Strathallan through the keen interest and co-operation of Sir James Denby Roberts, Bt. During 1948 virus-free stocks of Craigs Bounty, Craigs Royal, Craigs Snow-White, Craigs Alliance, and six unnamed seedlings were grown.

As in previous years samples of material were forwarded to many different countries for experimental purposes. Particular interest has been shown, however, by the Agricultural Departments of Tanganyika Territory and of South Africa, where the improvement of the potato crop is being vigorously

pursued. The heaviest losses are caused by blight and leaf-roll, and new varieties resistant to these diseases are urgently required. Several of the Society's seedlings which have shown considerable promise under African conditions are being multiplied locally for more extensive cultivation.

#### *Virus Diseases—Craigs House.*

G. COCKERHAM, B.Sc., Ph.D.

T. M. R. M'GHEE, B.Sc., N.D.D.

Work on potato viruses has for its objectives the provision of information and material which will assist in breeding for resistance to the A, X, Y, and leaf-roll viruses. Investigations in progress are concerned with the nature and inheritance of qualities of resistance and with the establishment of efficient, standardised tests for the detection and evaluation of resistance characters.

*Virus A.*—Resistance to virus A has its foundation in hypersensitiveness to the virus. The hypersensitive character, however, is not readily detected, even after graft inoculations, and difficulty has been encountered in recovering the virus from susceptible hosts. This latter difficulty has now been surmounted by using a variety of *S. demissum*, obtained from a Swedish source, as a diagnostic host. This variety is very sensitive to the virus, and when young leaves are rubbed with infective sap the presence of the virus is revealed within a few days by the appearance of characteristic necrotic lesions. The use of this variety has proved highly satisfactory and it has led to both quicker and more reliable results in working with virus A.

Routine tests, by graft inoculation, have been completed on 37 named varieties and 65 seedling varieties, and the reactions of 271 tetraploid seedlings and 215 diploid seedlings have been examined in genetical work.

*Virus X.*—Various aspects of resistance to virus X have received further attention. In field trials studies have been made on the effect of time of inoculation, method of inoculation, manuring, and strain of virus on the incidence of systemic infection in both hypersensitive and non-hypersensitive varieties. The results of these trials, together with evidence from other sources, have thrown much light on the nature of

field resistance (klendusity) and field immunity. They give support, for example, to the hypothesis that the establishment of infection is largely a matter of size of dose, and they indicate that the varietal factors which determine response, local or systemic, in a hypersensitive variety are identical with those which determine the degree of field resistance in a non-hypersensitive variety. They oppose the view that ability to localise infection is correlated positively with sensitivity to infection.

Studies on strains of virus X have been continued in analytical examinations of naturally infected material and in the comparison of strains in their rates of spread and effects on potato varieties. Indication has been obtained that mild strains spread more readily than severe strains, that spread is usually along rows and rarely between rows, that it is almost entirely by direct contact and rarely extends beyond neighbouring plants, and that it usually takes place late in the season.

Yield trials, in contrast with those of 1947, have shown all strains of virus X to have a depressing effect on yield, the amount of depression being correlated with the severity of symptom expression.

Genetical studies on the relationships between the genes conditioning hypersensitive responses to different strains of virus X have been pursued by making use of the close linkage between the loci of the Nx and the Na genes.

Routine testing with a standard strain of virus X has been applied to 32 named varieties and 216 commercial seedlings and to 248 tetraploid and 299 diploid seedlings in experimental work. Similar tests with regard to aberrant strains have been applied to 32 named varieties, 27 commercial seedlings, and 90 experimental seedlings.

*Virus Y.*—The field trials laid down in 1947 in an attempt to evaluate field resistance to virus Y gave disappointing results, as there was little spread of the virus. More promising results were obtained in laboratory trials in which relatively small numbers of tubers were exposed to infection under uniform conditions but at different levels of aphid infestation.

Studies on hypersensitive resistance as found in *Solanum simplicifolium* and *Solanum demissum* were continued. Genetic abnormalities which had obscured the interpretations of segregation data have been recognised, and it now seems

clear that a single gene conditions the basic necrotic response upon which hypersensitiveness depends. In contrast with the self-sufficiency of similar genes in establishing field immunity from viruses A, X and C, however, the gene Ny leads to field immunity only in the presence of other genetic factors which enable the host plant to localise the virus at the site of infection. As in the case of virus X there is reason to believe that these modifying factors are identical with the factors which control field resistance.

The apparent immunity of a variety of *Solanum Rybinii* was further investigated. From genetical work indication was obtained that this is not a true immunity but a high degree of field resistance.

A study of resistance in relation to strain of virus has been initiated. Among hypersensitive material some clones have been found to show necrotic responses to only one strain, some to three strains, and some to six strains of virus Y.

A further 30 named varieties and 52 seedlings were tested for reaction to the common strain of virus Y, and 31 named varieties and 28 seedlings for reaction to the C strain of the virus. In addition, 959 experimental seedlings were tested with the common strain and 329 seedlings with the C strain.

For the detection of virus Y, increasing use has been made of a variety of *Solanum demissum*, contained in the Commonwealth Potato Collection, which serves as a diagnostic host for all strains of the virus.

*Leaf-roll.*—As in the case of virus Y, the field trials laid down in 1947 to evaluate leaf-roll resistance yielded disappointing results owing to a low rate of infection. In the susceptible control varieties, King Edward, Majestic and Craigs Defiance, the extent of infection in the various forms of trial varied between 1 per cent and 6 per cent and varieties with only a slightly greater resistance—*e.g.*, Arran Banner—were entirely unaffected. Further trials were laid down in 1948.

During the past ten years there has been a gradual accumulation of seedlings resistant to leaf-roll. Many of them were undesirable in some respect and these have now been discarded. Further observations were made on seedling progenies combining resistance to blight, viruses X and A and the leaf-roll virus, and two additional progenies of this type were entered into the trials.

*Breeding.*—Several potentially useful interspecific hybridisa-

tions have been made, mainly between hexaploid seedlings of blight-resistant *S. demissum* and diploid seedlings possessing the character of apparent immunity from virus Y. Further breeding was directed towards the elimination of "wild" characters in progenies combining resistance to blight with resistance to viruses A, X, Y, and leaf-roll.

*Aphides*.—Winged aphides, *Myzus persicae*, were observed in small numbers on 19th May. No marked build-up of population took place until mid-July, however, and a maximum of 418 aphides per 100 leaves was recorded at the end of July, followed by the usual seasonal decline.

*Serology*.—A small serological unit has been established and anti-sera against X and Y viruses prepared. The use of these sera has greatly facilitated investigations relating to these viruses.

#### *Herbage Plants.*

J. W. GREGOR, Ph.D., D.Sc., F.L.S.  
PATRICIA J. WATSON, M.A., Ph.D.

*Grassland Investigations*.—It has been suggested in previous Reports that in mountainous districts the intensive cultivation of grass at low altitudes, even though suitable sites may be few and very limited in area, might meet the nutritional requirements of breeding stock better than reseeding more extensive areas of upland grazing. This possibility has been further examined and the results of the work during the past year have been published in 'Scottish Agriculture.' The following account gives, in outline, the nature of the investigation.

It has been assumed that the usual purpose of cultivating grass in stock-raising districts is to meet a demand for additional food. But it does not necessarily follow that by increasing the supply of cultivated herbage this demand will be satisfied. The results indicate that the productive seasons of natural and reseeded grasslands of the higher elevations do not differ to any marked extent, though their respective peak yields of both dry matter and protein may differ widely. The period of low-protein yields from an upland natural grazing extended roughly from September until June, and that of an adjoining reseeded sward from September until

May. Thus where stock numbers are determined by the amount of winter keep available, the raising of summer grass yields above the existing level will almost inevitably lead to waste unless the surplus can be conserved for winter use.

When, however, grass is intensively cultivated at low elevations, instead of extensively under the more rigorous conditions of an upland climate, it becomes possible to shorten this period of vegetative inactivity. Even so, the months of December, January, February, and March still remain beyond the productive growing season, and therefore to make good the shortages at these times it is necessary to conserve part of the active season's production. By confining the cultivation of grass to readily accessible areas the practical difficulties of conservation, so very real at the higher elevations, are overcome.

Since the ultimate objective is the more efficient utilisation of natural herbage the immediate aim of the investigation is (1) to provide protein-rich "complementary" grazing from about 15th April until there is an adequate supply of hill grass, (2) to produce silage and hay crops during the summer months, and (3) to supply "complementary" grazing again in the autumn. As the term "complementary" implies, the protein-rich herbage is used in conjunction with rough vegetation, and the animals during the spring and autumn grazing periods are given only part of their daily diet in the form of cultivated grass.

The opportunity for the very intensive manurial treatment of grass which is afforded by a complementary system of grassland utilisation permits, and in fact requires, the use of highly productive, fertility-demanding plants, and the immediate problem is to determine which representatives of this class of plant can best be fitted into such a system. At the present time a sequence of early, mid-season, and late strains of perennial ryegrass is being used, and it has been possible to maintain protein production at a high level throughout the complementary grazing periods. But a series of three strains has certain practical disadvantages, and attempts are being made to find varieties with a more prolonged period of high protein production. Attention is also being given to the potentialities of certain types of natural vegetation as summer complementary grazing, and in this connection the altitudinal

hereditary variation in plant size of "wild" species is being studied.

In connection with the Society's complementary grazing experiments at Dundonnell and Dalmahoy, acknowledgment is made of the assistance given by the Edinburgh and East of Scotland College of Agriculture in providing facilities for the necessary chemical analyses, again made by Mr W. D. Connell, of herbage plant samples.

*Hill Fescue Investigations.*—Further investigations on a species naturally occurring in the wild have been carried out on hill fescues. Seed samples were collected at 200-foot intervals along an altitudinal gradient extending from sea-level to the summit of Ben Cruachan at a height of 3689 feet. Three main types of fescue occur on this gradient: (1) Red fescue, which occurred almost exclusively in samples from sea-level; (2) the sexual form of Sheep's fescue, with a distribution from sea-level to 2600 feet; and (3) the viviparous form of Sheep's fescue which was found at all altitudinal stations. Cytologically the red fescues of this area are not all of the usual hexaploid type, but at sea-level are also found as octoploids and occasionally as heptaploids with root-tip chromosome counts of 42, 56, and 49 respectively. With the exception of a single tetraploid (28) plant from sea-level the sexual Sheep's fescues were of the diploid type (14); whilst the viviparous group was exclusively tetraploid (28).

In view of the occurrence of a tetraploid sexual Sheep's fescue on the gradient, and the fact that tetraploids have previously been reported from elsewhere in Britain, an additional series of samples of this sexual fescue was gathered from various parts of the Scottish Highlands and Islands, Southern Scotland, England, Wales, and Ireland. A preliminary cytological survey of part of this material indicated that the diploid race has a more northerly distribution than the tetraploid. A more detailed study of this distribution is at present being undertaken.

Within both the sexual and viviparous races of Sheep's fescue which occupy the Cruachan gradient the variation of a number of characters has been investigated under the uniform environment of the experimental garden, and the data obtained have been analysed statistically. The results demonstrate the nature of racial tolerance to differences in



altitudinal environment and show how tolerance involves heritable differences in the visible expression of economic characters such as plant size and growth habit.

*Regional Races.*—Two years ago a collection of ryegrasses was made from South-West England. This region is naturally divisible into the following two sub-regions: (1) Mainland, which includes Devon and Cornwall, and (2) the Scilly Isles. Each sub-region has been found to contain a wide range of ryegrass types, but these belonging to the Scilly Isles sub-region appear to be of the greatest agronomic interest. In an experiment involving representative samples from the two sub-regions it was found that, although among the latest to flower, some from the Scilly Isles made as much early spring growth measured as dry-matter yields from a given area of individual plants as did earlier-flowering types from the mainland. On the other hand, when entire plants were used for estimation, the yields of dry matter and protein were higher from the earlier mainland types. Since, however, at the time of choosing the sample populations their time of flowering was unknown, further investigations are being carried out.

*Meadow-grass Investigations.*—In 1947 a collection of meadow-grasses, including a number of species hybrids, were received for study from Dr Jens Clausen, Director of the Carnegie Institution of Washington (Division of Plant Biology), Stanford, California. The main object of the investigation was to determine how far the expressions of certain heritable characters as observed in California were paralleled at Edinburgh. Dr Clausen visited the Plant-Breeding Station last autumn, and in view of the interest of the results so far obtained, it was then agreed to conduct a more comprehensive transplant experiment on an inter-continental scale. Seven main (including Edinburgh) and four subsidiary centres have been chosen, and, in addition, Dr Hiesey of the Carnegie Institution will study the most important hybrids and their parents under strictly controlled conditions in greenhouses at the Californian Institute of Technology. Thirty-nine seed samples have been received from Drs Clausen, Keck and Hiesey, and these have been duly sown.

*Multiplication of Strains.*—There is a very considerable risk of stocks, particularly of ryegrass, becoming contaminated by foreign pollen during the early stages of multiplication at

Corstorphine. In fact, several strains, including *Ca 434*, *Ca 448*, and *Ca 457*, after having been developed to the initial commercial stage of production, have had to be discarded on account of excessive contamination of this kind. To reduce the risk, steps have been taken to raise larger quantities of seed under glass and thus avoid multiplication on a small scale in the open field. For this purpose portable glasshouses, made as pollen-proof as is practicable, will be tried this summer. All the available seed (approximately 60 cwt.) of Scotia Cocksfoot from crops grown under contract in 1948 in South-East England was sold to members of the Society.

#### ROOT CROPS.

V. M'M. DAVEY, B.Sc., Ph.D.  
F. J. W. ENGLAND, B.Sc.

A full programme of yield trials was carried out this year with swedes, kales, sugar beet, and fodder beet. The number of isolation plots in which plants for seeding were grown was increased to ten, and the usual propagation was carried out by bag-selling of swedes and in the greenhouse. Clubroot tests were carried out on a large number of seedling plants. Mr England was appointed in time to help with the autumn work.

#### *Swedes.*

The work of observing and testing strains derived from a series of intervarietal crosses mostly made in 1934 has reached the stage where one strain, AFT or Ds 32, is to be multiplied and tested on a field scale. Strains of more recent origin are coming forward, and one group of twenty was tested by yield trial. The crops this year gave heavy yields with satisfactory percentages of dry matter, though part of the area, sown before May, was retarded by drought and suffered damage from the turnip "fly" beetle. In common with crops elsewhere in Scotland, there was much elongation of "neck" and even "bolting" to flower, especially in the earlier-sown breaks, and this gave an opportunity for comparisons of bolting tendencies to be made.

*Strain AFT or Ds 32.*—It has been decided that the strain

known from its crossing reference as AFT, and recently numbered Ds 32, should be multiplied up, selected on a field scale, and if its present good qualities are confirmed, placed on the market. It is a winter-resistant purple-top globe, giving relatively large yields of average dry-matter percentage, and having a skin colour intermediate between those of Victory and the later types of purple-top. The cross AFT was made in 1934 between plants of Buffalo and Stirling Castle, and after the severe winter of 1935 it was noted that plants of the first generation had survived in an area where other swede strains had been completely destroyed. In 1945-46 the strain was tested in a small winter-resistance trial and 60 per cent of the bulbs were found to be sound in February, the mean survival of the trial being 33. Only the Aberdeenshire hardy control gave a comparable resistance. In two later trials AFT gave the best winter resistance—viz., in 1947-48 it had 61 per cent sound bulbs, when the mean was 40, and in 1948-49 it had 85 compared with a mean of 62, the winter being less severe. Estimates of feeding value were made on half-plots of these trials in late autumn, and in all three trials AFT was highest in yield of dry matter. In 1948 also the strain was included in a yield trial with plots of larger size. Out of twenty-five strains it was second only to Victory in yield of dry matter. Its gross yields were relatively high, exceeding Victory in one trial, while the dry-matter percentage has been about average—*i.e.*, lower than some types but higher than Victory.

*Yield Trials.*—There were three trials of swedes in 1948, the first of which contained twenty lines selected from an intervarietal cross, AMJ, and bred for three or four generations, and these were compared with five commercial varieties. Some good performances were noted and the lines which gave the lowest values were discarded.

The second was a yield trial containing twenty-one strains and four commercial varieties. Some of the strains were old and others of recent origin. Victory headed the list for dry-matter yield with about five strains of almost equal value. These included AFT, which has been discussed above, and AFS, which is another old line which has received much attention. A pedigree bronze-tankard line, KOa-, which was selected by the late Dr Wilson and is the longest inbred strain at the Station, was also in this group on account of its high

dry-matter percentage and average yield. Two pedigree lines of Victory type, LPbb- and LPca-, also yielded highly.

The *Winter Resistance Trial* contained seven strains and the usual controls—Victory, Champion, and an Aberdeenshire Hardy type. It has already been mentioned that strain AFT showed most sound bulbs in February, though the test was not severe. A newer strain, ANI, was almost as good as AFT in winter resistance. This strain had exceptionally high dry-matter percentage, 12.3 compared with 10.9, the next highest, and though its yield was relatively low it gave quite a good yield of dry matter. The next best winter resistance was shown by a German green-top variety, Hohenheimer, which had the highest yield and lowest dry-matter percentage in the trial, but yielded second to AFT for dry matter.

*Clubroot Resistance.*—Boxes of seedlings were set up and tested throughout the season. One batch of boxes sown in mid-season showed no disease through failure of the infection, though others sown earlier and later were effectively infected. Gammexane dressings prevented damage by cabbage root-fly maggots. Progenies of resistant plants were tested and further selections were made, but so far no evidence of any considerable hereditary resistance being concentrated in individual plants has been found, though the accumulation of resistance factors in mass-bred strains may be inferred from the better growth and relative freedom from disease which disease-resistant varieties usually show in the box tests.

*Propagation.*—Few casualties occurred among the seed-parent plants, and fair quantities of seed were obtained in bag isolation. The seed from the ten isolation plots was not abundant, but there was sufficient for the Station trials and for a few outside tests to be arranged.

### *Kales.*

Hybrid strains derived from crossing Perpetual kale with Scotch Curly kale and Thousand-headed kale were seeded in isolation plots. Attention was paid to those plants which showed tendencies towards vegetative growth rather than seed production, since the object is to obtain a Perpetual form with curled leaves. The Thousand-headed kale  $\times$  broccoli hybrids and Marrow-stem kale selections were tested in trials.

*Thousand-headed Kale* × *Broccoli*.—The first two generations of this hybrid had shown vigorous growth and were considered interesting as fodder forms. The third generation yielded poorly and the same tendency was found in the fourth generation under examination this year. The strain has been propagated from a few plants in an isolation plot each year, and it seems that vigour must be increased by a greater amount of out-crossing. Comparing the mean weights per plant of progenies from six of the hybrid mother plants with the corresponding values found in two commercial strains of Thousand-headed kale the following figures were obtained respectively. Total plant weight 1.37 v. 1.87 lb.; leafage 1.03 v. 1.32 lb.; and stems 0.34 v. 0.54 lb. The hybrids were thus inferior in each case, but in ratio of leaf:stem they gave better results—3.0 : 1 v. 2.3 : 1.

*Marrow-stem Kale*.—A strain of Marrow-stem kale from Germany was compared with two British strains in 1946. It was then noted that the German strain had a greater proportion of leaf to stem than the British forms, but lacked weight. Selected plants were seeded together in isolation, and some crosses were also made with the leafier of the British strains. Progenies were tested this year in two small trials, one of which was sown out and the other transplanted. There was not a great deal of difference between the leaf weights of the different forms, but stem weight varied considerably. The British strains had larger and heavier stems than the progenies of the German strain, and the hybrids also had large stems and relatively low weights of leafage. The ratios of leaf:stem indicated this trend. German strains giving 1.5 : 1, British 1.1 : 1 and 0.8 : 1, and the hybrid German × British 0.9 : 1. It remains to be seen whether leafy forms with good yield can be selected from the descendants of the hybrid.

#### *Sugar Beet.*

The first year of the sugar beet programme, undertaken with the approval of the Department of Agriculture for Scotland and of the Sugar Beet Research and Education Committee, Ministry of Agriculture, was carried out. The main objects of the work are to find types of sugar beet suited to Scottish conditions and to propagate any promising strains

to the field-trial stage with the least possible delay. Two lines of work were commenced: (1) a search for non-bolting strains of true sugar beet, and (2) inquiries into the possible use of heavy cropping forms of beet for sugar production on upland farms.

*Resistance to Bolting.*—A small trial was sown out very early, in mid-March, to compare Klein AA with three other strains. By September Klein AA had 8 per cent of bolters, foreign strains of Klein E and Hilleshög had 35 and 56 per cent respectively, and the fourth strain, which is not on the market, had 27 per cent.

Another trial, of 49 strains in small plots, was sown at the beginning of April. Forty-two of these strains had been bred by Dr Bell at the Cambridge Plant-Breeding Institute by selecting for resistance to bolting under artificial light treatment. Only one showed bolters comparable with the controls, 24 had no bolters at all, and another 16 had only 1 per cent or less in September. Foreign Klein E and Hilleshög had 10 and 20 per cent respectively, but Klein AA, which is a German variety bred for autumn sowing on the Continent, had only 1 per cent. The trial confirmed the value of the Cambridge method, but on account of scarcity of seed it was not possible to have plots large enough to permit a critical examination of yield and sugar production.

*Heavy Cropping Forms.*—Three varieties of fodder sugar beet were compared in a small yield trial with three of sugar beet and two of mangolds. Fodder beet was intermediate between the other forms in most characters, including gross yield, sugar percentage, and weight of top. While the mangolds bolted badly the fodder beet had as few bolters as the sugar beet and also approached sugar beet in purity of juice. In sugar yield the fodder beets were highest, out-yielding the sugar beet on the average, but individually not significantly better than Klein E, which gave the best yield of the sugar beets. As fodder producers, the fodder beet varieties yielded slightly less dry matter than the mangolds. The tarehouse staff at Cupar Beet Sugar Factory kindly carried out analyses for this and the larger bolting trial.

*Selection.*—With the consent of Dr G. D. H. Bell selections were taken from some of the Cambridge strains of non-bolting sugar beet. Selections were also made from an early-sown crop of Klein AA, by kind permission of Mr John Arbuckle

of Logie Farm, Newburgh. The crop was examined on lifting and 630 plants of good appearance were chosen and taken to a laboratory where they were weighed and tested for sugar with a refractometer. Fifty-five were finally selected, stored during the winter, and planted out in isolation plots in spring.

1949 *Trials*.—Early sowings were made of trials and observation plots for the testing of non-bolting properties in sugar beet strains.

### *Broccoli.*

A seed crop of 9 : 3, the Station strain of Royal Oak broccoli, yielded about 10 lb. of seed in 1948, and another break was planted out for seeding in 1949. Included in this break were some progenies of crosses made in the greenhouse between winter-resistant plants of the 1946-47 trials. Good foliage types were noted in some of these plots, and the best plants from them will be harvested separately. Two strains of broccoli from the National Institute of Agricultural Botany, Cambridge, were grown for observation in both the 1947-48 and 1948-49 breaks. One of the strains, Cambridge X10, was too early for conditions in this district in the spring of 1948, though it has done better in 1949 after the mild winter. The other strain, Cambridge XMX, gave a crop of large heads in mid-April.

## II. Publications and Lectures by Staff for the Year ended 31st March 1949.

### Publications (P) and Lectures (L).

Director of Research.

"Some Scottish Plant-Breeding Problems." Teviotdale Farmers' Club, Hawick. (L.)

William Black, B.Sc., Ph.D., F.R.S.E.

"Breeding Potatoes for Disease Resistance." British Agricultural Bulletin, Vol. 1, No. 3, 1948. (P.)

"Breeding for Disease Resistance in Potatoes." Empire Journal of Agriculture, Vol. XVII., No. 1, 1949. (P.)

"Potato Breeding." Perthshire Association of Young Farmers' Clubs, Perth. (L.)

William Black and George Cockerham, B.Sc., Ph.D.

"Potato Breeding for Resistance to Blight and Virus Diseases." *Farming Leader*, No. 2, 1948. (P.)

George Cockerham, B.Sc., Ph.D.

"Potato Breeding for Virus Resistance." Horticultural Education Association, Edinburgh. (L.)

"Potato Virus Diseases." Perthshire Association of Young Farmers' Clubs, Perth. (L.)

J. W. Gregor, Ph.D., D.Sc., F.L.S.

"Presidential Address: Some Reflections on Intra-Specific Ecological Variation and its Classification." *Trans. and Proc. Bot. Soc., Edinburgh*, XXXIV., Part 4, 1948. (P.)

"Some Ideas Regarding the Use of the Grass Crop." *Clan Albainn Society*, Edinburgh. (L.)

"Contribution to 'Science Review.'" B.B.C. (L.)

J. W. Gregor, Patricia J. Watson, M.A., Ph.D., and W. D. Connell.

"Cultivated Grass in Mountainous Districts." *Scottish Agriculture*, Vol. XXVIII., No. 4, 1949. (P.)

### III. Visits.

Director of Research.

National Institute of Agricultural Botany, Cambridge.

Plant-Breeders' Conference, John Innes Horticultural Institution, London.

William Black, B.Sc., Ph.D., F.R.S.E.

Plant-Breeders' Conference, John Innes Horticultural Institution, London.

Eighth International Congress of Genetics, Stockholm, Sweden.

Institute of Genetics of University of Lund, Lund and Svalöf.



- Horticultural Research Station, Alnarp, Sweden.  
 Plant-Breeding Institute of Swedish Seed Association,  
 Svalöf.  
 Plant - Breeding Institute, Weibullsholm, Landskrona,  
 Sweden.  
 Sugar Beet Breeding Institute, Hilleshög, Sweden.  
 Institute of Forest Tree Breeding, Kallstorp, Sweden.  
 Royal Agricultural College, Ultuna, Uppsala, Sweden.  
 Plant Protection Institute, Stockholm, Sweden.
- D. Cameron, B.Sc.  
 Plant Breeders' Conference, John Innes Horticultural Insti-  
 tution, London.  
 Rothamsted Experimental Station, Harpenden.
- G. Cockerham, B.Sc., Ph.D., and T. Mairi R. M'Ghee, B.Sc.  
 Strathallan Farms, Auchterarder, Perthshire.  
 Rothamsted Experimental Station, Harpenden.  
 Plant-Breeders' Conference, John Innes Horticultural Insti-  
 tution, London.
- V. M'M. Davey, B.Sc., Ph.D.  
 Meeting of Commonwealth Plant Breeders, Cambridge.  
 British Sugar Corporation, Ltd., Beet Sugar Factory, Cupar.
- F. J. W. England, B.Sc.  
 British Sugar Corporation, Ltd., Beet Sugar Factory, Cupar.
- J. W. Gregor, Ph.D., D.Sc., F.L.S.  
 Plant-Breeding Station, Stormont, Belfast.  
 Hannah Dairy Research Institute, Kirkhill, Ayr.  
 Ecotype Garden, Institute of Plant Systematics and Genetics,  
 Uppsala, Sweden.
- J. C. Haigh, B.Sc., Ph.D., A.R.C.S.  
 Plant-Breeders' Conference, John Innes Horticultural Insti-  
 tution, London.  
 Meeting of Commonwealth Plant Breeders, Cambridge.

Patricia J. Watson, M.A., Ph.D.

Plant-Breeding Station, Stormont, Belfast.

Plant-Breeders' Conference, John Innes Horticultural Institution, London.

#### IV. Acknowledgments.

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

Åkerman, Å., Plant-Breeding Station, Svalöf, Sweden.

Allison, William, Almond Hill, Kirkliston.

Arbuckle, John, Logie, Newburgh.

Barclay, Ross & Hutchison, 67 Green, Aberdeen.

Bell, David, 15 Coburg Street, Leith.

British Sugar Corporation, Ltd., Cupar and Peterborough  
(per O. S. Rose, J. M'Cloy, F. W. Sutton, J. Simpson,  
A. L. Stewart, and other members of staff).

Centraal Bureau, G.A. (National Co-op. Aan- en Verkoop-  
vereniging voor de Landbouw), Rotterdam.

Commonwealth Agricultural Bureau, Cambridge (per P. S.  
Hudson, J. G. Hawkes, R. H. Richens, and W. R. G.  
Wortley).

Corner, H. H., Agricultural College Office, Newtown St  
Boswells.

Cross Seed Co., Alexander, 21 Hope Street, Glasgow (per  
Thomas Hogg).

Dale, John R., Auldham, North Berwick.

Department of Agriculture for Scotland, East Craigs,  
Corstorphine (per T. M'Intosh, C. E. Foister, J. L. Hardie,  
M. Noble, and James Mitchell).

Dunn's Farm Seeds, Ltd., Salisbury (per H. C. Gregory).

Edinburgh and East of Scotland College of Agriculture,  
Edinburgh (per A. M. Smith, A. S. B. Wilson, W. Dobson,  
and Mrs Stirling).

Elder, James H., Cregganore, North Berwick.

Findlay, W. M., Agriculture Department, Marischal College,  
Aberdeen.

- Howie, Andrew, Agricultural College Office, 5 High Street, Dingwall.
- Hutton, E. M., Council for Scientific and Industrial Research, Australia.
- Institute v. Veredeling van Landbouwgewassen, Nude 66, Wageningen, Holland (per H. Toxopeus.)
- John Innes Horticultural Institution, Merton Park, London (per Gordon Haskell).
- Landbo-og Husmandsforeningernes, Roskilde, Denmark (per K. J. Frandsen).
- M'Leod, John, Brae House, Dundonnell, by Garve.
- Milne & Sons, Southesk Granaries, Montrose (per F. G. Milne).
- Ministry of Agriculture, Plant-Breeding Division, Stormont, Belfast (per J. Adams).
- Ministry of Agriculture and Fisheries, London.
- Moe, Professor G. G., University of British Columbia, Vancouver.
- National Institute of Agricultural Botany, Huntingdon Road, Cambridge (per F. R. Horne and E. G. Thompson).
- North of Scotland College of Agriculture, 41½ Union Street, Aberdeen (per R. Bain).
- Plant Breeding Institute, Cambridge (per G. D. H. Bell and H. W. Howard).
- Plant-Breeding Station, Tammisto, Malmi, Finland (per Otto Valle and V. Brummer).
- Plant Pathology Department, Rothamsted Experimental Station, Harpenden (per F. C. Bawden).
- Roberts, Sir James Denby, Bt., Strathallan Castle, Auchterarder.
- Roughead & Park, Ltd., Haddington (per Fred Mills).
- Royal Danish Agricultural High School, Rolighedsvej 26, Copenhagen, Denmark.
- Welsh Plant-Breeding Station, Aberystwyth (per E. T. Jones).
- Weibulls, W., A-B., Weibullsholm, Landskrona, Sweden.
- West of Scotland Agricultural College, Auchincruive, Ayrshire (per J. Grainger and P. J. Jones).
- Waite Agricultural Research Institute, Adelaide, Australia (per A. T. Pugsley).
- Young, James, Meadowfield, Corstorphine, Edinburgh.

### V. Student Workers.

The undernoted students were granted facilities for study during the year :—

- A. Ganguly, B.Sc., India.
- M. B. Patkar, B.Sc., India.
- D. K. Mukerjee, M.Sc., India. —
- K. Swiezynski, Poland.
- An Min Wong, B.Sc., China.

WILLIAM ROBB,  
*Director of Research.*

## LIST OF MEMBERS

as at 31st March 1949

---

- Adam, A., Covesea, Elgin.  
 Adam, Robert, South Gilmerton, Edinburgh.  
 Adam, Robert M., Newhouse of Glamis, Glamis.  
 Adam, Thomas, Sutherland Estates Office, Golspie.  
 Adams, J. W., Woodriffe Farm, Newburgh, Fife.  
 Aikman, John S., Jedneuk, Jedburgh.  
 Aitken, G., Traprain, Haddington.  
 Aitken, G. R., Traprain, Haddington.  
 Aiton, R. Scott, M.C., Legerwood, Earlston.  
 Alexander, Robert F., Boyne Farm, Inchtute.  
 Alexander, Thomas G., Newton, Garmouth.  
 Alexander, W., O.B.E., Home Farm, Eynsford, Kent.  
 Alison, John P., D'Arcy, Dalkeith.  
 Allison, Alex. Y., Turnhouse Farm, Corstorphine, Edinburgh.  
 Allison, David, Duddingston, South Queensferry.  
 Allison, John M., Overton, Kirkliston.  
 Allison, William, Almond Hill, Kirkliston.  
 Allison, William, Campend, Dalkeith.  
 Amour, John, Pinkiehill, Inveresk, Musselburgh.  
 Amour, Richard, Cramond Bridge, Barnton, Midlothian.  
 Anderson, R. Brewis ('Farming News and North British Agriculturist'), 5 South St Andrew Street, Edinburgh.  
 Anderson, R. Gayler, 41 Mitchell Street, Leith.  
 Anderson, Thomas, M.A., B.Sc., 31 Royal Terrace, Edinburgh 1.  
 Arbuckle, John, Logie, Newburgh.  
 Archibald, Robert, "Viewpoint," Ashgrove Road, Kilwinning, Ayrshire.  
 Archie, Alex. R., South Leckaway, Forfar.  
 Austin, Robert (Charlton & Sons, Ltd.), 43 Whitesands, Dumfries.  
 Baillie, R. R. Webster, The Bensil, Carnoustie.  
 Baird, W. J., Estate Office, Elie.  
 Baldie, William, 71 Hendry Road, Kirkcaldy.

- Balfour, David B. (W. P. Laird & Sinclair, Ltd.), Dundee.
- Bankier, William, Farms Manager (Corporation of Glasgow),  
Gartloch Farm, Gartcosh, Glasgow.
- Bannatyne, John, Drumalbin, Biggar.
- Barbour, Robert C. (Jamieson Bros.), 60 High Street, Annan.
- Barnfather, William (Charles Sharpe & Co., Ltd.), Sleaford.
- Barr, S., Woodhouse, Peebles.
- Barr, William, Harelaw, Lanark.
- Barron, J. R., Findowrie Farm, Brechin.
- Batchelor, D. Hill, Ferry Road, Montrose.
- Baxter, A. Manton (Baxter & Guion, Ltd.), Museum Buildings,  
Priestgate, Peterborough.
- Baxter, Norman, Crieff Farm, Kirriemuir.
- Baxter, William, Templehall, Ormiston.
- Bell, David (David Bell, Ltd.), 15 Coburg Street, Leith.
- Bell, J. C. (David Bell, Ltd.), 15 Coburg Street, Leith.
- Bell, P. A., Colluthie, Cupar, Fife.
- Bennett, James L., Rulesmains, Duns.
- Berwick, D. F. G., Ardross, Elie.
- Berwick, P. W., Wadeslee, Elie.
- Beveridge, Hugh V., Elphinstone Tower, Tranent.
- Black, George, Penston, Macmerry, Haddington.
- Blackley, John, Lochfield, Dumfries.
- Blackwood, Adam, Balleave, Kinross.
- Blair, David, Littleinch, Wormit.
- Borland, T. W. (James Borland & Sons, Ltd.), 9 St Marnock  
Street, Kilmarnock.
- Bowe, D. L., Skateraw, Dunbar.
- Boyd, Alexander, Douglasfield, Murthly, Perthshire.
- Brebner, Major R. F., C.B.E., The Leuchold, Dalmeny House,  
Edinburgh.
- Broadfoot, Abram, B.Sc., "Rhueval," Atholl Place, Dunblane.
- Brooks, J., Kilduff, Drem.
- Brown, James Hally (Brown & Polson, Ltd.), Paisley.
- Brown, Joseph, Merryton, Bentfield Drive, Prestwick (*since  
deceased*).
- Brown, J. S., General Manager, Farmers' Co-operative, Ltd.,  
Salisbury, Southern Rhodesia.
- Bruce, James S., 34 Girnigoe Street, Wick.
- Bruce, William, M.A., B.Sc., Seton Mains, Longniddry.
- Buccleuch and Queensberry, The Duke of, Drumlanrig Castle,  
Thornhill.
- Buckpitt, W. A., The Rowans, Duns, Berwickshire.

- Burke, P. B. (Austin & M'Aslan, Ltd.), 91-95 Mitchell Street, Glasgow.
- Cadzow, James, Duncrahill, Pencaitland.
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- Young, James L. (D. & W. Croll, Ltd.), 63 Commercial Street,  
Dundee.
- Young, Robert, West Briggs, Kirkliston.
- Young, Walter, Straiton, Loanhead.
- Younger, H. G. (W. Younger & Co., Ltd.), Abbey Breweries,  
Edinburgh.
- Youngson, John, Whitburgh Mains, Ford.

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- Allison, Robert, jun., Norton Mains, Newbridge.
- Anderson, Robert, Kirklawhill, East Linton.
- Atkinson, James, 37 St Andrew Street, Kilmarnock.
- Barr, John M. (Pattullo, Barr & Co., Ltd.), West Dock Street,  
Dundee.

- Billett, A. M., Lenton Experimental Station, Lenton House,  
Nottingham.
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- Brown, A. B., Fordel Parks, Dalkeith.
- Brown, G., South Melville, Lasswade.
- Brown, J. Chalmers, Thornylee, Clovenfords.
- Bruce, John H., Seton Mains, Longniddry.
- Clapperton, George, Sheriffhall Mains, Dalkeith.
- Clark, J. G. D., Luggate, Haddington.
- Cunningham, A. U., Threepwood, Galashiels.
- Davies, D. S., Halkerston, Gorebridge.
- Dawson, W. M., Whitelaw, Haddington.
- Dryburgh, W. S., Cairnie, Musselburgh.
- Dykes, Robert, The Myles Farm, Tranent.
- Eglinton, The Earl of, Skelmorlie Castle, Ayrshire.
- Elder, H. F. D. (William Dods & Son), Haddington.
- Elliot, A. D., Kettleshiell, Duns.
- Fair, Alex., Duniface, Windygates.
- Firn, Roland J., Morton Mains, Edinburgh.
- Fleming, William, Upper Deanpark, Balerno.
- Forrest, A. S., Balgone Barns, North Berwick.
- Forrest, R. L., Mersington, Greenlaw.
- Fullarton, A. W., Tranent Mains, Tranent.
- Gardner, J., Stonelaws, East Linton.
- Gibson, Frank P., Drylawhill, East Linton.
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- Gordon, F. S., 11 Newbattle Road, Eskbank.
- Gordon, Peter, J.P., Baleraig, Whauphill, Newton Stewart.
- Graham, Andrew S., Bush Home Farm, Roslin.
- Graham, Robert (Little & Ballantyne), Carlisle.
- Greenshields, J., Moffat.
- Hamilton, William, Phantassie, East Linton.
- Harwell, George C. M., Comiston Farm, Colinton, Edinburgh.
- Harrower, William P., Blackadder Mount, Edrom, Duns.

- Jack, A. G., Hermiston, Currie, Midlothian.  
 Johnston, W. C. (W. C. Johnston, Ltd.), Dumfries.
- Liston, J., 68 Corbiehill Crescent, Edinburgh.  
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 Lowrie, James, Blegbie, Humber.
- MacFarlane, T. S., 45 Commercial Street, Leith, Edinburgh.  
 M'George, John, 248 Milton Road East, Portobello, Edinburgh.  
 M'Kerrar, M., Addinston, Lauder.  
 M'Laren, John, Ballencrieff, Longniddry.  
 M'Laren, John T., Alloa Park, Alloa.  
 Manclark, Norman M., 28 Ravelston Garden, Edinburgh.  
 Mather, James, Printonan, Duns.  
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 Miller, D. M., Dale, Halkirk, Caithness.  
 Morton, William, Whippielaw, Ford.  
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 Munro, J. W., Craigton, Winchburgh.  
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- Robertson, William, Gateside, Linlithgow.  
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 Scott, R. Lyon, Loanhead.  
 Scott, William, J.P., 170 Mayfield Road, Edinburgh.  
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Todd, J., Pinkie Mains, Musselburgh.

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Walker, Robert, Capelaw, Rosewell.

Wallace, D. G., Westmains Farm, Blackshiels, Midlothian.

Wallace, William, West Bank, Macmerry.

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Wilson, Andrew, Broombank, Auldearn, Nairn.

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