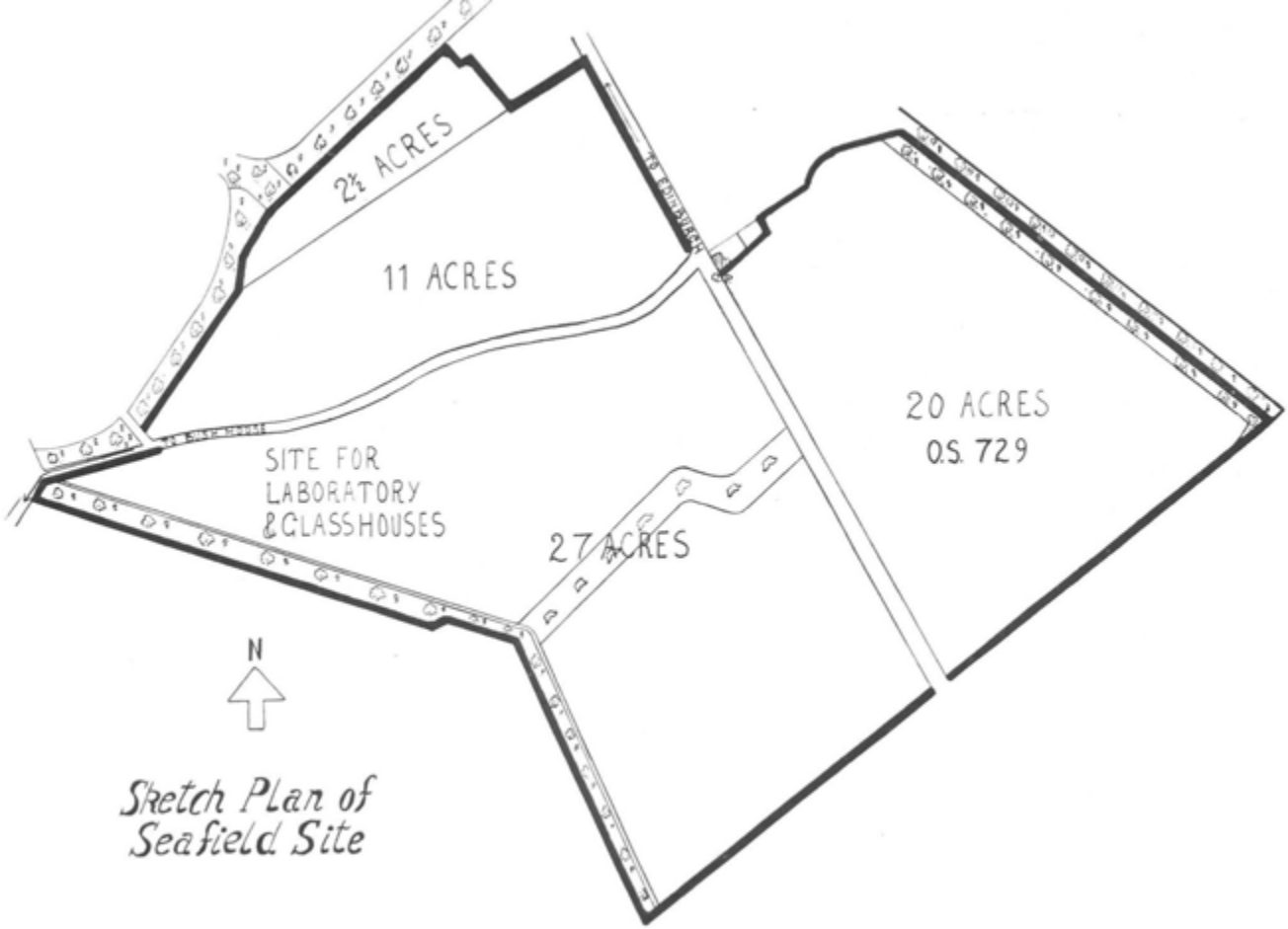
SPBS Annual Report [1951] (30)
SPBS Annual Report 1952 (31)
SPBS Annual Report 1953 (32)
SPBS Annual Report 1954 (33)



AJSJ

THE SEAFIELD SITE. Looking North-West towards the Pentland Hills, with field O.S. 729 in the foreground.




*Sketch Plan of Seafield Site*

# CONTENTS

# SCOTTISH SOCIETY FOR RESEARCH IN PLANT BREEDING

# I. REPORT

## BY THE

# BOARD OF DIRECTORS

---

### General

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

In last year's report it was mentioned that 100 acres of land at Dryden, Roslin, had been allocated to the Society by the Edinburgh Centre of Rural Economy as an initial step in the transfer of the Scottish Plant Breeding Station from Corstorphine to a site on the estate of the Centre.

It was also mentioned that the laboratories, greenhouses, &c., were to be erected within the policies of Bush House. At a meeting of the Board of Directors held in December 1950 it was decided, in view of probable coal-mining developments at Dryden, and the serious inconvenience of having the laboratories and glasshouses separated from the experimental area by a distance of nearly three miles, that these arrangements did not satisfactorily meet the Society's requirements, and that the possibility of acquiring a more suitable site elsewhere on the Bush estate should be explored. The result of subsequent negotiations has been that 60 acres at Seafield have been allocated to the Society and that the Edinburgh Centre of Rural Economy have agreed to all the Society's buildings being erected on that site. This new arrangement made it

necessary for the Society to dispose of their interest in the farm buildings and land at Dryden, and, with the approval of the Department of Agriculture for Scotland, both land and buildings have been transferred to other organisations.

It is hoped that the new buildings will be available in the not too distant future. In the meantime the Scottish Plant Breeding Station continues to occupy its present site at Craigs House, Corstorphine, and an account of the work being carried on there is given by the Director of the Station on pages 19 to 39.

During the year many individual visitors, especially from overseas, have come to the Station to see the work in progress and to discuss with members of the staff matters of mutual interest. In addition to the talks and demonstrations given by the staff to visiting parties, lectures to various organisations in different parts of the country have facilitated contact with current agricultural opinion.

The Fourth Annual Conference of British Plant Breeders was held at the Scottish Plant Breeding Station during 3rd and 4th August 1950, and was attended by representatives of the institutes at Aberystwyth, Bayfordbury, Belfast, Cambridge, and Wellesbourne.

In order to maintain contacts with the work of Continental institutes Dr V. E. M'M. Davey was granted leave of absence to visit Denmark and Sweden to study the techniques of beet breeding in those countries, and Dr F. Earnshaw attended the Seventh International Botanical Congress at Stockholm.

## Varieties of Crop Plants raised or selected by the Society and available to Members

*Oats*—

Elder.

Bell.
Early Miller. } "Approved" as eligible under the Department of Agriculture for Scotland *Seed Oat Certification Scheme.*

Craigs
Afterlea.

*Wheat*—

Scottish Iron III.

*Barley*—

Craigs Triumph.

*Grasses*—

" Scotia " Cocksfoot.
" Scotia " Timothy.

*Potatoes*—

Craigs Defiance.
Craigs Royal.
Craigs van Riebeeck (for overseas only).

In view of the oat certification scheme now operated by the Department of Agriculture for Scotland the Society is limiting to elite stocks its multiplication of those oat varieties " approved " as eligible for certification. Therefore, in order to provide an adequate supply of certified seed, it is recommended that growers who receive elite seed of " approved " varieties should take steps to have their crops entered for certification. Elite stocks of the other cereal varieties listed above which do not come within the scope of the scheme will also be maintained.

Under the grass seed-crop certification scheme operated by the Seed Production Committee of the National Institute of Agricultural Botany only those merchants' crops of the " Scotia " strains grown from stock seed obtained direct from the Society are eligible for certification. Growers who intend entering for certification " Scotia " crops derived from the Society's stock seed should notify the Executive Officer, Seed Production Committee, National Institute of Agricultural Botany, Huntingdon Road, Cambridge, from whom particulars of the scheme can be obtained.

Members wishing to obtain elite stocks of any of the above-mentioned varieties of cereals, grasses, and potatoes are advised to intimate their requirements by 1st January 1952 to the Secretary, Scottish Plant Breeding Station, Craigs House, Corstorphine, Edinburgh 12.

The Board of Directors wish to express their thanks to Messrs David Bell, Ltd., Leith, who so kindly cleaned, stored, and dispatched bulk quantities of cereal and grass seeds for the Society.

## Staff Changes

On 30th November 1950 Mr William Robb retired from the post of Director of Research. He joined the staff at Corstorphine in 1920 as Chief Assistant, and became Director of Research in 1925. Mr Robb's chief interest was the improvement of the oat crop in Scotland, and, assisted by his associates in the Cereals Section, he bred and introduced into commerce the oat varieties Glebe, Elder, Bell, Early Miller, and Craigs Afterlea. The Board of Directors take this opportunity of recording their high appreciation of Mr Robb's work for the Society. In acknowledgment of such services members of the Society have contributed £170 towards a Fund from which presentations will be made to Mr and Mrs Robb at the conclusion of the Annual General Meeting on 31st July 1951.

Dr J. W. Gregor has been appointed to succeed Mr Robb, and he assumed the duties of Director of the Scottish Plant Breeding Station on 1st December 1950.

## Obituary

The Vice-Chairman of the Board of Directors, Mr W. J. Campbell, died on 23rd January 1951. Mr Campbell was one of the Society's founder members, and at the Annual General Meeting in 1929 he was elected to the Board of Directors, and in 1941 to the Vice-Chairmanship. Throughout this period he played an active part in conducting the affairs of the Society, and the Directors wish to record their sincere appreciation of his services, rendered so enthusiastically for so many years.

## Membership

During the year 26 new members were elected; deaths, resignations, and cancellations numbered 21; and at 31st March 1951 there were on the roll 587 members, comprising

192 life members and 395 annual members (14 at the 5s. rate and 381 at the 10s. rate of subscription). The County distribution of membership is as follows :—

| | | | | | |
|---|---|---|---|---|---|
| Aberdeen | 20 | Fife | 30 | Perth | 25 |
| Angus | 35 | Inverness | 3 | Renfrew | 4 |
| Argyll | 3 | Kincardine | 2 | Ross and Cromarty | 12 |
| Ayr | 18 | Kinross | 3 | Roxburgh | 13 |
| Banff | 2 | Kirkcudbright | 3 | Selkirk | 2 |
| Berwick | 39 | Lanark | 30 | Stirling | 8 |
| Bute | 1 | Linlithgow | 23 | Sutherland | 2 |
| Caithness | 9 | Midlothian | 123 | Wigtown | 6 |
| Clackmannan | 2 | Moray | 9 | England | 36 |
| Dumbarton | 5 | Nairn | 1 | Ireland | 3 |
| Dumfries | 13 | Orkney | 3 | Abroad | 6 |
| East Lothian | 89 | Peebles | 4 | | |
| | | Total | 587 | | |

Having regard to the present acute shortage of paper it is considered advisable to discontinue, until the position improves, the practice of publishing annually a list of members. A list is not, therefore, included in the present report.

The membership subscription is 10s. per annum. Donors of £10 or over are entitled to become life members without further payment. Donors of £5 or over may become members of the Society by payment of an annual subscription of 5s.

## Election of Directors

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

David Bell, 15 Coburg Street, Leith.
James H. Elder, B.Sc., Cregganore, North Berwick.
William Hugh Hamilton, W.S., O.B.E., J.P., Cairns, Kirknewton.
Alexander D. C. Main, B.Sc., Windyedge, Perth.
Fred Mills, M.C., J.P. (Roughead & Park, Ltd.), Haddington.
Andrew M. Riddel (W. Drummond & Sons, Ltd.), Stirling.

To fill the vacancy of Vice-Chairman created by the death of Mr W. J. Campbell the Directors recommend the election of Sir James Denby Roberts, Bt., Strathallan Castle, Auchterarder.

To fill the vacancies on the Board for 1951 the Directors recommend the election of the following :—

William Allison, Almond Hill, Kirkliston.
John Arbuckle, Logie, Newburgh.
G. B. R. Gray, East Fenton, Drem.

Principal JOHN KIRKWOOD, O.B.E., B.Sc.(Agic.), West of Scotland Agricultural College, 6 Blythswood Square, Glasgow.
R. M. LEMMON, B.L., 8 Eglinton Crescent, Edinburgh.
A. S. B. WILSON, B.Sc., Boghall, Biggar Road, Edinburgh.

To fill the vacancy on the Board created by the death of Mr W. J. Campbell, the Directors recommend the election of Mr John Miller, 2 Charlotte Square, Edinburgh.

## Finance

The audited accounts for the year ended 31st March 1951 and Balance Sheet prepared at that date give full particulars of income and expenditure during the year, and of the Society's financial position at 31st March. They are printed on pages 10 to 15.

The Directors tender their thanks to the Department of Agriculture for Scotland and to the Sugar Beet Research and Education Committee for grants received; and to the individuals, firms, and organisations who gave donations to the Society's funds. They wish to mention especially the legacy of £500 bequeathed to the Society by the late Mr William J. Reid of Fordhouse and Canterland, Laurencekirk, and to record their appreciation of this generous recognition of the value of the Society's work.

R. M. LEMMON,
*Secretary*

# ABSTRACT OF

## For the year ended

*INCOME.*

| | | | |
|---|---|---|---|
| Interest Received | | | £1,093 14 2 |
| Recoverable Income Tax | | | 482 13 10 |
| | | | £1,576 8 0 |
| Director's Rent and Rates | | | 42 4 0 |
| Sales— | | | |
| Ordinary, including Stocks on Hand | £945 19 5 | | |
| Extraordinary— | | | |
| "Scotia" Cocksfoot Account | £39 3 10 | | |
| "Bell" Oat Account | 47 0 0 | | |
| "Craigs Afterlea" Oat Account | 259 12 10 | | |
| | 345 16 8 | | 1,291 16 1 |
| Subscriptions—Annual | | | 186 0 0 |
| Donations—Sums under £10 | | | 10 1 3 |
| Total Ordinary Income | | | £3,106 9 4 |
| Grant received from the Department of Agriculture for Scotland for the year 1950-51 | | | 18,580 13 0 |
| Capital Income— | | | |
| Life Membership Subscriptions | £70 0 0 | | |
| Donations over £10 | 50 0 0 | | |
| Interest on Donations and Life Membership Subscriptions (£3757, 5s. 1d. at 3 per cent, *less* Income Tax) | £77 4 10 | | |
| Recoverable Income Tax | 35 9 8 | | |
| | 112 14 6 | | 232 14 6 |
| Total Income | | | £21,919 16 10 |
| Balances at 1st April 1950— | | | |
| Funds in Hand | £46,295 9 6 | | |
| Department of Agriculture for Scotland Maintenance Grant | 3,647 6 3 | | 49,942 15 9 |
| | | | £71,862 12 7 |



# ACCOUNTS.

## 31st March 1951.

*EXPENDITURE.*

| | | | |
|---|---|---|---|
| Salaries— | | | |
| Officers, including Sub-Station | | | £10,163 2 7 |
| Secretary and Office | | | 939 15 4 |
| | | | £11,102 17 11 |
| Gratuity to Mr William Robb | | | 1,000 0 0 |
| Superannuation Contribution | | | 1,080 14 0 |
| Auditor's Fee | | | 31 10 0 |
| Labour, including Sub-Station | | | 2,711 2 5 |
| National Insurance | | | 260 12 0 |
| Seeds and Roots | | | 32 16 3 |
| Manures | | | 178 4 9 |
| Sundry Working Expenses | | | 619 0 6 |
| Standard Vanguard Van | £650 0 0 | | |
| New Laboratory Apparatus | 125 17 6 | | |
| | | | 775 17 6 |
| Laboratory Expenses | | | 129 18 7 |
| Library Expenses | | | 74 18 5 |
| Rates and Insurances | | | 105 4 5 |
| Printing, Telephone, Postages, and Office Supplies | | | 359 0 1 |
| New Office Furniture and Equipment | | | 305 7 4 |
| Heating, Lighting, and Cleaning | | | 453 2 1 |
| Travelling Expenses | | | 385 2 8 |
| Property Repairs | | | 137 16 2 |
| Regional Trials | | | 110 4 5 |
| Grassland Experimental Area, Dundonnell | | | 69 9 0 |
| Boghall Sub-Station Maintenance Expenses | | | 289 1 6 |
| Total Ordinary Expenditure | | | £20,212 0 0 |
| Depreciation on Temporary Buildings, Tools, &c. | | | 105 19 3 |
| Total Expenditure | | | £20,317 19 3 |
| Balances at 31st March 1951— | | | |
| Funds in Hand per Balance-sheet | | £46,422 4 9 | |
| Department of Agriculture for Scotland Maintenance Grant :— | | | |
| Brought forward from previous year | £3,647 6 3 | | |
| Unexpended during Financial year 1950/51 | 1,475 2 4 | | |
| | | 5,122 8 7 | 51,544 13 4 |
| | | | £71,862 12 7 |

## EDINBURGH CENTRE OF RURAL ECONOMY

*INCOME.*

| | | |
|---|---|---|
| Sales of Produce (including Potato Subsidy) | | £3,426 14 1 |
| Seeds, Unexhausted Manures &c., at Valuation | | 1,149 16 11 |
| Total Ordinary Income | | £4,576 11 0 |
| Grant received from the Department of Agriculture for Scotland for the financial year 1950-51 | | 6,449 2 3 |
| | | £11,025 13 3 |
| Balances at 1st April 1950— | | |
| Funds in Hand | £3,267 1 6 | |
| Department of Agriculture for Scotland Maintenance Grant | 1,610 0 0 | |
| | | 4,877 1 6 |
| | | £15,902 14 9 |

## SUGAR BEET

| | |
|---|---|
| Grant received from Sugar Beet Research and Education Committee during the year 1950-51 | £1,209 3 1 |
| *Less:* Balance due for previous year | 189 3 1 |
| | £1,020 0 0 |
| Balance due to Society for year 1950-51 | 152 3 2 |
| | £1,172 3 2 |

## BUILDINGS AND EQUIPMENT

| | |
|---|---|
| Balance at 1st April 1950 | £92 14 10 |
| Interest | 0 9 0 |
| | £93 3 10 |

## DR WILSON MEMORIAL

| | |
|---|---|
| Funds at 31st March 1951— | |
| Investments at Cost | £176 5 0 |
| Sum in Savings Bank | 271 3 5 |
| | £447 8 5 |

## W. J. REID

| | |
|---|---|
| Funds at 31st March 1951—Sum on Deposit Receipt | £500 0 0 |

## AND DRYDEN MAINS DEVELOPMENT WORK.

*EXPENDITURE.*

| | | | |
|---|---|---|---|
| Dryden Mains Ingoing Expenses — Proportion of Arbiter's Final Award | | | £2,023 5 2 |
| Seeds, Labour, Cultivations, &c. | | | 1,917 12 10 |
| Interest, Fire Insurance, Telephone Expenses | | | 13 10 2 |
| Total Ordinary Expenditure | | | £3,954 8 2 |
| Society's Share of E.C.R.E. Expenses | | | 844 7 0 |
| | | | £4,798 15 2 |
| Capital Expenditure— | | | |
| Cottages under Construction—amount certified during year 1950-51 | | £5,604 15 3 | |
| Balances at 31st March 1951— | | | |
| Funds in Hand per Balance-Sheet | | £8,871 16 9 | |
| Department of Agriculture for Scotland Maintenance Grant— | | | |
| Brought forward from previous year | £1,610 0 0 | | |
| Excess of Income over Expenditure for the year 1950-51 | 622 2 10 | | |
| | | 2,232 2 10 | |
| | | | 11,103 19 7 |
| | | | £15,902 14 9 |

## INVESTIGATIONS:

| | |
|---|---|
| Salaries and Superannuation Contribution | £692 0 0 |
| Wages | 247 12 6 |
| National Insurance | 19 4 3 |
| Manures | 15 17 0 |
| Travelling Expenses | 30 1 10 |
| Sundry Working Expenses | 75 7 7 |
| Equipment | 92 0 0 |
| | £1,172 3 2 |

## —FIRE DAMAGE ACCOUNT.

| | |
|---|---|
| Sum on Deposit Receipt at 31st March 1951 | £93 3 10 |
| | £93 3 10 |

## FUND ACCOUNT.

| | |
|---|---|
| Funds at 1st April 1950 | £433 19 2 |
| Interest for year | 13 9 3 |
| | £447 8 5 |

## BEQUEST.

| | |
|---|---|
| Legacy received | £500 0 0 |

# BALANCE-SHEET.

## As at 31st March 1951.

*LIABILITIES.*

| | | | |
|---|---|---|---|
| I. Accounts Outstanding, due by Society | | | £778 5 4 |
| II. Subscriptions paid in advance | | | 8 0 0 |
| III. Department of Agriculture for Scotland :— | | | |
| Balance of General Maintenance Grant | £5,122 8 7 | | |
| Balance of Dryden Mains Grant | 2,232 2 10 | | |
| | | | 7,354 11 5 |
| IV. Funds at 31st March 1951— | | | |
| General | £46,422 4 9 | | |
| Dryden Mains | 8,871 16 9 | | |
| | | | 55,294 1 6 |
| | | | £63,434 18 3 |

EDINBURGH, *4th May* 1951.—The undersigned, having had access to all the Accounts and verified the same with the Accounts and Vouchers relating thereto, now

16 ALVA STREET.

*ASSETS.*

| | | | |
|---|---|---|---|
| I. Houses and Lands, at Cost, *less* Depreciation | | | £7,980 9 9 |
| II. Virus Scheme Buildings, &c., at Cost, *less* Depreciation— | | | |
| Craigs House | £1,643 3 3 | | |
| Boghall | 248 12 7 | | |
| | | | 1,891 15 10 |
| III. Dryden Mains— | | | |
| Cottages under Construction—Amount certified to date | £7,147 16 9 | | |
| Buildings and Equipment | 1,724 0 0 | | |
| | | | 8,871 16 9 |
| IV. Greenhouses, Huts, Frames, and Equipment at Sub-Station, at Cost, *less* Depreciation | | | 101 16 7 |
| V. Implements and Tools, at Cost, *less* Depreciation | £176 6 11 | | |
| Additions during year | 650 0 0 | | |
| | £826 6 11 | | |
| *Less* Charged to Revenue | 650 0 0 | | |
| | | | 176 6 11 |
| VI. Laboratory Apparatus, at Cost, *less* Depreciation | £50 1 8 | | |
| Additions during year | 125 17 6 | | |
| | £175 19 2 | | |
| *Less* Charged to Revenue | 125 17 6 | | |
| | | | 50 1 8 |
| VII. Office Furniture and Fittings, at Cost, *less* Depreciation | £48 6 8 | | |
| Additions during year | 305 7 4 | | |
| | £353 14 0 | | |
| *Less* Charged to Revenue | 305 7 4 | | |
| | | | 48 6 8 |
| VIII. Stocks on Hand, as valued by Directors | | | 139 8 2 |
| IX. Accounts Outstanding, due to Society | | | 1,069 3 3 |
| Seeds, Unexhausted Manures, &c., at Dryden :— | | | |
| Sum due to Society by Animal Breeding Genetics and Research Organisation | | | 1,149 16 11 |
| Balance of Grant due to Society by Sugar Beet Research and Education Committee | | | 152 3 2 |
| X. Income Tax Recoverable | | | 518 3 6 |
| XI. Investments, at Cost :— | | | |
| Value at 31st March 1951. | | | |
| £12,999 12 0 — 1. £14,130, os. 9d. 3½ per cent War Stock | | £12,530 0 0 | |
| 14,560 0 0 — 2. £14,000 4 per cent Funding Stock, 1960-90 | | 10,045 0 0 | |
| 15,421 5 0 — 3. £16,900 3½ per cent Conversion Stock | | 11,140 3 6 | |
| £42,980 17 0 | | | 33,715 3 6 |
| XII. Cash Balances— | | | |
| In Bank on Current Account | £5,551 6 9 | | |
| In Savings Bank | 1,892 6 3 | | |
| On Hand | 126 12 7 | | |
| | | | 7,570 5 7 |
| | | | £63,434 18 3 |

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.*

# ESTABLISHMENT FOR 1950-51.

## 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, D.L., J.P., Elibank, Walkerburn.
ALEXANDER M'CALLUM, O.B.E., M.A., LL.B., 78 Craiglea Drive, Edinr.

### *Ordinary Directors.*

**1948.**

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

**1949.**

Major R. F. BREBNER, C.B.E., The Leuchold, Dalmeny House, Edinburgh.
JOHN CROZIER, B.Sc. (Scottish Agricultural Industries, Ltd.), Charlotte Street, Leith, 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.

**1950.**

ROBERT HOWIE, B.Sc., The Grange, Kirkcaldy.
ROBERT L. SCARLETT, O.B.E., Sweethope, Musselburgh.
WILLIAM A. SMITH, M.B.E., M.A., B.Sc., 10 South Castle Street, Edinburgh.
FRANK S. NAGEL (Peter Lawson & Son, Ltd.), 1A George IV. Bridge, Edinburgh.
DAVID LOWE, C.B.E., Elvingston, Gladsmuir.

### *Directors Co-opted.*

WILLIAM ALLISON, Almond Hill, Kirkliston.
Principal JOHN KIRKWOOD, O.B.E., B.Sc.(Agric.), West of Scotland Agricultural College, 6 Blythswood Square, Glasgow.
Professor Sir WILLIAM WRIGHT SMITH, F.R.S., Inverleith House, Arboretum Road, Edinburgh.

### *Directors nominated by the Secretary of State for Scotland.*

Sir PATRICK R. LAIRD, C.B., F.R.S.E., St Andrew's House, Edinburgh 1.
ALEXANDER M'CALLUM, O.B.E., M.A., LL.B., 78 Craiglea Drive, Edinr. 10.
T. P. M'INTOSH, O.B.E., B.Sc.(Agric.), Ph.D., East Craigs, Corstorphine, Edinburgh 12.
ALEXANDER NELSON, Ph.D., D.Sc., N.D.A., University of Edinburgh, Department of Botany, Royal Botanic Garden, Edinburgh 4.

---

*Chairman of Directors*—Sir JOHN H. MILNE HOME, D.L., J.P., Elibank, Walkerburn.
*Vice-Chairman*—.....

# COMMITTEES.

## RESEARCH.

Fred. Mills, *Convener.*
William Allison.
David Bell.
Major R. F. Brebner.
.....
John Crozier.
James H. Elder.
W. H. Hamilton.
Sir John H. Milne Home.
Robert Howie.
Principal John Kirkwood.
Sir Patrick R. Laird.
David Lowe.
Alexander M'Callum.
J. F. M'Gill.
T. P. M'Intosh.
A. D. C. Main.
George G. Mercer.
James B. Miller.
Frank S. Nagel.
Alexander Nelson.
A. Gordon Porter.
A. M. Riddel.
Sir James Denby Roberts, Bt.
Robert L. Scarlett.
Professor Sir William Wright Smith.
William A. Smith.

## MANAGEMENT.

William Allison, *Convener.*
David Bell.
Major R. F. Brebner.
Sir John H. Milne Home.
Robert Howie.
Principal John Kirkwood.
Alexander M'Callum.
T. P. M'Intosh.
A. D. C. Main.
George G. Mercer.
James B. Miller.
Fred. Mills.
A. Gordon Porter.
A. M. Riddel.

## FINANCE.

Alexander M'Callum, *Convener.*
William Allison.
.....
W. H. Hamilton.
Sir John H. Milne Home.
Sir Patrick R. Laird.
George G. Mercer.
Fred. Mills.
Sir James Denby Roberts, Bt.
Robert L. Scarlett.
Professor Sir William Wright Smith.
William A. Smith.

## STAFF, 1950-51.

### Scottish Plant Breeding Station.

| | |
|---|---|
| *Director* | J. W. Gregor, Ph.D., D.Sc., F.L.S. |
| *Chief Assistant* | W. Black, B.Sc., Ph.D., F.R.S.E. |
| **Cereals** | D. Cameron, B.Sc.<br>H. D. Garvin, B.Sc. |
| **Herbage Plants and Genecology** | J. W. Gregor.<br>Miss P. J. Watson, M.A., Ph.D.<br>F. Earnshaw, M.A., Ph.D. |
| **Potatoes—** | |
| *Breeding* | W. Black.<br>J. C. Haigh, B.Sc., Ph.D., A.R.C.S. |
| *Virus Disease Investigations* | G. Cockerham, B.Sc., Ph.D.<br>Miss T. M. R. M'Ghee, B.Sc., N.D.D.<br>A. W. Macarthur, B.Sc. |
| **Root Crops** | V. M'M. Davey, B.Sc., Ph.D.<br>F. J. W. England, B.Sc. |
| **Sugar Beet** | V. M'M. Davey.<br>F. J. W. England. |
| *Secretary* | R. M. Lemmon, B.L. |
| *Assistant Secretary* | Miss A. Malcolm. |
| Clerical and Typing | Mrs H. H. Gray.<br>Miss J. K. Gordon. |

# II. REPORT

BY

# THE DIRECTOR

SCOTTISH PLANT BREEDING STATION,
CORSTORPHINE, EDINBURGH 12

---

## RESEARCH PROGRAMME.

### Cereals

*Oats*

The oat programme can be divided roughly into four sections: (1) Breeding, (2) Trials at the Plant Breeding Station of fixed hybrid selections, (3) Propagation and distribution of promising types for Regional Trials, and (4) Multiplication and disposal of elite stocks of the Plant Breeding Station's named varieties.

As in the past, the breeding programme was concerned with the production of new varieties adapted to conditions prevailing in different parts of Scotland, particular attention being given to the characteristics of earliness of ripening and resistance to lodging combined with a high yielding capacity. Attention has also been paid to the breeding of types resistant to sprouting in the stook, and a number of hybrid selections which have exhibited a high level of dormancy at harvest time over a number of years have been included in the 1951 replicated trials at the Plant Breeding Station.

Forty grains were obtained in 1950 from an *Avena barbata* × *Avena strigosa* hybrid which had been treated with acenaphthene in 1949. These were germinated in the spring

of 1951 and should any prove to be hexaploid, an attempt will be made to cross them with the hexaploid *Avena sativa*, with the object of obtaining a variety possessing the tolerance for alkaline conditions of *Avena strigosa*.

Tests for the presence of *Helminthosporium avenae* and of *Fusarium* spp. have been carried out, and a number of promising selections noted as possible sources of resistance.

Nineteen selections from previous years' trials were included in a randomised block trial of four replications with Star, Sun II., Yielder, and Onward as controls. This trial was severely affected by stem eelworm (*Ditylenchus dipsaci*) over two of the replications with the result that data from these replications had to be discarded. It appeared from observations of the distribution of eelworm attack in this area, and in another area where oats were growing, that the eelworm effect was most severe on that part which had previously been cropped with field beans. The part on which potatoes had been grown was apparently free from eelworm. In the trial area beans preceded the oat crop by three years, and in the other by five years. It seems, therefore, that on land on which stem eelworm of oats has been observed, it is undesirable to include field beans in the rotation as they would appear to enable the parasites to survive and multiply in the soil and endanger ensuing oat crops. A comparison of the effect of eelworm attack on yield, percentage kernel, and grain size was made between the affected and unaffected plots, and in each case eelworm reduced values to a highly significant extent.

The results of the remaining two replications of the trial are set out in Table I., the varieties being grouped in Maturity-Height classes and arranged in order of yield in each class. It will be seen from Table I. that figures for grain size have been included ; these were obtained by means of the grading cylinder constructed at the Station in 1950. An examination of the size fractions, into which the varieties are separated by this cylinder, shows that the percentage of small grain—*i.e.*, below ·098 in. in diameter—can be used as a quantitative expression of the mean grain size of the variety, and the varieties have been classed as plump, medium, thin, and very thin, on the basis of these figures.

The columns for yield of millable kernel and for the milling-suitability index require some explanation. The former has

# TABLE I.

## Data from 1950 Replicated Oat Trial.

| Maturity-Height Class and Identification Letter | Name of Variety or Station No. of Hybrid Selection | Estimated Yield of Dressed Grain per acre in cwt. | Grain over ·098-in. dia. | | Percentage Small Grain below ·098 in. | Size | Estimated Yield of Millable Kernel per acre in cwt. | Milling Suitability Index |
|---|---|---|---|---|---|---|---|---|
| | | | Percentage Kernel | 1000-Grain Weight in grammes | | | | |
| **Late Short** | | | | | | | | |
| Y | *Aa* 725 | 26·4 | 73·54 | 33·19 | 37·4 | Medium | 18·0 | 60·4 |
| **Late Medium** | | | | | | | | |
| AW | Onward | 27·9 | 70·92 | 42·86 | 20·4 | Medium | 18·7 | 52·9 |
| BJ | *Aa* 730 | 27·5 | 72·86 | 34·08 | 57·7 | Thin | 18·0 | 61·8 |
| AY | Sun II. | 25·7 | 75·13 | 39·66 | 41·5 | Thin | 18·1 | 61·2 |
| AX | Star | 25·3 | 74·04 | 39·33 | 38·1 | Medium | 17·6 | 60·3 |
| X | *Aa* 724 | 21·7 | 73·89 | 39·78 | 27·5 | Medium | 15·4 | 57·1 |
| AU | — | 21·4 | 74·81 | 38·63 | 31·2 | Medium | 15·3 | 57·2 |
| **Mid-Season Medium** | | | | | | | | |
| I | *Aa* 719 | 26·1 | 72·01 | 31·93 | 72·2 | Very Thin | 18·8 | 60·0 |
| S | *Aa* 727 | 24·7 | 74·79 | 37·79 | 62·6 | Thin | 14·7 | 57·4 |
| A | *Aa* 698 | 24·2 | 69·98 | 45·83 | 26·4 | Medium | 15·6 | 54·0 |
| Q | *Aa* 726 | 22·8 | 76·10 | 41·50 | 26·3 | Medium | 15·8 | 52·3 |
| AI | *Aa* 729 | 21·5 | 73·96 | 37·74 | 63·6 | Thin | 13·7 | 60·6 |
| AG | *Aa* 731 | 20·3 | 74·58 | 39·87 | 37·0 | Medium | 13·9 | 60·9 |
| **Early Short** | | | | | | | | |
| BH | *Aa* 676 (R) | 19·2 | 70·56 | 32·58 | 60·5 | Thin | 12·4 | 61·9 |
| BF | Craigs Afterlea | 18·5 | 72·25 | 37·47 | 29·2 | Medium | 12·3 | 54·8 |
| **Early Medium** | | | | | | | | |
| N | — | 21·2 | 75·48 | 40·70 | 16·4 | Plump | 15·2 | 48·7 |
| G | *Aa* 718 | 21·1 | 73·43 | 36·44 | 57·2 | Thin | 13·6 | 60·3 |
| L | *Aa* 720 | 20·7 | 72·62 | 42·57 | 31·3 | Medium | 14·1 | 59·5 |
| AV | Yielder | 20·3 | 68·92 | 40·25 | 24·8 | Medium | 12·7 | 47·4 |
| BG | *Aa* 732 | 19·5 | 73·52 | 38·72 | 41·9 | Thin | 12·8 | 59·7 |
| **Early Long** | | | | | | | | |
| AR | *Aa* 728 | 19·8 | 76·00 | 35·34 | 49·4 | Thin | 12·6 | 56·8 |
| AA | — | 18·7 | 72·03 | 47·08 | 25·6 | Medium | 12·7 | 59·2 |
| E | *Aa* 714 | 16·4 | 73·16 | 43·02 | 25·7 | Medium | 9·3 | 56·6 |
| Differences for significance between Means . . | 5 per cent | 3·4 | 1·33 | 3·04 | | | | |
| | 1 per cent | 4·7 | 1·81 | 4·14 | | | | |

been obtained by multiplying the yield per acre by the product of the percentage kernel and the percentage of grain of millable size—*i.e.*, grain between ·098 in. and ·128 in. in diameter. This column is intended to be indicative of the relative values of the different varieties as sources of oatmeal. The grain passing through the three sieves—No. 2, ·088 in. to ·098 in. diameter; No. 3, ·098 in. to ·109 in. diameter; and No. 4, ·109 in. to ·118 in. diameter—has been estimated as percentages of the total sieved, and the milling-suitability index obtained by multiplying the kernel percentage by the higher sum of two of these three adjacent fractions, a measure of uniformity of size.

The higher the index, the better the variety will suit the miller, a variety whose index is lower than 55 not being regarded as a milling oat.

It is realised that the use of data from a grading machine, in which the sieve sizes are fixed at definite intervals, has disadvantages, in that some oat varieties of medium size, with the bulk of their grain falling between the limits ·098 in. and ·109 in., have almost equal proportions above and below those limits and get a relatively low value for the suitability index as a result. Provided, however, that the sieve sizes in the grading cylinder correspond to the sizes preferred by the miller, this suitability index is a convenient method of assessing the usefulness of new varieties from the milling point of view.

From observation and performance data from this and previous years' trials, it was decided that a number of the varieties in the 1950 replicated trials should be multiplied and distributed to the Agricultural Colleges in Scotland and the National Institute of Agricultural Botany in England for extended regional trials. The station numbers *Aa* 724-*Aa* 732 have been allocated to these varieties (see column 2, Table I.), and a brief account of their characteristics is given below :—

*Aa* 724 (X).—A late variety of medium height, with medium grain and medium kernel percentage. To be tried as a general purpose oat against Sun II. and Star.

*Aa* 725 (Y).—A late very short-strawed oat, with small grain of uniform size and high kernel percentage. To be tried in early districts where fertility is high.

*Aa* 726 (Q).—A midseason variety of medium height with large grain and high kernel percentage. Has high yielding capacity under average conditions. To be tried as a general-purpose oat.

*Aa* 727 (S).—A midseason oat of medium height with medium grain size and high kernel percentage. To be tried under same conditions as *Aa* 726.

*Aa* 728 (AR).—An early long-strawed variety with small grain and high kernel percentage. To be tried in late districts under low fertility conditions.

*Aa* 729 (AI).—A midseason oat of medium height with medium size grain and medium kernel percentage. Has shown some resistance to lodging. To be tried on more fertile soils in lowland areas.

*Aa* 730 (BJ).—A late variety of medium height with small grain and medium kernel percentage and a high yielding capacity. To be tried as a general-purpose oat against Sun II. and Star.

*Aa* 731 (AG).—A midseason oat of medium height with large grain and medium kernel percentage. To be tried against Early Miller.

*Aa* 732 (BG).—An early oat of medium height with large grain and medium kernel percentage. To be tried against Early Miller.

A small multiplication plot of the variety Elder was grown in 1950 and has been sown on a larger scale in 1951 to meet a limited demand for this variety from Northern Ireland. The variety Bell was in considerable demand and there was no difficulty in disposing of the entire stock of seed from the 6 acres grown on contract by the Department of Agriculture for Scotland. The seed from the 2 acres of Early Miller grown at the Plant Breeding Station did not find such a ready sale, perhaps because some 40 acres of this variety were certified by the Department of Agriculture during the 1950 season. Thirty acres of Craigs Afterlea were grown on contract, 10 acres by Mr Robert Howie, Grange, Kirkcaldy, and the remainder by Mr D. C. Gregor, Thurston Mains, Innerwick. Both these crops were visited and rogued by the staff of the cereals department, and all but a few hundredweights of the seed has been sold.

In 1951, 2 acres only of Bell oats have been sown at the Plant Breeding Station and 2 acres each of Early Miller and Craigs Afterlea are being grown on contract by the Department of Agriculture, at East Craigs. In addition to the above, 2 acres of *Aa* 676, a short-strawed oat of the Potato type bred at the Station from Castleton Potato × Yielder, which has given consistently good results at an elevation of 1100 feet at Milton of Edinglassie in Aberdeenshire, is being grown on contract by the Department of Agriculture, and this variety has been submitted to the Oats Sub-Committee of the Plant Registration Station as a short-strawed Potato-type oat for cultivation in upland areas of low fertility.

### *Barley*

A further series of tests for prompt germination in second- and third-generation barley hybrids was carried out in 1950, and a large number of plants showing low dormancy at harvest time have been selected.

It is proposed to continue selections for prompt germination until a number of true-breeding lines have been established, but no extension of the barley-breeding programme beyond that is contemplated at present.

The Plant Breeding Station selection, Craigs Triumph, was grown in 1950, and although the demand for the seed was small it was disposed of eventually.

Small multiplication plots of a naked barley, colchicine-treated Plumage Archer, and of an unnamed short stiff-strawed selection were grown in 1950; the last mentioned is being multiplied further and a quantity of seed has been supplied to Boghall Experimental Farm for trial.

### *Beans*

Steps are being taken to multiply certain selected lines with a view to having them included in yield trials in bean-growing areas. Seed of several lines already multiplied has been distributed for trial to a number of centres. No further selection of beans is contemplated at the Station, and the inclusion of beans in the crop rotation has been discontinued owing to the occurrence of stem eelworm in the oat crops.

A trial of the use of Pestox III. systemic insecticide for the control of black fly on beans was carried out. There were three treatments: (*a*) control, (*b*) spraying of the foliage, and (*c*) spraying of the soil in the immediate neighbourhood of the plants. Two sprayings were done at an interval of sixteen days, the first being on 27th June when the first signs of black fly attack in the field were apparent. On 28th June half the plants in each treatment, including the unsprayed control, were infested with black fly by placing colonies of the aphids on each plant. In the case of foliage-sprayed plants a complete control of aphids was obtained, no colonies being formed on the plants until the pods were almost ripe. All the unsprayed plants and the soil sprayed plants were heavily infested. Pestox III. provided no protection against aphids in the latter case.

It is concluded that Pestox III. sprayed on the foliage of the plants was a very satisfactory insecticide for the protection of valuable bean breeding material from destruction by aphids and other sucking insects.

## Herbage Plants and Genecology

One important aspect of the herbage-plant programme to which a good deal of time has been devoted in recent years is the study of some of the botanical factors governing the food supply of hill stock. The exploratory investigations with a bearing on this subject which have been conducted by the Plant Breeding Station for five years at Dundonnell in Wester Ross-shire have now been concluded since they have served their primary purpose. This would therefore seem to be an appropriate time briefly to review the progress of the " hill land " studies.

In the earlier years the emphasis was placed on upland reseeding and the breeding of strains of the commonly cultivated grasses for this purpose. On the assumption that the stock-carrying capacity of the average Scottish hill farm is seldom, if ever, limited by a lack of summer grazing, but, instead, is primarily determined by the available supply of winter keep, attention was at that time concentrated on raising early and late grass strains in the hope that by employing such extreme

types to replace the natural vegetation the effective grazing season would be materially extended and so help to narrow the period of greatest food shortage. But it became clear when these strains were tested in an upland district that the problem of closing the winter gap remained virtually unsolved. It was then decided that the conservation of summer grass for winter use offered greater practical possibilities than winter grazing. Here again, however, degree of exposure, low soil fertility and remoteness of many hill pastures, imposed severe limits to economic cropping at the higher altitudes, and for these reasons it was considered that more satisfactory results might be obtained by reorientating the programme and examining the possibilities of increasing the output of the relatively accessible low-ground acreage. It was, nevertheless, appreciated that because the low altitude acreage on hill farms is often very small, the improvement and utilisation of such areas along orthodox lines could at best only lead to moderate stock increases.

Investigations were accordingly started with the aim of exploring methods of grassland farming whereby specialised cultivated herbages could be used as nutritional complements to adjacent rough grazings and so make the most of the feeding potentialities of both vegetational types. From experiments conducted at the Plant Breeding Station it was evident that both dry-matter yields and percentages of protein in the dry matter of arable grass could be raised to exceptionally high levels by the appropriate choice and treatment of strains. Very liberal dressings of nitrogen gave a diet very rich in protein, in itself unbalanced, which could be used to supplement a basic diet of low quality roughage. The putting into practice of such a complementary system of herbage utilisation presented certain difficulties, and it was for the purpose of defining the problems that part of the field work was transferred from Edinburgh to the high-rainfall area of Dundonnell in Wester Ross-shire.

Designed to supply field information regarding the practical possibilities of the complementary utilisation of cultivated and natural herbage, mainly in the interest of hill cows, these Dundonnell investigations have been most instructive in indicating the kind of problems, both breeding and agronomic, likely to be encountered and which are in need of further study. This practical study was made possible by the kind-

ness of Sir Michael Peto in providing facilities, and by the co-operation of the farm manager Mr John Macleod. The essentially agronomic problems have now been referred to the Hill Farm Research Committee and will in future be studied in Argyll, while the associated breeding and genecological problems will continue to be dealt with by the Plant Breeding Station at Edinburgh. As the intensive manurial treatment of cultivated grass is a feature of these "complementary" experiments, the breeding problems which they present have the advantage that in many respects they are typical of those relating to other forms of intensive grassland farming.

The general plan at Dundonnell was to provide high-yielding protein-rich complementary grazing from the middle of April until the hill vegetation started active growth in early June, and again in autumn from September to November, and during the summer months to conserve production in the form of silage or hay. It soon became apparent, however, that introduction of summer conservation made it necessary to sacrifice maximum yield during the summer months, and, by reducing the quantities of nitrogen applied, to bring down production to a level compatible with efficient cutting, for with the normal monthly application of 5-6 cwt. of nitro chalk per acre, midseason and late varieties of perennial ryegrass in particular produced so dense a stand that the mower proved incapable of cutting the crops clean. This failure to clean-cut the crop leads to relatively poor protein percentages being recorded during the subsequent period of autumn complementary grazing, a serious defect in a system of herbage utilisation demanding high-quality dry matter. As a result of this experience, efforts are being made to breed a late ryegrass which can be more easily cut when subjected to intensive treatment, and a promising variety is now in the initial stages of multiplication and should be ready for trial in the near future.

Trials at Edinburgh had shown that in the spring it was possible to maintain high protein percentages until June by employing three maturity types of ryegrass—early, mid-season, and late—and grazing them in sequence. Contrary to expectation the early strains proved to be no less productive of dry matter in late autumn than the late. At Dundonnell, however, despite their similarity in autumn yielding capacity it became quite evident that the grazing

sequence should be followed just as rigidly in autumn as in spring, for late autumn grazing of early ryegrass was found seriously to retard its response to March applications of nitrogen, and hence to depress mid-April yields of dry matter. Incidentally the tendency on the part of early varieties to shoot after the removal of the last conservation crop resulted in relatively low protein percentages in August, and as a consequence detracted from the usefulness of such strains for autumn complementary purposes. Breeding experiments are now in progress with the object of remedying this defect.

By the end of the fourth year all the Dundonnell swards, irrespective of maturity type, had become to some extent invaded by native species, and the desired responses to the heavy dressings of nitrogen were no longer being obtained. This contamination by unsown species was in marked contrast to the situation at Edinburgh, and was doubtless largely a reflection of the failure to clean-cut the conservation crops. But taking into account the results of all field trials to date it would seem that to obtain the greatest returns from the nitrogen applied, the arable complementary swards should be renewed after three or four years. Reseeding such swards has presented no practical difficulties and has resulted in an immediate return to high-level production. The employment of three different maturity types certainly complicates the adoption of a suitable rotation of types, especially where the available acreage is small. Accordingly, attempts are being made to breed late varieties capable of earlier spring growth than those which have so far been used. If such a late variety could be made to assume the functions of both the late and midseason types, then by reseeding with early and late in alternate years three areas would suffice to provide swards of appropriate ages for high production.

Since these investigations are not aimed at any large-scale replacement of natural vegetation by cultivated, but rather at supplementing a basic diet of hill herbage, and since it is becoming increasingly evident that many factors militate against any extensive use of lowland species in the mountainous districts of Scotland, a wider knowledge of the intra-specific structure and economic possibilities of the existing hill vegetation is a matter of importance. The amount of variation within the hill species and its geographical and ecological distribution is virtually unknown, and it is for this reason

that work has been proceeding upon the Sheep's fescue, a species of widespread distribution in hill districts and elsewhere. Two chromosome races occur within the British Isles. It is, however, impossible to distinguish between them in the field, but the cytological examination of collections made from many localities has given a fairly clear picture of their distribution in Britain. Various populations of both races are now being studied in trial plots in order to ascertain the extent of inter- and intra-racial differences.

It is well known that in widely distributed species the selective effect of different climates results in the formation of races adapted in their developmental rhythm and habit of growth to the climatic conditions of particular zones. It is, however, true to say that little information exists concerning the origin, development and economic properties of such specialised races in restricted areas where the range of climatic variation is relatively small. Ecological study has shown that some species are virtually restricted to a particular type of habitat and type of plant community while others are common to a range of floristically different communities. Indeed the preferences of communities for particular broadly defined habitats are in many cases so marked that distinctive floristic communities are frequently used as indicators of environmental conditions. The genecologist is primarily concerned with investigating the environmental relationships of hereditary variation within species—that is, with the ecotypic variation within the floristic components of plant communities. Studies along this line have demonstrated the existence of ecotypically specialised intra-specific populations and it is possible that communities of the same general species-composition may be of dissimilar ecotypic composition. This being so, it may well follow that similar floristically delimited communities are not necessarily of equal agronomic worth.

One of the objects of the genecological investigations at the Plant Breeding Station is to determine the extent to which ecotypic specialisation occurs in species widely distributed in different types of vegetation on hill grazings. A preliminary survey carried out during the past year has indicated a floristically suitable and conveniently situated area in the Pentland Hills for conducting the field work so essential to an investigation of this kind.

## Potatoes

The investigations concerning the problem of resistance to the blight fungus (*Phytophthora infestans*) in potatoes were continued during 1950, employing seven different biotypes of the parasite in routine and experimental tests. These biotypes were the common strain A, four strains $B^1$, $B^2$, C and D of local origin, strain E obtained from Tanganyika, and a mutant strain F which arose from strain E in the course of experiments. The results of the investigations show that the hypersensitive reaction to blight in *S. demissum* (C.P.C. 2127) is controlled by at least four major independent genes, each of which induces in the plant a predisposition to react with necrosis when attacked by any member of a particular group of strains. Although these genes are combined in *S. demissum*, they tend to become separated in the course of hybridisation and back-crossing to commercial varieties. As a result it has been possible, by means of tests, to identify each and to study its mode of inheritance as an individual unit. The reactions for which each of the four genes is responsible are :—

| | | | | | |
|---|---|---|---|---|---|
| (1) | resistance to strains | A, C, D | susceptibility to strains | $B^1$, $B^2$, E, F. |
| (2) | ,, ,, | A, $B^1$, $B^2$, D, E, F | ,, | ,, strain C. |
| (3) | ,, ,, | A, $B^1$, $B^2$, C, D | ,, | ,, strains E, F. |
| (4) | ,, ,, | A, $B^1$, E | ,, | ,, strains $B^2$, C, D, F. |

It will be noted that the gene combinations (1) + (2) and (2) + (3) are capable of providing resistance to all seven strains. Although some of the older and more promising seedlings are so constituted, the breeding work is designed to recombine all the resistance genes available and thus reproduce in commercially-suitable varieties a degree of resistance comparable with that of the original wild species. Of the 2nd-year seedlings grown in 1950, over one hundred were obtained from crosses between two parent types, one of which possessed genes (1) and (2) and the other, genes (3) and (4). It is possible that some of these seedlings will have inherited all four genes, but proof can be obtained only by laborious progeny tests.

In the course of the breeding work for resistance to blight, parents were selected where possible on the basis of other important characters such as resistance to mosaic and leaf-roll

viruses, and to scab and other fungi, in order to introduce into single varieties resistance to as many diseases as possible. Tests for reactions to the mosaic viruses were carried out as usual.

The eelworm trial of 1949 confirmed the general results found in the previous year. In no case was there freedom from attack—in fact, there were no great differences between the numbers of cysts found on the roots of trial plants and on the susceptible controls; but the cysts taken from the roots of the trial plants in the course of sampling were found to have a lower survival value than those from the controls.

An investigation into the possibility of breeding for frost resistance has been continued. The "wild" source of frost resistance is the sub-section *Acaulia* of the genus Solanum, and the two species *S. acaule* and *S. depexum* are capable of withstanding temperatures of — 8° C. Although they are tetraploids, all attempts to cross them with commercial forms have failed, but crosses are easily made with the (presumed) octoploids obtained by treating the germinating seed of either species with colchicine. In this way a hybrid progeny has been obtained with which it is hoped to learn something of the mode of inheritance of resistance to low temperature. The reaction to freezing and subsequent thawing of promising commercial material is also being examined, since it may well be that, as in the case of Epicure, the damage done by spring frosts to commercial crops depends less on a variety's ability to withstand low temperatures than in its power of recovery from the damage caused thereby.

In season 1950 over 17,000 seedlings were raised to provide material for experimental purposes and for selection as potential economic types. Most of them were tested for their reaction to one or more strains of blight and approximately 4250 were planted out, many of which were destroyed by crows. Selected 1st-, 2nd-, and 3rd-year-and-older seedlings numbering 442, 139 and 40 respectively, were retained for further trial.

On account of an outbreak of wart disease among the 1st-year seedlings in 1949, none of the varieties grown in the same field was eligible for inclusion in official trials in 1950. As a result ten seedlings recommended for further trial by the Registration Committee were withheld and no new selections were entered. Only one seedling, 1092*a*(4) which was

in *Solanum simplicifolium* (C.P.C. 51A) and *S. demissum* (C.P.C. 2167). The sixth strain, C, is not only more weakly pathogenic than the rest of the strains but it also differs from them in its ability to induce lethal necrosis in a number of commercial varieties which are not so affected by any other strain.

Inheritance studies on the inter-relationships of genes conditioning necrotic responses to individual viruses have given indications of a complex linkage group involving genes brought into action by A, X and Y viruses. Component parts of this group have been found in three widely different sources and steps have been taken to synthesise material for examination of the group as a whole. Additional genetical studies on progenies derived from hexaploid *S. demissum* have provided evidence that necrotic reaction to virus Y in this species is conditioned by a single dominant gene and that, in relation to this gene, inheritance in the species follows a diploid pattern.

In continuation of the breeding programme to combine resistance to the A, X, Y and the leaf-roll viruses with resistance to blight, four second-backcross seedling progenies were raised and tested in the breeding section, for resistance to blight strains B and C. Rather more than half the seedlings survived the double test and were entered into the preliminary stages of virus testing. Further breeding from selected plants of earlier progenies was carried out and hybridisations within diploid, tetraploid and hexaploid material were made to extend genetical investigations.

Field trials for the detection and evaluation of resistance to leaf roll contained 625 seedlings, of which 227 were new entries and 49 were in the final stages of assessment. Of these latter, 2 Continental seedlings and 21 experimental seedlings showed a high level of resistance and were judged to be of potential value as parents in future breeding for this character. Four of the Society's advanced commercial seedlings were included in this trial and though none was highly resistant they all compared favourably with the control varieties Arran Banner, King Edward and Majestic.

Field trials with virus Y contained experimental material only. The object of these trials was to compare laboratory assessments of resistance to this virus—that is, assessments based on controlled sap and aphis inoculations—with those

obtained under natural conditions of infection. Fairly good agreement was obtained between the two tests and it is considered that laboratory methods are sufficiently reliable to enable at least a preliminary selection of material to be made in advance of the more laborious field tests.

In a trial to assess varietal resistance to infection with virus X it was found that Gladstone and Arran Pilot are appreciably more resistant than Majestic, Arran Banner and Craigs Alliance, which in turn are appreciably more resistant than Arran Victory and Kerr's Pink.

Laboratory tests for the recognition of hypersensitive reactions to infection, and hence of potential field immunity from one or more members of the A, X and Y groups of viruses, were applied to 157 seedlings submitted by the breeding section and approximately 880 seedlings used in experimental breeding.

The spring migration of aphides to potatoes at Craigs House was first observed on 30th May. The migration was of normal proportions and there was a steady build-up in population to a maximum of 1700 aphides per 100 leaves in late July. Thereafter there was a rapid decline and numbers continued small until counts ceased at the end of August when the population was 58 per 100 leaves.

## Root Crops

Investigations of breeding methods with the swede, and attempts to obtain improved strains are the main objects of this section, but some work is also carried out with other forms of Brassica. Fodder strains derived from crosses between kales and other members of the cabbage tribe were reduced to the condition of inbred families during the war because it was only possible to propagate a limited number of individuals. A start has been made to increase the number of unrelated families with a view to forming compound strains with restored hybrid vigour. During and since the war a winter-hardy strain of broccoli has been bred to meet the requirements of home producers. A seed crop of this strain was rigorously culled to reduce variation in leaf habit, and about 14 lb. of seed was obtained and sold to seedsmen. Seed from selected mother plants was harvested separately

for further attempts to improve the habit type, and a comparison of winter hardiness and weight of curd was made on plants of two generations in a small yield trial.

### *Swedes*

The land available at the Plant Breeding Station was insufficient to accommodate the whole experimental material of both swedes and sugar beet, but permission was obtained to grow selection plots or yield trials of swedes at East Craigs, Boghall, the Bush estate and Auldhame Farm, North Berwick. The results of the trials are discussed in relation to the main groups of experimental swede material.

*Strain Ds* 32.—Large-scale observation and selection was planned for Ds 32, in an attempt to improve its general appearance. This swede strain has shown promise of good winter hardiness and yielding capacity, but the shape of the root is somewhat coarse and the neck inclined to be long. About 3¼ lb. of seed were sown out in a break at Boghall Experimental Farm and in plots at Corstorphine, and a close examination was made of the plants. There appeared to be very little variation from the type, which appears to have become fixed through inbreeding. A hundred roots were selected for seeding, and, in this connection, the National Institute of Agricultural Botany have kindly consented to multiply a small quantity of the stock seed to provide seed for their trials. The strain continued to show promise in trials. Four of the constituent lines, after standing in the field till February in a winter resistance trial, had 86 per cent (83-90 per cent) of sound roots, compared with the controls—Champion 56 per cent, Aberdeen type 47 per cent and Victory (an early type) 27 per cent. Half-plots of this trial tested in November, and samples of Ds 32 grown in two other trials all out-yielded the controls in dry matter. Taking Victory as 100 the relative yields were :—

| Trial | Ds 32 | Victory | Champion | Aberdeen |
|---|---|---|---|---|
| Craigs House . . . | 111 | 100 | 105 | 94 |
| Winter Resistance Trial . | 115 | 100 | 90 | 88 |
| Bush Estate . . . | 104 | 100 | 97 | 90 |

In previous years the strain Ds 32 has usually been placed second to Victory. It is not extreme either in yield or dry-matter percentage, but is above average in both respects.

*Cross Strain ANI.*—Another strain which attracted attention for its winter hardiness in 1948 was named ANI, and derived from the crossing of two Station strains. Two lines from this cross were included in the winter-resistance trial: ANIcaa, the direct descendant of the 1948 line, and ANIaada. The roots of both lines resisted the winter well, 91 and 88 per cent being sound in February. They were also outstandingly high in dry matter giving 12·9 and 13·6 per cent respectively, but the yields were very poor, and the yields of dry matter were in both cases below average for the trial. Further selections have been made from this material.

*Cross AOE.*—Extensive selections had been made for two generations from a cross, AOE, in which both parents were heavy-yielding, early types. Groups of plants were selected at North Berwick and Craigs House and seeded in isolation plots, but a few selfings were also made. A bulk sample of AOE was tested in the strain trial at Bush, where its yield of dry matter compared favourably with that of Victory. Lines of AOE were grown in a yield trial at East Craigs, but this failed because of bad plant stands, and only one replication was worth testing. The best lines were further selected, and some plants were also taken from another plot grown at North Berwick.

*Cross AOG.*—A group of lines had been derived by the mass-seeding of selections from a cross, AOG, between early and late types, the object being to secure hardy and club-root resistant types. However, the seven lines included in a trial of late types at Craigs House gave poor results, and appeared to be early forms in most cases. Clubroot tests were carried out on some of the lines, and selections were made from these and from a series of observation plots.

Lines from a somewhat older cross, AMJ, have been tested in small yield trials for several years. In 1950 eight of the lines were included in the trial of late types, in which they were mostly well placed for yield of dry matter, and headed the dry-matter percentage list. Another large group of lines from a cross, AON, between maincrop and early types had insufficient seed for trial in 1950. Selections were made mainly from four lines which gave the best performance in

observation plots. Besides the above groups there were numerous individual lines, some of which were tested in 1950.

Clubroot resistance tests were carried out on seedlings in boxes of infected soil, and in an infected field plot. The material used was mainly derived from crossings between resistant plants obtained from earlier tests, but in 1950 a considerable part of the work was concerned with the strains Ds 32 and AOG.

## Sugar Beet

The third year of the sugar beet research programme, undertaken at the request of the Sugar Beet Research and Education Committee for Great Britain, involved progeny tests on material propagated by the Station as well as the testing of strains and families supplied by the Cambridge Plant Breeding Institute. The main object of the work is to find types of sugar beet suited to Scottish conditions and to aid in bringing any promising strain into cultivation with the least possible delay. Attention is at present concentrated on the production of a non-bolting strain which can be safely sown a few weeks earlier than the normal date, and may out-yield the present varieties by virtue of the longer growing period.

Two resistance-to-bolting trials designed to test the same twenty-five units were sown out on 14th March and 20th April respectively. The units consisted of two samples of a Cambridge non-bolting experimental strain, a number of lines from families of Cambridge origin, some of which had been selected and propagated at the Scottish Plant Breeding Station, and several commercial controls. No bolting occurred in the late sowing, but in the March-sown trial commercial varieties showed 73, 51 and 34 per cent. The non-bolting German variety, Klein AA, had 8 per cent of bolters and the Cambridge material ranged from 10 to less than 1 per cent. Several of the Cambridge units appeared to be significantly less susceptible to bolting than Klein AA. The plots of the two trials were tested for yield of tops and washed roots and for sugar content. The chief point of interest lay in the effect of early sowing, but for various reasons, such as differences in plant stands this could only be assessed by computation. There were

indications in this particular trial that much of the Cambridge material when sown early yielded more sugar per acre than the commercial varieties sown late. The early sowings of the commercial varieties had so many bolters that their yields were greatly reduced. In most years it is not possible in Scotland to cultivate the soil for sowing at such an early date as in 1950.

At the Scottish Plant Breeding Station progeny trials were carried out with seed obtained from a number of plants selected from a commercial crop. The object was to start some families of sugar beet suited to Scottish conditions, and the resistance to bolting, if not satisfactory, was to be improved subsequently by selection after artificial-light treatment. The main trial of this material was sown on 15th March, and the progenies ranged from 0 to 18 per cent of bolters, while Klein AA had 7 per cent and two ordinary commercial varieties showed 45 and 76 per cent of bolting. The plant stands were irregular and the trial was not tested for sugar content, but selections were made, employing the refractometer test, from a number of the more promising progenies.

The season was unfavourable for seed production, and most of the plants were still green when harvested in September. Although the quantities of seed obtained were small they will be sufficient for the 1951 trials and the germination appears to be satisfactory. The selections for seeding in 1951 required 24 isolation plots, and arrangements were made to obtain sites for this number.

## Publications

BLACK, W. "Inheritance of Resistance to Blight (*Phytophthora infestans*) in Potatoes: Strain C and its Relationships." *Proc. Roy. Soc.*, Edinburgh, B. LXIV., pp. 216-228, 1950.

The common strain A of the blight fungus (*Phytophthora infestans*) and two new strains, B and C, have been employed in testing potato varieties and seedling progenies, bred from the wild species *S. demissum*, for resistance to the disease. The reactions of seedlings to infection with strain C are compared with those of strains A and B. The C strain is shown to be more virulent than A, since it attacks some A resistant as well as A susceptible plants. Likewise the B strain is more virulent than A. The difference between the pathogenicity of strains B and C, however, is not one of degree of virulence; one plant may be B resistant-C susceptible, while another may be B susceptible-C resistant. This difference is essentially of a qualitative nature. Resistance to these strains, which is manifested by the hypersensitive condition of the plant's cells, is produced in the presence of three major independent genes, Rc, Rb and Rbc, which confer resistance to strains A and C, A and B, and A, B and C respectively. Segregations in each case are similar in type, and are characterised by an excess of recessive individuals.

BLACK, W., and ALBERTO MEZZETTI. "Biotipi di *Phytophthora infestans* De By in Italia." (*Boll. d. Stazione di Patologie Vegetale, Anno VI.*) Rome, 1950.

A study of some isolates of *Phytophthora infestans* obtained from various regions in Italy. In addition to the common strain, other biotypes were present, but none of the latter was identical with any of the races isolated in Scotland and could not be clearly defined by the standard series of differential hosts employed. The isolates were classifiable into three main groups.

BLACK, W. "Potato Breeding in Relation to Disease Resistance." *Proc. Ass. Appl. Biol.—Ann. Appl. Biol.*, 38, No. 1, pp. 306-307, 1951.

Plants hypersensitive to a particular disease may be regarded as virtually immune. The hypersensitive condition behaves as a dominant character and is inherited in Mendelian fashion. Hypersensitiveness to the wart fungus and to viruses A and X are already present in commercial varieties, and it is a relatively simple matter to breed new types possessing all these characters in combination. In the case of virus Y the necrotic response which certain varieties and seedlings exhibit appears to be fully effective only in the presence of a high degree of resistance to infection. None of our commercial varieties provides these conditions, but it seems possible by breeding methods to intensify resistance to infection to the desired degree. So far, no species or variety has been found to be hypersensitive to the leaf-roll virus, but in certain varieties resistance to infection provides a valuable protection against the disease. Effective resistance to the blight fungus is not present in ordinary commercial varieties and must be introduced from certain wild Mexican species, the most promising of which is *Solanum demissum*. This species is hypersensitive to the parasite.

GREGOR, J. W. "The Wintering Problem with Special Reference to Cattle." *Proc. Ass. Appl. Biol.—Ann. Appl. Biol.*, 38, No. 1, p. 304, 1951.

A brief summary of a contribution to the Association's symposium on biological aspects of hill farming.

GREGOR, J. W., P. J. WATSON and W. D. CONNELL. "The Moorland Farm: Using Permanent Grass for a Special Purpose." *Scottish Agriculture*, 30, No. 2, pp. 102-106, 1950.

In the tourist districts of Scotland summer milk production may be of considerable importance even on the moorland farm. On this type of farm, apart from arable normally required to supply winter keep, there is often a limited acreage of comparatively fertile grazing land which is unsuited to modern methods of cultivation. In the past such land was

often cultivated by hand and as a result supports a relatively good class of rough vegetation to-day, which might, if it were suitably treated, be capable of nutritionally supplementing a principal summer diet of moorland herbage. It is true that in summer the rough grazings are generally producing more than enough bulk of herbage, but not as a rule of sufficient quality for high milk production. The results presented in the paper show that with adequate basic manuring lavish dressings of nitrogen are capable of increasing the yield and quality of herbage from an inferior fescue-dominated sward to surprisingly high levels. Increases were progressive, due to changes in the floristic composition of the vegetation. For instance, by the fourth year the contribution of Smooth-stalked Meadow Grass (*Poa pratensis*) to samples of cut herbage had risen from 2 per cent to 46 per cent. Fourth-year June and July yields of the unploughed vegetation which had received 36 cwt. of nitro-chalk per acre per annum were very little inferior to those of control reseeded plots (rye-grass + S100 white clover) similarly manured, and from four to five times greater than the values obtained from adjacent reseeded plots treated in the customary fashion.

## 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 :—

Åkerberg, Erik, Swedish Plant Breeding Station, Uppsala.
Aktiebolaget Lauxien-Casco, Stockholm.
Allison, William, Almondhill, Kirkliston.
Bell, David, Ltd., 15 Coburg Street, Leith.
Bjaanes, M., State Experiment Station, Møystad, Hjellum, Norway.
British Sugar Corporation, Ltd., Cupar (per Messrs M'Cloy, Sutton and Stuart).
Commonwealth Potato Collection, Cambridge (per K. S. Dodds).
Corner, H. H., Agricultural College Office, Newtown St Boswells.

Cowie, William, Agricultural College Office, Thurso.
Cross Seed Co., 21 Hope Street, Glasgow (per Thomas Hogg).
Dale, John R., Auldhame, North Berwick.
Department of Agriculture for Scotland, East Craigs, Corstorphine, Edinburgh (per T. P. M'Intosh, A. E. W. Boyd, C. E. Foister, J. L. Hardie, J. Mitchell, M. Noble, A. Revolta, and N. Wight).
Dominion Experimental Station, Lethbridge, Alberta (per S. A. Wells).
Drummond, Wm., & Sons Ltd., Stirling (per A. M. Riddel).
Edinburgh and East of Scotland College of Agriculture, 13 George Square, Edinburgh (per A. S. B. Wilson, A. R. Dobson, M. Noble, P. Osborne, and G. Stuart).
Findlay, William, Agriculture Department, Marischal College, Aberdeen.
Frandsen, K. J., Øtoftegaard, pr Taastrup, Denmark.
Gibb, Lt.-Col. J. E., Keppoch Farm, Dundonnell, by Garve.
Gill, W. H. M., Rosskeen, Invergordon.
Goulden, C. H., Dominion Cerealist, Department of Agriculture, Canada.
Grant, Lt.-Col. J. P., Rothiemurchus Estate, Aviemore.
John Innes Horticultural Institution, Bayfordbury, Hertford (per C. D. Darlington, G. Haskell, and W. R. Stanton).
Laing & Mather Ltd., Kelso (per A. D. Service).
Larson, R. H., University of Wisconsin, U.S.A.
Lawson, Peter, & Son Ltd., 1A George IV. Bridge, Edinburgh (per F. Nagel).
Levieil, F., Station de Recherches de Trevarez, France.
Macarthur, J., Middleton, Tiree.
M'Dowall, Mrs Flora, Mungoswells, Duns.
Marshall, J., Dalreoch, Dunning.
National Institute of Agricultural Botany, Cambridge (per F. R. Horne and K. O. Müller).
Nattrass, R. M., Scott Agricultural Laboratories, Nairobi, Kenya.
New Zealand Department of Scientific and Industrial Research, Crop Research Department, Lincoln, New Zealand (per T. P. Palmer).
New Zealand Government Offices, London (per W. V. Hadfield).
North of Scotland College of Agriculture, Aberdeen (per C. M. Allen, E. G. Gray, and J. R. Moir).

Owen, F. V., U.S. Department of Agriculture, Salt Lake City, Utah.
Pajbjergfonden, Denmark (per Dr Bøgh).
Parker, A. H., Gilbert Plains, Manitoba.
Plank, J. E. van der, Department of Agriculture, Pretoria, South Africa.
Plant Breeding Institute, Cambridge (per G. D. H. Bell, G. K. Graham Campbell, and H. W. Howard).
Poehlmann, J. M., Department of Field Crops, Columbia, Missouri, U.S.A.
Reddick, Donald, Cornell University, Ithaca, New York.
Roberts, Sir James D., Bt., Strathallan Castle, Auchterarder.
Schmidt, E., Saatzuchtwirtschaft Krafft, Buir, Germany.
Scottish Agricultural Industries Ltd., Aberdeen (per D. J. R. Macpherson).
Silcock, D. S. G., Glen Lake Farm, Versailles, Kentucky.
Smith, Wm., & Son, Aberdeen (per N. Keith Robson).
Smith, Professor Sir William Wright, Royal Botanic Garden, Edinburgh.
University of Aberdeen, Department of Statistics (per M. H. Quenouille).
Valentine, B., Thainstone, Kintore.
Wallace, G. B., Department of Agriculture, Tanganyika.
Webb, Edward, & Sons (Stourbridge) Ltd., Wordsley, Stourbridge.
Weibull, W., A-B, Landskrona, Sweden (per G. Weibull).
Young, James, Meadowfield, Corstorphine, Edinburgh.

J. W. GREGOR,
*Director.*

# SCOTTISH SOCIETY FOR RESEARCH IN PLANT BREEDING.

## APPLICATION FOR MEMBERSHIP.

*I desire to be enrolled a Member of the above Society, and enclose.....for* 10s., *being subscription for the year* 1*st April* 19..... *to* 31*st March* 19.....

(*Signature*).....

(*Address*).....

.....

(*Date*).....19.....

THE SECRETARY,
SCOTTISH PLANT BREEDING STATION,
CRAIGS HOUSE, CORSTORPHINE,
EDINBURGH 12.

---

**The membership subscription is 10s. per annum. Donors of £10 or over are entitled to become life members without further payment. Donors of £5 or over may become members of the Society by payment of an annual subscription of 5s.**