SCOTTISH SOCIETY FOR RESEARCH IN PLANT-BREEDING

REPORT

BY THE

DIRECTORS

TO THE

ANNUAL GENERAL MEETING

28th July 1924

1924

SCOTTISH SOCIETY FOR RESEARCH IN PLANT-BREEDING.

REPORT.

THE Directors, in submitting the third Annual Report to the Members of the Scottish Society for Research in Plant-Breeding, have to record that the work of the Society continues to make steady progress.

An account of the research work carried out at the Station at East Craigs, Corstorphine, during the past year is given in the Report by the Director of Research, Mr Montagu Drummond, B.A., F.L.S., &c., which appears on pages 13-35 hereof.

General.

During the past year the Directors have arranged for the removal of all the trees along the boundary fences of the Society's experimental ground. This is regarded as an improvement, as these trees, besides shading the crops, formed a harbour for birds, which were very destructive to the cereal crops.

Hedges also are being removed for the same reasons, and in view of this an arrangement was made with the Board of Agriculture to renew all boundary fences between the Society's property and the ground of the Plant Registration Station.

An important addition to the equipment of the Station is the recent purchase of an 8-10 H.P. Simar Rototiller. It is hoped that this machine will be of great service not only for general cultivation, but also for tilling between the rows of certain crops, and keeping the spaces between the plots free of weeds.

The Society was invited to appoint two representatives to give evidence before the Departmental Committee on Agricultural Education and Research, and evidence was given by the Chairman of Directors, Mr James Elder, and the Director of Research, Mr Montagu Drummond. Emphasis was laid on the desirability of the Society being able to reckon upon a grant of a definite amount each year. This grant, it was pointed out, should be adequate not only to prevent a deficit, but to allow for the expansion that is necessary if the full usefulness of the Society is to be realised. The minimum sum which could be regarded as sufficient for this purpose was an annual grant of £1500.

Financial.

A slight decrease—about £95—in the Society's funds at the end of the third financial year, 31st March 1924, is shown by the audited accounts. In comparison with the previous year's accounts, on the income side there is an increase of £30 under "Life Subscriptions" and also an increase of £3 under "Annual Subscriptions," but there is a decrease of about £10 under "Donations." Interests received from investments show a decrease of about £100. This decrease in interest received is almost balanced by an increase of about the same amount by "Sale of Produce."

On the expenditure side, labour expenses have increased by nearly £182 on account of the normal expansion of the research programme. A start was made last year with the testing of new potato varieties in different localities; this is a new item of expenditure, and one which is likely to increase as the work of the Station progresses. A considerable reduction is shown under "Laboratory Expenses," but this is a figure that may fluctuate considerably from year to year. The figures under the other items approximate more or less closely to the figures under the corresponding items last year. Capital expenditure amounts to slightly over £117, and the amount included there for manures will, as usual, fall to be transferred to ordinary expenditure in next year's accounts.

In the Balance Sheet the principal assets remain at practically the same figures as last year. Investments, as before, are valued at cost.

A sum of £878, 10s. 4d. was received from the Development Fund through the Board of Agriculture for Scotland towards maintenance expenditure for the year ending 31st March 1923. In calculating the amount of this annual grant, Capital Expenditure, Income Tax, and the amount written off for Depreciation are not reckoned. This annual grant, which in no case will exceed £1100 in any one year, is an amount which, when added to the interest derived from the grant made from the Agriculture (Scotland) Fund in aid of capital, will be equivalent to two-thirds of the maintenance expenditure of the Society during the year. The Society's main source of income at present, apart from the grant from the Development Fund, is from investments, and the amount accruing from that source last year was £1856. Of that sum about £1237 is, for the purpose of grant, treated as interest on the capital sum of £22,500 originally received from the Agriculture (Scotland) Fund. It is evident, therefore, that the whole of the capital outlay on buildings and equipment has had to come out of the private subscriptions, and this method of calculating the grant greatly reduces the annual sum receivable each year as grant. The balance of income from investments, together with the ordinary income from other sources, is comparatively small, and cannot be estimated in advance with any certainty. It is therefore impossible for the Society at present to earn the maximum annual amount that might be obtained from the Development Fund—viz., £1100—without drawing on capital. It is obvious that if the capital funds of the Society are diminished, the Society's grant-earning capacity is also further reduced. While the assets of the Society at 31st March 1924 stand at slightly over £43,000, a very considerable part of that sum is invested in land, buildings, and equipment, from which practically no financial return is obtained. Further outlays in the matter of capital expenditure are urgent and necessary to further

progress at the Plant-Breeding Station, but this expenditure cannot be faced until there is an increase in the Society's funds or income.

The Wilson Memorial Fund shows an increase of £10, and now stands at £201, 5s.

Membership.

There is very little alteration in the membership of the Society since last year. Six life members and ten annual members were enrolled. Three members resigned and three died.

The Directors regret to find that so small a proportion of subscribers to the Preliminary Fund have become members of the Society. Increased membership will further assist the Society to attain the objects it has in view, and agriculturists will undoubtedly reap the benefits accruing from any improvements effected on crop plants. There is no gainsaying the fact that there is scope for such improvements. As an institute working for the national benefit, it is hoped the Society will not only receive hearty support from agriculturists all over Scotland, but also from manufacturers and merchants, even although their connection with agriculture may be less direct.

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

Chairman of Directors.

It is with deep regret that the Directors record the death, during the year under review, of Mr Charles Douglas, D.Sc., C.B., of Auchlochan, who acted not only as Convener of the Joint-Committee, whose efforts led to the formation of the Society in 1920, but as Chairman of the Board of Directors and as a Trustee of the Society from its institution up till the

date of his death. He rendered most valuable services to the Society, and his death is deeply deplored.

In March the Directors appointed to the office of Chairman, Mr James Elder, Athelstaneford Mains, Drem, and to the office of Vice-Chairman, Mr David Bell, 15 Coburg Street, Leith.

Trustees.

The death of Dr Douglas caused a vacancy in the Board of Trustees, and a further vacancy occurred in December 1923, when, through the change of Government, the Right Hon. Viscount Novar of Raith and Novar vacated the office of Secretary for Scotland. The Directors unanimously recommend that Viscount Novar be appointed a Trustee in room of the late Dr Douglas. The Right Hon. William Adamson, M.P., the present Secretary for Scotland, has kindly agreed to accept office as a Trustee.

Election of Directors.

In accordance with the rules of the Society, six Directors retire at this time. As there are still twelve of the original Directors elected in July 1922, the six to retire were determined by ballot, as provided by Rule 38 (*a*), and their names are as follows :—

Mr William Cuthbertson, V.M.H. (Messrs Dobbie & Co., Ltd.), Edinburgh.
Mr J. Inglis Davidson, Saughton Mains, Corstorphine.
Mr A. T. M'Robert (Aberdeen Lime Co., Ltd.), Aberdeen.
Mr G. G. Mercer, Southfield, Dalkeith.
Mr G. B. Shields, Dolphingstone, Tranent.
Sir David Wilson of Carbeth, Bart., D.Sc., Killearn.

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

Mr James Cruickshank, Kilmarnock Arms, Cruden Bay.
Mr James W. Drummond (Messrs W. Drummond & Sons, Ltd.), Stirling.
Mr James Gardner, South Hillington, Cardonald.
Mr A. W. McAlister, Seedsman, Dumfries.
Mr J. T. M'Laren, The Leuchold, Dalmeny.
Mr Robert Miller, Ferrygate, North Berwick.

ABSTRACT OF ACCOUNTS.

For year ended 31st March 1924.

INCOME.

		Year to 31st Mar. 1924.
Subscriptions—		
Life	£60 0 0	
Annual	69 10 0	
	£129 10 0	
Donations	31 18 3	
Interests	1,856 4 5	
Rents	20 0 0	
Income Tax Recovered	277 6 8	
Sale of Produce and Stock on Hand	276 6 7½	
Total Ordinary Income	£2,591 5 11½	
Grant from Board of Agriculture	878 10 4	
Investments realised	£1,000 0 0	
Total Extraordinary Income	£878 10 4	
Total Income	£3,469 16 3½	
Funds at 1st April 1923—	£43,097 9 4	
	£46,567 5 7½	

EXPENDITURE.

			Year to 31st Mar. 1924.
Salaries—			
Officers		£1,513 10 6	
Secretary and Office		220 0 0	
		£1,733 10 6	
Labour		723 6 5	
Seeds and Roots		18 0 4	
Manures		127 4 6	
Locality Trial of Potatoes		51 5 0	
Working Expenses, including renewals of Implements and Tools		279 6 0½	
Laboratory Expenses		26 12 6	
Library Expenses		27 6 6	
Rates and Taxes		276 10 2	
Insurances		24 15 0	
National Health and Unemployment Insurances		9 9 3	
Office Expenses		98 16 7½	
Advertising		0 11 7	
Heating, Lighting, and Cleaning		22 0 11	
Travelling Expenses		31 12 10	
Property Repairs		73 7 6	
Depreciation		41 5 5	
Total Ordinary Expenditure		£3,565 1 1	
Capital Expenditure—			
Laboratory Apparatus	£3 11 9		
Office Fittings	13 10 0		
Manures for Crop, 1924	100 5 2		
Investments made	£500 0 0		
Total Capital Expenditure	£117 6 11		
Funds at 31st March 1924, per Balance-sheet		43,002 4 6½	
		£46,567 5 7½	

BALANCE SHEET.

As at 31st March 1924.

LIABILITIES.

I. Accounts Outstanding	£98 2 9	
II. Funds at 31st March 1924	43,002 4 6½	
		£43,100 7 3½

DR WILSON MEMORIAL FUND.

Funds at 31st March 1924	£201 5 0	
		£201 5 0

EDINBURGH, *21st May* 1924.—I, the undersigned, having had access to all the Accounts, and verified the same with the Accounts and Vouchers relating thereto, now sign the same as found to be correct, duly vouched, and in accordance with law.

45 QUEEN STREET.

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

ASSETS.

I. House and Lands (at Cost)			£7,813 16 4
II. Implements and Tools			423 17 7
III. Laboratory Apparatus			196 15 2
IV. Office Fittings			102 19 7
V. Stocks on Hand			144 4 3
VI. Accounts Outstanding			56 4 8
VII. Investments at Cost:—			
1. £14,000 5 per cent War Stock, 1929/47	£12,390 0 0		
2. £14,000 4 per cent Funding Stock, 1960/90	10,045 0 0		
3. £16,900 3½ per cent Conversion Stock	11,140 3 6		
4. £500 Edinburgh Corporation Loan	500 0 0		34,075 3 6
(Value at 31st March 1924)—			
1.	£14,280 0 0		
2.	12,110 0 0		
3.	12,844 0 0		
4.	500 0 0		
	£39,734 0 0		
VIII. Cash Balances—			
In Bank—			
On Current Account	£258 16 11		
On Hand	28 9 3½		287 6 2½
			£43,100 7 3½

MEMORIAL FUND.

Value at 31st March 1924.		
£204 0 0	£200 5 per cent War Stock, 1929/47—valued at date of transfer	£176 5 0
	Interest to date	25 0 0
		£201 5 0

Books and Accounts of the Society, and having examined the foregoing Statement of

BALANCE SHEET.

As at 31st March 1924.

LIABILITIES.

I. Accounts Outstanding	£98 2 9	
II. Funds at 31st March 1924	43,002 4 6½	
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		£201 5 0

Books and Accounts of the Society, and having examined the foregoing Statement of

Year 1923-24.

ANALYSIS OF MEMBERS.

Aberdeen	5	Linlithgow	2
Argyll	2	Mid-Lothian	20
Ayr	21	Moray	2
Banff	1	Nairn	..
Berwick	9	Orkney	2
Bute	..	Peebles	3
Caithness	1	Perth	13
Clackmannan	..	Renfrew	15
Dumbarton	2	Ross and Cromarty	5
Dumfries	10	Roxburgh	4
East Lothian	23	Selkirk	..
Fife	14	Shetland	..
Forfar	7	Stirling	1
Inverness	..	Sutherland	1
Kincardine	1	Wigtown	3
Kinross	2	England	1
Kirkcudbright	8		
Lanark	4		182

Life Members	95
Annual Members—	
£1 rate	58
10s. rate	29
	182

ESTABLISHMENT FOR 1923-24.

BOARD OF DIRECTORS.

Trustees.

THE RIGHT HON. VISCOUNT NOVAR OF RAITH AND NOVAR, P.C., G.C.M.G., Secretary for Scotland.
CHARLES DOUGLAS, D.Sc., C.B., of Auchlochan, Lesmahagow. (*Deceased.*)
JAMES ELDER, Athelstaneford Mains, Drem.
DAVID BELL, 15 Coburg Street, Leith.
JOHN FINLAYSON M'GILL, 69 Kyle Street, Ayr.

Ordinary Directors.

1922.

D. L. BOWE (Messrs J. H. Bowe & Sons), Dunbar.
Sir JAMES CAMPBELL, LL.D., 14 Douglas Crescent, Edinburgh.
WILLIAM CUTHBERTSON, V.M.H. (Messrs Dobbie & Co.), Edinburgh.
J. INGLIS DAVIDSON, Saughton Mains, Corstorphine.
LORD FORTEVIOT, Dupplin Castle, Perth.
J. H. MILNE HOME, Irvine House, Canonbie.
JOHN M'CAIG of Belmont, Stranraer.
A. T. M'ROBERT (Aberdeen Lime Co.), Aberdeen.
G. G. MERCER, Southfield, Dalkeith.
Principal W. G. R. PATERSON, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow.
G. BERTRAM SHIELDS, Dolphingstone, Tranent.
Sir DAVID WILSON of Carbeth, Bart., D.Sc., Killearn.

1923.

Sir ISAAC CONNELL, S.S.C., 18 Duke Street, Edinburgh.
JAMES HISLOP ELDER, B.Sc., Athelstaneford Mains, Drem.
CHARLES E. GREGOR, Innerwick, East Lothian.
THOMAS HOGG (Messrs Alex. Cross & Sons), 19 Hope Street, Glasgow.
WILLIAM J. REID, Fordhouse of Dun, Montrose.
JOHN SPEIR, Newton Farm, Hallside, Glasgow.

Directors Co-opted.

JAMES W. DRUMMOND (Messrs W. Drummond & Sons, Ltd.), Stirling.
JAMES GARDNER, South Hillington, Cardonald.
J. T. M'LAREN, The Leuchold, Dalmeny.

Directors nominated by the Board of Agriculture.

Sir ROBERT B. GREIG, M.C., LL.D.,
JAMES WOOD, O.B.E., M.A., B.Sc.,
T. ANDERSON, M.A., B.Sc.,
ALEXANDER M'CALLUM, M.A., LL.B.,
} York Buildings, Queen Street, Edinburgh.

Chairman of Directors—CHARLES DOUGLAS, D.Sc., C.B., of Auchlochan, Lesmahagow. (*Deceased.*)
Vice-Chairman—JAMES ELDER, Athelstaneford Mains, Drem.
Director of Research—MONTAGU DRUMMOND, B.A., F.R.S.E., F.L.S., Craigs House, Corstorphine.
Secretary—JOHN STIRTON, 3 George IV. Bridge, Edinburgh.
Assistant Director and Assistant Secretary—WILLIAM ROBB, N.D.A., Craigs House, Corstorphine.

COMMITTEES.
1923-24.

RESEARCH.

G. Bertram Shields, *Convener.*
T. Anderson.
William Cuthbertson.
J. W. Drummond.
James H. Elder, B.Sc.
James Gardner.
Sir Robert B. Greig.
Thomas Hogg.
J. F. M'Gill.
A. T. M'Robert.
Principal W. G. R. Paterson.
William J. Reid.
Sir David Wilson, Bart., D.Sc.
Charles Douglas, D.Sc., C.B., *Chairman, ex officio.* (*Deceased.*)
James Elder, *Vice-Chairman ex officio.*

MANAGEMENT.

David Bell, *Convener.*
D. L. Bowe.
J. Inglis Davidson.
Charles E. Gregor.
J. H. Milne Home.
J. T. M'Laren.
G. G. Mercer.
G. Bertram Shields.
John Speir.
James Wood.
Charles Douglas, D.Sc., C.B., *Chairman, ex officio.* (*Deceased.*)
James Elder, *Vice-Chairman, ex officio.*

FINANCE.

J. H. Milne Home, *Convener.*
David Bell.
Sir James Campbell, LL.D.
Sir Isaac Connell, S.S.C.
Lord Forteviot.
John M'Caig.
Alex. M'Callum.
G. Bertram Shields.
Charles Douglas, D.Sc., C.B., *Chairman, ex officio.* (*Deceased.*)
James Elder, *Vice-Chairman, ex officio.*

REPORT

BY

DIRECTOR OF RESEARCH.

I. Research Programme—for 1923.

A. Cereals.

Oats.—Area, 6 acres. Division VI. (Experimental), Divisions IV. and VII. (Multiplication and Commercial).

Manuring :—

Breeding Plots—

Superphosphates . . .	2 cwt. per acre.

Other Plots—

Superphosphates . . .	2 cwt. per acre.
Muriate of Potash . .	½ „ „
Sulphate of Ammonia . .	¾ „ „

Breeding.—The work with Potato, Sandy, and Tam Finlay hybrids is being continued on the same lines as indicated in previous reports. Over 200 selections from fifteen distinct hybrids, ranging from the F_2 generation upwards with these varieties, were under experiment. Some of these are now thought to be fixed, and are ready for small comparative trials and multiplication. Most of these fixed hybrids are in the sixth generation. Experiments are being carried out in order to find a suitable method of testing the yielding capacity of hybrid selections at an early stage. It is necessary to test at the earliest stage as many hybrid selections as possible. The quantity of seed available at this period is small, and as it is necessary to keep the stock absolutely pure, replication of plots is not possible on a field scale, if only because it greatly increases the possibility of admixture. The method of testing which is being tried is to make comparisons on the basis of the yield of grain from a known and fairly large number of plants. Sowing the grain thinly in the breeding plot largely reduces the effects of interference, and also allows of individual plants being selected and harvested separately. Damaged or abnormal plants are kept separate at harvest, and their yields not included in the test figures. The experiments have not yet reached a stage at which definite con-

clusions can be drawn regarding this method of comparison, but there are indications that it will prove useful, at any rate in the early stages of selection. Later on it may be possible to compare the performance of selections in field plots with their earlier performance in the small plots at present being tried. Pure line selections of Potato, Sandy, and Victory will be used as controls. All small plots from which yields of grain had to be determined were covered by nets in order to prevent damage by birds. It is found that small plots, if not protected, suffer much from damage by birds, the smaller plots apparently suffering more severely than the larger plots.

In addition to the above-mentioned Potato, Sandy, and Tam Finlay hybrids, selections from seven hybrids from other varieties, ranging from F_2 generation upwards, were under experiment. From these crosses selections were also made, all of which are as yet unfixed.

In previous years considerable loss has been occasioned in the F_1 generation through damage by wireworm and other pests. In 1923 all F_1 oat hybrids (eleven in number) were grown in pots during the entire season, and this method proved advantageous in many ways. Eleven hybrid grains were sown. Ten germinated and produced strong plants, which yielded an average quantity of grain. Incidentally, note-taking on these plants was greatly facilitated by having them grown in pots. Also, when the plants are grown under glass, the natural colour of the grain can generally be more accurately discerned than when the plants are grown in the open, while the grain ripens as well as, if not better than, in the field.

Inheritance of Ear-Type.—The experiments on the inheritance of ear-type were continued, and further data obtained. It is evident that inheritance of ear-type is of a complex nature. The many types of ears found to occur intermediate in form between the two extremes of open panicle, such as in Tam Finlay and the close type of panicle such as in Giant Yellow or Storm King, make accurate classification of ear-types genetically most difficult. In order to test the classification in the F_2 generation, it is necessary to go on to the third generation. The loss of many F_3 generation plants in 1922 has greatly interfered with this line of work; a fresh start will have to be made with the progeny of another F_1 hybrid plant. It may seem at first sight that this line of work has

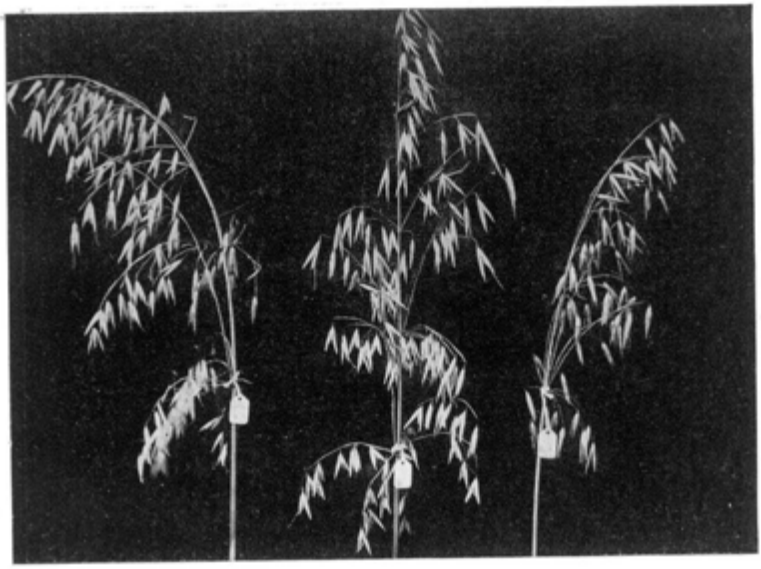

FIG. 1.

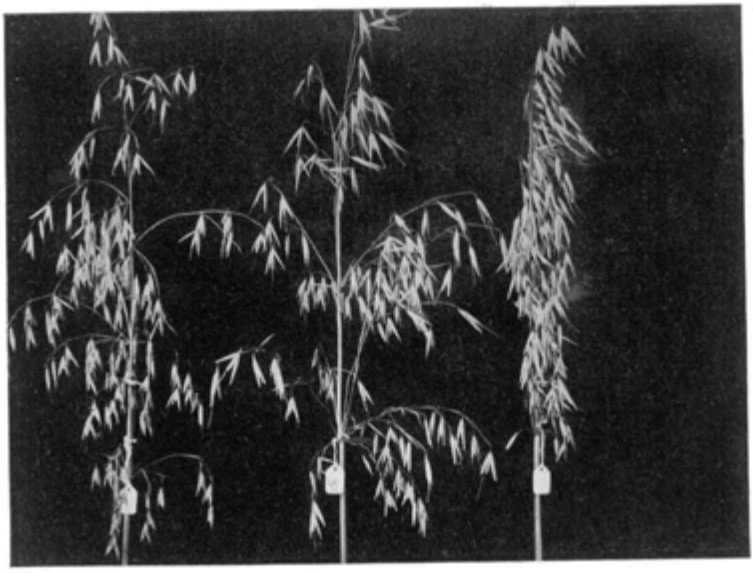

FIG. 2.

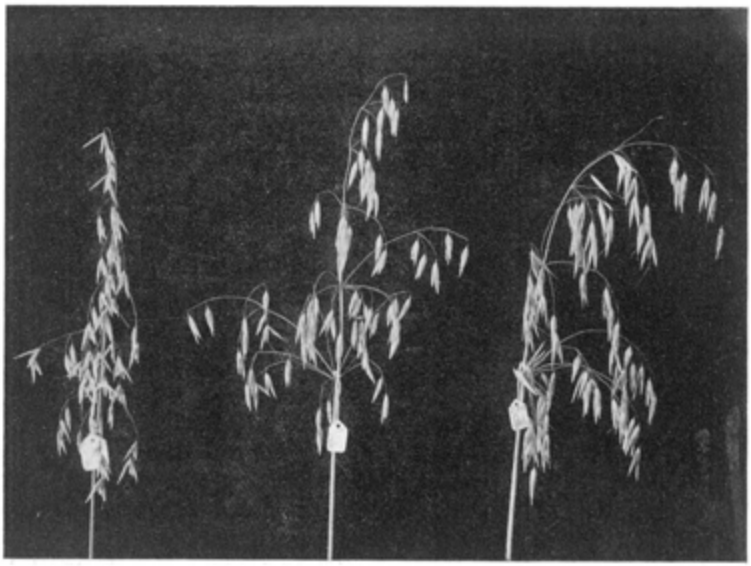

FIG. 3.

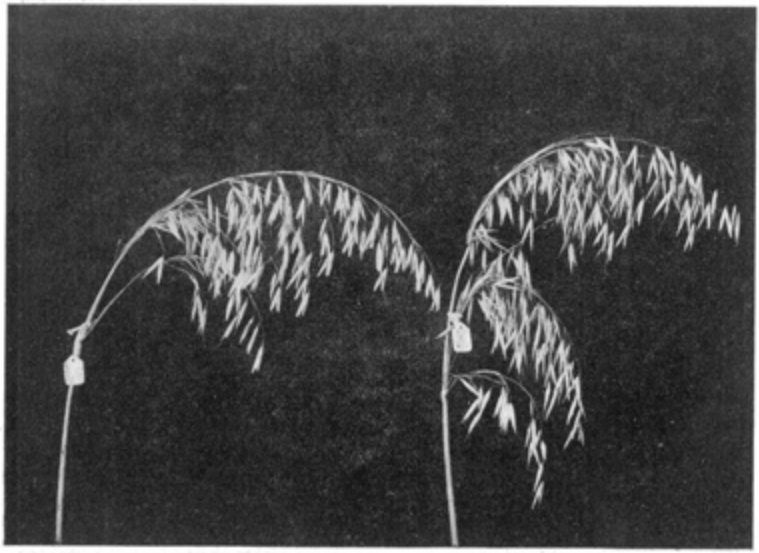

FIG. 4.

little practical bearing; but when it is remembered that crosses between these ear-types are likely to be made, and that the progeny of any of these crosses must be fixed—*i.e.*, breed true to type—before they can be tested, it will be evident that it is most important that the various genetic types should be distinguishable at as early a stage as possible. The main practical difficulty is to distinguish variations from fluctuations. Variations are heritable differences, but fluctuations are not held to be heritable. In the F_3 generation, which was grown in 1923, ear-types appeared which had not been observed in the F_2 generation. Whether these types are variations or fluctuations is not known, but it is hoped further breeding from them may give some indication of their genetic constitution. Representative types of these have been photographed, and it is intended to sow grain from the photographed ears, and to compare the ear-types in the progeny with that of the parent. Figs. 1, 2, 3, and 4 illustrate some of the different forms of ear-type found in the F_3 generation.

The following list shows the pedigrees, the number of selections, and the age of the various hybrids grown last year :—

TABLE I. Oat Hybrids Grown, 1923.

Parentage.	Generation.	Number of selections sown.
Golden Rain × Leader . . .	F_6	7
Sandy × Golden Rain . . .	F_6	9
Potato × Daubeny	F_6	2
Potato × Leader	F_6	7
Potato × Leader	F_6	3
Huskless × Daubeny	F_3	14
Algerian × Leader	F_6	7
Sandy × Leader	F_6	6
Sandy × Leader	F_5	27
Sandy × Daubeny	F_6	14
Sandy × Giant Yellow . . .	F_6	10
Eighty Day × Beseler's Prolific . .	F_4	26
Sandy × Record	F_4	39
Sandy × Record	F_4	7
Sandy × Record	F_4	6

TABLE I.—*continued.*

Parentage.	Generation.	Number of selections sown.
Sandy × Record	F_4	2
Sandy × Victory	F_3	6
Sandy × Eighty Day	F_3	10
Tam Finlay × Giant Yellow	F_3	52
Potato × Victory	F_3	67
Castleton Potato × Beseler's Prolific	F_3	25
Castleton Potato × Beseler's Prolific	F_3	8
Victory × A. sterilis	F_3	7
Beardless Propsteier × Eighty Day	F_4	8
Potato × No. 9 (3)	F_3	12
Tam Finlay × Beseler's Prolific	F_3	8
Crown × Potato	F_2	1
Potato × Crown	F_2	1
Victory × Glebe	F_2	1
Sandy × Huskless	F_1	
Potato × Record	F_1	
Victory × Potato	F_1	
Victory × Golden Rain	F_1	
Golden Rain × Huskless	F_1	
Golden Rain × Potato	F_1	
Victory × Red Oat	F_1	
1000 Dollar × Eighty Day	F_1	
Red Oat × Castleton	F_1	
Tam Finlay × Propsteier	F_1	
Tam Finlay × 1000 Dollar	F_1	

Frit-fly caused comparatively little damage, but a portion of the ground occupied by breeding plots was found to be badly infested with eel-worms, and as a result all the selections in the area were almost entirely destroyed.

Named Varieties and Pure Lines.—The work of forming and maintaining a representative living collection of named varieties was continued; a considerable addition of named varieties has been made to the list given in last year's report. The table shows the varieties grown at the Station. Many of the varieties are pure-line selections, and small quantities of some of these could be supplied on demand to Agricultural

Research Stations to work up stocks of genetically pure material for experiments on manuring, &c.

TABLE II. Oats—Collection of Named Varieties.

*=Pure Lines.

Name of Variety.	Station Number.	Name of Variety.	Station Number.
A. fatua		1000 Dollar	Aa 25*
A. sterilis		Dun	,, 384
A. strigosa		Early Champion	,, 53*
Abundance	Aa 393	,, Hamilton	,, 12*
Algerian (Black)	,, 95	,, Siberian	,, 368*
,, (Red)	,, 94	Echo	,, 405
,,	,, 62*	Eighty Day	,, 21*
,,	,, 96	Fortuna	,, 407
Ascot	,, 44	Fulghum	,, 52*
Aurora	,, 50	Garris	,, 104
Banner	,, 38	Giant Yellow	,, 61*
Beardless Propsteier	,, 31*	Glebe	,, 97*
Bell	,, 76*	,,	,, 17*
Beseler's Prolific	,, 27	Golden Rain	,, 65*
,, ,,	,, 32	Gordon	,, 385
,, ,,	,, 287	,,	,, 378
Big Four	,, 383	,,	,, 379
,, ,,	,, 389	,,	,, 380
Black Mesdag	,, 77*	Grange	,, 18*
Black Mogul	,, 89	Hamilton	,, 20*
Black Tartarian	,, 93	Hardy Winter	,, 74*
Blainslie	,, 8	Hedehavre	,, 19
Californie	,, 49*	,,	,, 72
Captain	,, 48*	Hero	,, 39
Castleton Potato	,, 11*	,,	,, 40
,, Sandy	,, 381	Huskless	,, 1*
Comewell	,, 59	Hutcheson	,, 73*
Crown	,, 29*	Idamine	,, 386
Culberson	,, 70	Iowar	,, 58
Dala	,, 22*	Joanette Hybrid	,, 75
Daubeny	,, 23*	Kent Berlie	,, 13*

TABLE II.—*continued.*

Name of Variety.	Station Number.	Name of Variety.	Station Number.
Kherson . . .	Aa 63*	Sandy	Aa 5*
Kinness	,, 26*	,, ...	,, 6*
Leader	,, 47*	,, ...	,, 403
Liberty	,, 412	Scots Berlie . .	,, 15*
Lincoln	,, 394	,, ,, . .	,, 16
,, ...	,, 377	Sir Douglas Haig .	,, 90
Ligowo	,, 28*	Sixty Day . . .	,, 60*
Mansholts III. . .	,, 101	Sparrowbill . . .	,, 56*
Myrtle	,, 91	Stable King . .	,, 392
,, ...	,, 92	Storm King . .	,, 45*
Naked × Polish .	,, 409	Supreme . . .	,, 88
New Ascot . . .	,, 33	Swedish Select . .	,, 35
New Sandy . . .	,, 411	,, ,, . .	,, 391
Odal (1)	,, 36	Tam Finlay . .	,, 7*
,, (2)	,, 37	,, ,, . .	,, 382
Orion	,, 340	Tersets Potato . .	,, 410
Ostend's Glory . .	,, 57	Trifolium . . .	,, 103
Potato	,, 10*	Triumph . . .	,, 46*
,, ...	,, 396	Triumphal . . .	,, 388
,, ...	,, 397	Tyrone Tawny . .	,, 71
,, ...	,, 398	Victory	,, 30*
,, ...	,, 399	Waverley . . .	,, 9
,, ...	,, 400	Wexford Tawny .	,, 68
,, ...	,, 401	White Horse . .	,, 395
,, ...	,, 402	,, ,, . .	,, 34
Prolific Pfeffelbacker	,, 43	White Russian . .	,, 54
Record	,, 24*	,, ,, . .	,, 55
,, ...	,, 41	,, ,, . .	,, 404
Red Oat . . .	,, 66*	Wide Awake . .	,, 440
Red Rustproof . .	,, 67*		
Richland . . .	,, 51*	,, ,, . .	,, 441
Ruakuras . . .	,, 406	Winter Turf . .	,, 69*
Sandy	,, 2*	Wisconsin . . .	,, 390
,, ...	,, 3*	Yellow Naesgaard .	,, 64
,, ...	,, 4*	Yielder	,, 42*

The pure-line stocks of Potato, Sandy, and Tam Finlay were further multiplied.

The varieties raised by Dr Wilson, Glebe and Kinness, were also multiplied, and were grown in triplicate $\frac{1}{10}$th acre plots. The following results were obtained :—

	Plots 12 and 13.		Plots 14 and 15.		Plots 16 and 17.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
Kinness .	254 lb.	349 lb.	245 lb.	323 lb.	265 lb.	392 lb.
Glebe .	314 ,,	385 ,,	294 ,,	333 ,,	278 ,,	305 ,,

The calculated yield of grain per acre works out at 70 bushels (42 lb.) in Glebe and at 60 bushels (42 lb.) in Kinness. Pure-line stocks of standard named varieties were not available in sufficient quantity to sow $\frac{1}{10}$th acre plots for comparison.

Samples of Glebe and Kinness oats were sent for preliminary trial in East Lothian, and as a result it is intended to test Glebe oat, which promised well, on a larger scale.

Two acres of Orion oats were grown. This is a black oat obtained from Sweden, and it ripens remarkably early. It ripened about ten days earlier than the next earliest ripening oat at the Station, and about the same time ahead of any other oats observed growing in the neighbourhood. It was thought that there might be a demand in late districts for such an early ripening oat, but the demand was disappointing. The oat, however, will again be tried in various late districts in the coming year. Attempts to cross Orion with later ripening white oats have failed in previous years, but a fresh effort is being made to obtain such hybrids, which might be expected to prove of much value.

Four other varieties were grown in $\frac{1}{2}$ acre plots as commercial samples.

Barley and Wheat.—Thirty-one varieties of barley were grown in small plots. Fifteen samples were Common Scotch Barley, each sample being from a different district, and selections were made from these samples for further experiment. About fifty varieties and species of wheat were grown in breeding plots. The expansion of the oat-breeding work, which, so far as Scotland is concerned, is probably more important than wheat-breeding, precludes, under present

arrangements as regards staffing, any further expansion of the work with barley and wheat.

B. Potatoes.

Area, 4 acres: 1 acre Experimental, 3 acres Multiplication and Commercial. Division I., Experimental and Multiplication; Division XI., Multiplication and Commercial.

Manures—

Stable Manure	15 tons per acre.
Superphosphates 30 per cent .	3 cwt. „ „
Sulphate of Potash . . .	2 „ „ „
Sulphate of Ammonia. .	1 „ „ „

The potato-breeding work continues on the lines as described in previous reports.

Seedlings (raised from true seed in 1923).—About 11,000 seeds, representing the produce of over 100 berries or " plums," were sown under glass and grown in the usual way at the Station. In accordance with the Sub-Committee's instructions, preference in selecting seed for sowing was given to the seeds raised by the late Dr Wilson, only three samples of seed secured at the Station being sown. The Wilson seeds range in age from about five years to fourteen years. Much of the oldest seed failed to germinate. From the seedlings obtained, over 1000 were selected and planted out in the field. A considerable proportion of the seedlings in certain series ripened or died down early in the season. Tubers from many of these were retained for further trial, although the yield was low, in view of the possibility of discovering early ripening types. There is reason to believe that in the seedling stage early ripening types on the whole may be relatively more tender than late ripening types. It has been noted that amongst the Wilson varieties which have so far been tested at the Station no immune first early varieties have been observed. In addition to the early ripening types referred to above, selections from amongst the other seedlings were also made at harvest time. All the selected seedlings were examined in store during the winter and undesirable types eliminated. The total yield and number of tubers per plant and other data were noted.

Trials of Varieties and Selections raised from Seed prior to year 1923. These trials, as in previous years, were divided into five classes, 100-tuber tests, 50-tuber tests, 25-tuber tests, 12-tuber tests, and 5-tuber tests. The 25-tuber, 12-tuber, and 5-tuber tests were not replicated, the 50-tuber tests were laid down in duplicate, the 100-tuber tests in quadruplicate. Standard named varieties, grown in the previous year at the Station, were grown in the plots as controls. The selections of unnamed seedling varieties in these trials numbered over 300. In a summary report it is obviously impossible to give a detailed account of the results of the trials, but it may be of general interest to give the results of the tests in the 100-tuber, 50-tuber, and also those from a number of the 25-tuber tests along with the data obtained from the controls. It is to be noted that representative samples of all the selections named in the list were found to be free from Wart Disease in the first year immunity trials. The cropping power in a number of the selections compares favourably with that of the controls of similar ripening period. The Potatoes Sub-Committee inspected the trials twice during the season, and adjudged three varieties as of outstanding merit. It is generally recognised that Leaf-roll and Mosaic diseases are the cause of the " degeneration " in many potato varieties. These diseases occur freely at the Plant-Breeding Station, but their presence may not be entirely disadvantageous, as the frequency with which they occur provides a means of eliminating in the early stages the most susceptible types. Certain varieties seem less susceptible than others, and the policy pursued at the Station is not to multiply any selections which are markedly susceptible to attacks of these diseases. It falls to be recorded that a few selections which promised well in 1922 dropped down very appreciably in cropping capacity in 1923 as a result of attack of Leaf-roll Disease, and consequently they have been discarded.

Attempts have been made to ascertain the cooking quality of a number of the selections. There is reason to assume that cooking quality in potatoes depends to a large extent on soil conditions and on the quantity of and the ingredients in the manures applied to the crop. Nevertheless, it is probable that certain varieties may be more readily adversely affected as regards " quality " than others as the result of unfavourable conditions.

Table III. shows the yields, &c., of selections in the 100-tuber, 50-tuber, and 25-tuber tests.

The figures in the third column ("Ripening Period") have the following significance :—

(1) Varieties which began to wither before 31st August.

(2) Varieties which began to wither after 31st August and before 21st September.

(3) Varieties which began to wither after 21st September and before 10th October.

(4) Varieties which began to wither after 10th October.

TABLE III. POTATOES, TRIALS OF UNNAMED SEEDLINGS.

I.=Immune. S.=Susceptible.

Reference Number.	Average yield of Tubers per Plant.	Ripening Period.	Ware.	Seed and Small.	Immunity.
			100-TUBER TRIALS IN QUADRUPLICATE PLOTS OF 25 TUBERS EACH.		
	lb.		Per cent.	Per cent.	
480 (*a*) (41)	4.39	3	82.22	17.78	I.
456 (*a*) (1)	3.75	4	75.09	24.91	I.
884 (11)	3.7	4	58.76	41.24	I.
878 (3)	3.5	4	87.22	12.78	I.
884 (2)	3.1	3	78.54	21.46	I.
884 (3)	2.8	3	74.79	25.21	I.
40 (2)	2.6	4	69.43	30.57	I.
916 (2)	2.37	3	68.18	31.82	I.
142 (6)	2.01	4	72.73	27.27	I.
			50-TUBER TRIALS IN DUPLICATE PLOTS OF 25 TUBERS EACH.		
1 (13)	3.9	3	84.76	15.24	I.
480 (*a*) (13)	3.85	4	88.16	11.84	I.
480 (*a*) (14)	3.85	4	77.22	22.78	I.
884 (1)	3.8	4	86.53	13.47	I.
1 (22)	3.7	3	81.52	18.48	I.
655 (2)	3.4	3	69.38	30.62	I.
1 (21)	3.2	3	89.48	10.52	I.

TABLE III.—*continued.*

50-TUBER TRIALS IN DUPLICATE PLOTS OF 25 TUBERS EACH—*continued.*

Reference Number.	Average yield of Tubers per plant.	Ripening Period.	Ware.	Seed and Small.	Immunity.
	lb.		Per cent.	Per cent.	
480 (*a*) (7)	3.2	2	56.97	43.03	I.
480 (*a*) (42)	3.2	4	76.35	23.65	I.
296 (1)	2.9	3	80.26	19.74	I.
1 (12)	2.6	2	85.32	14.68	I.
1 (17)	2.3	2	48.95	51.05	I.
1 (35)	2.2	3	87.41	12.59	I.
25-TUBER TRIALS.					
480 (*a*) (48)	4.08	4	90.29	9.71	I.
480 (*a*) (10)	2.9	2	47.76	52.24	I.
480 (*a*) (23)	2.8	2	88.98	11.02	I.
1 (36)	2.7	3	69.17	30.83	I.
1 (19)	2.6	3	87.81	12.19	I.
1 (25)	2.3	2	71.77	28.23	I.
1 (39)	2.3	2	80.76	19.24	I.
560 (4)	2.3	2	82.49	17.51	I.
1 (6)	2.2	2	83.75	16.25	I.
1 (43)	1.8	2	79.47	20.53	I.
480 (*a*) (37)	1.72	3	48.84	51.16	I.
626 (*b*) (7)	1.4	4	94.33	5.67	I.
CONTROLS (100 TUBERS OR MORE).					
Epicure . . .	4.0	1	41.89	58.11	
Tinwald Perfection .	3.8	3	80.59	19.41	
Great Scot . .	3.5	2	91.22	8.78	
King Edward . .	3.4	3	86.48	13.52	
Majestic . . .	3.3	2	91.45	8.55	
Kerr's Pink . .	3.2	3	82.26	17.74	
Witchhill . . .	3.2	2	63.46	36.54	
Templar . . .	3.1	4	71.66	28.34	
Arran Chief . .	2.0	3	80.17	19.83	
Midlothian Early .	1.9	1	73.07	26.93	

As described in last year's Report, comparisons of yields are made on the basis of the average yield per plant from a known number of plants taken consecutively in the drill.

" Seed " includes all tubers passing through a $1\frac{3}{4}$" riddle.

" Ware " includes all tubers passing over a $1\frac{3}{4}$" riddle.

5-*Tuber Tests of Seedlings selected in* 1922.—Included in the above-mentioned figure of 300 selections as being under trial are over 200 5-tuber tests of seedlings raised in 1922. Comparative data have been obtained regarding these selections also, and single-tuber samples from each selection were sent to the Wart Immunity Trials conducted by the Board of Agriculture for Scotland at Philpstoun in 1923.

Wart Immunity Trials.—One-tuber samples from 668 seedlings, including samples from almost all those included in the 5-tuber tests, were sent to the trials referred to. In a few instances tuber samples from all the seedlings derived from a berry were sent, in order to have as large a number of seedlings as possible tested for Wart Immunity, and thus obtain more reliable figures regarding the percentage immunity in particular crosses. In some of the crosses a very high proportion of the seedlings was affected with Wart Disease. One series of seedlings (Up-to-Date × Majestic) was of particular interest on account of the large number of seedlings available for planting (207 seedlings), all of which were the produce of one berry, or " plum." From the official report at least 77 per cent of the seedlings from this particular cross were affected with Wart Disease. The result is approximately in accordance with the Mendelian Ratio of 3 to 1, with immunity as the recessive character. The parents of this series of seedlings are heavy croppers and of good shape, but the seedlings as a whole were very inferior both as regards habit of growth and cropping power. It was disappointing to find that the most promising seedlings of the series were affected with Wart Disease. Amongst the imunnes very few were held to be of average merit as seedlings.

The high proportion of non-immune and worthless plants and the large amount of variation found in this series of seedlings are worthy of note. Indications of the same results being obtained from various other crosses lend further evidence in support of the opinion that it is most desirable from the breeders' point of view that some homozygous strains should be evolved for breeding purposes, a line of work which is now in progress at the Station.

Tubers from some of the most promising seedlings which, as stated above, were found to be affected with Wart Disease have been retained for breeding in order to find out how they breed when selfed. It is well known that immunity to Wart Disease is recessive to non-immunity ; it therefore seems desirable to obtain an F_2 generation and also progeny from succeeding generations for study, as it might be found that on selfing some of the desirable types of non-immunes of the F_1 generation desirable immune plants might be obtained.

TABLE IV. POTATOES, RESULTS OF IMMUNITY TRIALS AT PHILPSTOUN.

Reference Number of Series.	Number of tubers from series.	Number free from Wart Disease.	Number affected with Wart Disease.	Number failed to grow.
3	7	4	2	1
4	3	3	—	—
6	6	—	5	1
8	3	2	1	—
9	4	4	—	—
10	22	14	5	3
11	2	2	—	—
12	208	46	158	4
13	11	4	7	—
14	1	—	1	—
15	5	1	4	—
16	25	4	21	—
17	25	13	11	1
18	35	20	14	1
681 (*b*)	5	3	2	—
682	6	2	3	1
690 (*a*)	10	3	7	—
701	6	2	4	—
704	4	3	1	—
716	2	1	1	—
724	8	5	3	—
725	3	3	—	—
962 (*c*)	1	1	—	—
966 (*c*)	2	1	1	—
988 (*a*)	3	3	—	—
990 (*b*)	3	3	—	—
993 (*d*)	5	3	1	1

In order to obtain fuller information regarding the cropping power, &c., of certain promising seedlings under different conditions, samples were sent for trial in various districts—*viz.*, in the counties of East Lothian, Midlothian, Stirling, Renfrew, Ayr, Aberdeen, and Forfar. As was to be expected, the reports vary. Two varieties which were most widely distributed did not come up to expectations, but samples are again to be under trial. It is now thought from the results obtained at the Station that these varieties are proving too susceptible to virus diseases to be of commercial value.

Named Varieties.—Forty-five named varieties were grown in small plots for observation and for breeding purposes.

Hybridisation.—A considerable amount of time was spent during the season in crossing and selfing certain varieties, as far as possible under control, by using Pergamine paper bags or special boxes to exclude the entrance of pollen-carrying insects.

C. Herbage Plants.

Perennial Rye-grass.

Pedigree Culture.—The controlled seedings of 1922 were sown, but only eight of them brairded at all, and in every case the seedlings obtained were few. This result is almost certainly due to self-sterility (see below). The plants chosen for seeding in 1922 were one year old; in 1923 many of them proved to have no permanence, and to be poor tillerers. It would therefore seem advisable, in regard to pasture types, to select parents from plants at least three years old. The prevalence of self-sterility has been confirmed this year. One wild and presumably permanent type (Ca 134) produced two seeds on selfing, and the seedlings are being grown on; the parent has been divided up for vegetative multiplication.

Phenotype Crossing (*i.e.*, crossing between plants of similar external appearance).—As pure-line work, if it proves practicable at all, will necessarily proceed very slowly, phenotype crossing of selected plants has been started as well, *e.g.* :—

Ca 134 × Ca 85
Wild Type Compromise Type; [1]
(hand pollinated) produced one seed.

Ca 41 × Ca 134
Grazing Type Wild Type;
(hand pollinated) one spike, produced seventeen seeds

[1] Type which is fairly leafy, but also seeds well.

In addition, 25 natural seedlings of Ca 134 were obtained.

Clones.—(Vegetative multiplication.)

Ca 134. See above.

Ca 41 (1921 seedling, grazing type). There are now three plots of this, each containing 54 plants.

Commercial Strains.—Nine rows, each 16 yards long, of various commercial strains, were sown in the open in late autumn. The severe winter killed about 90 per cent of these; the survivors are being grown on for further tests of hardiness and general suitability.

1921 *Seedlings.*—22 per cent of these died from natural causes, and a further 21 per cent have been rejected as worthless. About 60 per cent remain for further study and selection.

Cocksfoot.

Of the 1922 seedlings nine brairded, some very well, others poorly or not at all. Taking this year's experience into account, the general conclusion regarding self-fertility in Cocksfoot is that it varies very much from plant to plant.

Broad-leaved Type.—The 1921 seedling Cc 8, which was considered a good type, was selfed in 1922, natural seed being obtained at the same time. Both strains seem very uniform, and, on the whole, like the parent.

Narrow-leaved Type.—A number of plants of narrow-leaved type have been collected, and are proving of interest. Several distinct and promising wild types have been collected in various parts of Scotland by Mr J. W. Gregor. As far as the evidence so far obtained goes, these appear to be retaining their natural characteristics under cultivation.

Clones.—A few types are being multiplied vegetatively for experimental purposes.

Early and late types for hay have been obtained from Mr J. F. M'Gill and Mr J. H. Elder, and are being kept under observation in small plots.

Timothy.

Eight of the 1922 selfings produced plants. Self-fertility seems to vary from plant to plant even more than in Cocksfoot; the results of 1922 in this respect have been confirmed this year. For purposes of crossing, self-sterility may prove an advantage in Timothy, as hand crossing is very difficult. Several crosses have been carried out on these lines; a self-

sterile plant is used as the female parent, its spike being enclosed, without castration, in a hybridising box together with spikes of a male parent of different type. Among the 1921 seedlings two seem worth attention, one being very leafy though tall, the other with unusually erect foliage. A number of obviously inferior seedlings have been discarded.

Clovers.

Wild Red Clover.—Natural seed has been saved from selected plants of various strains—*e.g.*, a strain 14″ high, very leafy at base (pasture type), a second strain 36″ high, leafy on stems, but not at base (hay type).

It has proved impracticable, with the staff available, to carry on more than a minimum of work on clovers.

Lucerne.

The advantage of inoculation at time of sowing was confirmed on the sample of soil from Forgandenny sent by Mr J. J. Calder for this purpose. Mr Calder expressed his satisfaction with the test, and his intention of growing twelve acres of Lucerne if bacterial cultures could be obtained for inoculation. It is suggested that the Plant-Breeding Station might undertake soil tests in this connection, a small fee being charged.

General Technique.

Mr J. W. Gregor, who is in general charge of the herbage work, has been largely occupied with such general questions as self-fertility, the best methods of isolation, &c. The results regarding self-sterility may be summarised as follows :—

It is very pronounced in Italian Rye-grass, of which about half a dozen strains have been tested ; also in Perennial Rye-grass, though less so. Cocksfoot varies. Some plants when selfed produce 50 per cent seed (equal to average natural seeding) ; others are quite self-sterile. Timothy resembles Cocksfoot, but is never quite self-sterile.

Methods of Isolation.—Waterproof paper bags are satisfactory for indoor work ; for work in the open an isolation box of special pattern designed by Mr Gregor has proved satisfactory and reasonably cheap. Various interesting observations on the best stage for pollination, on the viability of pollen and the

general conditions of fertilisation, in so far as such delicate physiological points can be determined with the appliances available at the Station, have been carried out, and a number of points of great importance for technique ascertained.

D. Swedes and Turnips.

The work on Swedes and Turnips was continued by Mr F. W. Sansome in conjunction with the Director of Research on the lines indicated in previous reports.

Pedigree Strains (Line Selections and Hybrids) ¼ acre.

Thirty-five individual roots, representing ten commercial varieties of Swedes and eight of Turnips, seeded in isolation bags in 1923 (Pergamine "Blossom Envelopes" were used in nearly ever case), were sown in short drills replicated as far as the amount of seed would permit, side by side with control drills of the parent stocks (received in 1921); in many cases additional control drills of varieties bearing the same names as the original stocks and drawn from the same sources, but received in 1922, were also grown. The objects were:—

(1) To determine whether individual plants could be seeded satisfactorily in this manner.

(2) If a satisfactory crop was obtained, to compare the respective pedigree strains with the parent stocks in respect of uniformity and trueness to type.

Satisfactory results were obtained with Swedes, but Turnips proved refractory; in the sequel, therefore, the two crops are dealt with under separate heads.

Swedes.—Considering the small size of the Pergamine bags used (9″ × 6″), and their waterproof character, which permitted of no gaseous interchange except by diffusion, satisfactory crops of seeds were obtained in every case (up to 700 seeds per 9″ × 6″ bag). The drying facilities available in 1922 were not good, and the threshed seed was generally indifferent in appearance; nevertheless the field generation of the seeds in 1923 was excellent. Pergamine bags are thus to be recommended for work under glass, as they are absolutely pollen-proof. They are, however, too fragile for out-

door use, except in very sheltered situations, and cloth-fabric bags have accordingly been used for 1923 seedings.

The pedigree strains were, on the whole, noticeably more uniform than the parent stocks, and in some cases strikingly so. No serious departures from type were observed, with the exception of one *Superlative* Line Selection (Da 31), which segregated into Purple-Top Tankards (not quite typical Superlative colour, though true to shape) and Pale Bronze-Top Tankards, in a ratio nearly approaching 3 P.T. : 1 Br.T. (actual ratio 145 : 42, or 3.5 : 1). The parent root was in appearance a typical Superlative, but must evidently have been an F_1 hybrid P.T. Tankard × Br.T. Tankard. The strain is being further investigated with a view to determining the inheritance of P.T. and Br.T. bulb colour. It is of some interest to note that hares and rabbits, which handled all the genuine Superlative drills severely, left this false stock strictly alone.

Most of the individual roots seeded in 1922 were selfed, as, owing to the genetically mixed character of all, or nearly all, commercial stocks, intelligible results can scarcely be expected from crossing until more uniform strains have been isolated by repeated controlled selfing. As an experiment in technique, a large flowering shoot of a Green-Top Swede was cut off, its stem fixed in a tube full of water and the shoot enclosed in an isolation bag together with the flowering shoot of a P.T. Swede. Swedes are distinctly protogynous—*i.e.*, the stigma is exserted, and presumably ripe, for a considerable time before the flower opens or the pollen is shed, so that a large proportion of cross pollination might be expected under the conditions described. The pedigree strain obtained (Da 26), while conforming in general type to the female parent (P.T.) showed signs of hybridity by greater vigour (" heterosis " due to crossing), and by having a much more pronounced " neck " than either of the two control stocks grown side by side with it. Every root showed this feature, and it is probable that 100 per cent cross-pollination occurred in this stock. The strain is being followed up, as owing to the difficulty of obtaining more than a few pods by hand crossing, a short cut of this kind, though not suitable for strictly scientific experiments on inheritance, might prove very valuable in the raising of new hybrids for practical purposes.

Turnips.—In contrast to Swedes, all the Turnips selfed under

control in 1922 set very few pods (average crop of seeds for 6 roots (5 varieties) 25 seeds per 9″ × 6″ bag, as against 600 seeds per bag for 6 Swede roots (6 varieties)). Further investigation is needed in order to decide whether this very poor seeding is due to genuine (heritable) self-sterility or to some mechanical difficulty. There is some evidence, both direct and indirect, that genuine self-sterility is at least partly responsible. In one instance, two plants of the same stock but different in type were hand-crossed; 21 seeds were obtained from a single pod. Again, where flowering shoots of two plants belonging to different varieties were enclosed in the same bag, the crops obtained were 220 seeds in one case and 320 in the other. Finally, the far greater diversity of type which is found in most commercial Turnip stocks as compared with commercial Swedes (especially if the plants are examined in the second or flowering year), also indicates that natural selfing is rarer in Turnips than in Swedes. The pedigree strains (Db 30 and Db 31) obtained from the inter-varietal mass-cross mentioned above (Sheepfold × Centenary and Centenary × Sheepfold) were indistinguishable from one another in the first year, but clearly distinct from either parent; their bulb characters (colour and surface) showed a mixture of the parental features. They were recognised as blend types by several practical experts who were unaware of their origin. An interesting Line Selection is Db 15, produced by selfing a plant of Centenary, the bulb of which was rather badly split vertically. Every one of the seedlings obtained (15) showed a splitting of the bulb in an exaggerated degree. The tendency to split along vertical planes thus appears to be hereditary; this point is being investigated by further selfing and by crossing with non-splitting plants. Two other Selections from the same stock were of interest as showing extreme difference of type, especially in the foliage, though the parent bulbs were apparently of the same type.

Attempts to demonstrate inheritance of the variegated foliage which is a prevalent and undesirable feature among commercial Turnip stocks have so far given negative results. It is probable that there are several kinds of variegation, one possibly being akin to the mosaic found in potatoes and many other plants. A diseased condition strongly suggestive of leaf-roll appeared in a Line Selection (Db 28) of Pomeranian White Globe.

Controlled Seedings.

Cloth-fabric bags were used for isolation. As these are much stronger than the Pergamine envelopes employed in 1922, larger bags can be used and better crops of seed secured.

The fabric-bags are believed to be pollen-proof (Swede and Turnip pollen, though, no doubt, normally transferred by the agency of insects which visit the conspicuous and strongly scented flowers in large numbers, is dusty rather than sticky, and can be carried by wind for considerable distances); but this point cannot be definitely settled until the progeny of the seed set in 1923 has been examined.

Swedes.—Forty individual plants representing 12 varieties (all P.T.) were selfed, average crop of seeds per 24″ × 15″ bag, 1100; highest average, 1700 (Stirling Castle, average of 5 plants). The samples were, in general, distinctly better in appearance than those of 1922, doubtless owing to the improved facilities available for drying.

Note.—When the fabric bags are removed at the end of the flowering period, butter-muslin bags are substituted, which prevent loss of seed by shedding and also effectually protect the ripening pods from birds, so that a protective cage can be dispensed with. Regular inspection of the seeding plants is, however, necessary owing to the prevalence of "aftergrowth"—*i.e.*, the development of secondary flowering branches, the seed produced by which cannot be relied upon to be selfed. A cage would help in this respect, as aftergrowth is easily overlooked unless the muslin bags are removed at each inspection.

Turnips.—Eleven individual roots representing half a dozen varieties were selfed. Very poor crops of seeds were obtained in every case (average crop per bag 50), a result which agrees with the experience gained in 1922 with Pergamine bags, and supports the theory of prevalent self-sterility in turnips. In future, turnips will be dealt with by bagging together pairs of externally similar plants (identical phenotypes). As this method is very uncertain in comparison with true selfing, since identical phenotypes may be widely different in heritable constitution (genotype), it would seem advisable to concentrate attention on Swedes and to relegate Turnips to a secondary position meanwhile.

Dr Wilson's Swedes—Dry Matter Determinations.

Individual plants of a limited number of Dr Wilson's pedigree strains of Swedes (see Annual Report 1923, pp. 39-41) were seeded in 1923. In selecting roots for seeding preference was given to extreme variants—*i.e.*, plants the bulbs of which had proved either unusually rich or unusually poor in dry matter. By determining the average dry-matter content of the progeny of extreme variants from strains respectively of high and of low average dry-matter content, it should be possible to decide whether there is any pronounced inheritance of potential high and low dry-matter content or not.

During the winter 1923-24 dry-matter determinations were carried out on certain of the pedigree strains started in 1922 and on their parent stocks, in order to determine whether any increase of uniformity in respect of dry-matter content had been effected by pedigree culture; the results suggest that a single act of selfing has little or no effect upon the variation in dry-matter content within a strain.

Yield Tests and Singling.

In the Annual Report for 1923, reference was made (p. 35) to the grave discrepancies observed in 1922 between the yields of samples, containing approximately 64 roots, of replicate small plots (16 yards linear of drill = $\frac{1}{400}$th acre approximately) of the same variety; and it was pointed out that irregularity of singling and insufficient replication were probably among the chief causes of trouble. In order to throw further light on this important point, a singling test was carried out in 1923, on a single commercial variety of Swede (Darlington).

Medium-sized plots (approximately $\frac{1}{600}$th acre) were singled at different intervals between roots in the drill as follows: 9″ (by hoe), 9″ (by hand), 12″, 15″, 18″, and 21″, all by hand. Each plot was repeated eleven times, the whole series occupying an area of approximately 1½ acres (inclusive of paths). The results of this trial were somewhat inconclusive, owing to indifferent braird and unforeseen difficulties in regard to the best method of selecting random samples of approximately 64 roots from each plot. A similar trial will be carried out in 1924, from which it is hoped, with the aid of the experience

gained in 1923, to arrive at some definite conclusions as to the type of plot most likely to give reliable yield data on the small scale. It should also be pointed out that such trials may be expected to give better results when genetically pure stocks are available in sufficient quantity for use on the scale indicated.

II. Lectures and Official Visits by Staff.

Lectures.

Director :—

Conference of Agricultural Research Workers (Scotland), Aberdeen, July 1923.

National Farmers' Union of Scotland (East Lothian Branch), Haddington, October 1923.

University of Glasgow (special course of four Public Lectures on " Genetics Applied to Crop Improvement "), Nov.-Dec. 1923.

Botanical Society of Edinburgh, February 1924.

University of Edinburgh. Course of seven Lectures on Genetics Applied to Crop Improvement. Delivered in the Animal Breeding Research Department, Feb.-March 1924.

Visits.

Director :—

Agricultural Research Council (Ministry of Agriculture and Fisheries), London, January 1924.

Assistant Director :—

Welsh Plant-Breeding Station, Aberystwyth, February 1924.

III. Demonstration and Exhibits.

The Royal Philosophical Society of Glasgow (Biological Section) visited the Station in June 1923.

The Society is represented at the British Empire Exhibition, Wembley, by an exhibit illustrating " The Improvement of Oats by Selection and Hybridisation," as carried out at the Station. The exhibit is housed in the Government building, and the costs are being borne by the Ministry of Agriculture and Fisheries.

IV. Acknowledgments.

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

Messrs Henry Alexander & Co., Nottingham Place, Edinburgh.
David Bell, Esq., J.P. (Messrs David Bell, Ltd.), Leith.
The Board of Agriculture for Scotland, Edinburgh.
W. Cuthbertson, Esq., J.P., V.M.H. (Messrs Dobbie & Co., Ltd.), Edinburgh.
The Department of Agriculture, New South Wales.
Professor H. H. Dixon, F.R.S., Dublin.
The Director, Royal Botanic Gardens, Kew.
J. H. Elder, Esq. (Messrs Wm. Dods & Son), Haddington.
Messrs Wm. Kay & Son, 10 South St David Street, Edinburgh.
P. T. Knappe, Esq., Vec Vale, p.o. Jaun Vale, Latvia.
J. F. M'Gill, Esq. (Messrs M'Gill & Smith, Ltd.), Ayr.
J. T. M'Laren, Esq., The Leuchold, Dalmeny.
D. Mackelvie, Esq., Newlanark, Lamlash.
N. M'Millan, Esq., The Knowe, Kirkconnel.
A. Nelson, Esq., Bardowie.
Regius Keeper, Royal Botanic Gardens, Edinburgh.

Thanks are also due to Messrs M. A. Muir Dickie, A. P. Chaudry, J. E. Peat, W. B. Nicol, Mackintosh, G. D. Davidson, and J. C. Muir, who kindly gave their services as honorary members of the staff for varying periods, and whose assistance has been of the utmost value.

PRINTED BY WILLIAM BLACKWOOD AND SONS.