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(Some experiments on the behaviour of different varieties to high nitrogen manuring and the economic return.)
Z. Pflanzenernährung, Düngung u. Bodenkunde 1931: 10: 169-81. (German)

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(Quality of wheat flour in 1930. Investigation on the method of determining the baking quality of wheat flours.)
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Untersuchungen über eine neue luxurierende Gerstenform.
(Researches on a new luxuriant form of barley.)
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Bull. Appl. Bot. Leningrad 1914: 7 (2): 91-96. (Russian)

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NIHI, Moscow and Tashkent 1932: Pp.16. (Russian)

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(Artificial fertilization of oranges. Production of new varieties.)
Agricultura, Madrid 1932: 4: 97-101.
[Translation of pages 98-100.] (Spanish)

TISCHLER, G. 634.771:581.331.2

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(Investigations on the development of banana pollen. I.)
Arch. Zellforsch. 1910: 5: 622-70. (German)

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Bull. Appl. Bot. Leningrad 1929/30:
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School of Agriculture,
Cambridge,
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July, 1942.

FULL TRANSLATION.

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Arhiv Minist. Poljopr. 1937: 4: No.8: 88-108.

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(Inheritance of chemical composition of tubers in interspecific potato crosses). (Russian)
Soviet Plant Industry Record 1940: No.4: 51-60.

IROKOSHEV, S.M. and 633.491:581.192:576.16
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(Biochemical characteristics of new species of potatoes). (Russian)
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Vsesojuznyi N-I Institut Sakharnoi Promyślennosti (Sci. Inst. Sug. Ind.)
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ORLOVSKII, N.I. 633.63:576.16

(Breeding and seed production of sugar beet). (Russian)
Naučnye Zapiski Sakharnoi Promyślennosti (Sci. Trans. Sug. Ind.) 1939: No.2-3: 19-32.

POSTHUMUS, G. and
UVEN, M.J. 633.912-1.557:519.24

Vereffening van Proefveldresultaten in de Rubbercultuur.
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Arch. Rubbercult. Ned.-Ind. 1935: 19: 27-46.

C.P.C. NUMBERS.

	Tubers and virus content				Seed
S. tuberosum continued	1758	LR+Y	2121	X	
	2072	X	2122	X	
	2073	H	2123	LR	
	2074	X	2195	X	
	2081	X	2293		
	2082	X	2323		
	2083	X			
CUL 2x (2n=24)	1598	Y			
CUL 3x (2n=36)	287	X	1505b	X	
	349	LR	1510b	H	
	356	LR	1560	X	
	401	(LR)	1571	X	
	408	X	1590	(X)	
	423	X	1599	X	
	467	X	1608	X	
	483	X	1617a	(X)	
	491	X	1647	H	
	515b	H	1649	LR	
	607	X	1650	X	
	621a	X	1669	X	
	705	Y	1691a	H	
	706	H	1698	H	
	707	X	1777	H	
	709	(X)	1796b.	(X)	
	715	X	1812	(X)	
	723	X	1813	X	
	758	X	1815a	X	
	842	X	1852	(X)	
	879	X	1870	?	
	1140	X	1901	(X)	
	1382	X	1919	X	
	1404	X	1920	?	
	1412	X	(1925)	H	
	1426a	X	(1936)	X	
	1482d	X	(2164b)	X	
CUL 4x (2n=48)	527.2	H	1929	H	1973
	529.1	?	1973	X	
	1595	H	1979	H	
	1619	(Y)	1981b	H	
	1629	(H)	2038	H	
	1719	(A)	2059a	H	
	1926	H	2090	X+Y	
	1927	H			
CUL x	~~1729b~~	~~?~~	2052	H	2052
	1735	X+Y	2059b	?	
	1747	Y	2153	H	
	1750	LR+(A)	2154	H	
	1754	Y	2165a	H	
	1766	(LR)	2166	H	
	1782	?	2184	X	
1796a →	1865	(X) X	2185	?	
	1887	H	2186a	H	
	1892	?	2189	(A)	
	1934	X	2192	H	
	1962	X	2341		
	2001	H			

Heterodera

S. andigenum . 1685
1673
1692
Cul. 4x. 1595

} Very promising after 2 years of testing.

Selfed seed — 1685
1673

Cul 4x — tubers.

1692 — Selfed seed.

S. Raphanifolium — resistance probably due to the small root system. (Dr. Reddick - Cornell).

Alternaria

* CPC 1773 *Torvalapanum* (Tub 2x)

CPC 516 *Vallense* (Cont. 2x)

M. S. Swaminathan

COMMONWEALTH POTATO COLLECTION

ANNUAL REPORT FOR 1950 - 1951

Commonwealth Potato Collection,
Huntingdon Road,
Cambridge,
England.

COMMONWEALTH POTATO COLLECTION

Report of Officer-in-Charge for 1950-1951

General. During the period under review considerable time has been given to the re-organization of the Collection so that it may become a "working" Collection usable in research and not merely a museum of tuberous Solanums. This revised policy has become necessary now that the bulk of the Collection has been examined and tested for resistance to various diseases. Many self-fertile lines are stored as true seed, for example, those of the wild species Solanum acaule, S. depexum, S. demissum and forms of the cultigen S. tuberosum subsp. andigenum. This procedure has freed glasshouse space for experimental purposes and at the same time removed a high proportion of virus infected tuber lines from the Collection. Furthermore, we no longer maintain a Collection of Domestic varieties. Of those which were formerly maintained, the fairly healthy ones have been handed over to the National Institute of Agricultural Botany and are being kept in Northern Ireland.

1. Genetics — Dr K.S. Dodds

Attention is being given to the use of S. demissum (2n = 72) as a maternal parent in various crosses with cultivated and wild diploid species (2n = 24). With the co-operation of Dr Margaret A. Keay and Dr W.R.S. Wortley, resistance to late blight and immunity from virus Y is being studied in the tetraploid hybrids.

Genetical studies of cultivated diploids, particularly S. Rybinii, are in progress.

2. Virus Diseases — Dr W.R.S. Wortley

During the 1950 season 62 recent accessions to the Collection have been quarantined and tested for virus content by the usual methods; 54 of these were found to be free from virus infections and, apart from four instances of

viruses of doubtful identity which are being kept under observation, the remainder contained common viruses only.

Evidence has been obtained that the mild virus reported in certain clones of S. Rybinii in 1949 may be a strain of virus Y and, by using a Y-intolerant clone of S. demissum as an indicator, the presence of a similar virus has been detected in a number of other cultivated species in the Collection and in two wild species. Over 200 clones of the Collection have been re-tested and where necessary re-classified.

Continuing the survey of the Collection for immunity or resistance to virus Y, over 400 clones have been tested by mechanical inoculation during the year. Enough data have now been accumulated to provide a reliable indication of the range and types of response to virus Y which are to be found in those species well-represented in the Collection. A few species more recently received have still to be explored. High intolerance to virus Y is relatively frequent in the series Cardiophylla, Commersoniana and Longipedicellata, and immune clones occur in these series and also in the Pinnatisecta. High intolerance occurs rarely in the series Demissa and Tuberosa. In the Acaulia only a low degree of intolerance has been found. In the cultivated species intolerance is rare, but has been found in about 30 out of 850 clones of S. tuberosum subsp. andigenum. As previously reported, a high degree of resistance to infection occurs in certain clones of S. Rybinii, and this appears to be a property distinct from intolerance.

Many seedlings from crosses made by Dr Dodds, using S. Rybinii (C.P.C. 979) as one parent, were again tested by sap inoculation with virus Y. These had been grown for a single season in the open and there was a strikingly low incidence of mosaic in these families compared with others of which 979 was not one of the parents. Continuing this work, 15 F_1 families were rubbed with Y-infective sap before being planted in a field plot, and further tests will be carried out on the surviving seedlings in the coming season.

A small number of hybrid seedlings between S. demissum clones of known Y-reaction and S. Rybinii (C.P.C. 979) were also tested, the results showing

the transmission of high intolerance from the demissum parent rather than low susceptibility to infection from S. Rybinii.

The two trials for leaf-roll resistance which have now been completed have included over 600 clones of the Collection, of which about 40 per cent (including representatives of most of the cultivated species) have contracted leaf-roll under natural field conditions. The experiments have been hampered by wire-worm and a high incidence of virus Y and further progress, especially in testing the wild species, requires intensive tests with the insect vectors under controlled conditions.

3. Resistance to Phytophthora infestans (late blight) — Dr Margaret A. Keay assisted by Barbara S. Rogers

(i) Maintenance of the fungus

We have been able to store P. infestans in King Edward tubers at +5°C for six months, and sometimes longer, provided 1) that the tubers were inoculated soon after harvest and 2) that each culture was replicated. Replication was necessary because individual tubers varied in the time taken to develop the low-temperature breakdown which made re-isolation of the fungus impossible. Cultures maintained by the liquid paraffin method were still alive after 24 months so this method seems superior to that using tubers. It remains to be seen, however, whether prolonged periods under liquid paraffin will affect pathogenicity and vigour.

(ii) Differentiation of pathogenicity groups

The C.P.C. lines which have revealed differences in pathogenicity between isolates of the fungus have been inoculated with as many of them as possible using the detached leaflet method. The isolates used were those collected in previous years and several received in 1950 through the continued co-operation of the National Agricultural Service. As a result, the isolates have been classified into six pathogenicity groups as follows:-

Group No.	Isolate No.	Origin	Host type	Terminology of groups
1	13	Domestic variety, tuber, 1947	fully susceptible	A
2	41	Edinburgh breeding line, received 1947	AC resister (Edin.)	B
	192	Craigs Snow-White. Isle of Wight. 1950	AC resister (Edin.)	B

Group No.	Isolate No.	Origin	Host type	Terminology of groups
2	196	Craigs Snow-White, Yorkshire, 1950	AC resister (Edin).	B
	197	Craigs Snow-White, Cumberland 1950	"	B
	198	Cambridge 35/105/43. Madryn Castle, 1950	AC resister (Camb.)	B
3	193	Cambridge 53/77/44. Madryn Castle, 1950	AB resister (Camb.)	C^2
	194	Cambridge 38/5. Cardiff 1950	"	C^2
	195	Cambridge 72/105 Cardiff 1950	"	C^2
4	123	Edinburgh breeding line, received 1948.	AB resister (Edin.)	C^1
5	59	German breeding line, Germany Dr Müller's culture 963. Received 1948	resister (German)	
6	167	Edinburgh 1253a (12). East Africa Received 1949	resister (Edinburgh)	

The terminology for the groups is that employed by plant breeders in Great Britain, with the exception that C^1 and C^2 are used for the isolates from AB resistant breeding lines. The isolates of German and East African origin proved to be distinct but they have not been given a letter because the nomenclature of pathogenicity groups in P. infestans is already confused and it is not yet clear whether the groups comprise strains, physiologic races or biotypes.

Selfed seed of the clones which have revealed specialization in parasitism was obtained in 1950 along with hybrid seed between certain of the clones. A study of the interactions of these seedlings and the fungus should provide data on the genetics of blight resistance and specialization in parasitism. As a preliminary, an investigation has been made of techniques for the inoculation of large populations of seedlings, with special reference to the amount of inoculum to be applied, i.e., the number of sporangia per ml. of suspension.

It has seemed advisable to discover whether any criteria, other than behaviour on the host, could be found for distinguishing between isolates.

The problem of growing the fungus in artificial culture has again been investigated. Grateful acknowledgement is made to Dr Maria de Lourdes d'Oliveira, Estação Agronómica Nacional, Sacavem, Portugal for her co-operation in this matter. A study of the growth of the fungus in artificial culture at different temperatures has been begun. A survey of the size of sporangia of different isolates on artificial media and on various hosts is also proceeding for the evidence about this in the literature is somewhat conflicting.

(iii) Resistant species

Resistance to P. infestans has only been found in the wild species of Solanum. Several clones infected with virus have given doubtful reactions and an investigation, still in progress suggests that the resistance claimed for S. gigantophyllum, C.P.C. 1770, in the 1948 report resulted from the presence of virus Y.

Lines of species containing resistance often react differently to the various isolates. Categorical statements about the resistance of a species and a line are, therefore, impossible until several lines have been inoculated with different isolates. Moreover, on account of this differential reaction the results are difficult to present concisely and a full survey would far exceed the space here available. There follows a list of those species which contain one or more clones resistant to A, B and C groups of the fungus, C here including C^1 and C^2. The results are based on the inoculation of detached leaflets.

S. bulbocastanum Dun. (2n = 24), S. cardiophyllum Lindl. (2n = 36), S. demissum Lindl. (2n = 72), S. lanciforme Rydb (2n = 24), S. longipedicellatum Bitt. (2n = 48), S. pinnatisectum Dun. (2n = 24), S. polyadenium Greenm. (2n = 24), (S. sambucinum) Rydb, (2n = 24). It will be observed that all these species, in which the resistance is of a high order, originate in Mexico, that they belong to different taxonomic series and that they differ in their chromosome complement.

In addition lines of the following species have been found to be resistant to pathogenicity group A.

S. Andreanum Baker (2n = 24), S. ajuscoense Buk. (2n = 48), S. Antipoviczii Buk. (2n = 48), (S. boreale) (A. Gray) Bitt. (2n = 48), S. capsicibaccatum

Cárdenas (2n = 24), S. colombianum Dun. (2n = 48), S. morelliforme Bitt. et Muench. (2n = 24), S. Salamanii Hawkes (2n = 60) S. semidemissum Juz. (2n = 60), S. tlaxcalense Hawkes (2n = 48), (S. violaceimarmoratum) Bitt. (2n = 24). Further investigation may reveal that some of these should have been included in the first list. Here again the species belong to different taxonomic series, have different chromosome numbers and several of them come from Mexico. Three species, however, come from S. America, namely S. capsicibaccatum, Bolivia, S. colombianum, Colombia and (S. violaceimarmoratum), Bolivia. This finding substantiates the statement by Bukasov and Lechnovitz (Revista Argentina de Agronomia, 2, 173-183, 1935) that blight-resistant forms occur not only in Mexico.

4. Resistance to Alternaria solani (early blight) Mr A.W. Charles

i) Further tests on C.P.C. lines

During 1950 lines which had not been tested previously owing to lack of material and new accessions of wild species were tested for resistance to A. solani. In addition, those lines which were resistant in 1949 were re-tested.

As more glasshouse space was available than in 1949, the test period was extended from 4 - 7 days to at least 10 - 12 days. Symptoms thus developed further. The resistance of S. saltense, C.P.C. 51b, remained unaffected, and S. toralapanum C.P.C. 1773 has maintained an even higher degree of resistance than S. saltense in many tests. Both species are diploids. Amongst the new accessions, S. bulbocastanum C.P.C. 2239 has shown high resistance in preliminary tests, and some other wild species have been moderately resistant. Some lines, however, which were previously reported as highly resistant, namely S. Schickii C.P.C. 1317, S. tarijense C.P.C. 1727 seedlings, and C.P.C. 1459.1 are now classed as semi-resistant.

ii) Physiological specialisation in A. solani

Leaves infected with A. solani and cultures of the fungus have been sent from many countries, and the writer wishes to thank all those who have helped in this way. The number of isolates received during 1950 from each

country was as follows:- Australia 3, India 2, Israel 1, South Africa 6, U.S.A. 5.

Each isolate was tested on a panel of hosts comprising about 20 C.P.C. lines which had shown some resistance in previous tests, together with a few susceptible Solanum spp., and tomato, tobacco, Datura, and Capsicum. There was no indication of physiological specialisation, using this panel of hosts.

5. Resistance to Potato-root Eelworm (Heterodera rostochiensis)

Dr C. Ellenby,
King's College,
Newcastle-upon-Tyne.

During the season of 1950, about 150 forms of S. tuberosum subsp. andigenum were tested for susceptibility to the potato-root eelworm. All were attacked.

6. Resistance to Colorado Beetle (Leptinotarsa decemlineata)

224 lines were sent from the Collection to the Central Experimental Farm, Department of Agriculture, Ottawa, Ontario, Canada, but no report has yet been received.

POTATO MATERIAL DISTRIBUTED DURING THE PERIOD

1 APRIL 1950 - 31 MARCH, 1951

A. BRITISH COMMONWEALTH

Destination		Tuber samples	Seed samples
Canada	(Dr J.C. Craigie)	224	7
England	(Dr C. Ellenby)	392	4
India	(Mr S.K. Basu)	54	30
"	(Dr J.N. Mukherjee)	10	6
Ireland	(Mr J. Clarke)	11	3
Scotland	(Dr G. Cockerham)	5	20
"	(Dr T.P. McIntosh)	7	1
South Africa	(Dr J.E. van der Plank)	6	-
		709	71

B. OTHER COUNTRIES

Belgium	(Dr M. Rigot)	20	20
Colombia	(Dr J.G. Hawkes)	10	-
France	(Dr A. Vilmorin)	6	-
Germany	(Dr R. Schick)	13	17
"	(Dr H. Ross)	29	8
Portugal	(Dr M. d'Oliveira)	-	3
		78	48

POTATO MATERIAL RECEIVED DURING THE PERIOD

1 APRIL 1950 - 31 MARCH, 1951.

B. OTHER COUNTRIES

Destination		Tuber samples	Seed samples
Colombia	(Dr J.G. Hawkes)	35	-
		35	-

M.S. Swaminathan

CLASSIFICATION

KEY TO SYMBOLS

I. WILD SPECIES

Section			Species
CON	=	CONICIBACCATA	Adr, col, lgc, San, vio.
BUL	=	BULBOCASTANA	bul, mor.
CPH	=	CARDIOPHYLLA	cph, lan.
PIN	=	PINNATISECTA	Jam, pin, smb.
COM	=	COMMERSONIANA	Com, Gar, gbb, Par, slt, Sch, tar.
ACA	=	ACAULIA	aca, dep.
DEM	=	DEMISSA	dem, sem, Slm, ver.
LON	=	LONGIPEDICELLATA	aju, Ant, bec, Fen, lpd, mal, sto, tla, vll.
CUN	=	CUNEOALATA	pla.
POL	=	POLYADENIA	pol.
CIR	=	CIRCAEIFOLIA	cap.
TUB	=	TUBEROSA	Adr, anm, Bal, Ber, brv, can, gig, lap, Lec, mlt, pam, pun, rap, sim, Sou, tor, Wit; Mag; lpt, sub, scr.

Species undefined

(i) Section known

e.g.	COM	Chroms. no. undet.	= COM x
	"	Diploid	= COM 2x
		Etc.	
e.g.	TUB	Chroms. no. undet.	= TUB x
	"	Diploid	= TUB 2x
		Etc.	

(ii) Section unknown

e.g.	WLD	Chroms. no. undet.	= WLD x
	"	Diploid	= WLD 2x
		Etc.	

II. CULTIGENS

CUL	=	-	stn, Yab, gon, Aba, Phu, Crd, Asc, Kes, Ryb; Juz, Cha, ten, mml, coe, adg, tub; cur, aya.

(iii) Species unknown

Chroms. no. undet.	= CUL x
Diploid	= CUL 2x
Triploid	= CUL 3x
Tetraploid	= CUL 4x

aca	=	acaule	ACA	lpt	=	leptostigma	TUB
adg	=	andigenum	CUL				
Adr	=	Andreanum	~~CON~~TUB	Mag	=	Maglia	TUB
Ajh	=	Ajanhuiri	CUL	mal	=	malinchense	LON
aju	=	ajuscoense	LON	mml	=	mamilliferum	CUL
anm	=	anomalocalyx	TUB	mor	=	morelliforme	BUL
Ant	=	Antipoviczii	LON	mlt	=	multidissectum	TUB
Asc	=	Ascasabii	CUL				
aya	=	'Aya-papa'	CUL	pam	=	pampasense	TUB
				Par	=	Parodii	COM
Bal	=	Ballsii	TUB	Phu	=	Phureja	CUL
Ber	=	Berthaultii	TUB	pin	=	pinnatisectum	PIN
bor	=	boreale	LON	pla	=	platypterum	CUN
brv	=	brevimucronatum	TUB	pol	=	polyadenium	POL
bul	=	bulbocastanum	BUL	pun	=	punoense	TUB
can	=	canasense	TUB	rap	=	raphanifolium	TUB
cap	=	capsicibaccatum	CIR	Ryb	=	Rybinii	CUL
Cha	=	Chaucha	CUL				
col	=	colombianum	CON	San	=	Santolallae	CON
Com	=	Commersonii	COM	Sch	=	Schickii	COM
cph	=	cardiophyllum	CPH	scr	=	sucrense	TUB
Crd	=	Cardenasii	CUL	sem	=	semidemissum	DEM
coe	=	coeruleiflorum	CUL	sim	=	simplicifolium	TUB
cur	=	curtilobum	CUL	Slm	=	Salamanii	DEM
				slt	=	saltense	COM
dem	=	demissum	DEM	smb	=	sambucinum	PIN
dep	=	depexum	ACA	Sou	=	Soukupii	TUB
				stn	=	stenotomum	CUL
Fen	=	Fendleri	LON	sto	=	stoloniferum	LON
				sub	=	subandigenum	TUB
Gar	=	Garciae	COM				
gbb	=	gibberulosum	COM	tar	=	tarijense	COM
gig	=	gigantophyllum	TUB	ten	=	tenuifilamentum	CUL
gon	=	goniocalyx	CUL	tla	=	tlaxcalense	LON
				tor	=	toralapanum	TUB
Jam	=	Jamesii	PIN	tub	=	tuberosum	CUL
Juz	=	Juzepczukii	CUL				
				ver	=	verrucosum	DEM
Kes	=	Kesselbrenneri	CUL	vio	=	violaceimarmoratum	CON
				vll	=	vallis-mexicae	LON
lan	=	lanciforme	CPH				
lap	=	lapazense	TUB	Wit	=	Wittmackii	TUB
Lec	=	Lechnoviczii	TUB				
lgc	=	longiconicum	CON	Yab	=	Yabari	CUL
lpd	=	longipedicellatum	LON				

M.S. Swaminathan

COMMONWEALTH POTATO COLLECTION.

ANNUAL REPORT FOR 1949

Commonwealth Potato Collection,
Huntingdon Road,
Cambridge,
England.

COMMONWEALTH POTATO COLLECTION

ANNUAL REPORT FOR 1949

General. Dr J.G. Hawkes has been in Colombia during the year and is not due to return to the Commonwealth Potato Collection until early in 1951.

Mr K. Shepherd resigned from the post of Junior Botanist at the end of 1949.

These two vacancies leave the Station very short staffed with regard to the routine maintenance and care of the Collection.

The 1948 Report stated that Laboratory and Glasshouse space was taxed to the utmost, there being in the Collection at that time, a total of 2418 living lines. A check of the Collection in the middle of 1949 showed that it consisted of the following groups of samples:-

(a)	Collections from South and Central America	2010 lines
(b)	Domestic varieties from Europe and Africa	139 lines
(c)	Breeding lines (Australia, Germany, U.S.A.)	316 lines
		2465 lines

Since then, Dr Hawkes has forwarded 42 tuber samples and 15 seed samples from Bolivia and 84 tuber samples and 32 seed samples from Mexico. This latter material was obtained during a collecting expedition of four months' duration in Mexico.

In view of our limited facilities for storage and maintenance, a revised policy has had to be adopted to meet the situation. More frequent use is being made of true seed for storage, particularly with those species that have shown little promise of providing valuable characters for breeding work. Furthermore, lines containing exotic viruses have been discarded, after selfed seed has been obtained where possible.

1. Cytogenetics — Dr K.S. Dodds

A cytogenetical study of the wild and cultivated diploids in the Collection has been started. Improved diploids are being selected and these will be crossed with S. demissum to obtain tetraploid breeding lines. With the co-operation of Dr Keay and Dr Wortley, attention is being given to resistance

to late blight and immunity from virus Y.

2. Virus Diseases Dr W.R.S. Wortley

During the past season 108 clones, representing recent accessions to the Collection, have been quarantined and tested for virus content by the usual methods; 48 per cent of these were found free from virus infections and the majority of the remaining 52 per cent contained only viruses common in this country. Twenty clones of S. Rybinii, however, appeared to contain a mild unidentified virus and are being kept under observation. Veinal necrosis virus of tobacco was found in five cultivated clones and the virus causing stunting of Datura in one cultivated clone; these clones have been destroyed.

Most of the healthy part of the Collection was again checked for freedom from virus, with a result similar to that reported last year; that is, approximately 10% spread of virus, almost entirely virus X. 155 diseased lines were re-tested and re-classified where required. Together with tests on the collections of breeding lines and domestic varieties, the total number of determinations of virus content amounted to about 250.

380 C.P.C. lines have been tested for resistance to virus Y by sap inoculation. Immunity to the virus was confirmed in most of the species previously reported as promising, but mid-winter tests with S. Rybinii (C.P.C. 979) suggested that this clone is not completely immune. Analysis of the results obtained on 44 clones of S. demissum indicated several reaction types to virus Y, ranging from an almost symptomless carrier to a highly intolerant type reacting with a systemic lethal necrosis and further, to a probably field-immune form in which the virus is confined to local necroses at the points of entry.

In conjunction with Dr Dodds, inoculations with Y virus were carried out on several families of hybrid seedlings involving the highly resistant C.P.C. 979 as one parent. These were subsequently planted out in the field and the obviously susceptible seedlings eliminated, the remainder being harvested for further testing in 1950.

A second batch of C.P.C. material was interplanted with leaf-roll infectors in the field (see 1947 Report), and the tubers will be regrown in

1950 for the elimination of those definitely susceptible to this virus. Further progress in this direction depends upon the availability of extra glasshouse accommodation, for controlled tests with the insect vectors.

3. Resistance to Phytophthora infestans (late blight) Dr Margaret A. Keay

(i) Maintenance and collection of isolates of P. infestans

Cultures growing on an artificial medium (1948 Annual Report) have been stored using the liquid paraffin method (Buell and Weston, 1947, Amer. J. Bot. 34: p.555). After eight months at 18°C. the cultures were alive and their pathogenicity unaltered. These cultures are still under observation. The results suggest that the method is at least as satisfactory as storage in tubers and well worth the initial work of preparing the cultures.

Only one new isolate of P. infestans was received during the year; this was of East African origin and was obtained through the courtesy of Dr W. Black.

(ii) Identification of isolates of P. infestans

Continuing the work described in the 1948 Annual Report, an intensive study has been made of isolates of P. infestans from America, Britain, East Africa and Germany. It has become increasingly apparent that the physiological condition of the host plant at the time of inoculation greatly influences the result. This finding not only bears upon the problem of defining the pathogenicity groups of the fungus but must be considered in testing the reactions of C.P.C. lines.

(iii) Inoculation techniques

Investigation has been made in order to devise a satisfactory technique for inoculating large numbers of young seedlings or small plants. Coupled with this has been some study of the influence of environmental factors upon the reaction of the host plant to the fungus.

(iv) Reactions of tubers to P. infestans

Examination was made of the tuber reactions to P. infestans of 317 C.P.C. lines, 104 breeding lines and 26 domestic varieties. Where resistance was found the reactions to a B group isolate were also examined. The investigation has been inevitably hampered by the small tuber size of many of the

resistant species and also by the small number of tubers available for testing. Individual tubers from the same sample vary considerably in their reaction and much larger samples are needed if reliable results are to be obtained.

(v) Reactions of foliage to P. infestans.

The foliage reactions of 677 C.P.C. lines to an A group isolate of P. infestans have been examined. These lines include the material recently sent by Dr Hawkes from Colombia and Mexico. There has also been investigation of the behaviour of 25 breeding lines and 18 domestic varieties including 10 blight resistant U.S.A. varieties received from Dr F.J. Stevenson. When a line has been found to be resistant, its reactions to B, C and X group isolates have then been tested.

To the 1948 list of species containing resistance there may now be added those listed below:-

Species	C.P.C. Number
S. colombianum	2175, 2177, 2178
S. bulbocastanum	2242
S. Andreanum	2179

S. bulbocastanum was described as resistant by Bukasov (Suppl. 58 Bull. Appl. Bot. Leningrad, 1933) and by Reddick (Phytopathology 24, 555-557, 1934). These authors also list S. verrucosum as resistant, but all C.P.C. lines of this species are susceptible.

Resistance has also been found in the following lines of species recorded in the 1948 Report as containing resistance:-

Species	C.P.C. Number
S. cardiophyllum	2244
S. lanciforme	2269, 2271
S. demissum	2095.1, 2095.2, 2097.1, 2098.1, 2098.3, 2102.1, 2167, 2168.
S. semidemissum	2277
S. longipedicellatum	2270
S. tlaxcalense	2256

An intensive examination has been made of the reactions of close on 200 lines belonging to the species listed as resistant in last year's Report. These have been tested with as many as possible of the isolates from the various pathogenicity groups. This survey has provided information of use in breeding

work and for classifying the fungus according to its pathogenic behaviour.

4. Resistance to Alternaria solani (early blight) Mr A.W. Charles

Testing of the C.P.C. material for resistance to Alternaria solani had been carried out in the field by Dr J.E. van der Plank in South Africa. He has found lines which, because of local adaptation, are able to withstand the main attack of the pathogen. Since October 1948, laboratory tests have been undertaken at the Commonwealth Potato Collection to discover whether true genetic immunity or high resistance may be present in the Collection.

Test plants are grown in small pots in the glasshouse and, when 6 - 9" tall, are sprayed with a suspension of A. solani spores. After incubation in a humidity chamber for about 24 hours, they are placed on the bench for 4 - 7 days, after which time large lesions have developed on the leaves, and frequently also on the stems, of susceptible types. Over 2000 plants have been tested thus, covering about 1500 C.P.C. lines. Classification for resistance has been made on the basis of lesion size. No line has been immune to the South African isolate of A. solani used, but some are apparently highly resistant. Even when the inoculum is very heavy only a few small lesions (ca. 1 mm. diam.) develop on the resisters; susceptibles show many large lesions (ca. 5 mm. diam.) which spread and may become confluent.

The highest resistance has been found in certain wild diploids of the group Commersoniana (e.g. S. saltense C.P.C. 51b; S. Schickii C.P.C. 1317; S. tarijense C.P.C. 1727 seedlings; C.P.C. 1459.1).

5. Resistance to Synchytrium endobioticum (wart disease).

The reactions of certain C.P.C. lines to a 'strong strain' of Synchytrium endobioticum were examined by Frau Dr T. Steyer at Leipzig. These were lines which had remained free from infection in the tests carried out by the Ministry of Agriculture and Fisheries. Dr Steyer reported the following as not diseased:-

Species	C.P.C. Number
S. andigenum	677, 876, 1095, 1473a
S. anomalocalyx	122
S. Ajanhuiri	232
S. calcense	450
S. lapazense	62
S. simplicifolium	51a
S. sucrense	162
S. tenuifilamentum	402

The following she found susceptible:-

Species	C.P.C. Number
S. andigenum	101b
S. Chaucha	400
S. coeruleiflorum	1521
S. goniocalyx	1504
S. tuberosum	1528

6. Resistance to Fusarium caeruleum (dry rot).

Dr A.E.W. Boyd, Department of Agriculture for Scotland, East Craigs, Corstorphine, Edinburgh.

Since autumn 1948, the reactions of 341 C.P.C. lines to Fusarium caeruleum, dry rot, have been examined. The reactions were assessed on a percentage basis and classified thus:- 1 - no reaction; 2 - slight, up to 12.5%; 3 - moderate, 13-35%; 4 - severe, 36-74%; 5 - very severe, 75% and over. The first test was made in the winter of 1948; lines which showed no reaction were re-tested in spring, 1949. Normally, susceptibility is higher in spring than in winter and consequently many lines which gave no reaction in the winter test proved fairly susceptible in the spring one. These have therefore been placed in sub-groups designated 1-2, 1-3, 1-4, 1-5 according to the reaction in the second test.

In the winter of 1949, a further examination was made of certain lines which had shown no reaction in the 1948 (winter) and 1949 (spring) tests; these lines were thus tested three times and are indicated in the results by an asterisk.

The species in groups 1, 2 and the sub-groups are all cultigens. The great majority of the lines belong to S. andigenum and S. stenotomum but there are also represented S. Yabari (1492a, 1794, 1977), S. tenuifilamentum (402, 1083), S. tuberosum (1529, 1542, 1702.3, 1718, 1734) and S. curtilobum (205.1).

C.P.C. lines in groups 1 and 2.

Numbers marked with an asterisk were tested three times.

Group 1. No reaction. Highly resistant or immune.	60, *127, *139, *140, 153, 156, *158, 191, *202.2, *236, *253.1, *306, 319, *328, 345, *348, *357, *359, 373, 405a, 688, *1084, 1108, *1427, 1474, 1498, 1501, *1596, *1597, *1601, 1686, *1699, 1805.

Group 2. Reaction slight - up to 12.5%.	63.5, 106, 106.3, 136, 164, 171.1, 179.3, 194, *224.1, 228, *250.1, 261, 267.2, 268, 320.2, 354, *361, 374, 381a.1, 402, 504, 650, 712.3, 720, 854, *865, 940, 1004b, 1083, 1092, 1113, 1117, 1144, 1368, 1396, 1426a, 1429, 1478, 1488, 1492a, 1497a, 1503b, 1510b, 1520a, 1529, 1542, 1556, 1592, *1602, 1615, 1621, 1625, 1639, 1664, 1674a, 1677, 1691a, 1695, 1702.3, *1704, 1715, 1797, 1859, 1923, 2044, 2074, 2081.
Subgroup 1-2 No reaction in winter group 2 in spring	143.1, *147, 152, 180.2, 205.1, *267.1, 275, 597, 611, 1089, *1096, *1101, *1109, *1151, *1371, 1417, *1435, 1611, *1663, 1666, 1668, 1690, *1694, *1794.
Subgroup 1-3 No reaction in winter group 3 in spring	143.3, 249.2, 587, 859, 1081, 1148, 1476, 1491b, 1519, 1661.
Subgroup 1-4 No reaction in winter group 4 in spring.	244, 253.2, 735, 749.3, 1449, 1591, 1718
Subgroup 1-5 No reaction in winter group 5 in spring.	155, 234.2, 1734

7. Resistance to Potato-root Eelworm (Heterodera rostochiensis)

Dr C. Ellenby,
King's College,
Newcastle-upon-Tyne.

During 1949 about 300 forms were subjected to routine tests for susceptibility. These were grown in pots in infected soil in the field; all were found attacked. Work was continued with a number of other forms found promising in previous years, some being grown under short day conditions. Results continued to be promising particularly in the case of Solanum Ballsii.

8. Resistance to Colorado Beetle (Leptinotarsa decemlineata).

Extracts from a report by W.C. Matthewman, H.N. Racicot and E.W. Rockburne; Ottawa, Canada.

In 1949, 216 lines of wild and cultivated species of potatoes from the C.P.C. were screened for resistance to the Colorado potato beetle, together with 14 lines which had been considered promising in 1948.

Following the same procedure as in 1948, the feeding injury of both adults and larvae was assessed and total numbers of eggs, larvae and adults recorded. Scoring was weighted by factors of x3 for foliage injury, x2 for eggs and larvae and xl for adults, and the results were used to

determine an index of resistance. The following sixteen lines were most resistant:-

Species	C.P.C. Numbers
S. capsicibaccatum	1701
S. gibberulosum	1157
S. Jamesii	1439
S. jujuyense	84.1.2
S. Parodii	1316
S. Schickii	1155, 1317
S. sucrense	162.1
S. tarijense	1727.2, 1727.3
S. violaceimarmoratum	1732
Unclassified	1458, 1459.1, 1459.2, 1775, 2062

There were indications that a correction factor for height of plant may be needed in future resistance tests.

9. Resistance to Frost — Mr A.W. Charles

Testing for frost resistance was re-commenced towards the end of 1948. By August 1949, 1300 tests had been made on 854 C.P.C. lines, 743 of which were previously untested. Some clones of known frost-reaction were included in order to standardise readings with those recorded in previous years: the same test temperatures and reaction classes were used. Resistance was found in a few further wild diploid lines and the resistance of additional clones of previously-resistant species was confirmed. Plants were raised at the Commonwealth Potato Collection and tested at the Low Temperature Research Station, where the authorities kindly made cold-chambers available. Facilities were better than when the previous testing was carried out in 1942-45, because adequate space was available for pre-cooling at the desired temperature (+3°C) in the room adjoining the freezing chamber.

In the standard test, plants are either grown outside or hardened outside before testing. During the winter of 1948-49, a number of test plants was grown in the heated glasshouse and tested for frost reaction without hardening. There was a general lowering of frost resistance in such plants, but the relative resistances of the species remained about the same. Species of intermediate resistance such as S. Juzepczukii and S. Ajanhuiri seem especially susceptible to environmental change.

Further, a field planting of about 100 lines was made at Cambridge in the late Summer of 1949 so that the plants were subjected to the first

winter frosts. Under these conditions lines with any frost resistance were more resistant in the field than in the freezing chamber, and the same relative resistances were maintained. For practical purposes it seems that the freezing chamber will give the order, though not the absolute measure, of field resistance.

POTATO MATERIAL DISTRIBUTED DURING THE PERIOD

1 APRIL 1949 - 31 MARCH, 1950.

A. BRITISH COMMONWEALTH

Destination		Tuber samples	Seed samples
England	(Mr G.S. Bains)	18	3
"	(Dr C. Ellenby)	-	6
"	(Miss I. Modlibowska)	-	1
India	(Dr S. Ramanujam)	12	-
Scotland	(Dr A.E.W. Boyd)	123	-
"	(Dr J.C. Haigh)	-	2
		153	12

B. OTHER COUNTRIES

Belgium	(Dr N. Rigot)	-	5
Bolivia	(Dr M. Cardenas)	-	2
Colombia	(Dr E.R. Pena)	9	-
France	(Mlle Boczkowska)	7	-
Germany	(Dr P. Schaper)	14	6
Holland	(Dr H.J. Toxopeus)	7	27
Norway	(Dr A.P. Lunden)	12	-
		49	40

POTATO MATERIAL RECEIVED DURING THE PERIOD

1 APRIL, 1949 - 31 MARCH, 1950.

B. OTHER COUNTRIES

Destination		Tuber samples	Seed samples
Bolivia	(Miss W.M.A. Brookes)	-	3
Colombia	(Dr J.G. Hawkes)	120	36
France	(Mlle Boczkowska)	-	1
Holland	(Dr H.J. Toxopeus)	2	8
		122	48