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Relationships between disease levels on seed tubers, on crops during growth and in stored potatoes. 3. Silver scurf

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Zusammenfassung, Résumé p. 238

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Summary

Incidence of silver scurf (*Helminthosporium solani*) was assessed macroscopically (silver scurf lesions) or microscopically (*H. solani* infection of tuber eyes) on seed tubers, on progeny tubers during growth or at harvest, and on stored tubers, from up to 26 commercial crops cv. King Edward in each of 5 years, and up to 13 crops grown from 'healthier' seed in 4 years.

Infection of eyes was frequent on seed in all years, scarce on progeny tubers during growth, but had increased by harvest. Silver scurf was prevalent in stored tubers, except in 1975, and more developed at 10 °C than at 3 °C.

Infection of tubers during growth, at harvest, or after storage, was not related to incidence of eye infection on seed. In 3 years, infection at harvest was significantly related to infection during growth, but only in 1975 was infection at harvest related to silver scurf in store.

In 2 years amounts of silver scurf on crops grown from seed derived from stem cuttings ('healthier' seed) were positively correlated with disease incidence in commercial crops grown on the same fields.

Introduction

This paper reports results for silver scurf (*Helminthosporium solani* Dur. & Mont.) from a 5-year study of relationships between disease incidence on seed tubers and on progeny tubers during growth, at harvest, and after storage, in cv. King Edward crops growing in Eastern England (Adams et al., 1980a).

Materials and methods

Details of the sampling procedure and times have been reported earlier (Adams et al., 1980a). Seed and progeny tuber eye tissues were examined microscopically by excising all eyes from 20-tuber samples of each crop. After incubation at 15 °C for 5 days the proportion of eye plugs with conidiophores of *H. solani* on the tuber skin was recorded (Hide et al., 1968). Stored progeny tubers were inspected, and numbers with silver scurf, and with more than 10 % of the surface area affected (severe infection), were recorded on 3 replicates of 7 kg of each storage treatment per crop.

In 1975 20-tuber samples of seed and harvested tubers were washed and incubated over water in sealed plastic buckets (Adams et al., 1980b) at 20 °C. After 4 weeks all tubers were washed in 600 ml water, and the suspension centrifuged at 1200 g for 15 minutes. The pellet was resuspended in 10 ml water and 9 counts of *H. solani* conidia were made on each of 3 aliquots with a haemocytometer. Also in 1975 samples of harvested tubers were examined microscopically, by excising from each of 20 tubers 3 plugs of tissue taken at random from tubers but avoiding the eyes. Plugs were incubated at 15 °C and the number with *H. solani* conidiophores recorded after five days.

Table 1. Mean incidence of silver scurf or *Helminthosporium solani* infection on seed tubers and on progeny tubers during growth, at harvest and after 3–4 months' storage of crops grown from commercial seed.

Crop stage[1]	Test[2]	1971	1972	1973	1974	1975
Seed[3]	Eyes[a 11]	62.7	54.4	41.1	32.5	42.3
Growth[4]	Eyes[a]	1.9	4.3	2.0	7.1	6.9
Harvest[5]	Eyes[a]	58.1	20.6	12.7	12.9	26.3
Storage[6] 3 °C not cured[7]	Tubers, total[b 12]	50.6	99.4	33.2	83.5	10.4
3 °C cured[8]	Tubers, total[b]	58.6	99.6	34.2	85.2	-
10 °C not cured	Tubers, total[b]	82.5	99.4	90.4	98.0	-
10 °C cured	Tubers, total[b]	78.8	99.5	91.2	98.5	-
S.E.D. storage means[d 9]		±1.96	±0.29	±2.32	±1.58	
Storage 3 °C not cured	Tubers, severe[c 13]	17.5	2.0	10.5	24.7	0.6
3 °C cured	Tubers, severe[c]	22.7	3.0	9.8	28.8	-
10 °C not cured	Tubers, severe[c]	60.7	12.9	80.6	74.5	-
10 °C cured	Tubers, severe[c]	51.7	24.2	83.1	77.5	-
S.E.D. storage means[d]		±1.82	±1.60	±2.78	±2.32	-
D.F.[10]		116	124	164	156	

[a] Tuber eyes with *H. solani* conidiophores (%) - *Knollenaugen mit Konidienträgern von H. solani in % - Yeux avec conidiophores de H. solani (%).*
[b] Tubers with silver scurf (%) - *Knollen mit Silberschorf in % - Tubercules atteints de gale argentée (%).*
[c] Tubers with silver scurf (%), > 10 % surface affected - *Knollen mit Silberschorf in %, > 10 % der Oberfläche befallen - Tubercules avec plus de 10 % de la surface atteinte de gale argentée (%).*
[d] For effect of curing comparison - *Zum Vergleich des Einflusses der Wundheilung - Pour comparaison de l'effet de cicatrisation.*

[1] *Entwicklungsstadium - Stade de la culture;* [2] *Prüfung - Test;* [3] *Pflanzgut - Semence;* [4] *Wachstum - Végétation;* [5] *Ernte - Récolte;* [6] *Lagerung - Conservation;* [7] *Ohne Wundheilung - Sans cicatrisation;* [8] *Mit Wundheilung - Avec cicatrisation;* [9] *Signifikante Fehlerdifferenz der Mittelwerte der Lagerung - Ecart type sur les moyennes, en conservation;* [10] *Freiheitsgrade - Degré de liberté;* [11] *Augen - Yeux;* [12] *Knollen, insgesamt - Tubercules, total;* [13] *Schwer - Graves.*

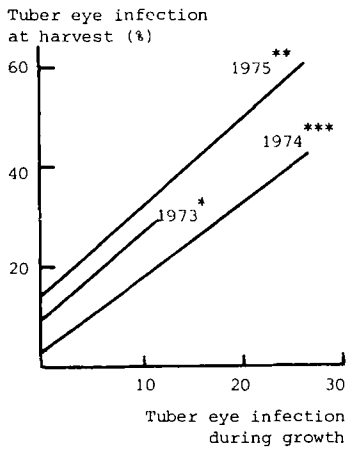
Tabelle 1. Durchschnittliches Auftreten von Silberschorf oder Infektion mit *Helminthosporium solani* an Pflanzkartoffeln und an Tochterknollen während des Wachstums, bei der Ernte und nach 3–4 Monaten der Lagerung, aufgewachsen aus Marktware.
Tableau 1. Incidence moyenne de la gale argentée ou de l'infection par *Helminthosporium solani* des tubercules de semence et des tubercules-fils en cours de végétation, à la récolte et après 3–4 mois de conservation dans des cultures issues de lots de semence du commerce.

Results

On average, 30–60 % of eye plugs excised from seed tubers produced conidiophores of *H. solani* (Table 1) and incidence of infection was greatest in 1971 and least in 1974. Few eye plugs from progeny tubers were infected in July or August, but by harvest infection was more common, especially in 1971.

Silver scurf was prevalent on stored tubers except in 1975, and more developed at 10 °C than at 3 °C. Although the disease was equally common in 1972 and 1974, fewer tubers were severely affected in 1972 after storage at either temperature. Curing for 2 weeks at 15 °C seldom affected the incidence of silver scurf in these experiments, but in 1971 disease incidence was increased on tubers subsequently stored at 3 °C, and

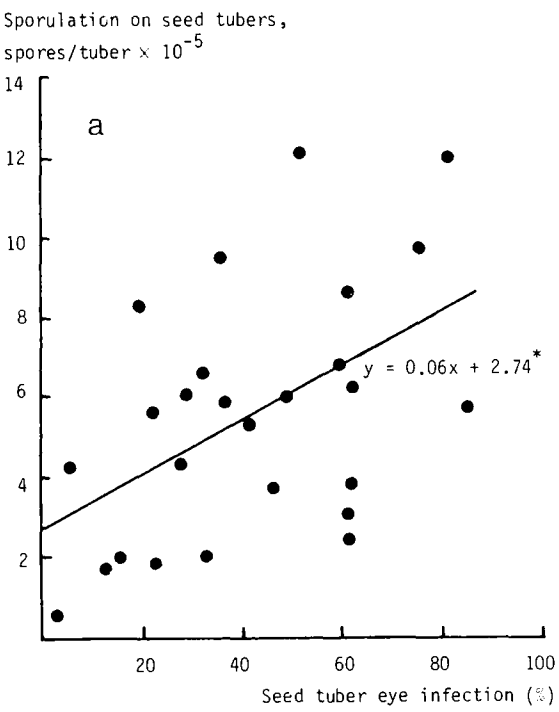
Fig. 1. Graph showing the relationships between assessments of eye infection by *Helminthosporium solani* on tubers in growth and at harvest in crops grown from commercial seed for those years they were significant. Asterisks indicate significance of the regressions:

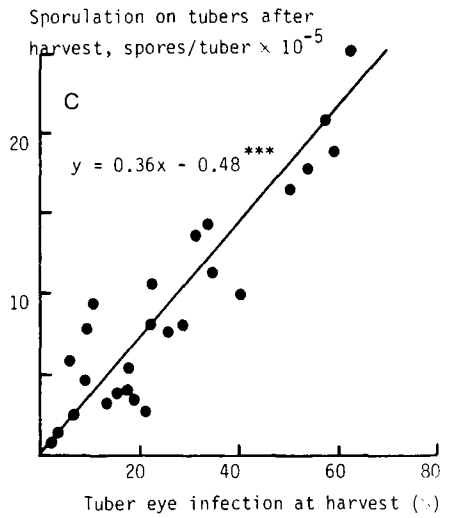


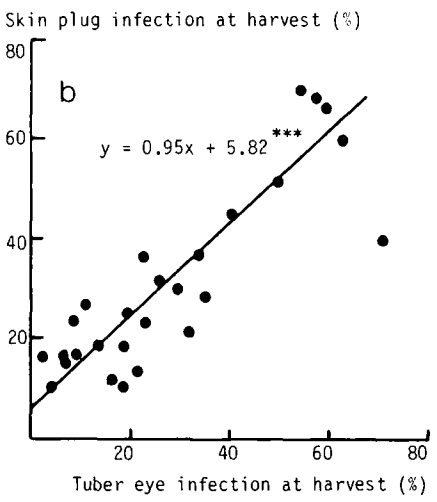
* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$.

Tuber eye infection at harvest - *Infektion der Knollenaugen bei der Ernte - Infection des yeux des tubercules à la récolte.*
Tuber eye infection during growth - *Infektion der Knollenaugen während des Wachstums - Infection des yeux des tubercules durant la croissance.*

Abb. 1. Diagramm der Beziehungen zwischen der Infektion der Augen durch Helminthosporium solani von Kartoffeln während des Wachstums und bei der Ernte, aufgewachsen aus Marktware, für jene Jahre, in denen sie signifikant sind. Die Sternchen geben die Signifikanz der Regressionen an.
Fig. 1. Graphique montrant les relations entre les notations d'infection des yeux par Helminthosporium solani sur les tubercules durant la période de croissance et à la récolte, dans des cultures issues de lots de semence du commerce pour les années où elles étaient significatives. Les astérisques indiquent la signification des régressions.


Sporulation on seed tubers,
spores/tuber × 10^-5
a
y = 0.06x + 2.74*
Seed tuber eye infection (%)


Sporulation on tubers after
harvest, spores/tuber × 10^-5
c
y = 0.36x - 0.48***
Tuber eye infection at harvest (%)


Skin plug infection at harvest (%)
b
y = 0.95x + 5.82***
Tuber eye infection at harvest (%)

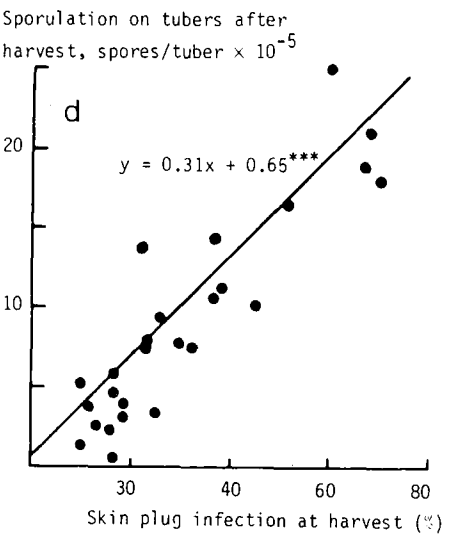
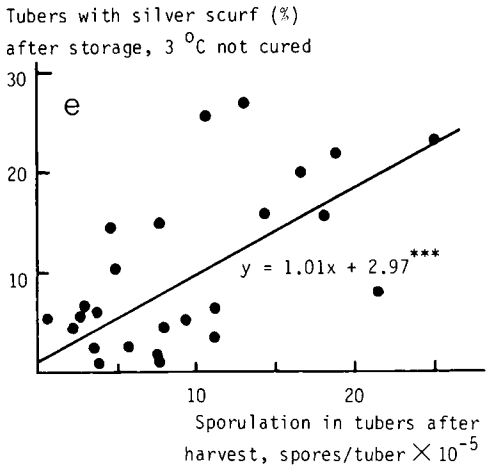

Sporulation on tubers after
harvest, spores/tuber × 10^-5
d
y = 0.31x + 0.65***
Skin plug infection at harvest (%)

Fig. 2. Graphs showing the relationships between different tests of silver scurf inoculum or disease at different stages on 26 commercial crops in 1975. Asterisks indicate significance of the regressions.



* $P < 0.05$; *** $P < 0.001$.

Tuber eye infection at harvest - *Infektion der Knollenaugen bei der Ernte - Infection des yeux des tubercules à la récolte.*
Seed tuber eye infection - *Infektion der Augen der Pflanzkartoffeln - Infection des yeux des tubercules de semence.*
Tubers with silver scurf after storage, 3 °C not cured - *Knollen mit Silberschorf nach der Lagerung bei 3 °C ohne Wundheilung - Infection présentant de la gale argentée après conservation à 3 °C sans cicatrisation.*
Skin plug infection at harvest - *Infektion der Schale bei der Ernte - Infection des fragments de peau à la récolte.*
Sporulation on seed tubers, spores/tuber × 10^{5} - *Sporulation auf Pflanzkartoffeln, Sporen/Knollen × 10^{5} - Sporulation sur les tubercules de semence, spores/tubercules × 10^{5}.*
Sporulation on tubers after harvest, spores/tubers × 10^{5} - *Sporulation auf Knollen nach der Ernte, Sporen/Knollen × 10^{5} - Sporulation sur les tubercules à la récolte, spores/tubercules × 10^{5}.*

Abb. 2. Diagramme der Beziehungen zwischen verschiedenen Prüfungen auf Inokulum von oder Befall mit Silberschorf in bestimmten Stadien, an 26 Proben von Marktware im Jahr 1975. Die Sternchen geben die Signifikanz der Regressionen an.
Fig. 2. Graphique montrant les relations entre les différentes analyses d'inoculum de gale argentée ou de maladie à différéntes époques sur 26 cultures issues de lots de semence du commerce en 1979. Les astérisques indiquent la signification des régressions.

decreased on those stored at 10 °C. In 1972 curing caused an increase in the proportion of tubers that were severely affected at 10 °C.

'Healthier' seed had fewer eyes infected than commercial stocks (Table 2). However, during growth, and at harvest, incidence of eye infection on progeny tubers from 'healthier' seed was as great or greater than on tubers from commercial stocks. The average incidence of silver scurf was similar on stored tubers from 'healthier' and

Table 2. Mean incidence of silver scurf or *Helminthosporium solani* infection on seed tubers and on progeny tubers during growth, at harvest and after 3–4 months' storage of crops grown from 'healthier' seed.

Crop stage[1]		Test[2]	1972	1973	1974	1975
Seed[3]		Eyes[a 11]	4.0	0	16.3	1.2
Growth[4]		Eyes[a]	10.1	–	10.0	5.4
Harvest[5]		Eyes[a]	24.6	14.1	23.2	25.7
Storage[6]	3 °C not cured[7]	Tubers, total[b 12]	99.5	27.1	83.7	10.8
	3 °C cured[8]	Tubers, total[b]	99.5	32.6	84.3	–
	10 °C not cured	Tubers, total[b]	99.8	88.9	97.4	–
	10 °C cured	Tubers, total[b]	100.0	88.6	99.0	–
S.E.D. storage means[d 9]			±0.27	±3.15	±2.12	
Storage	3 °C not cured	Tubers, severe[c 13]	1.8	4.7	31.4	0.5
	3 °C cured	Tubers, severe[c]	2.5	8.3	35.9	–
	10 °C not cured	Tubers, severe[c]	18.2	76.7	70.6	–
	10 °C cured	Tubers, severe[c]	24.0	75.0	84.3	–
S.E.D. storage means[d]			±3.10	±4.19	±4.09	
D.F.[10]			36	100	91	

[a-d] See Table 1 - *Siehe Tabelle 1 - Voir tableau 1.*

[1 13] *Siehe Tabelle 1 - Voir tableau 1.*

Tabelle 2. Durchschnittliches Auftreten von Silberschorf oder Infektion mit *Helminthosporium solani* an Pflanzkartoffeln und an Tochterknollen während des Wachstums, bei der Ernte und nach 3–4 Monaten der Lagerung, aufgewachsen aus 'gesünderem' Pflanzgut.
Tableau 2. Incidence moyenne de gale argentée ou de l'infection par *Helminthosporium solani* des tubercules de semence et des tubercules-fils en cours de végétation, à la récolte et après 3–4 mois de conservation dans des cultures issues de semences 'plus saines'.

Table 3. Significance of regressions between silver scurf assessments on seed tubers and on progeny tubers during growth, at harvest and after 3–4 months' storage of crops grown from commercial seed.

Crop stage[1]	Test[2]	Crop stage[1] → Test[2]	Growth[4] → Eyes[a 11]	Harvest[5] Eyes[a 11]	Storage[6] Tubers[b 12]
Seed[3]	Eyes[a 11]		0 n.s.[c]	0*	0 n.s.
Growth[4]	Eyes			3 n.s.	0 n.s.
Harvest[5]	Eyes				1 n.s.

[a, b] See Table 1 - *Siehe Tabelle 1 - Voir tableau 1.*
[c] Number of years out of 5 in which regression was significant ($P < 0.05$). Significance of regression for all years combined in brackets - *Zahl der Jahren innerhalb der fünf in denen die Regression signifikant war ($P < 0.05$). Die Signifikanz der Regression für alle Jahre ist in Klammern angegeben - Nombre d'années sur 5 où la régression est significative ($P < 0.05$). La signification de la régression pour l'ensemble des années est entre parenthèses.*
[d] n.s. = Not significant - *Nicht signifikant - Non significatif.*
* $P < 0.05$.

[1-6, 11-12] *Siehe Tabelle 1 - Voir tableau 1.*

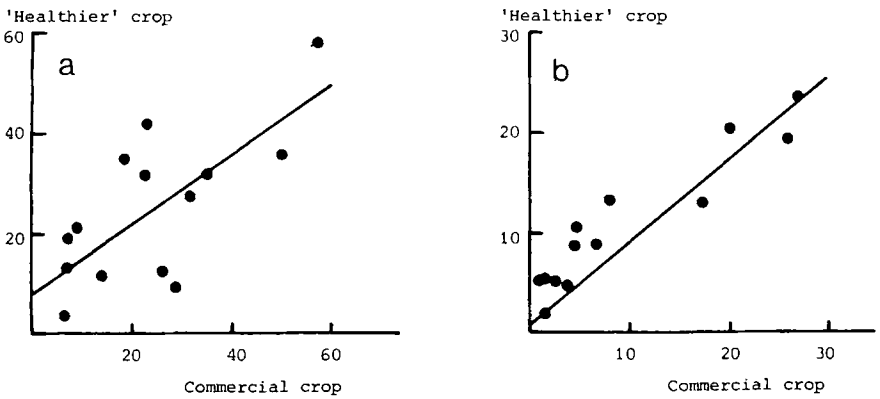
Tabelle 3. Signifikanz der Regressionen zwischen den Bonituren des Befalls mit Silberschorf von Pflanzkartoffeln und Tochterknollen während des Wachstums, bei der Ernte und nach 3–4 Monaten der Lagerung, aufgewachsen aus Marktware.
Tableau 3. Signification des régressions entre les notations de gale argentée sur tubercules de semence et sur les tubercules-fils en végétation à la récolte et après 3–4 mois de conservation dans des cultures issues de lots de semence du commerce.

commercial stocks.

The statistical significance of relationships between different tests on seed and progeny tubers are given in Table 3. The incidence of tuber eye infection during growth or at harvest was not significantly related to that on seed tubers in individual years. In three years incidence of eye infection at harvest was related to that during growth (Fig. 1), but only in 1975, when least silver scurf developed on stored tubers, was the incidence of eye infection at harvest related to total or severe silver scurf after storage ($P < 0.01$).

In 1975 the results of the two methods of assessing disease on seed, incubating eye plugs and determining numbers of conidia produced on incubated whole tubers, were in fairly good agreement (Fig. 2a), but neither was significantly related to incidence of

Fig. 3. Graphs showing the relationships between assessments of silver scurf inoculum or disease made at harvest or after 3–4 months' storage on crops grown from commercial seed and those from adjacent crops grown from 'healthier' seed in 1975. Asterisks indicate significance of the regressions: (a) $y = 0.70x + 7.84$ ($F = 10.89^{**}$); (b) $y = 0.67x + 4.42$ ($F = 81.08^{***}$).



** $P < 0.01$; *** $P < 0.001$.

a: Eye infection at harvest - *Infektion der Augen bei der Ernte - Infection des yeux à la récolte.*
b: Tubers with silver scurf after storage, 3 °C not cured - *Siehe Abb. 2 - Voir Fig. 2.*

'Healthier' crop - *'Gesündere' Ware - Cultures 'plus saines'*
Commercial crop - *Marktware - Cultures commerciales.*

Abb. 3. Diagramme der Beziehungen zwischen den Bonituren von Inokulum von oder Befall mit Silberschorf bei der Ernte oder nach 3–4 Monaten der Lagerung von Proben, aufgewachsen aus Marktware und solchen aus benachbartem 'gesünderen' Pflanzgut im Jahr 1975. Die Sternchen geben die Signifikanz der Regressionen an: (a) $y = 0.70x + 7.84$ ($F = 10.89^{**}$); (b) $y = 0.67x + 4.42$ ($F = 81.08^{***}$).

Fig. 3. Graphique montrant les relations entre les évaluations d'inoculum de gale argentée ou de maladie à la récolte ou après 3–4 mois de conservation dans des cultures issues de lots de semence du commerce et dans celles adjacentes issues de semence 'plus saines' en 1975. Les astérisques indiquent la signification des régressions: (a) $y = 0.70x + 7.84$ ($F = 10.89^{**}$); (b) $y = 0.67x + 4.42$ ($F = 81.08^{***}$).

eye infection on progeny tubers. Disease assessments on harvested tubers made by excising plugs of tissue bearing either eyes or tuber skin gave similar results (Fig. 2b), and both were significantly related to numbers of conidia produced on whole tubers (Figs. 2c and 2d). Regressions of silver scurf (total tubers affected) after storage on incidence of tuber infection at harvest, measured by incubation of eye or skin plugs, were significant ($P < 0.01$), but the regression on sporulation on whole tubers (Fig. 2e) had a larger variance ratio.

In 1975, the incidence of eye infection during growth on crops grown from 'healthier' seed was related ($P < 0.05$) to infection at harvest, and to the amount of silver scurf after storage. In 1975 there was a significant relationship between infection of tubers grown from commercial seed and that of tubers from adjacent crops grown from 'healthier' seed, both at harvest (Fig. 3a) and after storage (Fig. 3b). Amounts of silver scurf on tubers grown from commercial and 'healthier' seed were also significantly ($P < 0.001$) related in 1973.

Discussion

Although previous observations (Jellis & Taylor, 1977) have indicated that the soil may not be an important source of *H. solani* inoculum, the fungus can survive on tubers left in soil from previous potato crops (Jellis, 1972). At Rothamsted infected tubers have been found in some fields 10 years after the previous potato crop had been grown (Hide et al., 1977), but in the present experiments few groundkeepers were seen in any crop. It is considered that most silver scurf in crops derives from inoculum on seed tubers (Burke, 1938; Mooi, 1968; Jellis & Taylor, 1977), and many eye plugs from tubers in almost all seed stocks used in these experiments produced conidiophores of *H. solani* after incubation.

Jellis & Taylor (1977) showed that silver scurf lesions spread over the surface of seed tubers in soil, and that conidia of *H. solani* are abundantly produced during 4 weeks after planting. As stems and stolons have not been found infected, it suggests that conidia produced on seed tubers become dispersed in soil and spread into the zone where young tubers are developing. Consequently, tubers produced on short stolons near the seed tuber may be the first infected, and first infections on tubers are sometimes found at the stolon end (Schultz, 1916; Burke, 1938; Hide et al., 1968; Jellis & Taylor, 1977).

Because lesions spread over seed tubers after planting, and because ageing lesions lose their ability to sporulate, extensively affected seed tubers can produce crops with less disease than seed with moderate infection (Mooi, 1968; Lennard, 1970; Jellis & Taylor, 1977). Whereas this negative relationship between seed and crop infection has been demonstrated with seed with different levels of disease planted on the same field, our experiments were with seed grown on different farms. Although more than half the regressions relating seed and tuber infection in growth, at harvest, or after storage, had a negative slope, none was statistically significant. However, 'healthier' seed with least disease did produce crops with as much or more tuber infection than commercial seed stocks.

We did not assess the extent of silver scurf on seed tubers, but determined infection after incubation of eye plugs for 5 days. In attempts to measure the potential

sporulation of *H. solani* on seed tubers after planting, whole tubers were incubated for 4 weeks in 1975 and, although results of this test were significantly related to results of incubating eye plugs, neither was found to be related to amounts of infection on progeny tubers. However, assessments of sporulation on harvested tubers were better related to silver scurf in store than were results of incubating eye plugs.

Although conidia of *H. solani* can be found in soil around tubers in July and August, few conidiophores develop on tuber skin during incubation, but a greater incidence of infection is detected at harvest.

Jellis (1972) found that sporulation did not occur until 3–5 weeks after inoculation, so it is likely, as suggested by Jellis & Taylor (1977), that results of incubating eye plugs from developing tubers indicate only those infections that had occurred several weeks before. The conditions of incubation used in our tests were a compromise between development of conidiophores of *H. solani* and *Polyscytalum pustulans* (Owen & Wakef.) Ellis, overgrowth by faster growing fungi and contaminants, and appearance of new infections (Hide et al., 1968). We showed that incubation of eye plugs at 25 °C, and for longer than 5 days, doubled the numbers producing *H. solani* conidiophores but also encouraged growth of *Rhizoctonia solani* Kühn and *Penicillium* spp. so that accurate recording became more difficult.

The amount of silver scurf developing on tubers is affected by storage conditions, and drying tubers before storing can prevent much disease (Burke, 1938; Mooi, 1968). In our experiments tubers were held at 90–95 % relative humidity both during the initial curing period and subsequently throughout storage at both temperatures. This might explain why the disease was prevalent in most years and why curring did not consistently affect incidence or severity of the disease. Furthermore, as storage temperature and humidity were achieved by recirculation of air, it is possible that conidia of *H. solani* produced on infected tubers were dispersed within the store (Hide & Stedman, 1968) and infected hitherto uninfected tubers.

Although seed tubers are commonly infected with *H. solani* in the U.K. (Hirst et al., 1970) results of these experiments on different farms suggest that the incidence of disease on crops may not be related to that on the seed. Transmission of inoculum from seed to progeny tubers may be influenced by soil conditions, and results in 1975 showed that when samples of seed from a healthy stock were grown alongside commercial crops on several farms, amounts of disease in the progeny were related. However, in a later paper (Adams & Hide, 1980), we shall show that the relationship between the incidence of infection on seed and progeny tubers was better when samples from different seed stocks were grown on the same field.

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Zusammenfassung

Beziehungen zwischen dem Krankheitsbefall von Pflanzkartoffeln, an Kartoffeln während des Wachstums und im Lager. 3. Silberschorf

Zwischen 1971 und 1975 wurde in bis zu 26 Proben von Marktware der Sorte King Edward das Auftreten von Silberschorf an gelagerten Kartoffelknollen untersucht sowie die Infektion mit *Helminthosporium solani* von Knollenaugen des Pflanzgutes, von Tochterknollen während des Wachstums und zur Ernte (Adams et al., 1980). Zwischen 1972 und 1975 wurden diese Erhebungen auch an Erntegut aus 'gesünderem' Pflanzgut (das von Stecklingen abstammte) das benachbart zur Marktware aufwuchs, gemacht.

Das durchschnittliche Auftreten von Infektion oder Krankheitsbesatz auf Marktware (Tab. 1) zeigte, das in allen Jahren die Infektion der Knollenaugen des Pflanzgutes häufig war, seltener an den Tochterknollen während des Wachstums, aber vorallem 1971 zur Ernte wieder verstärkt war. Ausser 1975 trat Silberschorf häufig auf gelagerten Knollen auf, und entwickelte sich bei 10 °C mehr als bei 3 °C.

Eine Wundheilung von 2 Wochen bei 15 °C hatte keinen Einfluss auf diese Krankheit. Bei 'gesünderem' Pflanzgut waren weniger Augen infiziert als im Durchschnitt der Marktware, aber während des Wachstums und zur Ernte war der Befall der Augen genau so gross oder grösser als von Marktware (Tab. 2).

Die Signifikanz der Regressionen zwischen den Feststellungen des Krankheitsbesatzes oder der Infektion, die zu verschiedenen Zeiten gemacht wurden (Tab. 3) zeigte, dass die Bonitur der Infektion des Pflanzgutes im allgemeinen mit den folgenden Bonituren nicht in Beziehung stand. In drei Jahren war das Auftreten von Augeninfektionen zur Ernte mit dem während des Wachstums verbunden (Abb. 1).

1975 wurden Pflanzkartoffeln und geerntete Knollen unter feuchten Bedingungen inkubiert und die Sporulation von *H. solani* nach dem Waschen und dem Zentrifugieren der Flüssigkeit untersucht. Die Sporulation war abhängig vom Auftreten von Augeninfektionen des Pflanzgutes (Abb. 2a) und des geernteten Nachbaus (Abb. 2c). Untersuchungen des Inokulums von *H. solani* bei denen Schalenstückchen, ausgenommen Augen, verwendet wurden, ergaben Beziehungen zum Ergebnis von Augenstückchen des Pflanzgutes (Abb. 2b) und zur Sporulation auf geerntetem Nachbau (Abb. 2d). Das Auftreten von Silberschorf nach der Lagerung war mit allen verschiedenen Messungen des Inokulums verbunden und am besten mit den Ergebnissen der Sporulation (Abb. 2e).

Ein Vergleich der Ergebnisse 'gesünderer' Ernte mit den Ergebnissen benachbarter Marktware ergaben nur wenig signifikante Beziehungen. 1975 waren jedoch das Ausmass der Augeninfektion zur Ernte (Abb. 3a) und des Krankheitsbesatzes nach der Lagerung (Abb. 3b) verbunden, was auf eine allgemeine Quelle des Inokulums, eine Verbreitung zwischen benachbarten Ernten oder die Bedeutung der allgemeinen Bodenbedingungen hinweist.

Résumé

Relations entre les taux de maladie des tubercules de semence, les cultures en végétation et les pommes de terre en conservation. 3. La gale argentée

L'incidence de la gale argentée sur les tubercules en conservation et l'infection par *Helminthosporium solani* des yeux des tubercules de semence et des tubercules-fils durant la croissance et à la récolte, ont été notées, de 1971 à 1975, dans 26 cultures issues de lots de semence du commerce de la variété King Edward (Adams et al., 1980a). Entre 1972 et 1975, des évaluations ont également été faites sur des lots issus de semences 'plus saines' (dérivées de boutures) cultivées près de certains lots commerciaux.

L'incidence moyenne de la contamination ou de la maladie sur les lots commerciaux

(tableau 1) montre que la contamination des yeux a été fréquente sur les semences tous les ans, rare sur les tubercules-fils en végétation mais plus fréquente à la récolte, surtout en 1971. La gale argentée est apparue fréquemment en conservation, sauf en 1975, et s'est plus développée à 10 °C qu'à 3 °C. La cicatrisation des blessures pendant deux semaines à 15 °C n'a pas eu d'effet marqué sur l'incidence de la maladie. Les semences 'plus saines' avaient moins d'yeux atteints que la moyenne des semences des autres lots, mais la contamination des yeux en végétation et à la récolte atteignait ou dépassait celle des tubercules des autres lots (tableau 2).

La signification des régressions entre les notations de maladie ou d'infection réalisées à différentes époques (tableau 3) a montré que les notations de contamination des tubercules de semence n'étaient pas généralement en relation avec les suivantes. Pour 3 années, l'incidence de l'infection des yeux à la récolte était en relation avec celle notée durant la croissance (Fig. 1).

En 1975, on a aussi placé les tubercules de semence et la récolte en conditions humides et on a contrôlé la sporulation de *H. solani* après lavage et centrifugation du liquide. La sporulation était liée à l'incidence de l'infection des yeux des tubercules de semence (Fig. 2a) et celle des tubercules-fils récoltés. Des analyses d'inoculum de *H. solani* sur des fragments de peau sans yeux se sont montrés corrélées aux résultats obtenus sur les yeux des tubercules de semence (Fig. 2b) et à l'importance de la sporulation sur la récolte (Fig. 2d). L'incidence de la gale argentée en conservation s'est montrée liée à toutes les différentes mesures d'inoculum effectuées sur la récolte et en particulier aux mesures de sporulation (Fig. 2e).

La comparaison entre les notations sur les cultures 'plus saines' et leurs homologues de la série commerciale n'a révélé que peu de relations significatives. Cependant, en 1975, il y avait relation entre la contamination des yeux à la récolte (Fig. 3a) et la maladie après conservation (Fig. 3b) sont liées, laissant supposer soit une source commune d'inoculum, soit une propagation d'une culture à l'autre, soit l'importance des conditions habituelles de sol.

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