MEETINGS

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TIMING OF PEST AND DISEASE CONTROL IN SOME FIELD AND ORCHARD CROPS IN ISRAEL

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There are four accepted approaches to the timing of pest control: chemical control at fixed, prescheduled intervals or according to regular observation (field scouting), integrated control, and biological control. Prescheduled control is the most expensive, but is popular among farmers. The three other control methods involve surveillance of pest populations as the basis for decisions with regard to control operations and pest management.

The field scouting programs operating in Israel are concerned with (*a*) leaf rust of wheat in the Bet She'an Valley; (*b*) the main cotton pests, *viz.*, American bollworm, Egyptian cotton leaf worm, spiny bollworm and pink bollworm; this program has covered all cotton fields in the country (100,000 acres) for more than 20 years; and (*c*) apple pests in the Hula Valley, including operation of light traps, pheromone and sack traps for attraction of the codling moth.

Two additional field scouting programs will be initiated in 1977, on tomatoes for canning in the Yizre'el Valley and on vineyards in the central and the southern part of the country. Integrated control is practiced in citrus, avocado and date palm plantations.

BACTERIAL DISEASES

BACTERIAL LEAF SPOT OF CARNATION AND ITS CONTROL

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Results of field experiments for the control of *Pseudomonas woodsii* indicated that weekly spray applications at the beginning of the season, with Bromobac 20 [2,2-dibromo-3-nibrilo-propionamide (O.B.N.P.A.)] or Eryptanal (8-hydroxy quinoline sulfate) with the addition of a copper compound, were efficient in preventing the spread of the disease.

Preventive measures such as use of disease-free mother plants, plastic covering of propagation nurseries, rapid diagnosis of the pathogen in mother plants and cuttings, as well as spray application with the above-mentioned chemicals, contributed to a great reduction in disease spread.

RECENT OCCURRENCE OF NEW BACTERIAL DISEASES ON VEGETABLE CROPS

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The importance of bacterial diseases in Israel has increased greatly during the last decade with the import of seed, introduction of new varieties, successive cultivation of the same crops without rotation, and the use of cultivation procedures favorable for disease development (in particular, cropping under plastic cover).

A survey was conducted on the occurrence of new diseases and also of new races or pathotypes of pathogens previously found in the country, *e.g.* the one responsible for the recent serious spread of bacterial spot caused by *Xanthomonas vesicatoria* (Doidge) Dowson on pepper in several areas during spring and autumn, the main seasons of cultivation. When the disease attacks the plant at an early stage of its development, heavy defoliation may ensue, and the crop is seriously affected; for the first time in this country, fruits were also affected by the disease under natural conditions. Seed disinfection with common chemicals was not sufficiently efficient, but chemicals found promising in laboratory tests will be tested in the field.

Speck disease (*Pseudomonas tomato* (Okabe) Alstatt) is now wide-spread on most of the fresh market and canning varieties of tomatoes and often assumes epidemic proportions, especially on tomatoes in open fields in the Rafiah area. A technique for easily and rapidly diagnosing the disease and for controlling it in nurseries has been developed. Promising sources of resistance have been detected in screening tests. Introduction of these sources into local susceptible varieties is being studied in a general breeding program carried out jointly with vegetable breeders.

A spot and wilt disease of carrots caused by *Xanthomonas carotae* (Kendrick) Dowson occurred recently in Israel on several plants in a field for seed production. The disease is seed-borne, and hence the danger of its dissemination in the country. In preliminary tests it was found that the varieties 'Nanti' and 'Chantenay', known abroad as resistant, were susceptible to the local isolates.

A strain of *Pseudomonas lachrymans* (Sm. & Bryan) Carsner, different from the common cucumber isolates, has become established over the last 3 years in melon fields on the varieties 'Honey Dew' and '612'. It causes fruit and leaf spots, but attacks mainly the fruits, and may cause serious losses.

BACTERIAL SOFT ROT DISEASES OF ORCHIDS AND THEIR CONTROL

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Soft rot diseases have caused great damage to *Oncidium splendidum, Phalenopsis* spp. and *Cymbidium* spp. plants in greenhouses in Israel during the last few years. A bacterial pathogen, identified as *Erwinia chrysanthemi* by its morphological, biochemical, physiological and pathological characteristics, was isolated from infected parts of the plants. In addition, other organisms, identified as *Pseudomonas* spp., were also isolated from leaf spots and soft rots of pseudobulbs on *Cymbidium;* these organisms induced soft wet rot on plants following artificial inoculation.

A survey was carried out on the rate and progress of disease development in the greenhouses. Experiments were conducted to test the efficiency of various chemicals in controlling the spread of diseases. The diseases could be checked by treating the plants with 8-hydroxyquinoline sulfate, as well as with antibiotics such as streptomycin or oxytetracycline. However, the antibiotics were found to be phytotoxic, which could be explained by the effect of these substances on the plastids and mitochondria of the plants.

FUNGAL DISEASES OF LEAF, FLOWER AND FRUIT

ASSESSMENT OF THE RELATIONSHIP BETWEEN EPIDEMICS OF SEPTORIA LEAF BLOTCH OF WHEAT AND YIELD LOSSES

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Septoria leaf blotch of wheat incited by the fungus *Septoria tritici* Rob. in Desm. often assumes epidemic proportions, causing serious yield reductions. Assessment of disease progress and disease severity in relation to losses in yield components of wheat cultivars, may serve as a useful screening measure. Susceptible wheat cultivars with high pycnidial coverage on plant parts responsible for grain filling, exhibit differential yield-loss response to Septoria leaf blotch. The tolerant wheat cultivar 'Miriam' has shown consistent non-significant losses in yield under severe epidemics in various locations over several years and when exposed to infection by different isolates of the pathogen. Similar yield-loss responses were recorded for the moderately resistant cultivar 'Yafit', which exhibited low pycnidial coverage. In all studies, wheat cultivars varying in plant height and in maturity were included.

The inheritance of low yield-loss response in heavily infected segregating populations of F_3 and F_4 bulks and derived lines was investigated for crosses between 'tolerant x susceptible' cultivars and 'tolerant x resistant' wheat cultivars.

Selection of single plants within segregating populations was based on desirable agronomic characteristics combined with low yield-loss response compared with that in infected and fungicide-protected populations and parents. The scarcity of germ plasm resistant to Septoria leaf blotch and the lack of knowledge about the types of resistance or their manipulation and accumulation, direct attention to heritable protection phenomena capable of maintaining the high yield potential of modern wheat cultivars.

BREEDING CHICKPEAS (*CICER ARIETINUM* L.) FOR RESISTANCE TO ASCOCHYTA BLIGHT

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One of the major problems of chickpea growing in Israel is Ascochyta blight, caused by the fungus *Ascochyta rabiei* (Paff.) Lab. Commercially grown cultivars are very susceptible to the disease, except for 'Bulgarian' – which is resistant but suffers from low yields and has small rounded seeds which fetch low prices on the market.

Some introduced cultivars with very good field resistance but unsuitable for commercial cultivation have been used as resistance donors in our breeding program.

Some cultural practices, mainly late planting, are efficient means for controlling the disease. However, delay in planting a long-day plant shortens the growth period and causes a significant decrease in yields.

Chemical control of Ascochyta blight is also possible – by frequent applications of 'Maneb', but this is quite expensive and control depends on weather conditions and on the time of application.

A breeding project started in 1966 has resulted in several resistant cultivars. Two of them, 'Ayelet' and 'Ofra', have been tested for two years in various regions. 'Ayelet' originated from a cross between the improved local variety M 43 and E 100 (an Ascochyta blight-resistant variety,

with black seeds and purple flowers, introduced from Greece). 'Ayelet' produces a large creamy seed with a dark, small hilum; it has excellent agronomic properties: plants are erect, very prolific, and show moderate field resistance to blight.

'Ofra' originated from a cross between 'Californian' (of unidentified origin, widely grown in Israel, susceptible to Ascochyta blight, very prolific, with large creamy seeds) and 'Bulgarian' (also of unidentified origin, resistant to blight, with small rounded seeds and medium prolificacy). 'Ofra' shows very good resistance to blight and has creamy seeds of medium size.

Additional breeding lines are now at the F_5 stage. In this program, commercial and advanced strains are being crossed with new blight-resistance donors.

RESISTANCE OF *VENTURIA PIRINA* ADERH. IN PEAR ORCHARDS TO BENZIMIDAZOLE FUNGICIDES, AND ALTERNATIVE CONTROL MEASURES

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Resistance of pear scab (*Venturia pirina* Aderh.) to benzimidazole fungicides was first noticed in the spring of 1975 in a pear orchard at Tel Tsofit, which had been sprayed four times with fungicides of this group. Infestation was very severe on young fruits and leaves; benlate sprays at a concentration of 0.12% (which is four times the recommended concentration) failed to give control.

Laboratory trials conducted in 1975 showed that resistance had developed in four out of the 40 pear orchards infected by scab. In a field trial conducted in spring 1976 at Tel Tsofit, successive applications of Merpan, Delan and Merpan plus Imazalil, were very effective in controlling the disease. Commercial applications of Delan and Merpan also effectively controlled the disease, and the fruit at harvest was entirely scab-free.

A survey was conducted in 1976 of 37 scab-infected pear orchards throughout the country, including 29 orchards which had been examined in the previous year; eight of the orchards, two of which were examined for the first time in 1976, were infected with benzimidazole-resistant strains of the fungus.

STONE FRUIT RUST DISEASE ON *ANEMONE CORONARIA* AND ITS SYSTEMIC CARRY-OVER

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Anemone coronaria is the alternate host of the rust disease (*Tranzschelia pruni-spinosae* (Pers.) Diet. var. *discolor* (Fuck.) Dun.) on stone fruits, on which pycnia and aecia stages develop. *A. coronaria* is widespread in Israel and is attacked severely by the rust, year after year, in all the natural growing areas.

In greenhouse trials and field screenings it was found that the stone fruit rust on *Anemone coronaria* causes severe damage, expressed as inhibition, prevention or deformation of flowering; over-enlargement of the leaf petiole; and chlorotic, fleshy and deformed leaves. These phenomena bring about degeneration of wild *Anemone* in this country.

Trials in sterile soil with externally disinfected *Anemone* corms showed systemic carry-over from one generation to the next by infected young corms developed from diseased mother corms. These results were obtained repeatedly during three years in controlled trials.

In microscopic anatomic cuttings of *Anemone* corms at different stages of development, intercellular hyphae of the rust fungus were found in the parenchyma, and intracellular haustoria extended from the hyphae.

Effective control and prevention of carry-over of the rust by the corms was obtained by heat treatment (4 days in water at 34°C) and by treatment with the systemic compound benodanil (BAS 3170 F). Benodanil was given in the irrigation water at sowing time and one month afterwards (5 cc at 1000 ppm to each 12-cm-tall pot). No perennial mycelium of the rust fungus was found in anatomic cuttings of diseased corms treated with heat or with benodanil.

THE CHERRY LEAF-SPOT DISEASE IN ISRAEL CAUSED BY THE FUNGUS *CERCOSPORA CIRCUMSCISSA*

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The causal agent of the leaf-spot disease of sweet and sour cherries was found to be *Cercospora circumscissa* Sacc. The disease, which is common in the Judean Mountains and in Galilee, appears at the beginning of the season, in May-June. Symptoms on the leaves are round necrotic spots colored light brown, with brownish red edges. Sometimes the necrotic tissue drops out, leaving shot-hole symptoms.

The disease causes early defoliation, and in a severe attack the trees are completely defoliated at the end of July – beginning of August. This debilitates the trees and reduces the yield. The disease attacks different varieties of sour cherries, *e.g.* 'Chios', and of sweet cherries, *e.g.* 'Early Black', 'Windsor', 'White Esperen', 'Red Esperen', 'Emery', etc.

The fungus is carried over from one season to the next by the stromata on diseased leaves that remain in the orchard during winter, and which in spring develop characteristic conidiophores and conidia of the fungus. Control measures are being studied.

CONTROL OF CARNATION AND STATICE RUSTS BY SYSTEMIC FUNGICIDES

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Plantvax (oxycarboxin) and Calirus (benodanil) were tested against *Uromyces caryophillinus* on carnations. In a field trial Plantvax WP 75% as 0.1% spray or 1 g/m^2 drench, Plantvax EC 20% sprayed at 0.15 or 0.3%, and Calirus WP 50% as 0.1% spray or 1 g/m^2 drench, were applied to rust-infected plots at intervals of about 1 week. All treatments gave positive results and acted chiefly by preventing new infections. In a second trial, Plantvax as WP 75% or EC 20%, sprayed at 75 g a.i./1000m^2 on rust-infected dwarf carnations, prevented spread of the rust to uninfected leaves and affected existing pustules and their viability. Addition of a spreader did not improve control but improved flower appearance by reducing the visible amount of spray deposit.

One field trial with Plantvax WP 75% was carried out against *Uromyces savulescui* on statice. Prophylactic sprays were applied at 75 and 150 g/1000m^2, while rust-infected plots were sprayed at 150 and 300 g/1000m^2. The unsprayed control plots dried up completely; treatment prevented rust appearance when applied prophylactically, and spread of rust when applied after infection.

EFFECT OF TEMPERATURE AND HUMIDITY ON DEVELOPMENT OF *BOTRYTIS CINEREA* ON CUT ROSE FLOWERS

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Cut rose flowers, cv. 'Zorina', were artificially inoculated with *Botrytis cinerea* spores and kept under controlled conditions of temperature and humidity. The first disease symptom, small raised bleached pimples, appeared 24 hours after inoculation when the flowers were kept at high humidity and optimum temperature (20-25°C). At 15° or 30°C, fewer and smaller pimples developed, and none developed after 24 h at 5° or 10°C. Shortening the duration of exposure to high humidity from 24 to 9, 6, and 3 h, reduced pimple size and number proportionally.

A regular sequence of symptom development was always found: formation of pimples, their enlargement, necrosis of petals, and sporulation. The period from inoculation to sporulation was shortest (4-5 days) at 20-25°C, and increased to 6, 8 and over 12 days at suboptimal temperatures of 15°, 10° and 5°C, respectively. Spores that failed to induced symptoms under unfavorable incubation conditions, produced pimples when the flowers were subsequently exposed to favorable conditions.

Eight rose cultivars of different susceptibility to *Botrytis*, when inoculated and incubated under optimum conditions for disease development, varied in the number of pimples per flower or the time required for sporulation to occur; in highly susceptible varieties, variations occurred in both factors.

CONTROL OF *BOTRYTIS CINEREA* ON CUT ROSE FLOWERS BY FUNGICIDE TREATMENT

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In order to control petal rot on cut flowers, artificially inoculated flowers of cv. 'Belinda' were dipped in fungicide suspensions either three hours prior to inoculation (preventive) or after various incubation periods (curative). Ronilan 50% WP (BASF) and Rovral 50% WP (Rhone Poulenc) were most effective in preventing or arresting symptom development and sporulation throughout the 12 days of the test, while untreated flowers or those treated with one of eight other fungicides were covered with spores 5 days after inoculation.

The number of *Botrytis*-incited pimples decreased following either preventive or curative fungicide application, as the fungicide concentration was increased from 0.1 to 0.5% a.i. Curative treatments had the greatest effect when the time between inoculation and fungicide dip was brief, or when flowers were stored under conditions unfavorable for spore germination (at 10°C rather than 20°C, or at low rather than high humidity).

The extent of flower opening affected the efficacy of treatments: the further opening of flowers had progressed, the more pimples per flower and the less effective the control.

Dipping or spraying Ronilan or Rovral at 0.5% a.i. left a visible residue on the petals and caused some tip burn. Disease control was excellent and there was no phytotoxicity when cut flowers from a heavily infected commercial crop were dipped or sprayed with Rovral or Ronilan at 0.1% a.i. immediately after cutting.

CONTROL OF BOTRYTIS GREY MOLD (*BOTRYTIS GLADIOLORUM*) IN GLADIOLI

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Botrytis gladiolorum causes severe damage to flowers and foliage of gladioli grown during December – April. During this period of rainy weather and nights with frost, regular spraying fails to control the disease and most flowers are destroyed.

A trial was conducted under these conditions on two susceptible cultivars sprayed to runoff (1000 l/ha) at weekly intervals for 8 weeks. Cv. 'Peter Pierce' had 4-5 leaves and no symptoms when spraying was begun; cv. 'Eurovision' had 5-6 leaves and some visible symptoms of infection. Disease development was rated weekly on a scale of 0-5.

Maneb 50% (flowable) failed to give adequate control (rating 3.5 as compared with 4.5 in untreated plots). Ronilan 50% WP and Rovral 50% WP halted disease development in 'Eurovision' and prevented infection in 'Peter Pierce'. The degree of infection with Ronilan or Rovral 50% WP sprayed at 0.5 and 1.0 kg/ha was evaluated as 1-2, with slightly better control obtained at the higher rate. The 50% flowable formulation of Rovral was the most effective of all treatments, with no difference between applications at 0.5 and 1.0 kg/ha.

Corms from the plants sprayed with Rovral or Ronilan were larger than and twice as heavy as those from plants sprayed with Maneb or left untreated.

THE INFLUENCE OF PRE-DEGREENING 2,4-D TREATMENTS ON THE KEEPING QUALITY OF CITRUS FRUITS

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To facilitate earlier picking and marketing of citrus fruit, grapefruits and oranges are customarily degreened with ethylene gas under controlled conditions. The degreening causes destruction of chlorophyll in the fruit peel and the appearance of the desired color. Concurrently, it causes senescence in the degreened fruit, as expressed by dryness, shedding of the stem-end, and development of stem-end rot – caused mainly by the fungus *Diplodia natalensis* P. Evans.

Pre-degreening treatments of the fruits, by drenching with a water solution containing TBZ (500 ppm conc.), were carried out to determine whether a combined treatment with 2,4-D (200 ppm conc.) and the above drench, could preserve stem-end vitality (freshness) and prevent development of stem-end rots without disturbing color development during the degreening process. The results obtained with pre-degreened grapefruits showed that 2,4-D in the drench solution preserved the vitality of the stem end, this being more pronounced when degreening was performed with 5 ppm than with 10 ppm.

Rot incidence in grapefruits treated with TBZ was only about 5%, 60 days after storage at 17°C. This rot was caused only by *Alternaria citri*. However, in pre-degreening fruits treated with 2,4-D combined with TBZ, no rot developed during the same storage period. The combined treatment also prevented the appearance of blemishes in 'Michal' clementines degreened with ethylene gas.

Color-development in the degreened fruits did not differ visually between fruit treated with 2,4-D or not, but examination with the Gardner-Hunter colorimeter showed some inhibition in chlorophyll destruction in the treated fruits. Differences were also found in the effects of 2,4-D amine and 2,4-D isopropyl ester.

FUNGAL ROOT DISEASES

VERTICILLIUM DAHLIAE – ITS HOSTS AND CONTROL IN ISRAEL

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Among the crops grown in Israel and affected by *Verticillium dahliae* Kleb., three groups are distinguished:

Crops suffering commercial loss: cotton, potato, peanut, tomato, eggplant, watermelon, okra, Duboisia, gerbera, olive, avocado, mango, almond. Isolates from most of these crops have been found to be pathogenic to most other crops in this group.

Crops occasionally affected with varying amounts of damage: pepper, melon, cucumber, onion, artichoke, flax, clover, chrysanthemum, peach, cherry, plum, grapevine. An isolate from pepper has been found unable to infect tomato, eggplant or watermelon in cross-inoculation tests.

Crops constituting symptomless carriers: wheat, and occasionally carrot and sugar beet.

In addition to the above, the following weeds are affected: weeds exhibiting symptoms (*Solanum villosum, Brassica tournefortii, Amaranthus retroflexus, Malva* sp.); and weeds acting as symptomless carriers (*Chenopodium album, Molucella laevis, Heliotropium rotundifolium*).

Of the crops listed in the first group, the following have resistant or immune varieties: cotton (SJ-1, SJ-2, SJ-3); potato (Mirka, Desirée, Blanka); tomato (VF-lines of canning tomatoes, and market garden varieties such as Orit, 1645, Gilat 38); and watermelon (highly tolerant: Charleston Grey, Smokeylee).

In order to solve the problem in crops where tolerant varieties are unavailable, or where the tolerance is affected by other pathogens – such as nematodes, various chemical treatments were examined, especially on potatoes, and on watermelons grown under plastic. The chemicals tested were Vapam (methyl Na-dithiocarbamate) and Edapic (a mixture of ethylene-dibromide and chloropicrin). Both treatments controlled the fungus to varying degrees, especially when applied in the cool season to well-tilled moist soil. In the watermelon variety 'Sugar Baby', yield increases of up to 800% were obtained, emphasizing the extreme susceptibility of this variety when grown in plastic tunnels in the winter.

STUDIES OF THE VERTICILLIUM DISEASE OF POTATOES

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Finding cultural practices which would solve the problems posed by *Verticillium dahliae* Kleb. on potatoes was dependent on the development of a suitable experimental technique. This was developed at the Gilat Experiment Station and was based on comparing the results obtained in infested and in similar, but uninfested, soil. This allowed for a more exact measurement of the loss due to the disease. The following experiments were performed.

Foliar applications of minor elements: Yield increases of 15-20% were obtained in infected plants treated with a mixture of iron, zinc and urea. No increases were obtained in similarly treated healthy plants.

Date of spring planting: Early planting, as practised in the region, led to poor growth, and yield decreases due to *Verticillium* were greater in early sown potatoes than in those sown 2 weeks later.

Infected seed tubers: Autumn sowing of infected tubers in infested soil led to a sharply decreased yield, of up to 40-50% less than that obtained from control plants. Yield loss was less when non-infected tubers were sown in infested soil.

Varieties resistant to Verticillium: Among 20 varieties obtained from the United States, only 'Ona-2249' produced similar yields in infested and non-infested soil, in both the spring and autumn seasons. The 19 other varieties were either not suitable under our conditions or were not tolerant enough under our local pathogen-environment complex.

Testing of commercial potato varieties: Three degrees of susceptibility were found: Very susceptible, such as 'Nicola', in which death of plants occurs one month earlier in infested plots, leading to yield decreases of 40-60%; moderately susceptible, such as 'Up-to-Date', in which death occurs two weeks earlier in infested plots, with yield losses of 20-40%; and tolerant varieties, such as 'Desirée', in which death in infested and healthy plots occurs at a similar date, and yield loss does not exceed 20%.

STUDIES OF THE INTERACTION OF *VERTICILLIUM DAHLIAE* AND *PRATYLENCHUS THORNEI* ON POTATO

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The importance of nematodes – particularly of the genus *Pratylenchus* – in increasing the severity of wilt due to *Verticillium dahliae* Kleb. in numerous crops, is recognized. Field observations indicated that such a complex exists in autumn-grown potatoes, in the northern Negev. Fumigation experiments designed to investigate this problem were conducted on the varieties 'Up-to-Date', 'Blanka', 'Desirée' and 'Spunta'.

Results obtained from field and greenhouse experiments, and in commercial fields which received fumigation treatments, led to the following conclusions: (1) there exists a positive correlation between the presence of *Pratylenchus thornei* (Sher & Allen) and the severity of *Verticillium* wilt; (2) a fairly high population of the nematode is needed to obtain this effect; (3) the nematode, by itself, does not appreciably lower yield; and (4) even relatively *Verticillium*-tolerant varieties such as 'Blanka' and 'Desirée', in the presence of nematodes, will sustain losses of about 30-40%. The studies pointed up the high susceptibility to *Verticillium* of 'Up-to-Date' in comparison with the other varieties tested.

Wheat is apparently the crop most involved in increasing the populations of the nematode; populations of up to 5,000 nematodes per gram fresh weight of wheat root were found.

BREEDING PEANUTS FOR RESISTANCE TO *PYTHIUM*-INDUCED POD ROT

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Pod rot due to *Pythium myristylum* Drechsl. causes considerable damage to peanut yields, especially in light soils. In a collection of about 200 accessions, the cultivar 'Schwarz-21' was found to be resistant. Disease incidence and severity (when the dissease appeared) were low. 'Schwarz-21', a small-podded 'Spanish'-type cultivar, was crossed with the jumbo-podded 'Virginia Bunch Bet Dagan No. 4'.

The segregating progenies were tested in infested fields for several generations for resistance to pod rot. Resistant plants with 'Virginia'-type pods and high yields were selected; an experimental line, 'FA-12-n', was developed. In the process, part of the resistance of Schwarz-21 was lost. FA-12-n is more resistant than the widely used 'Shulamit'. At locations with intermediate *Pythium* infestation level, there was a significant difference both in the frequency of plants with diseased pods (69% *vs.* 94%) and in the proportion of rotted pods in the total pod yield (10% *vs.* 20%). In fields with light and random infestation, the difference between the two cultivars was small and non-significant. In fields with very heavy infestation, the partial resistance of the new line "broke." Therefore, back-crosses are now being made between 'FA-12-n' and 'Schwarz-21' and with another source of resistance, also with small pods. Until a suitable cultivar with a higher level of resistance is developed, the partially resistant 'FA-12-n' can facilitate, in combination with appropriate cultural practices, continuation of 'Virginia'-type peanut cultivation in fields with intermediate levels of infestation.

BACTERIAL AND FUNGAL PARASITISM OF OOSPORES AS A BIOLOGICAL CONTROL MECHANISM AGAINST *PHYTOPHTHORA MEGASPERMA* VAR. *SOJAE*

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Oospores of *Phytophthora megasperma* var. *sojae* were incubated in moist soil or on flooded soil for 4 – 14 days, using Nuclepore membrane filters as carriers. The oospores were then transferred onto water agar on slides. This procedure provided a clear background for microscopic observation. Subsequent development of the oospores and their parasites could be observed after further incubation of the slides. Individual infected oospores, when transferred to appropriate agar media, yielded bacteria, Actinomycetes chytrids and filamentous fungi. Chytrid zoospores were released when the agar bearing infected oospores was flooded with water. Bacteria, spores and mycelia of the other parasites were used to inoculate fresh oospores on membranes floated on sterilized extract of soil. Our results indicate that soils contain a large number and great diversity of oospore parasites which may have the potential of reducing populations of plant pathogenic oomycetes in soil. The parasitic microorganisms identified were: Bacteria – fluorescent and non-fluorescent *Pseudomonas* sp.; Actinomycetes – *Actinoplanes missouriensis*; Chytrids – *Hyphochytrium catenoides, Canteriomyces stigeoclonii, Rhizidiomycopsis japonicus*; Phycomycetes – *Leptolegnia* sp., *Pythium* sp.; Hyphomycetes – *Dactylella spermatophaga, Humicola fuscoatra, Diheterospora chlamydosporia, Cephalosporium* sp., *Fusarium oxysporum, Alternaria tenuis*. At soil moisture levels up to field capacity, oospores were infected by Hyphomycetes, whereas in flooded soil Chytrids, *Actinoplanes*, Phycomycetes and bacteria infected the oospores. In some soils, more than 60% of the oospores were infected after 7 days' incubation.

MECHANISM OF BIOLOGICAL CONTROL OF *THIELAVIOPSIS BASICOLA*, PATHOGENIC ON SOYBEANS IN ALFALFA-AMENDED SOIL

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The chlamydospore population of *Thielaviopsis basicola* in soil and the disease severity in soybean seedlings were reduced considerably after incubating soil in containers with 1% alfalfa (w/w) for 3 weeks, as compared with non-amended soil. Chlamydospore germination stimulated by

the amendment was followed by germ-tube lysis within 3-6 days. When chlamydospores were added immediately after the amendment, germination was greatest after 2 days. The number of spores with germ-tubes declined to zero after 6 days, due to lysis. The effect of the amendment was reduced or nullified when the amended soil was incubated for one or more days before the chlamydospores were added. It has been reported that unsaturated fatty acids in alfalfa hay or in the rhizosphere of beans stimulated chlamydospore germination. However, we found that water extracts were more stimulatory and caused a greater decline in chlamydospore population in soil than did ether or chloroform-methanol extracts. The water extracts were further separated to cationic, anionic and neutral fractions containing amino acids, organic acids and carbohydrates, respectively. Chlamydospore germination was stimulated equally by the three fractions.

THE FUNGUS *DEMATOPHORA NECATRIX* CAUSES THE WHITE ROOT ROT DISEASE OF FRUIT TREES IN ISRAEL

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In studies carried out to isolate and define the causal agent of the white rot of fruit tree roots in Israel, it was found that the disease is incited by the fungus *Dematophora necatrix* Hartig. The characteristics of the fungus are: dense white mycelium with very high capability of growth; hyphae with a pear-shaped swelling at the end of each cell and dichotomous branching at the colony's periphery; production of synnemata 1-1.5 mm tall, stipe 40-200 μ thick; conidia one-celled, hyaline, ellipsoid, 3-4.5x2-2.5 μ; and microsclerotia single at the beginning, then uniting to "microsclerotial sheets." These were formed *in vitro* after 3-4 weeks on potato dextrose agar and other media. The synnemata developed on diseased roots of apple after two months in a wet chamber.

The fungus grows extensively on potato dextrose agar, oatmeal agar, Gramineae and legume seeds. The optimum temperature for growth is 23-25°C and the optimum pH is 6-7.

The disease severely attacks the roots of fruit trees, which rot and become covered with cottony white mycelia. The leaves of the tree turn yellow, wilt and die. Death of the tree follows. The fungus grows, propagates and persists on residues of plants in the soil. The disease is local and has been found in the Upper Galilee, the Jerusalem region and the coastal plain. So far, apple, peach, pear and plum trees have been damaged severely. Studies are being carried out on the host range and on disease control.

EVALUATION OF SOIL DISINFECTION FOR CONTROLLING FUSARIUM DISEASE OF CARNATION

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Trials were conducted in 1975/76 and 1976/77 to evaluate soil fumigants for control of the carnation disease caused by *Fusarium oxysporum* f. *dianthi* and *F. oxysporum* var. *redolens* f. *dianthi*. The work was done on soils on which carnations had been grown for years, and in which disease incidence was high.

In the first trial, at the end of one year, 60% of the plants had died in the untreated plots (96% showed vascular browning). Following Vapam treatment at 2000 and 3000 l/ha there were only 12% and 8% dead plants (30% and 40% browning) respectively, while after methyl bromide (MB) at 500 and 1000 kg/ha there were only 2-3% dead plants (*ca.* 10% browning).

In the second trial about 88% of the plants in the untreated plots died 2-3 months after planting and *F. oxysporum* or *F. oxysporum* var. *redolens* was isolated from every sampled dead plant. At the end of the 7-month growth period 10-16% of the plants were dead in the plots treated with chloropicrin (CP) 500 kg/ha, Vapam 1500 l/ha, or a mixture of 500 kg/ha each of MB and CP. Better control was achieved with higher doses: there were 7% dead plants in plots treated with 1000 kg/ha CP or with a mixture of 700 kg/ha MB and 300 kg/ha CP, and only 3% dead plants in the plots treated with 500 or 1000 kg/ha MB or 3000 l/ha Vapam.

In a combination treatment of MB (500 kg/ha) followed by Vapam (1500 or 3000 l/ha), only 1-1.5% of the plants died of Fusarium infection. Flower yields following such treatments were up to ten-fold higher than in untreated plots, while yield differences between treatments were small but proportionate to their control efficiency.

SOIL DISINFECTION FOR CONTROLLING FUSARIUM INFECTION OF GLADIOLI

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The control effectiveness of methyl bromide (MB), of mixtures of MB and chloropicrin (CP) at two proportions – 50/50 and 70/30, all given at 1000 kg/ha, and of Vapam at 2000 and 4000 l/ha, was tested in gladiolus fields infected by *Fusarium oxysporum* f. *gladioli*. After the sorbed bromide was leached from soil with 2000 m^3/ha water, a residue of 2.3 ppm Br was found in the top 30 cm of soil and 7.8 ppm in the 30-60-cm layer.

All plots were planted with corms of several varieties and different sizes. Despite the small residue of Br, its effect on flower yields in the MB and MB/CP treatments was pronounced. On small corms (8-10 cm circumference), sorbed bromide caused a drastic reduction in the number of flowers; on large corms (12-14 cm), flowering was delayed by a few days. Flower yield and size differed little between Vapam-treated and untreated soil, but a higher percentage of infected corms was found in the plots of untreated soil after harvest.

Infected corms, left in the soil after harvest, provide a source of inoculum for subsequent crops. Naturally infected corms were buried at several depths in the soil prior to treatment and tested for the presence of *F. oxysporum* after treatment. The highest dose of Vapam failed to eliminate the pathogen from the corms. MB killed the fungus in corms buried in the 0-60-cm layer, but the proportion of infected corms increased in this layer with increasing depth.

VIRUS DISEASES

PRODUCTION OF VIRUS-FREE CITRUS BUDWOOD MATERIAL IN ISRAEL

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After 20 years of the Israel citrus budwood registration program (by the Departments of Plant Protection and of Citriculture, Ministry of Agriculture, and the Divisions of Virology and Citriculture, ARO), almost complete elimination of psorosis and impietratura has been achieved. However, the recent appearance of tristeza in the main budwood plantation made it imperative to re-examine the program and to select new budwood sources for immediate use. The following steps are suggested in order to supply the need for citrus budwood: Short term: selecting plantations in new growing regions (in which citrus has not been grown for longer than 10-15 years) for

immediate use. Long term: (*a*) development of new sources of budwood following selection of preferred types and elimination of viruses by nucellar embryos, thermotherapy and shoot tip grafting; and (*b*) establishment of commercial citrus groves specializing in budwood production.

Stocks of nucellar budwood of the main varieties free of xyloporosis, psorosis, exocortis and tristeza are available, but their use has been limited – mainly due to horticultural considerations. Using thermotherapy, budwood free of psorosis, tristeza, stubborn and impietratura has been obtained. The recently developed shoot tip grafting technique has been adapted to free also local old-line budwood from exocortis.

The epidemiological factors affecting the rate of budwood reinfestation differ considerably among the citrus viruses. The three main types are vector transmitted: tristeza and stubborn (little-leaf); mechanically transmitted: exocortis; and mode of transmission unknown: psorosis, impietratura, xyloporosis.

A VIRUS ASSOCIATED WITH LEAF ROLL IN GRAPES

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A virus associated with grape leaf roll disease was successfully transmitted from grapes to herbaceous plants by phenolation. The suspension obtained was either mechanically inoculated on herbaceous plants or pressure-injected into them.

The virus was shown to be a flexuous rod, measuring 13 x 790 mm. It contains 5% ribonucleic acid that is single-stranded. The RNA that was electrophoresed was eluted and found infertile when inoculated to *Nicotiana glutinosa* plants. Infected *N. glutinosa* tissue shows typical inclusions such as pinwheels, crystalline arrays and giant mitochondria. All this places the virus in the potyvirus group.

The virus could be transmitted from grapes to *N. glutinosa*, back to grapes, and back again to *N. glutinosa* plants.

No virus particles could be detected in grape plants; this could be attributed to the high dilution or very specific location of the virus in this host.

VIRUS-FREE MATERIAL IN GRAPES

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In most of the vineyards planted since 1971 in Israel, virus-free grapes are used. The origin of the material is mainly, for indexal varieties, from Davis, California, U.S.A.; and for rootstocks, visual selection (sélection class élite), from France.

The virus-free material is grown in Yizre'am in the Negev and undergoes a double control every year: visual examination of all the plants in the vineyard; and indexing of random samples by grafting on indicator plants. Soil samples are taken every year to check the nematode population.

Varieties and rootstocks for which virus-free material can not be obtained from abroad are subjected to thermotherapy in the laboratory. The procedure, which is long and tiresome, includes: rooting of the stock, thermotherapy at 38°C for 6-12 weeks, rooting of the tip of the treated plant, and indexing of the rooted plant. The entire procedure takes about 7 years.

Some of the plants are now being indexed to check whether they have been freed from known virus diseases, after thermotherapy.