DOWNLOAD PDF CONTROL OF CROP DISEASES

Chapter 1 : Crop diseases | Agriculture and Food

Thoroughly revised and updated to reflect current and emerging practices, this book explores modern methods of disease control in field and glasshouse crops. It outlines the major crop diseases, with a particular emphasis on those features of symptomology and life cycle that are most relevant to the development of control measures.

Bring fact-checked results to the top of your browser search. Symptoms and signs Bacterial diseases can be grouped into four broad categories based on the extent of damage to plant tissue and the symptoms that they cause, which may include vascular wilt, necrosis, soft rot , and tumours. The subsequent multiplication and blockage prevents movement translocation of water and nutrients through the xylem of the host plant. Drooping, wilting, or death of the aerial plant structure may occur; examples include bacterial wilt of sweet corn, alfalfa, tobacco, tomato, and cucurbits e. Pathogens can cause necrosis by secreting a toxin poison. Symptoms include formation of leaf spots, stem blights , or cankers. Soft rot diseases are caused by pathogens that secrete enzymes capable of decomposing cell wall structures, thereby destroying the texture of plant tissueâ€”i. Soft rots commonly occur on fleshy vegetables such as potato , carrot , eggplant , squash , and tomato. Tumour diseases are caused by bacteria that stimulate uncontrolled multiplication of plant cells, resulting in the formation of abnormally large structures. Most bacteria produce one major symptom, but a few produce a range or combination of symptoms. In general, it is not particularly difficult to tell whether a plant is affected by a bacterial pathogen; however, identification of the causative agent at the species level requires isolation and characterization of the pathogen using numerous laboratory techniques. Transmission and infection In order for a bacterium to produce a disease in a plant, the bacterium must first invade the plant tissue and multiply. Bacterial pathogens enter plants through wounds , principally produced by adverse weather conditions, humans, tools and machinery, insects, and nematodes, or through natural openings such as stomata , lenticels, hydathodes, nectar-producing glands, and leaf scars. Most foliage invaders are spread from plant to plant by windblown rain or dust. Humans disseminate bacteria through cultivation, grafting, pruning, and transporting diseased plant material. Animals, including insects and mites , are other common transmission agents. When conditions are unfavourable for growth and multiplication, bacteria remain dormant on or inside plant tissue. Some, such as the crown gall bacterium, may survive for months or years in the soil. Bacterial diseases are influenced greatly by temperature and moisture. Often, a difference of only a few degrees in temperature determines whether a bacterial disease will develop. In most cases, moisture as a water film on plant surfaces is essential for establishing an infection. Control In general, the diseases caused by bacteria are relatively difficult to control. This is partly attributable to the speed of invasion as bacteria enter natural openings or wounds directly. Direct introduction also enables them to escape the toxic effects of chemical protectants. Losses from bacterial diseases are reduced by the use of pathogen-free seed grown in arid regions. Examples of diseases controlled by this method include bacterial blights of beans and peas , black rot of crucifers , and bacterial spot and canker of tomato. Bactericidal seed compounds control some bacterial diseases, such as angular leaf spot of cotton , gladiolus scab , and soft rot of ornamentals. Rotation with nonhost crops reduces losses caused by wilt of alfalfa , blights of beans and peas, black rot of crucifers, crown gall, and bacterial spot and canker of tomato. Eradication and exclusion of host plants has been useful against citrus canker, angular leaf spot of cotton, fire blight , and crown gall. Resistant varieties of crop plants have been developed to reduce losses from wilts of alfalfa, corn, and tobacco ; angular leaf spot of cotton and tobacco; and bacterial pustule of soybeans , among others. Protective insecticidal sprays help control bacterial diseases, such as wilts of sweet corn and cucurbits and soft rot of iris. Protective bactericidal sprays, paints, or drenches containing copper or antibiotics are used against bacterial blights of beans and celery , fire blight , crown gall, blackleg of delphinium, and hazelnut and walnut blights. The characteristics of several plant diseases caused by bacteria are summarized in the table. Some bacterial diseases of plants disease.

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Chapter 2 : Biological Control of Crop Diseases - Google Books

Disease control in commercial crops is both economically important and environmentally controversial. The second edition of this book, originally published in , provides a concise introduction to modern practices of disease control on commercial crops.

Strategies for disease control in crops Understanding the big picture can help you reduce crop losses from plant diseases. October 28, - Author: Harvest activities are progressing well and farmers are looking forward to successful completion of field work. Burying crop residues is an ancient practice intended to reduce plant diseases in following years. However, increased interest in minimum and no-till practices has resulted in less incorporation of residues. Along with developments in crop production practices, understanding of plant disease has also increased. Farmers are responsible for their own decisions related to these types of situations and should have an understanding of strategies for controlling crop diseases. Basically, an overall strategy for crop disease management might include the following three components: Reduce the initial plant disease inoculum. Reduce the infection rate. Reduce the duration of the epidemic. Each of these components can be further developed using traditional principles of plant disease control, for example: Reduce the level of disease by selecting a season or a site where the amount of inoculum is low or where the environment is unfavorable for infection. Reduce the amount of initial inoculum introduced from outside sources. Reduce the production of initial inoculum by destroying or inactivating the sources of initial inoculum sanitation, removal of reservoirs of inoculum, removal of alternate hosts, etc. Reduce the level of initial infection by means of a toxicant or other barrier to infection. Use cultivars that are resistant to infection, particularly the initial infection. Use thermotherapy, chemotherapy or meristem culture to produce certified seed or vegetative planting stock 2. Reduce the rate of production of inoculum, the rate of infection or the rate of development of the pathogen by selecting a season or a site where the environment is not favorable. Reduce the introduction of inoculum from external sources during the course of the epidemic. Reduce the rate of inoculum production during the course of the epidemic by destroying or inactivating the sources of inoculum roguing. Reduce the rate of infection by means of a toxicant or some other barrier to infection. Plant cultivars that can reduce the rate of inoculum production, the rate of infection or the rate of pathogen development. Cure the plants that are already infected or reduce their production of inoculum. Reduction of the duration of the epidemic. Plant early maturing cultivars or plant at a time that favors rapid maturation of the crop. Delay the introduction of inoculum from external sources by means of plant quarantine. This article was published by Michigan State University Extension. For more information, visit http: To have a digest of information delivered straight to your email inbox, visit http: To contact an expert in your area, visit http:

Chapter 3 : Plant pathology - Wikipedia

Control of Crop Diseases Thoroughly revised and updated to reflect current and emerging practices, this book explores modern methods of disease control in.

Compare poinsettia, geranium, New Guinea impatiens and calibrachoa cultivars to determine their relative susceptibility to Pythium and Phytophthora root and stem rots. Identify effective disinfestation treatments for the elimination of Pythium and Phytophthora inoculum on greenhouse floors. Measure the effect of fungus gnat larval feeding on Pythium disease incidence and severity. Evaluate effectiveness of biological controls and low-toxicity fungicides as replacements for standard chemical controls when used preventively or eradicatively for the control of Pythium and Phytophthora root rot, as well as for powdery mildew diseases. Develop strategies for managing fungicide-resistant strains of Pythium. Project Methods Compare flower crop cultivars for their susceptibility to Pythium and Phytophthora species: Rooted cuttings of 20 cultivars of each species will be inoculated at transplant, with 10 single-plant replications in randomized complete blocks. Data will be collected on symptom incidence and severity. Determine the most effective disinfestation to eliminate Pythium and Phytophthora inoculum on greenhouse floors: Ground cloth squares 5 X 5 cm will be contaminated by contact with soilless growing medium infested with P. After dipping squares in disinfestants for 0, 1, 10 and 30 minutes, Pythium regrowth will be measured on selective medium. Data will be collected on disease incidence and severity. Evaluate the influence of fungus gnat larvae on Pythium disease incidence and severity: Geraniums with or without P. Next, geraniums will be grown in non-inoculated mix or mix infested with fungus gnats, Pythium, or both. Evaluate effectiveness of biological controls and low-toxicity fungicides as replacements for standard chemical controls when used preventively or eradicatively for the control of Pythium and Phytophthora, as well as for powdery mildew diseases: Spray treatments will be applied pre-inoculation to test protectant ability against powdery mildew on verbena and poinsettia. A parallel trial of eradicant activity will be conducted in the same greenhouse: Treatments will include a botanical, a bicarbonate, SAR materials, biologicals, a horticultural oil and the latest strobilurins. Colony counts will be made on four leaves for each plant weekly for 6 weeks. Similar studies will be conducted on geraniums, treating preventively against P. Roots will be rated on a 1 to 4 scale. Plants will be harvested for dry weights. Treatments will include SAR materials, biologicals, etridiazole, azoxystrobin and mefenoxam. These will also be tested as protectants against Phytophthora drechsleri on calibrachoa. Develop strategies for managing fungicide-resistant strains of Pythium: Registered fungicides will be tested alone and in combination for Pythium control, with one mefenoxam sensitive and one mefenoxam insensitive isolate used for inoculation for each treatment. Treatments will include mefenoxam alone; etridiazole alone; mefenoxam plus fosetyl-Al; mefenoxam plus azoxystrobin; etridiazole first , rotated with mefenoxam; and mefenoxam first , rotated with etridiazole. All trials will be replicated and data subjected to analysis of variance. A new downy mildew on coleus was identified in as a new Peronospora species. It was found to have ITS sequences almost identical to those of an unnamed Peronospora species harming greenhouse basil crops in Italy and Switzerland. Symptoms on coleus include spotting and twisting of leaves, as well as leaf drop. Tests to date have found 11 seed cutivars and 37 vegetative coleus cultivars to be susceptible. Studies on management of this new disease have found phosphorous acids drenches and sprays and strobilurin sprays to have only low effectiveness, whereas dimethomorph and fenamidone sprays and mefenoxam drenches gave excellent control of symptoms and sporulation; mancozeb also provided significant protection. Host range studies have identified both basil and agastache as additional hosts of the coleus downy mildew, while other members of the mint family inoculated and incubated under high relative humidity conditions have remained symptom-free. Familiar diseases have been addressed in this project as well. Efforts to improve powdery mildew management in verbena have identified cultivars that are highly-susceptible and highly-resistant to powdery mildew caused by Podosphaera xanthii. Sprays with the biological controls Streptomyces lydicus and Bacillus subtilis were also found to be effective when rotated with a strobilurin Compass , by treating with the biocontrol two weeks after strobilurin application and using the strobilurin one week after the biofungicide. Fifteen cultivars of poinsettia were compared for susceptibility to Pythium aphanidermatum under conducive summer greenhouse conditions. All cultivars were stunted by pathogen inoculation and mortality was as high as 75 percent, thus no effective level of resistance was observed in any cultivar. Twenty poinsettia cultivars were compared for susceptibility to Phytophthora drechsleri crown rot, and disease incidence varied from forty-three percent to zero. Cultivars of calibrachoa with lower Thielaviopsis black root rot susceptibility than Million Bells Terra Cotta were identified, and suppression of the disease at higher pH was verified for this crop. Studies on Thielaviopsis root rot of calibrachoa and pansy have identified phosphorous acid materials as a potential new control tool and have shown that only thiophanate-methyl treatment appears to eliminate root colonization by Thielaviopsis basicola. Plants given other chemical treatments that suppress symptoms still have chlamydospores on the root system that are detectable by microscopic observation. Tests of experimental materials showed benefit of cyazofamid for Pythium control on geraniums, a new azoxystrobin formulation for Rhizoctonia control on poinsettias, V for Pythium aphanidermatum on snapdragons, AB for Thielaviopsis control on pansies, and STBX for powdery mildew control on hydrangea. Impacts This research has provided greenhouse growers with critical knowledge of a new downy mildew disease on coleus, so that they now know how to recognize it, its host range, and some of the chemical tools that will help to suppress it. Materials generally expected to work well against downy mildews have been shown to provide only weak control. Growers can now avoid the more powdery mildew susceptible verbena cultivars and grow those that do not need chemical treatment. One plant company has discontinued a highly susceptible verbena cultivar, Aztec Peach, as a result of our research. Growers have also been shown how to use biological control as one aspect of their powdery mildew management program, by using biofungicides in rotation with reduced-risk chemical materials for protection of their crops. Growers of calibrachoa can choose the less susceptible cultivars identified in our research, and follow the cultural control measures shown to suppress disease. Identifying the ability of thiophanate-methyl to suppress sporulation on the root system of calibrachoa and pansy has been especially helpful to those who are plant propagators, who are particularly concerned that they not ship disease inoculum to others. Data developed on poinsettia susceptibility to root diseases, calibrachoa susceptibility to Thielaviopsis, and verbena susceptibility to powdery mildew will continue to be used by plant breeders. Data developed on experimental chemical materials will be used by the manufacturers to develop non-phytotoxic, reduced-risk chemicals for use against flower diseases. First report of downy mildew on greenhouse and landscape coleus caused by a Peronospora sp. Fertilizer and mix effects on Thielaviopsis root rot of calibrachoa. Tests of fungicides for powdery mildew control on hydrangea. Test of materials for control of Thielaviopsis on pansy. Calibrachoa cultivar comparison for Thielaviopsis susceptibility. Fungicides for control of Thielaviopsis root rot of calibrachoa. New downy mildew disease on coleus crop. Cultural, biological and chemical controls were investigated for Thielaviopsis root rot of calibrachoa, a newly popular crop for use in hanging baskets. All cultivars tested were much more resistant than Million Bells Terra Cotta. Two fertilizers, and , and two mixes bark-based SunGro and peat-based ProMix 8 were evaluated for effects on Thielaviopsis disease development at two different inoculum levels on three cultivars. Cultivar had the greatest effect on disease development: One cultivar was not susceptible. The third cultivar was found to be tolerant rather than immune, as Thielaviopsis sporulation was present on its roots when grown in the peat mix; it also exhibited reduced growth when inoculated in some fertilizer-mix combinations. In a fungicide trial, only the Thielaviopsis-inoculated calibrachoas treated with thiophanate-methyl Cleary WP, 16 oz per gal showed no symptoms, dry weight reduction, or sporulation on the roots. Drenches with triflumizole Terraguard, 4 oz per gal , phosphorous acid salts Alude, A trial of materials for Thielaviopsis control on pansy indicated that plants were best protected against symptom development by an experimental AB, 1 oz per gal as well as by a thiophanate methyl drench Cleary , 16 oz per gal ; only thiophanate methyl treated plants showed no Thielaviopsis sporulation on the roots. Botrytis control on geranium was addressed in two trials. In one, fenhexamid Decree, 24 oz per gal gave superior control to an experimental STBX and copper pentahydrate Phyton 27, 2. A second Botrytis control trial indicated dose-related phytotoxicity to geranium from AB and Medallion treatments that resulted in stunted, distorted new leaf growth. AB at 4 and 5 oz per gal was more effective than Decree at 24 oz per gal; other treatments with AA, Medallion, AB and Heritage at various rates were similarly effective at reducing the number of Botrytis lesions. Powdery mildew development on hydrangea was checked by copper pentahydrate Phyton 27, 2. Impacts Growers of spring bedding plants and floral hanging baskets have been challenged by serious disease losses in the popular new crop, calibrachoa. This research has provided growers with information that will allow them to choose to grow calibrachoa cultivars that are less suceptible to the highly damaging black root rot caused by Thielaviopsis basicola. Flower producers have also been given new information on cultural variables and chemical and biological tools that can reduce Thielaviopsis root disease development on susceptible cultivars, as well as on the effectiveness and safety of new chemistries against Botrytis blight and powdery mildew. Temperature and leaf wetness requirements for pathogen establishment, incubation period, and sporulation of Phytophthora infestans on Petunia x hybrida. Epidemiology and management of petunia and tomato late blight in the greenhouse. Phytopathology 95 6 S8. Principles of plant health management for ornamental plants. Suppression of Fusarium wit of cyclamen with bioantagonists and fungicides. Control of Rhizoctonia on poinsettia. Test of pyraclostrobin for phytotoxicity to open flowers. Control of powdery mildew with STBX on gerbera. Control of Fusarium wilt on cyclamen with bioantagonists and fungicides. Attempt to control Phytophthora on pansy with biologicals. Test of new materials for Phytophthora control on viola. Tests of new materials for Pythium ultimum control. Powdery mildew control on balsam impatiens with Strike, Compass and Milstop. Phytophthora susceptibility of Ecke poinsettia cultivars. The performance of biologicals and chemical fungicides against Fusarium wilt on cyclamen was examined: Thirty-nine verbena cultivars were screened for susceptiblity to powdery mildew Podosphaera xanthii. Powdery mildew Oidium sp. Plants treated weekly with Milstop developed a few colonies. On gerberas challenged with powdery mildew, curative-scheme treatments with ZeroTol and an experimental outperformed weekly protectant treatments, but were not sufficiently effective under high disease pressure. Twenty poinsettia cultivars were compared for susceptibility to Phytophthora drechsleri crown and root rot. Trials for control of Phytophthora nicotianae on pansy indicated that Plantshield HC and the experimental G were not effective at suppressing this disease when the surface of the growing medium was inoculated.

Chapter 4 : Plant disease - Symptoms and signs | www.nxgvision.com

Thoroughly revised and updated to reflect current and emerging practices, this book outlines the major diseases of field and glasshouse crops and the methods used to control them.

Open in a separate window BE: In pot cultures, populations of R. The colonization of plants by both R. Another fungus, Pythium oligandrum, has the potential to control bacterial wilt disease, in which cell wall proteins may play an important role in the induction of resistance to R. Shiitake mycelia leachate was found to contain an antibiotic ingredient that suppressed the growth of R. In addition, three endomycorrhizal fungi Gigaspora margarita, Glomus mosseae, and Scutellospora sp. In the inoculation methods of BCAs, pouring or drenching soil was more prevalent than other methods, whereas the biocontrol efficacy range appeared to be lower than that of the dipping of roots or seed coating method. There are some disadvantages to BCAs. The biggest obstacle is their poor performance due to inconsistent colonization. Suppression by BCAs has been observed in a narrow range of host plants or restricted to a single pathogen or disease The degree of suppression is sometimes too low to be commercially acceptable or requires uneconomically high rates of inoculums to be applied Difficulties have also been associated with producing, storing, and subsequently applying BCAs. An option to overcome the storage problem is to select spore formers as BCAs e. They are advantageous because they improve the physical, chemical, and biological properties of soil, which can have positive effects on plant growth The degradation of organic matter in soil can directly affect the viability and survival of a pathogen by restricting available nutrients and releasing natural chemical substances with varying inhibitory properties Carbon released during the degradation of organic matter contributes to increasing soil microbial activity and thereby enhances the likelihood of competition effects in the soil Organic amendments to soil have been shown to stimulate the activities of microorganisms that are antagonistic to pathogens 6. In addition, organic amendments often contain biologically-active molecules such as vitamins, growth regulators, and toxins, which can affect soil microorganisms. Youssef and Tartoura recently reported that plant resistance against the bacteial wilt pathogen was enhanced through the augmented activities of ascorbate peroxidase, monodehydroascorbate reductase, dehydroascorbate reductase, and glutathione reductase following the application of compost. Organic matter originates from recently living organisms and decays or is the product of decay. It is categorized into plant or animal origins, and simple organic carbons. In the previous references to an R. Larkin 67 found that biological amendments were generally effective for delivering microorganisms to natural soil, resulting in a wide variety of effects on soil microbial communities depending on the particular types, numbers, and formulations of organisms added. A new approach is the suppression of bacterial wilt in an organic hydroponic system through a rhizosphere biofilm that only forms on roots in the organic system The possible mechanisms of action of the plant residues are mainly considered to be antimicrobial activities, followed by the indirect suppression of the pathogen through improved physical, chemical, and biological soil properties For example, the antimicrobial compounds from Tagetes patula that suppressed R. Other plants such as Cryptomeria japonica produced sandaracopimarinol and ferruginol 80 while Cyphomandra betacea contained a glycosidase inhibitory protein that suppressed R. Previous experiments demonstrated the successful application of organic matter against bacterial wilt in greenhouses and in the field. For example, the application of pig slurry decreased the population of R. The mechanisms underlying the enhanced decline of the population of this pathogen and disease suppression remains unclear; however, shifts in bacterial community profiles have been proposed. Another study suggested that the suppression of bacterial wilt by poultry and farmyard manure were related to higher microbial activity and higher numbers of cultural bacteria and fungi In that study, a lower disease index was related to the poor survival of the pathogen. However, limitations are associated with the wide use of organic waste. The application of lysine to a pumice culture medium 0. The suppression mechanism was not attributed to the induction of systemic resistance, but to shifts in the soil microbial community structure that led to the more rapid death of the pathogen In contrast, riboflavin induced a series of defense responses and secondary metabolism in cell suspensions and, thus, protected tobacco against R. DL,aminobutyric acid BABA also increased polyphenol oxidase activity and decreased that of catalase in tomato plants, suggesting the induction of resistance to bacterial wilt in the tomato Another study showed that methyl gallate exhibited strong bactericidal effects on R. Physical methods, including biofumigation A number of physical control methods, e. Soil solarization reduced soil pH, potassium K , sodium Na , boron B , and zinc contents, microbial biomass, and microbial respiration in soil, but did not significantly affect other soil chemical properties. Several parameters need to be carefully considered before the application of soil solarization can be expanded: In addition to heat treatments, cold temperatures are also sometimes effective. Bacterial wilt rarely occurs in tobacco crops planted in May or June winter crop in north Queensland because of cool weather conditions, whereas the disease developed when crops were planted in spring September to November , particularly when bacterial wilt had previously occurred and crop rotation was not practiced 7. The mechanism of action responsible for the suppression of bacterial wilt by physical methods generally involves killing pathogens with high or low temperatures. Biofumigation, which refers to the agronomic practice of using volatile chemicals released from plant residues to suppress soil-borne plant pathogens, has recently been attracting attention Biofumigation is called biological soil disinfection BSD and the production of organic acids or heavy metal ions is involved in the suppression of pathogens Another approach is control with a high voltage electrostatic field and radio frequency electromagnetic field, in which ISR is involved in the suppression mechanism Silver-coated non-woven cloth filter and a visible light source 15 or electrostatic spore precipitator ozone-saturated water was developed as a sterilization device and inactivated the pathogen. Cultural practices 1 Cultivar resistant The growth of cultivars that are resistant to bacterial wilt is considered to be the most economical, environmentally friendly, and effective method of disease control. Breeding for resistance to bacterial wilt has been concentrated on crops of wide economic importance such as the tomato, potato, tobacco, eggplant, pepper, and peanut, and has commonly been influenced by factors such as the availability of resistance sources, their diversity, genetic linkage between resistance, and other agronomic traits, differentiation and variability in pathogenic strains, the mechanism of plant-pathogen interactions, and breeding or selection methodology 19 , 28 , Potato genotype BP9, which is a somatic hybrid between Solanum tuberosum and S. Somatic hybrids between S. Dourga and two groups of S. Public acceptance in Japan is needed prior to the commercial use of such genetically modified crops. A proteomic approach was used to elucidate molecular interactions in the cell walls of resistant and sensitive plants inoculated with R. Resistance to bacterial wilt in many crops has generally been negatively correlated with yield and quality. Thus, the release of resistant cultivars may be poor because of other agronomic traits and are not widely accepted by farmers or consumers. The breeding of a good resistant cultivar is expected in the future through stronger efforts in the genetic enhancement of bacterial wilt resistance through biotechnology approaches in order to improve yield crop. While continuous cropping with the same susceptible host plant will lead to the establishment of specific plant pathogenic populations, crop rotation avoids this detrimental effect and is often associated with a reduction in plant diseases caused by soil-borne pathogens 51 , In an example of multi-cropping, Yu et al. Calcium Ca is the most well-known fertilizer to suppress disease. Increased Ca concentrations in plants reduced the severity of bacterial wilt as well as the population of R. Furthermore, an increase in Ca uptake by tomato shoots correlated with lower levels of disease severity , Li and Dong 70 showed that the combined amendment of rock dust and commercial organic fertilizer reduced the incidence of bacterial wilt in the tomato. A single amendment with rock dust also effectively reduced the incidence of bacterial wilt in the tomato and higher soil pH and Ca content were key factors in the control of bacterial wilt by the rock dust amendment. Many elements in the cell walls influence the susceptibility or resistance of plants to infections by pathogens and silicon is considered to be a beneficial element for plants and higher animals Si and chitosan exhibited synergistic effects against the disease. Integrated Pest Management IPM According to Agrios 5 , the main goals of an integrated plant disease control program, regarded as integrated pest management IPM , are to i eliminate or reduce the initial inoculums, ii reduce the effectiveness of initial inocula, iii increase the resistance of the host, iv delay the onset of disease, and v slow secondary cycles. For example, the incidence of bacterial wilt in the tomato was monitored in soil infested with R. We previously demonstrated that suppressive effects against bacterial wilt in the tomato were enhanced by combinations of BCAs and their substrates, such as lysine, sucrose, and anaerobically digested slurry, in which the addition of substrates improved the colonization of tomato roots by BCAs 87 , The relative importance of factors accounting for production losses need to be assessed in order to develop IPM. Combinations in cultural practice methods, such as the combination of crop rotation with a resistant cultivar or a soil amendment, or the combination of organic matter with a non-pesticide chemical such as formaldehyde or bleaching powder appear to have effectively reduced the incidence of bacterial wilt and increased crop yield 4 , 68 , , The combined application of ASM and P. A previous study reported that the combination of endophytic bacteria Bacillus sp. Grafting is an important strategy in integrated pest management for soil-borne pathogens. Disease management by grafting has been reported for fungal pathogens such as Verticillium, Fusarium, Pyrenochaeta, and Monosporascus , oomycete pathogens Phytophthora , bacterial pathogens particularly Ralstonia , root knot nematodes, and several soil-borne viruses We need to select methods that are easy, practical, profitable, and also environmentally healthy to control diseases and improve yields. Cautions for disease control measures 1 Keep the environment healthy Preventive methods are essential for maintaining fields that are free of bacterial wilt. Thus, to keep environment free of this pathogen, it is important to clean seeds, soil, water, and tools in order to improve crop production by preventing this disease. The use of healthy seeds that are free of pathogens is the most economical, environmentally friendly, and effective method for disease control. Cultural practices involving soil amendments, including organic matter, crop rotation, and multi-cropping, can be used to maintain soil health. These agricultural practices influence the chemical, biological, and physical properties of soil, which, in turn, influence the viability and distribution of pathogens as well as the availability of nutrients for pathogens in the soil. Researchers are becoming more interested in investigating the effects of such practices on microbial communities, or in assessing their potential to control soil-borne pathogens. Soil health indicators may be very useful for risk prevision and technical advice The early detection of R. A sensitive quantitative assay was recently developed to detect Ralstonia solanacearum in soil by the most probable number MPN analysis based on PCR results, in which a pre-culture was performed in a buffer containing antibiotics, but no other carbon source in order to allow the pathogen to grow and to suppress the growth of other soil microorganisms This assay enabled pathogens to be detected at levels as low as 9. Abiotic factors such as nutrient organic matter and minerals conditions, soil type, pH, anaerobic conditions, temperature, and moisture content influence the development of R. Biotic factors are related to microorganisms, flora, fauna in the soil, and plants that can affect R. Previous studies investigated the biotic factors controlling R. Various suppression mechanisms are considered to be biotic factors for the pathogen, such as enhanced microbial activity, which can suppress R. Our primary goal is to contribute to safe, sustainable, and high agricultural production. Attention to cost-benefit analyses is indispensable in the short, middle, and long term. However, some of these indiscriminating fumigants are prohibited in European countries, e. Due to public concerns and environmental impact, it is not advisable to rely only on single controlling methods, such as fumigants, for high yield and quality crop production. Proper control methods need to be adopted based on the density of and crop resistance to pests. Concluding remarks The research discussed in this review shows how many different diverse options have been reported on control methods against diseases caused by R. This unequivocally indicates the importance of these diseases worldwide. The avoidance of crop losses due to pathogens significantly contributes to increased crop production worldwide.

Chapter 5 : Recent Trends in Control Methods for Bacterial Wilt Diseases Caused by Ralstonia solanacear

Most often, failure to control the disease happens because the problem was misdiagnosed in the first place. This is a list of the most important general strategies for management of plant diseases: Crop Resistance - should be first line of defense whenever possible.

The previous goal of the project before this was to identify and define symbiotic candidates for symbiotic control. We and our collaborators have had great success with that; however, this renewal introduces a new breakthrough technology for the delivery of those symbiotic control and other biopesticide agents. In collaboration with colleagues at the University of New Mexico Medical school, we are identifying target pests and plant diseases for delivery of symbiotic or biopesticide control agents. One side-strategy is to formulate the microparticles as baits. The first of these targets is delivery of entomopathogenic fungi in microcapsule baits to control katydid pest of citrus in California. A spin off of that side-strategy is to develop a bait formulation to control desert locust in North Africa and the Near East. The New Mexico collaborators initiated that with our help this winter at field trial sites in Tunisia and Ethiopia. Glassy-winged sharpshooter, the vector of Pierces disease of grapevines in California and elsewhere is another target. We are perfecting the packaging of Pantoea agglomerans a bacterial symbiont to carry anti-Pierces disease reagents to the mouthparts of glassy-winged sharpshooter for the purposes of preventing Pierces disease in grapevines. Patents have been applied for to protect this new delivery and formulation paradigm. A new company, Ecobiopesticides International, is being formed in Albuquerque New Mexico to exploit microencapsulation for crop protection and to seek market outlets. Since proof of concept is currently being provided, we seek partners to widen the application of this new technology. Project Methods What is new about microencapsulation for delivery of biopesticdes and symbiotic control agents is the coating layers. The coating material can be made attractive to the target insect, but fungal spores contained inside are protected by a uv light barrier that greatly extends the life of the fungal spores. Upon being consumed by the target insects, the capsules are designed to open in the foregut and midgut. Once the spores are present in the aqueous environment of the gut, their germination will be encouraged, much for so than, for example when in contact with the surface cuticle of the insect in low humidity of arid conditions. The main difficulty with neurotoxic insecticides always was delivery, not toxicity. Compared to drip irrigation delivery, genetically modified crops containing insecticidal endotoxins from insecticidal bacterial are another example of more efficient delivery. The drawbacks of those two established technologies are that systemic properties are rare and development of genetically modified crops is very expensive and only attempted in high volume crops with large acreage and therefore large markets. We plan to exploit these new methods by established agricultural research companies who test and perfect new technologies and who are in contact with the grower community, like Pacific Ag Research in San Luis Obispo, CA. As an extension of the Jefferson Science Fellowship, I was invited by Global Knowledge Initiative, a Washington DC non-profit organization, to spend 2 weeks in Rwanda January to consult on an insect pest of coffee of the genus Antestiopsis. The visit included several lectures on new methods of pest control including symbiotic control to National University of Rwanda students and faculty members and stakeholders in the coffee industry. We also gave a briefing to the Minister of Agriculture, Agnes Kalibata. A large section is symbiotic control. I invited about a third of the participants and determined most of the agenda. They are planning to return next summer to perfect the delivery system. We applied for a patent for the microencapsulation packaging concept through UC Riverside and University of New Mexico. I helped organize the scientific program and was chief consultant to the Organizing Committee of the International Congress of Entomology held in Daegu, Korea August I gave a lecture on International entomology for pest control at a satellite conference in Yeocheon, Korea, August I invited collaborator Adam Forshaw to the same meeting; he gave a talk on Microencapsulation as a means to extend uv resistance to Metarhizium anisopliae for desert locust control. We also attended the international session on control of red palm weevil to meet participants from Saudi Arabia elsewhere in connection with the Workshop mentioned above. I was invited to, but did not attend the BIODESERT meeting in Tunisia in December that was the final meeting of a research project aimed at exploring the natural resources of the Sahara desert for pharmaceuticals and pest control agents. Their main success was symbiotic control of American Foul Brood disease of bee hives. These activities contributed to the success of the project by strengthening collaborations in symbiotic control approaches. He oversaw the project along with laboratory manager, Genet Tulgetske. Tulgetske remains on the project as a postdoctoral in the Miller lab. He is an expert on antibody research and perfected the main symbiotic control reagent used in symbiotic control. All of the websites in the Miller lab were redesigned by Andrew Guzman, the undergraduate. Miller invited Yupa to participate in the red palm weevil workshop scheduled for March in Saudi Arabia to explain the symbiotic control approach. He too was invited to the red palm weevil workshop to discuss entomopathogenic fungi to control insect pests. Collaborator Ravi Durvasula was also invited and is planning to attend the red palm weevil workshop to describe microencapsulation of symbiotic control agents and the symbiotic control strategy. Together they are directing 7 graduate students studying integrated pest management of coffee insect pests. Simon Martin is head of coffee research for Rwanda Agricultural Board. Simon oversees isolation of microbes from coffee beans that might be responsible for potato taste defect. His replacement is not yet in place. Ed Whitman, head of quality control, Rogers Family Company, provides research samples of green coffee beans for analysis of potato taste defect. Nothing significant to report during this reporting period. Impacts As a direct result of the microencapsulation technique perfected by collaborators, a patent was applied for by UC Riverside and University of New Mexico. The new application attracted a group of investors who desired to start a new company to exploit the method. Desert locust control in North Africa is the first application. The company will be based initially in Albuquerque, New Mexico. The first conference call describing the company was held December The organization of the company will be established in the spring of Initial financing is expected to come from the Gates Foundation that is supporting field trials in Ethiopia and Tunisia taking place now. Gates wants proof of concept established before larger funding is awarded. In the California trials, it was a little surprising that microencapsulation was able to deliver a symbiotic control agent to glassy winged sharpshooter, Homalodisca vitripennis, and the agent gained access to the buccal cavity. It will be a challenge to document the acquisition. Delivery is the largest hurdle to overcome in applying the symbiotic control method. A publication came from collaborator Yupa Hanboonsong and her graduate student Jittawadee Wangkeeree on symbiotic control of white leaf disease of sugar cane in Thailand. The publication describes isolation and identification of a candidate symbiont for symbiotic control. Predominant bacteria symbionts in the leafhopper Matsumuratettix hiroglyphicus - the vector of sugarcane white leaf phytoplasma. Molecular Biology and Genetics of the Lepidoptera, ed by M. Honey Bee Colony Health, ed by D. Hvmar1, a mariner-like element from the tobacco budworm Heliothis virescens, can transpose in Drosophila melanogaster. Identification of mariner-like elements belonging to the cecropia subfamily in two closely related Helicoverpa species. The use of symbionts expressing pear PGIP to delay or possibly prevent development of Pierces disease. PhD dissertation, University of California, Riverside, 98 pages. Jefferson Science Fellowship August to July 31, Established January an interagency Discussion Group within the Department of State on the subject of genetically modified insects. Discussed biotechnology for pest and disease control, activities of Jefferson Science Fellowship and the future International Congress of Entomology in Daegu, Korea scheduled for August Seoul National University, 4 pm, 11 May , invited talk: Wolfe Street, Sheldon Hall. Drove back to California. Wrote two editorials about use of genetically modified insects for crop protection and disease control, both invited listed with publications. He oversaw the project largely via email with Genet Tulgetski. Tulgetske joined the project as postdoctoral in fall of and remains. Genet supervised candice and Laura Wong and is responsible for the main laboratory work. His expertise is paratransgenesis of sandflies and triatomid bugs that transmit the pathogen causing Chagas disease. He has expanded his interests to global food security, which explains his participation with us in plant protection from pathogens transmitted by insects. Ravi is pioneering the use of nanotechnology as a delivery vehicle in symbiotic control with Sandia National Laboratories in Albuquerque. Leger is PI on our biopesticide control of plant pests with genetically modified and entomopathogenic fungi. I visited his labs there during the course of the Jefferson Science Fellowship in and we had him for dinner to our apartment in Rosslyn, VA. Genet

Tulgetski conducts bioassays on test insect with fungal biopesticides provided by the St. Surachet Lek Charoenkajonchai worked on the project and completed a PhD one month ago. This amounts to proof of concept of this reagent to control PD. This title was not reported in publications. The publication date is December An undergraduate, Candice Sanscartier, worked part time on the project. She monitored the presence of insect pests on sticky traps in experimental vineyards in agricultural operations at UC Riverside. Another undergraduate, Laura Wong, joined the project in September She is rearing insects and mailing samples and keeping the lab clean. Grape and wine industry in California; fruit growers; oil palm industry in Papua New Guinea; Specialty coffee industry in Rwanda. No significant public outreach this year. Impacts The issue of use of genetically modified insects came to a head while I was serving as a Jefferson Science Fellow at the US Department of State and convened an interagency discussion group on the topic. They reported a cost analysis showed they would save millions of dollars a year by replacing radiation-based sterile insects with genetically modified screwworms with conditional lethal genes. USDA picked a person to lead the project who is fundamentally opposed as shown by word and deed to using genetically modified insect for any practical purpose. They could spend a million dollars and wind up with nothing to show for it. The Dengue virus appears to have been brought to Key West by return of an infected traveler. By there were over a hundred clinical cases reported with no fatalities and evidence of the virus was present without symptoms in over a citizens of Key West on the basis of positive tests of blood samples for Dengue serotypes.

Chapter 6 : www.nxgvision.com; Diseases of crops

Flower crops are susceptible to serious diseases that growers would like to control without using highly toxic pesticides. This project explores the options for floral crop disease control through the use of resistant varieties, biologicals, reduced-risk pesticides and cultural management tools.

Evaluate and develop improved methods of disease control on vegetable crops. Project Methods Experimental and EPA approved pesticides will be evaluated on a wide range of vegetable crops including potatoes, peas, snapbeans, beets, melons, lettuce, peppermint, and other vegetables common to Wisconsin to determine efficacy in control of economically important diseases. Application methods will include, but not be limited to, conventional tractor mounted boom and airblast units, overhead irrigation systems, and aerial application units. Information on disease incidence and control obtained in field plot performance tests will be used to foster the safe application of agricultural pesticides when needed for disease control and to support pesticide label additions where needs exist. This project focused on the development of tools and strategies for cost-effective, reduced risk and improved management of diseases affecting vegetable crops grown in Wisconsin. This past year was a year of transition of my program to Dr. Amanda Gevens in July I provided assistance to Dr. Gevens in terms of advice for maintaining continuity in vegetable disease research programming. I provided a summation of research activities during and disease management recommendations to the annual Wisconsin Potato Growers Conference in February I also provided timely advice to the Wisconsin potato and vegetable growers through weekly newsletters during June. James - Provided technical support for this program; R. Rand - Provided technical support for this program Z. Atallah - Postdoc and research scientist for this program; Multiple graduate and undergraduate students. Each year, I participated in up to 50 educational events throughout Wisconsin, neighboring states such as Michigan and Minnesota, potato and vegetable growing regions of the US and Canada and in over 20 foreign locations. Participants in these training programs included growers, extension agents, educators, government workers, representatives of the chemical industry and pest management practitioners. Audiences included growers, extension agents, educators, government workers, representatives of the chemical industry and pest management practitioners. Nothing significant to report during this reporting period. Impacts This project focused on developing effective, economically feasible and environmentally friendly disease management tools for use by the vegetable industry. Results assisted growers in making effective disease management decisions with fewer pesticide inputs. The project also increased the awareness of disease resistant cultivars in potato, pumpkin, snap bean, carrot and mint. Overall, we have seen increased awareness and adoption of integrated disease management techniques including field scouting, planting disease resistant cultivars, disease forecasting, use of reduced risk pesticides and overall reduced use of fungicides. Freedom Russet A dual purpose russet potato cultivar with resistance to common scab and good fry quality. Refining your management for early blight. Proceedings of the Wisconsin Annual Potato Meeting Assessing the decay potential of potato crops. The progress focuses on the development of tools and strategies for cost-effective, reduced risk and improved management of diseases affecting vegetable crops grown in Wisconsin. Individual projects during focused on key potato diseases. Field trials were conducted at university research station stations throughout WI. Highlights include the following: Data from this trial were used in the registration and recommendation of new effective and safer fungicide programs for the potato industry. These evaluations are critical as we develop resistance management recommendations for grower use of newer single site mode of action fungicides. We have successfully demonstrated that a season-long disease and resistance management program on potato, which uses five or more fungicide modes of action, provides a highly efficacious and cost effective alternative to more conventional and higher risk spray programs. High levels of useful resistance were observed in this trial. This trial provides important information to breeding programs throughout North America. Not relevant to this project. Impacts This project focuses on developing effective, economically feasible and environmentally friendly disease management tools for use by the vegetable industry. Results assist growers in making effective disease management decisions with fewer pesticide inputs. Evaluation of

QoI fungicide application strategies for managing fungicide resistance and potato early blight epidemics in Wisconsin. Monitoring and tracking changes in sensitivity to azoxystrobin fungicide in Alternaria solani in Wisconsin. Evaluation of fungicides for the control of early blight of potato Hancock, Plant Disease Management Reports online. The American Phytopathological Society, St. Evaluation of potato cultivars and breeding selections to identify resistance to early blight, Evaluation of potato tuber resistance to early blight, late blight and pink rot, Evaluation of pumpkin varieties for resistance to powdery mildew - Hancock, Evaluation of potato cultivars and breeding selections for resistance to common scab Antigo, Evaluation of potato cultivars and breeding selections for reaction to common scab Endeavor, Project WIS focuses on the development of tools and strategies for cost-effective, reduced risk and improved management of diseases affecting vegetable crops grown in Wisconsin. Crops included under this project during included carrot, potato, snap bean and. Field trials were conducted at university research station stations and on numerous grower farms throughout WI. Data from these trials were used in the registration and recommendation of new effective and safer fungicides for multiple uses in the vegetable industry. We have successfully demonstrated that a season-long disease and resistance management program on potato, which uses five fungicide modes of action, provides a highly efficacious and cost effective alternative to more conventional spray programs. Growers have adopted these technologies on their commercial farms. This approach will be helpful to producers using conventional and organic approaches to disease management. For the duration of this project beginning in , we have focused on field, greenhouse and laboratory evaluation of tools needed to build comprehensive disease management programs. We have successfully developed programs for potato, carrot and processing bean that require fewer inputs, increase the adoption of IPM technology and improve the economics of production. Many of the components are suitable for use in organic and reduced input production systems. Individuals who worked in my lab on this project - R. Target audiences included agricultural agents, crop consultants, field personnel for processing industry, agribusiness representatives and growers. There were no major changes in the approach we planned and implemented for this project over the life of the project. For the snap bean industry, we have developed recommendations for the use of biological controls for white mold and the adoption of advanced IPM practices that reduce the risk of disease and risks associated with production. Spatio-temporal colonization by Verticillium dahliae of two potato cultivars with differing responses to potato early dying. MegaChip - A new potato variety for chipping. Amer J of Potato Res Evaluation of foliar fungicide treatments to control powdery mildew on pumpkin - Hancock, Evaluation of potato cultivars and breeding selections to identify reaction to tuber blemish pathogens - Suring, A methodology to detect and quantify five pathogens causing potato tuber decay using real-time PCR. Multiplex real-time quantitative PCR methodology to assist in the breeding of potato lines with resistance to Verticillium wilt. Evaluation of pumpkin and squash cultivars for resistance to powdery mildew - Hancock, Evaluation of red potato cultivars and breeding selections for reaction to common scab - Endeavor, Evaluation of the efficacy of seedpiece and foliar treatments for potato disease control, Evaluation of carrot cultivars and breeding lines to identify resistance to two foliar diseases - Hancock Evaluation of fungicides to control carrot foliar diseases - Hancock, WI, Evaluation of fungicides for the control of early blight of potato - Hancock, Fungicide spray programs for Defender - A new potato cultivar with resistance to late blight and early blight. Evaluation of chemical control of white mold on snap bean - Hancock, Crops included under this project during included carrot, potato, snap bean, pumpkin and squash. These observations are critical as we develop resistance management recommendations for grower use of newer single site mode of action fungicides. Disease pressure was again light in all treatment blocks during due to unusually hot and dry weather during the bloom period. Growers are adopting these sets of technologies on their commercial farms. Evaluation of pumpkin and squash varieties for resistance to powdery mildew, Hancock, WI, Evaluation of red potato cultivars and breeding selections for reaction to common scab, Endeavor, Evaluation of tubers of potato cultivars and breeding selections to identify resistance to early blight, late blight and pink rot, Evaluation of carrot cultivars and breeding lines to identify resistance to two foliar diseases, Endeavor, Evaluation of carrot cultivars and breeding lines to identify resistance to two foliar diseases, Hancock, Evaluation of fungicides to control carrot foliar diseases, Hancock, WI, Fungicide and Nematicide Tests online. Integration of host resistance, disease monitoring, and reduced fungicide practices for the management of two foliar diseases of carrot. Evaluation of fungicides to control potato early blight, Hancock, WI, Evaluation of potato cultivars and breeding selections to identify resistance to common scab, Antigo, Evaluation of potato cultivars and breeding selections to identify reaction to tuber blemish pathogens, Suring, Evaluation of seedpiece and in-furrow chemical application for management of powdery scab, Suring, Disease pressure was light in all treatment blocks during due to unusually hot and dry weather. A dual purpose russet potato variety. Evaluation of pumpkin and squash varieties for resistance to powdery mildew - Hancock, WI, Assessment of carrot cultivars and breeding selections to identify resistance to foliar diseases - Endeavor, Evaluation of carrot cultivars and breeding selections to identify resistance to two foliar diseases - Hancock, WI, Evaluation of fungicides to control early blight of potato - Hancock, WI,

Chapter 7 : Control of Flower Crop Diseases - CORNELL UNIVERSITY

The Corn Disease Working Group (CDWG) developed ratings for how well fungicides control major corn diseases in the United States. The CDWG determined the efficacy ratings for each fungicide by field-testing the materials over multiple years and locations.

Figure 65 Create an environment unfavorable to the pathogen and favorable to the crop. There are many theories and ideas on the best time of the day to water. From a plant pathology point of view, it is preferable to water late morning, after the dew dries from leaves, but early enough to allow leaves to dry before evening. Of course, ideally, you would water only the soil surface because the roots are the water-absorbing organs. Answers Figure 58 Drip irrigation is used here. The water moves out into the field in the blue pipes which, in turn, feed water to small emitter lines that deliver water under the plastic mulch right at the base of plants. Return to question Figure 60 Mulching is the obvious answer. Of course, there are many benefits to be gained from mulching, including weed control, soil moisture optimization, and soil temperature moderation. But mulches can serve as a barrier between above-ground plant parts and pathogens in the soil. Also, by reducing weeds and alternate hosts for pathogens, such as several viruses, mulches help in the battle against diseases. Return to question Figure 61 This photo shows pruning shears being disinfected a better word is disinfested by immersion in a chemical. Isopropyl alcohol from the drugstore also works well. When pruning out diseased plant material, it is best to disinfest after each pruning operation. Also, make cuts several inches beyond diseased tissue in healthy tissue to make sure you get all of the pathogens. Return to question Figure 62 These seedlings have typical "v-shaped" lesions characteristic of black rot, a serious cabbage disease. These could easily be sold to unsuspecting customers but not well-informed Master Gardeners. Be aware that diseased planting material is out there. Obviously, one of the best ways to manage diseases is to keep them out in the first place. Inspect all planting material and be a discerning buyer! Return to question Figure 63 You can see rust resistant snapdragons, VFN Verticillim wilt, Fusarium wilt, nematode - resistant tomato and mildew-resistant powdery mildew zinnia.

Chapter 8 : CHEMICAL CONTROL OF VEGETABLE CROP DISEASES - UNIV OF WISCONSIN

The control of diseases in crops is still largely dominated by the use of fungicides, but with the increasing incidence of fungicide resistance, plus mounting concern for the environment resulting from excessive agrochemical use, the search for alternative, reliable methods of disease control is gaining momentum.

Beginnings of pest control Wherever agriculture has been practiced, pests have attacked, destroying part or even all of the crop. In modern usage, the term pest includes animals mostly insects , fungi , plants, bacteria, and viruses. Human efforts to control pests have a long history. Even in Neolithic times about bp , farmers practiced a crude form of biological pest control involving the more or less unconscious selection of seed from resistant plants. Severe locust attacks in the Nile Valley during the 13th century bp are dramatically described in the Bible, and, in his Natural History, the Roman author Pliny the Elder describes picking insects from plants by hand and spraying. The scientific study of pests was not undertaken until the 17th and 18th centuries. The first successful large-scale conquest of a pest by chemical means was the control of the vine powdery mildew Unciluna necator in Europe in the s. The disease, brought from the Americas, was controlled first by spraying with lime sulfur and, subsequently, by sulfur dusting. Another serious epidemic was the potato blight that caused famine in Ireland in and some subsequent years and severe losses in many other parts of Europe and the United States. Insects and fungi from Europe became serious pests in the United States, too. Among these were the European corn borer, the gypsy moth , and the chestnut blight , which practically annihilated that tree. Though farmers were well aware that insects caused losses, Curtis was the first writer to call attention to their significant economic impact. The successful battle for control of the Colorado potato beetle Leptinotarsa decemlineata of the western United States also occurred in the 19th century. When miners and pioneers brought the potato into the Colorado region, the beetle fell upon this crop and became a severe pest , spreading steadily eastward and devastating crops, until it reached the Atlantic. It crossed the ocean and eventually established itself in Europe. But an American entomologist in found a practical control method consisting of spraying with water-insoluble chemicals such as London Purple, paris green, and calcium and lead arsenates. Other pesticides that were developed soon thereafter included nicotine, pyrethrum, derris, quassia, and tar oils, first used, albeit unsuccessfully, in against the winter eggs of the Phylloxera plant louse. The Bordeaux mixture fungicide copper sulfate and lime , discovered accidentally in , was used successfully against vine downy mildew; this compound is still employed to combat it and potato blight. Since many insecticides available in the 19th century were comparatively weak, other pest-control methods were used as well. A species of ladybird beetle , Rodolia cardinalis , was imported from Australia to California, where it controlled the cottony-cushion scale then threatening to destroy the citrus industry. A moth introduced into Australia destroyed the prickly pear , which had made millions of acres of pasture useless for grazing. In the s the European grapevine was saved from destruction by grape phylloxera through the simple expedient of grafting it onto certain resistant American rootstocks. This period of the late 19th and early 20th centuries was thus characterized by increasing awareness of the possibilities of avoiding losses from pests, by the rise of firms specializing in pesticide manufacture, and by development of better application machinery. Pesticides as a panacea: DDT was far more persistent and effective than any previously known insecticide. Originally a mothproofing agent for clothes, it soon found use among the armies of World War II for killing body lice and fleas. It stopped a typhus epidemic threatening Naples. Research on poison gas in Germany during World War II led to the discovery of another group of yet more powerful insecticides and acaricides killers of ticks and mites â€”the organophosphorus compounds , some of which had systemic properties; that is, the plant absorbed them without harm and became itself toxic to insects. The first systemic was octamethylpyrophosphoramide, trade named Schradan. Other organophosphorus insecticides of enormous power were also made, the most common being diethyl-p-nitrophenyl monothiophosphate, named parathion. Though low in cost, these compounds were toxic to humans and other warm-blooded animals. The products could poison by absorption through the skin, as well as through the mouth or lungs, thus, spray operators must wear respirators and special clothing. Systemic insecticides need not be carefully sprayed, however; the compound may be absorbed by watering the plant. Though the advances made in the fungicide field in the first half of the 20th century were not as spectacular as those made with insecticides and herbicides, certain dithiocarbamates, methylthiuram disulfides, and thaladimides were found to have special uses. It began to seem that almost any pest, disease, or weed problem could be mastered by suitable chemical treatment. Farmers foresaw a pest-free millennium. Crop losses were cut sharply; locust attack was reduced to a manageable problem; and the new chemicals, by killing carriers of human disease , saved the lives of millions of people. Problems appeared in the early s. In cotton crops standard doses of DDT, parathion, and similar pesticides were found ineffective and had to be doubled or trebled. Resistant races of insects had developed. In addition, the powerful insecticides often destroyed natural predators and helpful parasites along with harmful insects. Insects and mites can reproduce at such a rapid rate that often when natural predators were destroyed by a pesticide treatment, a few pest survivors from the treatment, unchecked in breeding, soon produced worse outbreaks of pests than there had been before the treatment; sometimes the result was a population explosion to pest status of previously harmless insects. At about the same time, concern also began to be expressed about the presence of pesticide residues in food , humans, and wildlife. It was found that many birds and wild mammals retained considerable quantities of DDT in their bodies, accumulated along their natural food chains. The disquiet caused by this discovery was epitomized in by the publication in the United States of a book entitled Silent Spring , whose author, Rachel Carson , attacked the indiscriminate use of pesticides, drew attention to various abuses, and stimulated a reappraisal of pest control. Integrated control Some research into biological methods was undertaken by governments, and in many countries plant breeders began to develop and patent new pest-resistant plant varieties. One method of biological control involved the breeding and release of males sterilized by means of gamma rays. Though sexually potent, such insects have inactive sperm. Released among the wild population, they mate with the females, who either lay sterile eggs or none at all. The method was used with considerable success against the screwworm, a pest of cattle , in Texas. A second method of biological control employed lethal genes. It is sometimes possible to introduce a lethal or weakening gene into a pest population, leading to the breeding of intersex effectively neuter moths or a predominance of males. Various studies have also been made on the chemical identification of substances attracting pests to the opposite sex or to food. With such substances traps can be devised that attract only a specific pest species. Finally, certain chemicals have been fed to insects to sterilize them. Used in connection with a food lure, these can lead to the elimination of a pest from an area. Chemicals tested so far, however, have been considered too dangerous to humans and other mammals for any general use. Some countries notably the United States, Sweden, and the United Kingdom have partly or wholly banned the use of DDT because of its persistence and accumulation in human body fat and its effect on wildlife. New pesticides of lesser human toxicity have been found, one of the most used being mercaptosuccinate, trade named Malathion. A more recent important discovery was the systemic fungicide, absorbed by the plant and transmitted throughout it, making it resistant to certain diseases. The majority of pesticides are sprayed on crops as solutions or suspensions in water. Though spraying suspended or dissolved pesticide was effective, it involved moving a great quantity of inert material for only a relatively small amount of active ingredient. Low-volume spraying was invented about , particularly for the application of herbicides, in which 10 or 20 gallons of water, transformed into fine drops, would carry the pesticide. Ultralow-volume spraying has also been introduced; four ounces about grams of the active ingredient itself usually Malathion are applied to an acre from aircraft. The spray as applied is invisible to the naked eye.

Chapter 9 : Disease Prevention and Control - Illinois Vegetable Garden Guide - University of Illinois Extens

Identifying symptoms and knowing when and how to effectively control diseases is an ongoing challenge for WA growers of cereals (wheat, barley, oats and triticale), pulses (field pea, chickpea, faba bean), canola and lupin crops.