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A COMPILATION OF PLANT DISEASES AND DISORDERS IN INDIANA - 1990

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Abstract: Numerous diseases were influenced by environmental conditions during the 1990 growing season. A radical drop in temperature in December 1989 resulted in extensive cold injury to cambial tissues of woody plants and trees in 1990. Gusty spring winds and several late frosts were responsible for damage to tender emerging tree leaves, while sand blasting damaged young corn seedlings. The excessive rainfall which occurred during the spring and summer months of 1990 caused an increase in both disease incidence and disease severity. Foliar diseases and root rot were prevalent problems. Anthracnose of shade trees, *Cladosporium* on peony, apple scab, bacterial canker on tomato, *Botrytis* on flowers, corn and soybean seedling blights, Barley Yellow Dwarf Virus in wheat and oats, Phytophthora and Rhizoctonia root rot of soybean, and Stewart's leaf blight of corn were several of the commonly diagnosed infectious disease problems noted during the growing season

INTRODUCTION

Accurate diagnosis of plant problems is both an art and a science. Differences in site location, environmental conditions, chemicals used and cultural practices as well as numerous other variables necessitate a unique diagnosis for each of the plant samples submitted to the Plant and Pest Diagnostic Laboratory (P&PDL). Diagnosis of plant problems in the P&PDL is offered as a service of the Cooperative Extension Service, Purdue Agricultural Experiment Station. As of 1990, this diagnostic service is now of an interdisciplinary nature, incorporating the expertise of Plant Pathologists, Entomologists, Horticulturalists, Agronomists, and Weed Scientists. Plant disease diagnosis, as well as insect and plant identification, are gratuitous services offered by the Lab. Samples are submitted by county extension agents, farmers, commercial growers, homeowners, private consultants, and other interested persons. This paper is a summary of the major plant diseases and disorders which were diagnosed in the clinic and observed within the state in 1990.

METHODS

Plant specimens are submitted to the Plant and Pest Diagnostic Laboratory by county extension agents, homeowners, growers, nursery operators, golf course superintendents, consultants, and others. Specimens are diagnosed visually or by

culturing the pathogen on selective media. Some viral diseases are diagnosed by the leaf dip (negative stain) technique, utilizing the electron microscope. Serological rapid assay detection is also utilized. After a disease or disorder is diagnosed, appropriate control measures are suggested upon request. A summary of the samples diagnosed from January 1 through November 19, 1990 is given in Table 1.

RESULTS

As of November 19, 1990, 2226 samples, including agronomic, ornamental, fruit, turf, and vegetable crops, had been diagnosed for diseases and disorders (Table 1). Of these samples, approximately 50% were diagnosed as infectious disease problems with causal agents such as fungi, bacteria, and viruses; 27% were diagnosed as noninfectious problems caused by factors such as environmental/site and cultural stresses; 7% were diagnosed as chemical injury; and 4% exhibited a nutritional problem. The remaining 12% were either poor samples or lacked adequate information for a proper diagnosis.

In general, there was an increase in the number of infectious disease problems noted this season over last year. This increase was attributed to unusually wet conditions, which resulted in a proliferation of diseases on all types of crops. Due to the interdisciplinary nature of the new lab, the number of specimens submitted to the Plant and Pest Diagnostic Laboratory was the largest, since the inception of diagnostic services in 1960 (Pecknold, 1974; Evans, *et al.,* 1980; Evans-Ruhl, *et al.,* 1981; Ruhl, *et al.,* 1982-1989).

SHADE AND ORNAMENTAL TREES

Diseases: Cool, wet spring weather was conducive to several woody plant diseases. Anthracnose on hardwood tree species was especially severe this spring. In particular, heavy to severe sycamore anthracnose (*Gnomonia platani*) occurred across the State following the rainy weather in mid-May. The northern part of the state had the greatest degree of damage. Sycamores were just expanding their leaves, when infection occurred. In southern Indiana, leaf development was more advanced, and the tissue was not as susceptible. However, twig dieback and cankering occurred in all areas of the state.

Outbreaks of ash, maple, and oak anthracnose (*Discula* sp.) were periodically diagnosed. Oak wilt (*Ceratocystis fagacearum*), blister leaf (*Taphrina caerulscens*), and Actinopelte leaf spot (*Tubakia dryina*) were common problems on oak. Diplodia tip blight (*Sphaeropsis* sp.) on pine was noted as being especially severe due to the predisposition of trees by environmental stress factors during the last 4-7 years. Needlecasts on pine were primarily attributed to *Dothistroma septospora*. Verticillium wilt (*Verticillium albo-atrum*) was diagnosed on several maple specimens, Amur maple in particular. Arborvitae and junipers continued to be plagued with tip diebacks caused by both *Phomopsis* and *Kabatina* spp. Cedar quince rust (*Gymnosporangium clavipes*) on hawthorne was abundant. Phytophthora

Table 1. Plant samples diagnosed in the Purdue Plant and Pest Diagnostic Laboratory, January 1 through November 19, 1990*.

Plant specimen	Number of samples[1]	Diseases[2]	Disorder[3]	Chem[4]	Nutr[5]	Other[6]
AGRONOMIC						
Corn	274	107	89	56	23	24
Soybeans	316	339	36	54	28	25
Wheat	50	60	8	1	1	5
Other (Forage grasses and legumes; specialty field crops	84	51	6	3	5	7
ORNAMENTAL						
Shade Tree	407	103	135	9	14	100
Oranamental Tree	291	62	109	7	5	58
Shrubs	169	36	81	3	6	24
Flowers	166	103	22	5	7	18
Interior plants	42	8	20	0	0	7
Specialty Hort	41	4	2	3	1	9
FRUIT						
Tree Fruit	68	30	30	2	1	3
Small Fruit	60	38	29	5	0	9
VEGETABLE	142	80	19	9	0	36
TURF	116	78	16	1	3	15
TOTAL	2226	1110	602	158	94	340

[1] The number of diagnosed problems add up to more than the number of samples received since many samples have more than one problem.

[2] Problem caused by an infectious disease causing agent, e.g. fungus, bacterium, virius.

[3] Problem caused by noninfectious stresses such as environmental, cultural, mechanical and site-related problems e.g. wind, drought, heat, soil compaction, root stress, etc.

[4] Problem caused by herbicide/ pesticide misuse.

[5] Problem caused by nutrient imbalance.

[6] "Other" includes the causal agent categories, no disease, and inadequate sample for diagnosis.

* Does not include insect-related problems or plant identification.

root rot on a fir sample was also confirmed.

Miscellaneous leaf spots were also found in greater numbers on woody ornamentals across the State. Apple scab (*Venturia inaequalis*) on crabapple was severe. Susceptible crabapples were partially defoliated by mid-June. Even many of the reputed "resistant" crabapples showed heavy infection from scab. Many elms in northern Indiana were killed during June and July by Dutch Elm Disease (*Ophiostoma ulmi*). The disease was especially noticeable in northeastern Indiana. This degree of damage to elm from DED has not been observed for several years.

Disorders: Early spring leaf scorch was the most frequently reported disorder on all trees throughout the state. High winds occurred just as new leaves were emerging, resulting in extreme scorching of the new growth. Although moisture was plentiful this year, the continued occurrence of dieback and decline in many woody ornamentals was attributed to the lingering effects of the 1988 drought as well as to a possible suffocating effect on feeder roots by saturated soils during the spring of 1990. Extremely cold temperatures in early December, 1989 also contributed to decline problems. Dieback in Japanese barberry, needle drop/dieback on blue spruce, and decline of white pines were common noninfectious problems.

FLOWERS

Diseases: *Fusarium* and *Pythium* spp. were responsible for root rots and subsequent wilt problems in several different dried flower varieties, including baby's-breath and statice. Bacterial leaf spot (*Pseudomonas cichorii*) was diagnosed on chrysanthemum, as in years past. Bacterial wilt (*Xanthomonas pelargonii*) was confirmed on geraniums in several commercial establishments. Alternaria leafspot on marigold was severe, as was *Cladosporium* on Peony. Phytophthora root rot was confirmed on petunia. Poinsettia's were plagued with Pythium and Rhizoctonia root and stem rots as well as root rots from excessive soluble salts.

TREE FRUITS

Diseases: The wet spring weather resulted in a high incidence of foliar and fruit diseases in unsprayed orchards. Apple scab (*Venturia inaequalis*) was especially severe; however, in sprayed orchards, it did not become a major problem. Fire blight (*Erwinia amylovora*) was present, primarily in southern Indiana, but not in any epidemic proportions. Phytophthora root rot was found with more than expected frequency. Sooty blotch (*Gloeodes pomigena*) and flyspeck (*Microthyriella rubi*) were very common, but they were really only severe in unsprayed orchards and home gardens. Frogeye leafspot (*Botryosphaeria obtusa*) and branch die back (*Botryosphaeria* sp.) were common problems on apples.

Disorders: The very cold temperatures of December 22, 1989, and repeated late spring freezes resulted in extensive injury to peach, plum, apricot, and cherry bud and wood tissue leading to a complete crop loss for most stone fruits in the State. In addition, substantial winter damage to the trunks (severe cambium browning) of

peaches and other stone fruits was very evident. The late spring freezes also resulted in a heavy crop loss of apples in southern Indiana.

SMALL FRUITS

Diseases: Strawberry leaf spot diseases were common. Gooseberry anthracnose (*Pseudopeziza ribis*) and raspberry anthracnose (*Elsinoe veneta*) were commonly diagnosed. Also diagnosed on raspberry were Septoria leaf spot (*Septoria rudbeckiae*), spur blight (*Didymella applanata*), and Botrytis fruit rot.

Disorders: Wet feet/clay soil related root problems on strawberries were the prominent disorders recorded. Cold injury to raspberries caused some cane dieback and wilting.

VEGETABLES

Diseases and Disorders: In the area of vegetable problems, the cool wet conditions that persisted through May and June significantly delayed vegetable planting in all parts of the State. As precipitation varied according to region, so did the appearance of main-season foliage blights caused by fungi and bacteria. Warm wet conditions over the entire Midwest during September contributed to the occurrence of fungal fruit infections on many fresh market vegetables. In general, 1990 was a moderately severe year for vegetable diseases.

The normal complement of infectious diseases occurred on cucurbits. Gummy stem blight (*Didymella bryoniae*) was diagnosed on watermelon seedlings grown in greenhouses in the southern part of the state. The heavy load of primary inoculum combined with the wet conditions to sustain serious epidemics in many fields. Incidence of gummy stem blight in the northern part of the state was low, but anthracnose (*Colletotrichum lagenarium*) was responsible for major losses. A bacterial fruit blotch problem (*Pseudomonas pseudoalcaligenes* subsp. *citrulli*) did not materialize in commercial watermelon fields in 1990. A rapid and irreversible wilt of watermelon vines occurred in several fields in southern Indiana. The fungus, *Pythium aphanidermatum,* was consistently isolated from wilted vines. The disease is possibly associated with cool wet weather, but management factors also may play a role in its development. Bacterial wilt (*Erwinia tracheiphila*) and Alternaria leaf blight (*Alternaria cucumerina*) were common problems on muskmelons. Powdery mildew (*Sphaerotheca fuliginea*) was first diagnosed on muskmelons on July 6. For the first time since the fungicide triadimefon (Bayleton) was registered for use on cucurbits in 1984, farmers were unable to achieve satisfactory control of powdery mildew in some fields. Cottony leak caused by *Pythium* sp. was most often identified in fields of cucumbers for fresh market. A higher than usual incidence of belly rot (*Rhizoctonia solani*) was observed in pickling cucumbers. Indiana pumpkin farmers achieved very good control of powdery mildew; there were few reports of a crown and foot rot of pumpkin caused by *Fusarium* spp. Late August and September rains contributed to considerable fruit loss caused by *Pythium* spp.

Insect pest problems overshadowed disease incidence in most of Indiana's potato crops; however, early blight (*Alternaria solani*) epidemics were severe in several fields. Early blight was also severe on many plantings of tomatoes for fresh market. Main season and late season tomatoes sustained considerable losses caused by fruit anthracnose (*Colletotrichum coccodes*). Early blight, anthracnose, bacterial canker (*Clavibacter michiganense* subsp. *michiganense*), and Sclerotinia stem rot (*Sclerotinia sclerotiorum*) were identified in processing tomato fields through the State. The leaf scorch symptoms of bacterial canker were evident in almost all fields sampled. Fruit spots associated with canker were rare. Incidence of tomato spotted wilt virus (TSWV) in tomato fields was low.

Pepper crops throughout the state sustained severe epidemics of Phytophthora blight (*Phytophthora capsici*). Many reports of the disease followed heavy rains during mid-late August. On many farms where peppers were seriously affected by Phytophthora blight, other vegetables also suffered damage. Phytophthora infections also were evident on turban and acorn squash, eggplant, and melons. The outbreak of this disease on many vegetable farms will present long term disease management problems, because of the number of vegetables affected by the pathogen.

Stands of early planted green beans suffered from a Fusarium, Rhizoctonia, and Pythium root rot complex. Bacterial blights of leaves were not observed in fields sampled in 1990. White mold caused by *Sclerotinia sclerotiorum* was severe in many fields.

TURFGRASSES

Diseases: Helminthosporium leaf spot/melting out (*Drechslera poae*) was common in numerous home lawns and other Kentucky bluegrass turf areas early in the spring. Red thread (*Laetisaria fuciformis*) caused problems in scattered fescue and ryegrass turf areas in late spring. Rust (*Puccinia* spp.) developed to epihytotic proportions in some northern Indiana turfs in the fall. Dollar spot (*Lanzia* and *Moellerodiscus* spp.) was the most widespread disease of bentgrasses, and the disease was active throughout the entire growing season. This disease was also commonly found, but less damaging, in bluegrass, ryegrass, and fescue turfs. Brown patch (*Rhizoctonia solani*) was moderately severe in many bentgrass areas in mid-August, but the disease occurred only for about one week. Take-All patch (*Gaeumanomyces graminis* var. *avenae*) caused significant damage on fairways and greens of two newly established golf courses in northern Indiana and moderate damage on a newly reconstructed green in central Indiana.

AGRONOMIC CROPS

Diseases—Corn: Seedling blights caused by several pathogens were common, especially in fields that were planted immediately prior to the start of wet weather in early May. Reduced stands necessitated replanting in some individual fields. In addition, portions of some fields were replanted due to flooding. Crazy top (*Scleropthora macraspora*) was prevalent in many fields planted prior to the the wet

weather, but the disease was confined to relatively small spots in fields, and yield losses were minimal.

The leaf blight phase of Stewart's Disease (*Erwinia stewartii*) was the most prevalent foliar disease on corn throughout the State. The disease was present in virtually every field due to the high populations of the corn flea beetle (*Chaetocnema pulicaria*), vector of the pathogen. However, yield losses from this disease were negligible to very light. In spite of the above normal rainfall during the growing season, fungal leaf blight diseases did not become yield limiting, except in a few individual fields planted to highly susceptible hybrids. Northern corn leaf blight (*Exserohilum turcicum*), southern corn leaf blight (*Bipolaris maydis*), common rust (*Puccinia sorghi*), and anthracnose (*Colletotrichum graminicola*) were the most commonly found foliar diseases scattered throughout the State. Grey leaf spot (*Cercospora zeae-maydis*) appeared in scattered fields in the southern half of Indiana, and minor amounts of eyespot (*Kabatiella zeae*) and holcus spot (*Pseudomonas syringae*) were indentified in the northern portion. Common smut (*Ustilago zeae*) was also present in fields over the State, but not in damaging amounts.

Stalk rots were prevalent throughout the State, and significant lodging occurred in many fields. Due to the extensive corn borer damage in numerous fields, it was frequently difficult to assess whether the lodging was due to stalk rots or corn borer damage. Anthracnose stalk rot (*Colletotrichum graminicola*) was the most prevalent stalk rot, and it was found in many fields over the State. Gibberella (*Gibberella zeae*) and Fusarium (*Fusarium moniliforme*) stalk rots also occurred over the State. Severe Diplodia stalk rot (*Stenocarpella maydis*) occurred in some south-central Indiana fields, where corn followed corn with reduced tillage, especially no-till. Charcoal stalk rot (*Macrophomina phaseolina*) was identified in southern Indiana, but it was rare.

Ear rots were less prevalent in 1990 than in 1989, in spite of similar weather conditions at and shortly after pollination. Fusarium ear rot (*F. moniliforme*) was found in approximately 50% of the fields (compared to almost 90% in 1989), but severity was generally less than 2% of the kernels affected. The mycotoxin fumonisin, associated with this pathogen, was not detected above background levels in any of the samples tested. Gibberella ear rot (*G. zeae*) was found in approximately 30% of the fields (compared with 13% in 1989) with severity being less than 3% of an ear. Deoxynivalenol (DON or vomitoxin) was the only mycotoxin found in association with Gibberella ear rot. Except for a few rare cases, DON levels were below 3 ppm. There were at least two high yielding hybrids planted in the State that were highly susceptible to Gib ear rot and that were extensively damaged by this disease. Both hybrids had upright ears with tight husks. There were relatively few fields in the State planted to these hybrids. None of these fields were included in the ear rot survey, and no mycotoxin determinations were made. Diplodia ear rot (*Stenocarpella maydis*) occurred in less than 5% of the fields, all in southern Indiana. This disease incidence was similar to 1989 and was severe in only a few fields. Diplodia ear rot was almost always associated with corn following corn and with reduced tillage.

Diseases—Soybeans: Regardless of the facts that saturated soils delayed planting or necessitated replanting and that soybean disease problems were widespread, soybean yields for the State were exceptionally good. Seedling blights, caused by species of *Phytophthora, Rhizoctonia, Fusarium,* and other pathogens, were identified in many fields. Foliar diseases such as brown spot (*Septoria glycines*)

and downy mildew (*Peronospora manshurica*) were prevalent in numerous fields, but apparently did little damage. Bacterial blight (*Pseudomonas syringae pv. glycinea*) and bacterial pustule (*Xanthomonas campestris pv. glycines*), however, were at much lower levels that in recent years.

The most widespread, significant soybean problem occurred in mid-July following 5 days of heavy rains, thick overcast skies, and exceptionally cool nights. Two types of field symptoms were observed. In some fields, the problem appeared as a sudden wilting of plants, followed by a grayish-green, tip or marginal leaf desiccation. Severely affected plants died, while less severely affected plants survived with varying degrees of vigor. The second, more common, symptom appeared as a slight yellowing and stunting of plants, which progressed, to varying degrees of stunting and/or plant death. Regardless of which type of symptom developed first, the root systems appeared near normal at first glance during the early stages of symptom development. However, when the affected plants were dug and the root systems carefully washed, light tan to dark brown lesions were observed on the lateral roots, generally more towards the root tips. When the tap roots of affected plants were cut longitudinally, tissues in the central portion were frequently, but not always, a light tan to light gray. As the above ground symptoms progressed, increased lateral root deterioration occurred, and the internal tap root discoloration generally increased in intensity. Immunoassay tests for *Phytophthora* and *Pythium* were performed using the Multiwell Immunoassay Kits for plant pathogenic fungi produced by Agri-Diagnostics Associates, Cinnaminson, New Jersey. In addition, samples were plated on $P_{10}VP$ medium and on acidified PDA for recovery of other fungi. Cultures presumed to be *Phytophthora* spp. were transfered to frozen lima bean agar, dilute V-8 juice agar, and PDA for confirmation.

A total of 198 samples were analyzed. Of these, 137 samples were positive for *Phytophthora* spp. by immunoassay. Of the 137 samples which were positive by immunoassay, 128 were cultured, and, of those, 50 appeared to be positive for *Phytophthora* spp. There were 61 samples which were negative for *Phytophthora* spp. in the immunoassasy, of which 5 yielded cultures of *Phytophthora* spp. In addition, numerous cultures tentatively identified as *Pythium, Rhizoctonia, Fusarium, Macrophomina, Diaporthe/Phomopsis, Phialophora* spp., and other fungi were isolated.

Following the initial onset of symptoms, several days of excellent growing conditions occurred. Surviving, but affected plants in many, but not all fields appeared to recover. The degree of recovery was variable from field to field; some appeared to completely recover, while others recovered to varying degrees. Recovery of affected plants appeared to be improved in those fields that were cultivated shortly after initial symptoms occurred. In a few fields, there was no apparent recovery, and affected plants continued to decline.

During the week of September 3, 1990, premature yellowing and death of plants was observed in the same areas of many fields that were initially affected but had recovered to varying degrees. This premature yellowing and death is thought to be directly related to root damage earlier in the season.

Sclerotinia stem rot (*Sclerotinia sclerotiorum*) was present in many northern Indiana fields. While the disease occurred in damaging proportions in only a few widely scattered fields, it was found in more numerous and widespread areas than in any previous year. Brown stem rot (*Phialophora gregata*) was identified in several

northern Indiana fields, although not as widespread and damaging as in 1989. Sudden death syndrome (*Fusarium solani* race A) occurred in scattered fields in southwestern Indiana, but symptoms were milder and less widespread than in 1989. Stem canker (*Diaporthe phaseolorum* var. *caulivora*) was identified in a few fields, but damage was relatively light. Charcoal root rot (*Macrophomina phaseolina*) was found late in the season in several fields that were damaged earlier by the root problem described above. The soybean cyst nematode (*Heterodera glycines*) was identified in many western Indiana fields and continues to be a significant soybean production problem.

Diseases—Small Grains: Foliar diseases of wheat were widespread throughout the State and were particularly severe and damaging in southwestern Indiana. Yield losses approached 50% in some fields. Septoria leaf blotch and glume blotch, caused by *Stagorospora nodorum,* were the most prevalent and damaging diseases. Septoria leaf blotch, caused by *Septoria triticii,* was present, but most varieties grown in the state have good resistance to this pathogen. Powdery mildew (*Erysiphe graminis*), leaf rust (*Puccinia graminis*), and scab (*Gibberella zeae*) were also commonly found in wheat fields, but damage from these diseases was relatively light, except in fields planted to highly susceptible varieties. Wheat spindle streak mosaic virus symptoms were prevalent throughout the State in the early spring, but this disease causes only minor disease losses. Barley yellow dwarf virus was present to a greater extent than in 1989, but yield losses were limited to relatively few fields.

CONCLUSION

The moist conditions of 1990 and the lingering effects of the drought of 1988 contributed to the diverse nature of plant problems diagnosed in the P&PDL. Through proper understanding of the ways in which plant diseases develop and by promoting and encouraging proper methods of prevention or control, losses due to plant disease can be kept to a minimum.

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