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A COMPILATION OF PLANT DISEASES AND DISORDERS IN INDIANA - 1989

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INTRODUCTION

The Plant Diagnostic Clinic in the Department of Botany and Plant Pathology at Purdue University is a service of the Cooperative Extension Service, Purdue Agricultural Experiment Station. Plant disease diagnosis and weed identification are gratuitous services offered by the clinic. Of the 1757 specimens received, approximately 80% were submitted by county extension agents. The remainder of samples came directly from 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 throughout the state in 1989.

METHODS

Plant specimens are submitted to the Plant Diagnostic Clinic from county extension agents, homeowners, growers, nursery operators, consultants, and others. Specimens are diagnosed visually or by culturing the pathogen on selected media. Some virus diseases are diagnosed by the leaf dip (negative stain) technique utilizing the electron microscope. Serological rapid assay detection is also utilized. Once a disease or disorder is diagnosed, appropriate control measures are suggested. A summary of the samples diagnosed from January 1 through October 20, 1989 is given in Table 1.

RESULTS

As of October 20, 1989 the clinic has received 1757 samples, including agronomic, ornamental, fruit, turf and vegetable crops (Table 1). Of these samples, approximately 54% were diagnosied as infectious disease problems, 23% were diagnosed as environmental/site disorders, 13% were diagnosed as chemical injury and 5% exhibited a nutritional problem. The remaining samples were either damaged by insects, were poor samples or lacked adequate information for a proper diagnosis.

In contrast to the hot, dry summer of 1988, with record drought conditions, 1989 was cooler than normal, with near to above normal precipitation throughout most of Indiana. These conditions were conducive to outbreaks of many diseases. The number of specimens submitted to the Plant Diagnostic Clinic was the largest since its inception in 1960 (Evans, *et al.*, 1980, 1981; Recknold, *et al.*, 1974; Ruhl, *et al.*, 1982-1988).

SHADE AND ORNAMENTAL TREES

Diseases: Cool, damp spring weather was conducive to several woody plant diseases. Sycamore anthracnose (*Gnomonia platani*) was devastating. Shoot and bud blight were followed by severe twig blight and cankering. However, the leaf blight phase of the disease was almost completely absent. Outbreaks of ash anthracnose (*Gloeosporium*

Table 1. Plant samples received in the Purdue Plant Diagnostic Clinic Jan 1 through Oct 20, 1989.

Plant Specimen	Number of[1] Samples	Diseases[2]	Disorders[3]	Chem.[4]	Nutr.[5]	Insect[6]	Other[7]
AGRONOMIC							
Corn	165	54	49	79	8	6	14
Soybeans	183	150	21	63	8	3	25
Small Grain	133	91	31	34	7	4	23
Forage Grasses and Legumes	22	16	2	0	0	3	1
ORNAMENTAL							
Trees-Shade and Ornamental	374	105	133	11	9	65	83
Shrubs and Groundcover	106	41	18	0	0	1	28
Flowers	183	110	42	5	18	5	27
House Plants	33	8	5	0	8	1	12
FRUIT							
Tree Fruit	96	46	21	2	3	14	16
Small Fruit	46	23	9	2	1	4	12
VEGETABLE	151	102	17	7	14	6	29
TURFGRASS	69	102	4	0	2	3	6
PLANT I.D.	196	—	—	—	—		
TOTAL	1757	848	352	203	78	115	276

1) The number of diagnosed problems add up to more than the number of samples received since many samples may have more than one problem.
2) Problems caused by an infectious disease causing agent, e.g. fungus, bacterium, virus, mycoplasma, nematode.
3) Problem caused by noninfectious environmental stress, e.g. wind, drought, heat, soil compaction, etc.
4) Problem caused by herbicide/pesticide misuse.
5) Problem caused by a nutrient imbalance.
6) Problem caused by an insect. Does not include samples submitted to Entomology Diagnostic Clinic.
7) "Other" includes the causal agent categories: No disease, and inadequate sample for diagnosis.

aridum) and maple anthracnose (*Gloeosporium apocryptum*) were relatively mild, but more common than in 1987 or 1988 (Ruhl, *et al.* and Ruhl, *et al.*). Apple scab (*Venturia inaequalis*) on crabapples was also the most severe it's been in memory. The severity of scab caused unusual symptoms on the more scab susceptible cultivars; terminal growth wilted and turned dark brown to black, similar to the appearance of twig blight caused by fire blight. Dutch elm disease (*Ceratocystis ulmi*) and elm yellows (MLO) were common all across the state this summer. Mortality from these diseases appeared to be more prevalent this year than in the past five years (Ruhl *et al.*, 1984-1988).

Disorders: In contrast to the hot, dry summer of 1988, with record drought conditions, 1989 was far cooler than normal with near to above normal precipitation throughout most of Indiana. In addition, the winter of 1988-89 was relatively mild with few rapid changes in temperature. As a consequence, little if any freeze damage occurred on trees and shrubs, even though many woody plants entered the winter severely weakened by the 1988 drought. During July and August, several calls were received con-

cerning white pine needles that were bending and drooping. The droop was attributed to the hot, humid and moist growing conditions this year.

Table 2. Clinic Samples from Indiana that tested positive for Tomato Spotted Wilt

Greenhouse Ornamentals (impatiens strain of TSWV)	Greenhouse Vegetable Transplants (impatiens strain of TSWV)
Gloxinia	Eggplant
Portulaca	Celery
Dahlia	
Coleus	(impatiens and common strain of TSWV)
Babysbreath	
Garden impatiens	Tomato
Double impatiens	Pepper
New Guinea impatiens	
Nonstop tuberous begonia	
Exacum	

ORNAMENTALS

Diseases: In greenhouse ornamentals, Tomato Spotted Wilt (TSWV) continued to be a serious problem. Samples that tested positive for the virus in Indiana included garden and new guinea impateins (Table 2). In addition, some vegetable crops grown as transplants in Indiana greenhouses also tested positive for TSWV (Table 2). Spread of the TSWV by its vector, the western Flower Thrips (WFT) has been increasing as the WFT is becoming the dominant species of thrips in greenhouses due to its tolerance to many insecticides. The wide host range, variability in symptom expression and difficulty in vector eradication all contribute to making TSWV a difficult disease to control. It is at present the most important problem in the greenhouse ornamentals industry. Black spot (*Diplocarpon rosae*) of rose was especially noticeable during early spring and summer. As in previous years of this survey, powdery mildew was prevalent during late summer on lilac, zinnia, dahlia and numerous other susceptible hosts.

Disorders: Little if any freeze damage occurred on woody ornamentals, even though, as mentioned previously, many woody plants entered the winter severely weakened by the 1988 drought.

TREE FRUITS

Diseases: Cool, damp spring weather resulted in severe apple scab (*Venturia inaequalis*) in unsprayed orchards. The above normal rainfall also resulted in brown rot (*Monilinia fructicola*) of stone fruits (cherry, peach, plum and nectarine) being very prevalent throughout harvest. Fire blight (*Erwinia amylovora*) of pear and apple was most severe in localized areas of southern Indiana but was not widespread. Frequent and heavy rainfall during summer resulted in sooty blotch (*Gloeodes pomigena*) and fly speck (*Microthyriella rubi*) of apple fruit being extremely common throughout the state. The wet conditions throughout the year triggered an increase in collar rot of apple (*Phytophthora cactorum*) which was detected in a number of orchards in late summer.

Disorders: The apple crop was lighter than normal in some areas due to a very heavy June Drop or light return on some cultivars. These effects were thought to relate in part to the 1988 drought in combination with planting density. Hail damage occurred in a number of orchards in southern Indiana.

SMALL FRUITS

Diseases: Strawberry grey mold (*Botrytis cinerea*) caused significant damage in a number of commercial strawberry plantings throughout the state due to the wet weather in May and June. In a few fields growers suffered up to a 50% loss. Strawberry leaf spot diseases (*Mycosphaerella* sp.; *Diplicarpon* sp.) were also common.

Disorders: There were no prominent disorders recorded for small fruits. Several complaints of poor root/crown systems on plants set in 1987 and 1988 were attributed to drought related stress factors of the 1988 season.

VEGETABLES

Diseases and Disorders: From the standpoint of vegetable diseases, 1989 was both a normal and an unusual year. As expected, Septoria leaf spot (*Septoria lycopersici*) defoliated many fresh market tomato crops, Alternaria leaf blight (*Alternaria cucumerina*) consumed its share of melon fields, black rot (*Xanthomonas campestris* pv *campestris*) occurred with its usual frequency on cabbage, and anthracnose (*Colletotrichum orbiculare*) appeared in many cucumber plantings. Unexpected diseases included a relatively new virus disease that affected a significant portion of our tomato acreage and a new bacterial disease that plagued southwestern Indiana watermelons. Certainly the cool wet spring and the rainy summer contributed to the development of new and old diseases. However, the normal Midwestern compliment of vegetable diseases may be changing due to changes in our crop management practices and to circumstances beyond our control.

The major disease concern in the early part of the season was the unusually high incidence of tomato spotted wilt virus (TSWV) among our processing-tomato crop. There were several reports of more than 50% infection. In such fields estimated yields were poor and some farmers decided to destroy the crop early and try to cut their losses. In many other cases infection was estimated at less than 5%, a situation where compensation by neighboring plants would off-set the loss of a few individuals. Some of the infected plants were introduced from southern plant growers; others originated in Indiana greenhouses used from transplant production. The virus is transmitted by the Western Flower Thrips (WFT), and these thrips were not observed in Indiana in 1989. Apparently, there was no detectable spread of the disease in the field. The major concern for next year is to do everything possible to ensure that the supply of transplants is disease-free. Southern growers must do their best to provide virus-free plants. Perhaps the greater threat will be from local greenhouses that are used to produce flowers as well as vegetable transplants. Many common flowers are hosts (Table 2), and the WFT will survive the winter in Midwestern greenhouses.

As our resident-transplant industry continues to grow, following the trend occurring in other midwestern states, previously scarce diseases may make a more regular appearance. For the first time in eight years, Sclerotinia stem rot (*Sclerotinia sclerotiorum*) was observed in a greenhouse used for tomato transplant production. The Sclerotinia fungus (a common Midwestern pathogen) is quite capable of taking full advantage of

the ideal greenhouse climate (warm and humid) and the availability of an ample supply of susceptible seedlings. Incidence of Sclerotinia stem rot is expected to increase in the future. The wet summer weather certainly helped to promote the spread of bacterial canker of tomato (*Clavibacter michiganense* pv *michiganense*). Foliar symptoms were widespread by mid-July. The extent of yield losses due to canker remains unknown. The fact that canker is a seed-borne pathogen also increases the threat of disease development in our resident greenhouse-grown transplants.

The bacterial fruit blotch of watermelon, a disease that is new to Indiana, caused some very substantial yield losses (more than 90% in some fields). Nomonclature of the pathogen remains uncertain. It was identified as *Pseudomonas pseudoalcaligenes* in the mid-1960s. Technological advances in methods for distinguishing plant pathogenic bacteria have precipitated a tentative change to *Chromobacterium violacearum*. Initially the disease was isolated to the Prince Charles variety of watermelon; it spread to other watermelon varieties later in the season. The disease occurred in several fields near Oaktown, IN. It also will attack cantaloupe and other cucurbits. Because it is not known whether this bacterial pathogen will overwinter in the Midwest, we must proceed with disease control recommendations as though it will survive. There is very strong evidence that the pathogen is seed-borne. With proper management precautions and a disease-free supply of seed, we may be able to eradicate the bacterial fruit blotch.

AGRONOMIC CROPS

Diseases and Disorders - **Corn**: Only minor seedling blight problems due to pathogenic organisms were encountered in spite of the wet spring. The majority of the emergence problems encountered in the State were due to non-infectious agents.

Leaf blight diseases were more prevalent in 1989 than in 1988 (Ruhl, *et al.*, in press) due to considerably more rainfall. Northern corn leaf blight (*Exserohilum turcicum*) caused significant yield losses in a few scattered fields planted to highly susceptible hybrids in the west central portion of Indiana. Southern corn leaf blight (*Cochliobolus heterostrophus*) was widespread in the State, but caused only minor yield reductions in a few scattered fields. Northern corn leafspot (*Cochliobolus carbonum*) was widespread and prevalent in many seed production fields planted to susceptible inbreds. This disease was present in hybrids, but to a much less degree and was not considered to be damaging. Gray leaf spot (*Cercospora zeae-maydis*) was identified in several fields in the southern half of the State and caused some yield reduction in a few fields. Anthracnose (*Colletotrichum graminicola*) leaf blight was present in many fields in the State, especially early in the season, but caused very minor damage. This disease was most noticeable later in the season as a top-kill phase. Yield losses from the top-kill phase of anthracnose are unknown.

Due to the wet spring and flooding of some fields shortly after planting, crazy top (*Sclerophthora macrospora*) was observable in many fields. However, crazy top did not affect a large number of plants in any given field to our knowledge.

Stalk rots were prevalent in the State, but early harvest conditions were good and severe lodging occurred in only individual, scattered fields. Fusarium (*Fusarium moniliforme*), Gibberella (*Gibberella zeae*) and anthracnose (*C. graminicola*) were the most commonly encountered stalk rot pathogens.

An extensive ear rot survey was conducted in cooperation with the Indiana Agricultural Statistics Service during the 1989 harvest season. Approximately 70% of the

ears from earlier maturing hybrids had from 1-3% ear rot. Later maturing varieties had approximately 30% of the ears with 1-3% ear rot. Fusarium ear rot (*F. moniliforme*) was, by far the most commonly identified ear rot pathogen (>90%) and was found throughout the State. Minor amounts of Gibberella ear rot (*G. zeae*) were identified from northwestern and central Indiana. Other minor ear rots caused by *Penicillium* spp., *Trichoderma* spp. and *Alternaria* spp. were identified from the State. There was no indication of any aflatoxin in any of the samples.

Diseases and Disorders - **Soybeans**: Due to the wet spring, seedling blight problems due to *Phytophthora megasperma* f. sp. *glycinea, Rhizoctonia solani* and the *Diaporthe/Phomopsis* spp. complex occurred in many fields. Some fields were partially or totally replanted due to the disease/environment interaction.

Foliar diseases were more prevalent in 1989 than in 1988 (Ruhl, *et al.*, in press) due to heavier rainfall patterns. Brown spot (*Septoria glycines*) appeared early and continued to develop through July. Fortunately drier weather prevailed during the latter part of August and in September. Some fields had sufficient defoliation to cause minor yield losses. Bacterial blight (*Pseudomonas syringae* pv. *glycinea*) was widespread, but did not cause significant yield losses. Downy mildew (*Peronospora manshurica*) was also prevalent but did not cause yield reductions. Soybean mosaic (SBMV) and bud blight (TRSV) were identified in several fields, with bud blight being severe in portion of some scattered fields.

Phytophthora root rot (*P. megasperma*) occurred thorought the growing season in fields planted to susceptible varieties. Brown stem rot (*Philaophora gregata*) was the most widespread and damaging in Indiana in at least the past twenty years. The disease was found throughout the State and especially in the western half from the Michigan to the Kentucky borders. A few severely affected fields were known to suffer near 50% yield losses. Sudden Death Syndrome (*Fusarium solani* race A) was more widespread and damaging than in the past three years. The disease was identified for the first time in three new northern Indiana counties (Newton, Carroll and Clinton).

Pod and stem blight (*Diaporthe/Phomopsis* spp. complex) was severe in many fields planted to Group II and early Group III varieties in the northern half of Indiana and on later maturing varieties, especially in the southwestern portion of the State. Purple seed stain (*Cercospora kikuchii*) was found in many areas of the State, but damage was light to moderate. The soybean cyst nematode (Heterodera glycines) continues to be an increasing and serious problem.

Diseases and Disorders - **Wheat**: Wheat diseases were prevalent during 1989. Early in the spring, symptoms of wheat spindle streak mosaic (WSSMV) and soilborne wheat mosaic (SBWMV) were observed in most areas of the State. Both virus diseases are caused by soilborne viruses that are transmitted by the soilborne fungus *Polymyxa graminis*, and produce similar symptoms. Serological tests confirmed both viruses were present in the State. Yield losses were minimal since most varieties grown in the State have reasonable resistance. Wheat streak mosaic (WSMV) was serologically identified in a few fields in 1989. This destructive virus is transmitted by the wheat curl mite, and is found in those years that are conducive to increased populations of the mite coupled with early planting. The 1988 drought produced these conditions. The barley yellow dwarf virus was at a very low level in 1989, as indicated by a state-wide survey conducted by Dr. Robert Klein and Dr. Richard Lister, Department of Botany and Plant Pathology, Purdue University. Septoria leaf and glume blotch (*Leptosphaeria nodorum*) was widespread throughout the State and resulted in significant yield losses, especially

in the central and southwestern parts of Indiana. Septoria leaf blotch (*Mycosphaerella graminicola*) was present in many fields but did not develop to damaging levels. Leaf rust (*Puccinia recondita*) was common in the State, but not severe in most fields. Stem rust (*P. graminis*) was found in the northern part of Indiana and caused damage to late maturing varieties. Scab (*Gibberella zeae*) was sporadic and caused only minor damage in most fields. Take-all (*Gaeumannomyces graminis*), sharp eyespot (*Rhizoctonia cerealis*) and tan spot (*Pyrenophora tritici-repentis*) were sporadic, but severe in some fields where wheat followed wheat.

Disease and Disorders - **Forage and Specialty Crops**: Numerous leaf spot diseases were observed early in the season, but severe damage occurred in only a few fields. The most damaging disease of alfalfa in 1989 was Sclerotinia stem and crown rot (*Sclerotinia trifoliorum* or *S. sclerotiorum*). This disease resulted in poor to non-economic stands in many fall seeded alfalfa fields.

Sclerotinia stem rot (*S. sclerotiorum*) of canola was exceptionally severe in some southern Indiana fields. Yield losses of over 50% were reported from some fields.

TURFGRASSES

Brown patch (*Rhizoctonia solani*) and dollar spot (*Lanzia* or *Mellorodiscus* spp.) were widespread and damaging in both bentgrass and Kentucky bluegrass turf areas. Several foliar diseases including *Aschochyta* were observed, but damage was generally light.

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