

Extension Plant Pathology

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The information that follows focuses on some of the educational activities and programs in Extension Plant Pathology. It should not be viewed as a comprehensive review.

Early Development

In Professor L. E. Melchers' statement concerning the history of the Department of Botany and Plant Pathology, he stated:

From 1913 to 1917, the first extension work in plant diseases was that done by the subject-matter department. In those early days, Professor L. E. Melchers conducted the work on cereal smut control and potato disease work in the Kaw Valley

During 1918 and 1919, funds were available from the Bureau of Plant Industry, U. S. Department of Agriculture as a war emergency measure. John Blachly was employed as a specialist at that time.

He created interest among potato growers and showed what could be done by seed potato treatment.

The first full-time Extension Plant Pathology Specialist was E. A. Stokdyk, who served from

1921 to 1924. His pioneering placed Extension plant disease work on a firm basis.

Such features as the Kansas Potato Show, the Kaw Valley Potato Tour, the potato train, sweet potato improvement work, and the campaign for the control of wheat bunt were outstanding features of his work.

John Blachly, Plant Disease Specialist in the Bureau of Plant Industry, USDA, was a graduate of Kansas State Agricultural College. Some of his first work was in Shawnee County, Kansas.

Demonstrations in rhizoctonia control and oat smut prevention were two lines of work emphasized at that time. Interest spread gradually to other counties in the Kaw Valley.

First Project Agreement—1918

The first project agreement was entitled, "Demonstrations in the Control of Diseases of

Potatoes, Truck Crops, Forage Crops, and Related Plants." It was signed September 11, 1918.

Plant Pathology Title—1921

A new agreement was written and signed March 1, 1919 and the title changed to "Plant Pathology."

In 1921, two subprojects were listed:

- A - Vegetable Disease Control, and
- B - Grain Crops Disease Control.

Plant Pathology Projects—1921

In the 1920-22 Biennial Report for the Department of Institutes and Extension Schools, T. J. Talbert, then Head of the Department, stated:

The position of Extension Plant Pathologist was filled February 15, 1921. During the year, the principal projects undertaken were seed treatment of potatoes; variety tests of potato seed as between certified and commercial, and varieties from different states in their adaptability to Kansas soils; control of foliage diseases by spraying; seed treatment for sorghum, oats, and sweet potatoes; and a general survey of plant diseases in Kansas to determine losses caused by diseases; prevalence of diseases; and problems that require attention.

Sweet Potatoes—1921

Sweet potato diseases and their control, an important phase of the plant pathology program, began in 1921. It was devoted to seed treatment and hill selection of seed.

At that time it was thought advisable to secure sweet potato seed from New Jersey at least every third year, as the seed would "run out."

The demonstrations on the "hill selection" of seed, however, showed that after a few years of careful selection of seed it was possible to secure better quality and higher yields from the growers' own seed than from shipped in seed.

In the Kaw Valley area, Art Travis, Herman Theden, the Speaker Brothers, and the Johnson Brothers were leaders in sweet potato production.

Irish Potatoes—1921

Irish potato production received major attention by the Extension Plant Pathology Specialist until 1936. At that time the Extension Specialist in Horticulture was assigned responsibility for adaptability of seed, recommended varieties, and the use of fertilizers.

During a 20-year period, from 1921 to 1938, the acreage of Irish potatoes planted to certified seed increased from 1,500 to 6,257.

Tomatoes—1921

Tomato wilt disease commanded much attention in 1921. Varieties of tomatoes resistant to tomato wilt were tested. The work of field testing new, promising, varieties for resistance was coordinated with the Extension Specialist in Horticulture.

By 1939, recommended wilt-resistant varieties included Marglobe, Pritchard, Break O'Day, and Rutgers.

Cereal disease work also required much time by the Extension Plant Pathologist, John O. Miller, especially wheat diseases.

Wheat Smut—1921

Previous to 1921, very little wheat seed planted in Kansas had been treated for stinking smut. In 1921 a campaign to "Smite the Smut" was conducted and seed treatment urged. The campaign resulted in 171,000 acres of wheat planted with treated seed.

By 1938, 1,618,108 acres were seeded with treated seed wheat.

In 1963, the Extension Plant Pathology Specialist, Claude L. King, calculated the benefit of the seed wheat treatment program, at an annual savings of more than \$17 million.

Recommended wheat seed treatments changed through the years from formaldehyde, to copper carbonage, ceresan, new improved ceresan, pantogen, and similar liquids and dusts, which could be easily applied in a drill box, or be added to grain as it was elevated with an auger.

Kansas Wheat Train—1925-30

The Kansas Wheat Train or "Opportunity Special" was operated over the Santa Fe Railroad and Rock Island Railroad lines during the years of the five-year Wheat Program from 1925-30.

The trains provided an excellent opportunity to tell the wheat seed treatment story to thousands of Kansas farmers. Related subject matter discussed by Extension Specialists on the trains included agronomy, economics and entomology.

John Miller served as Extension Specialist in Plant Pathology from August 1, 1936 to May 11, 1946. He worked with the three Extension Agronomy Specialists in winter schools and tours in May and June each year.

Pawnee and Comanche varieties of winter wheat had been developed by the Agricultural Experiment Station in Kansas and cooperating states.

Comanche was so resistant to stinking smut that the seed did not need to be treated to prevent damage from this disease.

Pawnee was almost as highly resistant. Both had good resistance to loose smut and rusts.

By 1958, fifty percent of the Kansas wheat acreage was planted to these varieties due to the educational program conducted by the Extension Plant Pathology Specialist, Claude King, and the Extension Agronomists.

Control of take-all root rot and other wheat diseases were given major attention by John Miller.

Sorghum/Barley Seed Treatment—1921

Sorghum seed treatment was emphasized during the years following 1921. Ceresan dust made treatment easy. Some barley seed was also treated for smut. The value of such treatment was demonstrated many times by farmers under the direction of the Extension Plant Pathology Specialist.

Commercial Vegetable Program

Miller continued the work with commercial vegetable growers in the Kansas River and the Arkansas River valleys. The use of certified Irish

potato seed and seed treatment of potatoes was emphasized.

Potato Shows—1940's

Irish and sweet potato shows were held during the early 1940's each year at Topeka, Lawrence and Kansas City in cooperation with growers' associations that had been organized by the Extension Service.

Some of the leaders were: M. T. Kelsey, Scott Kelsey, and C. V. Cochran, Topeka; Emil Heck, Roscoe Pine, Les McGee, and Brune Brothers, Lawrence; Herman Theden, Bonner Springs; and Charles Speaker, Kansas City, KS.

Sweet potatoes became more popular as a crop after Dr. O. H. Elmer, Plant Pathologist for Kansas State, developed a new variety called Nancy Gold.

Recommendations were sweet potato seed selection at harvest time to eliminate stem rot and other diseases, and a corrosive sublimate seed treatment.

Seed treatment of other vegetable seeds with Arasan, Spergon, Semesan, and in some cases hot water, was recommended to give better stands and more vigorous seedlings.

Extension Plant Pathology Program—1940-60's

Home Garden Program—1940

A home garden program was organized about 1940. The Extension Plant Pathologist, Entomologist and Horticulturist provided a series of leader training meetings and tours under the sponsorship of Extension Home Demonstration Units.

They rotated years so the Extension Plant Pathologist worked in each county once every seven years.

Claude King was appointed Extension Plant Pathologist June 17, 1946 and served until June 30, 1974. King continued the cooperative work with the Extension Agronomy Specialists, Entomologist and Horticulturist as mentioned previously.

King also witnessed a broadening of the Extension Plant Pathology program as requests for assistance with diseases in lawn grasses, flowers, shrubs and trees came to him.

County Agricultural Extension Agents made many requests for Claude King to visit counties to help identify plant diseases and make recommendations for their control.

During the 1950's, King made visits to as many as fifty counties, one-half day each, during May and June to help County Extension Agents with plant pathology problems.

Hundreds of diseased plant specimens came to the Extension Plant Pathologist through the mail for identification and recommended treatment.

King used mass media to carry his plant disease control program to the people. Timely circular letters to Agents, special articles for farm magazines, radio and television programs were used.

Agents and commercial vegetable growers in the Kaw Valley requested that the Extension Plant Pathologist visit their counties several times a year to assist with the many problems confronting vegetable growers

Program Accomplishments—1958

In 1958, Claude King, Extension Plant Pathology Specialist, listed the greatest accomplishments during his tenure, beginning in 1946:

- 1) The acreage of wheat planted to treated seed increased from 1.3 million to 6 million acres.

- 2) Recommended sorghum seed treatment increased the stands of sorghum up to 300 percent, and the plants continued to be larger throughout the growing season, increasing the yields greatly. The treatments involved the use of captan or thiram fungicide and dieldrin insecticide.
- 3) Discovery in demonstration in the late 1940's that ferbam drenches in hotbed and greenhouse soils prevented the great losses growers were having with damping-off disease in cabbage, cauliflower, lettuce, peppers, tomatoes, eggplant and flowers.

This practice was readily adopted by most of the commercial vegetable growers. Leo DeBrandner of Johnson County was the original cooperator on this demonstration.

Plant Pathology Program—1961

In 1961, the Extension Plant Pathology program, under the leadership of Claude King, included:

- 1) Home garden and commercial vegetable disease control by the use of disease resistant varieties, modern chemicals and sanitation practices.
- 2) Field crop disease control made possible by continued research. Rust resistant wheat and oat varieties, milo root-rot-resistant varieties, crop sequence for disease control, and seed treatment to control smut each contributed to the success of the program.

Cultural practices and resistant varieties made it possible to reduce damage and losses due to soil-

borne and streak mosaic in wheat. The control of diseases common to barley, brome grass, corn, sweet clover, alfalfa, red clover, received attention.

- 3) The control of the diseases common to fruit trees, shade trees, small fruits and ornamentals received attention by the Plant Pathology Specialist.
- 4) Methods used to make the Extension Plant Pathology program effective included:
 - a. Assistance to County Extension Agents by the use of training schools, preparation of publications, news articles, special newsletters, growers meetings, training schools for leaders, farm visits with the agents, establishment of demonstrations, radio and television programs, identification of diseased specimens, and program planning with the agents and their committees.
 - b. Assistance given directly to fruit and vegetable growers with timely articles in state-wide farm magazines and daily newspapers, radio and television programs, public meetings, field meetings, timely leaflets and bulletins, and assistance to those involved with 4-H Club work.
 - c. Cooperation developed with State and Federal agencies, state officials representatives of commercial organizations, and co-workers in Extension, especially the Extension Entomologist and Extension Horticulturist.

Facilities For Extension Plant Pathology

Extension Plant Pathology was housed with the department of Plant Pathology beginning in 1956. Offices and labs were in Dickens Hall until August, 1981, when the department moved to the fourth floor of the new Throckmorton Hall.

The Diagnostic Lab started in 1962 with a table in the office, expanded into a small lab adjacent to the office about 1970, and to a 510 square foot laboratory in Throckmorton Hall in 1981.

Plant Disease Laboratory

Prior to 1962 plant disease samples were diagnosed by the Extension Specialist in Plant Pathology, with help from the research and teaching faculty.

The Extension Plant Pathologist did not have the time required to give proper attention to diseased plant specimens. In 1962 a more formal diagnostic lab was established.

A half-time position of Diagnostician was funded, and filled in 1962 by William G. Willis, who had experience as a County Extension Agent. As many as 900 such specimens were received from County Extension Agents and others in a year.

Disease Specimens—1962

In 1962, 902 plant disease specimens were received, the disease identified, and recommended control measures returned to the senders. The specimens included:

- 358 Field crops
- 71 Fruits
- 334 Trees and shrubs
- 25 Vegetables
- 75 Lawns and flowers
- 39 Miscellaneous

Eighty-nine percent came from County Extension Agents, seven percent from other individu-

als, and four percent from public and commercial agencies.

Diagnostic Lab Personnel—1967-82

Willis did graduate work in the department and finished a Ph.D. in Plant Pathology in 1967.

At that time the position was increased to full-time, and field travel responsibilities were added.

In 1978, a half-time Diagnostician position at the masters level was added. It was later increased

Graphic 1. **New or Unusual Diseases Detected from 1964 through 1988**

<u>Year</u>	<u>Host</u>	<u>Disease</u>	<u>Pathogen</u>
1964	Zoysia	Rust	Puccinia zoysia
1965	Sorghum & Corn	Maize Dwarf Mosaic	MDMV
1966	Sorghum	Root Knot	Meloidogyne spp.
1967	Sorghum	Downy Mildew	Peronosclerospora sorghi
1970	Corn	Corn Leaf Blight (T-strain)	Helminthosporium maydis
1972	Wheat	Cephalosporium Stripe	Cephalosporium gramineum
1972	Corn	Goss's Wilt	Corynebacterium michiganse
1973	Pine	Brown needle spot	Scirrhia acicola
1976	Corn	Corn lethal necrosis (CLN)	Maize Chlorotic Mottle Virus and Maize Dwarf Mosaic Virus or Wheat Streak Mosaic Virus
1978	Honey-locust	Canker	Thyronectria spp.
1978	Spruce	Needlecast	Rhizosphaera kalkhoyzii
1979	Juniper	Twig Canker	Kabatina juniperi
1979	Pine	Wilt nematode	Bursaphelenchus sp.
1979	Corn	Southern rust	Puccinia polysora
1980	Ajuga		Sclerotium rolfsii
1980	Fir	Shoot dieback	Dothiorella spp.
1980	Wheat	Strawbreaker	Pseudocercospora herpotrichoides
1982	Corn	Sting nematode	Belonolaimus sp.
1983	Fescue (tall)	Endophyte	Acremonium coenophialum
1984	Pear (Bradford)	Pseudomonas blight	Pseudomonas syringae
1984	Wheat	Spindle Streak Mosaic	WSSMV
1984	Sorghum	Acremonium wilt	Acremonium strictum
1985	Alfalfa	Verticillium wilt	Verticillium albo-atrum
1985	Soybean	Cyst nematode	Heterodera glycines
1985	Tomato	White mold	Sclerotinia sclerotiorum
1986	Black-walnut	Fusarium canker	Fusarium solani
1986	Pumpkin	Zucchini Yellow	Zucchini yellow mosaic virus
1987	Juniper	Canker	Botryosphaeria Stevensii

to .7. The position was made full time in 1982, .7 time in Extension and .3 time in teaching a diagnostic course in the Department of Plant Pathology.

Lab's Missions

The Diagnostic Lab had several missions in the 1960's through the 1980's:

- 1) Support County Extension Agents and train them to diagnose plant diseases.
- 2) Provide diagnostic service to growers and give control recommendations.
- 3) Serve as a limited indicator of plant disease conditions in the state.
- 4) Detect new diseases when they occur.

- 5) Provide plant disease materials for teaching.

Numbers of plant disease samples were variable from 1965 through 1988, depending on prevalence of plant disease each year.

In general they increased from 408 in 1962 to a peak of 2,341 in 1987. The average number of samples was about 1,400 per year over 25 years. More than half of these samples came in May, June and July.

Trees and woody ornamentals made up about 40 percent of all samples; all field crops about 30 percent; and fruits and vegetables about 15 percent.

County Agents and Extension Specialists sent most of the sample for diagnosis (80 percent).

Economic Impact

Plant Disease Control—1950's-60's

Following World War II, much progress was made in the Extension Plant Pathology program because of the development of disease resistant varieties of crops and new chemicals developed by research.

The Extension Specialist in Plant Pathology and the Extension Specialist in Entomology coordinated much of their work because farmers and gardeners were interested in both disease control and insect control.

Leader Training Schools

The Extension Specialists developed leader-training schools on a rotation plan. Schools were held in 15 counties a year for home demonstration unit leaders, 4-H Club leaders, and farmers.

In 1963 training was on lawn, flower, shrub, vegetable, fruit, shade tree, and household pest problems.

During the 1930's and later years, several plant diseases were discovered that had not previously caused noticeable losses. Examples were root-rot in wheat, wheat streak mosaic, soil-borne wheat mosaic, wheat seed rot, and seedling blight.

Each of these diseases was brought under control by practices developed by research and brought to the attention of farmers by the Extension Plant Pathologist.

Economic Impact Summary

In his 1962 annual report, Claude King, Extension Plant Pathologist, gave a summary of the economic impact of the field crop disease program (*See chart below*).

Other plant disease programs created during the early 1960's included: diseases of vegetables, both in the home garden and on commercial farms, shade trees, shrubs, flowers, and lawns. There was also a program on nematode control.

Publications Through 1965

In addition to the training-meetings held for leaders and County Extension Agents, mass media was used, including radio, television, and newspapers, including both dailies and weeklies.

Publications for free distribution were published. Many of the publications were on a single problem and could be used with written correspondence, or as handouts at meetings.

In 1962, the Extension Plant Pathology Specialist, Claude King, prepared the following publications:

- 1) Preventing Crop Diseases in Kansas
- 2) Clean and Treat Wheat and Barley Seed
- 3) Northern Corn Leaf Blight
- 4) Treat Spring Field Crop Seeds
- 5) Wheat in the Wheat State (Disease section)

- 6) Alfalfa in Kansas (Disease section)
- 7) Home Garden Pest Control
- 8) Evergreen Diseases
- 9) Shade Tree Diseases
- 10) Growing Healthy Tomatoes

In 1963, the following publications were written:

- 1) Correlation of Northern Corn Leaf Blight and Yields in 1962
- 2) Northern Corn Leaf Blight, Revised
- 3) Irish Potato Diseases
- 4) Preventing Diseases in Kansas Wheat
- 5) Vegetable Fungicide Chart

- 6) Diseases of Cucurbits
- 7) Damping-off Control in Crucifers and Lettuce

Lawn and Garden Clinics

City Lawn and Garden Clinics were originated at the suggestion of Otis Griggs, County Extension Agent in Reno County.

The number of participants in the clinics in 1963 were:

300 in Hutchinson	150 in Lawrence
750 in Kansas City	70 in Manhattan
150 in Salina	

Educational Methods

Diagnosis

Accurate diagnosis fundamental to an effective program in plant pathology. In addition to the lab diagnosis just described, field diagnosis by Extension Specialists was made when the importance of the problem warranted.

Incidence and Severity

Knowledge of incidence distribution and severity of diseases is a necessary basis for setting Extension educational and research priorities. This was accomplished informally for many years.

In 1975 the Kansas State Board of Agriculture initiated a disease survey to parallel their ongoing insect survey. Their survey plant pathologist, Tom Sim, was made an adjunct faculty mem-

ber of Kansas State University, housed in the Department of Plant Pathology.

He cooperated closely with Extension Plant Pathology Specialists. Sim was promoted to head of his section in 1988 and Jon Appel was appointed as survey plant pathologist in 1989 with the same arrangement.

Survey data collection, processing, storage and retrieval were computerized during this time.

The process followed was that Extension Specialists and Board of Agriculture personnel gathered data. After formatting, data were accessible for several uses.

Extension Specialists used it in their Kansas Plant Disease Alert newsletter to County Exten

Graphic 3. Economic Impact of Field Crop Disease Program		
<u>Disease Controlled</u>	<u>Research Controls Discovered & Applied</u>	<u>Profits to Kansas Last 10 Years</u>
Wheat streak mosaic	Resistant varieties, destruction of volunteer, and date of planting	\$95,000,000
Soil-borne wheat mosaic	Crop rotation and resistant varieties	10,000,000
wheat seed rot, seedling blight, and smut	Seed treatment and resistant varieties	170,000,000
Sorghum seed rot, seedling blight, and smut	Seed treatment	<u>140,000,000</u>
	10-Year Total savings to Kansas farmers	\$415,000,000

sion Agents.

It was put on the "Sunflower Dispatch" electronic mail system.

The data were also used in making estimates of disease losses.

Disease Loss Estimates

Estimates of losses caused by plant diseases are valuable for setting educational emphasis, research priorities, preparing reports, justifying expenditures, and detecting changing trends in diseases.

Wheat disease loss estimates were made for the years 1976-1988 cooperatively with the survey plant pathologist. (See charts on pages 180 and 181.)

Extension Meetings

In the 25 years, through 1988, the trend was from general crop meetings to more specialized single crop "full-load" schools; then to "in-depth" schools which covered only diseases and insects of one crop.

This paralleled specialization of farm enterprises. It was tailored to the needs of farmers who wanted to know the "why" as well as the "how" of disease control.

Specialized meetings also helped meet the needs of the growing numbers of crop consultants and fieldmen in the 15 years from 1973-1989.

Demonstration Plots

Demonstration plots continued to be a most effective teaching method. The Agronomy Department provided seed. County Extension Agents found cooperators who would plant the plots. County Extension Agents and Extension Specialists worked together on tours and field days.

Wheat variety demonstration plots were especially valuable in comparing varieties for disease reaction and in following the development of epidemics.

Information gathered from the plots was the major source for resistance ratings in the "Wheat Disease and Insect Rating," which was started in 1983 and was updated annually.

Field Days and Tours

Field days and tours at demonstration and research plots continued to draw good crowds.

The rapid acceptance of new soil-borne mosaic resistant wheat varieties for the ten year

period from 1978-88 was largely due to county Extension variety demonstrations planted in infested fields. There the dramatic contrasts drew large crowds to observe variety differences.

County Extension Agent Training

Few County Extension Agents had taken plant pathology courses, yet plant disease problems were an important part of their program. This deficiency in training required support which was supplied in several ways.

Updates

County Extension Agent updates in cooperation with Extension Entomologists were held in early spring nearly every year, beginning in the 1950's. One meeting was held for each of the five administrative areas.

The goal was to prepare Agents for the upcoming growing season with current plant disease situations, the most recent control recommendations, disease diagnosis aids and plant disease control references. Approximately 75-80 percent of the agents attended.

Field Training

Field training meetings with Agents were also held at different times during the growing season.

Agents liked this training but it was difficult to schedule the meetings at times when diseases and insects would be in the field and Agents' and Specialists' schedules permitted the training.

Newsletters

Newsletters were sent irregularly to County Extension Agents for many years to keep them up to date on current disease developments and control.

A more regular "Kansas Plant Disease Alert" was initiated in 1978 and proved so popular with County Extension Agents that it was continued on a regular basis.

It went out weekly, more or less, on Monday from March to September. Items were short, concise and designed to be used as they were, or localized by agents for newsletters, newspaper columns, radio and TV programs.

In 1988, the plant disease alert was made available on "Sunflower Dispatch" electronic mail so Agents could access it by Monday afternoon.

The Alert was written specifically for Agents' use, but was also mailed to about 100 others who requested it, including Agricultural Extension

Specialists, researchers at experiment stations and experiment fields, consultants, fieldmen and agricultural businesses.

Mass Media

Extension Plant Pathologists had regular radio programs for more than 25 years prior to and including 1988 on the KSU public radio station KSAC (later KKSU).

These were 5-10 minute interviews on the disease situation at the time, with control recommendations. Tapes of these programs were distributed to radio stations over the state who requested them.

Television was also used for more than 25 years. Programs were taped either at cooperating stations in Wichita or in studios on the Kansas State University campus. A few video tapes were produced in the 1980's.

News releases written by Extension Plant Pathology Specialists or by Extension Editors from Extension Communications were distributed to newspapers over the state.

Color Slides

Color film and small 35mm cameras became available in the 1930's. As they improved and became inexpensive, they were especially important for use in illustrating plant diseases.

Macro lenses and through-the-lens metering

in the 1960's enabled Specialists to develop close up pictures of plant disease symptoms.

A library of more than 4,000 slides of plants and plant disease specimens was accumulated during this time. Slide shows became the standard plant disease presentation.

They made color illustrations in many of the bulletins and leaflets produced in the 1980's possible.

The slides were also used in classroom teaching.

Publications

Bulletins and leaflets on plant disease identification and control were basic to the Extension educational program in plant pathology. From the general black and white publications of the 1960's two types of publications evolved.

One was the more expensive type of bulletin, with slick paper, color illustrations, and general control recommendations that would not go out of date for five to ten years.

The other was a black and white leaflet, Ag Fact, or spray schedule, listing specific chemicals for specific crop varieties which were easily updated every year or two.

An increasing number of single disease leaflets were produced to accompany diagnostic replies as time went on.

Major Disease Outbreaks

Wheat Scab

Wheat scab caused by *Fusarium roseum* was severe in 1982. Fear of mycotoxins was fanned by intense media coverage. Deoxynivalenol was detected at moderate levels, especially in northeast Kansas. That was the only mycotoxin reported.

Dutch Elm Disease

Dutch elm disease caused by *Ceratocystes ulmi* was first found in Kansas near Kansas City in 1957. By 1970 it had spread to the Colorado line.

The westward spread was considerably faster in the north than in the south. Cities with heavy concentrations of American elms were hard hit.

Control measures concentrated on early detection and removal of infected trees to slow the disease impact.

Southern Corn Leaf Blight

Southern Corn Leaf Blight caused by *Helminthosporium maydis* was severe in the corn belt in 1970 but was not found in Kansas until 1971.

It occurred when a new race "T" of the pathogen developed, which could attack hybrids that had been produced using Texas male sterile cytoplasm.

Moderate to severe infection occurred in the eastern 1/4 of the state, with trace amounts in 48 counties as far west as Finney County.

Cephalosporium Stripe

Cephalosporium stripe of wheat caused by the fungus *Cephalosporium gramineum* was first identified in Elk County in 1972. By 1973 it was found

in central Kansas from Oklahoma to the Nebraska line.

In 1976 loss from this disease was estimated at 10,000,000 bushels, or 3 percent of the wheat produced in Kansas, and had become a major disease through the continuous wheat area of central Kansas.

The disease was extremely erratic throughout Kansas from 1976 on, and gradually declined to trace amounts by the 1980's. This decline may have been due to a change of wheat varieties which controlled the oversummering of the fungus.

Strawbreaker of Wheat

Strawbreaker of wheat caused by the fungus *Pseudocercospora herpotrichoides* was first detected in Kansas in trace amounts in 1980.

It became severe in some fields in the central one-third of Kansas in 1984, and again in 1985. Losses, of the total production, were estimated at 0.8 percent in 1984 and 1.0 percent in 1985.

Several consecutive springs with extended cool rainy weather permitted strawbreaker of wheat to build up, and dry spring weather in 1987 and 1988 reduced it down to trace levels.

Wheat Streak Mosaic

Wheat streak mosaic caused by the wheat streak mosaic virus was first identified in Kansas in 1949. Losses statewide were estimated at 7 percent.

The worst epidemic on record was in 1959 with a 20 percent loss. Severe losses of 9.4 percent in 1974 and 7.0 percent in 1981 followed.

In 1988 the disease was widespread and the loss was estimated at 13 percent, 42,000,000 bu. or approximately \$160,000,000.

Several replicated performance tests of wheat were affected by the disease. This permitted better documentation of losses, and variety resistance comparisons, than had been possible previously.

The longtime recommendations of control of

volunteer wheat and late planting were not very effective in controlling the disease, even though the most severely affected fields were planted early, and near volunteer wheat.

Wheat Stem Rust

Wheat stem rust caused by *Puccinia graminis f. sp. tritici* was very erratic. Trace amounts occurred nearly every year, but usually developed late enough to cause minimal loss.

Losses had been low for more than 20 years until a severe epidemic occurred in 1986.

Spring weather was warmer than normal and rains were frequent enough across the southern great plains for wheat stem rust to move north in susceptible varieties such as TAM 105, TAM 101 and Chisholm.

These and other susceptible varieties in Kansas; Pioneer 2165, Pioneer 2157, Stallion and Triumph, were devastated.

Luckily these susceptible varieties made up only 14 percent of the state acreage so statewide estimated losses were 4.6 percent.

Personnel in Plant Pathology—1964-88

The number of Extension Plant Pathology staff members was up and down in the 25 years from 1964 through 1988. From 1964 to 1976 there were two Extension Specialists, with between 1.5–2.0 full time equivalents (FTEs) in Extension.

In 1977 and 1978 another State Extension Specialist, a Diagnostician and two Area Extension Specialists (Northwest, Southwest) were added, bringing the FTEs up to 6.0 in 1979.

Both Area Specialists left early in 1980 and were not replaced. From 1981 through 1988 the 2.6 to 3.3 FTE was spread among three State Extension Specialists and the Diagnostician.

Contributing Author. The primary contributing author to this summary of educational programs and activities in Extension Plant Pathology, from 1965 through 1988, was William G. Willis, Extension State Leader, Plant Pathology Program.

A complete list of personnel in Extension Plant Pathology is included in Chapter 6, Extension Personnel, pp. 74-75.