Introduction

Scope

The purpose of this Handbook is to assist users in diagnosing tree diseases and reducing their impact. Included are the most damaging diseases, along with some which, though of minor importance, are the subject of frequent inquiry.

The diseases included are those encountered primarily on trees in windbreak, Christmas tree, recreational, roadside, and landscape plantings in the Great Plains. Diseases of fruit and nut trees are included when they are encountered on such trees that are used in the above types of plantings. Information on nutrient deficiencies is not included, except in the article on chlorosis. There is no extensive coverage of damage by airborne pollutants except that caused by herbicides.

The articles are organized under hardwood diseases and conifer diseases; under each of these categories they are classified as to part of plant affected—foliage, branch and stem, vascular wilt, and root and soilborne.

Most of the diseases are treated separately in the following standard format: Hosts and Distribution, Symptoms and Signs, Disease Cycle, Damage, Control, and Selected References. The emphasis is on disease situations in the Great Plains. Accordingly, no special effort has been made to include the total distribution of pathogens, or to list all of their hosts. Similarly, Symptoms and Signs, and Diseases Cycles are described primarily as observed in the Great Plains.

Diagnosis

In making a diagnosis, the reader is referred first to the host index to see which diseases are listed for the tree host in question. Then the reader should check the write-up on the diseases on that host and also the photographs to see if they conform with the diseases under consideration. A glossary of technical terms is included for a more complete understanding of the articles. English units of measure are used for the most part; metric units are used primarily in descriptions of pathogens.

Control

Information on control (reducing damage) is provided. Where chemicals are suggested or recommended, the reader should determine if the material is currently registered for the intended use. Most of the articles listed in the Selected References were chosen because they will be useful in understanding the recommendations for reducing damage. Information on the disease cycle of some diseases is limited, thus the recommendations for their control are quite general.

Damage due to pathogens can often be reduced by increasing the vigor of trees. Thus, the Control section of several of the articles in this Handbook include recommendations for increasing vigor. Vigor of trees in the Great Plains usually can be increased by supplemental watering. Application of fertilizers sometimes can result in increased tree vigor; however, the wholesale application of fertilizers for increasing tree vigor is not recommended. Use of fertilizers should be based on evidence that tree species of the age in question will respond to fertilizers on the sites involved.

History

There has been a demand for trees in the Great Plains since the early settlers wanted orchards, woodlots, windbreaks, and hedges. Long before the federal Timber Culture Act of 1873, individuals, companies, associations, and local governments had promoted tree planting in the Great Plains. Establishment of dry-land Agricultural Experiment Stations at Mandan, North Dakota; Woodward, Oklahoma; and Cheyenne, Wyoming resulted in increased planting of trees by farmers and ranchers, who cooperated with these stations in tests of tree species, cultural methods, spacing of trees, and the number of rows needed (Droze 1977).

The above work aided the U.S. Department of Agriculture's tree distribution program authorized by the Clarke-McNary Act, which was begun in 1924. This program, under the direction of the Extension Service of the USDA, encouraged tree planting in the Great Plains.

The biggest impetus to tree planting on the Great Plains came, however, when President Franklin D. Roosevelt, by executive order in July 1934, authorized the Shelterbelt Project. This Project, later called the "Prairie States Forestry Project", was operative between 1935 and 1942. It resulted in 223 million trees being planted in 18,600 miles of field windbreaks. Tree planting for protection purposes continued after 1942 under the direction of the USDA Soil Conservation Service.

Tree planting since 1942 has not been as extensive as during the Prairie States Forestry Project, but has been rather steady. The Soil Bank program of the 1960's resulted in an increase in Plains tree planting when considerable land was taken out of crop production and planted to trees.

The increased cost of energy has resulted in an increase in tree planting, not only on farms and ranches but in communities as well. Recently there has been an increase in use of trees in several Plains states for "living snow fence" established along roads.

A number of pest problems were noted in the early plantings in the Great Plains, but there was very little systematic study of tree diseases and insects with the ex-

ception of research on diseases of seedlings (Dix, Pasek, and Peterson 1983).

Research on diseases of tree seedlings in the Great Plains was initiated some 70 years ago by Carl Hartley and colleagues of the U.S. Department of Agriculture. Their research resulted in a good understanding of damping-off disease of pines and other conifers (Hartley 1921) and provided some information on other diseases of conifer seedlings (Hartley, Merrill, and Rhoades 1918).

There was little additional tree disease research in the Great Plains until the period of the Prairie States Forestry Project (1935–1942). With the expansion of existing nurseries and the establishment of many new nurseries to provide trees for that project, a number of disease problems were encountered, particularly on hardwood seedlings. Thus, during this period, Ernest Wright and colleagues of the U.S. Department of Agriculture concentrated their research on disease problems of hardwood seedlings (Wright 1944, 1945), with some work being done on plantation diseases such as Phymatotrichum root rot (Wright and Wells 1948) and Cytospora canker of cottonwood (Wright 1957).

When the Prairie States Forestry Project was terminated in 1942, tree disease research in the Great Plains by the U.S. Department of Agriculture was discontinued. It was not resumed until 1958, when a plant pathologist position was established in the Lincoln Unit of the Rocky Mountain Forest and Range Experiment Station.

Prior to 1958 there had been occasional tree disease studies by Land Grant institutions in the Great Plains. Agricultural extension personnel in the Great Plains accumulated some information on tree diseases, but prior to 1960, they had little time to devote to tree problems. Also in the earlier periods, pest management specialists assigned to USDA Forest Service Regional Offices did not devote much time to tree disease problems in the Great Plains, other than those associated with federal nurseries and National Monuments.

Tree diseases in the Great Plains have received considerable attention since the early 1960's. Land grant institutions in North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma increased their research efforts; more extension plant pathologists were hired; USDA-FS pest management specialists increased their activities in the Plains, and pest management specialists were assigned to several State Forester's offices. Since 1958 there has been a continuous research effort on tree diseases by the Lincoln Unit; nursery diseases received first attention, then later pine and juniper diseases in plantings were emphasized. With the addition of another pathologist to the Lincoln Unit in 1972, research was expanded to include additional research on hardwood diseases and on mycorrhizae.

The increased effort on tree diseases prompted the Forestry Committee of the Great Plains Agricultural Council to establish a Pest Management Task Force to increase communication among workers and to coordinate activities in research, pest management, and extension. This task force sponsored the development of this Handbook.

References

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