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FILE REPORT NOR-Y-38

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WINDBREAK AND SHELTERBELT PROTECTION

(A review presented to the Shelterbelt Committee of the Western Canadian Horticultural Society meeting at Olds, Alberta; February 1970)

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INTRODUCTION

The object of this paper is to provide information on past and current insect and disease investigations which may prove useful in developing and maintaining tree vigor in recent plantings, and in rehabilitating old ineffective farmstead windbreaks and field shelterbelts in the Prairie Provinces. It is also intended as a review of the existing literature pertaining to windbreak and shelterbelt protection, to evaluate to some extent the usefulness of this literature in its present form to the user agency such as the farmer, parks supervisor, agricultural representative, etc., and recommendations with respect to future research needs for improving tree planting programs on the prairies.

HISTORICAL BACKGROUND OF TREE PLANTING

Tree planting has been a common practice on the Canadian Prairies almost from the earliest day of settlement. The first settlers planted them primarily to ameliorate the bleak environment of the windswept prairies and to improve the aesthetic values of their farmsteads. Although many difficulties were experienced with these early plantings, it soon became apparent that trees could be successfully established on the open grassland if they received reasonable care and attention.

Because of these early successes, it soon became apparent also that trees could be used for other farm needs rather than only for their aesthetic values. Consequently, as interest increased the concept of prairie tree culture gradually became diversified to include planting them for: (1) shelters around farmsteads for protection against high winds and drifting snow; and (2) field-row plantings to

reduce evaporation of soil moisture and crop damage by hot, drying winds, and to prevent excessive drifting of light textured soils.

The extent to which tree planting has developed since its early beginning is evidenced today by the relatively large number of windbreaks and shelterbelts that mark the location of many well-established farms on the prairies.

INSECT AND DISEASE PROBLEMS

The primary causes of tree failure throughout the southern sections of the Prairie Provinces are due to the unfavorable or marginal conditions under which they are required to grow. No tree species are particularly well adapted to the arid, open-prairie areas where nature itself has never succeeded in establishing them. Most plantings are subjected to low moisture supply, extreme winter temperature fluctuations, and off site planting; all of which are barely within the limits of tolerance for most of the introduced species. It is not surprising, therefore, that any slight deviation below this average is reflected in unhealthy conditions of various kinds, and additional stresses such as competition from other vegetation, soil compaction from livestock grazing, or persistent insect and disease attacks ultimately result in serious tree injury and mortality.

Numerous insect species occur on the prairies that are destructive to trees. The fall cankerworm, and to a lesser extent, the cecropia moth, have seriously and successively defoliated plantings of Manitoba maple, elm and ash over extensive areas in the three provinces.

Similarly, two closely related species, the spring cankerworm and linden looper, often occur at outbreak levels and have been as destructive in localized areas. Repeated attacks by these insects combined with drought conditions have resulted in serious top-killing and high tree mortality, particularly of Manitoba maple. During periods of grasshopper outbreaks blister beetles commonly strip caragana of its foliage for several consecutive years. Outbreaks of poplar- and willow-leaf beetle have occurred commonly on willow plantings in windbreaks. In recent years, the poplar-bud gall mite has increased in abundance in many parts of the prairie region, and has caused significant damage to hybrid poplar plantings. A leaf-mining beetle (Zeugophora sp.) has also become a serious pest in the same plantings. The pine needle scale, spruce spider mite, yellow-headed spruce sawfly, and balsam-fir sawfly, have caused widespread, severe defoliation and notable mortality of conifers from time to time. Free-living aphids have frequently been very abundant on Manitoba maple, elm, caragana and spruces. Gall-forming aphids also have occurred on spruces, elms, and cottonwood, and have caused considerable damage.

Another large group of insects which has produced serious problems are twig- and stem-borers. They are usually associated with older trees or trees that have been neglected. Many poplars are severely damaged by the poplar borer or by diseases usually associated with the injury by this insect. Local but severe outbreaks of the ash borer and carpenterworms have occurred on green ash, Mountain ash and hybrid poplars, and the boxelder twig-borer is found at varying population levels throughout the range of Manitoba maple on the prairies.

Tree diseases have generally been less conspicuous in prairie plantings, but a few have caused serious injury. Septoria and cytospora cankers are the most common infectious diseases of poplar plantings. The fungi that cause these cankers commonly enter the trees through wounds caused by feeding and egg laying of insects. Nectria canker has also been an important fungal disease of Manchurian elm in localized areas, and occasionally has caused complete mortality of entire rows of trees. Non-infectious diseases such as winter-browning of conifers and chemical injury (2,4-D) of deciduous trees occur almost annually throughout the prairie areas.

LITERATURE REVIEW

The volume of literature on windbreak and shelterbelt plantings in the Great Plains Region of North America is extensive. It covers a wide variety of topics such as: (1) aesthetic values of tree planting; (2) design and lay-outs of windbreaks and shelterbelts; (3) protection of crops and livestock; (4) influence on micro-climate; (5) effects on soil erosion, etc.

Only about 10 per cent of this available literature, however, applies to protection of windbreaks and shelterbelts from the ravages of insect and disease attacks, the effects of competition from encroaching vegetation, damage caused by livestock grazing, or the incidence of injury by wildlife such as rabbits, deer, etc. Also much of the literature is outdated (some extending as far back as the 1900's) and has little relavance to current protection problems. Many of the control recommendations contained in the publications are no longer

valid, especially since through current technology, new chemicals are being developed almost daily. Further, few of the publications relate to specific problems; most referring to windbreak and shelterbelt protection in a more or less general way.

A listing of publications pertaining to protection is contained in Appendix I.

CURRENT STATUS OF WINDBREAKS AND SHELTERBELTS

A variety of trees and shrubs, in pure stands or in different combinations or mixtures, have been used in windbreak and shelterbelt plantings. Caragana has been (and still is) the most extensively used species and has comprised 50 to 60 per cent of the deciduous stock. Poplars, willows, elms, Manitoba maple, green ash and various shrubs have comprised the balance. The most commonly used coniferous species have been white and Colorado spruces. Scots pine, lodgepole pine and other conifers have been planted to a lesser extent.

Available statistics indicate a relatively low distribution of poplars throughout the prairie region, but this is not indicative of the importance of this species. Many cuttings have been rooted by farmers over the years and in actual fact, poplar is the most common species in some areas, particularly in farmstead plantings in Alberta. In addition, several new hybrid poplars, developed during the last 20 years, are now being widely planted.

Since many of the prairie plantings date back 40 or more years, they are in various stages of decadence ranging from good, bad, to indifferent. The only comprehensive study in the Prairie Provinces of

windbreak and shelterbelt conditions was carried out in Alberta in 1963 by Mr. J. Baranyay of the Department of Forestry and Rural Development. The results of Mr. Baranyay's survey showed that insects and pathogens were generally secondary factors in the deterioration of plantings in Alberta. Drought, grass competition, livestock damage, and soil drifting were the most common causes of tree failures. Poor planting and maintenance practices, close spacing, and poor selection of species also were factors that predisposed trees to insect and disease attacks.

A preliminary appraisal of windbreaks and shelterbelts at two locations in Saskatchewan (namely Conquest and Swift Current) carried out in 1969 by the Liaison and Services Section, Department of Fisheries and Forestry, showed similar results. Of some 2,000 miles of single row plantings examined, over 55 per cent were classed as sickly or dead and required immediate replacement. About 53 per cent required weeding; 18 and 2 per cent respectively were in need of releasing and thinning; 40 per cent required pruning; and about 15 per cent needed insect and disease control. (The latter would probably have been significantly higher had the investigations been carried out in late spring or early summer rather than in late September when most current insect activity had ceased). Less than 7 per cent of the total plantings required no treatment.

OLD AND CURRENT RESEARCH PROGRAMS

When government-sponsored tree planting was begun in the Prairie Provinces soon after the turn of the century (1901), it was not envisaged what effect insects and diseases would have on such a program.

However, by the mid-twenties it had become abundantly clear that many problems required attention. Consequently facilities for the study of insects and diseases were gradually assembled and in the early thirties the investigation of windbreak insects was begun at Indian Head, Saskatchewan. Early research studies at this laboratory were mainly concerned with the biology and control of injurious insects. In 1957, the insect investigations unit at Indian Head was consolidated with the Forest Biology Laboratory at Winnipeg, Manitoba, and for the next decade investigations were limited to annual appraisals of insect and disease conditions, and to testing chemicals for control purposes.

Following this period of relative inactivity, the research program of the Forestry Branch, Department of Fisheries and Forestry, was expanded in 1967 to include problems associated with prairie tree growing. Accordingly research projects were initiated to study: (1) the biology and control of the poplar bud-gall mite on hybrid poplars; (2) the effects of canker diseases on poplar plantings; (3) caragana culture (including insect and disease associations) on the Canadian prairies;(5) the effects of competition from encroaching vegetation on tree growth; and (6) the study of defoliants and herbicides used in tree growing.

FUTURE RESEARCH NEEDS

Before considering research programs involving prairie tree culture it may be worthwhile to first evaluate the future of windbreaks and shelterbelts. The number of actual prairie farmsteads is steadily declining, and probably about 50 per cent have been abandoned to date.

It is possible that this trend will continue over the next decade. This suggests that there will be a much lesser demand for trees for windbreak plantings during the next few years. On the other hand, some relocation of farmsteads is taking place, especially as new farm homes and other buildings are being constructed. The modern facilities available to the rural resident today has made this more and more feasible, and it is possible that relocating farmsteads may gain in popularity. If this trend continues, the demand for trees could possibly increase.

Field shelterbelts have gained little popularity in the last 15 years, primarily because of the increased size of farm implements and the need for larger fields. It is also felt that there are alternatives, such as trash-farming, that provide the same or better protection. However, are these alternatives adequate? Will they provide the same protection? Will this type of farming be adequate if similar drought conditions recur? During that period there was little top growth of any kind and even virgin grasslands were subjected to serious soil drifting.

Despite the common belief, however, that the demand is decreasing, it is interesting to note that the total field and roadside plantings increased from 571 miles in 1967 to 829 miles in 1968 (Dr. W. H. Cram, P.F.R.A. Tree Nursery, Indian Head, Saskatchewan, Annual Report), and that 83 per cent of the mileage was planted by Saskatchewan farmers.

If tree planting continues at its present rate, it should be recognized that there are real problems associated with growing them in the grassland areas. Here the successful production of trees depends

primarily upon the suitability of growth sites; the right species and right type of trees; proper care and management practices; and replacement as required to insure they are serving the purpose for which they were planted.

In order to meet these requirements, there appears to be a need for:

(1) updating all literature pertaining to windbreak and shelterbelt protection. The material should be presented in a manner that is attractive and contains only information that is of benefit to the user agency.

(2) research should be continued with respect to the biology and control of the poplar bud-gall mite. This is undoubtedly the major problem concerning the successful establishment of poplar plantings on the prairies at the present time.

(3) disease problems associated with poplars should receive further attention--Septoria and Cytospora cankers are common in some areas and more information is required concerning the development of more disease-resistant poplar species.

(4) chemical control seems to be the only feasible method of protecting windbreaks and shelterbelts from insect and disease damage. Continued testing of new chemicals as they are developed is essential in order to attain maximum results from control programs.

APPENDIX I

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