RESEARCH ON CONTROL OF PHREATOPHYTES

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INTRODUCTION

Phreatophytes are plants that grow where their roots can extend into the water table or the capillary fringe above the water table. In the arid Southwest, there are about 75 species of plants that have been identified as phreatophytes (Robinson, 1958). In New Mexico there are five genera or species considered as problem phreatophytes: willow (Salix spp.), cottonwood (Populus spp.), Russian olive (Elaeangus angustifolia), screw-bean mesquite (Prosopis pubescens), and salt cedar (Tamarix spp.). Growth of these plants in the major river beds of the Southwest has greatly increased in the past twenty years. These plants not only create flood hazards by blocking river channels and present rapid flow of water into reservoirs, but they use excessive amounts of water. Robinson (1963) reports that willows use 2.5 acre-feet of water per surface acre, cottonwood uses about 5.2 to 7.6 acre-feet, and salt cedar from 6.0 to 7.2 acre-feet. Since salt cedar occupies the greatest land area, some 900,000 acres in the Southwest in 1961 (Robinson, 1963), it has received the most attention.

In New Mexico there are 42,500 acres of salt cedar on the Pecos River from Alamagordo Dam to the Texas state line, alone (Thompson, 1957). If a conservative water-use figure of 5 acre-feet per acre were used, savings on the Pecos River, alone, could amount to 212,500 acre-feet yearly if salt cedar were controlled.

Previous Work on Control

Federal and state government agencies have found that willows, Russian olive, cottonwood, and screw-bean mesquite are quite susceptible to phenoxy herbicides but salt cedar has proven very resistant. Top kills are relatively easy to obtain but salt cedar sprouts from the root crown and may regrow as much as 6 feet in one year. Before 1961, less than one man-year was devoted to research on control of phreatophytes by the Agricultural Research Service, U. S. Department of Agriculture, and all other state and federal government agencies combined (Timmons, 1963). In June of 1961, in cooperation with the New Mexico Agricultural Experiment Station, the Crops Research Division of the Agricultural Research Service employed a full-time research scientist at Los Lunas, New Mexico to carry out field and greenhouse studies on control of phreatophytes. A second research scientist was added in May 1962, to conduct physiological and biochemical studies on phreatophytes.

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Studies on Control of Salt Cedar

Since 1961, nearly all the research work on control of phreatophytes has been devoted to salt cedar. Lines of research have centered around four main projects:

1) Field studies on control of individual salt cedar trees, such as are found on ditch banks.

2) Field studies on control of large area stands that exist on the flood plains of rivers.

3) Field studies on the factors affecting the growth of salt cedar and its response to herbicides.

4) Greenhouse studies designed to study factors that cannot be controlled in the field. These studies involve ecological, as well as physiological, problems.

Individual Tree Control Studies

Treatments for control of individual salt cedar plants have consisted of basal spray, granular and wettable-powder herbicides applied to the soil, and of dormant cane spraying. Basal spray treatments, spraying around the base of the stem or trunk from ground level up 18 inches, using 8 pounds acid equivalent of silvex ester per hundred gallons of diesel oil, are very effective (Table 1). Treatments should be made any time from December to March. Granular applications of dicamba at 5 pounds per acre, on an active ingredient basis, will kill a high percentage of salt cedar trees. Applications should be made in early June or before the expected period of summer rains. Wettable powder herbicides sprayed on the soil surface have been ineffective.

Dormant cane treatment consists of spraying all of the dormant stems with diesel oil containing an ester of silvex. This method is particularly suited to thick stands of small, many-stemmed salt cedar. Results of studies initiated this winter will not be known until the summer of 1964 but previous work on other plants has shown much promise.

Foliage Applications of Herbicides

Foliar application consists of spraying the tops of plants while they are in full foliage, using a ground spray rig with a boom, an airplane, or a helicopter. Results of two years of aerial application research in Arizona, New Mexico, and Texas have shown that 4 pounds acid equivalent of silvex ester in a 1:9 oil:water emulsion per acre, or a total of 10 gallons volume per acre, is the most promising treatment. Plots sprayed in mid-May of 1962 near Phoenix, Arizona, showed

TABLE 1. Results* of basal spray treatments on salt cedar on R. Anderson farm, Picacho, New Mexico. (There were ten trees in each treatment.)

Chemical	Rate aehg (lb.)	Carrier	Area Treated	Average Diameter (in.)	Percentage Kill
Silvex ester	8	Oil	Cut stump	8	100
Silvex ester	8	Oil	Basal 2 ft.	8	70
Silvex oil-soluble amine	8	Oil	Cut stump	6	100
Silvex oil-soluble amine	8	Oil	Basal 2 ft.	6	100

* Treatments made in March 1962, and results evaluated in September 1963.

that silvex ester at 4 pounds/A reduced salt cedar stands 92 percent. Although very promising, such high percentages of root kill from aerial applications have not been observed before or since, using the same chemical, rate, and date of application. Research during the past year has shown that the stage of growth of salt cedar is apparently extremely important, so future research along this line should prove fruitful.

Mechanical and/or Chemical Treatments

Studies initiated in 1962 showed that, if plots were mowed or burned off in the winter and allowed to regrow in the spring, then sprayed in early June with 4 pounds ae/A of silvex ester, a 50 percent reduction in the stand of salt cedar could be obtained. If plants were not mowed or burned off, only 20 percent reduction was obtained. Plots mowed in the winter but mowed every two months afterward for two years, during the growing season, stunted the plants but did not kill them. Current research has shown that plots sprayed with 5 pounds ae/A of silvex ester then mowed 2-4 days after spraying, also appeared to reduce the stand at least 50 percent. These treatments are particularly useful where removal of the tops, as well as killing the plants, is desirable.

Ecological Studies

In 1962, studies were initiated to determine if weather factors (temperature, humidity, solar radiation, etc.), soil factors (moisture, salinity, etc.), and others, such as quality of ground water, variations in water table, etc., could be used to predict growth,

storage of carbohydrates, and susceptibility of salt cedar to silvex ester. After two years' work, it appears that growth may be predicted. Neither susceptibility to herbicides or to carbohydate storage appeared to be closely related to any variable measured. Work on their relationship will be continued for another year.

Germination studies with salt cedar seeds using 100, 500, 1,000, 5,000, 10,000, 20,000, and 40,000 ppm sodium, magnesium, potassium and calcium chloride (concentrations were based on the cation) have shown that even at 40,000 ppm, 20 percent of the seeds still germinate compared to 85 percent in distilled water. This indicates that salt cedar plants may be able to establish in highly saline soil conditions. Studies are planned to study seedling establishment under highly saline conditions.

Control Studies on Other Phreatophytes

Field studies initiated during the winter of 1962-63 have shown that Russian olive and screw-bean mesquite are susceptible to 6 pounds aehg of silvex ester when applied on a dormant basal spray. Frill treatments on cottonwood in December (herbicide placed in fresh axe cuts), using a 50:50 mixture of 2,4-D and 2,4,5-T amine, have shown that 3 cc of herbicide placed in 2 cuts per foot of circumference is moderately effective. Additional studies are planned on all three species.

SUMMARY

Previous research on control of salt cedar and other phreatophytes has shown that salt cedar is very resistant to herbicides, while most of the other phreatophytes are susceptible. Salt cedar occupies some 900,000 acres in the Southwest and grows in river channels, creating flood hazards as well as wasting water. Research has shown that scattered stands, such as on ditch banks, can be effectively controlled with a basal spray of 8 pounds aehg of silvex ester in diesel oil. Granular applications of 5 pounds ae/A of dicamba on the soil surface will reduce stands of salt cedar 50 percent or more.

Aerial application of herbicides to salt cedar in Texas, New Mexico, and Arizona has shown that 4 pounds ae/A of silvex ester in a 1:9 oil:water emulsion, or 10 gallons volumes per acre, is the most effective. Erratic results between years and areas indicate that stage of growth must be extremely important for effective control.

Spraying regrowth from mowed or burned salt cedar is nearly three times more effective than spraying undisturbed plants. Mowing 2-4 days after spraying appears to be promising.

Germination studies with salt cedar seed have shown that, even at 40,000 ppm of sodium, calcium, potassium, and magnesium ion (chemicals in chloride form) 20 percent still germinate. Studies on the inter-relations of factors affecting growth, carbohydrate storage, and susceptibility to herbicides of salt cedar are in progress.

Research on control of other phreatophytes has shown that 6 pounds aehg of silvex ester in diesel oil is effective as a dormant basal spray on Russian olive and screw-bean mesquite. Frill treatments on cottonwood, using 3 cc of a mixture (50:50) of 2,4-D and 2,4,5-T amine applied to axe cuts spaced 2 per foot of circumference, was moderately effective. Additional research is planned on control of these species.

REFERENCES

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