Control Program For Alligatorweed In The Southeastern States[1]

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ABSTRACT

Results of laboratory and field experiments have shown that the use of introduced insects alone frequently does not result in a satisfactory reduction of floating alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.) mats, and application of herbicides are necessary. Although the use of insects alone may result in an acceptable level of control over an extended period of time, if the reduction of alligatorweed is the immediate objective, then an integrated approach should be used. The following is a detailed outline for a 3-year period to illustrate the use of an integrated approach for alligatorweed management along the southeastern coast of the United States.

INTRODUCTION

Alligatorweed infestations have thrived and increased in the Southeastern states for nearly a century. The plants grow profusely in cultivated fields, drainage ditches, canals, rivers, lakes, and reservoirs. The first recorded problem was in 1897 when this plant completely filled a creek near Mobile, Alabama (2).

Alligatorweed varies in different locations, growing as a terrestrial, rooted-emersed, or completely free floating plant. When free floating, it forms a dense interwoven mat of stems.

Floating mats create the greatest problems for navigation and drainage (3), and are difficult to control with herbicides. Multiple applications of 2-(2,4,5-trichlorophenoxy)propionic acid (silvex) and (2,4-dichlorophenoxy)-acetic acid (2,4-D) will reduce alligatorweed mats somewhat (4); however, the economics of repeated applications limits the use of this control method.

The flea beetle (*Agasicles hygrophila* Selman and Vogt), thrips (*Amynothrips andersoni* O'Neill), and moth (*Vogtia malloi* Pastrana) have been introduced as biological control agents for alligatorweed and are well established in many areas in the United States (1). The flea beetle, which was introduced first, appears to be the most effective insect.

The effectiveness and spread of the flea beetle has been monitored since its release in 1964. In certain areas, peak flea beetle activity occurs twice annually, and in these areas the flea beetles have demonstrated an ability to severely damage surface vegetation of floating alligatorweed.[2] In Northern Florida, the two peaks of flea beetle activity, aided by plant competition from waterhyacinth (*Eichhornia crassipes* (Mart.) Solms), and other aquatic plants, has reduced the size of alligatorweed infestations. In Georgia and South Carolina, few flea beetles overwinter. Evidence of flea beetle activity is not noticeable until late summer or early fall. This corresponds with the period prior to frost when indigenous species of insects sometimes produce severe damage to surface alligatorweed.

Alligatorweed growth rates are greatest in early spring. New shoots continue to elongate until the plants fall over and become incorporated into the subsurface mat. The timing of this event varies with location, but usually occurs in mid-summer. Effectiveness of alligatorweed control will be determined by the degree of flea beetle feeding activity on the surface vegetation. A constant pressure applied by insect feeding on the plant prevents subsurface build-up of floating mats.

Results from experiments on small plots in the field[3] indicated that combined chemical-biological control is more effective than control obtained with either agent alone. The success of the integrated control program appears to be related to the prevention of plant replacement in subsurface mats.

PROGRAM FOR ALLIGATORWEED MANAGEMENT

The degree of control desired determines the most suitable method for alligatorweed management. The suggested program is based on research conducted in greenhouse and field experiments in Florida, Georgia, and South Carolina. In coastal rivers along the southeastern states floating alligatorweed mats may not be controlled by the program in some cases because there is a mechanical

[1]Studies of the U.S. Department of Agriculture, Agricultural Research Service, Southern Region, Florida-Antilles Area, Fort Lauderdale, Florida in cooperation with the Office of the Chief of Engineers, Washington, D.C.

[2]Weldon, L.W., R.D. Blackburn, and W.C. Durden. 1973. Evaluation of *Agasicles* n. sp. for biological control of alligatorweed, in APCP Technical Report 3, Biological Control of Alligatorweed. U.S. Army Corps of Engineers. Pp. D3-D54.

[3]Blackburn, R.D., and W.C. Durden. 1972. Integration of Biological and Chemical Control of Alligatorweed in Proceedings of Research Planning Conference on Aquatic Plant Control Project. Pp. C3-C17.

movement of mats from canals or impoundments into the river system. If evidence is found of alligatorweed mat discharge, it is advisable to initiate a control program in the areas which provide the source of infesting plant material.

STEPWISE MANAGEMENT CONTROL PROGRAM

A. Program For The First Year

1 *February-March*

(a) Survey alligatorweed infestations in problem areas.

(b) Use topographic maps where treatment is desired.

(c) Determine location and approximate size of floating alligatorweed mats.

2 *April*

(a) Select several mats of alligatorweed to be used in monitoring growth rates of surface vegetation. Mats near a boat landing or road bridge are ideal because of easy accessibility.

(b) Tag 25 plants with 0.5-inch^2 plastic tags. Insert small wire of the type used in aluminum screens with tag attached, through the top of the fourth internode.

(c) Loosely encircle tagged plants with number 14 copper wire and attach to plastic bottle.

(d) Secure bottle by inserting attached wire through a portion of the floating mat. The bottle will be used to locate tags when making observations.

3 *May-June*

(a) Observe tagged plants in the floating alligatorweed mats that were established in April as references for plant growth rate. As stem elongation occurs, the tags will be found in a lower position within the surface vegetation.

(b) Determine flea beetle and other insect feeding damage on leaves and stems.

4 *June-July*

(a) Initiate herbicide application when tagged internodes begin to fall over onto the floating mat. Application of herbicide at this time will kill most of the surface vegetation produced during the current growth season.

(b) Treat floating mats with the dimethylamine formulation of 2,4-D at the rate of 2 lb a.i./acre. The herbicide should be applied evenly over the plant foliage. Spray volume and pressure used when applying the herbicide will be determined by the type of operational equipment and area.

(c) Do not spray areas where flea beetles have congregated in large numbers. The skipped areas and most of the areas missed during herbicidal application will be controlled by insects as they migrate from vegetation that has been treated.

5 *August*

(a) Evaluate the effectiveness of the herbicidal application after 4 to 6 weeks. Regrowth in treated areas may have an average height of 6 inches. If insects were noted prior to spraying, then feeding damage should be evident on regrowth.

(b) If no insect damage is noted on regrowth, then collect and release introduced insects on regrowth. The number released can vary, but should average 100 for each acre treated. Flea beetles and alligatorweed moths should be released because of their mobility and ability to severely damage regrowth of treated alligatorweed mats. Note: Although introduced insects are difficult to find early in the spring season, they are usually abundant near late summer, depending on previous winter temperatures. Insects usually can be collected in previously infested areas.

6 *December*

(a) Observe and evaluate the effectiveness of the management program in the reference areas. Frost should have already occurred in the area and plastic tags placed in the floating mat in April can be easily located. Internodes with tags attached should be dead or in a poor condition.

(b) Record approximate reduction in size of floating mats and the general effectiveness of the program. If tags are found with dead internodes attached this is proof that most of the seasons' surface vegetation has been killed, thus, preventing mat replenishment. The floating mats should be in poor condition, and the alligatorweed infestation should have been reduced a minimum of 50%

B. Program For The Second Year

7 *March*

(a) Survey alligatorweed infestations and determine the percent reduction.

(b) If the reduction is satisfactory, it is suggested that Step 5b be repeated. A small increase in mat size may occur during the spring and summer months.

(c) Should additional reduction in alligatorweed mats be desired, Steps 4b, 4c, 5a, and 5b should be repeated. This should result in a minimum of 80% reduction in alligatorweed by the end of the second year. Tagging of alligatorweed plants the second year will be optional. The approximate time of application should have been established in Year 1. However, if tags were found attached to thriving internodes in December (Step 6a), then initiate the herbicidal application 2 to 3 weeks earlier than the previous year.

8 *September-November*

(a) Examine plant material and determine the population and the effectiveness of the insects.

(b) Record approximate alligatorweed infestation.

C. Program For The Third Year

9 *March*

(a) Repeat Steps 7a and 7b.

(b) If Step 8 was used during the second year and the alligatorweed mats have increased beyond acceptable control, then repeat (4b).

DESCRIPTION OF EVENTS

To illustrate the biological and integrated methods of control, the sequence of events are pictured in Figure 1. Left of center indicates the potential effects of insects when used as biological control agents. Right of center reveals the effects of an integrated approach where herbicide application is followed by insect feeding. The events are summarized as follows:

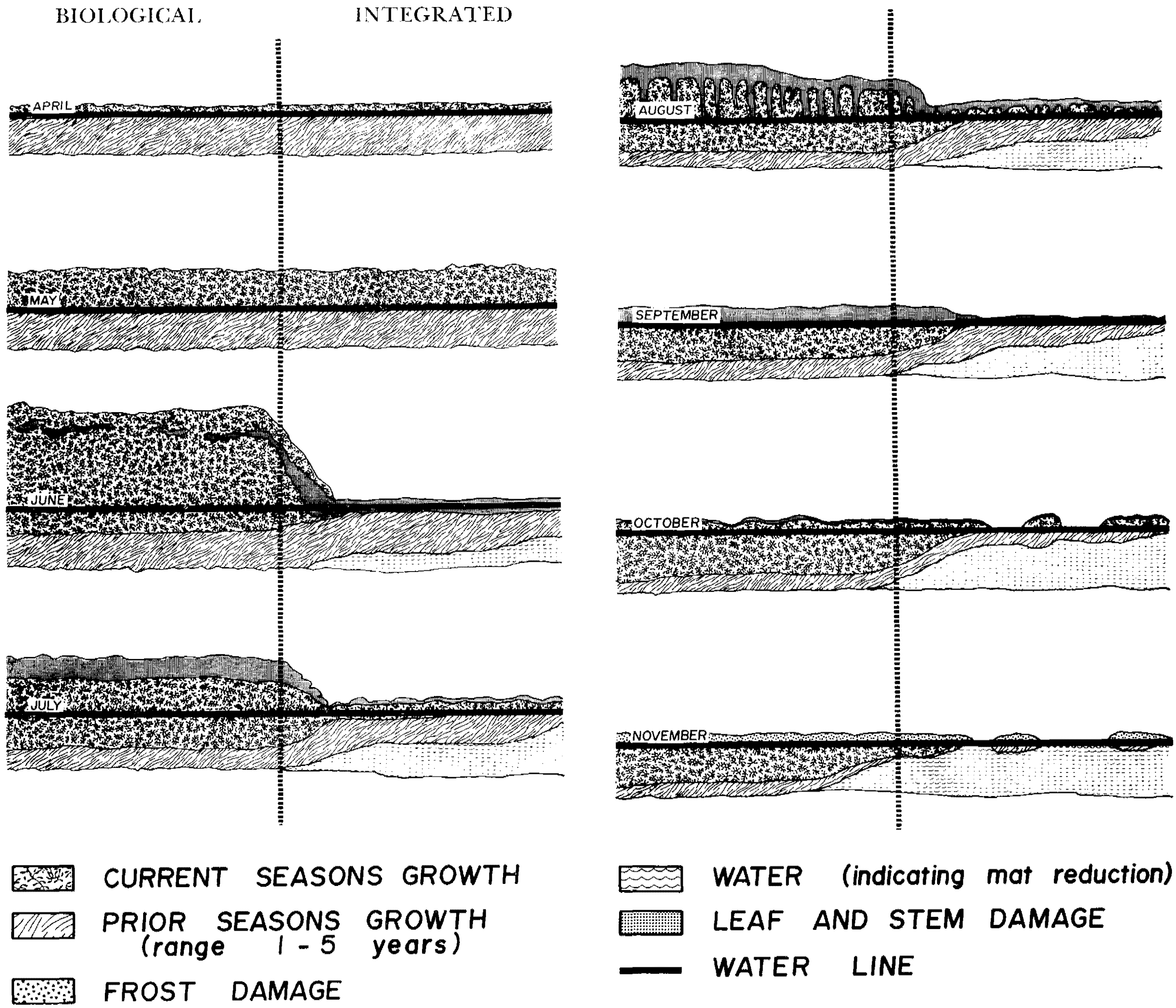

Figure 1. Sequence of events for the biological and integrated control program of alligatorweed mats for April through November.

April—Plant height averages 12 inches and is well established. Growth rate of alligatorweed is increasing rapidly with little or no insect damage to the plant.

May—Plant height has increased to 18 inches. Plant damage by insects is light. The weight of surface vegetation has increased but is not sufficient to press existing growth into the mat.

June—BIOLOGICAL—Insect populations have increased and insect feeding is evident on a few mats along the river. Feeding damage will be more severe near the mat perimeter. Plant height averages 18 inches. Additional surface weight has pressed early growth below the water, thus adding to subsurface mat.

June—INTEGRATED—Areas were monitored and surface vegetation sprayed with herbicide prior to plant fallover. This eliminated the surface growth that would normally have been added to the subsurface mat.

July—BIOLOGICAL—Growth rates have decreased, but stems continue to elongate and height of plants may average 20 inches. Close examination reveals stems of current seasons growth well below the water line. Insect damage is found on most leaves, but damage usually ranges from light to moderate and does not affect the growth substantially.

July—INTEGRATED—Areas which have been treated 1 month previously will have regrowth averaging 2 to 4 inches, and if insects are present they will have damaged the leaves and stems. The leaves of regrowth will be small and therefore more susceptible to insect damage.

August—BIOLOGICAL—Height of plants will have decreased because of added surface weight and plant fallover. Attack by domestic insects along with introduced flea beetles and moths will have damaged most of the leaves and stems. Damage by insects will be more predominant near the mat perimeter.

August—INTEGRATED—The effect of insect feeding on regrowth from previously treated mats will be severe. Plant height will vary because some alligatorweed stems will have shriveled and died.

September—BIOLOGICAL—Fall peak of insect activity will have reduced surface vegetation. Internodes will be void of leaves and dead. Plants of current seasons growth which have been pressed below the water line will not be affected by insect damage.

September—INTEGRATED—Regrowth will be reduced back to the water line by insects. The internodes below the water will be yellow and brittle because they will represent growth produced the previous season. Floating mats will be thin due to the combined pressures of chemical application and insect feeding damage.

October — BIOLOGICAL — Regrowth from attacked plants will be sparse. Insect populations will have decreased because the adults have left in search of alligatorweed with less damage. Insects that have remained will prevent mat replenishment.

October—INTEGRATED—Regrowth will be sparse. Internodes near the surface will be limp and void of chlorophyll. Deterioration of the mat will have advanced to the point that some mats will break free and float downstream. Mat fragments caught in the bend of the river will be rolled and inverted because of water pressure.

November—BIOLOGICAL—Frost will have killed surface vegetation. New leaves will be produced by stems pressed into the mat during the growing season. However, chilling temperatures will prevent any substantial growth. Insects may be found near the shore or under the cover of dried vegetation or floating on the surface. When first examined the insects will appear dead; but, when placed in the sun they will begin to revive.

November—INTEGRATED—Mats will be reduced by the combined pressures of herbicides and insect feeding damage. Large mats will have holes where portions of the mat have dropped out because of deterioration of internodes. Most of the alligatorweed infestation will be marginal.

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Towards Integrated Control Of Alligatorweed

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ABSTRACT

Under sponsorship of the U. S. Army Corps of Engineers a multifaceted research program is being conducted on major aquatic weed species in the United States. Alligatorweed [*Alternanthera philoxeroides* (Mart.) Griseb.] was an early target of this research due to the difficulty of controlling the weed chemically. Research in Louisiana, where alligatorweed is a problem in rice (*Oryza sativa L.*) growing areas and in canals and lakes, resulted in data on the use of four phenoxy herbicides. Included with this is information on the release of the alligatorweed flea beetle (*Agasicles hygrophila* Selman & Vogt) in the state and its subsequent impact on alligatorweed at several sites.

INTRODUCTION

Virtually every type of water transportation in the Nation's larger inland waterways is affected by dense growths of aquatic plants. Included are small pleasure craft, commercial fishing fleets, petroleum industry vessels, and modern barge tows which move hundreds of important commodities. These plants also increase the chance of local flooding by impeding natural runoff and are detrimental to fish and wildlife in bayous, swamps, and marsh areas adjacent to navigable waterways. They affect agri-

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