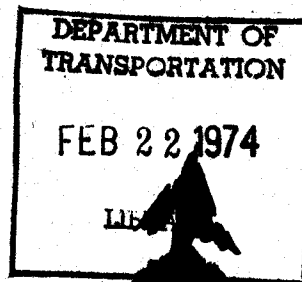


Selection of Woody Plants to be Used for Highway Landscaping and Erosion Control

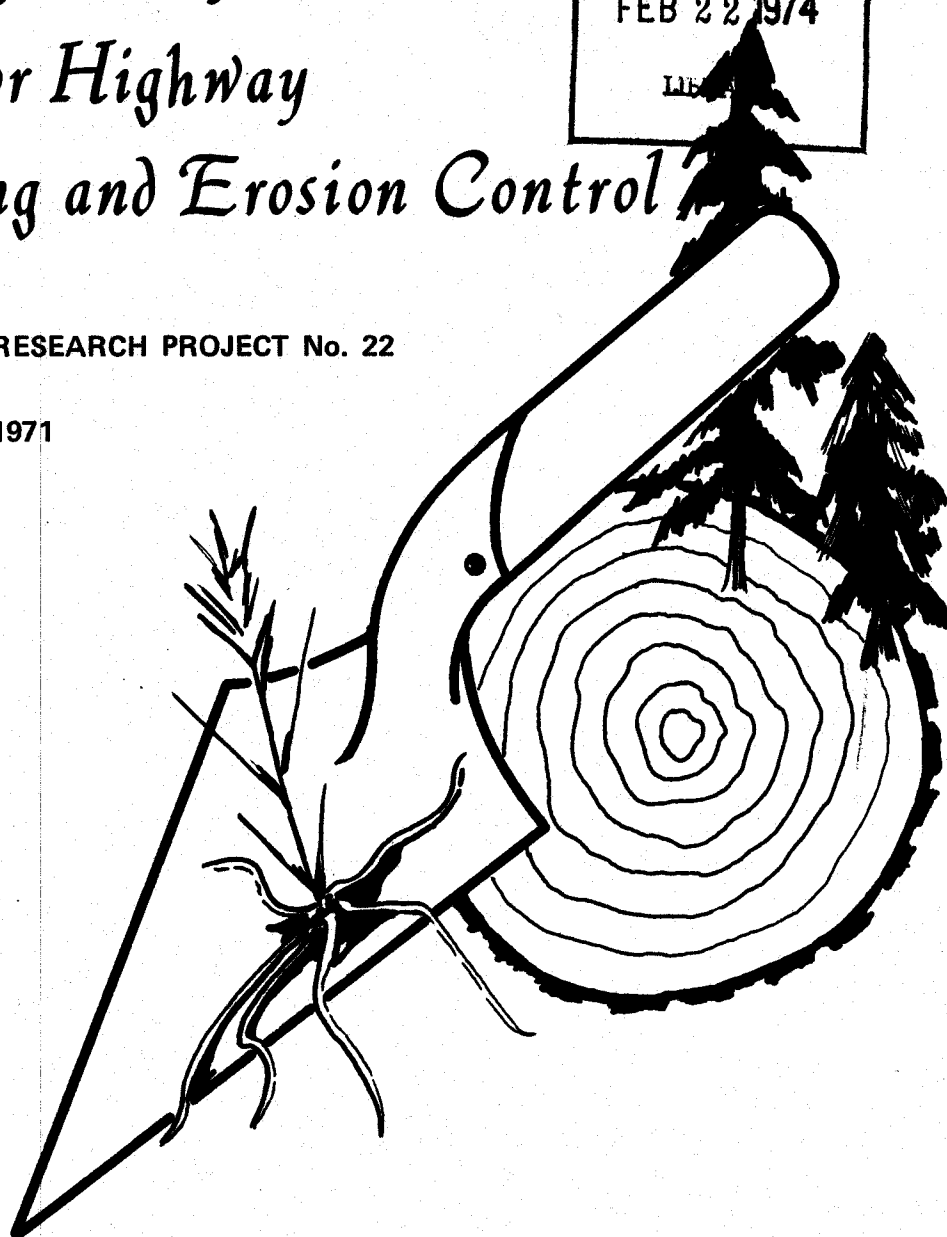


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HIGHWAY RESEARCH PROJECT No. 22

Final Report

August 31, 1971



by

A. W. Tennille, Agronomist

Dr. A. J. Langlois, Horticulturist

ARKANSAS STATE UNIVERSITY
Division of Plant Sciences

for the
ARKANSAS STATE HIGHWAY DEPARTMENT

in cooperation with the
U.S. DEPARTMENT OF TRANSPORTATION
Federal Highway Administration

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16. Abstract The types of woody plants best adapted to erosion control and landscaping have been determined. An index of existing plants on Arkansas highway rights-of-way was compiled. Native plants which may be used effectively have been determined. A guide for the establishment and maintenance practices has been developed according to the various geographical areas and soil types in the state. Different methods of propagation were studied. Plant arrangements were designed for checking erosion, screens, beautification and other safety factors. A guide for care and transplanting of plant material has been included as an appendix to the report.					
17. Key Words Plants, soil, fertilizer, planting, native vegetation, erosion control, headlight deterrants, lime.				18. Distribution Statement	
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NOTE - Type no more than 72 characters (Elite) per line, including all spaces and punctuation. Use all **CAPS**

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Card	Study Objectives	
G	INDEX NATIVE WOODY PLANTS; DETERMINE FERTILITY LEVELS OF NATURAL	
H	GROWTH; COMPARE ADAPTABILITY OF NATIVE TO CULTIVATED PLANTS;	
I	STUDY ECONOMIC ASPECTS OF PROPAGATION ESTABLISHMENT & MAINTENCE;	
J	AND RECOMMEND PRESERVATION OF NATURAL LANDSCAPE FEATURES.	

8	9	80
Card	Study Findings	
M	RECOMMENDS PLANT TYPES USEABLE; FERTILIZER RATES LIME	
N	REQUIREMENTS; TRANSPLANTING AND CARE OF PLANTS; SOIL PREPARATION.	
O	PRUNING & WEED CONTROL	
P		
Q		
R		

8	9	80
Card	Implementation - How Done	
V	ONLY LIMITED IMPLEMENTATION AS PROJECT PROGRESSED	
W		
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Indicate who to contact for any followup information.

_____ Name

_____ Name

ACKNOWLEDGEMENTS

The personnel of this research project wish to thank the personnel of the Arkansas State Highway Department and the Federal Highway Administration for their interest and cooperation in this project. This research was made possible by the financial assistance of these two agencies.

The opinion, findings and conclusions expressed in this report are those of the authors and not those of the Arkansas State Highway Department or the Federal Highway Administration.

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FORWARD

The following is the final report for Research Project No. 22, Selection of Woody Plants to be used for Highway Landscaping and Erosion Control. Results of individual experiments are reported by experiment number. The first number represents the individual experiment number and the second number represents the planting year in which the experiment was established.

Survey data is labeled by use of the soil association areas within Arkansas.

Each of these experiments has been reported in greater detail in the annual reports of this project. If more details about individual experiments are desired, the annual report for the year in which the experiment was established should be consulted.

This project was initiated in June, 1966. The following funds were expended by the University during this time.

Total Funds Expended on HRC - 22

(1) Salaries and Wages	\$53,680.06
(2) Materials, Supplies, ect.	4,778.07
(3) Travel	4,869.57
(4) Indirect Costs	<u>8,052.02</u>
Total	\$71,379.72

ABSTRACT

Experiments in this project during the period of 1966-1971 are discussed in this report. Laboratory analysis were conducted in the soils laboratory of Arkansas State University at Jonesboro. Survey and field experiments were conducted on or near highway rights-of-way throughout the state.

Laboratory analysis of the various soil samples taken throughout the state show that most all areas of the state are low in lime and fertility status. Nearly all areas will require some lime in order for best growth. Phosphorus and nitrogen content of soils were generally low throughout the State while the potassium content of the soils was medium.

Fertilizer amounts needed for each plant will vary according to size and type of growth habit. However, from the results of the laboratory analysis of soil samples it was determined that a 1-2-1 ratio of fertilizer would be best for all soil areas of the state.

During the first year of the research a plant survey was conducted. From these surveys it was found that most of the native vegetation along Arkansas highways consist of trees with very few vining or clinging types of plant material. The results obtained from this survey indicate that very few native plants can be adapted for use along highway right-of-way for soil stabilization purposes.

Field experiments were conducted throughout the state using many types of vining and low growing shrubs. From this it was found that bare root material did not survive the dry conditions readily. Best results were obtained by using balled and burlapped or container grown plant material.

From field experiments it was determined that the best erosion control of steep rights-of-way could be accomplished by use of certain of the junipers along with certain other creeping shrubs.

Fertilization of the experimental plots were conducted yearly. From this it was found that a complete fertilizer applied once per year was sufficient to maintain good growth of the plant material. Water seemed to be the most limiting factor of survival and growth of the plant material, whether it be bare root, container grown or balled and burlapped.

The best material found in the experimental plantings using bare root material was loblolly pine seedling. During the latter year of the experiment scotch broom began to show promise as a soil stabilizing plant material.

RECOMMENDATIONS

These recommendations are based upon experimental findings during the duration of this project. It is recognized that plant growth is slow and will require longer time periods for complete evaluation; certain trends in shorter periods can be established and recommendations can be made.

Many researchers do not realize that the practical application of their findings will at times be very difficult. Economics will play a great part in the implementation of the findings of this project. It is suggested that personnel of the Highway Department, responsible for implementing these practices, study these suggestions and put into practice those that are economical in their area.

A guide for the planting and care of trees and shrubs on highway rights-of-way as well as general fertilizer and lime recommendations is in the appendix of this report. Since these are a part of this report, no recommendations on how to plant or amount, type and rate of fertilizer will be given here. Only the type and kind of planting materials will be recommended in this section of the report.

Bare Root Plant Material:

Several species of bare root material were tried through the time of this project. The plant species which appears to give the best results as to survival is loblolly pine. Other bare root species which shows some adaption is Rose-acasia (Robina Hispida), American bittersweet

(clasture scandenel), and Scotch broom (cystisur scoparus).

Container grown and balled and burlapped plant material.

Species of container grown and balled and burlapped utilized in this experiment were numerous. Of the species utilized all of the junipers were very well adapted except two; those which show good promise for erosion control are: Pjitzer; Blue Pjitzer; Shore; Andorra; a Variegated horizontal; a prostrate Virginiana; and a prosptate horizontal. One other balled and burlapped plant specie which shows good adaptation for erosion control of hillsides was Santolina (Santolina Chamaecyparissur).

Plant material used for Headlight Deterrants.

Several species of upright growing evergreen shrubs were evaluated for use as headlight deterrants. The best plant species adapted for this function seems to be the Bronze Elaeagnus. The ligustrums, both the black wax leaf and wax leaf varieties show promise for use as headlight deterrant planting material.

SECTION I
SURVEY OF NATIVE PLANT MATERIAL
and
FERTILITY STATUS

Survey Data-Plant Material

Introduction:

During the summer and winter of 1966 and the spring of 1967, representative sites along the highway rights-of-way were selected for survey work. These sites were in the various soil association regions of Arkansas.

Objective:

The objective of this survey was to determine the amounts and size of the various native species of plants growing adjacent to the highway right-of-way and also those growing on the disturbed portion.

Method:

Survey sites of the various soil association areas within the state were selected. (Soil association areas were described in the Annual report dated April 1, 1967). These selections were based on an undisturbed area being adjacent to the highway. Four random areas of 900 square feet each were used as the basis of the plant material count.

Results and Discussion:

Detailed tables can be found in the Annual Report dated April 1, 1967 and April 1, 1968. For this report the survey sites have been averaged to show only the type of plant material found in each soil association area.

Table 1 shows that the largest amount of plant material found on the undisturbed areas are trees of a deciduous nature.

In some areas vining material such as the grape plant were found. Also some blueberry plants were growing in these undisturbed areas.

From Table 2 the major plant species found in the disturbed areas are upright deciduous trees. However, in previous reports it can be found that nearly all of the plants found in these areas were less than 2 feet tall. This was probably due to the continued mowing of the highway right-of-way during this time.

Table 1: The Occurrence of Various Species Found in Undisturbed Areas for the Different Soil Association Regions of Arkansas.

SOIL ASSOCIATION AREA

Species	Loessial Hills	Bottomland	Loessial Terraces	Ozark Mtns.	Ozark Highlands	Ark. Valley	Boston Mtns.	Ouachita Mtns	Coastal Plains
Red Maple	X	X	X				X	X	X
Devils Walking Stick	X								
River Birch		X							
Ironwood		X							
Bitternut Hickory			X						
Mockernut Hickory	X		X		X	X	X	X	X
Redbud	X							X	
Dogwood	X				X	X	X	X	X
Persimmon		X	X		X				
Possumhaw	X	X	X						
Ink Berry	X								
Red Cedar					X	X		X	X
Sweet Gum		X	X					X	X

Table 1 Cont. Soil Association Area

Species	Loessial Hills	Bottomland	Loessial Terraces	Ozark Mtns.	Ozark Highlands	Ark. Valley	Boston Mtns.	Ouachita Mtns	Coastal Plains
Apple									X
Mulberry		X							X
Black Gum		X					X	X	X
Shortleaf Pine					X	X	X	X	X
Water Elm		X	X						
Sycamore								X	
Plum		X							
Pear							X		
White Oak	X		X	X	X	X	X	X	X
Red Oak					X			X	X
Shingle Oak					X				
Blackjack Oak	X				X	X		X	
Chinquapin Oak					X				
Water Oak		X							
Pin Oak		X	X				X	X	

Table 1 Cont. Soil Association Area

Species	Loessial Hills	Bottomland	Loessial Terraces	Ozark Mtns.	Ozark Highlands	Ark. Valley	Boston Mtns.	Ouachita Mtns.	Coastal Plains
Willow Oak	X	X	X						X
Post Oak	X		X	X	X	X	X	X	X
Black Oak				X					
Rose	X	X			X				
Buckthorn		X							

Table 1 Cont.

Soil Association Areas

Species	Loessial Hills	Bottomland	Loessial Terrace	Ozark Mtns.	Ozark Highlands	Ark. Valley	Boston Mtns.	Ouachita Mtns.	Coastal Plains
Staghorn Sumac	X	X			X	X	X	X	X
Smooth Sumac				X					X
Sassafras	X			X	X				
Cypress		X							
Winged Elm	X		X		X		X		X
American Elm		X			X			X	
Slippery Elm	X	X	X		X	X		X	
Blueberry	X		X	X	X	X	X	X	X
Viburnum			X						
Muscadinegrape	X	X	X	X	X	X	X	X	
Black Cherry					X				

Table 2: The occurrence of various species found in disturbed areas for the different soil association regions of Arkansas.

Species	Soil Association Areas									
	Loessial Hills	Bottomland	Loessial Terraces	Ozark Mtns.	Ozark Highlands	Ark. Valley	Boston Mtns.	Ouachita Mtns.	Coastal Plains	
Red Maple			X							
River Birch			X							
Mockernut Hickory						X		X		
Persimmon					X	X			X	
Sweet Gum			X					X	X	
Black Gum	X									
Shortleaf Pine	X							X	X	
Sycamore									X	
Blackjack Oak		X			X			X		
Post Oak					X	X		X	X	
Staghorn Sumac		X			X	X		X	X	
Slippery Elm		X	X			X		X		
Blueberry					X					
Muscadine Grape					X					

Survey Data - Fertility Status

Introduction:

At each survey site during the collection of the plant material data, soil samples were obtained. From these various sample sites throughout the State, routine soil analysis were made on the samples.

Objective:

The major objective in this phase of the experiment was to determine something about the fertility level of the various soil associations within Arkansas.

Method:

Soil samples were obtained from each area utilized for plant material counts. Samples were gathered in a random manner throughout each 900 square feet area. The samples were then allowed to air dry in the laboratory. Chemical analysis to determine the pH; pounds per acre of potassium, phosphorus, and calcium; and percent organic matter were determined, in accordance with procedures as outlined in Bulletin No. 102 of the Southern Cooperative Series (Procedures used by State).

Results and Discussion:

The detailed data for all chemical analysis of the soil samples can be found in the annual reports dated April 1, 1967 and April 1, 1968. Only the average for each analysis will be utilized for this report.

From soil test data it was found that the pH values for all areas are low. Organic matter content, which is an indication of nitrogen, was found to be medium along with the available potassium. Phosphorus was found to be low in nearly all areas.

The soil test data indicates that the best fertilizer ratio to use in all areas in a 1-2-1 ratio such as 10-20-10.

Table 3: The average analysis of surface and sub-surface soil samples from undisturbed areas taken within the various soil associations.

Soil Association	pH	Potassium lbs/a	Phosphorus lbs/a	Calcium lbs/a	Organic Matter %
<u>Loessial Hills</u>	4.51	107.5	10.0	277.0	2.48
<u>Bottomland</u>	4.81	88.0	68.5	1067.0	2.00
<u>Loessial Terraces</u>	4.61	71.5	19.5	423.0	2.57
<u>Ozark Mountains</u>	5.81	163.5	13.5	1209.5	2.87
<u>Ozark Highlands</u>	4.95	73.0	18.5	175.5	2.76
<u>Arkansas Valley</u>	5.13	131.5	14.5	599.0	2.83
<u>Boston Mountains</u>	5.43	142.0	12.0	887.5	4.23
<u>Ouachita Mountains</u>	5.05	139.0	33.0	990.0	4.09
<u>Coastal Plains</u>	5.46	106.0	15.5	202.5	1.66

Table 4: The average analysis of surface and subsurface soil samples from disturbed areas within the various soil associations.

Soil Association	pH	Potassium lbs/a	Phosphorus lbs/a	Calcium lbs/a	Organic Matter %
Loessial Hills	4.80	92.5	7.0	571.5	2.21
Bottomlands	5.08	73.0	41.0	1238.5	1.40
Loessial Terrace	5.42	74.5	22.0	858.5	1.31
Ozark Mountains	6.18	220.5	13.0	1553.5	2.63
Ozark Highlands	4.70	71.0	25.5	118.5	0.67
Arkansas Valley	4.79	124.5	13.5	213.00	1.04
Boston Mountains	4.73	113.5	19.0	367.5	0.83
Ouachita Mountains	5.01	129.5	22.5	670.0	1.61
Coastal Plains	5.29	123.5	16.5	494.5	1.30

SECTION II
Description and Evaluation
of
Experimental Plantings Concerning
The Establishment of Plants
On Arkansas Highway Rights-Of-Way

DESCRIPTION AND EVALUATION
OF
1967 EXPERIMENTAL PLANTINGS

EXPERIMENT NO. 1-67

Previously discontinued due to high mortality rate of plants.

EXPERIMENT NO. 2-67

Evaluation of Bronze Elaeagnus for use as Headlight Deterrants.

Planting Date: February 24, 1967

Location: Mississippi County; at interchange of I 55 and Highway 140.

Thirty plants of Bronze Elaeagnus (*Elaeagnus pungens* 'Fruitlandi') were planted 6 feet apart in a straight line 18 feet from the edge of the pavement opposite the north and south entrances of Highway 140 onto I 55.

From the time that they were planted to Spring, 1970, these plants made excellent growth. In the spring of 1970, when this planting was evaluated, a number of the plants showed symptoms of fertilizer excess. It was assumed that highway maintenance personnel had so fertilized them. In July of 1971, only 18 of the plants were alive, out those remaining are making good growth.

In spite of the problems with this particular planting, this species continues to demonstrate that it is a very useful plant for headlight deterrants and beautification.

EXPERIMENT NO. 3-67 DISCONTINUED

EXPERIMENT NO. 4-67 DISCONTINUED

EXPERIMENT 5-67

Evaluation of Cherry Laurel and Bronze Elaeagnus for use as Headlight Deterrants.

Planting Date: April 21, 1967

Location: St. Francis County; at interchange of I 40 and Highway 1.

At the west entrance of Highway 1 onto I 40, 19 Cherry Laurel (*Prunus caroliniana*) were planted in the median in a straight line, 10 feet apart and 18 feet from the pavement edge. At the east entrance of Highway 1 onto I 40, 21 Bronze Elaeagnus (*Elaeagnus pungens* 'Fruitlandi') were planted 6 feet apart in the median in a straight line, 18 feet from the pavement edge.

The Elaeagnus were slow in getting established, apparently due to a very compact soil condition. They have, however, during the past year, made a large amount of growth. The average plant is approximately four feet tall and they have increased in width sufficiently to cause the disappearance of open space between plants. A few of the plants are missing, apparent victims of vehicles.

The Cherry Laurel on the west entrance have not performed very well. Only 8 of 19 are living after four seasons, and the surviving plants are making very little growth. This particular group of Cherry Laurel are the poorest of several plantings. This is probably due to a combination of factors including poor soil, compact soil, and lack of water.

EXPERIMENT NO. 6-67

Evaluation of Cherry Laurel, Wax Leaf Ligustrum and Black Wax Ligustrum as Headlight Deterrants.