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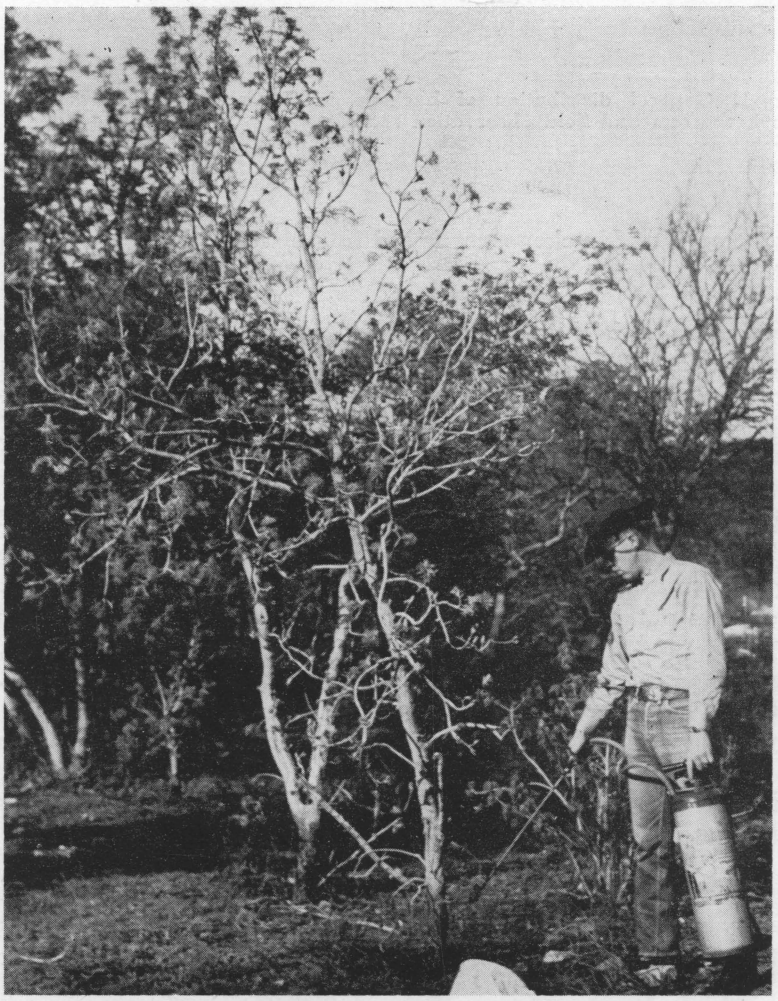
Buckeye--

Its Distribution and Control



Applying spray to the lower 12 to 18 inches of the stem of a buckeye tree in early leaf.

TEXAS AGRICULTURAL EXPERIMENT STATION

R. D. LEWIS, DIRECTOR, COLLEGE STATION, TEXAS

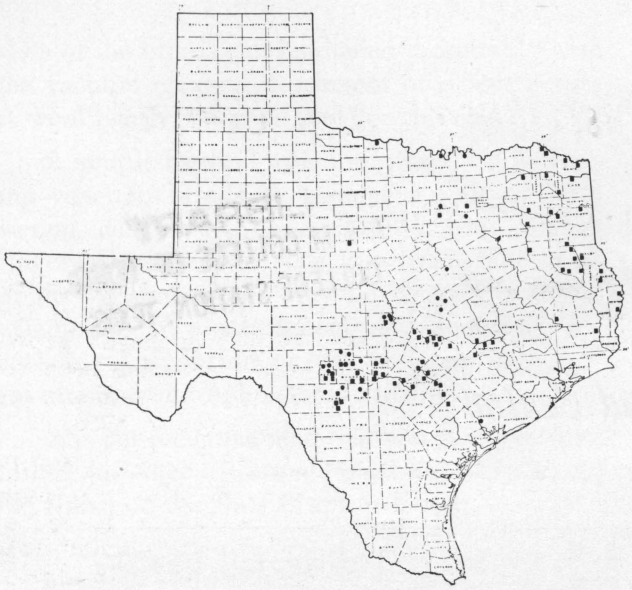


Figure 1. General distribution of buckeye in Texas, based on herbarium and field observation records.

SUMMARY

Three species of buckeye are found in the wooded areas of Central and East Texas. All are poisonous to livestock.

Experiments with chemical control of Texas buckeye were carried out in Kerr county in 1953, 1954 and 1955. Hormone herbicides were applied as basal and foliage sprays and by soil injection at intervals from February until June.

Seedlings, young plants, brushy plants, second growth from cut stumps and trees up to 40 feet in height and 12 inches in diameter were in the experimental area. Seedlings and young plants were killed readily when sprayed with the concentrations used for basal treatments. Concentrations used as foliage sprays also obtained good kill on young growth. The highest and most consistent tree kills were obtained with basal sprays on notched or frilled stems with concentrations of 4 percent in March, April and May treatments. Foliage sprays obtained a low stem kill and most shrubby growth thus treated produced root sprouts.

The degree of sprouting was high on plants top-killed with 2,4-D ester, 2,4-D and 2,4,5-T esters mixed, and 2,4,5-T amine as basal sprays. The highest total plant kill, as judged by a low percentage of basal sprouts, was obtained with the ester formulations of 2,4,5-T and MCPA.

A good kill was obtained by a single series of basal treatments with 2,4,5-T propionic at 4 and 6 percent concentrations.

Results obtained with the soil injector on one series of plots were inconclusive. In this method for buckeye control, more attention will be given to the nature and size of plants, period of plant growth and formulations and concentrations before recommendations can be made.

Good control can be obtained by basal sprays of 4 percent 2,4,5-T and MCPA esters in diesel oil on notched or frilled buckeye stems after plants are in good leaf and before defoliation starts.

Buckeye — Its Distribution and Control

OMER E. SPERRY and FLOYD W. POND*

BUCKEYES, species of the genus *Aesculus,* have been known to be poisonous to livestock, and occasionally humans, for many years. The young leaves, sprouts, flowers and seed apparently are more toxic than the mature leaves. The new growth of buckeye is frequently consumed by grazing animals in large quantities since it puts out leaves and flowers earlier than most of the associated species of woody plants. Herbaceous plants usually are not abundant in the wooded areas supporting buckeye, and animals are naturally attracted to the new buckeye growth when it is accessible. This is especially true in heavily grazed areas and during spring seasons of low rainfall. Although not all individual animals are poisoned by buckeye, cattle, sheep, goats, horses and swine are reported as susceptible to the poisoning.

Three species and several varieties of buckeye occur in Texas. Three or four additional species and numerous varieties are recorded for North America. The Texas species are: Texas buckeye, *Aesculus arguta,* a yellow-flowered form; the red buckeye, *A. pavia;* and yellow buckeye, *A. octandra* (Cory & Parks 1937, Little 1953). Distribution of buckeye in Texas is shown in Figure 1. This map includes all species in Texas and is based on both field and herbarium records.

Buckeyes are shrubs or trees with opposite petioled digitate leaves. The flowers are conspicuous and in terminal panicles (Figure 2). The fruit is a leathery capsule, normally 3-celled with a possibility of 2 large smooth seed in each cell. Frequently only one or two cells will develop with only one seed in each cell. Texas buckeye, also called Western buckeye (Figures 3 and 4), is commonly a shrub, but if not grazed or damaged when young may develop into a good size tree. The larger trees in the study area had bole diameters of 8 to 12 inches and were up to 40 feet in height.

The exact substances which cause the poisoning of animals are somewhat questionable, but both glucosides and alkaloids contained in the plant have been considered the toxic principle. The fruits and new growth are considered the most toxic parts of the plant. Massey and Hatch (1943) reported that buckeyes contained a bitter glucoside. Tehon *et al.* (1946) indicated the poisonous principle as a narcotic alkaloid.

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Most animal losses in Texas have been reported from the section of the State known as the Hill Country where Texas buckeye grows abundantly. Both cattle and hogs have been reported poisoned. Chemical control studies were started in Kerr county in this area in 1953.

Data of the U. S. Weather Bureau at Kerrville, about 10 miles east of the experimental area, show that rainfall during 1952 was about 10 inches above average (Table 1). Moisture conditions were near average during the 1953 treatment periods, but declined during the winter preceding the 1954 treatments. Total rainfall for 1953 was about 4 inches below average, for 1954 about 14 inches below average and was about normal for 1955.

Initial survey for buckeye control measures in five counties of the Hill Country showed that ranchmen with buckeye had tried several methods of control. Trees and brushy forms cut at the ground level gave immediate relief but sprouts in succeeding years created a more serious hazard than before cutting. Plants sprayed with various hormone-type herbicides were defoliated but little top kill was obtained. A fair kill was obtained by one operator by spraying dormant plants with a herbicide in an oil solution, but no systematic records were available.

METHODS

The use of chemicals in the control of poisonous and weedy species has received widespread attention. Results of spraying poisonous range plants in Texas are included in *Texas Range Plants Poisonous to Livestock* by Sperry *et al.* (1955). The control of noxious brush on Texas ranges was covered by Young *et al.* (1951). Meth-

TABLE 1. RAINFALL DATA FOR KERRVILLE FROM RECORDS OF THE U. S. WEATHER BUREAU, INCHES

Months	1952	1953	1954	1955	1956
January	.28	.10	.68	2.20	.71
February	1.65	1.80	.16	1.93	1.61
March	3.26	3.22	.64	.24	.20
April	7.02	1.37	2.68	.45	1.73
May	6.25	1.20	3.03	5.71	1.20
June	1.60	.05	1.85	5.03	.45
July	2.25	2.50	.20	7.03	.88
August	.05	2.12	.35	1.36	1.45
September	10.13	4.86	.78	3.84	
October	.00	7.29	3.08	1.88	
November	2.71	.96	.96	.78	
December	5.71	.89	2.40	1.23	
Total	40.91	26.36	16.81	31.68	

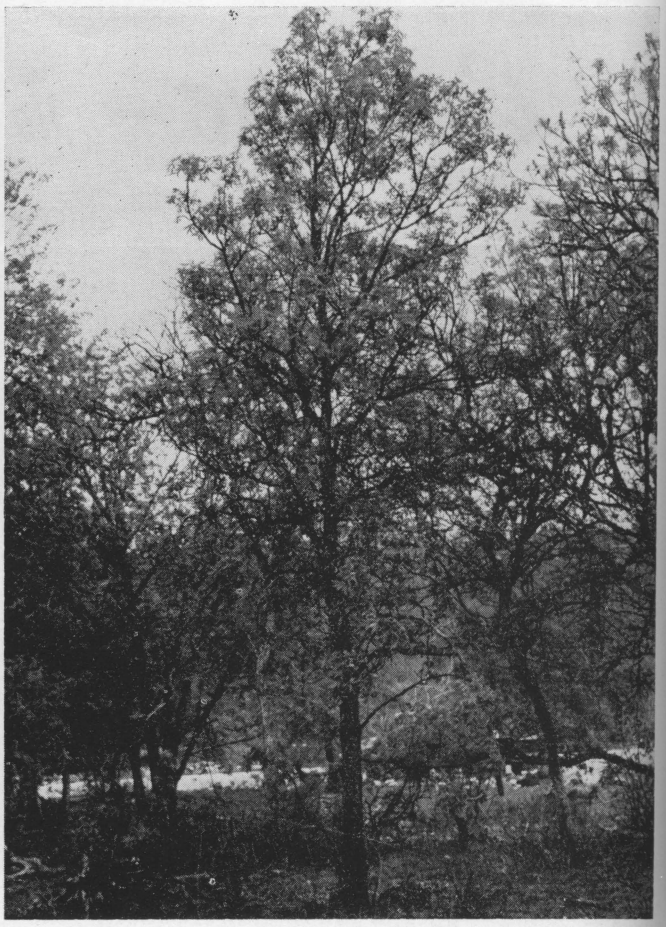

Figure 2. Left—A flowering branch of Texas buckeye. Figure 3. Right—A well-developed tree of Texas buckeye on an overflow area in Kerr county.

ods of basal and cut surface treatments are presented by McCully and McCullough (1953) in their study of oak control. The use of herbicides for controlling brush plants by the soil injection method (McCully 1956) included several species and, where adaptive, is a conservative method of brush control. Derscheid and Ferrell (1955), in recommended treatments for woody plants in South Dakota, indicated the susceptibility of red buckeye to spring and summer foliage spraying with a mixture of 2,4,-D and 2,4,5-T esters at the rate of 0.5 percent.

Seedlings, young plants, brushy forms, second growth 3 to 5 years old and good-size trees were in the area selected for this study. Basal and foliage treatments were made in 1953, basal treatments in 1954 and one series of soil injection treatments was made in 1955.

The first of three series of treatments was made in March 1953 and included only basal treatments at the rate of 1, 2 and 4 percent acid equivalent in diesel oil with the following herbicides: 2,4-D as propylene glycol butyl ether ester (2,4-dichlorophenoxyacetic acid); 2,4,5-T as propylene glycol butyl ether esters (2,4,5-trichlorophenoxy acetic acid); 2,4-D and 2,4,5-T (brush killer, 50-50 mix); 2,4,5-T as triethylamine salt (2,4,5-trichlorophenoxyacetic acid); and MCPA as butoxy ethanol ester (2-methyl-4-chlorophenoxyacetic acid). The basal sprays were applied to the lower 12 to 18 inches of the tree or shrub stems. Half of the plants were frilled or notched, the others were sprayed without notching. Shrub stems too small to frill were notched near the base and larger stems and trees were frilled. The method of chemical application is shown on the cover.

These treatments were repeated in April and May for trees above 5 feet in height. The foliage of all plants below 5 feet was sprayed with the chemicals in water at the rates of 0.1, 0.2, 0.4, 0.6, 0.8 and 1 percent acid equivalents. Since the smaller growth was abundant, the larger tree plots were divided for the brush foliage spraying.

Plants notched or frilled in the 1953 treatments showed a higher rate of kill than the unnotched. A low kill was obtained by foliage spraying. Earlier reaction and higher kills were obtained with the ester formulations and the amine formulation and foliage sprays were discontinued in the 1954 tests. All plants treated in 1954 were notched or frilled. Additional treatments including 2-(2,4,5-TP) at the rates of 4 and 6 percent and concentrations of 6 percent of all herbicides were included. The 1954 treatments were applied

in February, March and May. Trees were in late bud in February and in early leaf and flower in March.

Six plots were treated by the soil injection method in 1955 with the esters of 2,4-D, 2,4,5-T and 2-(2,4,5-TP). The instrument used, known as Mack's chemical injector, injects the chemicals into the soil at the base of the tree or shrub at a depth of about 4 inches. Soil injections were made at approximately 2 ounces of solution per inch of total stem diameter of the tree or shrub.

Final evaluations for each series were made during the second growing season for each treatment except for the soil injection plots. The final evaluations reported were made in June 1956.

Of the 87 treatments conducted with hormone herbicides, 30 were foliage sprays, 51 were basal treatments and 9 were soil injection. A total of 1,553 were trees and shrubby growth and 1,890 were seedlings and plants which showed a few years of above-ground growth. The several-stemmed shrubby forms apparently developed from plants browsed or injured when young and one site had sprout growth from stumps of trees that were cut in 1949 and 1950. The trees were 12 to 40 feet in height and 2 to 12 inches in diameter.

RESULTS

All seedlings and all plants less than 18 inches in height in the basal treatment plots were killed when the entire plants were sprayed with the basal treatment solutions.

The March, April and May treatments of 1953 and 1954 were more effective than the February 1954 treatments. With the exception of the April 1953 treatments, a higher top kill was obtained when trees and shrubs were frilled and notched before basal sprays were applied. The kill on multiple-stemmed shrubs was not as effective as on single-stemmed plants (Table 2). Stems of the shrubs were notched and the kill is based on total stem kill. On a basis of stem count, the kill was higher, but if a single stem remained alive, the plant was considered not killed. An explanation of the lower kill on shrubs seems to be in the root-stem ratio in that a large tap root reserve is apparent in the shrubs. Roots of single-stemmed plants have more branching and do not have proportionally as large a tap root. This stem-root diameter relation is shown in Figure 5.

Since the date of treatment, after trees were in full leaf, did not appear significant, data were compiled on the basis of formulations and concentration. On these bases, the 4 percent concentration gave the most consistently high kills.

The top kills obtained with basal treatments of herbicides in diesel oil during 1953 and 1954 are given in Table 3. Top-kill results obtained with

Figure 4. Shrubby growth of Texas buckeye in the experimental area in Kerr county. The low growth accessible to grazing animals is a livestock hazard.

2,4-D were satisfactory, but approximately 60 percent of all plants developed basal shoots the first or second year after treatment. Results obtained with a 50-50 mixture of the esters of 2,4-D and 2,4,5-T were not as consistent as with 2,4,5-T or 2,4-D alone and almost 50 percent of the plants produced basal shoots.

On a comparative basis of concentrations, the lowest kill of the chemicals tested was obtained with a triethylamine salt of 2,4,5-T. All top-killed trees produced basal shoots the following year. Most of the trees shed their leaves after treatment and about a third that produced leaves the year after treatment had leaves about half normal size and with leaflets slightly curled to the underside. These small leaves were again in evidence the second season after treatment. A similar condition appeared in a few of the trees treated with 2,4,5-T ester.

The most rapid reaction to herbicides was obtained on plants given basal applications of MCPA. Application of the herbicide at 6 percent gave the highest kill, but since this rate was applied only one season it is not safe to conclude on the possible consistency. Less than one-fourth of the trees showing top kill produced root sprouts, most of them the second year after treatment. The ester of 2,4,5-T applied as a basal spray followed MCPA in producing early external

TABLE 2. BUCKEYE TREES AND SHRUBS TOP-KILLED BY BASAL APPLICATIONS OF HERBICIDES, 1953-54

Date of treatment	Percent kill		
	Trees		Shrubs
	Notched or frilled	Not notched	All notched
3/12/53	95.4	72.6	65.4
4/30/53	90.9	92.6	
5/29/53	92.9	61.6	
2/19/54	71.9	61.9	
3/26/54	93.6		83.8
5/28/54	97.6		76.8

Figure 5. Left—Buckeye plants treated with basal sprays excavated to show the relative root-shoot diameters. The one on the left was killed, the plant on the right had a sprout about 6 inches below ground level. Figure 6. Center—Buckeye stems treated with basal sprays. The bark began to slough a few months after treatment and most of the stems had fallen by the following growing season. Figure 7. Right—Secondary-growth buckeye brush plants treated with 2,4,5-T ester by soil injection in June 1955. Branchlets were showing dieback in April 1956.

growth reaction of the leaves. As with most of the other herbicides tested, the best kills were obtained at the 4 percent level. Less than one-fourth of the trees top-killed produced root sprouts. Application of the herbicides in frills and notches gave consistently higher kills at all levels than when the same chemical was applied to unnotched trees. These comparisons are shown in Table 3.

TABLE 3. TOP KILL OF BUCKEYE TREES OBTAINED WITH BASAL APPLICATIONS OF HERBICIDES IN DIESEL OIL, 1953-54

Formulation	Percent concentrate	Notched or frilled		Not notched	
		No. trees	% kill	No. trees	% kill
2,4-D ester	1	22	86.4	24	66.6
	2	19	73.7	19	68.4
	4	50	92.0	25	80.0
	6	17	88.0	0	0
2,4-D + 2,4,5-T esters	1	41	83.0	39	61.6
	2	27	81.5	29	75.9
	4	51	78.5	35	68.5
	6	28	89.3	0	0
Triethylamine salt of 2,4,5-T	1	13	31.0	16	31.0
	2	28	57.0	30	33.0
	4	29	69.0	28	25.0
	6	0	0	0	0
2,4,5-T ester	1	15	46.7	18	38.8
	2	20	70.0	20	50.0
	4	42	92.9	22	84.4
	6	18	89.0	0	0
MCPA ester	1	25	84.0	25	64.0
	2	20	80.0	21	67.0
	4	46	93.5	26	85.0
	6	19	100.0	6	100.0
2-(2,4,5-TP) ester	1	0	0	0	0
	2	0	0	0	0
	4	3	100.0	0	0
	6	10	90.0	0	0

2,4,5-T propionic (2-(2,4,5-TP) was not added to the group of experimental chemicals until the May 1954 treatments. Reaction and kill were favorable, but too few trees were treated to be conclusive.

In the 15 plots of buckeye sprayed with foliage sprays on April 30, 1953, an average top kill of 26 percent was obtained, but only 5.6 percent top kill was obtained in the 15 plots treated on May 29, 1953. All of the foliage sprays which ranged in concentration from 0.1 to 1.0 percent also caused defoliation in some degree. All plants treated with foliage sprays in 1953 came into full leaf or had basal sprouts during the growing season of 1954. There were numerous seedlings in the plots treated with foliage sprays, but only two were found which survived the season.

The stems of plants killed deteriorated rapidly and in most cases the bark started to slough by the end of summer after spraying (Figure 6). With the exception of the larger trees killed, all decomposed to the degree that they were knocked down by livestock or wind by the end of the second year after treatment.

The test made by soil injection in June 1955 was inconclusive. The plants were mostly multi-

ple-stemmed caused by cutting trees near the ground level in 1949 and 1950. Of 123 of these second-growth plants treated, only 48 were top-killed 1 year after treatment. The highest top kill (52.9 percent) was obtained with an MCPA ester, the lowest with 2,4-D ester (13.3 percent), both with 1½ percent diesel oil solutions (Table 4).

Root sprouts grew on practically all plants top-killed by soil injection. Those on the two plants killed with 2,4-D were noticeably large and vigorous. Nine out of 19 of the plants that were not killed with the 1 percent 2,4,5-T ester showed a dieback of many of the branch tips which started when the leaves were young (Figure 7). When last observed in June 1956, the branchlets had died, but the rest of the plant appeared healthy. This same condition was noted on one plant treated with a 1½ percent MCPA ester and on six treated with 1½ percent 2-(2,4,5-TP) ester.

TABLE 4. BUCKEYE PLANTS TOP KILLED BY HERBICIDES APPLIED WITH A SOIL INJECTOR

Formulation and concentration	Plants treated 6/7/56	Percent of plants top-killed 6/4/56
2,4,5-T E 1%	33	42.4
2,4,5-T E 1½%	13	46.4
2,4-D E 1½%	15	13.3
MCPA E 1%	16	43.7
MCPA E 1½%	17	52.9
2-(2,4,5-TP) E 1½%	14	21.4

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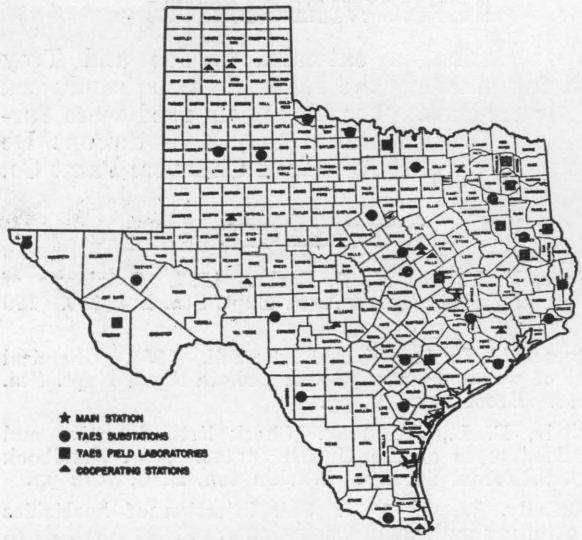

Location of field research units in Texas maintained by the Texas Agricultural Experiment Station and cooperating agencies

State-wide Research

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The Texas Agricultural Experiment Station is the public agricultural research agency of the State of Texas, and is one of nine parts of the Texas A&M College System

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