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Tests of Aerial Applications of Herbicides on Post Oak and Blackjack Brush in Oklahoma; Progress Report, 1954.

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TESTS OF AERIAL APPLICATIONS OF HERBICIDES ON POST OAK AND BLACKJACK BRUSH IN OKLAHOMA; PROGRESS REPORT, 1954.

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Tests of aerial applications of herbicides for control of oak brush on a relatively large scale were begun in 1952, following preliminary trials starting in 1948. Cooperation in these tests is being given by a number of groups and individuals, acknowledged on page 7. The first annual progress report of these tests was made in May, 1954, in Mimeographed Circular M-258. The present publication summarizes the results through 1954.

Location of Test Areas

The sites used for these studies are areas covered with post oak and blackjack types of brush and small trees. The location at Alex is in the southwestern part of the Kansas-Oklahoma-Texas brush area. The one at Bristow is in the central part; and the one near Pawhuska is in the northeastern section. In addition, applications have been made on the Red Plains Conservation Experiment Station, near Guthrie, Oklahoma, and on a cooperator's ranch, near Arcadia, in the Oklahoma County Soil Conservation District.

Plans of the Study

The initial plots for the ranch tests were 20 acres in size. Eight different treatments were made in 1952 at three locations. At the Red Plains Station and at the location in Oklahoma County, 5-acre plots were treated. New treatments in 1953 and 1954 on ranches were on 5-acre plots. The length of the plots varied from one-quarter to one-half mile.

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Herbicides Tested. The herbicides used at all locations were low-volatile esters. The major applications were with 2, 4, 5-trichlorophenoxyacetic acid (2, 4, 5-T) or an equal mixture of 2, 4-dichlorophenoxyacetic acid (2, 4-D) and 2, 4, 5-T. A few treatments were also made with 2, 4, 5-trichlorophenoxypropionic acid (2, 4, 5-TP). The chemical for each amount was mixed with sufficient diesel oil to make 1 gallon, emulsified in 4 gallons of water, and then applied at 5 gallons per acre. The rate per acre on an acid equivalent basis and number of treatments for each chemical are given in Tables I, II, and III.

Equipment Used. The main treatments in 1952, 1953, and 1954 were applied with a modified Stearman airplane. The modifications included a high lift wing section designed and squared wing tips. These plane modifications were made by the Aerial Applicator's Association and the USDA Aircraft and Special Equipment Center at Cimarron Field, Oklahoma City, Oklahoma. The distribution system included an improved hydraulically driven pump and a boom equipped with 5 nozzles delivering 5 gallons per acre in a 33-foot swath.

Table I. --Effect on Control of Brush and Trees of Repeated and Single Treatments Using Various Amounts of a Low Volatile 2, 4, 5-T Ester; Alex and Bristow, Oklahoma, 1952-1954.

Pounds Acid Per Acre				Percent of All Species [1]	
1952	1953	1954	Total	Defoliated	Apparently Dead [2]
1	1	2	4	85.5	62.3
2	2	-	4	63.6	58.1
2	-	2	4	75.6	40.3
-	2	2	4	80.4	46.5
2	1	-	3	59.1	46.7
1	-	2	3	72.1	40.7
3	-	-	3	29.8	16.4
2	-	-	2	25.6	16.6
1	-	-	1	26.5	7.8

[1] Average for the two locations. The species were 90 to 95 percent White, Post, Blackjack, Black and Chinquapin Oaks. Others were Elm, Hickory, Dogwood, Plum, Redbud, Sumac, and Chittum.

[2] Above ground growth completely killed. Untreated areas had an average of apparently dead plants of 4.3 percent.

At the start of the field applications in 1953, the plane was equipped with a 14-nozzle boom; however, after three plots were sprayed, it was changed back to the 5-nozzle system. To compare the relative efficiency of applications by the Stearman and a Cub airplane, additional treatments were made in 1954 by a 125-horsepower Cub plane equipped with a boom and nozzle as similar as possible to that on the Stearman. The only variation was the use of a propeller-driven gear pump on the Cub. The spray rate and swath width were the same for both planes. The Cub plane was equipped and furnished by the Aircraft and Special Equipment Center.

Conditions During Treatments. Soil moisture was generally favorable for active growth when the 1952, 1953, and 1954 applications were made. They were made each year at the various locations from the first to the middle of June. The spraying was done early in the morning or late in the evening, when the relative humidity was high and wind velocities were less than 5 miles per hour. A rain of about one-half inch occurred immediately after two of the areas at Alex had been sprayed in 1954. The remaining areas were sprayed after the rain.

Table II. --Effect on Control of Brush and Trees of Repeated and Single Treatments Using Various Amounts of Equal Quantities of Low Volatile 2, 4-D and 2, 4, 5-T Esters; Pawhuska, Oklahoma, 1952-1954.

Pounds Acid Per Acre				Percent of All Species [1]	
1952	1953	1954	Total	Defoliated	Apparently Dead [2]
3.0	1.5	3.0	7.5	92.1	82.4
4.5	---	3.0	7.5	82.0	33.5
1.5	1.5	3.0	6.0	88.9	74.5
3.0	3.0	---	6.0	63.5	51.3
3.0	---	3.0	6.0	80.0	65.5
---	3.0	3.0	6.0	89.9	62.4
3.0	1.5	---	4.5	69.2	65.5
4.5	---	---	4.5	45.0	28.1
1.5	1.5	---	3.0	64.8	56.4
3.0	---	---	3.0	40.0	36.1

[1] The species were 75 to 80 percent Blackjack, Black, and Chinquapin Oaks; and 10 to 15 percent Post and White Oak. The remainder were Hickory, Sumac, and Greenbrier.

[2] Above ground growth completely killed. Untreated areas had an average of apparently dead plants of 19.5 percent.

Drought prevailed each summer after the treatments were applied at all locations except one. During the summer months of 1954, the area treated at Pawhuska received about normal rainfall.

Procedures Used in Determining Results. A rating system of numbers from zero through ten was used to classify the various degrees of defoliation. The graduations starting from zero, indicating "no effect," increased ten percent for each consecutive number up to ten, which represented complete defoliation.

These readings were taken in September by three to four observers working independently. For each treatment, they rated the plants in nine random belts 12 feet wide and 100 feet long. Due to the heavy density of small brush at the Pawhuska location, the readings on small brush were made in belts only 6 feet wide. However, for the counts of trees, the 12-foot belts were continued.

Table III.--Comparison of Various Low Volatile Ester Herbicides Applied in Foliage Sprays for Controlling Brush and Trees; Oklahoma, 1953 and 1954.

Location and Chemical	Pounds Acid Per Acre			Percent of All Species [1]	
	1953	1954	Total	Defoliated	Apparently Dead [2]
Pawhuska					
2, 4, 5-TP [3]	2	1	3	72.8	65.7
2, 4, 5-TP [3]	2	0	2	60.2	50.3
2, 4, 5-T [4]	2	0	2	52.1	25.7
2, 4-D and 2, 4, 5-T [5]	3	0	3	42.0	16.3
Arcadia, Alex, and Bristow [6]					
2, 4, 5-TP	2	0	2	62.8	37.3
2, 4, 5-T	2	0	2	46.0	31.9

[1] Species were 90 to 95 percent White, Post, Black, Blackjack, and Chinquapin Oak; and others were Hickory, Sumac, and Greenbrier.

[2] Above ground growth completely killed. Untreated areas had an average of apparently dead plants of 19.5 and 4.3 percent at Pawhuska and the other locations, respectively.

[3] 2, 4, 5-trichlorophenoxypropionic acid.

[4] 2, 4, 5-trichlorophenoxyacetic acid.

[5] Equal parts of 2, 4-dichlorophenoxyacetic acid and 2, 4, 5-trichlorophenoxyacetic acid.

[6] Average for three locations.

Evaluations were made on the untreated areas at each location. The chief causes of apparent kill of plants in the untreated areas appeared to be fire (occurring two to three years prior to the start of spraying), and recent droughts.

The grass improvement on most of the treated areas was not determined since they had been grazed, and because droughts occurred during the summer at Bristow and Alex. However, forage samples of the grasses, native legumes, and weeds on treated and untreated areas were taken on ungrazed sites on the ranch near Pawhuska.

Results

The greatest brush control effectiveness of all herbicides tested was from the repeated applications. Results of defoliation and apparent kill obtained with the various treatments of the different herbicides used are given in Tables I, II, and III. The 2, 4, 5-T alone and the equal mixture of 2, 4-D and 2, 4, 5-T produced the most control when applied yearly for three consecutive treatments. Two applications of the 2, 4, 5-T made in consecutive years gave a higher apparent kill than where a year without treatment occurred between them. This, however, was not consistently true where the equal mixtures of 2, 4-D and 2, 4, 5-T were used. Amounts of acid at 4.5 pounds per acre in single applications or for an initial treatment followed by a retreatment gave very low apparent kills.

Based on comparable amounts of acid, the 2, 4, 5-TP gave 17 percent higher defoliation than 2, 4, 5-T as indicated by the averages of single treatments made at three locations in 1953 (Table III). Repeated treatments at Pawhuska with the 2, 4, 5-TP also increased control of the oak brush and trees over that of a single application. It was observed that white and post oaks were more readily affected by all the materials tested than were the blackjack, black and chinquapin oaks.

There was little difference in brush control obtained with the two types of planes used (Table IV). Very little drift of spray occurred from the place where the herbicide was applied when the 5-nozzle equipment was used. However, when 14-nozzles were used on the Stearman, movement of the spray was traced to about one-quarter mile from point of application.

The area at Alex, sprayed just before and after a rain, had defoliation of all plants of 75 and 61 percent, respectively.

The drought, and continuous grazing on most of the treated areas, prevented securing good measurements of the effectiveness of the treatments in promoting growth of grass. However, clippings taken on the ungrazed sprayed areas at Pawhuska showed an increase in forage production of native grasses of 3.5 to 4 times over that of the untreated areas. This increase occurred the second season

after treatment. Reestablishment of grasses was from suppressed plants existing in brush prior to its control with the herbicides. There was an average of about 2,800 pounds per acre of brush 0 to 2 inches in diameter in the understory prior to the spraying at Pawhuska and Bristow.

Summary

The selective, low-volatile esters of 2,4,5-trichlorophenoxyacetic alone, and an equal mixture of 2,4-dichlorophenoxyacetic and 2,4,5-T, or 2,4,5-trichlorophenoxypropionic acid were applied with airplanes to study their effects on control of oak and on grass development in Oklahoma. The greatest effectiveness of all herbicides tested was from repeated applications. The treatment of the oaks has resulted in development of good grass covers within one to two years. When applied in equal amounts, the 2,4,5-TP usually has given slightly better control of all the oaks than the 2,4,5-T alone or the 2,4-D - 2,4,5-T mixture. All of these herbicides were somewhat more effective on post and white oaks than on blackjack, black and chinquapin oaks.

Satisfactory brush and tree control was obtained from 2 pounds of acid per acre of either 2,4,5-TP or 2,4,5-T. Where a mixture of 2,4-D - 2,4,5-T was used, 1.5 to 3 pounds of acid as initial treatments also gave good control.

Table IV. --Comparison of Two Types of Planes for Applying Herbicides to Control Oak Brush and Trees; Oklahoma, 1954.

Plane [1]	Treatment [2]	Percent Defoliation [3] Woody Plants			
		Alex	Bristow	Pawhuska	Average
Stearman	Retreatment on area previously sprayed	82.1	83.7	81.1	82.3
"	First Application	64.4	67.8	79.2	65.9
				Average	74.1
Cub	Retreatment on area previously sprayed	69.9	77.1	82.5	76.5
"	First Application	79.8	63.9	65.3	69.7
				Average	73.1

[1] Each plane had same general type of spray equipment.

[2] The herbicide applied at each location and for each treatment was low-volatile esters of 2,4,5-T at 2 pounds per acre at Alex and Bristow and an equal mixture of the low volatile esters of 2,4-D and 2,4,5-T at 3 pounds per acre at Pawhuska. The spray at each location consisted of the chemical plus diesel oil to make 1 gallon, 4 gallons of water, and applied at 5 gallons per acre.

[3] Results were determined from observations of the degree of defoliation, in September, 1954.

However, based on observations from a number of commercial applications, the 3 pounds of acid per acre gave satisfactory effects more consistently than where lower amounts were applied. All treatments were more effective when followed the second year with applications of 1 to 3 pounds of acid equivalent per acre.

On areas heavily infested with woody species, 1.5 to 2 pounds of acid per acre of either the 2, 4, 5-T or 2, 4-D - 2, 4, 5-T mixture applied each year for three consecutive years produced very good results.

A spray solution, consisting of the chemical and sufficient diesel oil to make one gallon and emulsified with 4 gallons of water, gave satisfactory results when applied at the rate of 5 gallons per acre. This spray, delivered through 5 nozzles in swaths of 33 feet, produced good coverage of the foliage. Very little drift of spray occurred from the place where it was applied when the 5-nozzle equipment was used. However, when fourteen nozzles were used on a Stearman plane, movement of the spray was traced to about one-quarter mile from point of application.

There was no difference in coverage and control of spray from comparable applications made with either a Cub or Stearman plane.

A rain of about one-half inch, occurring one-half to one hour after the herbicides were applied, did not reduce their effectiveness.

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