

New Methods of Brush Control for More Grass

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THE introduction of selective herbicides, the development of machines and the need for better pasture cover have brought forth a demand for more information on the control of brush. Due to the possibility of better land use and greater production (5) by removing scrubby trees and brush, the problem of control is being attacked through use of both machines and chemicals. A cover of scrubby trees and brush on land does not provide as good a protective cover for erosion control as does grass. During an 8-year period of measurement at Red Plains conservation, Experiment Station, Guthrie, Oklahoma runoff water was 44 percent less from good grass land than from areas covered with brush.

According to Allred (1) woody vegetation requires two to four times more water to produce a pound of dry leaves than does grass. He further states that in "areas where there are dense stands of useless woody vegetation, more water is lost—transpires—through the leaves of those woody plants each year than runs off down the draws, streams and rivers."

Since there is a wide range of woody plants, grasses and soil conditions, methods of brush removal and grass development will vary greatly. The rainfall or other climatic conditions are also quite variable. Annual rainfall in the eastern part of the state varies from 40 to 50 inches, in the central part from 30 to 35 inches, and in the western section from 12 to 25 inches or less. The occurrence of drought usually reduces the growth and stand of the grasses. When this occurs, overgrazing of forage and fires are common. All of this further depresses the

grass and is chiefly responsible for the rapid encroachment of brush in woodland or other pastures.

METHODS OF REMOVING BRUSH

The ability of a site to produce palatable plants will often be indicated by the kind of grass intermingled in the brush. The erodibility of soil and the fertility level are important factors in the regrassing of such land. If the soil is shallow or subject to water and wind erosion, the method of brush control should be one which will conserve the maximum of residues. Information of this nature is given in Table 1. The soil on this particular site was rather shallow. But, it has a fair level of fertility and had not been overrun by fire or misused for several years. Grasses found in the undisturbed woods were big bluestem (*Andropogon furcatus*), little bluestem (*Andropogon scoparius*), Indiangrass (*Sorghastrum nutans*), switchgrass (*Panicum virgatum*), purple top (*Triodia flava*) and sand lovegrass (*Eragrostis trichoides*). But, due to the competition of the brush, these grasses were small, spindly and greatly depressed in growth.

After the brush was removed the grass developed rapidly. Where it was crushed with a machine onto the soil, grass production at the end of the second growing season had been increased about three times. There were more sprouts per given area than originally but their reduced size permitted good grass development. Where chemicals were used resprouting was greatly reduced. There were 25 times more sprouts on the plots cleared mechanically than on those sprayed with Ammate.

TABLE 1

Amount of vegetative cover in November 1948, on uncleared and cleared scrubby oak land on the Red Plains Conservation Experiment Station, Guthrie, Oklahoma

AREA	DATE TREATED	COVER (POUNDS PER ACRE)			SPROUTS PER ACRE NOW REMAINING	INCREASE OF NATIVE GRASS OVER UNDIS- TURBED SCRUBBY OAK
		Native Grasses	Weeds & Annual Grasses	Residue Accumula- tion		
Undisturbed ¹		645	47	7080	22,244	<i>Per cent</i>
Crushed (Marden Brush Cutter).....	June 1946	1957	517	3991	27,720	203
Weedone* (2,4-D) (Spray) ²	June 1945	3013	233	7593	2,250	367
Ammate* (Spray) ³	Spet. 1945	3010	843	3088	1,120	366

* Chemicals applied in accordance with manufacturers' recommendations.

¹ Original cover of scrubby oak.

² Retreated May 1947.

³ Retreated with 2,4-D May 1948.



FIGURE 1. Grass development at the close of the second season following treatment of oak brush with 2,4-D. This area originally was non-productive because of the heavy infestation of brush.

By the end of the third growing season grass production on the chemically treated plots had increased approximately five times (Fig. 1).

MACHINES USED

Machines studied for removing brush include power mowers, tractor and small powered saws, dozers, heavy root plows,

crushers, beaters, tree shears and buck rakes. These have been tried at the Guthrie Station (3) or elsewhere (2). They all gave satisfactory results when used on material within the limits for which each is best suited.

It is unlikely that any one machine or clearing method can be developed to operate satisfactorily under all conditions and types of brush. The types of vegetation may be classified into three groups: brashy shrubs, tough shrubs, and trees.

The brush beater or shredder machines are considered best for the control of brashy shrubs. The beater, shredder and crushing machines are better adapted for

TABLE 2

Percentage of original oak sprouts remaining on the land after clearing and spring mowing; Guthrie, Oklahoma

NUMBER OF YEARS MOWED*	PERCENT REMAINING IN 1945
10	8.5
8	11.1
2	44.7
Unmowed	58.3

* Light density brush before clearing (approximately) 22,200 shrubs per acre, 2 inches or less in diameter at 1 foot above ground level.

use on rough and rocky areas than are the circular power saws or the mowers.

On tough shrubs one and one-half inches or less in diameter, a brush mower equipped with stub guards, extra hold-down clips and sickle with heavy sections has worked with fair efficiency (3). Black-jack (*Quercus marilandica*) and white oak (*Quercus alba*) sprouts have been fairly easily controlled by several annual spring mowings. Those remaining after several years mowing (Table 2) are largely the running oak (*Quercus pumila*) or dwarf chinquapin oak (*Quercus prinoides*). These, however, offer little competition to the grasses.

Power saws, either the small portable

type or tractor mounted, work quite well in cutting trees. The small portable saws can be operated to cut the brush and trees more uniformly close to the ground than the large tractor-mounted ones. They are also more maneuverable for thinning tree stands or working in close places.

In using small portable saws it was noted that season influenced the cutting effect of the blade and man hours per acre. The man hours per thousand trees for the different seasons were: Winter, 15.4; spring 7.4; and summer 8.0. The major reason for the increased time for the winter clearing apparently is due to the greater difficulty in cutting the dormant plants. Saw blades remained sharp longer and cut faster during the growing season. Winter cutting also requires that saw teeth be more carefully shaped and maintained.

Power-lift buck rakes have been used to eliminate many man hours of labor required for assembling and piling brush. Regardless of the method used for cutting brush, these rakes have performed satisfactorily. A satisfactory procedure for operating a tractor saw has been to work out an alleyway around a land with sufficient room for the saw and brush rake to operate without interference. As the saw cuts a swath, the rake picks up the brush and pushes it out of the way.

Regardless of the machine used in removing brush, it must meet requirements as to sturdiness and economy of operation. The equipment must also be suited to handle the plants to be removed and the terrain over which the work is done. On shallow soils, the machine used should give a minimum disturbance to the soil and the grasses.

MACHINES FOR APPLYING HERBICIDES

The use of herbicidal chemicals to control weeds has brought forth a demand for sprayers which will distribute low volumes

of liquid uniformly. Drift must be controlled when treating areas adjacent to susceptible plants. The spray equipment must also have positive cut-off devices to prevent wastage and leaks.

Equipment for control of woody plants must be of sturdier construction and capable of delivering larger volumes of liquid than those used in weed control. It should be compact and free of mountings that would be damaged by woody growths or hinder movement through them.

In applying herbicides in large volumes of water, the hydraulic type sprayer has given fair results. Pressures of 100 pounds or less have given best results.

The air-blast sprayers offer some promise in applying spray chemicals on woody plants. In a preliminary test in July 1948 on the Red Plains Conservation Experiment Station, an air blast sprayer gave good control of scrubby oak. The air blast sprayer was furnished by the Davey Tree Expert Company, Kent, Ohio. Only 50 gallons of liquid and 100 pounds of ammonium sulfamate (Ammate) were used per acre. The hydraulic type spraying machine under comparable conditions and control required 300 pounds of Ammate in 300 gallons of water per acre. Thus, the air-blast machine used only one-third as much Ammate and one-sixth as much water as the hydraulic equipment.

The present type of boom sprayers have not been successfully used for applying herbicides on woody species encountered in the cross timber area of Oklahoma. Tests with such equipment on sprouts from cut-over land also did not give satisfactory control.

Several tests have been made by aerial spraying in the oak and hickory vegetation common to central Oklahoma. Since there is a wide range in height of woody plants, it is impossible to fly low over the brush. When applied by airplane, it has not been generally possible to get the

desired control by using the same amounts of herbicides which gave good results by ground application. However, a few aerial applications on oak brush of this type have been observed that appear to be rather encouraging. The exact formulations or carriers used are unknown. The procedure of a 1948 test was such that brush and trees from one foot to 20 feet high were 85 percent affected by one application. The chemical used did not injure the native grasses. It appears highly probable that a technique of air application may be developed for controlling woody plants in pastures and ranges of the cross timbers.

HERBICIDES USED

Herbicides for brush control have been studied at various locations in Oklahoma (6) during the past four years. This work has been under the direction of the Oklahoma Agricultural Experiment Station. The materials worked with included both selective and non-selective herbicides. Selective types included 2,4-D (dichlorophenoxyacetic acid) and 2,4,5-T (trichlorophenoxyacetic acid). The latter was available only in 1948. Ammonium sulfamate (Ammate) was the non-selective herbicide used.

The ester formulations of the two selective-type chemicals generally give the best control of brush. The 2,4-D is not effective on all woody species. Where a mixed population of plants is encountered, a fifty-fifty combination of 2,4-D and 2,4,5-T acid will effect a wider range of plants. However, both of the materials are sometimes erratic in reaction. Their effect is influenced by soil moisture and the growth stage of the plants. Generally, 2,4-D and 2,4,5-T acid spray solutions have caused the greatest deadening effect when applied on brush when the plants have just attained full leaf size. There pounds of acid equivalent of 2,4-D per

acre in a sufficient volume of water to get good saturation of leaves has given control of sumac (*Rhus copallina* and *R. glabra*), sand or Chickasaw plum (*Prunus angustifolia* and *P. texana*), buck brush (*Symphoricarpos orbiculatus*) and Western crab apple (*Malus ioensis* var. *palmeri*).

The white, black jack, dwarf chinquapin, running oaks and hickory (*Carya texana*) are somewhat resistant to 2,4-D. Satisfactory control can be obtained only under favorable conditions with 2,4-D. The combination of 2,4,5-T acid and 2,4-D will increase the effectiveness of the spray material. A spray of 2,4,5-T acid alone has been more effective than in the combination under more adverse conditions.

The amount of acid equivalent to control brush with 2,4-D or 2,4,5-T acid, or a mixture of both, will vary depending upon plant density, height and climatic conditions. On growths having 18 to 20 thousand plants per acre, four feet or under in height, three pounds of acid has given good control. This amount will need to be increased to four pounds per acre if dry soil moisture condition or greater density and height of plants is encountered. The 2,4,5-T acid kills the tops of persimmon (*Diospyros virginiana*) and Mesquite (*Prosopis glandulosa*) but both had resprouted from roots at the end of the season. Neither the 2,4-D nor the 2,4,5-T acid had any effect on cedar (*Juniperus virginiana*) or tamarack (*Larix laricina*).

Low aromatic oils either for low volume applications or mixed with water have improved the kills with organic herbicides on woody plants. However, large amounts of oils will often injure or retard the grasses. In using oil carriers an additional emulsifying material is often needed.

Other materials showing some promise of improving the intake and absorption of organic herbicides are ammonium trichloroacetate and phenylmercuric acetate.

Either of these compounds used at $\frac{1}{2}$ to $\frac{3}{4}$ ounce per gallon of water, plus the recommended quantity of chemical, has had consistent effect on woody plants. Further physiological studies will, no doubt, reveal ways of increasing absorption and movement of herbicidal chemicals through the plants.

Ammonium sulfamate has given good control of all woody plants common to the Cross Timbers. This material, in sufficient water to give good saturation of leaves, will give more positive reaction than the organic herbicides. It will, however, injure the native grasses. Like the selective-type chemicals, it is non-poisonous to livestock and man and will cause only temporary sterilization of the soil. Complete control of the undesirable woody growth sometimes requires two or three retreatings with these materials.

After brush has been deadened, it remains standing for several years if not crushed down. The heavy stalk cutter type machine used for this purpose the second or third year after applying the chemicals crushes the dead material on the surface of the soil.

RETURNS FROM THE LAND

Success of pastures after clearing depends upon the kind of treatment and management it receives. Full grass production will be obtained more rapidly, and erosion will be more completely controlled, if clearing is limited to areas having only light or medium brush cover (4). The original grass cover is more dense on gently sloping soil where the shade from woody vegetation is less. Therefore a complete grass cover is established more rapidly after brush is removed. There is also less likelihood of erosion starting between the time of clearing and the time the grass becomes well established.

Through proper management and fire protection, it is possible to obtain valuable

returns from formerly brushy land. During the last six years typical cleared land on the Guthrie Station has produced an average of 67 pounds of beef per acre in summer grazing.

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