MANAGEMENT NOTES

Spot Treatment for Gambel Oak Control

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Highlight: *Gambel oak can be effectively eliminated in localized, small scale projects by (1) foliage spraying with picloram-silvex at a 1:2 lb a.e./acre rate, (2) basal stem spraying with silvex, 2,4,5-T, or picloram, (3) soil application of picloram granules at 4 lb a.e./acre, or (4) complete top removal followed by root raking.*

Gambel oak (*Quercus gambelii* Nutt.) occurs naturally on several million acres of land in Utah, Colorado, New Mexico, and Arizona. It is found principally from 5,000 to 9,000 ft elevation in areas receiving 14 to 20 inches of average annual precipitation. Stand density varies from very dense thickets to open stands intermixed with serviceberry (*Amelanchier alnifolia*), mountainmahogany (*Cercocarpus montanus* and *C. ledifolius*), chokecherry (*Prunus virginiana*), maple (*Acer glabrum* and *A. grandidentatum*), cliffrose (*Cowania stanisburiana*), and snowberry (*Symphoricarpos* spp.). Sites dominated by Gambel oak frequently alternate with pinyon-juniper, sagebrush-grass, and ponderosa pine sites.

Growth form of Gambel oak varies at maturity from shrubby growth 3 to 10 ft high to clumps of trees up to 30 ft high on deep soils. Gambel oak produces rather unpalatable forage, prevents access of grazing animals, and is a high water user. Although it does provide some cover, browse, and mast for wildlife and is valuable for watershed protection on steep, erosive sites, its high water use and reduction of more desirable forage species often makes its partial or complete elimination desirable on productive sites and special use areas.

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Gambel oak typically grows in mottes characterized by many stems, a dense, connecting, underground root system, and extensive vegetative reproduction. Because of prolific sprouting from buds on the roots and stem bases following top removal whether by fire, mechanical means, or contact herbicides, the eradication or intensive control of Gambel oak is difficult and costly. Seedbed preparation techniques in widespread use on big sagebrush (*Artemisia tridentata*) such as disk plowing, chaining, and burning, are ineffective on Gambel oak and often increase its density. Effective broadcast control techniques are still being developed but generally require chemical treatment.

Local Treatment

However, there are several effective treatments that can be used to eliminate Gambel oak on small, localized sites, where higher control costs per acre are easily justified. Such sites include land being cleared for cultivation, roadways, residential areas, golf courses, and industrial sites. On farms and ranches local removal may be needed on sites for buildings, corrals, dams, fences, and trails. Eliminating Gambel oak and other woody vegetation in the vicinity of springs and seeps can also materially increase effective yield of stockwater. The best control method will depend upon density and size of Gambel oak plants, equipment

Table 1. Herbicidal control of Gambel oak in spot treatment at Spanish Fork, Utah, 1968-72.[1]

Herbicide	Application method	Application rate	Results
Picloram	Foliage spray	1 lb a.e./acre	25% top kill, 5–15% plant kill
2,4-D	Foliage spray	2 lb a.e./acre	25–50% top kill, 5–15% plant kill, sprouting prolific
Silvex	Foliage spray	2 lb a.e./acre	40–70% top kill, 20–40% plant kill, moderate sprouting
Silvex	Foliage spray	2 lb a.e./acre (repeated following year)	60–90% top kill, 50–75% plant kill, low sprouting
Silvex-picloram	Foliage spray	2:1 lb a.e./acre	85–100% top kill, 75–95% plant kill, minimum sprouting
2,4,5-T	Basal stem spray	16 lb a.e.h.g. (diesel carrier)	Nearly complete kill, minimum sprouting
Silvex	Basal stem spray	16 lb a.e.h.g. (diesel carrier)	Nearly complete kill, minimum sprouting
Bromacil	Basal stem spray	12 lb a.e.h.g.	Nearly complete kill, gradual killing
Picloram	Basal stem spray	8 lb a.e.h.g.	Kill complete, no sprouting, slow action
AMS	Basal stem spray	90% concentration	50% top kill, 25% plant kill
Picloram	Soil application	2 lb a.e./acre	80% plant kill, minimum sprouting
Picloram	Soil application	4 lb a.e./acre	100% plant kill, no sprouting

[1]With the application methods and rates reported here, perennial grasses were not materially affected except around the stems basally sprayed with bromacil.

availability, and purpose of oak clearing.

Chemical Control

Several herbicides utilizing foliage spray and basal stem and soil application provide practical means of eliminating Gambel oak in spot treatment. Herbicidal control trials reported in Table 1 were carried out since 1968 on Brigham Young University Farm near Spanish Fork, Utah. The study site containing Gambel oak in mottes comprised a west slope with silt loam soil receiving 15 inches average annual precipitation.

The 1 lb picloram-2 lb of silvex (or 2,4,5-T) was the only single-application foliage spray that gave effective control of mature Gambel oak. This apparent synergic effect was in contrast with picloram or silvex applied separately, neither of which adequately controlled the Gambel oak. Application of two pounds of silvex per acre in each of 2 successive years gave up to 90% top kill but only 50 to 75% plant kill. Although picloram-2,4,5-T mixtures were not applied to mature plants, use at 1:2 lb/acre ratio in related studies with oak sprouts and saplings suggested it would probably be as effective as the picloram-silvex mixture at equivalent rates. Some maintenance control in subsequent years following foliage application of herbicides may be required.

When applied as a basal stem spray to stems up to 6 inches in diameter, 2,4,5-T, silvex, and picloram were all very effective, but AMS was ineffective. Plants basally sprayed with bromacil went through a series of leaf drops; but after three growing seasons, most stems in the mottes treated were apparently dead. In the basal stem application, an attempt was made to saturate the lower 15 inches of each stem. Apparently, silvex, picloram, and bromacil applied basally was readily translocated through roots of Gambel oak, since stems located in excess of ten feet on the uphill side of study plots were killed. This plus the evidence that most stems in a Gambel oak motte underground root system, indicates it may not be necessary to treat all stems in mottes with marked boundaries.

Temporary soil sterilization with picloram granules at 4 lb a.e./acre provided another effective means of killing Gambel oak by spot treatment. However, this method requires adequate rainfall to carry the herbicide into the soil. When applied in late spring prior to a drought year, apparent herbicidal effects were delayed up to 15 months.

Mechanical Control

Gambel oak on deep soil sites can also be eliminated by intensive mechanical methods. Bulldozing followed by root raking to remove underground plant parts capable of sprouting is an effective approach. Mashing and burning followed by root raking can also be used. Where shallow or rocky soils prevent roots being combed from the soil, herbicidal treatment following top removal will generally be required. Since Gambel oak commonly occurs on heterogenous soils of varying soil depth and rockiness, plowing with a sweep-blade rootplow is seldom practical.

Musk Thistle (*Carduus nutans*): An Undesirable Range Plant

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Highlight: *Musk thistle, a spiny, unpalatable biennial plant native to Europe and Asia, is becoming widely established on western ranges. It is a vigorous grower and prolific seed producer and is spreading rapidly to uncultivated areas and wild lands used for ranges and watersheds. Though musk thistle spreads faster and is more vigorous where there is little plant competition, it is also spreading and growing well in good native and seeded ranges and in irrigated pastures and meadows. It is relatively easy to control with herbicides. It should be controlled before it spreads to larger acreages.*

Musk or nodding thistle (*Carduus nutans* L.), a plant native to Europe and Asia, is now widely established on western ranges. This thistle was introduced over 75 years ago into the eastern United States, where it apparently is not a serious problem. Though this plant has been sparingly established on midwestern and western ranges for a long time, only recently has it increased, become a problem, and been declared a noxious weed (Higgins, 1966; Furrer and McCarty, 1966; Nilson, 1969; Alley and Lee, 1969; Holmgren and Andersen, 1970; Jensen, 1970).

Description and Growth Characteristics

Musk thistle is a vigorous, aggressive plant with large, showy, purple flowers. Terminal heads are born singly on a relatively leaf-free stem and are usually at right angles to the stem. Lower down, the stem has clasping, spiny leaves. The stout, spiny, spreading involucre distinguishes this plant from other thistles. Plants are normally about 36 inches tall and have 10 to 100 seedheads, but they vary greatly in size with site and growing conditions. In southeastern Idaho, plants growing in a good stand of native vegetation varied from 8 to 40 inches (20 to 102 cm) in height and had from 1 to 40 or more heads. A single thistle was growing a few feet away on the edge of a wheat field with little plant competition. It was 6 feet (1.8 m) tall and widely branched and had 643 seedheads (Fig. 1).

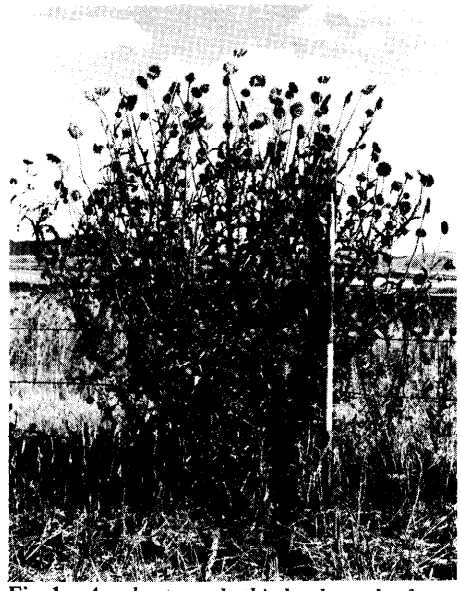

Fig. 1. *A robust musk thistle along the fence line in a dry-land grain area north of Soda Springs, Ida., is 6 feet (1.8 m) tall and has 643 heads.*

Musk thistle is a biennial or winter annual in that it forms a rosette in spring, late summer, or fall and then develops flowers and seeds the next year (McCarty and Scifres, 1966). Flowers and seeds are produced over a long period. Seed production begins with the maturing of the first flowers in June and continues as later flowers mature until after fall frost (Fig. 2). The seeds or achenes are attached to plumes or plume bristles and can be carried long distances, primarily by wind and to a lesser extent by water, animals, machinery, and vehicles (Fig. 3).

Musk thistle is an abundant seed producer. Ten large terminal seedheads from plants in southern Idaho, northern Utah, and western Wyoming had an average of

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