Managing range and pasture to suppress tarweed

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Spring herbicide, summer mowing, and chisel plowing treatments gave the greatest reduction in tarweed density.

Stockmen are interested in reducing tarweed, *Holocarpha virgata* (*Hemizonia virgata*), on their ranges and pastures because its tall, sticky, aromatic summer growth is not utilized well by livestock. It hides dried grass and forbs needed by them and coats their faces and legs with its resinous exudate. Historical evidence indicates that tarweed, a native plant, was not a major component of the perennial-grass-dominated rangelands in pre-European California.

European settlement in California, beginning in the late 1700s, led to heavy range use by livestock, control of periodic range fires, and introduction of many annual grasses and forbs that soon dominated wide areas. These annual grasses have a shallower rooting depth, a shorter growing season, and a shorter growth habit than the perennial grasses they replaced. Consequently, there is less canopy closure and less soil moisture utilization than in the pre-European period. Heavy livestock use also reduced herbaceous canopy and soil moisture utilization, while control of range fires allowed full maturation of summer growing species. These changes resulted in a range environment suitable for tarweed growth. Today tarweed is considered a major range weed.

The degree of competition between tarweed and the winter annual species is complicated by the large diversity within the winter annual group and by the large seasonal and annual variability in the botanical composition of the annual grassland. The deep rooting and rosette habit of tarweed suggest little competition between tarweed and the shallow-rooted, erect-standing winter grasses. However, many winter forbs (such as *Erodium botrys*) are deep rooting with a rosette habit

Tarweed in bloom.

Tarweed Plant Density Resulting from Various Treatments*

Treatment	Density plants/m²
Spring herbicide	0.3 a
Summer herbicide	4.7 c
Spring mowing	4.2 bc
Summer mowing	0.1 a
Chisel plowing	1.2 a
Fertilizer	1.7 ab
Control	10.9 d

*Treatment means followed by the same letter are not significantly different ($p<0.05$).

and may compete strongly with tarweed. The level of competition between tarweed and the winter annuals depends on the grass/forb balance of the annual grasslands.

Instead of being a highly competitive invader, like some alien annual grasses, tarweed seems able to invade annual grassland by using unutilized resources of moisture, nutrients, and light. Thus, its survival is due to niche separation from the winter annuals rather than to aggressive competition, and there is, therefore, some doubt as to whether removing tarweed will increase forage production and whether tarweed control is economically justified.

Management practices to reduce tarweed density require two basic strategies: (1) increasing canopy cover and soil moisture utilization by manipulating soil fertility and species composition, or (2) directly removing tarweed from the plant community by chemical or mechanical means.

Experimental site

The study site was 7 miles west of Lincoln in the Sacramento Valley, at an elevation of 70 feet, on Cometa sandy loam soil 22 inches deep overlying a hardpan. This soil is acidic (pH = 5.6) and low in nitrogen, phosphorus, and organic matter. The area has a Mediterranean-type climate: cool, rainy winters and hot, dry summers. Average annual rainfall is 21 inches. Vegetation is California annual-type grassland with the alien medusahead *(Taeniantherum asperum [Elymus caput-medusae])*, soft chess *(Bromus mollis)*, annual ryegrass *(Lolium multiflorum)*, and broadleaf filaree *(Erodium botrys)* co-dominant with native tarweed. No livestock graze on the site.

An area was staked out into 5- by 5-meter plots in January 1979, and these were divided into replicate groups by visual estimation of the density of senescent tarweed plants from the previous season. Treatments (replicated three times) were: (1) an application of 107 pounds per acre (120 kg/ha) of ammonium sulfate (21-0-0) on January 13, 1979; (2 and 3) herbicide applications on April 21 and July 14, 1979, of 1.5 pounds per acre (1.68 kg/ha) of low volatile ester of 2,4-D (2, 4-Dichlorophenoxyacetic acid); (4 and 5) mowing with a scythe on May 5 and August 25, 1979; and (6) chisel plowing on May 25, 1979. On September 22, 1979, all tarweed plants in each plot were counted. Unusually high rainfall in January and February 1980 resulted in flooding of the study site, disturbing it to the point where no data were available for 1980.

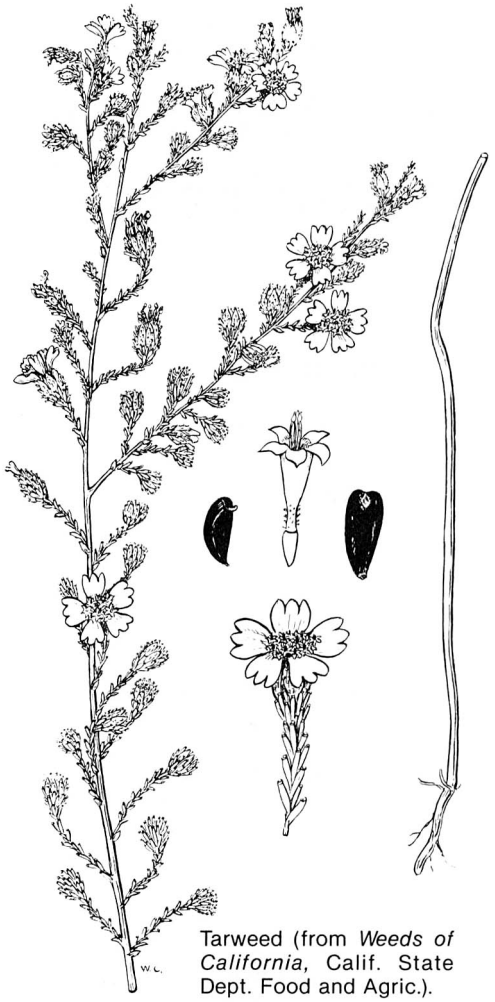
Results and discussion

The spring herbicide, summer mowing, and chisel plowing treatments gave the greatest reduction in tarweed density (see table). Fertilizer treatment was intermediate, and the summer herbicide and spring mowing treatments gave the least reduction. Least-significant-difference comparisons showed no significant differences among the fertilizer, spring herbicide, summer mowing, and chisel plowing treatments.

Thus, fall applications of nitrogen fertilizer have been shown here and by others to reduce tarweed density. Because tarweed depends on stored soil moisture for summer growth, this reduction is probably due to the increased soil moisture utilization by winter annuals benefiting from fertilization.

Mowing and application of 1.5 pounds acid equivalent per acre of the low volatile ester 2,4-D have resulted in nearly total mortality of tarweed. However, timing of treatment is critical for good results. Spring mowing gives little reduction of tarweed. Thus, mowing should take place in the summer just before flowering, eliminating the possibility of regrowth from lower branches. Spraying gives best results in early spring before stem elongation.

On productive range sites and pastures production of a dryland grain crop or of sudangrass *(Sorghum sudanense)* has proved effective in initially reducing tarweed. These crops leave little stored soil moisture for tarweed summer growth, resulting in decreased tarweed density. With these crops it is common to spray broadleaf herbicides early in the year for weed control and to harvest the crop in early summer. Both practices result in tarweed mortality before seed dispersal. After cropping, these areas can be fertilized and seeded with pasture grasses and legumes.



Tarweed (from *Weeds of California*, Calif. State Dept. Food and Agric.).

On the more productive sites perennial grasses can be included, since they have been observed to be more competitive with tarweed than are annual grasses. This practice combines the use of herbicides and mowing to kill tarweed with an increase in range productivity and soil moisture utilization to further suppress growth of surviving tarweed plants. Correctly managed, pastures treated in this manner maintain a high level of soil moisture utilization, and the remaining tarweed population is so reduced as to no longer constitute a problem.

On less productive soils efforts to increase productivity seldom meet with success, and mowing or the application of herbicide solely for tarweed control seldom is economical. Therefore, to reduce tarweed on such sites, it is recommended that grazing intensity be reduced in fall and winter to increase canopy closure and soil moisture utilization by winter annuals.

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