

Effective Fennel Control with Herbicides

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Fennel (*Foeniculum vulgare* Miller) is a perennial plant that is grown commercially and in home gardens for the edible young stems, the enlarged base of the stem, and the seed that are used in cooking. It is a member of the Apiaceae, a large family with 43 native and non-native genera listed as occurring in natural habitats throughout California. There are 24 genera in this family cultivated for food, herbs, and medicinal purposes in the US. Fennel was likely introduced into California for food uses over 150 years ago, and now has become a common invasive plant of roadsides and disturbed sites in lower elevation areas of the state.

Fennel is a tall herbaceous plant, typically about 2-2.5 m tall in southern California. The plant has finely dissected leaves with long clasping petioles and upright solid stems. Stems and leaves have a strong anise (licorice) odor when crushed. Flowers are yellow in compound umbels typically 5-8 cm across. Seed are small, compressed, and ribbed. Disturbance is regarded as an important factor favoring the establishment and spread of fennel. Once introduced, it spreads by seed and persists throughout the winter as a root crown. In many locations, it has developed a nearly monotypic stand.

Three field experiments were conducted in southern California over a three year period (2004 to 2006). Two experiments were conducted at Marine Base Camp Pendleton in San Diego County, CA. The third experiment was at Sepulveda Basin Park in Los Angeles CA. Each experiment consisted of the same ten treatments, shown in the Table. Herbicide rates were based upon manufacturer's printed label information and from available literature. All three experiments utilized a completely randomized design with four replications. All locations had high populations of perennial fennel plants. The MBCP 04 experiment used an area that had been burnt in a wildfire in the fall of 2003. The fennel was re-growing from root crowns following winter rains. Neither experiment in 2005 was on a site that had burned prior to treatment.

Treatments 1 –7 were applied in a broadcast spray which delivered the desired amount of herbicide spray solution evenly over each experimental plot. Treatments 8 and 9 were applied as a spot spray targeted to all fennel plants within a plot using a hand-pump pressured backpack sprayer with a single cone pattern nozzle. These two treatments used percent solutions of herbicide in water based upon herbicide label recommendations. Data collected included cover estimates, biomass estimates, and visual evaluations.

Visual evaluations of fennel control taken approximately six weeks after treatment were similar in all three experiments (Table 5). Control was good to excellent (> 85%) for all treatments except treatment 1 (Glyphosate at 1 lbai/A) at one of the Marine Base Camp Pendleton sites and the Los Angeles site. All sites were evaluated again approximately 12 to 14 months after treatment. Fennel control remained high for all broadcast treatments including triclopyr. In all three experiments, fennel biomass was statistically lower in all herbicide treatments compared to the untreated control. Fennel cover at the two MBCP sites was not different between treatment plots prior to herbicide treatment. Similar to the biomass data, fennel cover was significantly reduced by all herbicide treatments compared to the untreated control.

Effective herbicide treatments for fennel were verified in these experiments. Results are similar and confirm experiments at other locations in southern California. Overall, treatments including triclopyr worked very well, even when evaluated 14 months after treatment (MAT). The higher rate of glyphosate worked well, but not when evaluated 14 MAT. The lower rate of glyphosate is not sufficient for consistent control of fennel. Purple needlegrass (*Nasella pulchra*), a native perennial bunchgrass, was present in both the Marine Base Camp Pendleton sites. It survived most of these herbicide treatments well, even glyphosate. This was likely because herbicide treatments were made in early spring while the grass was emerging from winter dormancy and the plants translocation stream was upward, not down to the root system.

Table. Herbicide treatments for fennel control experiments.

Herbicide	Rate (kg active ingredient per ha)	Surfactant
1. Glyphosate	1 - broadcast	none
2. Glyphosate	2- broadcast	none
3. Triclopyr	1- broadcast	Non-ionic 1% by volume
4. Triclopyr	2- broadcast	Non-ionic 1% by volume
5. Glyphosate plus triclopyr	1 + 1- broadcast	None
6. Glyphosate plus triclopyr	1 + 2- broadcast	None
7. Glyphosate plus triclopyr	2 + 1- broadcast	None
8. Glyphosate	2% by volume, spot spray	
9. Triclopyr	1% by volume, spot spray	Non-ionic 1% by volume
10. Untreated control		

Literature:

Klinger, R. 2000. *Foeniculum vulgare* Miller, pp 198-202, in Bossard, C.C., J. M. Randall, and M.C. Hoshovsky. 2000. Invasive Plants of California's Wildlands. University of California Press, Berkeley.