

Biology, Identification, Losses, and Control Options for Horseweed and Hairy Fleabane in Tree and Vine Crops in California's Southern San Joaquin Valley

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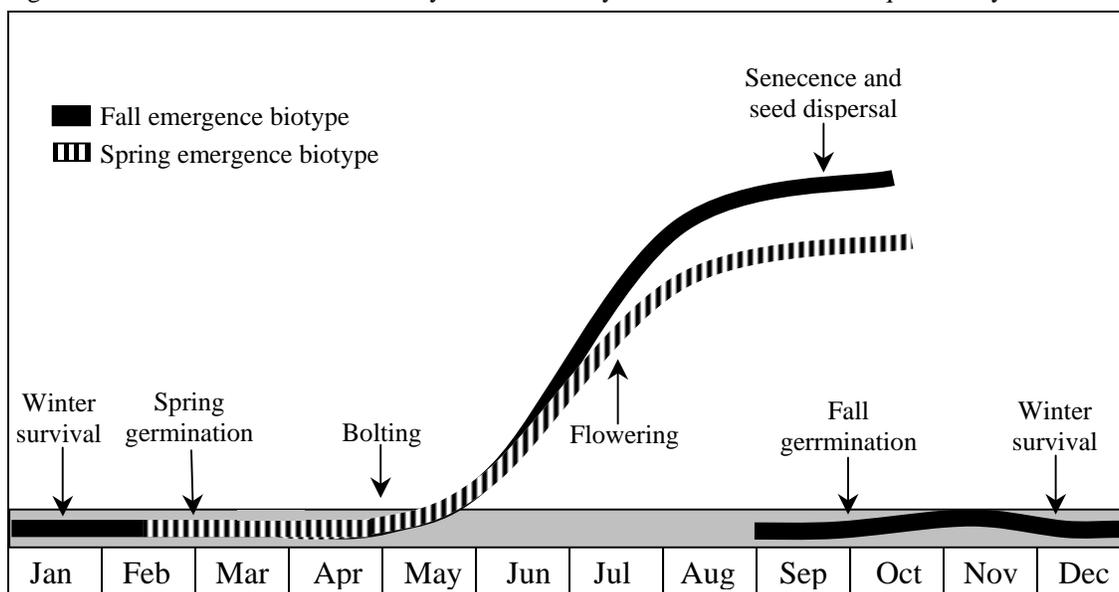
Horseweed or mare's tail (*Conyza canadensis*) and hairy fleabane (*C. bonariensis*) have become major weed pests for tree and vine growers in the southern San Joaquin Valley of California. While these weeds have been in California a long time, only recently have they become so wide-spread. These weeds are also commonly found along road sides, irrigation ditches, railroad tracks, and other rights-of-ways. Observations made since 2002 suggest that this increase in presence is due to several reasons, primarily; 1) reduced weed control inputs in vineyards, especially when raisin prices were depressed, 2) reduced use of effective preemergence herbicides, particularly in ground water protection areas, 3) improper timing of postemergence herbicides, and 4) inability during a prolonged wet winter in 2004/2005 to get into fields on time to apply herbicides.

In 2005, we documented the first case of glyphosate-resistant horseweed in California along an irrigation canal system, which might account for these weeds escaping control in some locations. In our findings, the horseweed biotype was resistant to glyphosate at as much as 4 lb ai/acre with weeds less than 6" tall. Including California, there are now 11 states that have documented cases of glyphosate-resistant horseweed in the USA. Hairy fleabane resistance to glyphosate has only been documented in South Africa and Spain. It is essential for growers, PCAs, and ranch managers to understand the biology of horseweed and hairy fleabane, types of losses they may cause, and control strategies available to prevent their further spread.

Biology

Horseweed and hairy fleabane are summer annual weeds belonging to the Asteraceae (sunflower) family. Unlike most summer annuals which begin germinating as early as late-winter, we see different biotypes of horseweed and hairy fleabane emerging in fall and spring (Figure 1). Plants emerging in the fall (September to November) can go through a vegetative or winter survival stage (similar to biannual weeds). Spring-emerging plants usually germinate from March to May. Both biotypes appear to bolt at a similar time, beginning in May. While these biotypes may look similar in size in the spring, fall-emerging plants may have larger root systems, possibly explains the lack of control with certain postemergence herbicides, like glyphosate. Both weeds begin flowering in July and produce mature seed from September thru October.

Figure 1. Observed horseweed and hairy fleabane life-cycle in the central San Joaquin Valley



Horseweed and hairy fleabane adapt to irrigated orchards and vineyard systems as well as drier, non-crop areas. Both species produce large amounts of seed, regardless of the setting (Table 1). Seed is dispersed solely by the wind. The hairy pappus on the seed, allow the seed to travel distances of ¼ mile or more, much like that of dandelion, establishing themselves in previously un-infested areas. With this, one can clearly understand why they are readily observed along well-traveled road sides. Unlike most other weeds, these do not require a period of dormancy to germinate, making it difficult to predict emergence. Mature seed falling to the soil in September or October can sprout as soon as adequate moisture becomes available (usually with the first rains). These weeds appear to prefer undisturbed situations, such as tree and vine rows, which are easily warmed during sunny parts of the day. Seed burial and debris on the soil surface seem to discourage germination. Seed survival is short (generally 3 years or less) under most conditions.

Identification

At early stages of growth, both weeds are often confused with chickweed or shepherd’s-purse (common winter annuals), but they are completely different and need to be recognize early to optimize control, especially where postemergence herbicides are used. As these plants mature, their differences become quite apparent. Table 1 below provides some key differences in plant characteristics to help identify the two species. Colored photographs of these weeds at different growth stages and in various settings are shown on the final two pages.

Table 1. Key characteristics of horseweed and hairy fleabane

Characteristics	Horseweed	Hairy fleabane
Leaves	Seed leaves dull green, oval, covered with soft, fine hairs. True leaves dark green with fine toothed margins, forming a compact rosette. Lower leaves inversely lance shaped, usually serrated margins, with short stalks. Upper leaves more narrow, without stalks, smooth around the margins, alternate and crowd around the stem, up to 4” long.	Seed leaves dull green, oval, covered with soft, fine hairs. True leaves light or dull green, somewhat crinkled. Mature leaves narrow, crinkled, grayish in color, slightly toothed around the margins, less than 3” long.
Mature plant	Erect, single stem, up to 10’ tall, somewhat rough to the touch, with shaggy hairs.	Multi-branched, without a central stem growing 1½ to 3’ tall, hairy.
Flowers	Small, yellowish flower heads at the ends of branched stems at the top of the plant.	Small, yellowish flower heads at the ends of branched stems at the upper part of the plant.
Seed	Tiny, narrow, tan colored, with firm grayish hair (pappus) at upper end. Up to 230,000 per plant.	Tiny, narrow, tan colored, with firm grayish hair (pappus) at upper end. 10,000 or more per plant.

Losses Caused

Both weeds compete significantly for water and nutrients, especially where low-volume surface drip or micro-sprinkler irrigation is used. They can be particularly competitive during the first two years of crop establishment, reducing vigor and delaying maturity. While they do not necessarily reduce growth in mature orchards and vineyards, they continue to compete for valuable resources. Horseweed, in particular, impedes with daily activities of spraying and harvest, especially in grapes. Horseweed is also known to be a host for the Glassy-winged sharpshooter (a carrier of Pierce’s Disease). These weeds may also interfere with the drying process of dried on the vine (DOV) raisins by raising the humidity level in the vine canopy. Where paper trays are used for drying raisins on the soil surface, seeds from mature plants can land in the folds of drying raisins and contaminate them.

Control Strategies

- Do not let these plants produce new seed. As a rule of thumb, apply control tactics before flower set.
- Apply preemergence herbicides before weeds emergence. Where these weeds emerge in fall and spring, consider splitting applications to meet these multiple flushes (see table 2 for herbicides).
- Apply postemergence herbicides when these weeds have fewer than 18-21 leaves (well before bolting). 2,4-D and Rely® seem to provide the best control at these early stages. Roundup Weathermax®, Touchdown®, and other glyphosate-based products work well as long as rates are used at 1-2 lb ai/acre. Since 2,4-D is only effective on certain broadleaf weeds, mix it with glyphosate where possible to broaden the weed control or where weed resistance is suspected. Relying on a single postemergence program year-after-year often leads to weed shifts or possibly weed resistance. Closely monitor for escapes and changes in weed types and alter your

treatment choices to maintain control. If you rely on postemergence herbicides for your primary means of controlling these weeds, time each application when these weeds are small or control will be reduced (see table 2 for herbicides).

- Use in-row shallow cultivation to disturb the soil to prevent emergence. If these weeds are already emerged, use mechanical cultivation similar to postemergence herbicides (<21-leaf stage). Possible equipment include Bezzerides®, Weed Badger®, Clemens® weed blade, L&H® hoe plow and other in-row mulchers and tillers. In most cases, mowing and flaming do not provide reliable control.
- Use shovels, hoes, and other hand tools to cut the plants below the soil surface and before flowering.

Table 2. Herbicides in orchards and vineyards for horseweed and hair fleabane control

Preemergence	Lb ai/A	Control Rating
bromacil (Hyvar X®)	3.2	Control
bromacil + diuron (Krovar®)	3.2	Control
diuron (Karmex®, Direx®)	2.5	Partial
eptc (Eptam®)	3.0	Control
flumioxazin (Chateau®)	0.375	Partial
isoxaben (Gallery T&V®)	1.0	Control
norflurazon (Solicam®)	2.0	Partial
oxyfluorfen (Goal 2XL®, Galigan®, etc.)	2.0	Partial
simazine (Princep®, Caliber 90®, etc.)	2.5	Control
simazine + diuron	1.5 + 1.5	Control
thiazopyr (Visor®)	1.0	Partial
Postemergence	Lb ai/A	Control Rating
diquat (Reglone®)	1.0	Partial*
glufosinate (Rely®) + AMS	1.0 + 10 lb/100 gal	Control*
glyphosate (Roundup Weathermax®, Touchdown®, etc.)	1.0 – 2.0	Control*
paraquat (Gramoxone Max®, etc.)	2.0	Control*
2,4-D (Weedaxe®, Dri Clean®, etc.)	1.4	Control
*Assumes treatment when weeds are small (<21 leaves) Refer to appropriate label and follow all use recommendations.		

In summary, there is little doubt that horseweed and hairy fleabane populations are on the increase in the southern San Joaquin Valley in California. To help resolve this problem, everyone needs to do their part and implement a plan of attack as soon as possible. To be successful, identify these weeds early and apply appropriate treatments when they are most vulnerable to control and do not let them go to seed. Since these weeds can emerge in the fall and in the spring, it may be necessary to split preemergence treatments to catch the different germination periods. When using postemergence herbicides, treat when they have fewer than 21 leaves or control will be greatly reduced. Thorough wetting of the weed foliage is necessary for effective control. Disturbing the soil mechanically can impede germination and cultivating when weeds are small can give effective control. Additionally, timely control around field margins, fence lines, road sides, and canal banks are essential components for eradication.

Horseweed (*Conyza canadensis*)



Seedling plant with 3 true leaves and older plant with 8 to 10 leaves.



Horseweed plants bolted up to 18" tall.



Single stem covered with short hairs and dark green leaves with toothed margins, alternating on the stem.



Flower and seeds attached to pappus, allowing for wind dissemination.



Mature horseweed growing in a vineyard.



Mature horseweed growing along a roadside.

Hairy fleabane (*Conyza bonariensis*)



Seedling plant with 2 true leaves and older plant with 8 true leaves.



Young plant that is bolting 6" tall.



Branched stems with leaves that are pale green, crinkled, have toothed margins, and are covered with shot hairs.



Mature plant and flower and seeds attached to pappus, which are spread by the wind.



Mature hairy fleabane growing in almonds.



Mature hairy fleabane growing in alfalfa.