

Yellow Starthistle Invasion and Management

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INVASION

Yellow starthistle (*Centaurea solstitialis*) is a winter annual (a plant that germinates from seed in the fall and over-winters as a rosette) that has invaded rangelands throughout the western United States. In the Pacific Northwest, the most susceptible rangelands are those with loamy soils, south facing slopes, receiving 12-25 inches (winter/spring peak) of precipitation. Yellow starthistle favors sites originally dominated by perennial grasses; primarily bluebunch wheatgrass (*Agropyron spicatum*), Idaho fescue (*Festuca idahoensis*), and Sandberg's bluegrass (*Poa sandbergii*). This weed does not appear to compete well with sagebrush, but readily invades areas of soil and/or vegetation disturbance within sagebrush communities.

The competitive success of yellow starthistle is directly related to its rapid growth and resource capture (Sheley et al. 1993, Sheley and Larson 1994a). However, yellow starthistle seedlings and rosettes are sensitive to resource stress (competition for light, water, nutrients, and space) and are subject to high mortality when stress conditions prevail. In general, yellow starthistle seedlings grow more rapidly than most perennial grass seedlings. This characteristic leads to poor grass stand establishment when new grass seedlings are infested with yellow starthistle. Once established, vigorous stands of perennial grass have been shown to limit re-invasion by yellow starthistle (Larson and McInnis 1989a, Larson and McInnis 1989b). Perennial grasses that initiate growth in the fall, maintain some growth through the winter months, and continue growth into mid-summer have the best success in competing with yellow starthistle.

In annual-dominated rangelands (i.e. cheatgrass [*Bromus tectorum*]) with deep soil, the rapid and deep penetrating roots of yellow starthistle tend to avoid direct competition with the fibrous root systems of annual grasses (Sheley and Larson 1994b). In areas where cheatgrass is widely dispersed, yellow starthistle root and shoot growth rates can be several times faster than cheatgrass. This growth attribute results in deep soil penetration by starthistle roots, continued growth well into the later part of the growing season, and increased starthistle seed production. In such circumstances, yellow starthistle can dominate the site. However, yellow starthistle growth rates tend to decline as plant density increases (cheatgrass and yellow starthistle) and/or soils become shallow (Sheley and Larson 1994b). This shift in competitive ability means that yellow starthistle will take on the role of a secondary rather than a dominant species when these conditions prevail.

PREVENTION

Prevention techniques are the least expensive and most effective method of limiting

yellow starthistle invasion on productive rangelands. Proper grazing management is an essential element in this strategy and, although additional research needs to be conducted, there are several key grazing elements that can be identified at this time. An effective grazing prescription should include moderate grazing (typically 30-50 percent utilization of annual production), altering the season of grazing, rotating livestock to allow plants to recover before being regrazed, and promoting litter accumulation. Grazing in this fashion will limit yellow starthistle germination and promote mortality of seedlings and rosettes through the maintenance of desirable vegetation cover and vigorous grass growth.

Yellow starthistle prevention cannot be achieved through grazing management and plant competition alone. Disturbance (soil and plant community disturbance) is a natural component of all plant communities and is an essential part of plant community development and maintenance. Unfortunately, yellow starthistle is well adapted to take advantage of most grassland disturbances. Therefore prevention programs need to include a rangeland monitoring component so that isolated patches and individuals of yellow starthistle can be identified, flagged, and treated for control. In most cases isolated infestations should be flagged for several years so that treatment effectiveness can be followed through time.

CHEMICAL CONTROL

An effective control program requires disruption of the annual cycle of yellow starthistle invasion and the closure of the plant community to rapid re-invasion. Yellow starthistle control involves using combinations of treatments, including herbicide applications (with follow-ups), cultivation and seeding desired grasses. A number of herbicides are available to initiate the process of yellow starthistle control. Specific herbicides and application recommendations should be developed through consultation with extension and weed control agents. Herbicide application should be done by qualified individuals according to label instructions.

Following initial control, a perennial grass cover should be established on the site to interrupt the cycle of re-invasion. Grass stand establishment will increase the level of resource stress faced by starthistle seedlings and rosettes, limiting their survival and the rate of re-invasion. Our demonstration and research plots using Oahe intermediate wheatgrass (*Agropyron intermedium*), Tualitin tall oatgrass (*Arrhenatherum elatius*), Paiute orchardgrass (*Dactylis glomerata*), Covar sheep fescue (*Festuca ovina*), Critana thickspike wheatgrass (*Agropyron dasystachyum*), and Sherman big bluegrass (*Poa ampla*) have successfully controlled or reduced the rate of starthistle re-invasion (Larson and McInnis 1989a, Larson and McInnis 1989b). The degree of success or failure of any seeding will depend on the selection of a grass species suited to the site, the density of the established stand of grass and the land manager's ability to maintain grass vigor. Yellow starthistle growth rates and seed viability (at least 15 years) require a long-term commitment to starthistle control programs. This commitment will likely include an initial control and vegetation establishment program followed by a program of vegetation management and monitoring with periodic chemical

application to control localized infestations. We recommend that land managers refrain from fertilizing new grass seedings that are infested with yellow starthistle because that practice has been shown to increase starthistle production (Larson and McInnis 1989a).

BIOLOGICAL CONTROL

Three weevil species (*Bangasternus orientalis*, *Estenopus villosus*, *Larinus curtis*) and two flies (*Urophora sirunaseva*, *Chaetorellia australis*) have been released in California and the Pacific Northwest during the past 8 years for yellow starthistle control. All of these agents attack the flowerhead. The goal of these control agents is to either reduce seed production and reduce colonization or establishment of this species. The effectiveness of insect control on yellow starthistle is currently under investigation and it is too early to determine their long-term impact on yellow starthistle populations.

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