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DYERS WOAD

Biology, Distribution and Control

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Dyers woad (*Isatis tinctoria* L.: Brassicaceae) is an alien invader in the Intermountain West where its dense infestations degrade native plant ecosystems and reduce forage production.

Where did it come from?

This member of the mustard family is apparently a native of southeastern Russia. Dyers woad history as a crop extends far back into antiquity. In the 17th and 18th centuries, an industry based on blue dye extracted from dyers woad leaves was a major source of wealth to England. Production of dye from this species declined as better dyestuffs were discovered, and many woad dye manufacturers turned to production of other chemicals, which now include the herbicides used to control weeds such as dyers woad. The modern term "weed" was apparently derived from the old English name "woad."

How did it get here?

Alfalfa seed containing dyers woad seed was imported from Ireland to Siskiyou County, California, in the early 1900's. The contaminated seed was apparently responsible for the introduction of dyers woad into northern California and southern Oregon. A third introduction was near Brigham City, Utah, about 1910, also from alfalfa seed contaminated with dyers woad seeds. That infestation has expanded to include parts of northern Utah, western Wyoming and southern Idaho. Dyers woad spread is associated with travel and commerce of man, and with movement of animals and birds. Seeds are transported by flower collectors, in hay, in crop seed, on vehicle undercarriages, in mud, in debris and many other ways.

Fig. 1. Dyers woad in flower.

Habitat

Dyers woad in Idaho grows between 3,000 and 8,800 feet in elevation, typically in full sun. Dyers woad infestations generally begin along roadsides and railroad rights-of-way. From there, the weed spreads readily to rangeland and crop fields. It is found in non-irrigated pastures and winter wheat, in irrigated alfalfa fields and along waterways, as well as along roadsides, railroad embankments, gravel pits and levees.

When dyers woad invades rangeland, annual grasses are soon suppressed. Perennial grasses seem to coexist moderately well with dyers woad, perhaps due to differences in growth timing and root systems. Generally, however, dyers woad's height, leaf size and leaf arrangement give it a light-gathering advantage that shades range grasses.

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Description and Biology

Dyers woad produces bright yellow flowers grouped in an umbrella-shaped top that makes single plants or patches of dyers woad easily recognizable. At flowering, dyers woad has erect, widely-branched stems, which may be solitary or multiple and usually are 1 to 5 feet in height (Fig. 1). Like all other members of the mustard family, each dyers woad flower has four petals, four sepals and six stamens. Both petals and sepals are yellow. The petals are narrow and twice as long as the sepals. Seed pods are pendulous, slightly pear-shaped, flattened, winged, 5 to 7 inches long and ½ to ¾ inch broad. They are generally one-seeded and hairless, green in color at first but dark purplish-brown to black when ripe (Fig. 2). These black seed pods provide an excellent way to identify the weed after the flowering period.

Dyers woad has both biennial and perennial plant characteristics. In non-crop land, seed germination, root development and rosette formation occur in fall or spring (Figs. 3, 4). The early spring rosette leaves are bluish-green and slightly hairy with a thick silvery midvein. Bolts (Fig. 5), flowers (Fig. 1) and fruits (Fig. 2) occur the following season. At the bolting stage, a stalk emerges from the rosette center and bears flowers as it nears its full height. At maturity, the main taproot is thick, woody and up to 18 inches long. The lowest leaves are 1½ to 7 inches long and succulent (Fig. 4). Stem leaves have no petiole and are long and narrow, clasping the stem at the base (Fig. 5).

Phenology

Time of bloom is correlated with elevation, probably as a function of temperature. Moisture, soil, light and site aspect also affect the timing. Plants at 5,000 feet in Franklin County are in full to late bloom on June 10. Dyers woad flowers by mid- to late May at 4,500 foot elevation, by mid-June at 6,000 feet and through mid-July at 7,000 feet. Dyers woad at 3,500 feet in eastern Idaho is normally in late bloom to seed set stages by June 15. Plants lose ripe fruits by July 20 at 4,700 feet.

A dyers woad plant may live for only 1 year, but more commonly the crown buds produce vigorous new growth for 2 years or more. This enables dyers woad to survive, compete and reproduce more successfully.

The success of dyers woad in plant competition is likely due to several factors, including excellent seedling vigor, rapid spring growth, a deep taproot, large succulent leaves, tall growth, leaf arrangement, prolific seed production and possibly production of natural plant toxins (allelopathic compounds).

Distribution

Dyers woad has been found nearly in all counties of southeastern Idaho. Small, isolated infestations have also been identified in a few southcentral and southwestern counties (Table 1). A University of Idaho survey showed that the main body of the Idaho dyers woad infestation is in the Bear River Valley, both east and west of the Wasatch Range in Bear Lake, Caribou and Franklin counties, and in the Marsh Creek and Portneuf River drainages in Bannock County (Fig. 6). It grows primarily on the east sides of these valleys, extending up the canyons, generally on south-facing slopes.

Overall, dyers woad infests over 1,300 quarter-sections in Idaho and occurs on over 24,000 acres in the state.

Control

Dyers woad is designated noxious by Idaho law. This means that control is required. Small infestations can and should be eliminated before they become more widely established. A persistent, intensive "search and destroy" program is essential for successful dyers woad eradication. Eradication of dyers woad from any area will require ensuring that no plants produce seed for at least 10 years, that no new plants are found for 5 years and that no more dyers woad seeds are brought into the area.

Biological Control — No effective control parasites of this weed are yet known. A rust fungus (*Puccinia thlaspeos*) was observed on dyers woad in Caribou County by University of Idaho scientists. Infected plants were stunted severely, but the disease was not widespread. This fungus has been found on other weedy mustards. Weed scientists and plant pathologists are attempting to develop it for practical application as a biological control.

Dense stands of vigorous perennial grass and other perennials provide excellent biological control of dyers woad through competition, but cannot prevent the weed

Table 1. Counties containing dyers woad.[1]

County	Quarter-sections (approx.) in which dyers woad exists	Acres on which dyers woad exists
Ada	2	2
Adams	1	1
Bannock	302	4,500
Bear Lake	612	15,000
Bingham	8	50
Blaine	8	10
Bonneville	7	7
Caribou	223	4,000
Cassia	1	1
Clark	8	8
Franklin	90	500
Fremont	11	11
Jefferson	2	2
Madison	19	19
Oneida	4	4
Power	2	2
State total	1,300	24,100

[1]If any dyers woad plants are found on a section or an acre, that area is considered infested. Counties with fewer than 20 infested sections generally have an average of less than 1 acre per section actually covered by dyers woad.

Fig. 2. Dyers woad plant bearing mature, black seed pods.

Fig. 3. Seedling of dyers woad.

Fig. 4. Rosette of dyers woad.

Fig. 5. Dyers woad in "bolting stage."

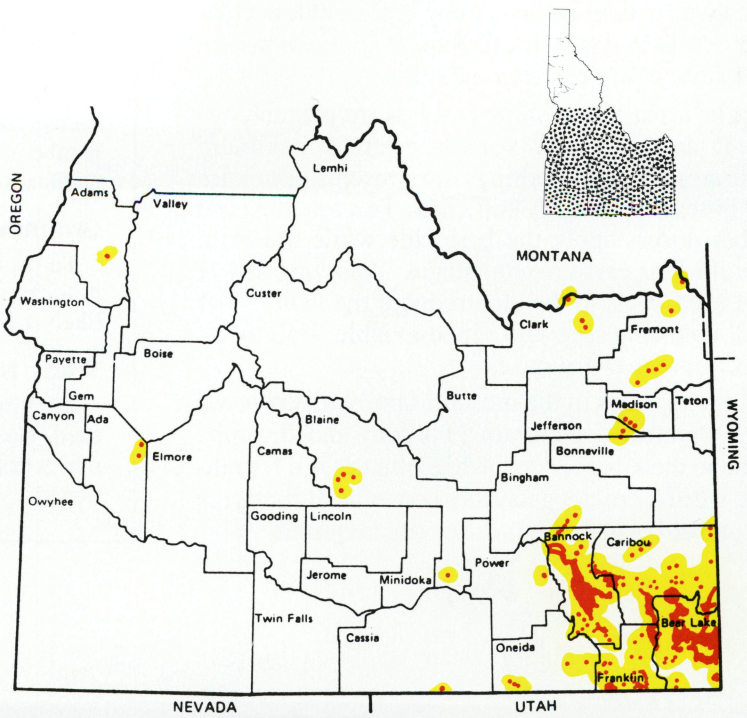

Fig. 6. Occurrence of dyers woad in Idaho. One dot represents a quarter-section on which dyers woad has been found. Occurrence is highly probable in yellow areas.

from surviving. Any means to promote vigor of desirable species will aid greatly in suppressing dyers woad infestation. Land that is in danger of invasion by dyers woad but not yet infested should be managed for best growth of desirable vegetation, so that the weed cannot easily invade and dominate. This may require reseeding or revegetating by other means if desirable species are depleted or low in vigor. Grazing management or other land use practices may need to be altered to allow renovation.

Mechanical Control — Frequent and consistent pulling or cutting before dyers woad plants flower can be effective on very small areas. When isolated plants or small patches are discovered, this is often the most appropriate treatment. Cutting must be below the crown, normally 2 inches below the soil surface if plants are large. Be sure to note the location precisely for future reexamination. Field tillage normally used to produce spring-planted annual crops is also effective for short-term control, and summer fallow tillage reduces weed density. No economical mechanical methods have been reported for large infestations on nonarable land.

Chemical Control — The most economically effective herbicide registered for dyers woad control is 2,4-D. The most effective, economical time to treat is in early spring from March to May, depending on location when dyers woad is in **seedling** and **small** rosette stages. This requires searching and mapping infestations between bolting and maturity when the weed is more visible, and then applying control practices the next spring when it is in the susceptible stages. Destroying larger plants requires much more herbicide. For economical spot treatment on small areas, spray to wet the plants with a solution containing 1 percent low volatile ester 2,4-D in water or oil. Repeat applications are necessary for complete eradication.

For large areas where large rosettes are present, apply 2,4-D amine or low volatile ester at maximum labelled rates. If only seedlings are present, minimum labelled doses are normally sufficient. To avoid the need for higher doses, apply the herbicide while the plant is in seedling or early rosette stages. Applying 2,4-D after the seed starts to develop reduces the viability of the seed, but some seed will remain viable. Follow label directions in every case.

Like other species in the mustard family, dyers woad is fairly tolerant to picloram (Tordon) and dicamba (Banvel), so these herbicides, while often useful for other range weeds, are not generally economical for dyers woad control because high doses are required.

Integrated Control — For long-term successful control, a combination of biological, mechanical and chemical practices is best. If dyers woad has invaded depleted range or pasture, use of herbicide alone may only return the land to its previous depleted and weed-susceptible condition. Reseeding will often help renovate badly depleted range after a herbicide treatment. Deferral of grazing is usually advisable immediately after treatment of dense dyers woad, to allow perennial forage to recover. Fertilization will often substantially extend the control by herbicides. Landholders who are trying to rid their land of dyers woad should take precautions to prevent reinvasion and to stop new spot infestations before they expand.

Prevention

Preventing infestations of dyers woad is a realistic, attainable goal. It involves full use of the provisions of the noxious weed law. It requires special effort to prevent seeds from entering a property. This means that equipment and vehicles, animals and animal feed, crop seed and other materials entering a property should be examined and cleaned. It may require placing restrictions on free or unmonitored public access to your property. If these kinds of preventive practices are not followed, the consequences are usually loss of property use and value to dyers woad and other weeds.

Eradicating the weed from rights-of-way and other frequently traveled or publicly used areas is especially important to minimize spread of dyers woad.

Pesticide Residues

These recommendations for use are based on currently available labels for each pesticide listed. If followed carefully, residues should not exceed the established tolerances. To avoid excessive residues, follow label directions carefully with respect to rate, number of applications and minimum interval between application and reentry or harvest.

Groundwater

To protect groundwater, when there is a choice of pesticides, the applicator should use the product least likely to leach.

Trade Names

To simplify information, trade names have been used. No endorsement of named products is intended nor is criticism implied of similar products not mentioned.

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