



Weed Common Name

Dyer's woad

Weed Botanical Name

Isatis tinctoria L.

Points to Consider

- Typically grows as a biennial and is most often found in dry, disturbed locations. In Idaho, it is most prevalent in the Southeast.
- Plants grow as rosettes the first year, with leaves up to 4 inches long that are widest at the tips and have long, narrow leaf stalks.
- Plants grow to 4 feet tall the second year, producing large clusters of small yellow flowers that develop into hanging, teardrop-shaped fruits. Fruits are lime green at first but turn deep purple to black upon maturity.
- Large infestations can displace native plant species and reduce agricultural land productivity.
- Can be managed with proper hand pulling, cultivation, goat grazing, and herbicides.
- A noxious weed in Idaho.

Integrated Pest Management of Dyer's Woad

Importance

Dyer's woad is an important rangeland and agricultural weed (Figure 1). It competes with native and/or preferred forage species for water, light, and nutrients. Most grazing animals avoid dyer's woad, which further increases its competitive ability and the displacement of desirable species. In the northwestern United States, dyer's woad can reduce rangeland grazing capacity more than 35%. It is also associated with declining soil fertility. In Utah, the weed is estimated to cause annual crop and rangeland production losses of \$2 million.



Figure 1. Dyer's woad infestation. Courtesy of Travis McMahon, MIA Consulting, [CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/), no alterations.

Description, Biology, and Ecology

For a visual-based description of the history and identification of dyer's woad, along with suggestions for differentiating it from look-alike species, see <https://www.youtube.com/watch?v=gKqqwONdG8w>.

Dyer's woad (Figure 2) is a terrestrial weed that spreads by seed. In northwestern North America, it typically grows as a

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biennial, but less frequently it may grow as a short-lived perennial or even less frequently as a winter annual. Native to Asia, Europe, and northern Africa, dyer's woad was intentionally introduced to North America by early colonists in the 1600s as a crop species for producing



Figure 2. Dyer's woad flowering plant (<https://www.inaturalist.org/observations/3285622>). Courtesy of Cheryl Beyer (via iNaturalist), [CC BY-NC 4.0](#), no alterations.

blue textile dye. It invades rangelands, fields, rocky hillsides, roadsides, fence lines, cropland, and other disturbed areas. Once established, it is capable of spreading outward into undisturbed habitats. It thrives in well-drained, dry, and alkaline soil, but tolerates a wide range of growing conditions.

Dyer's woad most commonly grows as a biennial. Seedlings (Figure 3) germinate in fall or early spring, quickly develop deep (up to 5 feet) taproots, and remain as rosettes the entire first year before flowering



Figure 3. Dyer's woad seedling. Courtesy of Travis McMahon, MIA Consulting, [CC BY-NC 4.0](#), no alterations.



Figure 4. Dyer's woad rosette. Courtesy of Travis McMahon, MIA Consulting, [CC BY-NC 4.0](#), no alterations.

and setting seed the second year. Rosettes are circular arrangements of relatively flat, basal leaves. The rosette leaves (Figure 4) grow up to 4 inches long and up to 1.5 inches wide with noticeable leaf stalks. Leaf tips are wider than leaf bases. Rosette leaves are characteristically bluish green, often covered in fine hairs, and have slightly wavy margins and an obvious whitish midvein on the upper side. In the second

year, dyer's woad produces one to a few flowering stems up to 4 feet tall. Flowering stems have numerous branches in the top half, leading to a characteristic umbrella-like appearance.

Stem leaves are alternate, decreasing in size further up the stem. Upper stem leaves clasp the plant stem (Figure 5). They have a



Figure 5. Dyer's woad stem leaves (<https://nenature.org/species/isatis-tinctoria>). Courtesy of Chiara Catalano (via NE Nature Explorer), [CC BY-NC](#), no alterations.

somewhat rubbery feel and may have slightly toothed margins. If hairs are present, they are usually only along leaf margins and the underside of the midvein. Large yellow flower clusters form at the stem and branch tips in late spring. Each flower (Figure 6) is ~¼ inch across with four petals and six stamens.

Fruits are teardrop-shaped and hang from the stems. They are lime green at first but turn deep purple to black upon maturity (Figure 7). A typical plant produces 85–500 seeds. Most remain viable for only one year, though some may stay viable longer, especially when buried in the soil. After plants produce fruit, they typically die.



Figure 6. Dyer's woad flowers. Courtesy of Travis McMahon, MIA Consulting, [CC BY-NC 4.0](#), no alterations.



Figure 7. Dyer's woad teardrop-shaped fruit. Courtesy of Travis McMahon, MIA Consulting, [CC BY-NC 4.0](#), no alterations.

When growing as a winter annual, seedlings germinate in fall and overwinter as small rosettes, then flower late the following spring. When behaving as a short-lived perennial, plants typically remain as rosettes for at least two years before flowering and dying the following year.

Weed Management

Management Tactics

Successful weed management includes routine monitoring throughout the growing season and accurate identification of the weeds present. Base management decisions on the species at the site, the level of infestation, and the availability of labor, resources, and management options. Generally, a combination of management tactics produces the best results. Primary management tactics in Idaho for this weed include hand pulling and digging, tilling, goat grazing, and herbicides.

Prevention

- Avoid transporting dyer's woad seeds on clothing, equipment, and animals.
- Use certified weed-free seed, hay, soil, soil amendments, and other landscaping materials.
- Regularly monitor, especially along transportation corridors and waterways, and rapidly control any newly established plants before seeds develop.

Mechanical

- Remove small infestations by hand pulling or digging, ensuring the removal of at least the top 6 inches of the taproot before flowers develop. If the plants have flowered and fruits are present, bag and properly discard all plant material.
- Till infested areas only if followed by seeding desirable plants; cultivation may be necessary in both spring and fall.
- Mowing is largely ineffective against dyer's woad since it is infeasible in rugged habitats where dyer's woad often grows; cut plants can regenerate from the root crown; and plants can still flower on shorter stems. However, repeated mowing throughout the growing season may reduce seed production.

Cultural

- In a crop, pasture, or landscape setting, use plant selection and adequate fertilization and irrigation to establish healthy, competitive plant communities.
- Sheep and cattle typically avoid dyer's woad, but targeted goat grazing may be effective if applied prior to flowering. Avoid overgrazing, which reduces competing vegetation and which can leave bare ground, where dyer's woad may germinate and establish.

Biological

- No classical biological control agents are currently available for dyer's woad; however, a seed-feeding and a shoot-mining weevil are both being investigated for their biocontrol potential.
- A native rust fungus, *Puccinia thlaspeos* Ficus and C. Schubert, was found infecting dyer's woad in Utah in 1978 and has since been found throughout the Northwest. Although this pathogen can significantly reduce dyer's woad seed production, infection rates are typically low and it does not control dyer's woad alone. At present, this rust cannot be intentionally redistributed without obtaining permission from the United States Environmental Protection Agency.

Chemical

The [PNW Pest Management Handbooks](#) website recommends herbicides to use in the management of dyer's woad (summarized in Table 1). Refer to the label on your product of choice for proper rates of application. Because dyer's woad has a thick leaf with a waxy surface, adding a surfactant to the herbicide mixture helps the product penetrate rather than bead up and roll off leaves. As with all herbicide usage, take several precautions:

- Ensure that both dyer's woad and your intended use (location, land use, proximity to water, etc.) are listed on the product label chosen.
- Follow herbicide label restrictions concerning weather conditions to ensure treatment success and to avoid volatilization and off-target drift.
- Because many herbicides have significant soil activity, be careful applying herbicides in or near the root zone of nontarget plants such as trees, shrubs, and garden plants.

- When possible, rotate the use of herbicides from different chemical families to prevent the development of herbicide resistance.

Further Reading

- DiTomaso, J. M., G. B. Kyser, S. R. Oneto, R. G. Wilson, S. B. Orloff, L. W. Anderson, S. D. Wright, J. A. Roncoroni, T. L. Miller, and T. S. Prather. 2013. *Weed Control in Natural Areas in the Western United States*. Davis: University of California Weed Research and Information Center.
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Weed Science 36(2): 186–93. <https://doi.org/10.1017/S0043174500074695>.
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- Spataro, G., and V. Negri. 2008. "Assessment of the Reproductive System of *Isatis tinctoria* L." *Euphytica* 159: 229–31. <https://doi.org/10.1007/s10681-007-9479-2>.
- Thomas E., and B. R. Kropp. 2011. "Some Effects of Abiotic Stress on Infection of Dyer's Woad (*Isatis tinctoria* L.) by *Puccinia thlaspeos* C. Schub.: Implications for Biological Control." *American Journal of Agricultural and Biological Sciences* 6(1): 45–51. <https://doi.org/10.3844/ajabssp.2011.45.51>.

Online Resources

- Biological Weed Control at the University of Idaho. 2022. "Invasive Plant Identification Series Western North America: Dyer's Woad (*Isatis tinctoria*).
YouTube video, 3 min., 23 sec. <https://www.youtube.com/watch?v=gKqgwONdG8w>.
- CABI Invasive Species Compendium, "Isatis tinctoria (Dyer's Woad)," <https://www.cabidigitallibrary.org/doi/full/10.1079/cabicompendium.28902>.
- Invasive Species of Idaho, "Dyer's Woad (Control)," <https://invasivespecies.idaho.gov/dyers-woad-factsheet>.
- US Forest Service Fire Effects Information System, "Isatis tinctoria," <https://www.fs.usda.gov/database/feis/plants/forb/isatin/all.html>.

Table 1. Herbicides recommended for control of dyer's woad. v/v = volume/volume percentage.

Active Ingredient	Trade Names	Family	Timing	Notes
2,4 D	Several names	Phenoxyacetic acid	Spring or fall to rosettes or in early summer when plant is in bud	Broadleaf-selective and has no soil activity. For satisfactory control, it may be necessary to treat infested areas during both the rosette and bud growth stages.
aminocyclopyrachlor + chlorsulfuron	Perspective	Pyrimidine carboxylic acid + Sulfonylurea	Actively growing plants in spring	Provides broad-spectrum control of many broadleaf species. Can injure several grass species. Do not treat in the root zone of desirable trees and shrubs. Not approved in all states. Adjuvants can be used; these include methylated seed oils 0.5%–1% v/v, nonionic surfactants at 0.25%–1% v/v, and crop oil concentrates at 1% v/v. Can be applied using an invert emulsion rather than water.
Chlorsulfuron	Telar	Sulfonylurea	Before or after weeds emerge, but results are best on young, actively growing weeds	Generally safe on grasses. Use on noncropland only. Persists in soil for a long time. Do not treat powdery, dry soils or light, sandy soils if rain is not likely soon after treatment. Do not apply to frozen ground. Constantly agitate while mixing and spraying. Add 0.25% v/v nonionic surfactant to spray mixture. Labeled for use on pasture, range, Conservation Reserve Program, and noncropland.
Imazapic	Plateau	Imidazolinone	Rosettes or after blossoms open (full bloom) until plants desiccate	Will not injure most grasses and has some soil residual activated. Before using, note crop rotation restrictions. Not registered for use in all states. Add 1 quart per acre methylated seed oil to the spray mix.
Metsulfuron	Escort and others	Sulfonylurea	Actively growing plants up to early flowering	Generally safe on grasses. Tolerance increases as flowering stage progresses. Apply only to pasture, rangeland, and noncrop sites; consult labels. Not registered for use in all states. Use a nonionic or silicone surfactant.

Caution: Read Pesticide Labels

Pesticide labels override other recommendations.

ALWAYS read and follow the instructions printed on the pesticide label. The pesticide recommendations in this UI webpage do not substitute for instructions on the label. Pesticide laws and labels change frequently and may have changed since this publication was written. Some pesticides may have been withdrawn or had certain uses prohibited. Use pesticides with care. Do not use a pesticide unless the specific plant, animal, or other application site is specifically listed on the label. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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.

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