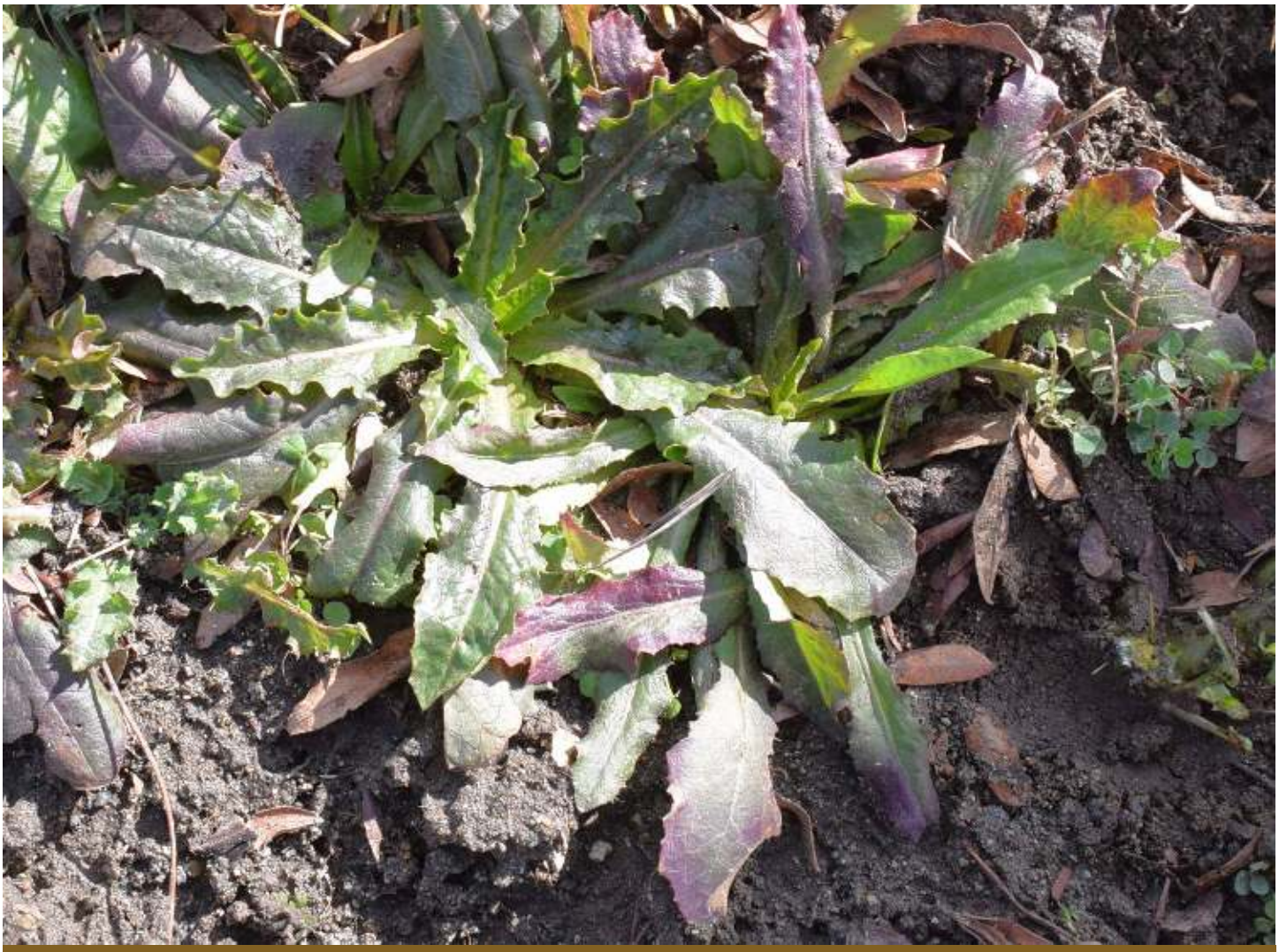

INTEGRATED MANAGEMENT OF PRICKLY LETTUCE IN WHEAT PRODUCTION SYSTEMS

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By
Drew J. Lyon, Endowed Chair Small Grains Extension and Research, Weed Science, Washington State University
Ian C. Burke, Research Weed Scientist, Washington State University

Integrated Management of Prickly Lettuce in Wheat Production Systems

Abstract

Prickly lettuce *(Lactuca serriola* L.) is a common weed in wheat production systems throughout the Inland Pacific Northwest (PNW). It is an annual, winter annual, or occasionally a biennial, that reproduces only by seed. Individual plants can produce from 35 to 2,300 flowers and 700 to 46,000 seeds. Sanitation (the prevention of weed seed production and dispersal) is an important aspect of prickly lettuce management, as is growing a healthy, competitive wheat crop. Herbicides can provide effective control of prickly lettuce in wheat, but many biotypes are now resistant to ALS-inhibitor and synthetic auxin herbicides. An integrated management approach is required for the sustainable, long-term control of this troublesome species.

Introduction

Prickly lettuce, also known as China lettuce, wild lettuce, and compass plant, is a native of the Mediterranean region. The genus name, *Lactuca*, incorporates the Latin word "lac" for milk, referring to the milky sap produced by the plant. Prickly lettuce is a member of the sunflower family (*Asteraceae*). It is an annual, winter annual, or occasionally a biennial that reproduces only by seed. It can be found throughout the US growing in disturbed sites, along roadsides, in orchards, and in cropland.

Prickly lettuce reduces crop yields through competition for water, nutrients, and light. Yield losses in winter wheat are usually less than 5%, but in spring wheat, prickly lettuce can reduce grain yields by up to 25%. The milky sap produced by the plant (Figure 1) contains latex and rubber that can cause problems with harvesting equipment and increase grain moisture content. Flower buds can be difficult to remove from grain. Grain that is contaminated with flower buds may be "docked" or graded at a lower value due to the presence of foreign material.

Identification

The cotyledons, also known as the seed leaves, are broad and oval in shape (Figure 2). Subsequent seedling leaves are similar in shape, pale green, papery thin, and cupped or curved upward at the outer ends (Gaines and Swan 1972). The seedling leaves form a basal rosette: outward radiating leaves from a short stem at soil level (Figure 3).

It is interesting to note that plants emerging after the spring equinox often skip the rosette stage, which

Figure 1. Prickly lettuce produces a milky sap, which is evident when a stem or leaf is damaged, that contains both latex and rubber.
Photo courtesy of Jared Bell, former WSU graduate student.

Figure 2. Prickly lettuce seedling with cotyledons (smaller pair of leaves) and first true leaves.
Photo courtesy of Henry Wetzel, WSU research associate.

Figure 3. Prickly lettuce seedlings form a basal rosette.
Photo courtesy of Henry Wetzel, WSU research associate.

makes these late emerging plants more difficult to control with herbicides. As prickly lettuce grows and develops an upright stem, leaves elongate (two to eight inches long and ¾ to 1 ¼ inches wide) and leaf edges become more deeply lobed and toothed, although this varies widely among biotypes (Figure 4). Spines form on the midrib on the underside of the leaf, which is a distinguishing characteristic for this plant, and the leaf clasps the stem with ear-like lobes. The leaves are alternately arranged on the stem. The leaves on the main stem are held vertically in a north-south plane, often perpendicular to direct sunlight (Van Vleet 2006). This attribute is why prickly lettuce is sometimes referred to as the compass plant.

Prickly lettuce has a deep taproot that will exude a milky sap. The plant grows to be one to five feet tall. The stem is prickly near the base and smooth above. The stem becomes more branched toward the top.

The flower heads of prickly lettuce are pale yellow, often blue when drying, approximately ⅓ inch in diameter, and composed of only ray flowers (Figure 5). Flowers are produced from late spring to early summer (Van Vleet 2006). Individual plants can produce from 35 to 2,300 flowers. Each flower head typically contains 18 to 24 seeds. Seeds are about ⅛ inch long, very dark gray to yellowish, and flattened, with five to seven ribs on each side and a slender beak with white hairs that carry the seed in the wind (Figure 6).

Biology

Prickly lettuce reproduces only by seed. Seeds are dispersed by wind and are viable and ready to germinate immediately after dispersal. Seeds that are exposed to water may become dormant if they dry before germination. Germination of dormant seeds can be delayed by one to three years.

Figure 4. Variable leaf shape in 20 biotypes of prickly lettuce collected in eastern Washington. Photo courtesy of Jared Bell, former WSU graduate student.

Figure 5. Close-up of prickly lettuce flower heads composed of only ray flowers.
Photo courtesy of Henry Wetzel, WSU research associate.

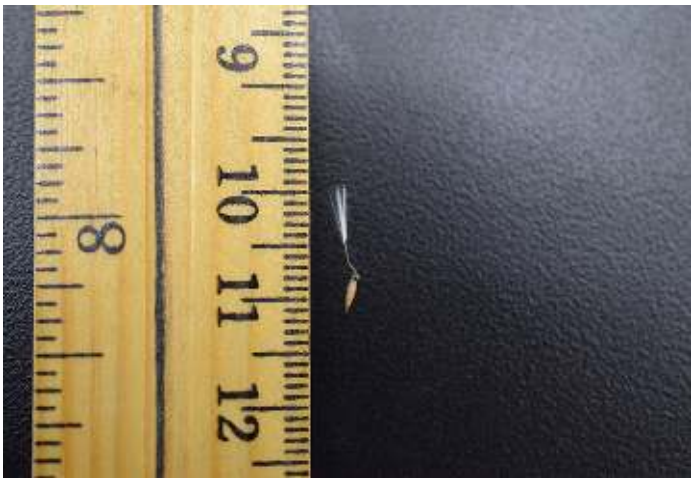

Figure 5. Prickly lettuce seeds are about ⅛ inch long and contain a pappus, a parachute-like structure that aids in wind dissemination of seeds.
Photo courtesy of Henry Wetzel, WSU research associate.

After emergence, a rosette is formed and a long taproot develops. Plants that emerge in the fall will overwinter as rosettes and produce one or more flowering stems in late spring or early summer. Individual plants can produce from 35 to 2,300 flowers. Each flower head contains an average of 20 seeds, giving an estimated seed production of 700 to 46,000 seeds per plant. Prickly lettuce seeds survive in the soil for only one to three years.

Management

Sanitation

Plant only certified, weed-free wheat seed. To prevent seed movement into the field, control prickly lettuce growing along field margins and roadsides. Mowing is usually not an effective control method because the rosettes lie too close to the soil surface, and mowing after stem elongation simply results in new stem and flower growth (Van Vleet 2006).

Sheep and goats enjoy feeding on prickly lettuce, so grazing may be one means of keeping this weed under control in non-crop areas adjacent to wheat fields. Given the mobility of prickly lettuce seed, management of areas adjacent to fields, including land enrolled in the Conservation Reserve Program, is critical for control.

Tillage

Seedlings and rosettes of prickly lettuce are easily controlled by tillage during non-crop periods (Van Vleet 2006). Because prickly lettuce has a taproot, shallow tillage may be as effective as deep tillage. Tillage works best when soils are dry and air temperatures are warm enough and relative humidity is low enough to cause the plants to wilt quickly.

Cultural Practices

A good stand of healthy wheat is one of the most effective means of controlling annual weeds, including prickly lettuce. Successful stand establishment requires selection of a well-adapted variety and use of fungicide-treated seed of large size. Seed must be planted at the appropriate depth (usually 1 ½ to two inches deep) into a firm, moist seedbed at the optimal time. Adequate fertility is needed to promote early growth. Placement of the fertilizer close to the wheat seed, although not so close as to cause damage, gives it preferential access to required nutrients.

Prickly lettuce is most easily controlled in grass crops due to the availability of broadleaf herbicides. Rotating winter wheat with spring crops or summer fallow provides an opportunity for the application of non-selective herbicides, or the use of tillage in the fall and early spring when prickly lettuce rosettes are easier to control.

Herbicides

In Wheat

When first introduced, the ALS-inhibitor herbicides (Group 2) provided excellent control of prickly lettuce in wheat, either directly or by use in rotational crops. Unfortunately, many prickly lettuce populations in the PNW are now resistant to some of the Group 2 herbicides, including chlorsulfuron (Glean), metsulfuron (Ally), thifensulfuron (Harmony), triasulfuron (Amber), and tribenuron (Express) used in wheat and imazethapyr (Pursuit) used in pulse crops. Although genetic tests for herbicide resistance can determine if a specific Group 2

herbicide will be effective for control, basing the entire control program on a Group 2 herbicide is not advised.

Synthetic auxin herbicides (Group 4) have worked well for the control of prickly lettuce in wheat, but some biotypes have become resistant to 2,4-D, dicamba (Clarity), and MCPA throughout the PNW. At Washington State University in 2009, Burke et al. (2009) first reported on a biotype of prickly lettuce from Whitman County that was 25 times more resistant to 2,4-D than the susceptible biotype. The resistant biotype was injured by the application, looking very similar to the susceptible biotype for the first ten days after treatment. After that, the resistant biotype began to put out new shoots. As many as 15 new shoots were observed growing out of the injured crown of the plant. Further study indicated that the resistant biotype likely had an altered signal receptor that resulted in less 2,4-D being absorbed into, or translocated within, the plant compared to susceptible biotypes (Riar et al. 2011).

Clopyralid, one of the active ingredients in WideMatch, Curtail, and Curtail M, is a synthetic auxin that continues to provide excellent control of prickly lettuce in wheat (Table 1).

Many synthetic auxin herbicides can cause crop injury if applied too early or too late. Make sure to check the herbicide label and determine the growth stage of wheat before application of these herbicides. See *Managing Wheat by Growth Stage* (Wise et al. 2011) for a good reference for staging wheat plants.

Huskie herbicide contains pyrasulfotole (Group 27, HPPD inhibitors) and bromoxynil (Group 6, photosystem II inhibitors), and it provides excellent control of prickly lettuce (Table 1). Talinor herbicide also provides excellent control of prickly lettuce in wheat. Like Huskie, Talinor contains an HPPD inhibitor, bicyclopyrone, and bromoxynil. Good coverage is important, so be sure to use an adequate carrier volume, correct nozzles, and the recommended spray pressure.

Table 1. Prickly lettuce visual control in winter wheat with postemergence herbicides averaged across sites in Pullman, Lind, and Davenport, Washington in 2008, 2009, and 2010.

Treatment[a]	Rate used oz product/acre	Prickly lettuce visual control[b] %
Huskie + UAN[c]	13.5 + 32	95
Orion	17	93
WideMatch	16	92
Metribuzin	12	81
Starane Ultra	6.4	80
Linex + Bromoxynil	8 + 16	79
Bromoxynil	24	76
Karmex DF	16	73
Dicamba	4	71
MCPA amine 4	16	71
Peak + NIS[d]	0.38 + 0.25% v/v	66
Aim + NIS	1.0 + 0.25% v/v	63
2,4D[e] amine 4	16	61
Amber[e]	0.35	59
Express[e] + NIS	0.5 + 0.25% v/v	48
Ally XP[e] + NIS	0.1 + 0.25% v/v	43
Harmony SG[e] + NIS	0.75 + 0.25% v/v	43
Glean XP[e] + NIS	0.33 + 0.25% v/v	36
LSD (p = 0.05)		19

[a]Treatments providing excellent control of prickly lettuce are highlighted in green, treatments providing fair control are highlighted in blue, and treatments providing poor control are not highlighted.
[b]Visual control scale is from 0 to 100% with 0% being no visible damage and 100% being plant death.
[c]UAN = urea ammonia nitrate (28-0-0).
[d]NIS = non-ionic surfactant.
[e]Prickly lettuce biotypes resistant to this chemistry are commonly found in the PNW.

The optimal herbicide timing for prickly lettuce control is during the rosette stage of growth. See product labels for specific application timing recommendations. Plants become very difficult to control after flowering stems begin to elongate. An herbicide program for wheat, particularly in a year with warm spring temperatures, may require two applications to manage prickly lettuce, as it germinates opportunistically over several months. Be sure not to exceed herbicide application limits listed on product labels.

In Fallow

Non-selective herbicides such as glufosinate (Liberty; Group 10, glutamine synthesis inhibitors) and paraquat (Gramoxone; Group 22, photosystem 1 electron diverters) provide effective control of prickly lettuce rosettes. Prickly lettuce is relatively tolerant of glyphosate (Roundup and many others; Group 9, EPSP synthase inhibitors).

For the past 30 years, growers in the region have included 2,4-D in combination with glyphosate for the control of prickly lettuce in fallow. However, 2,4-D antagonizes glyphosate activity in 2,4-D resistant prickly lettuce plants and control is reduced compared to that achieved with glyphosate alone.

If prickly lettuce populations in your fields are still susceptible to the ALS inhibitors, synthetic auxins, or both, adding one of these to a non-selective herbicide will improve control and reduce the risk of developing resistance to non-selective herbicides. The addition of saflufenacil (Sharpen), flumioxazin (Valor), tiafenacil (Reviton), or carfentrazone (Aim), all inhibitors of Protox (Group 14), to a non-selective herbicide can also improve control of prickly lettuce in fallow.

Curtail and Curtail M can provide effective control of prickly lettuce and are labeled for use in fallow. These may be good options for later in the fallow period when grassy weeds may no longer be prevalent as a result of earlier herbicide applications. They may be an especially good option during tough environmental conditions that result in reduced glyphosate activity.

Prickly lettuce infestations are often patchy, so scouting fields and targeting applications only to areas where prickly lettuce is present can keep costs down. Be sure to check crop rotation intervals before using any herbicide during the fallow period.

Herbicide trade names change, new products come to market, some products are removed from the market, and new cases of herbicide resistance develop over time. To stay current with these changes, view the current edition of the *PNW Weed Management Handbook*.

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Use pesticides with care. Apply them only to plants, animals, or sites as listed on the label. When mixing and applying pesticides, follow all label precautions to protect yourself and others around you. It is a violation of the law to disregard label directions. If pesticides are spilled on skin or clothing, remove clothing and wash skin thoroughly. Store pesticides in their original containers and keep them out of the reach of children, pets, and livestock.

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