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MontGuide

Tall Buttercup: Identification, Biology and Integrated Management

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Tall buttercup *(Ranunculus acris)* is an exotic perennial forb that can be weedy in moist fields and pastures. This publication describes the biology and ecology of tall buttercup and offers management recommendations.

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TALL BUTTERCUP *(RANUNCULUS ACRIS)*, ALSO known as meadow buttercup or tall crowfoot, is a perennial forb of the Ranunculaceae family that can be weedy and invasive, especially in irrigated or sub-irrigated areas. The common name of tall crowfoot refers to the resemblance of the leaf to the foot of a large bird. The genus, *Ranunculus,* means "little frog" and likely refers to buttercup's affinity for bogs and other moist places. The species name, *acris,* means "bitter" and describes the very pungent taste of tall buttercup foliage caused by a toxic chemical called glycoside ranunculin. European beggars supposedly used to intentionally blister their skin with buttercup juice to gain sympathy from passerbys.

Tall buttercup is native to central and northeastern Europe but is now widespread across North America. It has been reported in every state except Arizona, Texas, Oklahoma, Arkansas, Louisiana, Florida, and Hawaii; in every Canadian province except Yukon Territory; and in many western Montana counties. In Montana, tall buttercup can be found in moist fields, pastures, grasslands, and in irrigated and sub-irrigated meadows. It can also be found along rivers, streams, lakes, roads, and in irrigation ditches, parking lots, and gravel pits. It has been collected from elevations as high as 8400 feet.

FIGURE 1. General appearance of a tall buttercup plant. (USDA PLANTS Database).

Tall buttercup is a priority 2A state noxious weed in Montana. It is classified as a Facultative Wetland species, meaning 67-99 percent of tall buttercup occurrences are in wetlands. The impact of tall buttercup on forage production and plant diversity is of interest in North America, especially in Montana where it has now invaded over 20,000 acres.

Identification

Tall buttercup is a perennial, herbaceous forb that grows from a stout, abruptly ending root stock. It is **rhizomatous** and also spreads by seed. Basal leaves are deeply divided into 3-5 palmate lobes and grow directly from the **rhizome** or root crown. Stems are erect, hollow, and can sometimes be hairy. Stems range from 1-3 feet (0.3-0.9 m) in height and are leafy below while branched above (Figure 1). There may be one to several flower stems per plant. Stem leaves are alternate, short-stalked, and palmately divided. Leaf blades are broadly pentagonal in outline and are deeply lobed 4-5 times, with the lobes sharply cut into pointed segments (Figure 1). Stem and basal leaves have soft hairs on both sides. Tall buttercup flowers are glossy and bright yellow with typically five, but as many as eight, rounded petals. Seeds are disc-shaped, reddish-brown, and about 0.1 inch (2-3 mm) long with a sharply pointed, curved **beak** about 0.02 inch (0.5 mm) long (Figure 1).

Ecology and Spread

Tall buttercup has short, thick rhizomes that are capable of splitting to form daughter plants in clumps that are three feet in diameter. In late winter and early spring, 40-50 new leaves form on the apex of the rhizomes. After basal leaf formation, growth of the flowering stem and stem leaves begin. Flower buds develop in late summer the year before flowering. Flowering occurs the following late spring, peaking in early summer, and usually lasts two months but can be extended with high soil moisture. Tall buttercup typically produces less than four flowers per plant, but can produce more on sites with low species diversity or high soil fertility. Plants may not flower until the second year or for up to 10 years, and flowering is reduced at high population densities. Seed set begins in late summer and continues into early autumn. After flowering, both flower stalks and leaves die and are replaced by an overwintering **rosette**.

Seeds are likely the main mechanism by which tall buttercup spreads, because rhizomes can decay fairly quickly. However, regenerative shoots will form following defoliation or fungal attack, and trampling by livestock may promote vegetative reproduction. Tall buttercup seeds typically survive for less than two years when located in the top inch of the soil, but they can survive longer when buried deeper. Tall buttercup seeds often fall close to the parent plant but can also be dispersed long distances by the short-hooked beak at the tip that can attach to animal fur. Tall buttercup also commonly spreads via contaminated hay, irrigation water, hooves, or through the guts of grazing animals.

Impacts

Tall buttercup contains the glycoside ranunculin from which the bitter tasting and toxic protoanemonin quickly forms when plants are damaged or grazed. Therefore, tall buttercup is typically avoided by livestock and often found in overgrazed pastures. Protoanemonin can cause blisters on the lips and tongue, intestinal disorders, respiratory failure, and death in some cases. However, the risk of adverse effects due to tall buttercup consumption by livestock is low and tall buttercup appears to be toxic only with a very large dosage. Protoanemonin is unstable and volatizes when dried, so the toxic properties of tall buttercup are reduced when it is cut and dried in hay. A forage analysis of tall buttercup from Madison County, Montana, showed that it contained about 8% crude protein, 36% acid detergent fiber, and 57% total digestible nutrients (based on acid detergent fiber).

Some studies and anecdotal evidence suggest invasive plants displace both native and non-native plants and reduce plant community diversity. However, a study in irrigated hayfields in Montana found that tall buttercup was associated with an increase in overall plant diversity and in biomass and cover of two plant functional groups, in particular, grass-like species (e.g., sedges and rushes) and exotic forbs (e.g., clover). Grass-like species and exotic forbs have similar habitat requirements as tall buttercup; therefore, it is likely both groups thrive in similarly favorable conditions. This is promising in that grass-like plants in a natural wetland system may not be negatively affected by tall buttercup infestations.

In the same study, however, tall buttercup was associated with a decrease in perennial grasses, especially creeping meadow foxtail *(Alopecurus arundinaceus).* For example, an increase of tall buttercup by one pound per

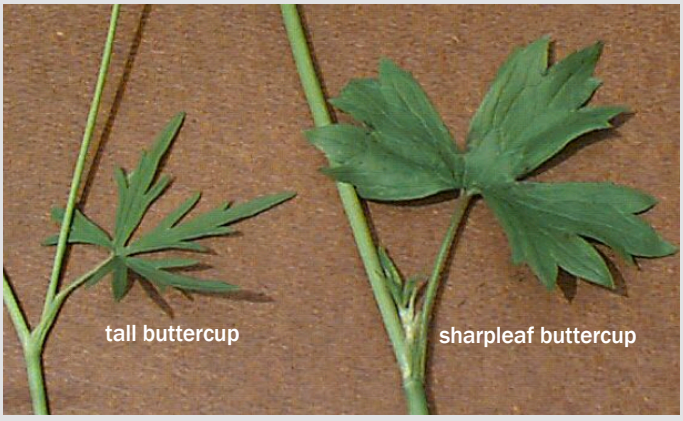

FIGURE 2. Differences in leaf shape between tall buttercup and sharpleaf buttercup (photo by Dave Brink, MSU Extension).

Other buttercup species

Sharpleaf buttercup *(R. acriformis)* is native to North America, similar in appearance to tall buttercup, and grows in similar habitats. The two species can be distinguished by observing their leaves and seeds. Sharpleaf buttercup typically has leaves with <4 lobes that are not as deeply indented (Figure 2). Tall buttercup has at least 4 lobes, and main lobes are indented nearly to the base (Figure 2). Beaks on the seeds of sharpleaf buttercup are longer than those of tall buttercup (~1 mm versus 0.5 mm). Creeping buttercup *(R. repens),* another non-native, can be distinguished from tall buttercup by a horizontal growth habit. It spreads by stolons and forms thick carpets on wetter soils that can crowd out other plants.

Irrigation and Tall Buttercup

Irrigation has created habitat conditions suitable for tall buttercup and likely has a large influence on the persistence of the species in many locations where it is invasive. Tall buttercup is tolerant of flooded conditions and has been found in areas with approximately 30 days of flooding per year. In the absence of irrigation, suitable habitat for the species declines in areas that do not receive adequate rainfall. In Montana, tall buttercup appears to be most prevalent in flood and sub-irrigated hayfield meadows. Landowners have noticed a decrease in the prevalence of the species following a reduction in irrigation or following a switch from flood to overhead sprinkler irrigation.

acre was associated with a decrease in perennial grasses by 2.7 pounds per acre. This decrease in perennial grass is fairly small, considering this study took place in a highly productive hayfield system. Overall, tall buttercup did not appear to reduce clovers and other forage species, so producers should consider both the costs and benefits to managing tall buttercup.

Management

There is limited published information available on tall buttercup management both in Montana and North America. Most information on tall buttercup taxonomy, general ecology, biology, and management has come from regions of Europe and New Zealand where tall buttercup has been weedy for many years.

Because the presence of tall buttercup is limited in Montana relative to many other noxious weeds, a key management strategy is preventing its spread and establishment to new areas. Education and awareness programs can help the public understand how tall buttercup spreads and what its impacts are.

Herbicides containing paraquat, diquat, 2,4-D, and MCPA have reduced tall buttercup in field experiments in other countries. However, some tall buttercup populations have developed herbicide resistance to certain group 4 herbicides, such as MCPA. Many products containing the active ingredient aminopyralid (e.g., Milestone®) or dicamba (e.g., Clarity®) are labeled for tall buttercup control in range and pasture in North America. Optimum timing for herbicide application is during the leafy phase in late spring prior to flower-shoot growth.

Mowing prior to seed set has shown some success in pastures infested with tall buttercup in other countries. Proper timing and frequency of mowing must be employed to promote competitiveness of desirable plants and reduce tall buttercup flowering.

Two pathogenic fungi that occur naturally on tall buttercup in New Zealand have been researched as a biological control option- 1) *Gnomonia* spp. and 2) *Sclerotinia sclerotiorum*. While the latter fungus has shown some promising results with little risk to desirable forage species, a commercial product is not yet available.

Grazing generally increases the density of tall buttercup infestations due to livestock avoidance. If grazing, avoid doing so at times when the disturbance would favor tall buttercup (e.g., spring).

Since tall buttercup has low drought tolerance, altering the timing or methods of irrigation in an invaded area may help. Avoid flooding on irrigated pastures and hay meadows, as it will favor tall buttercup over less flood-adapted grasses.

Integrated management strategies involve combining multiple control methods and can be a way to help prevent tall buttercup from developing herbicide resistance. To help inform and develop integrated management strategies to control tall buttercup in Montana, a study was conducted that tested various control strategies including herbicides applied alone or in combination with mowing, fertilization, or both. These control methods were applied in late June at two sites in hayfield meadows in southwestern Montana. One field was flood irrigated, while the other was sub-irrigated.

Four herbicide treatments were tested, including aminopyralid (Milestone® at 5 ounces per acre), dicamba (Vanquish® at 24 ounces per acre), aminocylopyrachlor + chlorsulfuron (Perspective™ at 3 ounces per acre), and an untreated control. Herbicides were tested alone and in combination with mowing, nitrogen fertilization, and mowing plus fertilization.

All herbicides provided up to two years of tall buttercup control at both sites. In the year after application, aminocylopyrachlor + chlorsulfuron and aminopyralid reduced tall buttercup biomass by 93% and 96%, respectively (Figure 3, page 4). While the use of aminocyclopyrachlor + chlorsulfuron provided good control of tall buttercup, it also reduced the dominant perennial grass species while increasing red top *(Agrostis stolonifera)* and grass-like species (i.e., sedges, rushes, and arrowgrass). All three herbicides resulted in non-target effects on exotic forbs, including clovers that had been seeded for their high forage quality.

At one of the study sites (sub-irrigated), mowing reduced tall buttercup by 71%, and fertilization reduced it by 57%. The combination of herbicides and mowing or herbicides and fertilizer did not increase tall buttercup control; rather, herbicides, mowing, and fertilizer used individually were just as effective as integrating the three tools. Despite these findings, it may still be

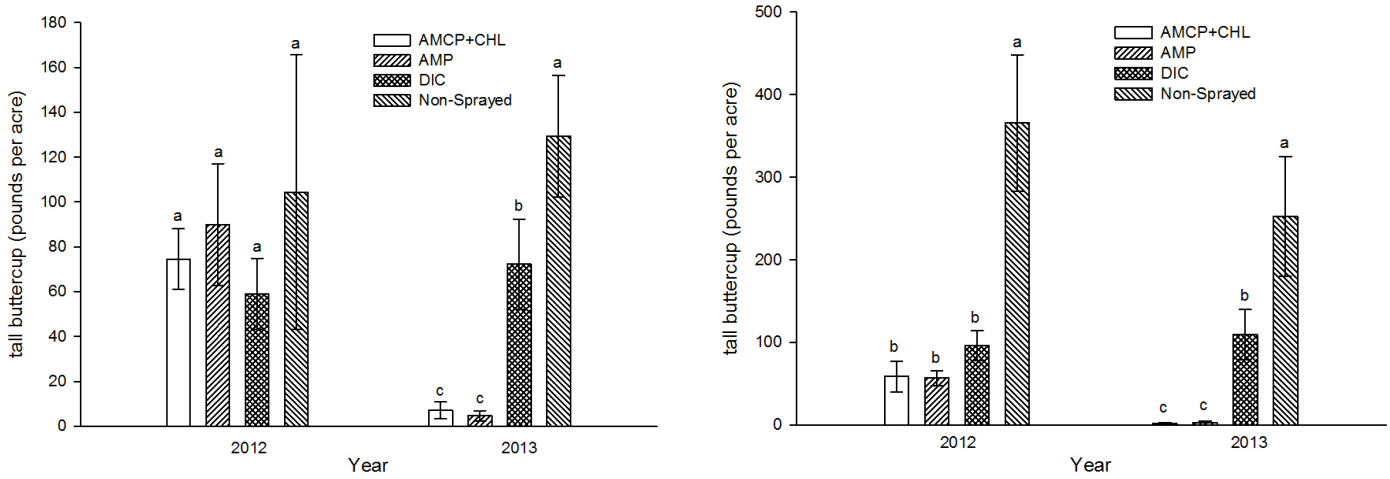

FIGURE 3. Tall buttercup biomass as affected by herbicide and year at the sub-irrigated (A) and flood-irrigated (B) sites. Error bars indicate one standard error of the mean. Lower case letters indicate means that are different across herbicide treatments within a year at each site. AMCP+CHL = aminocyclopyrachlor + chlorsulfuron (Perspective™); AMP = aminopyralid (Milestone®); DIC = dicamba (Vanquish®).

beneficial to utilize an integrated approach given tall buttercup's history of evolved resistance to herbicides in New Zealand. Furthermore, additional studies should investigate the combination of control measures under various irrigation schedules since irrigation appears to play a large role in creating suitable habitat for tall buttercup.

Glossary

Beak A long slender tip or projection

Rhizomatous A plant that is rhizome-like, with horizontal underground stems

Rhizome A horizontal underground stem; rootstock

Rosette Cluster of leaves radiating out in all directions from the stem, usually at base of plant

References

Bourdôt, G.,W., Lamoureaux, S. L., Watt, M. S., & Kriticos, D. J. (2013). *The potential global distribution of tall buttercup (Ranunculus acris ssp. acris): Opposing effects of irrigation and climate change.* Weed Science, 61(2), 230-238.

Lamoureaux, S. L., & Bourdôt, G. W. (2007). *A review of the ecology and management of Ranunculus acris subsp. acris in pasture.* Weed Research, 47(6), 461-471.

Strevey, H. K. (2014). *The Ecology and Integrated Management of Tall Buttercup (Ranunculus Acris L.)* (M.S. thesis, Montana State University, Bozeman).

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