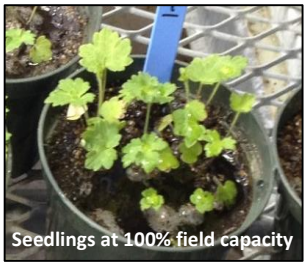
Tall buttercup seedling growth along a moisture gradient

Tall buttercup (*Ranunculus acris* L.) is an exotic, perennial, invasive forb that occurs in moist habitats including pastures, grasslands, and flood or sub-irrigated meadows. Tall buttercup can displace pasture grasses and clovers and is cause for concern due to its toxicity to livestock, especially cattle. In Montana it has invaded over 20,000 acres and is a Priority 2A noxious weed. Irrigation may create conditions conducive to tall buttercup growth and survival, but the amount of moisture required for optimal seedling emergence and growth has not been explored. Understanding the importance of soil moisture on seedling recruitment can inform effective management strategies.

We conducted a greenhouse study to assess seedling emergence and growth along a gradient of soil moisture. We collected seed from tall buttercup growing in flood and sub-irrigated hayfields in southwestern Montana, planted them in soil in half gallon pots, and subjected them to three soil moisture treatments including 25, 50, and 100 percent field capacity (field capacity = amount of water held in soil after excess water has drained away, usually 24 hours after a wetting event). After 65 days, tall buttercup seedlings in each pot were counted and measured.

Seedlings at 50% field capacity



Seedlings at 100% field capacity

Tall buttercup seedling emergence, height, number of leaves, and biomass were all affected by soil moisture (see table below). Seedling emergence was lowest at 25% field capacity; the 50% and 100% field capacity treatments resulted in similar seedling emergence. All three soil moisture treatments resulted in different seedling heights. The 50% field capacity treatment had the tallest seedlings followed by the 100% field capacity treatment and 25% field capacity treatment. The 25% field capacity treatment resulted in the lowest number of seedling leaves, while the 50% and 100% field capacity treatments resulted in similar tall buttercup seedling leaf numbers. Finally, the 50% field capacity treatment had the highest seedling biomass followed by the 100% field capacity treatment followed by the 25% field capacity treatment.

Tall buttercup emergence and seedling height, number of leaves, and biomass as affected by soil moisture treatment.

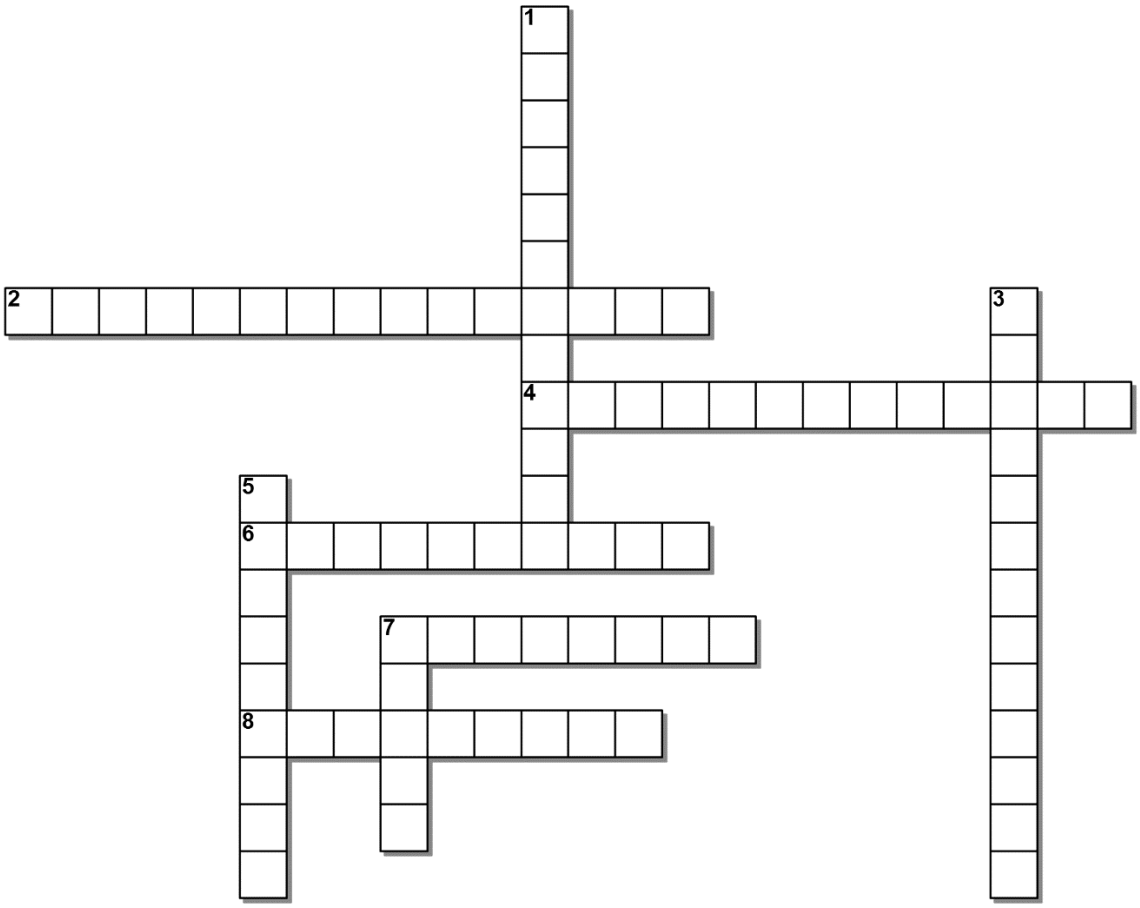
Soil Moisture Treatment	Emergence (%)	Height (cm)	Number of Leaves	Biomass (g)
25% field capacity	18 a*	0.8 ± 0.2 a	1.2 ± 0.3 a	0.009 ± 0.001 a
50% field capacity	40 b	6.0 ± 0.3 c	5.7 ± 0.4 b	0.2 ± 0.03 c
100% field capacity	36 b	4.0 ± 0.5 b	4.0 ± 0.6 b	0.1 ± 0.02 b

*Means with similar letters following them within a measured parameter (i.e. emergence, height, number of leaves, biomass) are statistically similar to each other ($\alpha = 0.05$).

Seedling emergence and growth are critical stages of plant development that result in recruitment of new individuals in plant communities. Our results indicate that tall buttercup emergence and growth was optimal in field capacities of 50% to 100%, and minimal in drier conditions. Other researchers have reported that without irrigation, habitat for the species declines in areas that do not receive sufficient rainfall. Flood and sub-irrigation management practices in western Montana with problematic tall buttercup infestations could be playing a role in the species' ability to persist. Altering irrigation amount or timing could be tested and considered as an integrated management tool to reduce or eliminate tall buttercup infestations.

Read more about this study in the 2015 MSU College of Agriculture and Extension Research Report at http://www.msuextension.org/coa/researchreport2015.html. Please also see the new MSU Extension MontGuide on tall buttercup at http://store.msuextension.org/publications/AgandNaturalResources/MT201502AG.pdf. This study was supported by a grant from the Noxious Weed Trust Fund (Grant #2013-038).

Test your knowledge of tall buttercup seedling growth



Across:

2 Seedling _____ and _____ are critical stages of plant growth

4 Term used to describe amount of soil moisture

6 This agricultural practice may encourage tall buttercup growth*

7 Tall buttercup shows more resistance to this event than other Ranunculus species*

8 Check this anatomical feature to differentiate between tall buttercup and native sharpleaf buttercup* (2 words)

Down:

1 Alternative common name for tall buttercup* (2 words)

3 Where you might find tall buttercup growing (2 words)

5 Seed _____ could have influenced emergence results from this study*

7 This percent field capacity resulted in the biggest and healthiest tall buttercup seedlings

*See additional reading for answers to these questions.

Solutions are posted to the MSU Extension Invasive Rangeland Weed website:

http://www.msuextension.org/invasiveplants/monthly_weed_post.html

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