WATERHEMP MANAGEMENT IN ESTABLISHED ALFALFA

Mark Renz[1/]

Dairy production systems rely on alfalfa as a key component in their ration. Alfalfa provides a high yielding and quality forage as well as key ecosystems services as part of a rotation with annual crops. One of the under-valued services is weed control as it has been documented that alfalfa stands can reduce weed populations if managed correctly (e.g., Clay and Aguilar, 1998; Goplen et al., 2017). Few annual weeds can compete with alfalfa stands and do not germinate unless alfalfa stand density is below recommended levels or the alfalfa is stressed due to lack of precipitation or pest (insect disease) damage. What few annual weeds that emerge are not able to produce viable seeds due to the frequent harvest interval present in a dairy system (every 28 to 35 days). For example, giant ragweed, a highly competitive annual weed that is capable of germinating throughout the spring, had emergence reduced by 59% when grown under alfalfa compared to corn and didn't produce any viable seeds in a research project in Minnesota (Goplen et al., 2017). Unfortunately established alfalfa systems are currently being invaded by waterhemp (*Amaranthus tuberculatus* (Moq.) J.D. Sauer), a weed species that has the potential to germinate and produce viable seed within this competitive forage system.

Waterhemp, while present in the region for over a century, has been documented to be rapidly spreading throughout the United States. In Wisconsin, while this plant has been present for over 150 years, it has recently been observed to be expanding its range with populations now in over 80% of counties, with 40% of the observations being reported in the last 4 years (Renz, 2018). This plant is similar to other pigweed species (red-root, smooth) but can germinate later into the growing season (Werle et al., 2014) even if under established plant canopies (Steckel et al., 2003) and compete against established crops and produce viable seed (Wu and Owen, 2014). While the harvest frequency of alfalfa grown for use in dairy systems have historically prevented annual species from competing with alfalfa, recent observations suggest waterhemp has the potential to behave differently. This past year reports from multiple crop consultants documented productive alfalfa fields with significant waterhemp biomass in the second and third harvests in established alfalfa fields that resulted in viable seed production (personal communication, Wisconsin Extension Educators in Clark and Outagamie County). According to the consultants, these fields had adequate stand densities with no visible stresses that would have facilitated emergence. Similar reports of spread have been received in other Midwestern and Eastern United States (e.g., Hager 2016).

It is not known what the impact of waterhemp invasions have on forage quality and productiveity and resulting milk production from established alfalfa fields. Weeds harvested often increase yields and can be utilized as a forage, but reduce forage quality (Cosgrove and

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[1/] Associate Professor and Extension Weed Specialist, Dept. of Agronomy, Univ. of Wisconsin-Madison, 1575 Linden Dr., Madison WI, 53706.

Barrett, 1987). While recent research suggests the level of reduction can be offset by the added biomass in milk production, weed biomass must be a minor component (<15%) of the total forage biomass (Renz et al., 2018). In addition, waterhemp may impact alfalfa stand density which could reduce long-term alfalfa stand life.

Several herbicides are registered for use in established alfalfa (acetochlor, flumioxazin, metribuzin, and pendimethalin) that have been documented to have success in controlling waterhemp in other crops. While effective, it is not clear when to apply each product to maximize season-long control of waterhemp in established alfalfa. In annual production systems (soybeans, corn), applications are typically applied at planting or just prior to waterhemp emergence, but labels restrict applications in established alfalfa to during green-up in the spring or after each harvest. The optimal timing for waterhemp control is not known in established alfalfa. While waterhemp emergence in annual crop systems is known (late May to early June), the dense canopy of established alfalfa may delay emergence. This has been observed with other annual weed species (Goplen et al., 2017). Applications during alfalfa green-up would provide early-season control, but may breakdown prior to the end of the season, thus not providing season-long control. While applications after the first harvest have the potential to provide season-long control with some products, it may not control early emerging waterhemp plants, which could produce significant biomass throughout the season.

Adding a post-emergent herbicide would be a common solution to this problem as it would provide control of emerged plants. Unfortunately many populations are resistant to commonly used products with post-emergent activity in alfalfa (imazamox, imazethapyr, and/or glyphosate) (Heap, 2018). Therefore these options cannot be relied on for manage-ment and greater emphasis on residual products for pre-emergent control. While these products may not provide complete control, several may provide sufficient control to eliminate impact on milk production.

Future research to be established in 2019 will evaluate the effectiveness of labeled residual herbicides at controlling waterhemp in established alfalfa for dairy systems and determine how treatments/timings impact forage quantity and quality and resulting milk production. Expected results will be discussed in this presentation. As many producers rely on alfalfa to reduce weed populations for subsequent crops, we will also assess the ability of treatments to prevent seed production. These efforts will provide valuable information that will allow producers to optimize waterhemp management in alfalfa production systems.

References

Clay, S.A., and I. Aguilar. 1998. Weed seedbanks and corn growth following continuous corn or alfalfa. Agron. J. 90:813–818.

Cosgrove, D.R., and M. Barrett. 1987. Effects of weed control in established alfalfa (*Medicago sativa*) on forage yield and quality. Weed Sci. 35:564–567.

Goplen, J.J., C.C. Sheaffer, R.L. Becker, J.A. Coulter, F.R. Breitenbach, L.M. Behnken, G.A. Johnson, and J.L. Gunsolus. 2017. Seedbank depletion and emergence patterns of giant ragweed (*Ambrosia trifida*) in Minnesota cropping systems. Weed Sci. 65:52–60.

Hager A. 2016. Spread of herbicide resistant weeds in Illinois and factors that prevent presence of herbicide resistance in Illinois fields. Proc. 2016 Wis. Crop Mgmt. Conf. 55:29.

Heap I. 2018. The international survey of herbicide resistant weeds. Online. Internet. Accessed 12/7/18: www.weedscience.org .

Renz, M.J. 2018. Waterhemp and Palmer amaranth in Wisconsin: An update on locations and call to report new infestations. Accessed 11/29/18: http://ipcm.wisc.edu/blog/2018/08/update-on-waterhemp-and-palmer-amaranth-in-wisconsin/.

Renz, M.J., C. Bloomingdale, R. Proost, and M. Ballweg. 2018. Managing volunteer wheat in late summer seeded alfalfa. Accessed 11/29/18: http://ipcm.wisc.edu/download/pubsPM/2018_VolunteerWW_Alfalfa_final-2.pdf

Steckel, L.E., C.L. Sprague, A.G. Hager, F.W. Simmons, and A.B. German. 2003. Effects of shading on common waterhemp (*Amaranthus rudis*) growth and development. Weed Sci. 51:898–903.

Werle, R., L.D. Sandell, D.D. Buhler, R.G. Hartlzer, and J.L. Linquist. 2014. Predicting emergence of 23 summer annual weed species. Weed Sci. 62:267–279.

Wu, C., and M.D.K. Owen. 2014. When is the best time to emerge: Reproductive phenology and success of natural common waterhemp (*Amaranthus rudis*) cohorts in the Midwest United States? Weed Sci. 62:107–117.