MANAGING *VENTENATA DU*BIA IN TIMOTHY HAY

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ABSTRACT

Ventenata [Ventenata dubia (Leers) Coss.] is a non-indigenous winter annual grass that has invaded agricultural and rangeland systems throughout the Pacific Northwest. Ventenata invasion reduces timothy hay crop profitability. This research project focused on developing integrated pest management techniques for timothy hay. We evaluated treatment efficacy in two infestations of ventenata (low <25% foliar cover vs. high >50% foliar cover). We also evaluated fertilize only, fall herbicide only (flufenacet plus metribuzin), fertilize plus herbicide and a control treatment at a 5 cm and 10 cm harvest heights in timothy hay. We found that greater control of ventenata can be achieved by integrating treatments and treatments resulted in different plant response on infestation level. In timothy, we found that timothy yield and ventenata control did not differ between the two cut heights but there was a consistent trend towards higher yield at the 10-cm harvest height. The fertilizer plus herbicide treatment performed the best in controlling ventenata and increasing yield regardless of infestation level whereas, fertilize only treatments increased ventenata biomass in low infestations but decreased biomass in high infestations. Our research will enable farmers and ranchers to better control ventenata infestations by integrating, fertilizer, harvest height and herbicide application to manage ventenata.

Key Words: timothy, Phleum pretense, Ventenata dubia, cutting height, weed control

INTRODUCTION

Ventenata [Ventenata dubia (Leers) Coss.], a non-native winter annual grass, is increasingly becoming a concern in the Pacific Northwest. Its invasion threatens Conservation Reserve Program (CRP) grasslands, pastures and timothy (Phleum pratense L.) hay by reducing habitat quality, soil retention, grazing and hay quality. Similar impacts by winter annual grasses have been observed in agricultural systems (Anderson 1998; Ball et al. 1995; DiTomaso 2000; James et al. 2011). Hay containing ventenata was not allowed in exported hay, Loss of export markets puts pressure on timothy hay producers to seek solutions to ventenata since domestic hay may be worth 25% of exported hay. Developing an integrated pest management (IPM) plan that focused on crop competitiveness and selecting treatments effective at low and high ventenata infestation levels was critical.

Ventenata, has been referred to incorrectly as North African grass or wiregrass. Currently using the genus as a common name has become accepted among farmers and land managers. Ventenata is a non-indigenous winter annual from North Africa and Eurasia. Ventenata can grow to over 70 cm tall, of which the open panicle is 10 to 40 cm (Crins 2007; Chambers 1985; Hitchcock et al. 1969). The stems are thin and glabrous, producing a fine litter (Crins 2007;

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Chambers 1985; Hitchcock et al. 1969). In spring, ventenata can be identified as having a brown colored node, an unusually long ligule (1-8 mm) and leaves without a canoe-shaped tip. The inflorescence opens in May and June and is an open panicle, which dries and shatters seed by mid-summer (Crins 2007; Hitchcock et al. 1969; Prather 2009). Ventenata uptakes nitrogen at a similar rate regardless of the amount of nitrogen applied (James 2008) making it a poorer competitor for nitrogen than other annual grasses like downy brome (Bromus tectorum L.) and medusahead wildrye [Taeniatherum caput-medusae (L.) Nevski]. Ventenata was first identified in the Pacific Northwest in 1952 and in Idaho in 1957 in Kootenai County (Crins 2007; Hitchcock et al. 1969; Prather 2009; Lass and Prather 2007; Scheinost et al. 2008).

Timothy hay competitiveness is important in maintaining a high yielding crop. Harvest height can directly affect timothy's ability to compete with weeds such as ventenata. Under current management in the Pacific Northwest, most timothy hay producers harvest timothy at 5 cm to maximize their yield. Additionally, some producers will conduct a light post-harvest grazing in fall. Harvesting and grazing timothy at these lower heights can damage the corm and reduce timothy's ability to store carbohydrates, making timothy less competitive for the following season (Bush 2002; Fransen 2005). However, harvesting timothy at a height of 10 cm can improve the plant's carbohydrate storage which promotes increased competitiveness going into the following season (Fransen 2005). Therefore, less stressed plants can compete better for limiting resources than otherwise stressed plants harvested at a lower height.

Primarily, timothy hay research has focused on increasing dry mater yield, water use efficiency, nutrient quality or controlling insects. A focus on integrating common strategies already employed by producers to achieve ventenata control and increase timothy yields will benefit hay producers.

MATERIALS AND METHODS

Timothy Hay. Field experiments were conducted from 2012 to 2013 on two study sites in northeastern Washington. Sites have been in agricultural production for at least five years. Both hay sites were near Cusick, WA (477539 N 5348457 E), the north timothy site was 0.34 km from the south timothy site. Soils at these sites were comprised of Cusick silty clay loam series which were moderately deep and poorly drained. Slopes were 0 to 3%. Average annual precipitation was 69 cm (Deer Park station; 40 km from field site). The timothy hay sites were predominately; timothy (*Phleum pratense* L.), ventenata, meadow foxtail (*Alopecurus pratensis* L.), Kentucky bluegrass (*Poa pratensis* L.) and Canada thistle [*Cirsium arvense* (L.) Scop.].

Our treatments included; 5 cm harvest height, 10 cm harvest height (Fransen 2005). We applied the following treatments to each harvest height; fertilize only, fall-applied herbicide only, fertilize with herbicide and a control treatment within the two infestation levels of ventenata. The differing timothy harvest heights allowed us to contrast hay production in conjunction with fertilization and herbicide application. Fransen (2005) suggests that harvesting timothy at a minimum 10 cm harvest height will increase the plant's ability to compete through increased carbohydrate storage capability. Each plot measured 4.9 m by 6 m. Foliar cover was estimated using a point intercept method to establish the 2 cover classes: low and high and one biomass sample was collected within each plot.

We used the herbicides flufenacet plus metribuzin (Axiom® DF) labeled for ventenata control in timothy. We applied flufenacet plus metribuzin to the timothy plots at a rate of 0.58 L ai ha-1, based on prior research (Wallace and Prather 2010). The fertilizer amendments were applied as a split application in the fall and spring, using recommendations provided by Shewmaker and Bohle (2010) and Mahler (2005a and 2005b). Soil samples were taken to a depth of 30 cm two weeks (Table 1) prior to fertilizer applications to determine the amount applied. The selected fertilizer (46-62-45) was applied in the form of a dry granular with phosphorus and potassium applied in the fall. Nitrogen was applied as a split application to the timothy sites as 11.3 kg in the fall and 11.3 kg in the spring. The fertilizer was intended to promote perennial vegetation carbohydrate storage and increase plant competitiveness (Fransen 2005).

Table 1. Soil sample results to a depth of 30 cm for each agrosystem by infestation level. Ventenata cover is expressed as low < 25% and high >50% ventenata foliar cover. N-P-K is listed as the amount available. OM is organic matter.

Site	Cover	P ug/g	K ug/g	NO3 ug/g	NH4 ug/g	OM %	pH
North	Low	3.9	49	<0.72	2.2	4.2	5.1
	High	2.8	47	<0.72	2.9	4.1	5.1
South	Low	1.6	39	<0.72	2.9	4.2	5.2
	High	1.2	39	<0.72	2.0	3.9	5.4

RESULTS

Flufenacet plus metribuzin applications resulted in control of ventenata and increased timothy yields. When herbicide treatment was combined with other treatments, control increased. Treatment effects depended on infestation level for ventenata biomass (P=0.0063, df =7). Overall means are reported for timothy biomass. Means are reported separately for high and low infestations for ventenata biomass. Overall timothy yield was similar for each treatment across low and high ventenata cover.

The flufenacet plus metribuzin only treatment significantly reduced ventenata biomass (data not shown). Ventenata control increased when fertilizer was applied to plots treated with flufenacet plus metribuzin. When harvesting timothy at 5 cm rather than 10 cm we observed greater control of ventenata biomass when infestations were high (Figure 1). Conversely, when ventenata infestations were low, control was better at the 5 cm harvest height after applying the fertilizer and flufenacet plus metribuzin (Figure 2). Interestingly, in high infestations, ventenata biomass decreased (Figure 1), whereas in low infestations ventenata biomass increased (Figure 2) when applying only fertilizer. While there were trends in low ventenata cover, no differences among treatments were detected.

The fertilizer only and the fertilizer with flufenacet plus metribuzin treatments both significantly increased timothy yield as compared to the control treatments (Figure 3). Interestingly yield at the 5 cm harvest height control was lower than the yield at the 10 cm harvest height control.

There was a trend to a decrease in forage yield at 5 cm harvest height across treatments (Figure 3). The similarity in response of timothy yield across harvest height between these two treatments suggests that timothy is more competitive against ventenata for limited resources when harvested at 10 cm. There was a significant difference between the 5 cm harvest height fertilizer with flufenacet plus metribuzin treatment and the 5 cm harvest height fertilize only treatment (P=0.066). Once again, this response to timothy yield suggests that timothy harvested at 5 cm is less competitive with ventenata. There was a marginal difference between the two harvest heights with respect to the fertilizer with flufenacet plus metribuzin treatment (P=0.0688) (Figure 3).

We succeeded with controlling ventenata and increasing timothy yield with the use of integrated treatments in both high and low infestation levels. Fertilizer only treatments in high infestations had a greater effect on ventenata by decreasing biomass. Ventenata capturing excess phosphorous could explain why ventenata biomass increased after the fertilizer only treatment. The increase in ventenata biomass observed in low infestations when applying fertilizer, could be negated by harvesting timothy hay at 10 cm and applying the flufenacet plus metribuzin only treatment. Though there was a trend for harvest height for either timothy hay yield, other research into timothy production found clear yield increases when harvesting timothy at higher cut heights (Efetha et al. 2009; Fransen 2005; Mislevy et al. 1977).

Looking across both systems we saw more available phosphorous in low infestations than high and suggests that ventenata has an advantage in low phosphorous sites (James 2008). We saw an increase in ventenata percent biomass when the fertilize treatment was applied alone which further suggests that ventenata may be taking advantage of phosphorous. As we observed in this study, biomass varied given the infestation level when applying fertilizer. Fertilizing in low infestations without herbicides could lead to increases of ventenata.

Proper fertilization and control with herbicides resulted in 1 ton additional yield when compared to fertilization alone. High quality, exported hay produced with fertilizer and herbicide that adds additional biomass would increase gross profits: potentially to 8 times that of infested hay sold domestically.

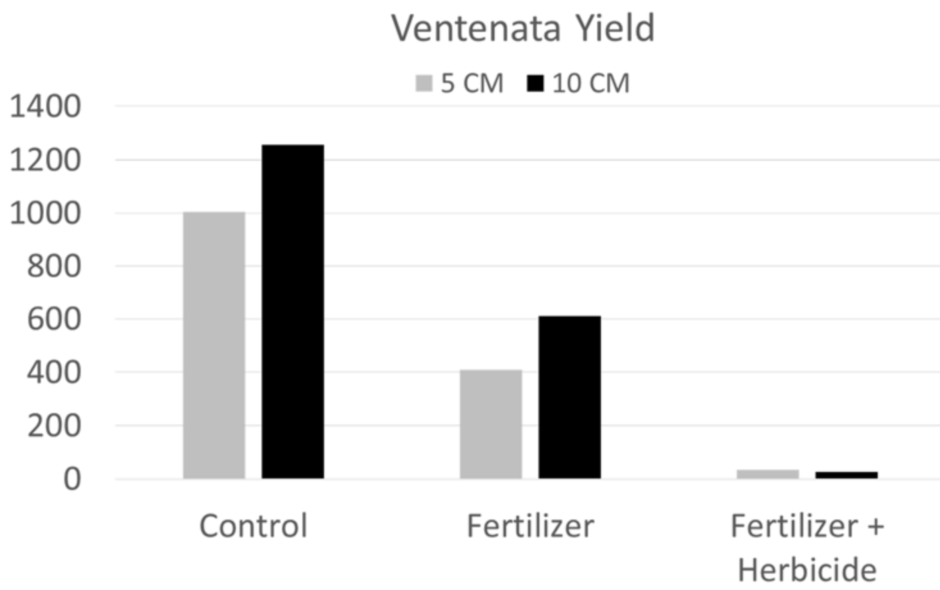

Figure 1 Biomass of ventenata expressed as kg/ha from post-treatment data within high ventenata infestation timothy hay plots.

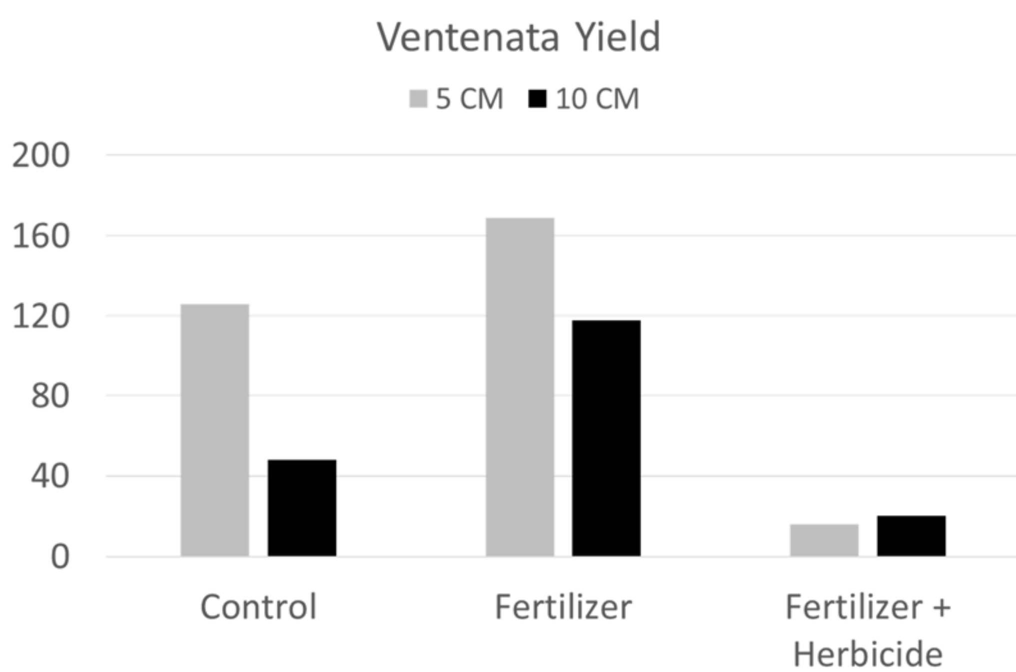

Figure 2. Biomass of ventenata from post-treatment data within low ventenata infestation timothy hay plots.

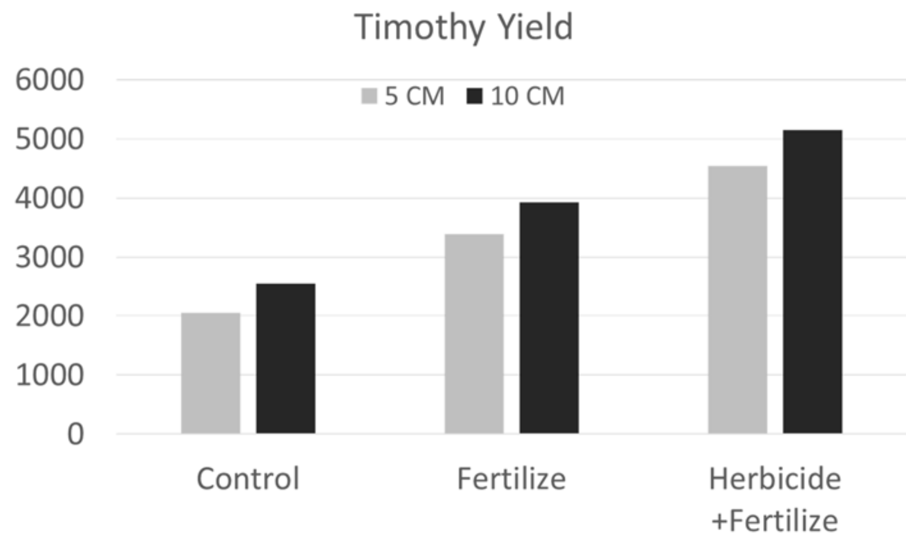

Figure 3. Biomass of forage from post-treatment data in timothy hay plots expressed as kg/ha.

LITERATURE CITED

Anderson, R. L. 1998. Ecological characteristics of three winter annual grasses. Weed Technology 12:478-483.

Ball, D. A., B. Klepper, D. J. Rydrych. 1995. Comparative above-ground development rates for several annual grass weeds and cereal grains. Weed Science 43:410-416.

Bush, T. 2002. USDA NRCS plant fact sheet: Timothy. East Lansing, MI; Rose Lake Plant Materials Center.

Chambers, K. L. 1985. Pitfalls in identifying Ventenata dubia (Poaceae). Madroño 32:120-121.

Crins, W. J. 2007. Flora of North America. Volume 24. Oxford University Press, Oxford, New York, USA.

DiTomaso, J. M. 2000. Invasive weeds in rangelands: species, impacts, and management. Weed Science 48:255-265.

Efetha, A., T. Dow, R. H. McKenzie, D. R. Bennett, and R. A. Hohm. Effect of irrigation management on yield and water use efficiency of timothy hay in southern Alberta. Canadian Journal of Plant Science 89:1075-1088.

Fountain B. 2011. Producing timothy hay and managing for the impacts for Ventana. Pages 107–108 in Proceedings of the Western Society of Weed Science. Volume 64. Las Cruces, NM: Western Society of Weed Science.

Fransen, S. 2005. Drought advisory: timothy hay. Washington State University Extension Bulletin EM4919E.

Hitchcock, C. L., A. Cronquist, M. Ownbey and J. W. Thompson. 1969. Vascular plants of the Pacific Northwest. Volume 1. University of Washington Press, Seattle, Washington, USA and London, Great Britain.

James, J. J. 2008. Effect of soil nitrogen stress on the relative growth rate of annual and perennial grasses in the Intermountain West. Plant Soil 310:201-210.

James, J. J., R. E. Drenovsky, T. A. Monaco, and M. J. Rinella. 2011. Managing soil nitrogen to restore annual grass-infested plant communities: effective strategy or incomplete framework? Ecological Applications 21:490-502.

Lass, L. and T. Prather. 2007. A scientific evaluation of noxious and invasive weeds of the Highway 95 construction project between the Uniontown cutoff and Moscow. Aquila Vision Inc. 78p.

Mahler. R. L. 2005a. Northern Idaho fertilizer guide: Grass seedings for conservation programs. University of Idaho College of Agricultural and Life Sciences Extension Bulletin CIS 820.

Mahler. R. L. 2005b. Northern Idaho fertilizer guide: Grass pastures. University of Idaho College of Agricultural and Life Sciences Extension Bulletin CIS 853.

Mislevy, P., J. B. Washko, J. D. Harrington. 1977. Influence of plant stage at initial harvest and height of regrowth at cutting on forage yield and quality of timothy and orchardgrass. Agronomy Journal 69:353-356.

Prather, T. 2009. Ventenata dubia: Increasing concern to the Inland Northwest Region. Center for Invasive Plant Management. June:1-2.

Scheinost, P., M. Stannard, T. Prather, J. Yenish. 2008. USDA NRCS Plant Guide: Ventenata dubia. Pullman, WA; Pullman Plant Materials Center.

Shewmaker, G. E. and M. G. Bohle, editors. 2010. Pasture and Grazing Management in the Northwest. Pacific Northwest Extension Publication. PNW 614.

Wallace, J. and T. Prather. 2010. Ventenata and downy brome control in timothy hay production. WSWS Research Progress Report. Pp 88.