MEDUSAHEAD CONTROL

Joseph M. DiTomaso, Guy B. Kyser, Neil K. McDougald, Ronald N. Vargas, Morgan P. Doran, Rob Wilson and Steve Orloff. University of California, Cooperative Extension

Medusahead (*Taeniatherum caput-medusae*) is native to the Mediterranean region of Europe and is well adapted to the semi-arid climate predominant in the western United States. It germinates in fall, which is followed by rapid root development during the winter (Sheley et al. 1993) and seed maturation in late spring to summer.

Medusahead was first introduced to Oregon as a seed contaminant around 1887 (George 1992, Young 1992). It rapidly spread north into Washington and throughout the Great Basin, into Utah and Idaho. As recently as 1950, medusahead was reported from only six counties in northwestern California. In the early 1990s, the species occurred in more than 20 counties, and was reported as far south as Riverside County (Young 1992). It continues to expand its range in California and we estimate that medusahead occupies more than a million acres of annual-dominated grassland, oak woodland, and chaparral communities in the state.

Medusahead is an aggressive non-native annual grass causing severe undesirable effects throughout western rangelands. It is an invasive species that has the ability to change the condition and nature of grassland ecosystems over a substantial area. It not only increases the fire frequency within an area, but can also lead to substantial litter accumulation that can suppress the establishment of native or other more desirable species.

Medusahead consists of very high silica content (>10% dry wt) (Bovey et al. 1961), which can reduce forage by as much as 75 to 80% in infested rangelands (George 1992, Hironaka 1961, Major et al. 1960). High silica content in plant tissues can also reduce the rate of tissue decomposition (Hironaka 1994) and can lead to 2 to 5 inches of litter build-up that may remain intact for two or more years (George 1992). The thatch layer does not impact medusahead germination and establishment, but excludes other species (Evans and Young 1970), leading to monotypic stands. Furthermore, accumulated medusahead litter increases the frequency of wildfires, thus eliminating the native shrub component from infested communities (Peters and Bunting 1994). Young (1992) hypothesized that medusahead litter build-up was the greatest threat to biodiversity of natural vegetation in the Great Basin.

Management Strategies

Although there are several well-documented management strategies for selective management of yellow starthistle, few options exist for selectively removing undesirable annual grasses from grasslands. Methods of controlling medusahead have been explored and implemented since the 1950s, but with limited success or inconsistent results.

In many cases, control programs are often based on the differential phenology of medusahead and desirable forages. In a Mediterranean climate, most range plants fully mature and disperse their seed by early to mid-June. In contrast, medusahead matures about 2 or more weeks later than most range species (George 1992), creating a time period when control methods, such as prescribed burning, can be selectively implemented.

Mechanical

Previous reports indicated that the competitive ability of medusahead in annual grasslands was primarily due to the slow breakdown of its thatch (high in silica) and that the thatch was the main component responsible for suppressing other competing species. Removing the thatch by either tillage or mowing in the fall can reduce the competitiveness of medusahead and provide better than 50% reduction in medusahead the following year. In addition, thatch removal can dramatically improved the efficacy of imazapic (not yet registered in California), regardless of whether the removal technique is through burning, tillage, or mowing.

Grazing

In a study designed to determine the effects of grazing on beef production, George et al. (1989) found that two years of intensive grazing significantly reduced medusahead from 45% of the total species composition to only 10%.

While the palatability of medusahead to livestock is low, earlier studies have shown that sheep will graze medusahead in all vegetative stages (Lusk et al. 1961). As plants matured, sheep preference declined as they selectively avoided medusahead. However, at high stocking rates sheep uniformly grazed medusahead-infested grasslands in all vegetative stages (Lusk et al. 1961). In an ongoing study in Yolo County, we intensively grazed medusahead with sheep in early-spring (March) and/or mid-spring (April-May) and monitored the cover of the annual grass in summer. Preliminary results indicate that mid-spring grazing reduced medusahead by greater than 80% with or without an early spring-grazing, but early spring grazing alone was ineffective.

Prescribed Burning

Medusahead and other long-awned invasive grasses (e.g., downy brome, ripgut brome, red brome, barb goatgrass) rely on animal dispersal for seed dissemination. Consequently, the seeds remain attached in the inflorescence longer than most desirable perennial and annual grasses. Medusahead matures a couple of weeks to more than a month later that most annual species, including grasses (Dahl and Tisdale 1975, Young et al. 1970). This directly exposes seeds to intense heat of fire flame when the senesced vegetation of other species or medusahead litter provides adequate fire fuel.

Effective control of medusahead with prescribed burning (>90%) was demonstrated as far back as 1953 (Furbush 1953). In contrast, Young et al. (1972) found that repeated annual burning in mid-summer increased medusahead infestations while decreasing the population of more desirable annual grasses. These inconsistent results suggest that burn timing may be critical to the success of this strategy. Murphy and Lusk (1961) and McKell et al. (1962) showed that the best timing for burning medusahead was in late May to early June before seed dispersal and before the seed moisture is below 30%.

In a more recent study in Yolo and Fresno counties, we have shown that prescribed burning conducted in late spring or early summer, before seed drop, is a very effective treatment, providing 99% and 87% control of medusahead after a single burn and over 99% control after two consecutive burns (DiTomaso et al., unpublished). This level of control in only two years suggests that seed longevity of medusahead in the soil is relatively short.

Despite the potential success of burning, it is not widely accepted because of air quality and liability issues that are exacerbated by construction of residential structures in rural areas.

Chemical Control

Currently registered herbicides are not a practical option in most cases since the extensive application of herbicides is difficult in rough terrain and selective herbicides are not yet registered in California for control of specific annual grasses.

Of the currently registered compounds, glyphosate can be an effective control method when applied in early spring to young medusahead plants. However, it is non-selective and can damage desirable broadleaf or grass vegetation, including native perennial grasses. Although not yet registered in California, imazapic has proven to be very effective on medusahead and other annual grasses. Imazapic is an imidazolinone herbicide registered for use in other states for the management of noxious annual grasses in rangelands, grasslands, and wildlands. We have shown that this new herbicide controls most invasive annual grasses in California without significantly injuring seedlings of many native perennial grass or broadleaf species. However, our data also indicates that imazapic ties up in the thatch layer, thus reducing its availability to germinating and developing medusahead seedlings (DiTomaso et al., unpublished). For example, in Yolo County we found that imazapic provided nearly complete control of medusahead in plots cleared of all thatch, but no significant control compared to untreated plots when the thatch was still present. Thus, it will be difficult for land managers to accurately determine the proper rate to apply if they have some level of thatch within their application site.

Imazapic does not injure most members of the Fabaceae (pea family) and Asteraceae (sunflower family). In some of our plots, this led to the selection of Asteraceae species including members of the genus *Hemizonia* (tarweeds), *Hypochaeris* spp. (catsears), and *Lactuca serriola* (prickly lettuce). Such species may not be desirable in a rangeland, where the goal is to improve the forage quality and quantity.

Integrated Approaches

Although the timely use of consecutive prescribed burns can be a very effective tool for medusahead control, this option is not always available to land managers. Other strategies for the selective control of medusahead are limited. In two sites in California (Yolo and Fresno County), we evaluated the effectiveness of a two-year integrated program using prescribed burning and the herbicide imazapic, either alone or in combination. At each site, we tested the response of five different treatments included two consecutive years of prescribed burning (May or June), two consecutive years of imazapic, a first year burning followed by a second year imazapic treatment, or a first year imazapic treatment followed by a second year burning.

In Fresno County, the medusahead cover in the untreated site averaged 45%, and in the Yolo County site it averaged 71%. As previously described, a single year of burning gave 98% control in Fresno County and 86% in Yolo County, and after a second year burn the control was better than 96% at both sites. By comparison, the combination of a late spring burn (which removed the thatch) followed by a fall imazapic treatment nearly always gave 100% control of medusahead the following year. Thus, it is possible to achieve complete control of this annual grass in a single season using the combination of prescribed burning and imazapic.

Conclusion

Preliminary results (DiTomaso et al., unpublished) indicate that the best approach for medusahead management is the use of prescribed burning. However, when thatch layers can be reduced by late season grazing, disking, mowing or burning, a fall application of imazapic can further reduce the medusahead population. In addition, an integrated approach combining late spring prescribed burning followed by fall imazapic treatment can provide excellent control of medusahead and may even provide complete control.

Literature Cited

Bovey, R.W., D. LeTourneau and L.C. Erickson. 1961. The chemical composition of medusahead and downy brome. Weeds 9:307-311.

Dahl, B.E. and E.W. Tisdale. 1975. Environmental factors related to medusahead distribution. Journal of Range Management 28(6):463-468.

Evans, R.A. and J.A. Young, 1970. Plant litter and establishment of alien annual weed species in rangeland communities. Weed Science 18: 697-703.

Furbush, P. 1953. Control of medusahead on California ranges. Journal of Forestry 51:118-121.

George, M.R. 1992. Ecology and management of medusahead. Range Science Report. Dept. Agronomy and Range Science, Agr. Exp. Stat. Series #32, 3 pp.

George, M.R., R.S. Knight, P.B. Sands and M.W. Demment. 1989. Intensive grazing increases beef production. California Agriculture 43(5):16-19.

Hironaka, M. 1994. Medusahead: natural successor to the cheatgrass type in the northern Great Basin. Pages 89-91, in Proc. Sym. On Ecology, Management, and Restoration of Intermountain Annual Rangelands. Ogden, UT.

Hironaka, M. 1961. The relative rate of root development of cheatgrass and medusahead. Journal of Range Management 14(5):463-267.

Lusk, W.C., M.B. Jones, D.T. Torell and C.M. McKell. 1961. Medusahead palatability. Journal of Range Management 14(5):248-251.

Major, J., C.M. McKell and L.J. Berry. 1960. Improvement of medusahead infested rangeland. California Agricultural Experiment Station, Extension Service. Division of Agricultural Sciences, University of California, Berkeley.

McKell, C.C., A.M. Wilson and B.L. Kay. 1962. Effective burning of rangelands infested with medusahead. Weeds 10:125-131.

Murphy, A.H. and W.C. Lusk. 1961. Timing of medusahead burns. California Agriculture 15(11):6-7.

Peters, E.F. and S.C. Bunting. 1994. Fire conditions pre- and postoccurrence of annual grasses on the Snake River Plain. Pages 31-36, in Proc. Sym. On Ecology, Management, and Restoration of Intermountain Annual Rangelands. Ogden, UT.

Sheley, R.L., L.L. Larson and D.E. Johnson. 1993. Germination and root dynamics of range weeds and forage species. Weed Technology 7:234-237.

Young, J.A. 1992. Ecology and management of medusahead (*Taeniatherum caput-medusae* ssp. *asperum* [Simk.] Melderis). Great Basin Naturalist 52(3):245-252.

Young, J.A., R.A. Evans and B.L. Kay. 1970. Phenology of reproduction of medusahead. Weed Science 18:451-454.

Young, J.A., R.A. Evans and J. Robison. 1972. Influence of repeated annual burning on a medusahead community. J Range Management 25:372-375.