Germination Comparisons of Crested Wheatgrass Cultivars, ‘Hycrest’ and ‘Hycrest II’

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Introduction

With increasing threats to western rangelands, such as fire and exotic plant invasions, there is an ever increasing need for plant materials that can be successfully revegetated in these vast and important ecosystems. Wildfires are an annual event throughout the West and wildfires often result in the conversion of native plant communities to exotic weeds, such as cheatgrass (*Bromus tectorum*). Protecting these disturbed plant communities often relies on choosing the most appropriate plant material that can achieve a desired goal. The first goal is establishment of seeded species in these harsh and xeric environments where average precipitation rarely occurs and failures are commonplace.

While native plant selections are continuously being researched, an exotic plant cultivar is often used for seeding efforts. Exotic cultivars, under low precipitation conditions, establish at higher rates of plants per area then any currently available native species. One such introduced plant is crested wheatgrass (*Agropyron cristatum*). Crested wheatgrass is native to Russia and was introduced to the United States in the early 1900s. Due to historical successes at establishing large acres of crested wheatgrass, it has been used regularly in seed mixes.

Currently there is debate over the importance of achieving such goals as establishing a number of plants per area (a requirement to prevent cheatgrass dominance). It has been suggested that favoring a first priority goal of having a higher percent of established plant cover being native plants is most important. Unfortunately this goal often does not consider the number of plants per area, a requirement for cheatgrass suppression, but focuses on the number of plants that are native or non-native. Accordingly, a seeding that established 10 plants per 100 ft^2, with 9 being native and 1 being introduced would be favored over a seeding that established 100 plants per 100 ft^2 (the minimum for cheatgrass suppression, 1 crested wheatgrass plant per ft^2) with 90 being introduced and 10 being native. So while the second scenario helps protect the site from cheatgrass conversion, reduces erosion better, provides more forage and decreases fire risk (by suppressing cheatgrass), the first scenario has become the main goal of many individuals regarding rangeland seeding efforts. Regardless of this new dogma that views crested wheatgrass as a problem and not a useful and practical means to move away from cheatgrass dominance, crested wheatgrass is still used in seeding efforts. It also has the benefit of being less costly than the native perennial plants currently available.

Since crested wheatgrass was introduced multiple cultivars have been developed. One common and widely used cultivar is ‘Hycrest’, which was developed from a hybrid of two tetraploid crested wheatgrass species and was released in 1984. Recently a new related cultivar, ‘Hycrest II’ has been developed in hopes of improving the success of establishing this plant.

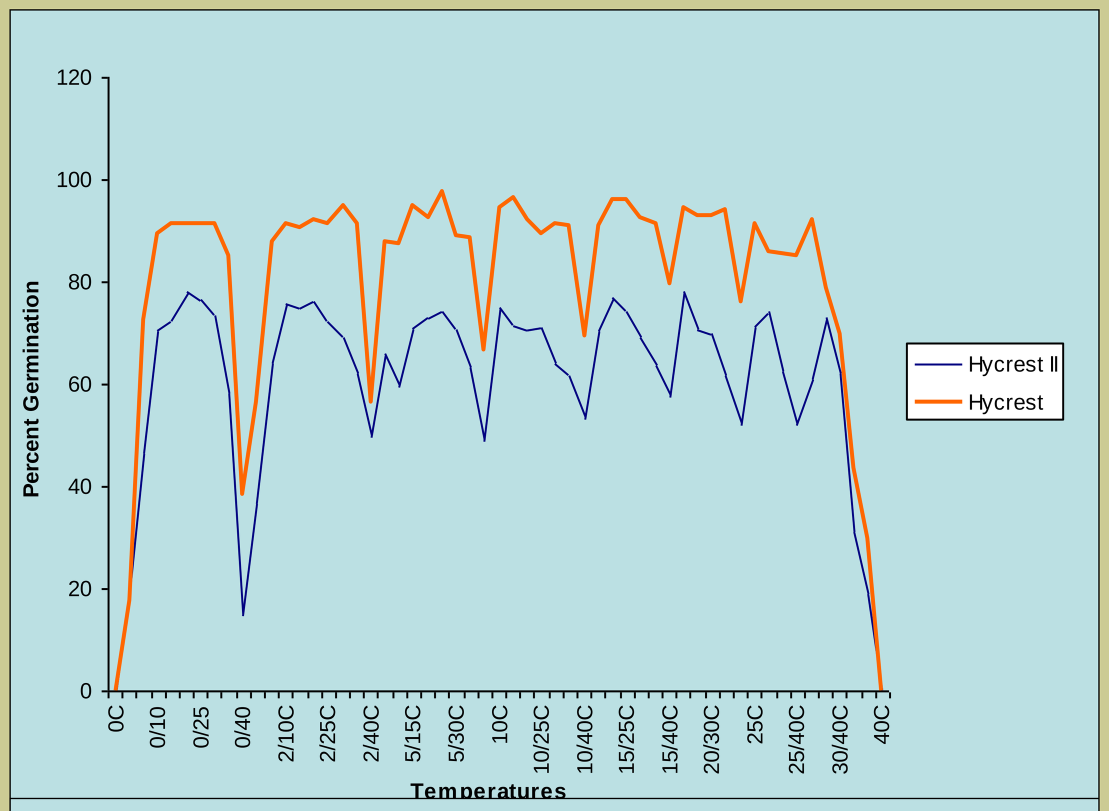

Figure 2. Germination results after four weeks under dark conditions in incubators at various temperatures.

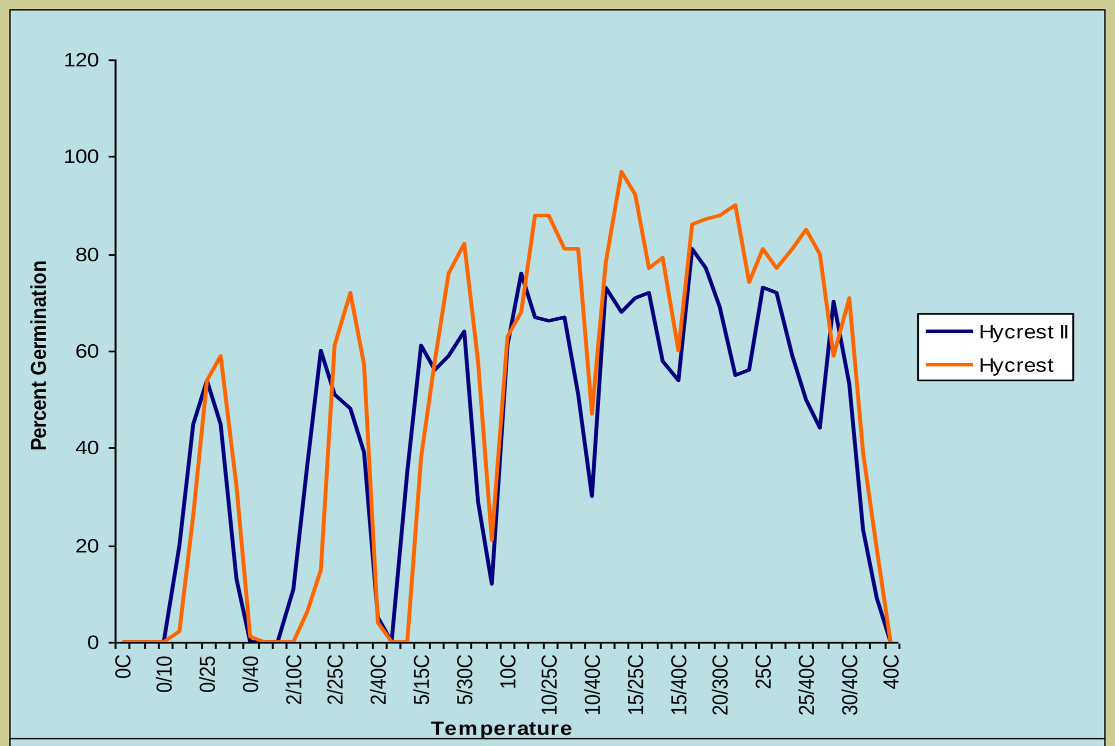

Figure 1. Germination results after 1 week in incubators.

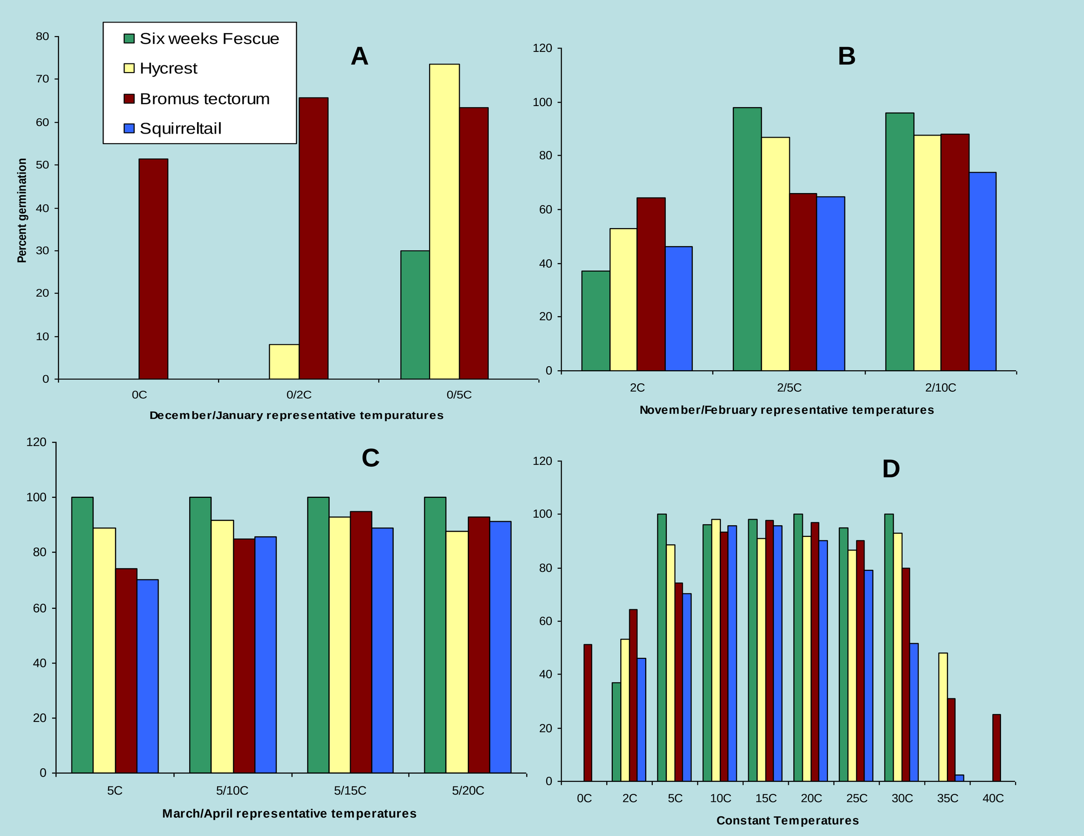

Figure 3. Germination test results of four species, Six Weeks Fescue (a short life cycle, native annual grass, commercial source), ‘Hycrest’ (commercial source), Cheatgrass (*Bromus tectorum*), average from 4 germination tests, seed from a variety of sites, and Squirreltail (*Elymus elymoides*) commercial source. **(A)** December and January representative temperatures based on averages from 10 northern Nevada towns. Cheatgrass clearly dominates this stage, **(B)** November and February representative temperatures. Cheatgrass begins to loose its advantage. **(C)** March and April representative temperatures. **(D)** Constant temperatures, Cheatgrass dominates at both extremes.

Methods

We tested and compared the germination potential of ‘Hycrest II’ to that of ‘Hycrest’ at 55 constant and alternating temperature regimes representative of Intermountain West seedbed temperatures. Temperatures ranged from constant 0ºC to 40ºC and every possible alternating temperature regime of 8 hours warmer and 16 hours colder. For example 0oC alternated with 2, 5, 10, 15, 20, 25, 30, 35, and 40ºC, while 35ºC only alternated with 40ºC. Twenty five seeds per four petri dishes (reps) were observed for germination for each temperature treatment at 1,2, and 4 weeks (Young et al. 1981)

Seed Source

Seed was provided by the USDA Natural Resource Conservation Service, Plant Material Center in Fallon, NV. New cultivars including ‘Hycrest II’ were going to be tested in field trials in comparison to the existing cultivars. The cultivars were provided by the Logan, Utah USDA Agricultural Research Service, Forage and Range Research Unit. We were given the seed in fall 2007 and performed a germination test in January 2008, comparing the ‘Hycrest II’ to ‘Hycrest’. We then performed another full germination profile to test our previous results and then used the average of the two results for final comparisons.

Results

Initial germination was higher for ‘Hycrest II’ during the first week for alternating temperature regimes at 0ºC/15ºC, 2ºC/15ºC, 2ºC/20ºC, 5ºC/10ºC and 5ºC/15ºC (Figure 1). This may indicate an increased potential for ‘Hycrest II’ to germinate faster and earlier in the growing season. Maximum germination after four weeks however did not show this pattern (Figure 2). Generally ‘Hycrest II’ had lower germination rates at most temperature treatments after four weeks.

Discussion

While these results may seem to be negative, germination tests show the optimal potential, which most know is never achieved. Furthermore higher optimal germination potential does not always equal greater success on the ground. Often greater moisture requirements compared to cheatgrass for germination and seedling survival usually equates to lower plant establishment when it comes to seed vs. seed on the ground, even though a species may exhibit high germination rates in germination tests, such as six weeks fescue (*Vulpia octaflora*) (Figure 3). Successful establishment requires seedling survival and is affected by seasonal timing of germination in regards to moisture availability. Germination seasonality can be evaluated to some degree by these germination tests (Figure 3). Low temperature germination can indicate fall/winter/early spring germination. While very little germination likely occurs during the hottest months for cheatgrass nor most seeded grasses, the coldest temperature tested (0ºC) represents one of the greatest advantages that cheatgrass has in regards to germination and temperature. It gets a head start in the race for root development, space and resources. Often cheatgrass not only germinates but actually develops a highly competitive root mass under its diminutive rosette during winter. It is often a race to get going before cheatgrass is so far ahead that it possibly limits available resources. The broadness of temperature regimes for which cheatgrass can germinate (Figure 3) reflects its success at dominating sites especially after fires when succession is back to ground zero and the race begins.

While it is probably not a coincidence that species that have a much narrower or lower germination potential under optimal conditions are usually less likely to establish and suppress cheatgrass on harsh sites, there is no golden rule. Nevertheless, faster germination at lower temperatures is a positive attribute plant material should exhibit.

In conclusion, ‘Hycrest II’ does show increased potential in this very important low temperature germination window that cheatgrass currently dominates.

Future

Taking advantage of native plants that could also have this ability to start early could be a great benefit in cheatgrass control. We are currently examining the potential for fall/winter germination of dozens of native species that we have also drill seeded at commonly used seeding rates at numerous sites throughout Nevada to test their potential under the same conditions as commonly seeded grass and shrub species.

Literature Cited

Young, J.A., R.E. Eckert, JR., and R.A. Evans. 1981. Temperature Profiles for Germination of Bluebunch and Beardless Wheatgrasses. J. of Range Management. 34:84-89.

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