Influence of Age and Awn Removal on Dormancy of Medusahead Seeds[1]

Jack R. Nelson and A. M. Wilson

Department of Forestry and Range Management, Washington State University, Pullman; and Crops Research Division, Agricultural Research Service, U. S. D. A., Pullman, Washington.

Highlight

The effects of seed age and awn removal were studied in two medusahead strains having different post-maturity seed dormancy characteristics. Awn removal increased the percentage germination. The proximity of removed awns inhibited the germination of de-awned seeds. Dormancy of intact seeds and inhibitory effects of awns decreased with increasing age of seeds.

Medusahead [*Taeniatherum asperum* (Simonkai) Nevski], a winter-annual grass, native to the Mediterranean area, has become a major problem in western United States (McKell et al., 1962). Millions of acres of range in California, Idaho, Nevada, Oregon, and Washington have been invaded by this undesirable weed. Eradication efforts have been futile and control measures are costly.

Medusahead strains from western United States differ in their seed dormancy characteristics (Nelson and Harris, unpublished; Young et al., 1968). Some strains exhibit only slight seed dormancy a few weeks after harvest; other strains remain dormant for 6 months or longer. Dormancy is most evident and prolonged when seeds are germinated at 20, 25, or 30 C. Germination at 10 or 15 C relieves dormancy in some strains, and shortens the period of dormancy in other strains (Young et al., 1968).

Environmental conditions during seed development and maturation also appear to influence dormancy in medusahead (Nelson and Harris, unpublished). Many strains exhibited greater dormancy when seeds were produced in a cool, moist nursery at Pullman, Washington, than when they were produced in a warm, dry nursery at Hooper, Washington. This phenomenon has also been observed in wheat (Belderok, 1961).

Intermittent and delayed germination of dormant seeds decreases the effectivness of most mechanical and herbicidal methods of controlling medusahead. A more complete understanding of dormancy would therefore assist in developing more effective control methods. This note gives preliminary results concerning the influence of age and awn removal on medusahead seed dormancy.

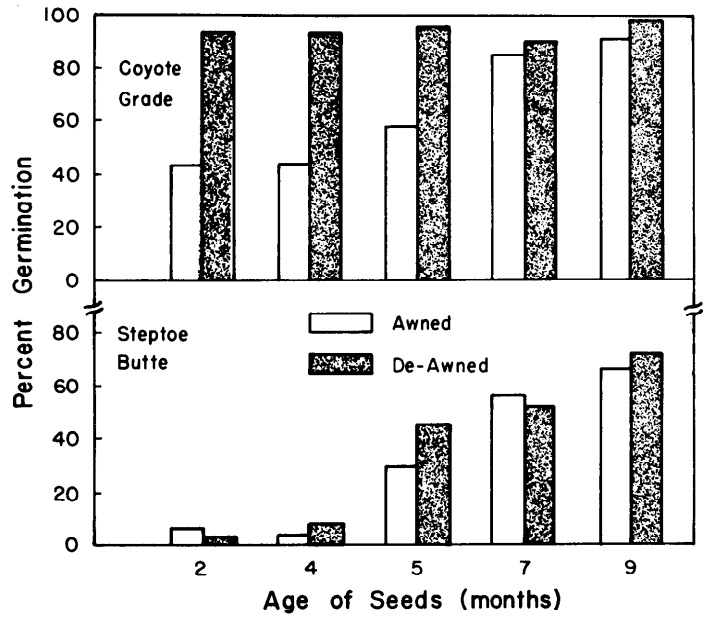

FIG. 1. Effects of age and awn removal on the percentage germination of nursery-grown medusahead seeds of the Coyote Grade and Steptoe Butte strains. Seeds were germinated for 7 days at 23 C. Values are means of four replications of 25 seeds each.

Materials and Methods

Seeds of two medusahead strains were originally collected at Steptoe Butte, Whitman County, Washington (21-inch precipitation zone 3,000-ft elevation) and at Coyote Grade, Nez Perce County, Idaho (16-inch precipitation zone, 1,400-ft elevation). They were planted in randomized rows in a nursery at Pullman, Washington, in October, 1965. These strains were selected because of their differing seed dormancy characteristics and their similar phenology during flowering and seed development.

Seeds for the dormancy tests reported in Fig. 1 were harvested from the nursery in July, 1966. Spikes had been covered with onionskin paper bags prior to anthesis to prevent hybridization between strains. Limited outcrossing among individuals of the same strain was permitted by enclosing spikes from three separate plants within each bag. The bags remained on the spikes until seeds were mature.

In the experiment shown in Fig. 1, the germinability of awned and de-awned nursery-grown seeds was compared 2, 4, 5, 7, and 9 months after harvest. Awns were separated from seeds with a razor blade. The temperature was 23 C. Germination activity had essentially ceased at 7 days, and seeds that had not germinated at that time were considered dormant. Dormancy could be broken by holding ungerminated seeds at 7 to 8 C for 1 week and then returning them to a temperature of 23 C. Cumulative germination percentage after this treatment was nearly 100%.

Wild-grown seeds for the dormancy tests reported in Table 1 were collected in July, 1968 at Coyote Grade and Steptoe Butte. The tests were started 2 days after harvesting seeds. The objective was to test the inhibitory effects of removed awns on seed germination. Awned seeds, de-awned seeds, or de-awned seeds together with their removed awns, were placed on the agar

---

[1] Cooperative investigation of the College of Agriculture, Washington State University, and Crops Research Division, Agricultural Research Service, U.S. Department of Agriculture. Scientific paper 3082, Project 1508, College of Agriculture, W.S.U. Supported in part by Bureau of Land Management, U.S. Department of the Interior, contract 14-11-0001-3674 with Washington State University. Received September 14, 1968; accepted for publication January 11, 1969.

surface. Newly harvested awns were also placed with 3-year-old seeds of the Coyote Grade strain. Seeds were held at 23 C for 10 days and then transferred to 10 C.

In all tests, seeds were germinated on 2% agar in a high humidity chamber. Seeds were considered germinated when the root and shoot were both visible.

Results and Discussion

Awn removal significantly increased germination of the 2-, 4- and 5-month-old seeds of the Coyote Grade strain (Fig. 1). Both awned and de-awned 7- and 9-month-old seeds germinated nearly 100%. Awns apparently contained inhibitors that moved into the caryopsis during germination of the 2- to 5-month-old seeds. Removing the awns may have reduced the concentration of inhibitors below a critical level for germination. The observation that awns became decreasingly inhibitory as the seeds aged suggests that inhibitory substances located in the awns were being broken down. An alternative explanation is that the embryo may have become less sensitive to the inhibitors as the seeds aged.

Germinability of seeds of the Steptoe Butte strain was very low in the 2- and 4-month trials, but increased as the seeds aged (Fig. 1). In this test at 23 C, removing the awn did not appear to affect the germination of seeds of the Steptoe Butte strain. Sufficient inhibitor may have been present in other parts of the seed, such as the lemma and palea, to inhibit germination.

The inhibitory effect of awns of the Steptoe Butte strain was evident when newly harvested wild-grown seeds were germinated at 10 C (Table 1). The removed awns, placed on the agar surface, inhibited the germination of de-awned seeds. Inhibitory substances in awns apparently are able to diffuse through the agar to adjacent de-awned seeds.

Table 1. Inhibitory effects of awns on percentage germination of aged and newly harvested wild-grown medusahead seeds of the Coyote Grade and Steptoe Butte strains.[1]

Seed treatment	Days of germination 5	10	20	30
Newly harvested seeds:				
Coyote Grade strain				
Awned	0	0	16	50
De-awned	0	0	48	72
De-awned + removed awns	0	0	38	69
Steptoe Butte strain				
Awned	0	0	0	3
De-awned	0	0	12	26
De-awned + removed awns	0	0	4	13
Three-year-old seeds of the Coyote Grade strain:				
De-awned	94	—	—	—
De-awned + Coyote Grade awns[2]	92	—	—	—
De-awned + Steptoe Butte awns[2]	95	—	—	—

[1] Temperature was 23 C during the first 10-day period and 10 C during the 10- to 30-day period. Values are means of 4 replications of 50 seeds each.

[2] Fifty newly harvested awns were placed on the agar with the 3-year-old seeds.

Awn removal increased the percentage germination of seeds of the Coyote Grade strain in the test at 10 C (Table 1). However, the proximity of removed awns appeared less inhibitory to de-awned seeds.

The proximity of newly harvested awns of the two strains did not inhibit the germination of 3-year-old seeds of the Coyote Grade strain (Table 1). Roots from these seeds were visible within 24 hours, and 94% of the seeds germinated within 5 days. Apparently inhibitors in the aged seeds had been broken down and the concentration of inhibitors from awns of the newly harvested seeds was too low to delay germination.

Severe winters kill some fall-germinated medusahead plants on cold northern sites. Thus, the dormancy phenomenon, by delaying germination until spring, may be a survival mechanism.

In warm, winter-rainfall climates, early fall germination is important, allowing over-winter growth and spring maturity. The absence of dormancy in this situation may similarly be a survival mechanism.

LITERATURE CITED

BELDEROK, B. 1961. Studies on dormancy in wheat. Proc. Inter. Seed Testing Assoc. 26: 697–760.

MCKELL, C. M., J. P. ROBISON, AND J. MAJOR. 1962. Ecotypic variation in medusahead, an introduced annual grass. Ecology 43: 686–698.

YOUNG, J. A., R. A. EVANS, AND R. E. ECKERT, JR. 1968. Germination of medusahead in response to temperature and afterripening. Weed Science 16: 92–95.