

GERMINATION OF GAMBEL OAK SEED

Two to four weeks of stratification at $2.0^{\circ}\text{C} \pm 1^{\circ}$ is the best preplanting treatment to overcome dormancy and obtain maximum seed germination.

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Gambel oak (*Quercus gambelii* Nutt.) is a small, informally shaped, coarse-textured tree which grows to be 9- to 15-foot tall. It sometimes grows as wide as it is tall, and has golden-brown to reddish-brown fall color. The natural range of Gambel oak extends from Nevada to Wyoming south to New Mexico and Arizona. To date, it is not cultivated as a landscape plant but it has desirable characteristics which may make it useful in massed plantings or in windbreaks.

Oaks are generally classified into two major groups, the white oak group and the black oak group. With a few exceptions, acorns of the white oak group have little or no dormancy and will germinate after maturing, while acorns of the black oak group exhibit embryo dormancy and germinate the spring following fall sowing (4). Variation in stratification requirements exist among species in the black oak group as well as in the white oak group. Among the black oaks, *Quercus rubra* and *Q. kelloggii* require from 30 to 45 days, while *Q. laevis* and *Q. nuttallii* require from 60 to 90 days. Of the white oaks reported, *Q. chrysolepis* requires from 0 to 60 days, while *Q. macrocarpa* requires 30 to 60 days.

Gambel oak belongs to the white oak group. Under natural conditions it perpetuates itself by seed and root suckers. Very limited information is available regarding the germination of Gambel oak seeds under controlled conditions. We conducted this study to determine storage and germination conditions most suitable for germinating the seeds. Hopefully, when the pre-germination requirements of its seed

are better understood, this promising landscape tree will be more widely used.

Materials and Methods

Acorns of Gambel oak were gathered from natural stands in the San Juan National Forest, Archuleta County, Colo., in the fall of 1975. The source is located 10 miles from Pagosa Springs, Colo., $37^{\circ} 30'$ N. latitude, $160^{\circ} 30'$ W longitude at an elevation of 8,000 ft.

The sample was sorted by discarding acorns that appeared abnormal or infested with oak weevil larvae. Seeds were divided into experimental lots consisting of 20 seeds per treatment. The treatments consisted of stratification in sealed polyethylene bags containing moist sphagnum moss at $2^{\circ}\text{C} \pm 1^{\circ}$ and $-12^{\circ}\text{C} \pm 1^{\circ}$ for periods of 2, 4, and 6 weeks. Stratification involves storage of seeds under high moisture conditions plus temperatures above freezing. A control treatment using untreated seeds was planted in a seed flat with a prepared greenhouse medium of 1:1 organic peat and vermiculite at the time the other seed lots were placed in the storage rooms for the different stratification treatments. Specified seed lots were removed from stratification after 2, 4, and 6 weeks and planted in the greenhouse in the same manner as those of the control. All treatments were replicated two times. Germination was recorded at 5-day intervals for 30 days after planting for each of the different treatments. Seeds with radicle emerged were considered germinated.

Results and Discussion

Seeds stratified at $-12^{\circ}\text{C} \pm 1^{\circ}$ were eliminated from the study because the seeds were killed during treatment. The seeds probably died because there was excess moisture within and around the cells.

The data on the germination response of Gambel oak seed to the different treatments are summarized in figure 1. Seeds of the untreated lot began germinating after 14 days and increased gradually for the remaining 16 days. A peak germination value of 90 percent was obtained 30 days after planting. Seeds stratified for 2 weeks began germinating 4 days after planting and reached a peak germination value of 92 percent after 15 days. Seeds which were stratified for 4 weeks had 92 percent germination at planting time but no increase was observed during the next 30 days. Those that were stratified for 6 weeks had 60 percent germination at planting time but no additional response was noted.

Emerged radicles of many germinated seeds in 4- and 6-week cold treatments showed abnormal discoloration. Many seeds were also partially rotten or infected with mold at the time of planting. Figure 2 shows this trend in the severity of seed contamination as stratification went beyond 2 weeks. Contaminations of 20 and 80 percent were noted for seeds that were stratified 4 and 6 weeks, respectively. No contamination was noted among the non-stratified and 2-week stratified seeds.

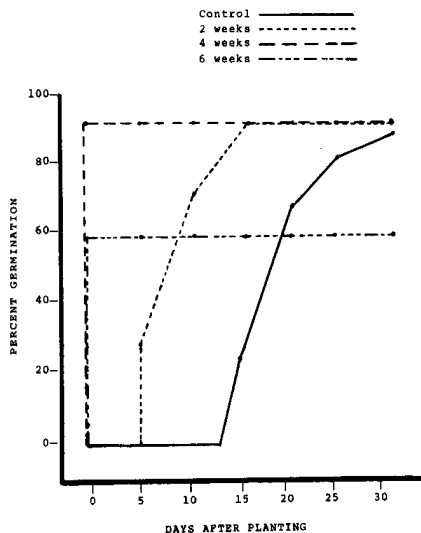


Figure 1.—Germination of Gambel oak seed following stratification at $2^{\circ}\text{C} \pm 1^{\circ}$ for different periods.

Several abnormalities were noted among the study's seedlings. Seeds with discolored radicles or partial contamination frequently produced abnormal seedlings. Seedlings developed from plural-seeded or polyembryonic acorns were also inferior in vigor. Beck and Weigle (1) reported similar findings in plural-seeded acorns of bur oak.

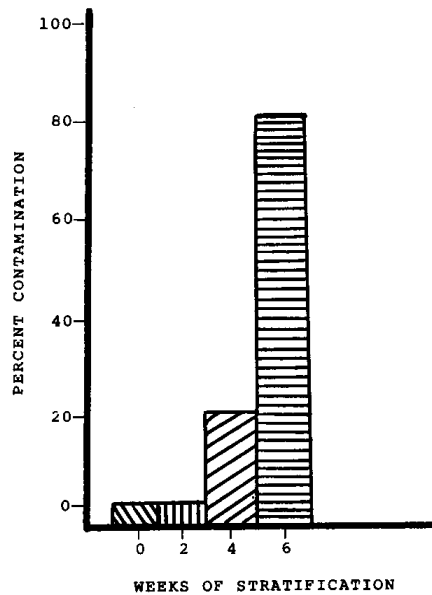


Figure 2.—Contamination of Gambel oak seeds as affected by period of stratification.

Summary

These data indicate that stratification of Gambel oak seeds for a period of 2 weeks at $2^{\circ}\text{C} \pm 1^{\circ}$ is superior to no pretreatment or to 4- to 6-week stratification in obtaining maximum germination.

It should be noted that there appears to be a need to disinfect Gambel oak seed prior to stratification to prevent contamination by pathogens. Also, trees producing a high frequency of plural-seeded acorns should not be used as a seed source for propagating Gambel oak.

Literature Cited

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