

# WHITE OAK SEEDLING SURVIVAL AND VIGOR FOLLOWING

## ACORN REMOVAL AND WATER STRESS

Eugene R. Thorn and Walter M. Tzilkowski<sup>1</sup>

**Abstract:** A lack of viable acorns, due to rodent depredation, may be the primary cause of advanced regeneration failure of oak in Pennsylvania. White oak (*Quercus alba*) acorns germinate immediately upon falling. Within three weeks, 30-50% of the nutrients in the cotyledon are transferred into the upper taproot; removing the cotyledon during winter may not affect survival and growth. Our objective was to determine whether nondormancy of white oak acorns contributed to seedling survival. Thirty-three or 34 sound white oak acorns were randomly assigned to each of six perforated trays (95 x 46 x 10 cm) filled with a mixture of 1/2 peat moss and 1/2 sterilized sand. Two weeks after acorns were planted at a depth of 2.5 cm in 8 equally spaced rows, cotyledons were carefully removed from the growing radicles in three randomly chosen trays, simulating removal by small mammals. Remaining acorns were used as controls. For the first nine weeks, the germination phase, trays were watered three times weekly until the soil mixture was saturated. Beginning with week 10, the water stress phase, each tray received only 0.5 l of water/week, until week 21, the resprout phase, when water was provided at the initial intensity. After eight weeks of greenhouse conditions, 68% of intact acorns germinated into seedlings, whereas only 53% of acorns without cotyledons germinated. After 10 weeks of water stress shoot mortality was observed. Seven weeks after watering was resumed, 17% of seedlings with cotyledons and 33% of seedlings without cotyledons resprouted. Seedling survival (with or without cotyledons) differed within the germination ( $P < 0.0001$ ), water stress ( $P < 0.0001$ ) and resprout phase ( $P < 0.0001$ ). Variation in seedling survival within either the germination, water stress or resprout phase was accounted for primarily by time. Survivorship of seedlings that lose the acorn food reserve was lower initially; however, after stressing seedlings until the shoots died back, seedlings with cotyledons removed resprouted and survived at double the rate of control seedlings. Recovery from cotyledon loss evidently prepared these seedlings for the next stressful situation. Our results suggested a potential for establishment of vigorous seedlings from white oak acorns, even if cotyledons are removed from the radicle by small mammals during late winter-spring.

---

<sup>1</sup>West Virginia Department of Natural Resources, Division of Wildlife Resources, Simon, W. VA 24882 and School of Forest Resources, The Pennsylvania State University, University Park, PA 16802, respectively.