Proceedings of the 13th North American Agroforestry Conference
June 19-21, 2013
Charlottetown, Prince Edward Island, Canada

Laura Poppy, John Kort, Bill Schroeder, Tricia Pollock and Raju Soolanayakanahally, Editors

THE EFFECT OF MESH SHELTERS AND NITROGEN FERTILZER ON GROWTH FOR BIGTOOTH ASPEN WILDLIFE PLANTINGS

Mike Demchik[1] and Emily Demchik[2]

[1]University of Wisconsin Stevens Point, 800 Reserve Street, Stevens Point, WI, 54481 USA mdemchik@uwsp.edu
[2]Oak Openings Farm, 8438 14th Road, Almond, WI 54909, USA

ABSTRACT

Bigtooth aspen (*Populus grandidentata*) is a good species for use in conservation plantings in the agricultural landscape of Central Wisconsin. The buds and twigs are utilized as forage by a range of species in winter. The species is easy to manage with coppice and the resulting pulpwood finds a ready market. Early establishment of plantings can, however, be plagued by excessive browse damage. Our objective was to determine if nitrogen fertilization, poultry mesh tree shelters or a combination of both would increase aspen seedling growth rate. We planted 8 split plots of 12 bigtooth aspen seedlings (1-0 stock) (96 total seedlings). Four of the plots were fertilized with polymer coated urea at a rate of 90 Kg N per hectare and four were controls. Half of the trees in each split-plot were caged with 5 foot tall poultry mesh shelters (5 inch diameter) and half were uncaged. The poultry mesh shelters increased seedling growth. Overall, sheltered seedlings averaged 91 cm while unsheltered averaged 51 cm, with or without fertilization. However, the combination of both shelters and fertilization (107 cm) had a much greater impact than either fertilizer alone (54 cm) or shelter alone (75 cm) or the control (47 cm). At this point, all seedlings are still within the browse height of deer; however, it appears that the impact of fertilization alone is not sufficient to help the trees outgrow deer browsing although the addition of fertilizer with the use of tree shelters results in significantly increased growth.

Keywords: urea, browse, deer, poplar

INTRODUCTION

Aspen is second only to maple in industrial roundwood use in Wisconsin; indeed, of all species groups in Wisconsin, the aspens are the only species that are being harvested at a higher rate than current growth (Perry et al. 2009). Annual growth in excess of a cord/acre/year are possible (Perala 1978) under extensive management conditions. Aspen is very easy to manage after establishment. Overstory removal often results in vigorous coppice from root sprouts. These coppices are strongly favored by grouse as part of their habitat requirements (Kubisiak 1985). For these reasons, aspen is a good species for use in farm forest plantings.

Farm forest plantings are often plagued by excessive deer browsing. In portions of the Wisconsin landscape, deer are far in excess of population goals (WI DNR 2011). Deer are a known to impact tree competitive ability due to selective browsing of preferred species (Stromayer and Warren 1997, Strole and Anderson 1992) and specifically to target aspen under some conditions (Prachar and Samuel 1988, Inouye et al. 1994). On our study site, we have seen multiple *Populus* species (both planted and natural) targeted heavily by deer.

Tree shelters may be a viable method of protecting seedlings aspen from deer browsing; however, the cost is generally high. Our per seedling cost of tree shelters (not including labor) was approximately $1.00. There is a sizable literature on the impacts of tree shelters on seedlings; however, the literature on mesh shelters is more limited. Sharpe et al. (1999) showed tree shelters to be potentially viable method of reducing deer browsing and tree mortality, with wire shelters the overall best choice. The use of shelters would likely be the most foolproof method of reducing deer browse on seedlings.

Fertilization has also been tried as a method of increasing seedlings growth. Van de Driessche et al. (2003) found the combination of irrigation and fertilizer to significantly increase aspen growth (78% more growth than the control). Czapowskyj and Safford (1979) used fertilization in an aspen-birch-red maple stand to increase growth. Bigtooth aspen was one of the most affected species with the combination of nitrogen, fertilization and lime increasing volume growth of aspen by 7 times over the control.

Our objective was to determine if nitrogen fertilization, poultry mesh tree shelters or a combination of both would increase aspen seedling growth rate.

METHODS

On April 23, 2011, 96 bigtooth aspen seedlings (1-0 stock from Wisconsin DNR nursery) were planted in plots adjacent to a pasture and among other tree plantings in Belmont Township, Portage County, Wisconsin, USA. The previous ground cover was sod, which was scalped in the planting plots prior to planting. The planting arrangement was 8 split plots of 12 bigtooth aspen seedlings each. Four of the plots were fertilized with polymer coated urea at a rate of 90 Kg N per hectare and four were controls. Half of the trees in each split-plot were caged with 1.5 m (5 ft) tall poultry mesh shelters 0.13 m diameter (5 in) tied to a wooden lath and half were uncaged. The sheltered seedlings were co-located all in the same portion of the planting plot to avoid having the closely spaced adjacent cages reducing the browsing on uncaged seedlings. The seedlings were planted at a spacing of approximately 0.6X0.6 m (2X2 ft). This close spacing was intended to create “clumps” of aspen for grouse habitat. At this stage of growth, this close spacing is most likely not having much impact on the growth of the seedlings. Periodically, plots were monitored and damaged shelters were corrected (a strong freezing rain storm in winter 2011-2012 required many of the shelters to be returned to vertical. This had minimal impact on browsing because although the seedling was bent over to the ground in some cases, it was still encased in the shelter. Seedling height was measured on Oct 16, 2011 and Oct 22, 2012. Split plot ANOVA was used to analyze the data.

RESULTS

The poultry mesh shelters increased seedling growth. Overall, sheltered seedlings averaged 91 cm while unsheltered averaged 51 cm, with or without fertilization. However, the combination of both shelters and fertilization (107 cm) had a much greater impact than either fertilizer alone (54 cm) or shelter alone (75 cm) or the control (47 cm) (Table 1). At this point, all seedlings are still within the browse height of deer; however, it appears that the impact of fertilization alone is not sufficient to aid the trees in outgrowing deer browsing although the addition of fertilizer with the use of tree shelters results in significantly increased growth.

Table 1. The impact of mesh shelters or fertilizer on the height of bigtooth aspen seedlings after two years of growth. Means expressed ± standard error.

		N	Mean
No fertilizer	No shelter	24	47±4
	Shelter	24	75±4
Fertilizer	No shelter	24	54±3
	Shelter	24	107±7

DISCUSSION

The impact of deer on the success of tree plantings is hard to overstate. With deer populations in excess of management goals in much of Central Wisconsin, alternative methods may be necessary to establish seedlings in new plantings. Preferential deer browsing has been shown to shift species diversity in favor of species with lower browsing preference (Strole and Anderson 1992; Stromayer and Warren 1997). With the overall ease of management of aspen after establishment as well as the significant wildlife benefits of the species, it may be justified to invest the effort to establish these plantings even in the presence of significant deer browsing.

We found that relatively inexpensive shelters increased the growth of seedlings by the end of the second year. The use of fertilizer also increased growth in combination with the shelters but was of minimal impact on seedling growth without shelters.

Through time, we will monitor the growth of these seedlings. In addition to determining the impact of shelters and fertilizer on seedlings success, we hope to determine whether these "patch plantings" will expand using root sprouts and whether patch planting may be an approach to converting marginal farmland into aspen cover.

ACKNOWLEDGEMENTS

We wish to thank Benjamin Demchik for assistance in shelter preparation and plot installation.

LITERATURE CITED

Czapowskyj, Miroslaw M. and Lawrence O. Safford. 1978. Growth Response to Fertilizer in a Young Aspen-Birch Stand. USDA Forest Service Research Note NE-274. Northeastern Forest Experiment Station, Newtown Square, PA. 6 p.

Inouye, R.S., Allison, T.D. and N.C. Johnson. 1994. Old Field Succession on a Minnesota Sand Plain: Effects of Deer and Other Factors on Invasion. Bulletin of the Torrey Botanical Club. 121(3): 266-276

Kubisiak, J. 1985. Ruffed Grouse Habitat Relationships in Aspen and Oak Forests of Central Wisconsin. Tech. Bulletin No. 151, Wisconsin DNR, Madison, WI. 22 pp.

Perala, Donald A. 1978. Thinning Strategies for Aspen: A Prediction Model. USDA Forest Service, Research Paper NC-161. North Central Forest Experiment Station, St. Paul, MN. 19 p.
Perry, Charles H.; Everson, Vern A.; Butler, Brett J.; Crocker, Susan J.; Dahir, Sally E.; Diss-Torrance, Andrea L.; Domke, Grant M; Gormanson, Dale D.; Herrick, Sarah K.; Hubbard, Steven S.; Mace, Terry R.; Miles, Patrick D.; Nelson, Mark D.; Rodeout, Richard B.; Saunders, Luke T.; Stueve, Kirk M.; Wilson, Barry T.; Woodall, Christopher W. 2012. Wisconsin's Forests 2009. Resour. Bull. NRS-67. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 62 p.
Prachar, R. E. and D.E. Samuel. 1988. Influence of White-tailed Deer Browsing on Mortality and Growth of Regenerating Aspen. Transactions of the Northeast Section of the Wildlife Society 45: 27-36.
Sharpe, William E., Bryan R. Swistock, Kelly A. Mecum, and Michael C. Demchik. 1999. Greenhouse and Field Growth of Northern Red Oak Seedlings inside Different Types of Treeshelters. Journal of Arboriculture. 25(5):249-257.
Strole, T.A. and R.C. Anderson. 1992. White-tailed deer browsing: Species Preferences and Implications for Central Illinois Forests. Natural Areas Journal. 12(3):139-144.
Stromayer, K.A.K. and R.J. Warren. 1997. Are Overabundant Deer Herds in the Eastern United States Creating Alternate Stable States in Forest Plant Communities? Wildlife Society Bulletin. 25(2):227-234.
van den Driessche, R., W. Rude, and L. Martens. 2003. Effect of Fertilization and Irrigation on Growth of Aspen (Populus tremuloides Michx.) Seedlings over Three Seasons. Forest Ecology and Management. Vol. 186(1-3): 381-389.
WI DNR 2011. Deer Abundance and Densities in Wisconsin Deer Management Units. Available at: http://dnr.wi.gov/org/land/wildlife/hunt/deer/maps.htm Last accessed Oct 21, 2011.