

Reforestation Appalachian Surface Mines: A Black Walnut Pilot Study (Nursery Stock vs. Seed, With Or Without Tree Shelters)



Sarah L. Hall¹, Christopher D. Barton², and Patrick N. Angel³

¹Berea College Agriculture & Natural Resources, Berea, KY, USA, Sarah_Hall@Berea.edu, ²University of Kentucky Department of Forestry, Lexington, KY, USA, ³US Department of Interior Office of Surface Mining, London, KY, USA

Background

- Surface mining for coal in the central Appalachian region has altered >600,000 ha [1] with much of that being reclaimed to non-forested (grassland) vegetation.
- Efforts are underway (largely by volunteers) to establish forest in these previously reclaimed minelands.
- Reforestation efforts typically use nursery stock (1-0 bareroot seedlings) of early successional and late successional species.
- Planting trees from seed is much less common on these sites, although some studies with American chestnut have shown promise [2] [3] [4] [5]. Planting by seed, if successful, can both decrease costs as well as introduce a new planting season.
- Tree shelters are often used with nursery stock, as they have largely been shown to increase growth and survival [4] [6]. Their impact on seedlings planted from seed is less known, although for chestnuts has been positive [3] [7].
- Black walnut (*Juglans nigra*) is a tree native to Appalachian forests and often found in urban/street settings with abundant and easily distinguishable mast. These characteristics together made it a good species for a simple study, using volunteer labor to collect, clean, and plant seed, as well as nursery stock for comparison. The presence of tree shelters was included as a second main treatment.



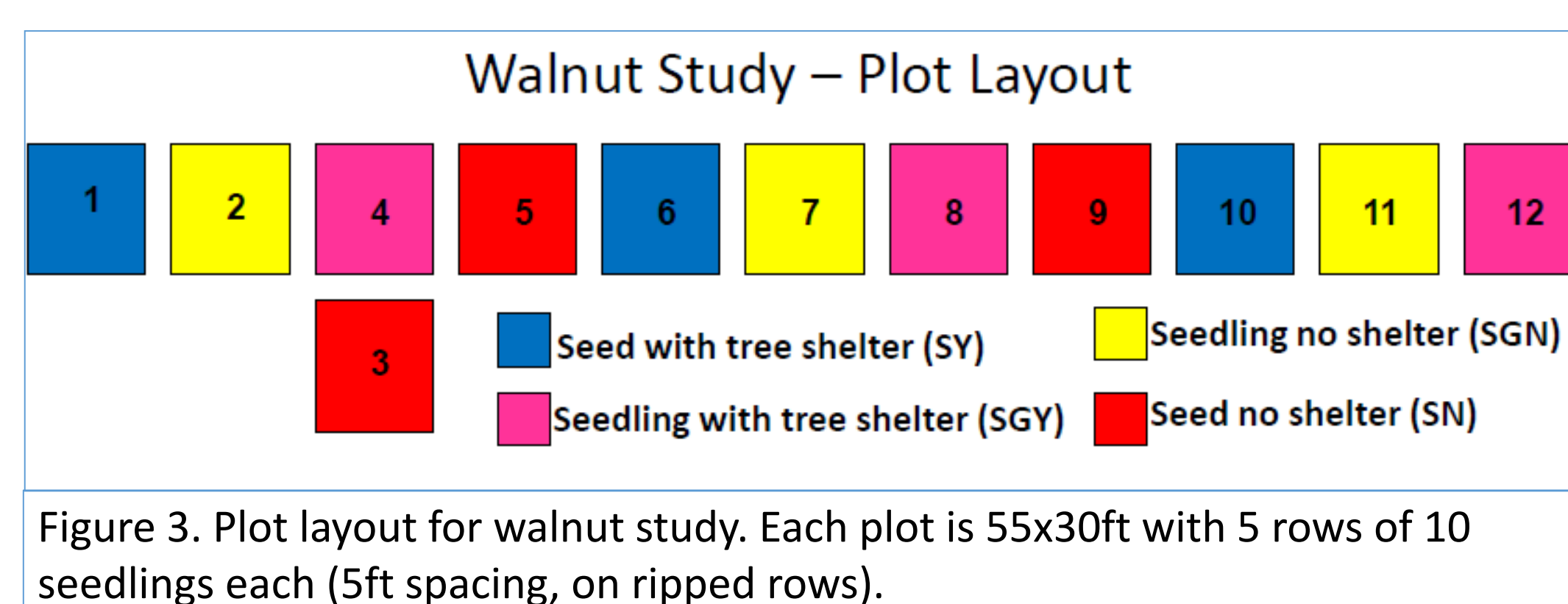
Figure 1. Walnut seeds ready to be planted on the site. Photo by Alaina Asbury



Figure 2. Walnut seedlings ready to be planted on the site. Photo by Alaina Asbury

Methods

- Walnuts were collected Sept-Oct 2011 by students at Berea College. Husks were removed, a float test was done (floaters discarded), and they were stored in moist peat moss in a walk-in cooler until the planting date (2-3 weeks, Fig 1).
- Nursery stock (1-0) was obtained from the Virginia Department of Forestry (Fig. 2).
- The site was ripped to a depth of 4 ft, and each plot was planted with 50 seeds/seedlings either with or without shelters on Nov. 5, 2011 (Fig 3).



- Individual seedlings were tagged and measured for height and diameter. Measurements were made in May 2012 and May 2013.
- Data Analysis:
 - All analyses were done using JMP 10.0
 - Plot means (n=3) were used to compare all four treatments (Fig 3.) using Means ANOVA, with Tukey-Kramer HSD used to compare means.
 - The main effects of nursery stock vs. seed and shelter presence (yes vs. no) were tested in separate Means ANOVA using plot means (n=6).



Results

Between the four treatments:

- Nursery stock seedlings (SG) were significantly taller than those from seed (S) in both years (with the exception of seed with shelter, which was comparable to seedling without shelter in 2013) (Fig 4).
- Shelter presence (Y vs. N) significantly increased height for nursery stock seedlings, but was not significant for those from seed (Fig 4).

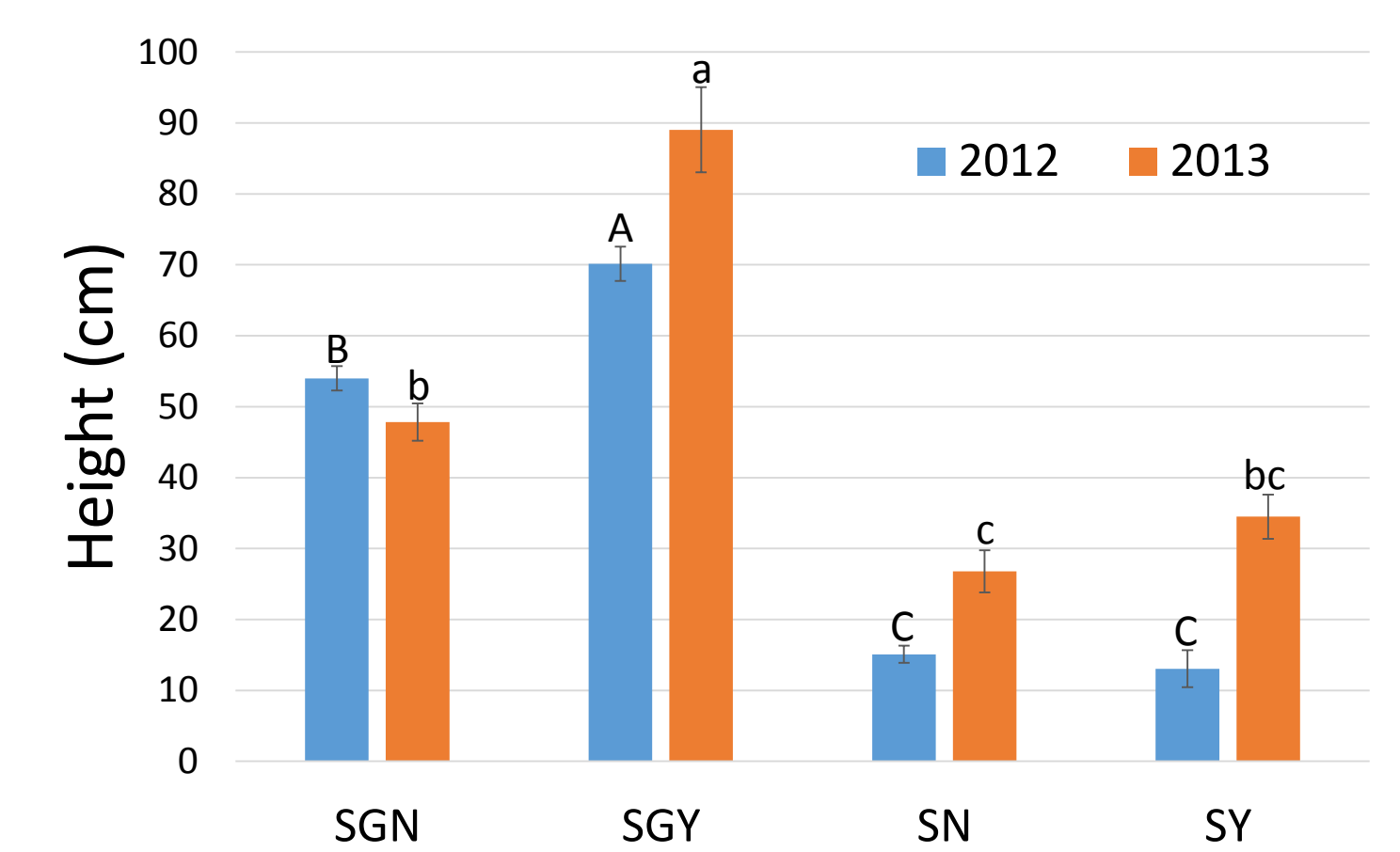


Figure 4. Bars indicate standard error for plot means (n=3). Letters indicate differences within each year.

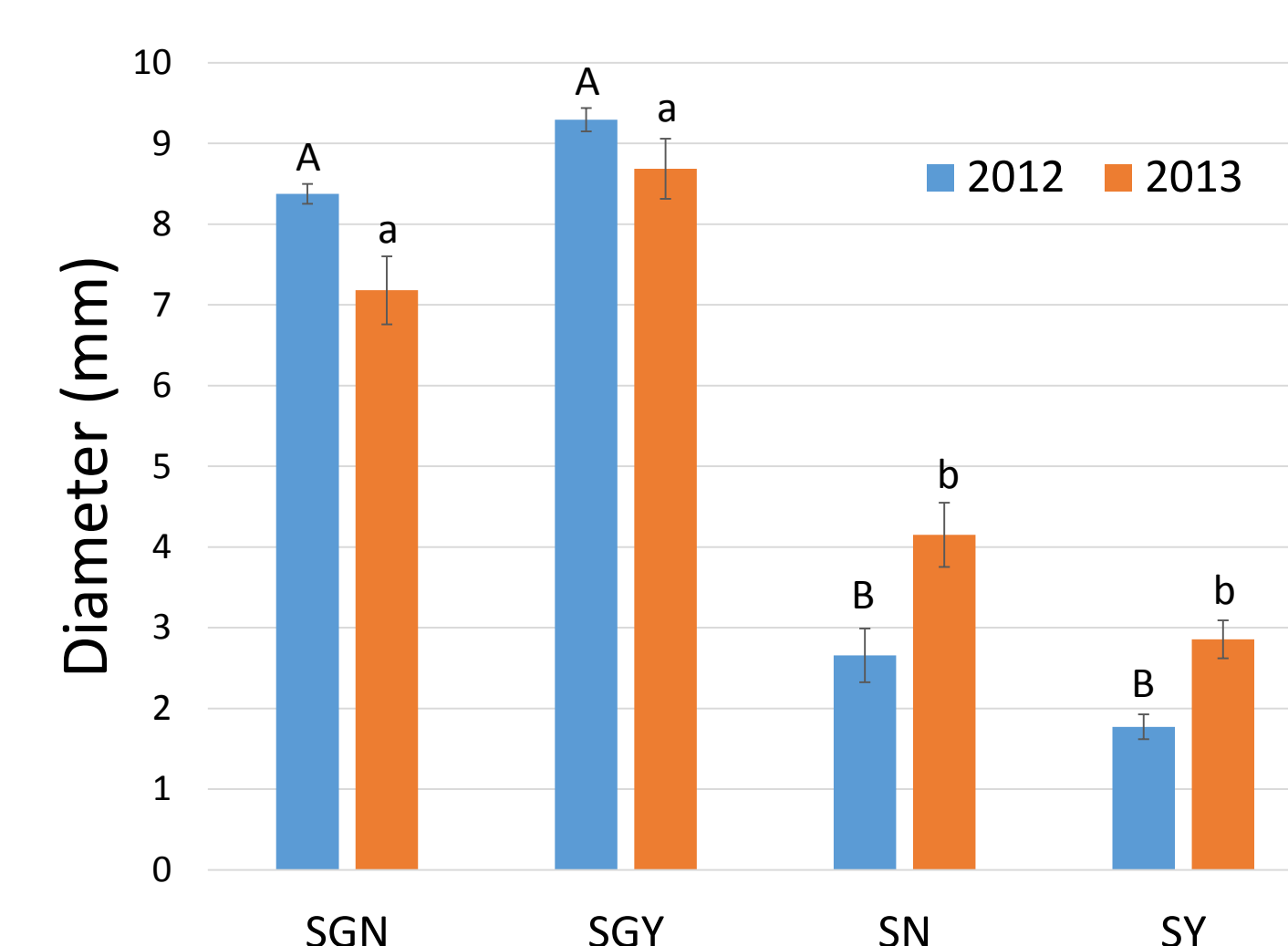


Figure 5. Bars indicate standard error for plot means (n=3). Letters indicate differences within each year.

- Diameter was greater for nursery stock seedlings than those from seed, but presence of a tree shelter made no difference within either planting type (Fig. 5).
- The apparent decrease in diameter for nursery stock (from 2012 to 2013) is likely due to loss of seedlings, but it increased for seed (Fig. 5).

- Survival rate was comparable between all treatments, except in 2013 those from seed with shelter had lower survival (Fig. 6).
- This decrease in survival for seeds with shelters is apparent also in height growth rate (2012-2013), which was lower for SY than all others (data not shown).

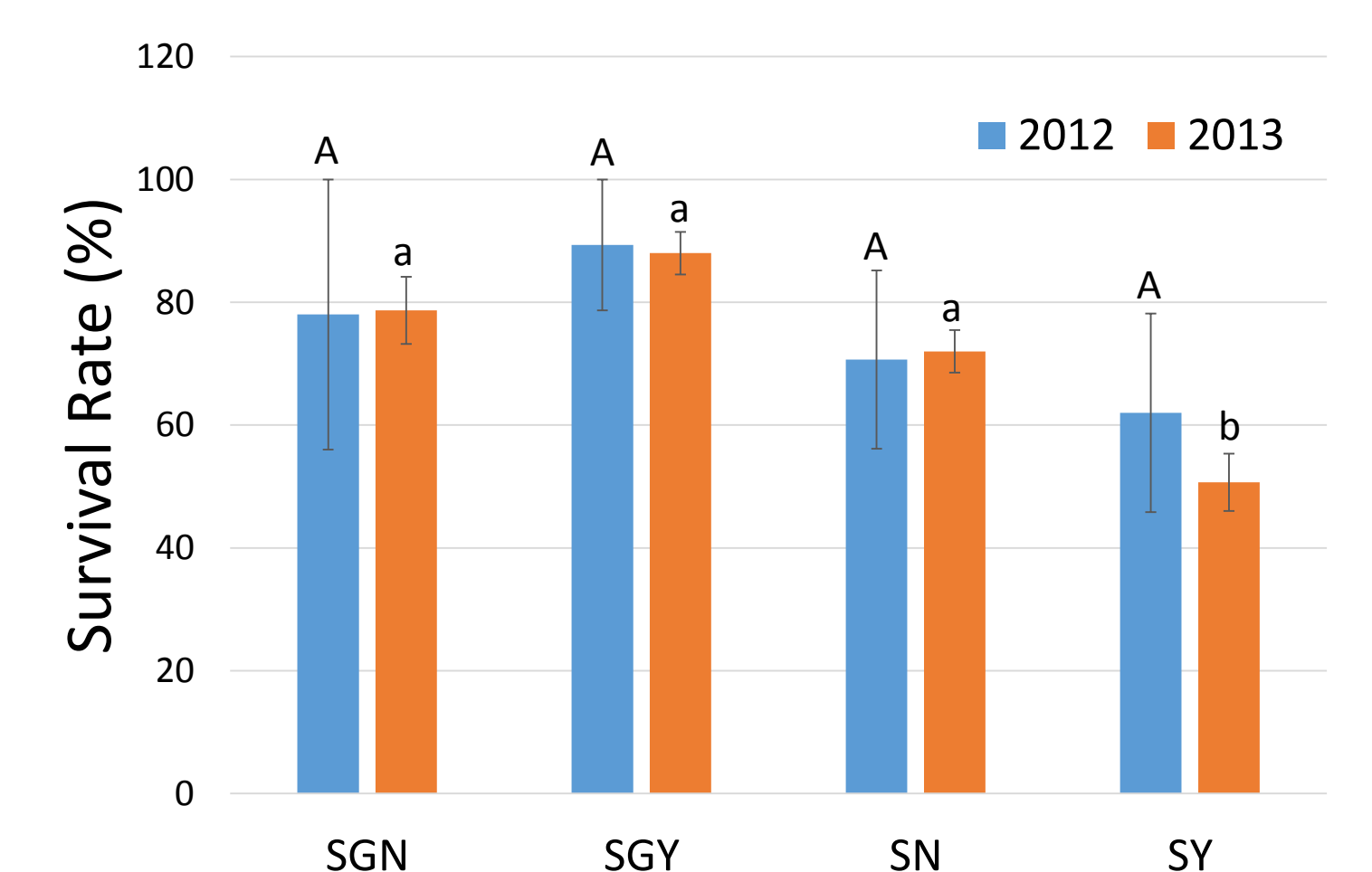


Figure 6. Bars indicate standard error for plot means (n=3). Letters indicate differences within each year.

Conclusions

- Survival rate for seedlings planted from seed was surprisingly similar to nursery stock, although use of shelters may actually inhibit growth of seeds (whereas it clearly helps nursery stock, though not nearly as much as it has for American Chestnut [4]).
 - This inhibition may be due to trapping in moisture and heat, as some seeds appeared to have molded in the ground.
 - The combination of a very mild winter in 2012, which may not have provided the stratification for germination of seeds, as well as the very wet summer of 2013 may have contributed to these problems with seeds with shelters. Use of shorter tubes may help with this.
- Height of seedlings from seed is approaching that of the 1-0 nursery stock after a year in the field.
- Black walnut, a species of rich forest sites is doing quite well on this legacy surface mine land, and may not need tree shelters.
- Planting from seed in the fall appears quite promising for this species, with other species in need of examination.

Literature Cited

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