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Species Trials for Biomass Production on Abandoned Farmland[1]

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ABSTRACT. As part of a nationwide study of the potential for woody crops to supply biomass for energy use, we evaluated seven hardwood tree species and six hybrid poplar clones on four different sites in Vermont, with three fertilizer treatments on some sites. Not all species were evaluated on all sites. Plots containing 25 trees were replicated three or four times at each site. Trees were planted at a spacing of 0.6 x 0.6 m or 0.9 x 0.9 m and grown for 3 years. The application of fertilizer did have significant effect on height, diameter, and stem weight. Species with high yields (about 16 oven-dry t/ha/year) included four of the hybrid poplars. Silver maple, black locust, and the other two hybrid poplars yielded about 10 oven-dry t/ha/year. Based on growth alone, these species and clones were recommended for short-rotation in

Table 1. Plot site locations in Vermont: elevations, soils, and study specifications.

Site	Location (elevation)	Soils	Experiment number	Number of species/clones	Number of replicates
1	Burlington (30 m)	Limerick series: deep poorly drained, loam.	1	2	3
2	Bolton (110 m)	Hartland series: deep, well drained, loam.	3	4	3
3	South Burlington (85 m)	Adams series: deep, loose, excessively drained loamy sand	1 3	4 5	3 1
4	Essex Junction (140 m)	Peru series: deep, stony, moderately well drained loam: fragipan starts at > 0.5 m.	1 2	8 9	4 3

levels of fertilization were tested. A 20-10-5 (N,P,K) fertilizer pellet was placed in each planting hole on a third of the replicated plantings. Granular 10-10-10 was spread at the rate of 2.24 t/ha on another third of the replicates. Two species were planted on site 1, four species on site 3, and eight species on site 4. Sites 1 and 4 were planted at a 0.6 x 0.6 m spacing and site 3 at a 0.9 x 0.9 m spacing. In the split-plot design fertilizer treatments were main plots and species were subplots.

Experiment 2 tested species effects on annual growth rate and annual yield. Fertilizer was applied, based on soil analysis, to the level for corn production. Nine species were planted at site 4 in three replicates at 0.6 x 0.6 m spacing. After the first growing season, after leaffall, one randomly selected row (five trees) from each of the three species plots was harvested to determine growth and yield. Two randomly selected rows (10 trees) were harvested each year from each species plot after the second and third growing seasons. Only the 3-year growth and yield are reported here.

Experiment 3 evaluated species differences in growth rate at two sites after three growing seasons. Four species were planted on site 2, 0.6 x 0.6 m spacing, and five on site 3 at 0.6 x 0.6 m spacing. Fertilizer was applied on all sites, based on soil analysis to the control level. There was only one replicate for Experiment 3 on site 3 because of the unavailability of planting stock.

Height and diameter were measured at the end of the third growing season in all plantings. Diameter was measured with calipers at 5 cm above ground level; height was measured as total height above ground level. Harvested stems were cut after leaffall at 5 cm above ground level and weighed. A section was cut from each stem and placed in a plastic bag. In the laboratory moisture content by weight for the sections was determined using ASTM D2016-74 (Am. Soc. for Testing Materials 1980). The moisture content was used to adjust the green weight of the stems to an oven-dry basis.

Omnibus species and fertilizer treatment differences were tested by the analysis of variance. Experiment 1, sites 1 and 4, were s

Red maple

Silver maple
Sugar maple
White ash
Green ash
Hybrid poplar nn[a]
Hybrid poplar NE-41
Hybrid poplar NE-209
Hybrid poplar NE-353
Hybrid poplar NE-380
Hybrid poplar NE-388
Black locust
Chinese elm

Table 3. Three-year height, diameter, and oven-

significant differences among means for the remaining five species, but their mean heights, diameters, and weights were so much less than those of the top three species that the differences were of little practical importance.

10-10-10 granular spread for yield. On site 4, it was clear that 10-10-10 granular spread applied at 2.24 t/ha gave consistently greater mean heights, diameters, and y