

## Hybrid Hazelnut Performance Trials Effect of Tree Tubes on Hazelnut Growth and Production

Jason Fischbach, UW Extension Agriculture Agent, Ashland and Bayfield County  
Kurt Tibbals, Bayfield County Hazelnut Research Assistant

### Introduction

The Wisconsin Hybrid Hazelnut Production Trials were established in the summer of 2011 at four locations in Wisconsin (Bayfield, Spooner, Stoughton, Eagle) with full sibling offspring from a controlled cross between two hybrids selected by Forest Agriculture Enterprises (Viola, WI). The long term purpose of these plantings is to evaluate the performance of the seedlings, conduct agronomic trials, and demonstrate hazelnut production to the public. Each planting has roughly 300 hybrid plants. To evaluate the effect of tree tubes on establishment, growth, and nut yields, a tree tube trial was established at the Bayfield and Spooner plantings.

The effect of the tree tubes on the establishment and early growth were reported in an earlier bulletin (Fischbach and Cogger, 2013). This bulletin reports on the effect of the tree tubes on plant growth, form, and nut yields of the plants at age 5.

### Methods

The full-sibling hybrid plants were provided by Forest Agriculture Enterprises. The plants were started from seed in a 1-quart round pot in February 2011 in a greenhouse, transferred to a cold frame, and planted in June at the Bayfield and Spooner locations. The seedlings were roughly 6" tall with 5-6 nodes (Photo 1, left). At the Bayfield location the plants were planted on June 8, 2011 and immediately mulched



**Photo 1.** A tree tube can be useful to protect vulnerable seedlings from wind and herbivory while also making it easier to control weeds with glyphosate or mowing. The tubes result in excellent early growth, but the long-term effects on precocity and yield are unknown. Picture at left: hazelnut seedling at planting. Picture at right: hazelnut seedling 13 months later.



**Photo 2.** This study is evaluating the effect of a full 30" tube on hazelnut seedling growth compared to a half (15") tube and no tube over the first five years after planting. Plant performance data was collected in the spring of 2013 and fall of 2015.

with 4” of woodchips. A 30” Tubex Vinegro® tree tube with a 1” diameter bamboo stake was installed on each plant and left in place the rest of the year and through the first winter. Since planting, all the plants have been watered as necessary with drip irrigation. Weeds have been controlled with glyphosate applied as spot treatments 1-2 times per year.

At the Spooner location, the plants were planted on June 24, 2011 and immediately mulched with green-chop orchardgrass (Photo 3). The same tree tubes were installed on all plants and left in place the rest of the year and through the first winter. Weeds have been controlled with hand-pulling and glyphosate as spot treatments 1-2 times per year. There has been no supplemental water.

At both Bayfield and Spooner, the tube trial was implemented starting the spring of 2012 with a randomized complete block design with 16 replications at Bayfield and 26 replications at Spooner. The tube treatments were: two years full tube, first year full tube-second year 15” tube, or first year full tube-second year no tube. All tubes were then removed at bud break in April of 2013. Herein the treatments are referred to as: “full tube”, “half-tube”, and “no-tube”, respectively.

In August of 2015, each planted was visually rated for yield with one of 6 ratings: 0=no nuts, 1=a few nuts, 2=some nuts, usually on one branch, 3=nuts on multiple branches, 4=many nuts all over the shrub, 5=exceptional yield, branches weighted down. In October of 2015, for each plant, the height was measured at its highest point, the width was measured in the N-S and E-W directions, and the total number of stems was counted. A stem was counted as a stem if it originated within 2 inches of the ground and was at least 6” tall. The total canopy coverage of each plant was determined by using the average of the two width measurements and calculating the area of a circle.

## Results

### Growth

At Bayfield, plants grown in the tubes for two years had fewer but taller stems than plants grown without tubes or in half tubes (Photo 4, Table 1). But, by the end of 2015, there was little to no difference in maximum plant height or number of stems among the tube treatments. Plants grown in full tubes, however, did have slightly larger canopies than plants grown in half tubes or with no tubes. At Spooner the trend was similar and by the end of 2015 the planting looked remarkably uniform despite stark differences in plant form in 2013 (Photo 5).

### Nut Yields

As shown in Table 2, there was no statistically significant difference in 2015 nut yield ratings



**Photo 3.** Plants grown in tubes at Spooner had 3-4 stems and had fully filled the tubes by the end of the second year.



**Photo 4.** By July 2013, plants grown in tree tubes at Bayfield were taller than when grown in half-tubes or no tubes.



**Photo 5.** By fall of 2015, plants at both sites were roughly the same size with the same number of stems regardless of tree tube treatments in 2012 and 2013.

Location	Tree Tube	Max. Plant Height (in.)		Total # of Stems		Canopy Coverage* (sq ft)
		May `13	Oct `15	May `13	Oct `15	
Bayfield	Full Tube	32.6a	32.4ab	2.6a	7.1a	5.3a
	Half Tube	22.2b	29.6a	2.8a	5.9a	3.6b
	No Tube	12.9c	36.7b	4.2b	6.8a	4.3ab
	<b>LSD (.05)</b>	<b>5.1</b>	<b>5.4</b>	<b>0.8</b>	<b>NS</b>	<b>1.4</b>
Spooner	Full Tube	29.5a	40.5a	3.2a	9.1a	7.0a
	Half Tube	19.9b	40.0a	3.0a	7.2a	6.2a
	No Tube	18.9b	40.4a	3.0a	7.5a	6.8a
	<b>LSD (.05)</b>	<b>3.8</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

Values in each column for each location with the same letter are not statistically different

\* Measured in October 2015

among the tree tube treatments at each location. However, at Bayfield the plants with full tubes in 2013 showed a slight trend toward having more nut production.

### Discussion

The tree tubes clearly promoted rapid stem growth with stems growing out the tops of the tubes by the end of the second year (2012). Photo 6 shows a typical full-tube plant in November of 2015 at Bayfield. Interestingly, the stems that started in the tree tubes transitioned from juvenile to reproductive and did not grow much taller between 2013 and 2015. The plants grown with no tube or half tube remained shorter in the first two years compared to plants grown in full tubes, but eventually some stems bolted, and on average, the plants were as tall or taller than the full tube plants by the end of 2015. There was no clear difference in production among the tube treatments.

The data suggest that use of a tree tube will affect plant form in the early years, but may have no longer term affect on growth or nut yield. However, 2015 was the first real bearing year so it will be interesting to see how nut yields vary over the coming years. Tree tubes do protect the plants from herbivory and make application of herbicides and mowing easier. As such, at this point, we conclude that use of 15” or 30” tree tubes to aid in establishment and weed control is a viable option for hazelnuts.



*The Upper Midwest Hazelnut Development Initiative is a collaboration of researchers in Wisconsin and Minnesota working with early-adopter hazelnut growers to develop an Upper Midwest hazelnut industry.*

**Table 2.** 2015 nut yield ratings as affected by tree tube treatments in 2012.

Location	Tree Tube	2015 Yield Rating
Bayfield	Full Tube	2.61
	Half Tube	2.06
	No Tube	1.82
	<b>LSD (.05)</b>	<b>NS</b>
Spooner	Full Tube	0.60
	Half Tube	0.80
	No Tube	0.70
	<b>LSD (.05)</b>	<b>NS</b>

NS = not statistically different



**Photo 6.** Five years after planting, plants grown in 30” tree tubes the first two years tend to have a distinct form, but are no taller or productive than plants grown with 30” tubes the first year and 15” tubes or no tubes the second year after planting.