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Hazelnut alley cropping for the Pacific Northwest

Year 1 final

December 5, 2025. Prepared by: Maayan Kreitzman

Introduction

Hazelnuts are typically grown in monocropped orchards where nuts are collected from the ground, making diversification of the system through intercropping in the alleys between rows a logistical challenge. This project aims to answer the question: Can hazelnuts be effectively alley-cropped with harvested intercrops in the Pacific Northwest? The BC Hazelnut Growers' association represents the BC Hazelnut industry, and seeks to improve the economic viability of investing in hazelnuts, which are a long-term perennial crop requiring significant upfront investment. This project establishes a small hazelnut grove with two varieties commonly grown in BC to investigate intercropping during tree establishment. The long term goal is to investigate management practices that would allow for both intercropping and nut harvest to take place as trees mature.

Site plan and installation

Tree rows

The plot was planted March 26th, 2025 at the KPU Garden City Lands farm in Richmond, BC, according to the plan below (figure 1). Trees were sources from Van Maren Farms located in Chilliwak, BC, one of the two main commercial hazelnut nurseries in the province. We chose two main varieties that are common among Fraser Valley hazelnut producers (Yamhill: 32 trees; Wepster: 30 trees; variety of polinizers: 8 trees). 70 trees total were planted in two 315 ft long rows, with two repeating blocks of each main variety (figure 1). In this design 8/70 trees (11%) are polinizers as recommended in the BC hazelnut production guide.

Before planting, we tilled wide strips for the tree rows in the cover crop and chickweed that was growing on the field with the BCS walk behind tractor. We planted the trees by shovel at double density (9 ft between trees, 18 ft between the rows), with a 14 ft buffer on the outside of each row. The total size of the plot was 46*315 ft (14 490 sq ft or .135 hectares)

We installed suspended drip irrigation for the two tree rows with two emitters per tree (see gallery below). Irrigation was connected and working on June 25th 2025.

The tree rows were mulched with a thick layer of wood chip mulch over the course of May and June,

North road

	14 ft		18 ft		14 ft	
1	intrcrp1	Wepster A	intrcrp1	Wepster A	intrcrp1	9 ft
2	intrcrp1	Wepster A	intrcrp1	Wepster A	intrcrp1	9 ft
3	intrcrp1	McDonald	intrcrp1	Wepster A	intrcrp1	9 ft
4	intrcrp1	Wepster A	intrcrp1	Wepster A	intrcrp1	9 ft
5	intrcrp1	Wepster A	intrcrp1	Wepster A	intrcrp1	9 ft
6	intrcrp1	Wepster A	intrcrp1	Wepster A	intrcrp1	9 ft
7	intrcrp1	Wepster A	intrcrp1	Wepster A	intrcrp1	9 ft
8	intrcrp1	Wepster A	intrcrp1	Felix	intrcrp1	9 ft
9	intrcrp1	Yamhill A	intrcrp1	Yamhill A	intrcrp1	9 ft
10	intrcrp1	Yamhill A	intrcrp1	Yamhill A	intrcrp1	9 ft
11	intrcrp1	Jefferson	intrcrp1	Yamhill A	intrcrp1	9 ft
12	intrcrp1	Yamhill A	intrcrp1	Yamhill A	intrcrp1	9 ft
13	intrcrp1	Yamhill A	intrcrp1	Yamhill A	intrcrp1	9 ft
14	intrcrp1	Yamhill A	intrcrp1	Yamhill A	intrcrp1	9 ft
15	intrcrp1	Yamhill A	intrcrp1	Yamhill A	intrcrp1	9 ft
16	intrcrp1	Yamhill A	intrcrp1	gamma	intrcrp1	9 ft
17	intrcrp1	Yamhill A	intrcrp1	Yamhill A	intrcrp1	9 ft
18	intrcrp1	Wepster B	intrcrp1	Wepster B	intrcrp1	9 ft
19	intrcrp1	Wepster B	intrcrp1	Wepster B	intrcrp1	9 ft
20	intrcrp1	gamma	intrcrp0	Wepster B	intrcrp1	9 ft
21	intrcrp1	Wepster B	intrcrp1	Wepster B	intrcrp1	9 ft
22	intrcrp1	Wepster B	intrcrp1	Wepster B	intrcrp1	9 ft
23	intrcrp1	Wepster B	intrcrp1	Wepster B	intrcrp1	9 ft
24	intrcrp1	Wepster B	intrcrp1	Wepster B	intrcrp1	9 ft
25	intrcrp1	Wepster B	intrcrp1	Jefferson	intrcrp1	9 ft
26	intrcrp1	Wepster B	intrcrp1	Wepster B	intrcrp1	9 ft
27	intrcrp1	Yamhill B	intrcrp1	Yamhill B	intrcrp1	9 ft
28	intrcrp1	Yamhill B	intrcrp1	Yamhill B	intrcrp1	9 ft
29	intrcrp1	Felix	intrcrp1	Yamhill B	intrcrp1	9 ft
30	intrcrp1	Yamhill B	intrcrp1	Yamhill B	intrcrp1	9 ft
31	intrcrp1	Yamhill B	intrcrp1	Yamhill B	intrcrp1	9 ft
32	intrcrp1	Yamhill B	intrcrp1	Yamhill B	intrcrp1	9 ft
33	intrcrp1	Yamhill B	intrcrp1	Yamhill B	intrcrp1	9 ft
34	intrcrp1	Yamhill B	intrcrp1	McDonald	intrcrp1	9 ft
35	intrcrp1	Yamhill B	intrcrp1	Yamhill B	intrcrp1	9 ft

315 ft total

Figure 1: Hazelnut demonstration plot layout.

Intercrop

We direct seeded a winter squash crop on June 5th, and did an additional round of direct seeding on July 2nd 2025. We sowed 10 different varieties of squash at 4 foot spacing, with two rows of squash in each intercrop bed (6 rows of squash total in the plot). We installed drip irrigation for the 6 intercrop rows on June 9th 2025. Varieties were:

- buttercup -burgess buttercup
- acorn -mashed potatoes; reno
- kamo kamo
- rouge vif D'etampes
- pumpkin - small sugar; winter luxury
- butternut – Walsh
- delicata- Delicata; honey boat
- red curi & baby blue

Management

Trees were sprayed with a 1.5% organic-approved copper fungicide (Cueva) twice after planting, on April 3rd and April 11th. They were fertilized with 350g 11-0-0 feathermeal in a ring around each tree (=38.5 g N per tree) in mid-April, before wood chip mulch was applied. Amount of N follows the recommendation of Cornel Van Maren, our farmer mentor from the BC Hazelnut growers' association. Ongoing management of the hazelnuts and alley crops has mostly consisted of weeding (Tilmor power-ox, and hand weeding), re-mulching the trees in areas that were too thin, and repairing irrigation.

Interim outcomes

Tree establishment and growth

Tree survival and growth was assessed in mid-July and the end of August. In mid-July, 14/ 70 of the trees had not leafed out at all. Another 9 trees showed suckering from the base of the stem or the roots, but no growth from the middle or top. Out of the 70, only 9 trees had 30 cm or more of new growth (including trees with new growth coming from the base only), with many that had weak new growth in the 5-15 cm range. We also observed that many trees budded out late, with buds but no leaves at the end of May.

The assessment at the end of August showed some recovery, with additional trees suckering and stronger growth. Only 4/70 trees that had not leafed out, and one died due to girdling.

At this point, our best guess about the slow establishment of the trees is that they dried out too much in June, before the irrigation was functional, and that they have recovered and put on more growth since receiving regular water.

The results of the final assessment of tree growth for the first season (conducted October 17th) are below (figure 2 and 3). Five (5) infill trees were also planted on October 17th to replace dead or weak trees. A winter cover crop was sowed on October 25th 2025.

Figure 2 shows that the most common amount of new growth was between 23-46 cm, followed by 46-69 cm. However, there were a significant portion of trees (15/70) that showed weak growth of less than 23 cm (this includes 3 trees that didn't leaf out at all).

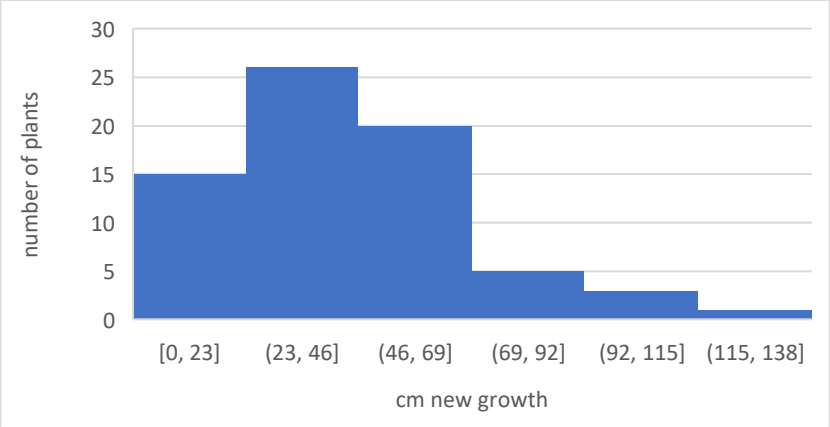

Figure 2. Year 1 shoot growth (cm new growth)

Figure 4 Shows the location on the plant of its longest new shoot growth. Suckering growth (ie from the base of the stem) was the most common location that the most vigorous shoot growth was coming from if adding together plants that had only sucker growth and plants that had sucker growth but also other growth. As discussed above, we currently assess this pattern to be a result of lack if water in the early summer and thus dieback or extended dormancy of vegetative buds on the stem.

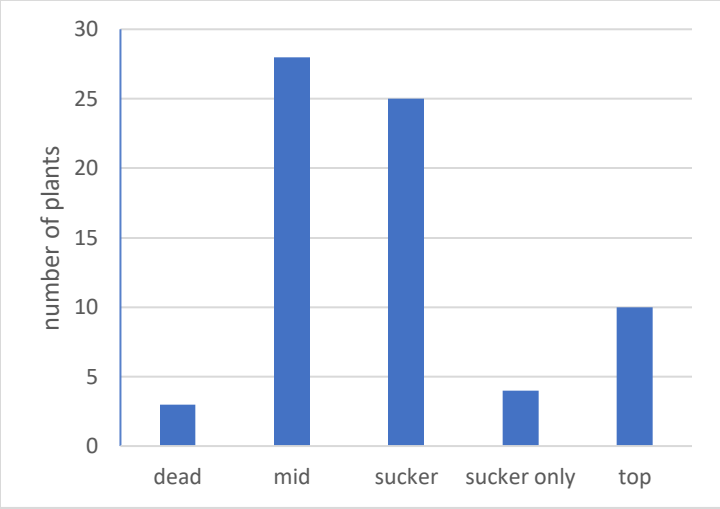

Figure 3. Location of longest shoot growth on the plant. "Sucker only" indicated that the only growth was from suckering (none from higher on the stem).

Labour

Labour inputs for year 1 are unusual because they include tree installation, mulching, and irrigation setup. Analysis of labour inputs in various management categories were analysed at the end of the season (Figure 4). A total of 171.5 hours were spent installing and managing the plot, including initial installation, management throughout the season, and harvest. Of these, 56.25 (33%) were for the trees, and 115.25 were (67%) for the alleycrop. The single most time consuming activity was hand weeding the squash. The second most time consuming was installing the irrigation (though the larger portion of this, which was for the tree irrigation would be a one-time investment since this irrigation is permanent). Harvest of the intercrop was the third most time consuming activity; there was no harvest of hazelnuts this year.

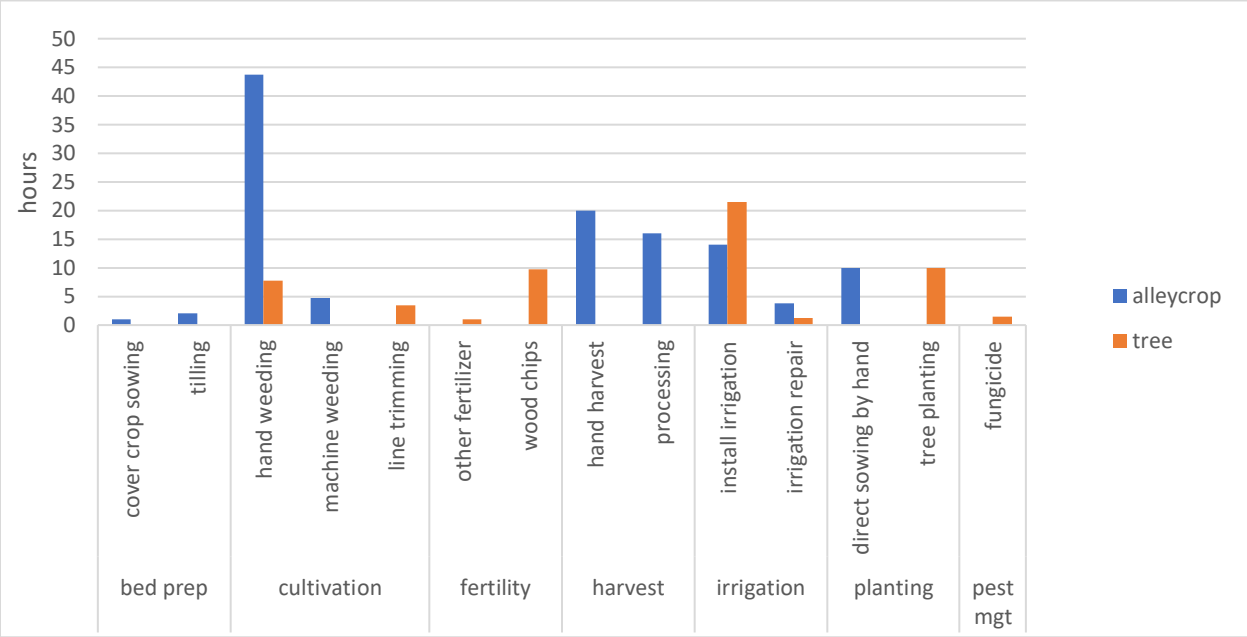

Figure 4. Labour by category for year 1 of hazelnut alleycropping.

Labour needs were highest in the earlier part of the season with planting and irrigation setup, fairly consistent with weeding through July and August, and spiked again with harvest (figure 5). Notably, labour lulled the full month before the squash harvest on October 10th, potentially providing a labour window for other farm tasks.

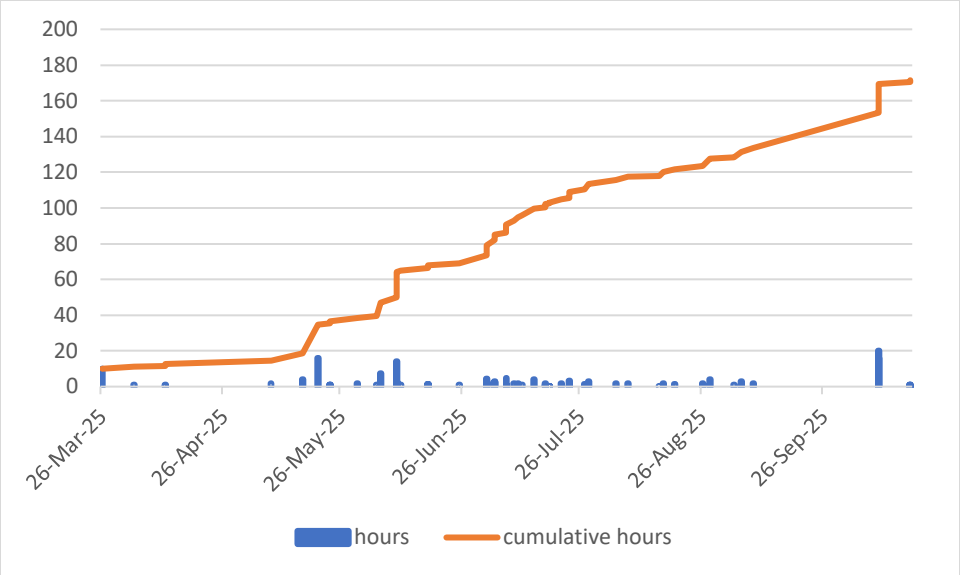

Figure 5. Labour by date for year 1 of hazelnut alleycropping.

Yield

Harvest for the winter squash intercrop took place on October 10, 2025. A total of 2532 kg of squash (mixture of 10 varieties) was harvested. The squash was donated to the Richmond Food Bank (the vast majority), shared to students at Cook elementary school, and distributed to the team.

Considering the total area of the plot is 46 ft by 315 ft, we subtracted 10 ft of the width (occupied by the two tree rows) in our yield calculation, thereby using 11340 sq ft or 0.1053 hectares as our area. This results in 24 t/hectare yield. If using the entire area of the plot to calculate yield (.135 hectares including tree rows), the yield falls to 19 t/hectare. Both these yields fall well within benchmark yields for conventional winter squash (table 1). Considering that these were grown organically, direct seeded fairly late in the season, and we did not fertilize, the yields were satisfactory.

Table 1. Benchmark and actual yields for winter squash.

Crop	Benchmark yield for BC (tonnes/hectare)	Benchmark yield other (tonnes/hectare)	**Yield year 1 (marketable) (tonnes/hectare)**
Winter squash & pumpkin	26.8 (pumpkin only)[1]	15-40[2]	**19- 24**

[1] Area, production and farm gate value of field vegetables British Columbia, 2012-2022. B.C. agriculture and seafood statistics publications - Province of British Columbia (gov.bc.ca). This yield is for pumpkin only, mostly consisting of "halloween" pumpkins rather than winter squash grown for consumption.
[2] Squash and Pumpkins - Vegetable crops production guide for the Atlantic provinces, https://www.gov.nl.ca/ffa/files/agrifoods-plants-pdf-squash-pumpkins.pdf

Cost and income projection

We show a rudimentary cost and income projection here based on one year of intercropping organic winter squash with a new planting of hazelnut trees. Through we received trees and wood chip mulch as free in-kind contributions (from Van Maren Farms and the City of Richmond, respectively), we have included estimated cost for these items in the table below. The costs here do not include capital investments (land, tractor, implements) or other costs like fuel and water. These calculations were done for our plot size, not on a per hectare basis.

A shown in table 2, with a premium farmers' market direct to consumer price of 3$/pound, this intercrop would cover costs of both trees (including labour and materials for tree establishment and irrigation setup) and alley crop and be profitable in year 1. With a lower wholesale price of 1$/pound, it would cover the alley crop costs of production and defray some of the non-repeating tree establishment costs. Thus, earlier cashflow through intercropping can be significant, and if appropriate markets are available, adding an intercrop in the establishment year may be worthwhile for some farmers.

Table 2. Costs and income potential from hazelnut intercropping with organic winter squash

Costs (trees)	
Labour (56.25 hours at 35$/hour)	*$1968.75*
Trees (75 trees at 20$/ tree)	*$1500*
Irrigation Setup	*$500*
Wood chips (31 yards at 40$/yard)	*$1200*
Fertilizer And Fungicide	*$450*
Total	*$5618.75*
Costs (alley crop)	
Labour (115.25 hours at 35$/hour)	*$4103.75*
Irrigation setup	*$500.0*
Seed	*$200*
Total	*$4803.75*
Income Potential	
Income Farmer' Market (3$/Pound)	*$16,735.00*
Income Wholesale (1$/Pound)	*$5,578.00*

Next Steps

Meetings with partners w3ill take place over the winter. Soil testing is planned for next year to assess basic fertility.

Next year's alley crop will be planned over the winter season and pruning and canopy strategies will be explored for next year.

Gallery