

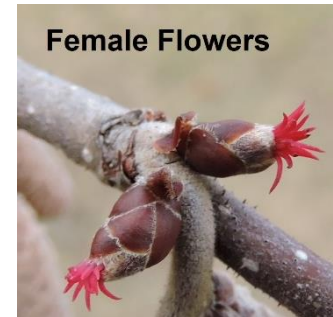
Hazelnut Trees for 4 Climate Zones in Ontario & Eastern North America

Introduction

European hazelnut trees are sensitive to cold winters that can damage the flowers making them less, or non-productive.

Hazelnuts typically bloom in March, earlier if there is a prolonged warm winter spell.

The male tassels, called catkins are more sensitive to cold than the female flowers that are housed in the tree buds. A cold snap during bloom can kill the catkins but not the females. Unless there are several pollinizers with early and late or extended pollen shedding periods, the females may not get pollinized. At Grimo Nut Nursery we chart the pollen shedding periods of all of our pollinizers to extend pollinization and ensure a crop.



For best nut quality irrigation during drought period is important. Tile drainage also is important to remove standing water and make it easier for equipment, especially during harvest time when tire tracks in soft ground would leave nuts behind. Establish windbreaks.

As it is with fruit crops, only selected cultivars are recommended for commercial nut production. Trees grown from seed, called seedlings, may act as pollinizers but are not suited as main crop trees for a variety of reasons. A study in Oregon has shown that the maximum distance pollen will reach trees for maximum pollinizing is 60 feet (18 m). The tree row arrangement and spacing are critical to maximize nut production. It is also valuable to have early and late ripening cultivars beside each other in order to keep nut varieties or shapes separate. The chart below shows an appropriate spacing of trees.

In order to have appropriate pollinizers in an orchard, they must have alleles expressed in the pollen that are different from the alleles in the female of the main crop varieties. Thirty-two alleles have been identified and are listed with the cultivar descriptions.

There are 5 important concerns when planting a commercial hazelnut orchard:

- 1) Use trees that have different alleles.
- 2) Use row & tree spaces and arrangements that are best suited for the cultivars.
- 3) Plant cultivars suited to your climate with a minimum of 3 various season pollinizers.
- 4) Arrange the rows so that early ripening trees are next to late ripening ones, to facilitate harvest and keep the nuts shapes or sizes separate.
- 5) Plant windbreaks especially in the colder zones.

Main Producing Trees for Climate Zone 6b-8 in Ontario

The fruit growing regions of Ontario are generally zones 6b-7b. These include the Niagara Peninsula area below the escarpment and Southwestern Ontario close to Lake Erie. The following trees are recommended for orchard production in these zones. Trees listed for zones 6a, 5a, 5b and 4b can also be grown here. They can be used as main crop producers or pollinizers.

‘Gamma’ is one of our favorite producing trees. It is only suited for zone 6a-7b in Ontario. It is recommended in Oregon as a Pollinizer only, but in Ontario it is hardy and productive enough to be considered a main cultivar. It appears to be a mid-season pollinizer in Ontario. The nuts are medium size, round and ripen early to mid-September. The nuts are similar to the nuts of ‘Yamhill’ and both ripen about the same time, making it unnecessary to harvest them separately. Of the 6 European and Oregon cultivars in the Grimo orchard, ‘Gamma’ has been the best producer. Two 8 year old ‘Gamma’ trees averaged 10 pounds of nuts in 2018. The 3 year crop from 6-8 years of age averaged 8 pounds, indicating a steady increasing regular production. The nuts average 48% kernel in Ontario. The alleles are 2 and 10, with 10 expressed in the pollen.

‘Yamhill’ is an Oregon main crop producing cultivar. It is only recommended for zone 6b-7b in Ontario. Les High in Beamsville, Ontario has reported good crops on ‘Yamhill’. ‘Yamhill’ is one of the original favoured hazel varieties of Ferrero in Brantford, Ontario. The alleles are 8 and 26 with 26 expressed in the pollen. This makes it a good match for ‘Gamma’. The nuts are slightly smaller than ‘Gamma’ but well suited for the kernel market. It blanches well. The nuts average 49% kernel.

‘Jefferson’ is an Oregon main crop selected to replace ‘Barcelona’ when EFB struck Oregon. The nut size is larger than the other selections to suit the fresh market. It also produces a nut that is preferred by Ferrero. The tree is bud mite resistant but only moderately resistant to filbert blight. Scouting, pruning out infected tissue and spraying to control blight will be necessary. It has alleles 1 and 3, with 3 expressed in the pollen. We only recommend it for zone 6b-7b.

A suitable choice of trees for this zone is represented in the following chart and is not limited to just these trees. We recommend planting in 18 x 15 foot (5.5m x 4.5 m) or 18 x 18 foot (5.5m x 5.5m) single density spacing with 2 main producing cultivars, Gamma and Yamhill. These can be next to each other since the ripening date and nut size and qualities are similar. Pollinizers can vary considerably and should be mid-season to late season ripening. There should also be early and late season pollinizers represented. A few are valuable because they have long pollination periods so if early season catkins are damaged later opening ones will open. On the other hand, pollinization can vary from less than 2 weeks to more than 2 months depending on climatic conditions, so they may all shed at the same time.

At the end of this article there are two expanded scenarios listed for this zone.

SINGLE DENSITY PLANTING - ZONES 6b-8												
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*	*	*	*	*	*	*	*	*	*	*	*	*

Legend:
 Black = Yamhill
 Red = Gamma
 Blue, Brown and Gold = ON Pollinizers

Tree spacing 18 ft x 15 ft (5.5m x 4.5m)
 161 trees per acre
 (400 trees pre Ha)

Main Producing Trees for Climate Zones 6a-7b

'Gene'[™] is a suitable pollinizer for trees in zone 6a-7b as well as for the main crop. It is not a cultivar favoured by Ferrero Roche, but there are other suitable markets. It has alleles 15 and 23 and its pollen expresses 15. It is highly blight resistant but bud mite susceptible, though it will still have good crops when not sprayed for bud mite control. It is a vigorous, highly selected tree from a large breeding programme in zone 6a. It was a cross of 'Rush' American x 'Red Lambert' European. The nuts drop in late September to mid-October making it a suitable partner for early ripening cultivars. They are medium to large in size and present 45% kernel.

'Slate'[™] is an exceptional nut producer of medium to large size nuts. It can be a pollinizer for zone 7a to 7b trees, but it would be better matched as a main crop nut producer in zone 6a. It came from the same breeding project as 'Gene' and was a cross of 'Rush x 'Barcelona'. It is highly blight resistant but is susceptible to bud mite. The nuts drop about the same time as 'Gene'. It has alleles 1 and 23, expressing 1 in the pollen. This means that 'Gene' and 'Slate' can cross pollinize, since the common allele "23" is not expressed in the pollen. Both cultivars can be harvested together since the nuts are very similar. This year 'Slate' yielded 38% kernel. It has been better other years.

'Alex'[™] is an open pollinized seedling of a Turkish tree hazel hybrid called 'Faroka'. The seed was obtained from the Gellatly Nut Nursery in Kelowna, BC in 1979 and planted in the orchard in 1981. It is both blight and bud mite resistant. It is a good producer of medium sized elongated nuts. In a 3 year production study it averaged over 9 pounds of nuts per tree. It is well filled with no fibre on the kernel. The alleles have not been determined yet, but we do recommend it as a pollinizer.

'Cheryl'[™] is a later selection from the same breeding programme that created 'Gene'. It is a cross of 'Rush' x 'Kentish Cob'. It is a heavy producing cultivar with alleles 10 and 12. Both alleles are expressed in the pollen. It cannot be used as a pollinizer for 'Gamma' where it shares allele 10. It is very blight resistant but susceptible to bud mite. The nuts are medium to large size and similar to 'Gene'. It is productive enough to be a main crop selection. It yields over 39% kernel.

'Linda'[™] is a later selection also from the same breeding programme as 'Gene'. It is a heavy producer similar to 'Gene'. It has alleles 14 and 23 with 14 expressed in the pollen. Since only 14 is expressed in the pollen and not the 23, it can be a pollinizer for 'Gene' and 'Slate'. It is productive enough to be a main crop tree. It is fully blight resistant but bud mite susceptible.

'Farris G17' is a selection made by Cecil Farris an enthusiastic hazelnut backyard breeder. This is a seedling of 'Faroka', like 'Alex', and the nuts are similar. Its 3-year production averaged over 6.5 pounds per tree. The alleles have not been identified yet but we do recommend it as a pollinizer. Like 'Alex' it is a medium size elongated nut.

'Matt'[™] is a sister tree of 'Alex'. It is more alternate bearing, and as a result it is only moderately productive. It is a good pollinizer with alleles 11 and 13 and able to pollinize any of our selections. It is blight and bud mite resistant.

More cultivars following chart...

Grimo 2018 Hazelnut Orchard Pollinizing Season

NAME	LOCATION	FEB	26	2	6	10	14	18	22	26	30	4	8	12	16	20	24	28	1	COMMENT
OREGON / EUROPEAN SELECTIONS (ZONE 6B-8)																				
Gamma	204 F																			
Yamhill	184F																			early pollen
Jefferson	202M																			late pollen
EUROPEAN X AMERICAN HYBRIDS (ZONE 5B-8)																				
Slate	200B																			early pollen
Gene	186 E																			
Cheryl	202A																			
Linda	206B																			
Carmela	204K																			late pollen
Norfolk	178N																			early pollen
TURKISH TREE HAZEL HYBRIDS (ZONE 5b-8)																				
Alex	184B																			early pollen
Grand Trav	186 C																			
Matt	208A																			early pollen
Farris G17	204D																			
NORTHERN HAZEL HYBRIDS (ZONE 4b-7)																				
Dawn	186 G																			early pollen
Aldara	192A																			
Andrew	178K																			
N.Blais	178H																			late pollen
Joanne	202C																			
Marion	204E																			late pollen
Frank	202F																			late pollen
Kiara	200 G																			late pollen
Dermis	196H																			late pollen

Top row (yellow) for each cultivar indicates pollinizing period.
 Lower row, pink to red indicates female receptivity period.
 Dates when pollinization occurs can vary annually.

‘Chelsea C28’7 is a seedling selected for blight resistance and hardiness in zone 6a near Simcoe, Ontario by Martin Hodgson. The nuts are medium-large and elongated. It is a moderate producer but a good pollinizer. It has alleles 1 and 20 with both alleles expressed in the pollen. It is not a suitable pollinizer for ‘Slate’ or ‘Jefferson’. It is blight resistant, but bud mite has not been determined.

‘Norfolk C16’7 is a seedling like ‘Chelsea’ and selected by Martin Hodgson. The nuts are also very similar. It has alleles 12 and 25 with 12 expressed in the pollen. It is considered a good pollinizer for zone 6-7. It is blight resistant, but bud mite resistance has not been determined.

‘Dermis’™ is outstanding in productiveness. ‘Dermis’ is an open pollinized seedling of ‘Skinner’. Mr. Skinner from Manitoba used pollen supplied by Mr. Slate in New York State to make his cross that was eventually named for him. ‘Skinner’ is a good producer, but has a number of failings, however ‘Dermis’ does not share them. In a 3 year production record, it produced an average of 18.8 pounds of nuts, the highest amount of any trees in the orchard. It yields 38% kernel, lower than some because of the moderate shell thickness. The nuts are medium size and well filled with little or no fiber on the kernel. The alleles have not been completed yet, but we know that it is compatible with ‘Frank’, ‘Marion’, ‘Dawn’, ‘Gamma’, ‘Linda’, ‘Cheryl’, and ‘Gene’. It could be considered a main crop producer for zone 5. It is late ripening and frost may bring the leaves down with the crop, making harvest a concern unless a harvester with a blower is used.

Pollination Periods in the Grimo Orchard		
Early	Mid-season	Late
Slate	Gamma	Jefferson
Norfolk	Gene	Cheryl
Matt	Alex	Linda
Farris G17	Norfolk	Carmela
Dawn	Farris G17	Aldara
	Aldara	N. Blais
	Dawn	Joanne
	Andrew	Marion
	Kiara	Frank
	Dermis	Kiara
		Dermis
Note that some selections span 2 seasons		

Main Producing Trees for Climate Zones 5-7

We have test trees in experimental orchards where cold conditions are a challenge for hazelnuts. These include Simcoe Ontario, plantings near Charlottetown Prince Edward Island, St. Paul Minnesota and Bayfield, Wisconsin. The trees have only been with them for a short time, so any trees we recommend for the colder zone of 5a will be tentative and may change with time.

The Grimo Northern Selections come from three main sources where cold hardiness is a limiting factor: the Saskatchewan source originated in Manitoba and Saskatchewan in zone 3; the Asian/Quebec source came from Quebec; and the Skinner source came from Manitoba also zone 3. However, the pollinizers from our orchard producing these selections were likely zone 6 trees. Our cultivars do show characteristics of hardier trees, but production has not been adequately evaluated outside of the Niagara area. We have confidence that these trees will perform better than any other cold hardy trees available.

These three sources are labeled as “Northern” hazels to identify them as originating in a colder zone than the standard hybrids are grown. Most of these trees are smaller in stature than the standard hybrids too, so they should be planted at closer spacing. We are suggesting a single density spacing regimen of 16 feet x 10 feet (5m x 3m). Rows can be closer at 15 or even 14 feet, if the equipment used can get between the rows. At 16 foot spacing it would require 272 trees per acre, or 673 trees per hectare.

The nut sizes and shapes are very similar on most of the trees, so separation by harvest date is not necessary. Generally, the Saskatchewan source trees are smaller than the Asian/Quebec source trees. ‘Dermis’ is the largest tree in the northern group, so wider row or tree spacing would be best.

Northern Cultivars

‘**Dermis**’™ is mentioned above as a suitable selection for these zones. It is a larger tree than the others in this group so a wider row spacing should be used.

‘**Dawn**’™ is in the Asian/Quebec genetic group of our trees. The parent was described as a *Corylus heterophylla* seedling tree, but it lacked some of the typical characteristics. Thus we believed it is a hybrid, possibly crossed with a *C. americana*. The offspring of this parent tree produce taller trees with larger nuts than the parent. Some have the blight resistance of the parent too. ‘Dawn’ is one such tree. It is very productive with small to medium nuts that are 47% kernel. In a 3 year study of this ten year old tree, it averaged 11.5 pounds of nuts. It has alleles 15 and 27 with 15 expressed in the pollen. ‘Dawn’ was planted in 2008 and at 10 years of age is 12 feet in diameter and about 10 feet tall. Rows of this tree should be planted at 16 feet x 12 feet.

‘**Aldara**’™ is an open pollinized sister seedling to ‘Dawn’. It along with ‘Dawn’ are the two best selections in our orchard of 60 seedlings from our *Corylus heterophylla* hybrid. It is still an outstanding tree for hardiness, production, annual bearing, nut shape, nut qualities and vigor. The nut is medium size slightly larger than ‘Dawn’. The original tree grew to a height of about 4 metres. The nuts drop in early September. Its alleles are 25 and 27. Until we know if one or both of the alleles are expressed in the pollen, we do not recommend it as a match for ‘Dawn’. The percent kernel for 2018 crop year was between 43% and 44%. The ‘Aldara’ trees were planted in 2008 and are 10 years old. They average 10 feet across so spacing will be good at 10 feet in the row. It is blight resistant but bud mite susceptible.

‘**Northern Blais**’™ is the best selection that came from a planting of 20 *C. heterophylla* hybrid seedlings purchased from the Grimo Nut Nursery and planted in Quebec at by Jacques Blais from Joly, QC in zone 4b. In the fall of 2011 Mr. Blais dug up the ortet and brought it to the Grimo Nut Nursery where it was planted in the orchard for further evaluation in 2012. It had a good crop every year since it was planted, even though it was bud mite susceptible. The tree has shown good blight resistance. The nut is similar to ‘Aldara’ in size and shape. It has proven hardiness for Quebec. It has 35% kernel. The alleles have not been determined as yet.

'Andrew'[™] is another sibling to 'Dawn'. It was selected for its blight resistance and nut qualities. It is bud mite susceptible. The nuts are medium size, round and well filled. It is a moderate producer and mainly recommended as a mid-season pollinizer. The alleles have not been identified yet.

'Kiara'[™] is a recent introduction from the Grimo collection. It is an open pollinized seedling of a hybrid produced at Morden Station by Les Kerr who was the director at the time. He used a Saskatchewan American hazel with pollen from George Slate at the Geneva Experimental Farm in NY. 'Kiara' is a small tree planted in 2001, measuring 2.5m across and about 2m high (9 x 7 feet). Rows of 'Kiara' should be 16 x 10 feet apart to maximize production. It is a heavy producer of medium size nuts and has 37% kernel. The alleles have not been identified yet, but its sister trees have a 14 allele, so this may be one of its alleles too. It would not be wise to use 'Kiara' as a pollinizer for any of these trees with the same parent background, or them for her. The best pollinizers would be those from the Asian/Quebec source. It is blight resistant but not bud mite.

'Marion'[™] is sister tree to 'Kiara' from the same parent source. It was planted in 2001 and is a small tree like "Kiara'. It is a moderate producer of medium size round nuts and 37% kernel. In a 3 year average, it produced 5 pounds of nuts. It has alleles 14 and 25 with 14 expressed in the pollen. It is a late pollinizer with a long receptive period to ensure a crop. The tree is 9 feet across at 17 years of age so it can be planted at 16 feet x 10 feet. It is blight resistant but not bud mite.

'Frank'[™] is a sibling of 'Kiara'. It was planted in 2001. 'Frank' is the widest tree in this group at 13 feet (4 m) and about 7 feet (2m) tall. Rows should be 16 x 13 feet apart. The nuts are medium size, round and 40% kernel. It is as productive as 'Marion'. One of the alleles has been identified as 14 so it must be matched with trees other than siblings. It is a good late pollinizer with a long receptive period. It is blight resistant but bud mite susceptible.

'Joanne'[™] is a sister tree to 'Kiara' and of similar size and spread. It was planted in 2001. The nuts are medium size, round and 40% kernel. It is similar in production to 'Marion'. It has alleles 2 and 14 with the pollen expressed in 14. It is not compatible with 'Linda', 'Marion', 'Frank' and probably 'Kiara'.

'Julia'[™] is a sister tree to 'Kiara' and a smaller tree because it is susceptible to filbert blight and the tree was pruned to remove blight infected branches. It is also susceptible to bud mite. It was planted in 2001 and is the second heaviest producer in this tree source, second to 'Kiara'. We only recommend it to growers who are willing to spray this tree for blight. The nuts are medium large and round. It has alleles 11 and 14 with 14 expressed in the pollen, so it will not pollinize 'Linda' or any of its sibling trees.

Please note that some trees may not have viable pollen or that catkins may not survive the winter during colder winters. 'Barcelona' for example seldom had catkins that survived winter in Niagara even though the females were hardy enough.

Also note that some cultivars have a very long female receptive period ensuring better nut set, especially during poor weather at pollination time. **These selections are:** ‘Gamma’, ‘Alex’, ‘Farris G17’, ‘Dawn’, ‘Northern Blais’, ‘Dermis’, and possibly others. Also note that the pollen shedding/receptivity period can vary considerably depending on climatic issues. All of our current figures are based on Niagara-on-the-Lake conditions.

Planting Design Considerations

These planting plans are suggestions only. Arrangements are based on these considerations:

1. Suitability of trees to pollinize with appropriate alleles
2. Maximize pollen shed periods
3. Allow for separation of harvesting times
4. Double or Single Density

Approximate Ripening Dates of Hazelnut Cultivars in Niagara				
Aug.30-Sep.10	Sep.10-20	Sep.20-30	Oct.1-10	Oct. 10-20
Andrew	Joanne	Matt	Gene	Cheryl
Aldara	Gamma	Julia	Carmela	Linda
Marion	Frank	Chelsea	Slate	Kiara
Dawn	Crimson	Norfolk	Jefferson	Dermis
194 M	Yamhill	Farris G17		
N. Blais		Alex		

Planting Scenarios for zone 6b-8.

These 2 choices use specific cultivars for the confectioner industry.

Scenario 1: PLANTING - ZONES 6b-8	
Legend: Black = Yamhill Red = Gamma Blue, Brown and Gold = 3 of Gene, Slate, Chelsea, Norfolk, Alex, Carmela or Dermis	Spacing 18 x 18 ft (5.5m x 5.5m) 150 trees per acre OR Spacing 18 x 9 ft (5.5m x 3m) 279 trees per acre
As trees mature, pruning and eventual removal will be necessary at 9 ft (3m) spacing to let in light.	

Scenario 2: PLANTING - ZONES 6b-7a	
Legend: Green = Jefferson Black = Yamhill Red = Gamma Blue and Gold = Chelsea, Norfolk, Alex, Carmela or Dermis	Spacing 18 x 18 ft (5.5m x 5.5m) 150 trees per acre OR Spacing 18 x 15 ft (5.5m x 4.5m) 150 trees per acre OR Spacing 18 x 9 ft (5.5m x 3m) 279 trees per acre
As trees mature, pruning and eventual removal will be necessary at 9 ft (3m) spacing to let in light.	

Planting Scenario for Zone 6a -7a

Scenario: PLANTING - ZONES 6a-7a													
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*	*	*	*	*	*	*	*	*	*	*	*	*	*
*	*	*	*	*	*	*	*	*	*	*	*	*	*
Legend: (Choose one for each)													
Black = Slate or Gene							Spacing 18 x 18 ft (5.5m x 5.5m)						
Red = Slate, Gene, Dermis, Linda or Cheryl							150 trees per acre						
Blue and Gold = Gamma, Chelsea or Norfolk							OR						
Brown = Linda, Cheryl, Alex, Dermis, Kiara							Spacing 18 x 9 ft (5.5m x 3m)						
As trees mature, pruning and eventual removal will be necessary at 9 ft (3m) spacing to let in light.							279 trees per acre						

Planting Scenarios for Zone 5b-7a

Senerio:1 Planting plan for Hazelnut Trees For Zones 5b-7b														Senerio:2 Planting plan for Hazelnut Trees For Zones 5b-7b													
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Legend: (Choose one for eachcolor)							Legend: (Choose one for eachcolor)							Legend: (Choose one for eachcolor)													
Black; Dermis (in row space at 18 x15')							Black; Aldara							Black; Aldara													
Red; Dawn							Red; Kiara							Red; Kiara													
Blue; Aldara							Blue; Frank or Joanne							Blue; Frank or Joanne													
Brown; N. Blais or Andrew							Brown; Dawn							Brown; Dawn													
Gold; Kiara							Gold; Northern Blais							Gold; Northern Blais													
Green; Marion, Frank, Joanne,							Green; Marion or Joanne,							Green; Marion or Joanne or Julia													
Single Density Planting 16 x 12 feet (5 x 3.6m) 227 trees per Acre (560 trees per hectare)							Single Density Planting 14 x 10 feet (4.2 x 3 m) 310 trees per Acre (770 trees per hectare)							Single Density Planting 14 x 10 feet (4.2 x 3 m) 310 trees per Acre (770 trees per hectare)													
As trees mature, pruning may be necessary at 12ft spacing to let in light.							As trees mature, pruning may be necessary at 10ft spacing to let in light.							As trees mature, pruning may be necessary at 10ft spacing to let in light.													

Other options for zones 5b-7a

- Row and tree spacing 18 x 18 ft (5.5 x 5.5m), 16 x 12 ft (5 x 3.6m),
- Pollinizers planted in two's down specific pollinizer rows (ie 2 Gamma, 2 Alex, 2 Gamma, 2 Alex...)

Planting Scenario for 4b – 5a

This choice is largely untested for these colder zones. AS these are still in testing we need feedback on the potential for these as commercial cultivars in your area.

Senerio: Planting plan for Hazelnut Trees For Zones 4b-5a													
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*	*	*	*	*	*	*	*	*	*	*	*	*	*
Legend: (Choose one for each color)								Single Density Planting					
Black; Northern Blais								14 x 10 feet (4.2 x 3 m)					
Red; Marion								310 trees per Acre					
Blue; Frank								(770 trees per hectare)					
Brown; Dawn								As trees mature, pruning					
Gold; Aldara								may be necessary at 10 ft					
Green; Joanne or Julia or Andrew								spacing to let in light.					

Other options for this zone is:

- Double density at 14 ft x 7 ft (4.2m x 1.5m)
- Single rows of cultivars instead of pairs (as shown above)