

# Hazelnut Hedgerow System

March 4, 2017

**Hazelnut  
Improvement  
Program**

**Upper Midwest  
Hazelnut  
Development Initiative**

# Today's Presentation

- Top 10 genotypes
- Are they good enough?
- When and how will they be available?

**A Production and Economic Model for  
Hedgerow Hazelnut Production  
in the Midwestern United States**



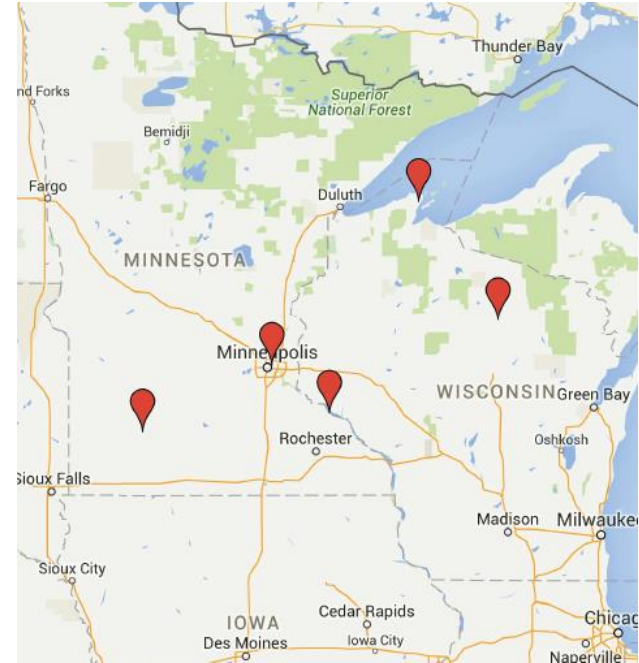
<http://midwesthazelnuts.org/research.html>

**Jason Fischbach**

February 2017

# UMHDI Performance Trials

- Evaluation of promising hybrid genotypes selected from on-farm plantings in the Upper Midwest
- The plants shown in the following slides are the top 10 genotypes based on data from replicated performance trials at three locations: Bayfield, St. Paul, Lake City (the Tomahawk and Lamberton sites are not yet bearing)



# Top 8 Genotypes

- Identified based on performance at Bayfield, St. Paul and Lake City – (Braun et al., 2017)
- Shown in no particular order

# In-Shell Nuts and Kernels of Top 8 Genotypes



From bottom to top: In-shell nuts, whole raw kernels, blanched kernels by roasting

# Cuddy 2-28



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.3	1.1	8.4	6.7		
SP	0.1	2.2	7.8	11.3		

## 2016 Nuts

### Kernel Weight

Bay - 0.46 g

SP - 0.36 g

Eric - 0.59 g

### % Kernel

Bay - 38%

SP - 37%

Eric - 38%



# Price W41



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	1.0	4.3	7.9		
SP	ND	7.1	3.3	14.4		

## 2016 Nuts

### Kernel Weight

Bay - 0.54 g

SP - 0.53 g

Eric - 0.62 g

### % Kernel

Bay - 41%

SP - 41%

Eric - 38%





# Eric 5-13



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	0.2	1.2	5.5	11.5	
SP	ND	0.4	1.5	3.9	9.9	14.6

## 2016 Nuts

### Kernel Weight

Bay - 0.28 g

SP - 0.32 g

Eric - 0.48 g

### % Kernel

Bay - 37%

SP - 39%

Eric - 42%





Rose 9-2

### Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	2.0	3.4	13.7		
SP	ND	ND	6.6	15.7		

### 2016 Nuts

#### Kernel Weight

Bay - 0.48 g

SP - 0.57 g

Eric - 0.81 g

#### % Kernel

Bay - 39%

SP - 45%

Eric - 48%



# Minar 342



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	0.0	0.4	4.8	9.6	
SP	ND	ND	ND	4.5	16.1	

## 2016 Nuts

### Kernel Weight

Bay - 0.77 g

SP - 0.68 g

### % Kernel

Bay - 38%

SP - 45%



# Gibs 5-15



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	0.1	2.4	4.9		
SP	1.9	1.2	4.4	16.0		

## 2016 Nuts

### Kernel Weight

Bay - 0.45 g

SP - 0.53 g

Eric - 0.52 g

### % Kernel

Bay - 37%

SP - 39%

Eric - 33%



# Arb 4-3



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.2	1.9	4.2			
SP	2.2	ND	11.3			

## 2016 Nuts

### Kernel Weight

Bay - 0.45 g  
 SP - 0.46 g  
 Eric - 0.54 g

### % Kernel

Bay - 37%  
 SP - 39%  
 Eric - 35%



# SpC-2D5



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	2.3	6.1			
SP	1.8	4.0	15.2			

## 2016 Nuts

### Kernel Weight

Bay - 0.65 g

SP - 0.62 g

Eric - 0.67g

### % Kernel

Bay - 36%

SP - 38%

Eric - 37%



# Other High-Performing Genotypes

- Identified based on performance at Bayfield, St. Paul, and Lake City
- Shown in no particular order



Arb 7-21

Arb 7-1

Stap N7-6

Stap N2-7

Stap S2-7

Rose 18-10



# Stap N7-6



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	2.1	5.9	5.3		
SP	ND	0.3	2.0	14.1	5.2	22.3

## 2016 Nuts

### Kernel Weight

Bay - 0.48 g

SP - 0.62 g

Eric - 0.29 g

### % Kernel

Bay - 36%

SP - 37%

Eric - 25%



# Eric 4-21



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	1.5	3.1	5.3		
SP	4.1	3.5	5.8	5.1	13.5	

## 2016 Nuts

### Kernel Weight

Bay - 0.40 g  
SP - 0.49 g  
Eric - 0.61 g

### % Kernel

Bay - 31%  
SP - 35%  
Eric - 25%



# Are They Good Enough?

Enterprise Budgeting Tool

<http://midwesthazelnuts.org/about.html>

# Hazelnut Hedgerow System

- Rows of shrubs with nut clusters harvested directly from the shrub
- Profitability will depend on 10,001 variables



# Key Variables

- Establishment costs (site prep, plants, planting, financing costs (financing and opportunity))
- Management costs (fertility, weeds, pests, plant size)
- Per acre yields
- Harvest costs (harvest and de-husking)
- Pay price of in-shell nuts

# Establishment Costs

- Site prep and weed control?
- Plant cost?
- What's the ideal density? (plants/ac)
  - Maximize early yields by filling growing space with fruiting wood ASAP



Bayfield, WI  
Age 6

6' x 15'

Too much  
wasted  
space  
within the  
hedgerows



Stoughton, WI  
Age 6

6' x 15'

Just right?





# Hedgerow Spaced-Plant Yield Extrapolations

- 5' in row x 12' between row spacing (726 pl/ac)
- Age 7, average of top 19: 285 lbs/ac at Bayfield, 380 lbs/ac at St. Paul
- Age 7, average of top 6: 330 lbs/ac at Bayfield, 500 lbs/ac at St. Paul

# For Comparison....In Oregon....

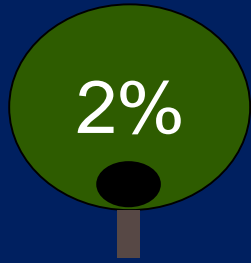
- Age 7 per acre yields of 1100 lbs in-shell
- At 46% kernel = 500 lbs kernel/ac



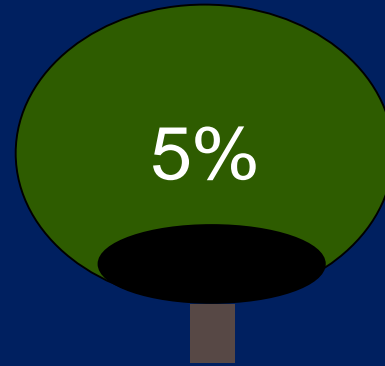
# Hedgerow Yield Density Extrapolations

- The raspberry system might be a better analog
- Yield per lineal foot or yield per square foot of canopy coverage

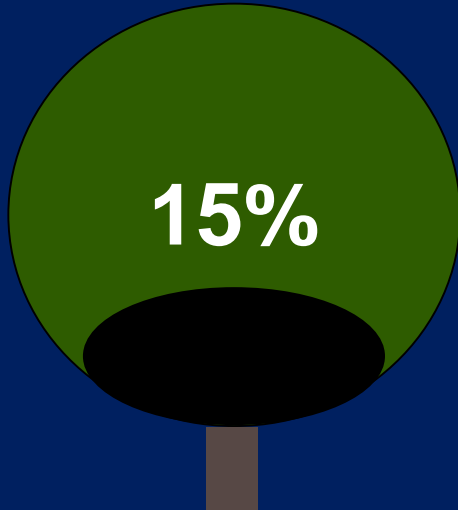




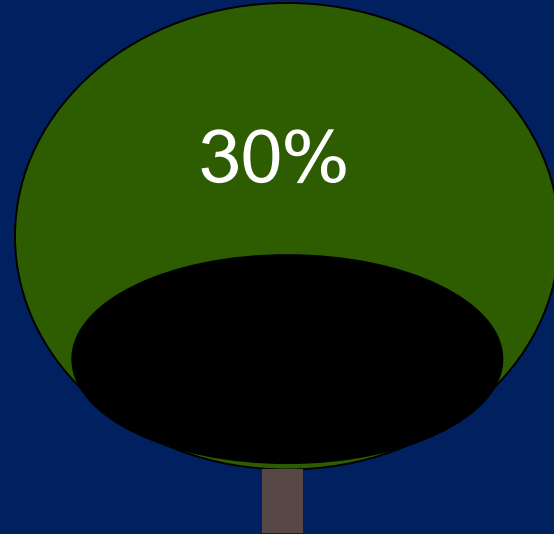
Dwarf 8'



Semi-dwarf 12'



Semi-Standard 16'



Standard 20'

## Early Plant Management





Cuddy 2-28



Stap N7-6



Big  
unknowns on  
plant size  
management

# Plant Size Management Options

- Start with compact genotypes with high early yields
- Renewal pruning to remove old wood and thin young stems?
- Whole plant coppice?
- Half plant coppice, narrow-row mowing?



# Average Yield Density of Top 8 Selections

- 4' x 12' plant spacing (908 pl/ac)
- Goal is to fill hedgerow with fruiting wood ASAP
- 6' wide hedgerows at maturity (50% canopy coverage)



## Actual Average Yields at Bayfield (Yrs 4-8), Projected Yields (Yrs 9-15)

<b>Plant Age</b>	<b>Canopy Coverage (sq ft)</b>	<b>oz kernel per sq ft</b>	<b>lbs kernel per acre</b>	<b>lbs kernel per plant</b>	<b>lbs in-shell per plant</b>	<b>lbs in-shell per acre</b>
<b>4</b>	10890	0.02	13	0.01	0.04	<b>32</b>
<b>5</b>	14520	0.17	152	0.17	0.42	<b>380</b>
<b>6</b>	18150	0.28	320	0.35	0.88	<b>801</b>
<b>7</b>	21780	0.42	576	0.63	1.59	<b>1441</b>
<b>8</b>	21780	0.62	844	0.93	2.32	<b>2110</b>
<b>9</b>	21780	0.66	901	0.99	2.48	<b>2252</b>
<b>10</b>	21780	0.72	981	1.08	2.70	<b>2452</b>
<b>11</b>	21780	0.85	1162	1.28	3.20	<b>2906</b>
<b>12</b>	21780	0.72	981	1.08	2.70	<b>2452</b>
<b>13</b>	21780	0.85	1162	1.28	3.20	<b>2906</b>
<b>14</b>	21780	0.72	981	1.08	2.70	<b>2452</b>
<b>15</b>	21780	0.85	1162	1.28	3.20	<b>2906</b>



# Harvest and Husking Costs

## Step 13a Harvest Costs

### Determine Your Annual Harvest Cost

*For each year choose whether to harvest by hand or with a machine. If you own the machine use an hourly rate equal to the annual depreciation and operating costs for the machine.*

Hand Harvest Rate:	13	lbs/hr
Hand Harvest Labor:	\$ 10.00	\$/hr
Machine Harvest Rate:	400	lbs/hr
Machine Custom Rate:	\$ 80.00	\$/hr

## Step 13b (Drying and Husking Costs)

### Determine Your Annual Drying and Husking Costs

*Enter the labor and equipment costs for husking and drying the hazelnuts*

Husker Flow-Through Rate:	150	lbs/hr
Hrs of labor/hr of operation:	1.00	hrs
Labor Rate:	\$ 10.00	\$/hr
Husker Lease Rate:	\$ 10.00	\$/hr



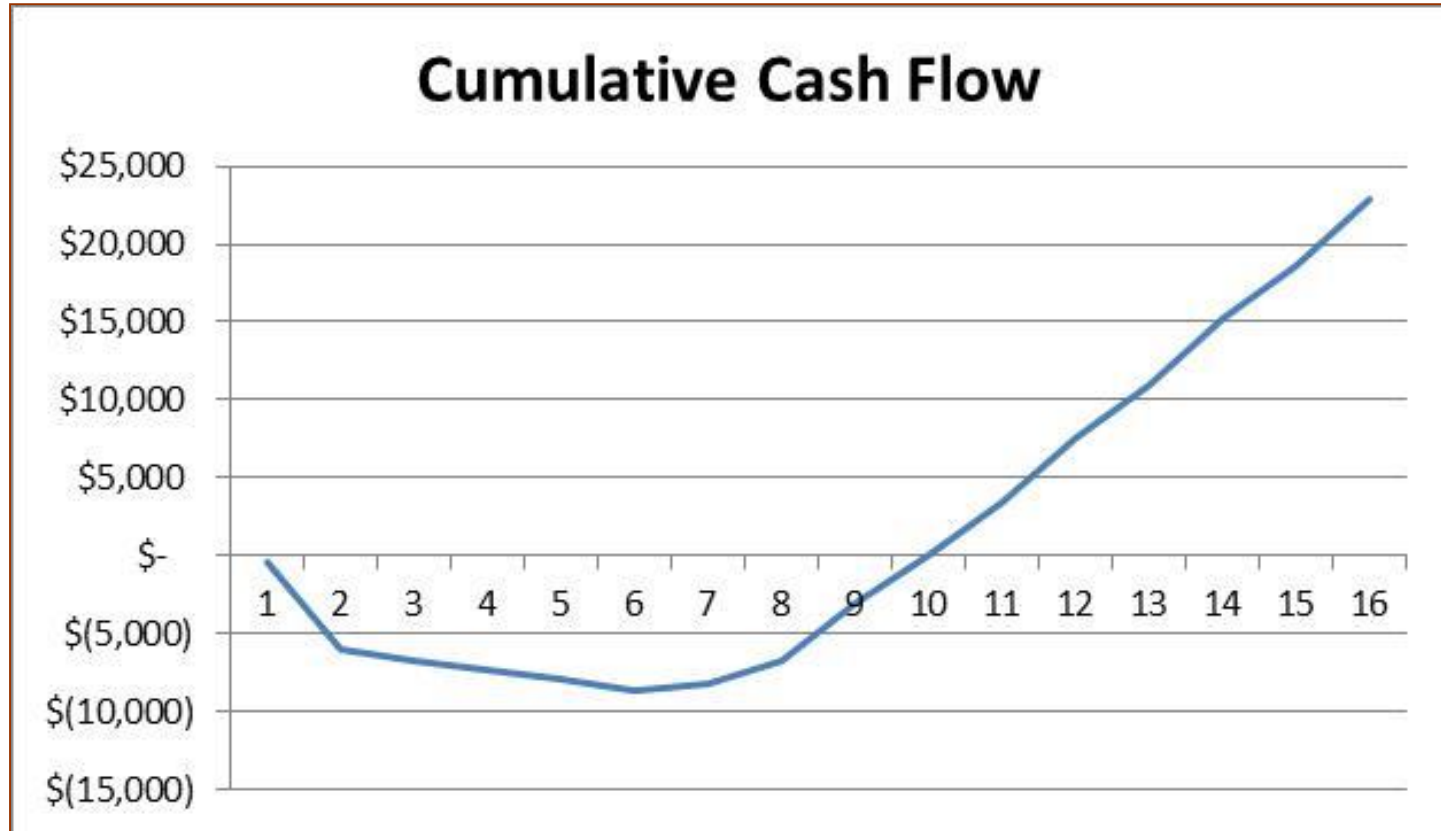
# Cash Flow Projection - Assumptions

- See publication for full list
- \$2/lb in-shell pay price
- All work hired on custom basis (no machinery costs)
- No interest or borrowing costs
- 40 hrs of pruning per acre per yr starting in year 5
- \$50/acre cash rent

## Cash Flow Projection – Hazelnut Hedgerow System

	Establishment		Pre-Production			Early Production				Full Production						
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Revenue</b>																
<b>In-shell nut sales</b>																
Market 1				\$ -	\$ 36	\$ 651	\$ 1,605	\$ 2,900	\$ 4,232	\$ 4,514	\$ 4,925	\$ 5,837	\$ 4,925	\$ 5,837	\$ 4,925	\$ 5,837
Market 2				\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Market 3				\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Total Gross Revenue</b>	\$ -	\$ -	\$ -	\$ -	\$ 36	\$ 651	\$ 1,605	\$ 2,900	\$ 4,232	\$ 4,514	\$ 4,925	\$ 5,837	\$ 4,925	\$ 5,837	\$ 4,925	\$ 5,837
<b>Expenses</b>																
<b>Land Cost</b>																
Owned	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Rented	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50	\$ 50
<b>Supplies and Materials</b>																
Plants	\$ -	\$ 2,827	\$ 164	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Drip Irrigation	\$ -	\$ 985	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Tree Tubes	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Fertilizer	\$ 103	\$ -	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56
Herbicide	\$ -	\$ 98	\$ 58	\$ 58	\$ 58	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18	\$ 18
Organic mulch	\$ -	\$ 502	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Synthetic mulch		\$ -														
<b>Total Supplies and Materials</b>	\$ 103	\$ 4,412	\$ 278	\$ 114	\$ 114	\$ 74	\$ 74	\$ 74	\$ 74	\$ 74	\$ 74	\$ 74	\$ 74	\$ 74	\$ 74	\$ 74
<b>Custom Equipment and Operator</b>	\$ 240	\$ 990	\$ 380	\$ 380	\$ 380	\$ 260	\$ 260	\$ 260	\$ -	\$ 240	\$ 240	\$ 240	\$ 240	\$ 240	\$ 240	\$ 240
<b>General Labor</b>	\$ -	\$ 150	\$ 75	\$ 75	\$ 75	\$ 675	\$ 675	\$ 675	\$ -	\$ 675	\$ 675	\$ 675	\$ 675	\$ 675	\$ 675	\$ 675
<b>Custom Harvest Cost</b>				\$ -	\$ 14	\$ 250	\$ 161	\$ 290	\$ 423	\$ 451	\$ 492	\$ 584	\$ 492	\$ 584	\$ 492	\$ 584
<b>Drying and Husking</b>				\$ -	\$ 2	\$ 43	\$ 107	\$ 193	\$ 282	\$ 328	\$ 389	\$ 389	\$ 328	\$ 389	\$ 328	\$ 389
<b>Total Expenses</b>	\$ 393	\$ 5,602	\$ 783	\$ 619	\$ 633	\$ 1,309	\$ 1,220	\$ 1,349	\$ 547	\$ 1,490	\$ 1,531	\$ 1,623	\$ 1,531	\$ 1,623	\$ 1,531	\$ 1,623
<b>Annual Cash Flow</b>	\$ (393)	\$ (5,602)	\$ (783)	\$ (619)	\$ (597)	\$ (658)	\$ 386	\$ 1,551	\$ 3,685	\$ 3,024	\$ 3,393	\$ 4,214	\$ 3,393	\$ 4,214	\$ 3,393	\$ 4,214
<b>Cumulative Cash Flow</b>	\$ (393)	\$ (5,995)	\$ (6,778)	\$ (7,397)	\$ (7,993)	\$ (8,652)	\$ (8,266)	\$ (6,715)	\$ (3,030)	\$ (7)	\$ 3,387	\$ 7,601	\$ 10,994	\$ 15,208	\$ 18,602	\$ 22,816

## Cash Flow Projection – Hazelnut Hedgerow System



# The Big Unknowns

- How they will perform at your property
- EFB resistance/tolerance
- Nut weevil and big but mite resistance
- Cost and method of plant size management
- Can processors make money paying \$2/lb for in-shell nuts?
- Market for relatively small kernels



# Big Bud Mite

- Feeds on inside of bud causing “blasted” buds
- Can reduce yields
- No IPM strategy for the Upper Midwest, yet
- In Oregon, monitoring and miticides, if necessary

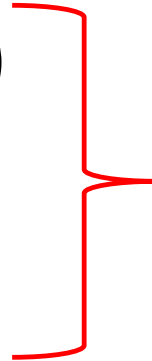
# In-Shell Nuts and Kernels of Top 8 Genotypes



From bottom to top: In-shell nuts, whole raw kernels, blanched kernels by roasting

# Size Classes for Oregon Kernels

- Extra Large (14+ mm)
- Large (13-15 mm)
- Medium (12-14 mm)
- Small (11-13 mm)
- Whole and Broken



Top selection range  
8-12 mm

# Strategies for Selling Small Nuts

- Sell local and sell direct
- Add value (oil, meal, spreads, confections, etc.)
- Find big processors that prefer small kernels
- Convince consumers to switch from roasted-salted peanuts to roasted-salted hazelnuts

# When Are They Available?

- Propagation is slow, first liners available this fall
- Working on logistics
- If limited supply, then prioritized release:
  - UMHDI Field Trials
  - JPT Trials
  - HIP Contributors
  - Growers Wanted – SARE
  - Growers Wanted



# Rose 18-10



## Average Plant Yield By Age

Plant Age	4	5	6	7	8	9
Site	-----oz kernel/plant-----					
Bay	0.0	0.4	2.6	4.3	8.9	
SP	ND	0.9	3.2	4.8	6.1	

## 2016 Nuts

### Kernel Weight

Bay - 0.44 g

SP - 0.74 g

Eric - 0.76 g

### % Kernel

Bay - 42%

SP - 42%

Eric - 36%



Bayfield

Spc

Eric