

# Dryland and Irrigated Horticultural Crops

## Research Update

By: Kyla Splichal

### Horticulture in 2018

*"The love of gardening is a seed once sown that never dies."*

-Gertrude Jekyll



*Horticulture staff from left to right: Rojee Pradhan, Ann Reinke, Tayder Jones and Kyla Splichal.*

Every season at the Williston Research Extension Center brings new life as well as a new set of challenges. The 2018 season was no different in that respect, however, it marked a special milestone in my career. This past March marked my fifth year since moving across the entire state from Wahpeton to Williston to start on a new adventure. It has truly been a pleasure being a part of the Williston Research Extension Center and I can't imagine life without these gardens! I look forward to many more seasons, but first a glance at the summer of 2018.

Spring seemed to take its sweet time arriving in North Dakota with the minimum air temperatures barely staying in the 40s for most of May, threatening the gardens with a late spring frost and taunting the gardeners who just wanted to plant their tomatoes! From May 1<sup>st</sup> through September 30<sup>th</sup> the gardens accumulated 2272 growing degree days, which made the cucumbers, peppers and various annual flowers happy. In fact, the gardens produced among other things 152 pounds of cucumbers, 160 pounds of squash and 176 pounds of peppers! The total vegetable and fruit production for the season was just under 860 pounds. The season ended right on the average predicted first fall killing frost date which is September 21<sup>st</sup>, just in time for fall. The seasonal rainfall was just below average with 11.06 inches recorded during the period of April 1<sup>st</sup> to October 31<sup>st</sup> according to NDAWN.

## Dryland

### All-America Selection Garden



*All-America Selection hot pepper, 'Flaming Flare' F1. Photo taken by Kyla Splichal.*

The All-America Selections this year did not disappoint! We enjoyed a bumper harvest of hot peppers, cucumbers, cherry tomatoes and squash. WREC has been a public display garden for nearly a decade and each season keeps us looking forward to the selections in which AAS has deemed winners and top performers in their class. Keep All-America Selections in mind as you begin receiving seed catalogs for next year's garden. Visit their website for more cultivar information as well as recipes and landscape ideas-you won't be disappointed!

<https://all-americaselections.org/>

### Haskap



*Figure 1. Haskap shrub. Photo taken by Kyla Splichal.*

Last year's report mentioned a newly funded trial, the haskap variety trial. Haskaps or Honeyberry (*Lonicera caerulea*) is an exciting new fruit crop for North America. It belongs to the Honeysuckle family and the name Haskap is a Japanese term for edible blue Honeysuckle. The fruits are oblong in shape, bluish to purple in color and about 1 cm in diameter (see Figure 3.). The plant is a deciduous shrub that can grow 3-6 feet tall (Figure 1.). The flowers are yellowish-white in color and are produced in pairs (see Figure 2.). Haskap is a circumpolar species native to the northern boreal forests of Asia, Europe and North America. It can be found in low lying wet areas or high in the mountains. In Canada, it can be found in the wild in every province except BC.



Figure 2. Haskap flower. Photo taken by Kyla Splichal.



Figure 3. Haskap fruit. Photo taken by Kyla Splichal.

Next season, the haskap trial will be conducted at the Williston REC dryland station as well as the NDSU Research Arboretum in Absaraka, ND in collaboration with High Value Crop Specialist, Dr. Harlene Hatterman-Valenti. We will be testing 12 different commercially available cultivars in each location.

## Hops

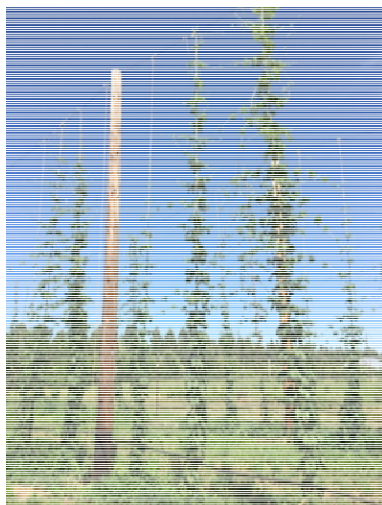


Figure 1. Hop training date trial. Photo taken by Kyla Splichal

In the fall of 2016, WREC was awarded a continuation grant through the Specialty Crop Block program to look at management practices on the established hop yards. Early, mid and late spring stringing dates were evaluated in 2017-2018. The p values of this 2-year study are found in Table 1. Significance was found in cultivar, training date and year by training date for the measured bine length. Significance was found in the cultivar and training date for the yields (kg/plant and pounds/acre).

Table 1. P values of bine length, kg and pounds per acre for hop training date study conducted in 2017 and 2018.

Sources of variation	df	Bine length	Kg	Lbs/A
		-----Probability > F -----		
Year	1	0.1099	0.1611	0.1611
Cultivar	11	0.0009*	<.0001*	<.0001*
Year*cultivar	11	0.1667	0.0469	0.0469
Training date	2	<.0001*	<.0001*	<.0001*
Year*training date	2	0.0243*	0.0787	0.0787
Cultivar*training date	22	0.6044	0.1803	0.1803
Year*Cultivar*Training date	22	0.6001	0.6169	0.6169

\* Denotes significant main effects and interactions at P<0.05.



Figure 2 indicates the highest yielding cultivar regardless of training date which was 'Zeus' followed by 'Challenger' and 'Galena'. The poorest yielding cultivar is 'Spalt Select'.

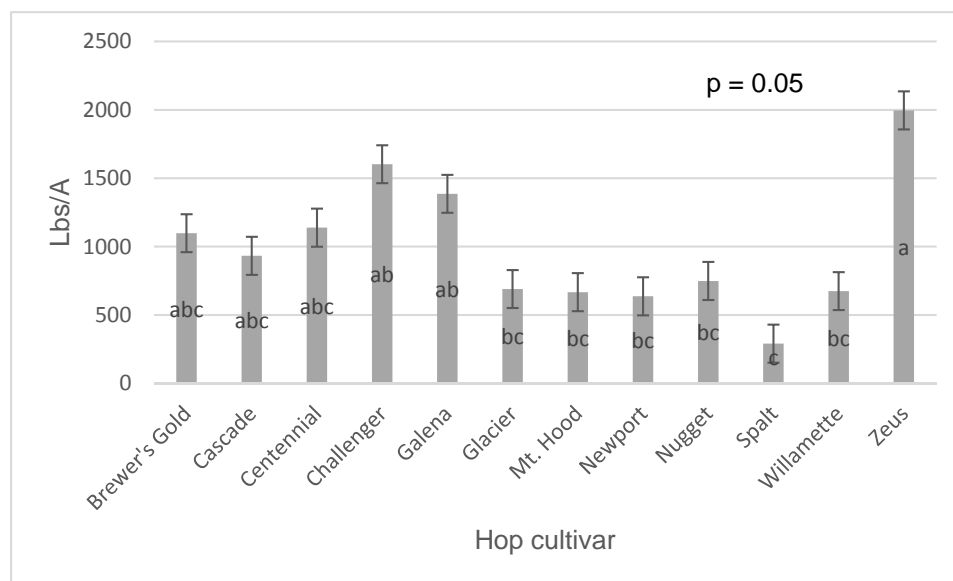


Figure 2. Mean hop yields per cultivar from the training date study conducted in 2017 and 2018.

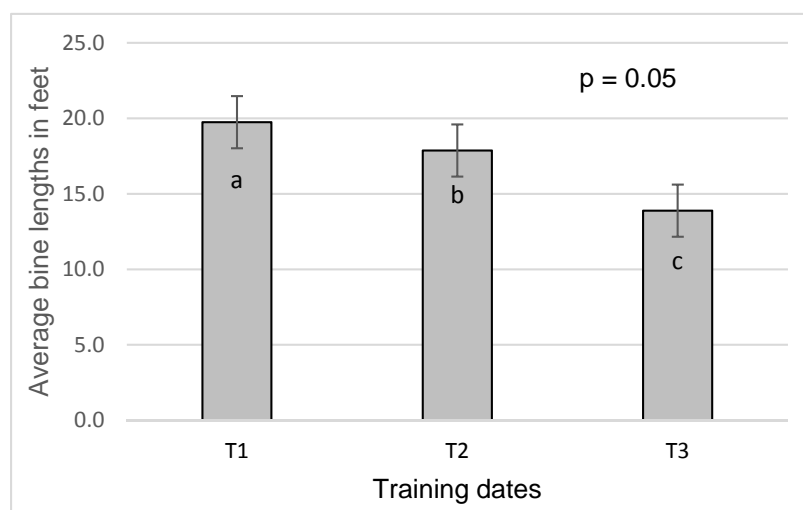


Figure 3. Average bine length in feet per training date.

Figure 3 indicates significant differences between training dates 1, 2 and 3 on bine length regardless of the cultivar. Training dates were as follows:

Year	T1	T2	T3
2017	5/1	5/16	6/7
2018	5/9	5/24	6/6

During the growing season, hops can grow up to 1 foot a day, reaching a height of 25' tall. The taller the hop bine, the more internodes the plant will

have. It is at these internodes that the hop cones are formed on side-arm shoots that begin forming in late June and early July. Hop plants are day length sensitive and need to reach their maximum height before the summer solstice (June 22<sup>nd</sup>) when the days become shorter. The shorter day lengths trigger a physiological response within the plant to begin reproducing. Delaying the training date, by not allowing the plant to reach its maximum height reduces the amount of cones produced and thus yield. Training date 1 produced 2.7 times more hops than training date 3. Training date 1 produced 1.3 times more hops than training date 2.

Table 2 summarizes information on the varieties tested.

Table 2. Cultivar information, alpha acid, hop storage index and harvest moistures.

Cultivar	Origin <sup>1</sup>	Brew Usage <sup>2</sup>	Typical Beer Style	Typical Alpha Acid Ranges	2017 Tested Alpha Acid <sup>3</sup>	2018 Tested Alpha Acid <sup>3</sup>	2017 Hop Storage Index <sup>4</sup>	2018 Hop Storage Index <sup>4</sup>	2018 Harvested Moisture
				----- % -----					---%---
Brewer's Gold	UK	B	Ale	8-10	2.2	3.3	0.25	0.22	75
Cascade	DM	A	American Pale Ale	5-7	3.4	5.0	0.21	0.34	74
Centennial	DM	D	American Pale Ale	9.5-11	12.4	8.1	0.23	0.25	75
Challenger	UK	D	English Ale	6.5-9	4.5	6.2	0.24	0.20	75
Galena	DM	B	English Ale	10-15	9	6.7	0.20	0.10	76
Glacier	DM	D	American Pale Ale	5.5	3	2.6	0.21	0.16	74
Mt. Hood	DM	A	Lager	4-7	--	2.2	--	0.17	78
Newport	DM	B	Barley Wine	13-17	3.7	6.2	0.23	0.24	69
Nugget	DM	B	Barley Wine	12-14	4.7	9.1	0.22	0.21	72
Spalt Select	GE	A	Bock	3-6.5	--	2.7	--	0.26	71
Willamette	DM	A	English Style Ale	4-6	2.1	2.9	0.22	0.28	75
Zeus	DM	B	Pale Ale	20	0.7	3.0	0.27	0.15	79

<sup>1</sup>DM = Domestic, UK = United Kingdom, GE = German as reported by Hopunion LLC

<sup>2</sup>A = Aroma, B = Bittering, D = Dual purpose as reported by Hopunion LLC

<sup>3</sup>Alpha acids adjusted to 10% moisture by sample weight. Missing values indicates insufficient sample size.

<sup>4</sup>HSI is a non-dimensional number calculated by measuring the adsorption of an alkaline methanolic hop extract at two different wavelengths using UV spectrophotometric analysis. Normal range is from 0.25 for fresh hops and 2.5 for fully oxidized hops.

## Master Gardener Pollinator Garden



Master Gardener Certified Pollinator Garden sign on display at the WREC gardens. Photo taken by Kyla Splichal.

Williams County and WREC again received additional funds through the Extension Master Gardener Pollinator Garden Grants. The purpose of these gardens is to provide Master Gardeners with volunteer opportunities, build a habitat that will nourish pollinators, and create a public teaching garden that can be jointly utilized by Master Gardeners and Extension Agents to encourage members of the general public to build home pollinator

gardens. The garden is really starting to shape up, thanks to the tireless efforts of volunteers.

## Perennial Trials



Figure 1. *Heuchera* cultivars from top left to bottom right: Apple Crisp, Autumn Leaves, Berry Smoothie, Caramel, Cherry Cola, Crimson Curls, Fire Alarm, Frosted Violet, Lime Marmalade, Marmalade, Midnight Rose, Miracle, Obsidian, Plum Pudding, Stainless Steel and Zipper.

In 2015, WREC along with NDSU Extension Horticulturist, Dr. Esther McGinnis and Dr. Hatterman-Valenti planted 16 heuchera cultivars in three locations across the state, NDSU campus in Fargo, Horticulture Research Arboretum near Absaroka and WREC in Williston. (See Figure 1 for cultivar names).

*Heuchera* is a genus of herbaceous perennial plants commonly referred to as coral bells or American alumroot. They are native to North America with more than 70 known species, but have been heavily hybridized

between 5 species *H. americana*, *H. micrantha*, *H. sanguinea*, *H. villosa*, and *H. cylindrical*.

After two years of data collection on winter survival and ornamental value, results indicate that 'Crimson Curls' had the highest average survival with 100% across three locations as well as the highest landscape ornamental rating. Other cultivars with 100% winter survival included 'Cherry Cola', 'Midnight Rose' and 'Obsidian'. In contrast, the variety 'Fire Alarm' died over the winter in all trial locations. Other varieties of poor survival included 'Caramel', 'Marmalade' and 'Autumn Leaves' all of which scored less than 60% on winter survival. Cultivars that scored 80% or higher on ornamental landscape rating included 'Crimson Curls', 'Obsidian', 'Midnight Rose', 'Marmalade', 'Stainless Steel', and 'Plum Pudding'.



## Tree Trial

Under the direction of Dr. Todd West, with the NDSU Woody Plant Improvement program, Williston REC and the cities of Dickinson, Bismarck, Minot and Williston received funding from a USDA Specialty Crop Block Grant to study the hardiness of commercially available tree species which may or may not be suitable for planting in western North Dakota. In the spring of 2016, '17 and '18, WREC along with the NDSU Woody Plant research team planted a total of 50 different tree species as part of the Western Tree Trial. The 2016 trial was planted at the WREC, while the 2017 and '18 trials were planted at Nesson Valley.

The purpose of this project is to provide updated tree species and/or cultivar information to North Dakota commercial nursery crop producers and retailers by evaluating potential woody species to enhance, diversify and increase the inventory of usable landscape plants for USDA hardiness zones 3-4. This trial will also help enhance and expand the North Dakota Tree Selector website (<http://www.ag.ndsu.edu/tree-selector/>).

### North Dakota Western Tree Trial cultivars

#### Bailey Nursery:

Silver Queen silver maple\*  
Northwood red maple  
Hot Wings® Tartarian maple\*  
Firefall™ freeman maple\*  
Red Baron crabapple\*  
Swamp white oak\*  
Boulevard American linden  
Unity sugar maple  
Fall Fiesta® sugar maple  
Regal Prince® hybrid oak  
Valley Forge American elm\*  
Princeton Gold® Norway maple\*  
Spring Wonder™ Sargent cherry\*  
Majestic Skies™ northern pin oak\*  
Mountain Frost® pear  
Autumn Gold ginkgo biloba

#### Carlton Plants:

Royal Red Norway maple\*  
Sutherland caragana\*  
Street Keeper® honeylocust\*  
Pink Spires crabapple\*  
Purple Robe black locust  
Ivory Pillar™ Japanese tree lilac\*  
Princeton American elm\*  
New Horizon hybrid elm\*  
Homestead buckeye  
Ironwood (Ostrya)

#### J. Frank Schmidt Nursery:

Red November™ Amur maple\*  
Prairie Stature™ hybrid oak  
Prairie Gold® aspen\*  
Prairie Dream® paper birch\*  
Heartland® catalpa  
Chinkapin oak  
Espresso™ Kentucky coffee tree  
Marilee® crabapple\*  
Urban Pinnacle® bur oak  
Crimson Spire® hybrid oak  
His Majesty™ cork tree  
Prairie Sentinel® hackberry\*  
Commemoration® sugar maple  
MaacNificent® maaackia\*  
Mountain Sentinel® aspen\*  
Patriot elm\*  
Eye Stopper™ phellodendron\*  
Ivory Spear™ crabapple\*

#### Speer&Sons Nursery:

Northern Acclaim® honeylocust\*

#### Swedberg Nursery:

Gladiator™ crabapple\*  
Harvest Gold Mongolian linden  
Prairie Expedition® elm\*  
Amur maackia

(\*) Indicates survival as of summer 2018.

## Irrigated

### High Tunnel



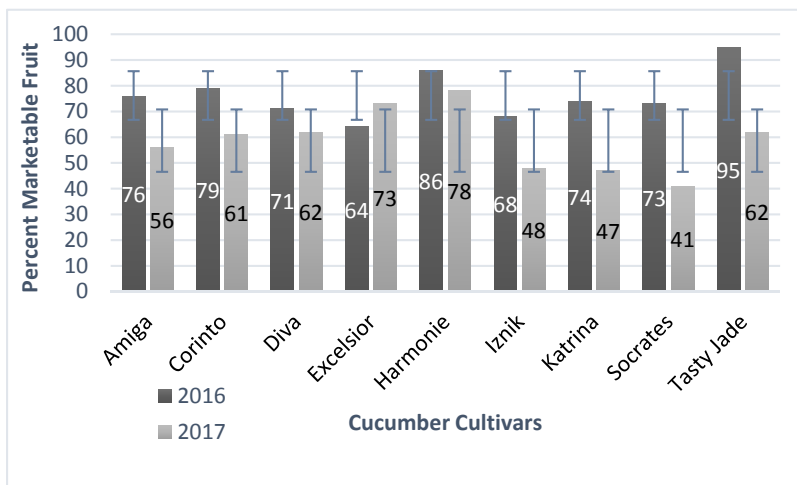
*High tunnel at Nesson Valley. Photo taken by Tyler Tjelde.*

In the fall of 2015, WREC along with NDSU High Value Crop Specialist, Dr. Harlene Hatterman-Valenti and Extension Horticulturist, Dr. Esther McGinnis were awarded a USDA Specialty Crop Block Grant through the North Dakota Department of Ag to look at high tunnels for season extension. One of the objectives was to evaluate traditional high tunnel vegetables tomatoes, peppers and cucumbers; and to evaluate non-traditional high value crops, cut flowers.

Locally grown, fresh-cut flowers were considered non-traditional crops for this trial (data not shown). There were nine cultivars of slicing tomatoes, nine cultivars of bell peppers and nine cultivars of cucumbers, each set up in

their own experiment and carried out at two trial locations, Williston and Absaraka, ND. The experiments conducted inside the high tunnel were also facilitated in a field adjacent to each high tunnel.

### Cucumber trial



The cucumber trial consisted of nine cultivars of cucumbers, three of which were considered pickling varieties. The percent marketability of each cultivar can be seen in Figure 1. The cultivars 'Tasty Jade', 'Harmonie' and 'Corinto' are well adapted to high tunnel production and produced the highest marketable yields in 2016. A heavier disease pressure in 2017, reduced marketability across all cultivars except 'Harmonie' which may indicate disease resistance.

*Figure 1. Marketability of high tunnel grown cucumbers by cultivar two-year results from Nesson Valley.*

### Pepper trial

There were nine cultivars grown in the pepper trials, however due to seed discontinuation only eight cultivars are represented in the data. The 2016 and 2017 high tunnel yields are shown in Table 1. The cultivar 'Islander' produced the most fruit per plant, followed by the cultivar 'Ace'. Both 'Ace' and 'Islander' consistently produced the highest total weight in both years as well. The poorest yielding cultivar was the only non-hybrid cultivar, 'California Wonder'.



Table 1. Pepper yields in 2016 and 2017 grown under high tunnel protection.

Cultivar	Total number	Total weight (kg)	Fruit weight (g)	Total number	Total weight (kg)	Fruit weight (g)
----- Average † -----						
	----- 2016 -----			----- 2017 -----		
Ace	19	2.1	106.3	9	0.7	89.3
California Wonder	9	1.6	172.0	5	0.4	93.2
Flavorburst	11	1.6	149.7	6	0.6	94.4
Intruder	13	1.9	150.3	4	0.4	88.1
Islander	24	2.1	86.4	7	0.7	107.9
King Arthur	13	2.1	159.9	3	0.4	95.2
Sprinter	11	1.8	172.0	5	0.5	105.3
X3R Red Knight	9	1.7	192.8	4	0.5	122.5
Mean	14	1.9	148.7	5	0.5	99.5
LSD (5%)	24	1.7	54.6	7	0.7	66.9
LSD (10%)	20	1.3	43.8	6	0.2	53.6

† Data collected from one plant per block averaged across locations Nesson Valley and Absaraka, ND.



Peppers from the high tunnel. Left to right: 'Flavorburst' and 'Islander'. Photos taken by Kyla Splichal.

## Tomato Trial

The tomato trial consisted of nine cultivars. A yield comparison of high tunnel to field for the year 2016 can be seen in Table 2. The cultivars 'New Girl' and 'Tomimaru Muchoo' are extremely well adapted to high tunnel production with the highest fruit harvested per plant at 29 and 28, respectively. The poorest adapted to high tunnel production was the only heirloom selection, 'Pink Berkeley Tie Dye'. The cultivar 'Tomimaru Muchoo' is not well adapted for field tomato production with only 3 fruits per plant harvested. The highest yielding cultivar for field production was 'Bigdena' with an average of 10 fruits per plant. Other cultivar performance to note was 'Cobra' with an average of 18 fruits per plant under high tunnel production and 9 fruits per plant in the field.

Table 2. Nesson Valley tomato yields per plant in 2016.

Cultivar	Fruit harvested	Total weight (kg)	Total weight (lbs)	Fruit harvested	Total weight (kg)	Total weight (lbs)
----- Average <sup>†</sup> -----						
	----- High Tunnel -----			----- Field -----		
Arbason	14	2.6	5.7	5	1.1	2.4
Best Boy	9	1.6	3.5	5	0.5	1.2
Bigdena	11	4.6	10.1	10	1.1	2.4
Cobra	18	4.6	10.0	9	1.3	2.8
New Girl	29	4.6	10.1	8	0.9	1.9
Pink Berkeley	7	2.8	6.2	5	1.1	2.3
Pink Wonder	12	3.5	7.7	8	1.6	3.5
Tomimaru Muchoo	28	6.1	13.5	3	0.4	1.0
Trust	16	5.1	11.1	8	1.7	3.7
Mean	16	3.9	8.7	7	1.1	2.3
LSD (5%)	13	2.9	6.5	7	1.0	2.1
LSD (10%)	18	4.0	8.8	10	1.3	3.0

<sup>†</sup> Data collected from one plant per block averaged across replications.



Tomatoes harvested from the high tunnel from left to right: 'Arbason', 'New Girl' and 'Pink Berkeley Tie Dye'. Photos taken by Tyler Tjelde.