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2019 Colorado Sunflower Variety Performance Trials
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Department of Soil and Crop Sciences
Colorado State University Extension
Colorado Agricultural Experiment Station

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Acknowledgments

The authors wish to express their gratitude to the collaborating Colorado farmers who voluntarily and generously contributed the use of their land, equipment, and time to facilitate the 2018 sunflower hybrid performance trials: Josh Lechman at Julesburg, Burl Scherler at Sheridan Lake, Gerhard Heintges at Burlington, and Tim Trupp at Prospect Valley. We thank Red River Commodities, Inc. for doing the confection sunflower seed-sizing analyses.
Summary of the 2019 Colorado Sunflower Hybrid Performance Trials
Jerry Johnson, Sally Jones-Diamond, Ed Asfeld, and Ron Meyer

Colorado State University conducts hybrid oil and confection sunflower performance trials to provide unbiased and reliable information to Colorado sunflower producers so they can select the best hybrids for their farms. Hybrid selection is a cornerstone of all crop production systems. Variable climatic conditions, innovations from plant breeding and biotechnology, acquisitions and mergers of seed companies, and rapid development of new hybrids means sunflower performance information is more important than ever to Colorado sunflower producers. The sunflower hybrid performance trial is made possible by funding received from company entry fees, the Colorado Sunflower Administrative Committee, and Colorado State University. CSU Crops Testing is a public service for Colorado producers powered primarily by entry fees by the seed companies. Please join us in thanking the sunflower seed companies that entered the 2019 trials.

Advances in weed control with a broader range of herbicides such as imidazolinone, Express, Clearfield, and Clearfield Plus have benefited sunflower producers. A new herbicide labeled for sunflowers, called Zidua, also has added reliable broadleaf weed control.

Colorado sunflower producers harvested 57.3 million pounds in 2019, according to the USDA National Ag. Statistics Service.

Figure 1 shows the variability of acreage for both oil and confection sunflowers in Colorado – especially for oil type sunflowers.

Sunflower acreage planted to oil type has ranged from 35,000 (2014) up to 175,000 (1999) planted acres. The planted acres of confection sunflowers have generally decreased since 1999 and held steady since 2006.

The variability of sunflower acreage could be due to several factors, including sunflower commodity prices, the availability of contracts, soil water at the time of planting, crop insurance requirements, and adoption of cropping rotations that do not include sunflower.

Dryland sunflowers may have fallen out of favor in recent years due to the increasing popularity of dryland corn and grain sorghum. On the other hand, herbicide tolerant sunflowers and new oil traits could lead to an increase of sunflower acreage in coming years. Food processors and consumers are demanding healthier oils, and sunflower oil meets...
this demand with the introduction of High Oleic type hybrids. High Oleic oil pressed from sunflower is more stable when used in cooking and has exceptional health benefits not found in other oils.

Colorado State University evaluated commercial and experimental oil and confection sunflower hybrids in eastern Colorado at one fully irrigated, one limited-irrigation, and two dryland locations in 2019. The fully irrigated trial at Prospect Valley returned results for confections but the oilseed trial was lost due to heavy bird damage/feeding. The limited irrigation trial at Burlington returned results for confection and oilseed trials and the dryland trial at Sheridan Lake did as well. The dryland trial at Julesburg was not reported due to poor establishment and highly variable stands.

Results tables for the irrigated trials are presented on the following pages. Twenty-six oil hybrids and thirteen confection hybrids with diverse origins and maturities were tested in the trials. Irrigated plot sizes were approximately 150 ft² at Burlington and Prospect Valley; all varieties in each trial were replicated four times at each trial location. Seed yield for all trial varieties are reported in the tables. Yield and oil content (for oil trials) are adjusted to 10% seed moisture content.
### 2019 Irrigated Oil Sunflower Hybrid Performance Trial at Burlington

**Brand** | **Hybrid** | **Oil Type**<sup>a</sup> | **Technology Traits**<sup>b</sup> | **Yield**<sup>c</sup> | **2-Year Avg. Yield** | **Moisture** | **Test Weight** | **Plant Height** | **Population** | **Oil Content**<sup>c</sup> | **lb/ac** | **percent** | **lb/ac** | **percent** | **lb/bu** | **in** | **plants/ac** | **percent** |
Nuseed | N4H521 CL | HO | Clearfield, DM | 3104 | 3285 | 5.6 | 31.6 | 70 | 15,899 | 39.3 |
Dyna-Gro | H49NS14CL | NS | Clearfield, DM | 3076 | 3148 | 5.8 | 33.1 | 74 | 14,084 | 39.8 |
Nuseed | 4170 CL Plus | Traditional | Clearfield Plus | 2971 | - | 6.1 | 32.1 | 80 | 15,609 | 39.8 |
Croplan by Winfield United | CP450E | HO | ExpressSun, DM | 2930 | - | 5.0 | 33.5 | 72 | 14,447 | 38.6 |
Croplan by Winfield United | CP545CL | NS | Clearfield, DM | 2872 | 3099 | 5.5 | 32.9 | 70 | 16,045 | 39.5 |
Dyna-Gro | H49HO19CL | HO | Clearfield, DM | 2671 | 2985 | 5.5 | 33.0 | 69 | 16,698 | 40.2 |
Nuseed | Hornet | HO | Clearfield, DM | 2667 | 2803 | 5.5 | 32.2 | 74 | 15,420 | 38.8 |
Nuseed | N4H407 CL | HO | Clearfield | 2623 | - | 5.6 | 32.1 | 70 | 15,682 | 39.8 |
Croplan by Winfield United | CP455E | HO | ExpressSun, DM | 2587 | 2618 | 5.4 | 32.8 | 74 | 14,956 | 39.1 |
Dyna-Gro | H48HO15CL | HO | Clearfield, DM | 2542 | 2969 | 5.6 | 31.9 | 72 | 14,302 | 40.4 |
Croplan by Winfield United | CP432E | NS | ExpressSun, DM | 2495 | 2533 | 4.9 | 32.8 | 66 | 16,480 | 38.6 |
Croplan by Winfield United | CPX59619CLP | NS | Clearfield Plus | 2466 | - | 5.2 | 31.8 | 70 | 14,956 | 39.4 |
Croplan by Winfield United | CL4909E | NS | ExpressSun | 2395 | - | 5.1 | 33.4 | 70 | 16,480 | 40.2 |
S&W Seed Co | NSW20440 | HO | Clearfield | 2339 | - | 5.6 | 32.1 | 70 | 15,246 | 39.7 |
Nuseed | N4H422 CL | HO | Clearfield | 2243 | - | 5.5 | 32.8 | 75 | 14,883 | 39.1 |
Croplan by Winfield United | CP3845 | HO | N/A | 2123 | 2505 | 5.0 | 33.1 | 68 | 16,262 | 41.0 |
Nuseed | N4H470 CL Plus | HO | Clearfield Plus, DM | 2078 | 2211 | 5.8 | 33.4 | 63 | 15,682 | 39.8 |
Croplan by Winfield United | CP432E ProSize | NS | ExpressSun, DM | 2076 | - | 5.0 | 32.7 | 64 | 14,447 | 38.5 |
Nuseed | N4HM334 | NS | Clearfield, DM | 1863 | - | 5.0 | 33.7 | 72 | 15,536 | 40.1 |
S&W Seed Co | NSW20110 | HO | Clearfield | 1736 | - | 5.1 | 32.9 | 68 | 14,883 | 40.2 |
Dyna-Gro | H45NS16CL | NS | Clearfield, DM | 1734 | 2063 | 5.1 | 32.2 | 68 | 15,028 | 40.5 |
Nuseed | N4H302 E | HO | ExpressSun | 1620 | 1832 | 5.3 | 31.9 | 64 | 15,173 | 39.0 |
Nuseed | 4140 CL | Traditional | Clearfield | 1469 | - | 7.0 | 32.4 | 78 | 17,714 | 38.9 |

**Average** | | | | 2377 | 2671 | 5.4 | 32.7 | 70 | 15,435 | 39.6 |

<sup>a</sup>Oil type designations: HO=High oleic; NS=NuSun/Mid-oleic.<br><br><sup>b</sup>Technology trait designations: Clearfield and Clearfield Plus=tolerant to Beyond herbicide; DM=downy mildew resistance; ExpressSun=tolerant to Express herbicide; N/A=no technology traits.<br><br><sup>c</sup>Yield and oil content were corrected to 10% moisture at harvest. Hybrids in the top yield group (P<0.30) are bolded.<br><br><sup>d</sup>If the difference between two hybrid yields equals or exceeds the LSD value, there is a 70% chance (P<0.30) or 95% chance (P<0.05) the difference is significant.<br><br><b>Site Information</b><br>Collaborator: Gerhard Heintges<br>Planting Date: June 10, 2019<br>Harvest Date: October 17, 2019<br>Irrigation: Center-pivot<br>Soil Type: Norka-Colby silt loam

*This table may be reproduced only in its entirety.*
# 2019 Irrigated Confection Sunflower Hybrid Performance Trial at Burlington

## Technology Trait Designations:
- Clearfield=tolerant to Beyond herbicide; N/A=no technology traits.

## Site Information:
- Collaborator: Gerhard Heintges
- Planting Date: June 10, 2019
- Harvest Date: October 17, 2019
- Irrigation: Center-pivot
- Soil Type: Norka-Colby silt loam

This table may be reproduced only in its entirety.

<table>
<thead>
<tr>
<th>Brand</th>
<th>Hybrid</th>
<th>Technology Traits</th>
<th>Yield&lt;sup&gt;a&lt;/sup&gt;</th>
<th>2-Year Avg. Yield&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Moisture</th>
<th>Test Weight</th>
<th>Plant Height</th>
<th>Population Over 24/64</th>
<th>Over 22/64</th>
<th>Over 20/64</th>
<th>Over 16/64</th>
<th>Seed Retained Over Screen</th>
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<td><strong>52.5</strong></td>
<td><strong>76.1</strong></td>
<td><strong>97.0</strong></td>
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</table>

<sup>a</sup>LSD (P<0.30) 269
<sup>b</sup>LSD (P<0.05) 517
Coefficient of Variation (%) 21.3

<sup>c</sup>Yield and oil content were corrected to 10% moisture at harvest. **Hybrid(s)** in the top yield group (P<0.30) are bolded.

<sup>c</sup>If the difference between two hybrid yields equals or exceeds the LSD value, there is a 70% chance (P<0.30) or 95% chance (P<0.05) the difference is significant.
# 2019 Irrigated Confection Sunflower Hybrid Performance Trial at Prospect Valley

## Technology Traits
- **Clearfield**: tolerant to Beyond herbicide
- **N/A**: no technology traits

## Yield and Oil Content
- Yield and oil content were corrected to 10% moisture at harvest.
- Hybrids in the top yield group (P<0.30) are bolded.

## LSD Values
- LSD (P<0.30): 234
- LSD (P<0.05): 455

## Coefficient of Variation
- 14.8%

## Site Information
- **Collaborator**: Tim Trupp
- **Planting Date**: June 11, 2019
- **Harvest Date**: October 23, 2019
- **Fertilizer**: Pre-plant: N at 100 lb/ac as urea; Planting: N at 4 and P at 13 lb/ac
- **Herbicide**: Sonolan at labeled rate
- **Irrigation**: Furrow
- **Soil Type**: Colby loam

This table may be reproduced only in its entirety.

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<thead>
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<th>Brand</th>
<th>Hybrid</th>
<th>Technology Traits</th>
<th>Yield$^a$</th>
<th>Moisture</th>
<th>Test Weight</th>
<th>Plant Height</th>
<th>Population</th>
<th>Seed Retained Over Screen</th>
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<td></td>
<td></td>
<td>lb/ac</td>
<td>percent</td>
<td>lb/bu</td>
<td>in</td>
<td>plants/ac</td>
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$^a$LSD (P<0.30): 234

$^b$LSD (P<0.05): 455

$^c$The difference between two hybrid yields equals or exceeds the LSD value, there is a 70% chance (P<0.30) or 95% chance (P<0.05) the difference is significant.
## 2019 Dryland Oil Sunflower Hybrid Performance Trial at Sheridan Lake

<table>
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<th>Hybrid</th>
<th>Oil Type</th>
<th>Technology Traits</th>
<th>Yield c</th>
<th>Moisture</th>
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<th>Plant Height</th>
<th>Population</th>
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- **LSD (P<0.30)**: 166
- **LSD (P<0.05)**: 318

Coefficient of Variation (%): 11.6

- Oil type designations: HO=High oleic; NS=NuSun/Mid-oleic.
- Technology trait designations: Clearfield and Clearfield Plus=tolerant to Beyond herbicide; DM=downy mildew resistance; ExpressSun=tolerant to Express herbicide; N/A=no technology traits.
- Yield and oil content were corrected to 10% moisture at harvest. Hybrids in the top yield group (P<0.30) are bolded.
- If the difference between two hybrid yields equals or exceeds the LSD value, there is a 70% chance (P<0.30) or 95% chance (P<0.05) the difference is significant.

### Site Information

- **Collaborator:** Burl Scherler
- **Planting Date:** June 20, 2019
- **Harvest Date:** October 18, 2019
- **Fertilizer:** Pre-plant: N at 60 and S at 10 lb/ac; Planting: N at 4 and P at 13 lb/ac
- **Herbicide:** Pre-plant: 2,4-D and sulfentrozone applied fall of 2018; glyphosate, 2,4-D, and sulfentrazone applied spring 2019
- **Soil Type:** Wiley loam
- **Trial Comments:** Trial hailed in early August, but no major damage was noted. Southern corn rootworm beetles were observed in the trial in the fall (as well as at harvest) at high levels. Rhizopus (head rot) was also noted at high levels prior to harvest.

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5000 Pounds per Acre Sunflower?
Ron Meyer

Are 5000 pounds per acre sunflower yields possible? Agronomists who work with sunflower are now asking the question with that production goal in mind. In the late-1990s the 3000 pound per acre target was hit using advanced production technology. As that technology improved in the mid-2000s, agronomists were breaking 4000 pounds per acre from elite hybrid trials. Plant genetic improvements coupled with new agricultural production techniques are allowing sunflower yields to continue to improve over time.

Genetic technology including CRISPR (clustered regularly interspaced short palindromic repeats), Double Haploid, Single Seed Descent Method, Composite Interval Mapping, and SNP (single nucleotide polymorphism) are terms that most of us are not familiar with. But plant breeders know what these technologies are and are employing these breeding tools to create giant leaps forward in terms of not only sunflower yield, but crop quality factors as well. Some of these methods involve using marker genes to identify a specific place in the DNA where yield improvement genes are located. These marker genes are “flags” that signal precise locations in the gene pool and enable plant breeders to snip a desired gene for a desired trait and insert it into a different plant to create better sunflower hybrids.

Is this creating a GMO? The answer is no. A GMO (genetically modified organism) is created when a foreign gene (a gene from a different species) is inserted into a plant. Sunflower plant breeding uses sunflower genes to insert into sunflower plants. There are approximately 20 species of wild sunflower (a direct relative of domesticated sunflower varieties) which provide a wide and distinct gene pool for plant breeders to obtain desirable genes from. While the gene pool hasn’t changed, the methods to find and transfer genes has.

Genetic maps of sunflower can now be produced which provide detailed locations of a plant’s DNA (genes). When exact locations of desired genes are not obtainable, breeders look for marker genes which “point” to a location. Think of this technology as scissors making a cut into a plant’s DNA to extract targeted genes and then transfer of the desirable genes into a different sunflower plant. As a result of this precision breeding effort, new sunflower plants will inherit better yielding capability and better-quality parameters such as healthier oil.

So, can Agronomists get sunflower yield to 5000 pounds per acre? They’re getting close. Yields from one trial administered by Colorado State University found a sunflower hybrid yielding 4,767 pounds per acre. Wondering if that was a one-off event, they looked at a second trial located beside it and found a different hybrid that yielded 4,998 pounds per acre. Clearly, 5000 pounds per acre sunflower yield is within reach.