Rick Novak - Director of Colorado Seed Programs
Department of Soil and Crop Sciences, Colorado State University
<table>
<thead>
<tr>
<th>Year</th>
<th>Registrants</th>
<th>Registrations</th>
<th>Acres</th>
<th>Greenhouse sq. ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>151</td>
<td>259</td>
<td>1,811</td>
<td>253,000</td>
</tr>
<tr>
<td>2015</td>
<td>166</td>
<td>333</td>
<td>3,659</td>
<td>570,980</td>
</tr>
<tr>
<td>2016</td>
<td>312</td>
<td>424</td>
<td>8,988</td>
<td>1,360,000</td>
</tr>
<tr>
<td>2017</td>
<td>386</td>
<td>532</td>
<td>12,024</td>
<td>2,300,000</td>
</tr>
<tr>
<td>2018</td>
<td>835</td>
<td>1,075</td>
<td>30,950</td>
<td>4,700,000</td>
</tr>
<tr>
<td>2019</td>
<td>1,933</td>
<td>2,572</td>
<td>85,917</td>
<td>13,800,000</td>
</tr>
</tbody>
</table>
Industrial Hemp vs Marijuana

**Industrial Hemp**

- THC content less than 0.3%
- Anything with a THC concentration of 0.3% - 0.9% is considered to have “only a small drug potential” but is legally *not* industrial hemp

**Marijuana**

- Tetrahydrocannabinol (THC)
- THC content between 5 – 10%
- THC may be as high as 25-30%
- THC at a level of 1% is considered the threshold for marijuana to have some intoxicating potential. However, any material with a THC above 0.3% *is* legally marijuana in CO, KS and federally

Sources:

Are the two crops regulated the same? Absolutely Not.

**Industrial Hemp**
- Cultivation regulated by Dept. of Ag
- Nine pages of actual Rules
- Matter of statewide concern and counties cannot opt out
- Federally addressed in the Farm Bill giving states some room to adopt rules

**Marijuana**
- All facets of the industry regulated by Dept. of Revenue
- Hundreds of pages of Rules
- Counties can opt out
- Remains federally illegal
MONOECIOUS types are usually TALLER and produced for Fiber and / or Grain & Oil markets.

DIOECIOUS types are usually SHORTER and produced for Grain, CBD & Oil markets.
Industrial Hemp Seed Certification Process in Colorado

• We developed a process to achieve a goal of having Certified hemp seed available!
• We worked with our national Association of Official Seed Certifying Agencies (AOSCA) to establish field and seed standards for hemp.
• Colorado Department of Agriculture (CDA) is a partner with Colorado Seed Growers Association (CSGA) in this process.
• CDA and CSGA together created a variety review process by committee for hemp seed varieties.
• CDA did establish five THC variety evaluation trial locations.
• CDA collects top plant samples within 30 days of maturity.
• CSGA field inspections occur using descriptors twice during the growing season.
CSGA and CDA developed a variety review process (review guide)
A Variety to be Eligible for Seed Certification, Specific Requirements Must be Met by the Owner. Industrial Hemp is not exempt!

- A. The name of the variety
- B. A statement concerning the variety’s origin and the breeding procedure used in its development.
- C. A detailed description of the morphological, physiological and other characteristics of the plants and seed that distinguish it from other varieties.
- D. Evidence supporting the identity of the variety, such as comparative yield data, insect and disease resistance, or other factors supporting the identity of the variety.
- E. A statement delineating the geographic area or areas of adaptation of the variety.
- F. A statement on the plans and procedures for the maintenance of seed classes, including the number of generations through which the variety may be multiplied.
- G. A description of the manner in which the variety is constituted when a particular cycle of reproduction of multiplication is specified.
- H. Any additional restrictions on the variety, specified by the breeder, with respect to geographic area of seed production, age of stands or other factors affecting genetic purity.
- I. A sample of seed representative of the variety as marketed. The sample will be retained to provide appropriate control samples against which future releases of stock may be tested to establish varietal characteristics.
Certification Standards

• **Land Requirements**----crop history, weed control, and crop rotation

• **Field Standards**----crop inspection, roguing, variants and contaminants
   "We require fields to be planted in a manner that can be inspected."

• **Isolation**----to prevent cross-pollination; the distance will decrease with lower seed class. A range of 16,150 feet down to 3,230 feet.

• **Impurity Standards**----based on plant counts of 10,000

• **Seed Standards**----purity of 98%, germination of 80%

• **Colorado Department of Agriculture**----With our diverse environment we require THC evaluation for all Certified seed varieties.
Field Inspection for Seed Certification
2019 Harvesting for Seed
“Hemp Seed Quality”

- Seed Viability (broad term)
- Tetrazolium (TZ)
- Germination (time sensitive)
- “Dormancy”
- Pure Seed
- Other Crop
- Weed Seed (common & Noxious)
- Inert Matter
Cannabidiol

• Dr. Raphael Mechoulam from the Weismann Institute of Science isolated Cannabidiol (CBD) in 1963 and then later identified Tetrahydrocannabinol (THC) in 1964.

• Essential oil extraction options:
  • Steam distillation (water)
  • Solvent extraction (ethanol, butane, isopropyl alcohol)
  • Super critical fluid extraction (CO2)
2016 THC Evaluation Trial
2019 THC Evaluation Trial
Plant Sample Collection
Roots can penetrate the soil very well.
Agronomic Challenges

• Plants are day-length sensitive (June 21\textsuperscript{st} )
• Harvest; for fiber varieties-\underline{during pollination}
• Harvest; for grain varieties-\underline{70\% seed is ripe ?}
• Seed oil content- \underline{30\%}
• Grain storage- \underline{8-10\% moisture}
• Bushel weight- \underline{44 pounds}
• Baling residue moisture < 14\%
Agronomic Challenges

• Weed Control; no chemical options
• Disease –
  – beet curly top virus in 2019 was #1 identified virus in Colorado spread by (beet leafhopper)
  – fusarium
  – pseudomonas
  – pythium
• Fertility requirements-?
• Water consumption-?
Hemp Insects

- [https://hempinsects.agsci.colostate.edu/](https://hempinsects.agsci.colostate.edu/)
- Goals of this Hemp Insect Website are to:
  - (1) Provide description of all insects and mites observed in production of hemp;
  - (2) Provide information on the habits of all insects that are associated with hemp production.

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Industrial Hemp Seed Varieties

Henola (monoecious)  
NWG 331 (dioecious)
Farmers are “now” looking for dual purpose hemp crop! (CBD, Fiber or Seed)
<table>
<thead>
<tr>
<th>Count</th>
<th>#</th>
<th>Year CDA Approved</th>
<th>Variety</th>
<th>Breeding Company</th>
<th>Origin</th>
<th>Flowering</th>
</tr>
</thead>
</table>
| 1     | 1   | 2016              | Eletta Campara | CREA, Italian Ministry of Agriculture  
Schiavi Seeds LLC (Lexington, KY)                                                   | Italy         | Dioecious                          |
| 2     | 2   | 2016              | Fibranova    | Schiavi Seeds LLC (Lexington, KY)                                                  | Italy         | Dioecious                          |
| 3     | 3   | 2016              | Helena       | Institute of Field & Vegetable Crops in Novi Sad, Serbia  
Schiavi Seeds LLC (Lexington, KY)                                                   | Serbia        | Monoecious                         |
| 4     | 4   | 2017              | Beniko       | The Polish Institute of Natural Fibers, Poland  
Schiavi Seeds LLC (Lexington, KY)                                                   | Poland        | Monoecious                         |
| 5     | 5   | 2017              | Tygra        | Schiavi Seeds LLC (Lexington, KY)                                                  | Poland        | Monoecious                         |
| 6     | 6   | 2017              | Bialobrzeskie| The Polish Institute of Natural Fibers, Poland  
International Hemp Solutions  
Bija Hemp (Denver, CO)                                                              | Poland        | Monoecious                         |
| 7     | 7   | 2017              | Elite        | New West Genetics (Fort Collins, CO)  
New West Genetics (Fort Collins, CO)                                                | USA           | Dioecious                          |
| 8     | 1   | 2018              | B11          | Potent 2018 Ltd (Hatchkiss, CO)                                                     | USA           | Dioecious                          |
| 9     | 2   | 2018              | CRS-1        | Hemp Genetics International (Canada)  
Hemp Genetics International (Canada)                                                | CAN           | Dioecious                          |
| 10    | 3   | 2018              | Henola       | The Polish Institute of Natural Fibers, Poland  
International Hemp Solutions  
Bija Hemp (Denver, CO)                                                              | Poland        | Monoecious                         |
| 11    | 4   | 2018              | Medicine Mother | Mountain Flower Botanicals (Hatchkiss, CO)  
Mountain Flower Botanicals (Hatchkiss, CO)                                         | USA           | Dioecious                          |
| 12    | 5   | 2018              | Rajan        | The Polish Institute of Natural Fibers, Poland  
The Polish Institute of Natural Fibers, Poland                                        | Poland        | Monoecious                         |
| 13    | 6   | 2018              | VC Star      | Grow Hemp Colorado (Boulder, CO)                                                    | USA           | Dioecious                          |
| 14    | 1   | 2019              | Carmanecta   | Enecta BV (Amsterdam Netherlands)                                                   | Netherlands   | Dioecious                          |
| 15    | 2   | 2019              | Enectarol    | Enecta BV (Amsterdam Netherlands)                                                   | Netherlands   | Dioecious                          |
| 16    | 3   | 2019              | NWG 331      | New West Genetics (Fort Collins, CO)  
New West Genetics (Fort Collins, CO)                                                | USA           | Dioecious                          |
| 17    | 4   | 2019              | B12          | Potent 2018 Ltd (Hatchkiss, CO)                                                     | USA           | Dioecious                          |
CBD production, what is that about?
The field below is 4 acres located in Oregon

- Seed source (reliable)
- Feminized seed?
- Planting, how and when
- Weed control (mechanical)
- Harvest planning (labor)
- Drying (plant yield 4 lbs.)
- Storage
- Marketing $2.00/lb
“Thank You”