Industrial Hemp Research at Virginia State University

Maru Kering, Ph.D
Virginia State University - ARS

Industrial Hemp Field-Day, 17 August, 2017

Introduction

College of Agriculture
VIRGINIA STATE UNIVERSITY

- A major agronomic up to the early part of the last century
- However, banned in the US for the last >70 Years, but production and research continued in other countries e.g in Europe
- A large gene pool of superior varieties exist in Europe/Canada
- In the US, passage of 2014 Farm Bill allowed for limited research
- The commonwealth of Virginia allowed for pilot studies in 2015-2016

College of Agriculture
VIRGINIA STATE UNIVERSITY

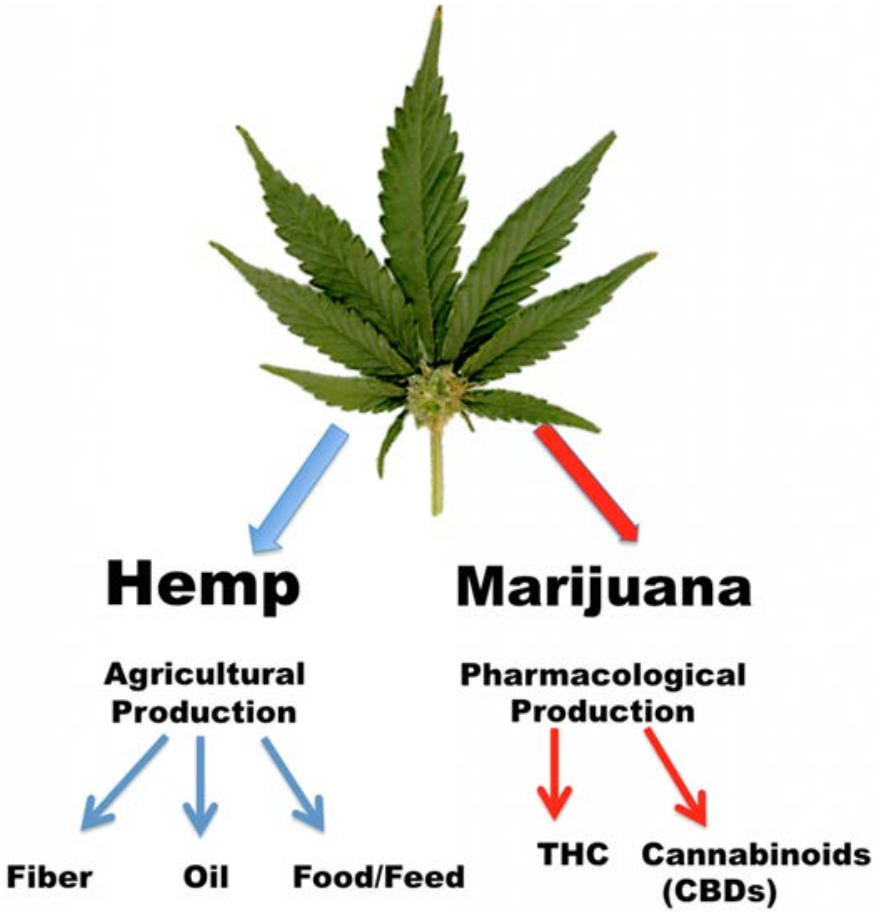
Industrial Hemp & Marijuana. Which is it?

- The same plant; *Cannabis sativa*

  Main difference is levels of the psychoactive compound THC

Classification:

THC concentration >0.3% (Marijuana)
THC concentration ≤0.3% (Industrial hemp)



Why Back and Why Now

Why Now!!!!

Federal and states legislatures loosening legal restriction on production

Why Back!!!!

Industrial hemp is a multi-use crop with three harvestable parts; 1) Stalks, 2) Seed/grain and 3) Flowers/bracts.

1) Stalks:

- Fiber production (25-35%).

  Uses; Yarn, fabric, electrical superconductors, etc

- Non-fiber (65-75%). Woody material (Hurds)

  Uses; For chip board, Particle board, insulation, structural reinforcement, Bioenergy feedstock

Why Back & Why Now Cont…

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

2) Seed/Grain

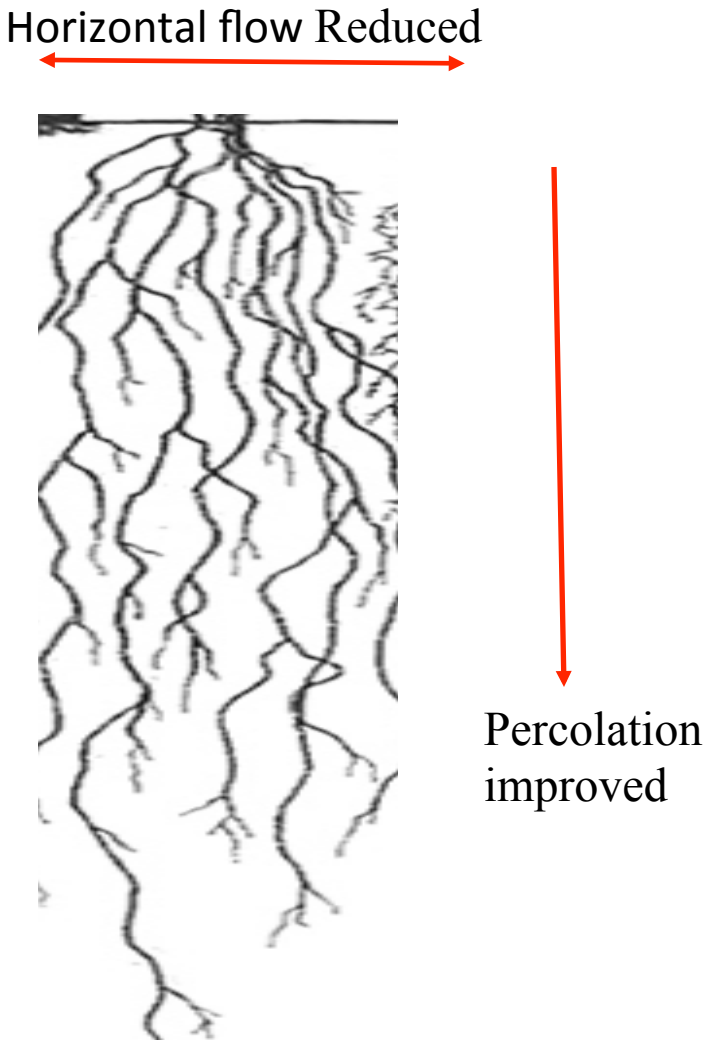
- Has high oil content ~30%, rich in omega 3 & 6 fatty acids
- High protein, a balanced amino acid profile, good for human dietary supplements
- Extracted oil used for cosmetic industry, cooking
- Residual protein rich-cake used for animal feed/supplements

3) Flower/bracts

Flowers are rich in cannabinoids, compounds unique to genus *Cannabis*.

- Cannabinoid,
  - Delta-9 tetrahydrocannabinol (THC), the active ingredient in marijuana.
  - Cannabidiol (CBD), for pharmaceutical and medical use

Roots are useful too



- Up to 2 m (6 ft) deep
- Used to clean soil.
- Dead roots increase soil organic matter
- Improve soil porosity
- Increase water infiltration
- Improve water reserve for next crop

Industrial Hemp in the Commonwealth of Virginia

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Pilot studies in the Commonwealth of Virginia are done at selected institutions: Currently

- **Virginia State University**
- **Virginia Tech**
- **James Madison**
- **University of Virginia- 2017**

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Industrial Hemp Research
Research at VSU

Three main area of research

- Planting Date Study
- Fertilizer Study
- Variety Trial

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Industrial Hemp- Planting

Field Plots- Early in the Season

Weeds are a real problem

Field Plots-Late Season

Felina 32 (Grain Variety)

Carmagnola (Fiber Variety)

Field Tour 2016- Mostly VDACS Personnel

VDACS staff and other visitors admire some hemp-based products.

Planting Date Study (PDS)-2017

- Variety performance at different planting dates
- Five planting dates
- Two week intervals
  - Mid –April through Mid –June

Planting Date Study (PDS) - PD 1

Mid April

- Soil temperatures are cold
- Seed germination low
- Emergence low
  - Low night temperature may kill a germinating seed

Planting Date Study - PD 2

End April/Early May

- Better seedling emergence
- More vibrant plant
  - Improving soil temperature promote emergence
  - Overall improved air temperature

Planting Date Study - PD 3

Mid-May

- Better seedling emergence
- More vibrant plant
  - Improving soil temperature promote emergence
  - Spring rain/tempearure promotes growth

Planting Date Study - PD 4

Early June

- Good seedling emergence
- Dependent on soil moisture
- Temperature increasing and dry condition setting
- Weed competition high

Planting Date Study - PD 5

Mid-June

- Seedling emergence depends on good soil moisture
- Temperature increasing and dry condition setting
- Competition from weed high

Preliminary PDS Result

- Mid April too early
- Excess rainfall in spring/poor drainage kills some seedling
- Early-Late May be good planting period
- Mid-June may be a little late. Plant flower at one foot tall
- Some varieties may tolerate unfavorable condition in early spring (Mid-Late April)

Felina 32- Nitrogen Study

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

100 kg N ha^{-1}

0 kg N ha^{-1}

Fiber Varieties

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Early Planting

Late Planting

Production Challenges

- Successful weed control
- Waterlogging & seedling death/potential root rot
- Dry soil conditions–Inhibits successful germination & Seedling emergence
- Pest infestation (lots of them). Examples
    - Mites
    - Piercing insect-seed damage/
    - Beetles
    - wild bird associated seed loss
- Seed loss from shuttering

Pest Infestation-A lot of bugs

Insect larval forms

Hemp leaf is tastey

Some of the Pests Observed

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Some of the Adult Insect Pests

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Grasshopper

Green stink bug

Brown stink bug

College of Agriculture
VIRGINIA STATE UNIVERSITY

College of Agriculture
VIRGINIA STATE UNIVERSITY

Hemp Seed Nutritional Value Well Recognized

VIRGINIA STATE UNIVERSITY College of Agriculture

VIRGINIA STATE UNIVERSITY

Wild birds knows it too!!!

Seed Loss in the Field

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Hemp leaf is tastey

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Preliminary Conclusion - VSU Study

- Some of these foreign-developed varieties can be produced here
- Weed management is paramount for succesfull crop
- Planting in mid-spring (May) gives a better crop
- The crop host/susceptible to a number of pests, mites, insects etc
- Grain loss from wild birds significant

Way Forward

College of Agriculture
VIRGINIA STATE UNIVERSITY

A lot of Work to Do

- **Soil and climatic conditions**
  - Adaptability to varied soil types, Marginal areas
- **Establishment**
  - Seeding rates. Row spacing, **Planting dates**, seeding depths
- **Fertilizer response**
  - Different fertilizer responses, Application rates & timing
- **Insect, pathogens, and other pest management**.
  - Variety sensitivity to pest and pathogens, Efficacy of fungicide and insecticide \
- **Weed management**
  - Pre/post emergence herbicides effectiveness, crop sensitivity, application timing
- **Harvest and handling practices**
  - Desiccants for accelerated drying
  - Fiber extraction (retting), handling and prossing
- **Crop rotations**
  - Industrial hemp suitability for rotation with other annual crops; Impact on pest/pathogen load and crop performances
- **Water use and demand**
  - Variety, Irrigation, and its interactions
  - Evapotranspiration and water demand

VIRGINIA STATE College of Agriculture
VIRGINIA STATE UNIVERSITY

Questions