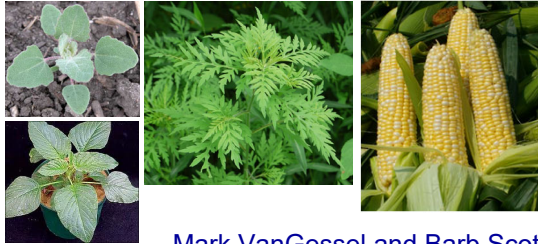


## Alternative Weed Control Options for Fresh Market Vegetables



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## Paraquat Requirements

- Paraquat dichloride

GROUP 22 HERBICIDE

**Gramoxone**<sup>®</sup>

**PARAZONE**<sup>™</sup>

**HELMQUAT 3SL**

**Quik-Quat**<sup>™</sup>



## Paraquat Requirements

- Restricted Use Pesticide
- Additional Certified Applicator Training
  - Training valid for 3 yrs
  - Available on-line
  - Mixing/loading, applying, transporting, disposal
- <https://npsec.us/paraquat>



2022/2023  
Mid-Atlantic Commercial Vegetable  
Production Recommendations



Updates are available

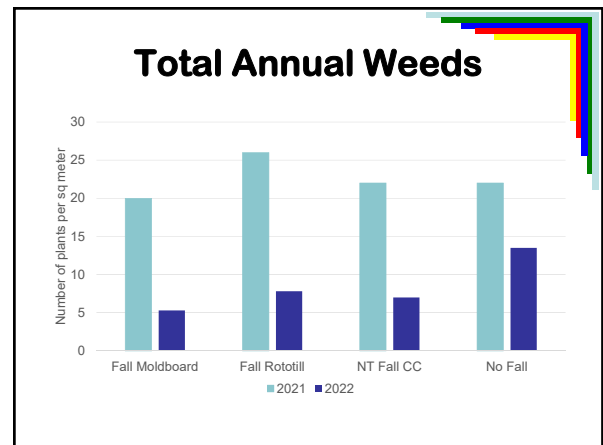
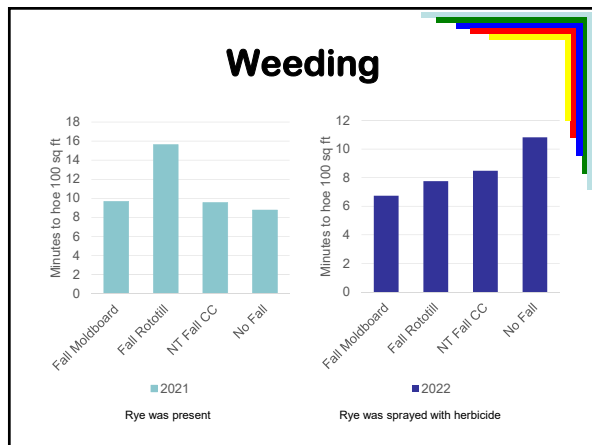
Updates highlight  
changes since 2022

Updates should be  
used in combination  
with the full guide



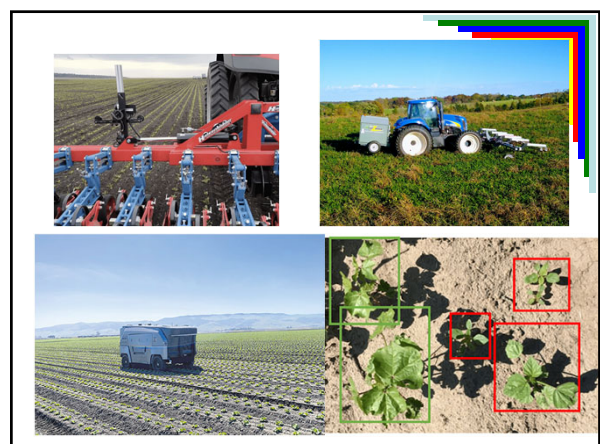
## “Tarp” Trial

1. Moldboard plow in fall fb cereal rye
  2. Rototiller in fall fb cereal rye
  3. Cereal rye, spring glyphosate, spring rototiller
  4. No fall management, spring rototiller
- Used 6 mil 150' by 24' silage bunker covers (cut to 75')
    - Reusable
  - Planted sweet corn, broccoli, and spinach



### Preliminary Observations

- 4 wks was not long enough for killing cereal rye
  - Soil temps did not rise as expected
- Able to plant NT with push planter
- Fall plowing reduced Palmer amaranth density in only one year



## Alternatives

### Additional Weed Control Options

- Lack of effective herbicide options
  - Often very few registered herbicides
  - Difficulties/challenges in registering new herbicides
- Herbicide resistance
- Labor shortages
- Most new technology can be used in combination with herbicides

## Technology / Tactics

- Some are just entering marketplace
  - Others have been around for 25+ years
- Changes coming quickly
  - New advances in camera technology
  - Improved plant recognition
    - Artificial intelligence or machine learning

## Technology / Tactics

- Electrocuting
- Guidance systems
- Sprayers
- Auto hoeing
- Automated platforms
- Lasers

## Electrocuting

- Not new technology
- Pulled by tractor, use tractor PTO to power generator
- Used on larger weeds that are taller than the crop
  - Weeds may have already impacted yield
  - Consider tire-damage to crop
- More weeds, more hp needed

## Electrocuting



## Electrocuting

- Lots of safety features
- Broadleaves are easier to kill than grasses
- Drought stress weeds harder to kill
  - Electricity generator heat and water in cells boil and kills tissue (less water less effective)
- Literature suggests at least two passes
- Can kill weed seeds

## Guidance

- Not new, technology is improving
- Camera tracks crop row, moves/shift cultivator to follow the crop row
- Allow for closer cultivation
- Higher speeds
- Less driver fatigue, less experienced driver



## Guidance

- Needs a crop row to follow
- Difficult to follow rows in weedy fields



## Drone Herbicide Applications

- Conventional herbicides applied as an aerial application
  - Using labeled products that provide good crop safety
- Limited in area that can be applied at one time



## Sprayers

- Precision sprayers use camera and onboard computers to distinguish weed from crop and allow precise application
- Advantage
  - Treat only where weeds are present
  - Possibly use non-selective herbicides "in crop"
- POST applications; not appropriate for PRE applications or where residuals are needed

## Sprayers

- Precision sprayers that distinguish weed from crop and allow precise application
  - Blue River
  - Vision Robotics
  - Foothill Packing
  - Ag Mechatronic
  - Ecorobotix (full automated)





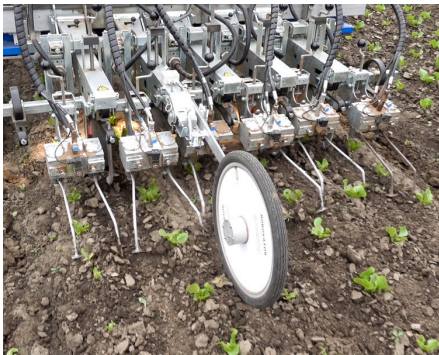
## Sprayers

- Commercially available
- Ongoing field research
  - Focused on field crops
- Plant recognition software rapidly improving
- Labelling for targeted applications has not been fully addressed
  - Number of applications/yr
  - Max ai/acre/yr

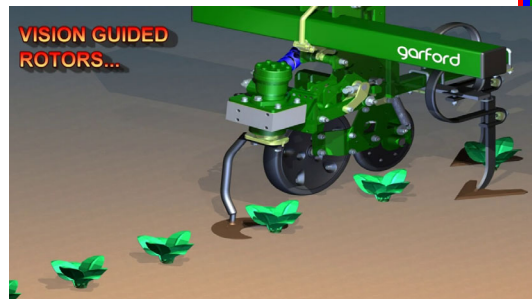
## Automated Hoeing

- Multi-row cultivator, typically pulled by tractor
- Follow crop row
- Using multi-cameras and on-board computer (ai), distinguish crop from weeds and remove weeds in the crop row
- Plant recognition software is advancing quickly

## Robovator



## Garford



## Automated Hoeing

- Can be used on range of row widths, up to 30ft units
- Light weight, up to 5mph
- Weeds need to be small
- Can operate within inches of crop
  - Root pruning
- When not using narrow-rowed beds, needs to be paired with other tools

## Automated Hoeing

- Robovator (Denmark)
- Ferrari (Italy)
- Garford (England)
- Farm Wise (US)
- Self propelled versions of some units are available

## Self-Guided Platforms



Tertill Weeding Robot

## Naïo Automated Systems

- Utilize RTK Guidance
- Battery operated
- Tools attached as needed ("tool carrier")
- Lacks camera for "with-in" crop row
- Limited width
- Autonomous

## Thermal Sprayer

- Sprays heated vegetable oil (160°C/320°F)
  - Instead of herbicide
- Tensorfield Ag (Precision Thermal Weeding)



## Lasers

- High energy, targeted lasers, transmitting heat
- Can be used with tilled and no-tilled soils
- Cameras to detect weeds and crop
- Literature says 2 acres/hr
  - 200,000 weeds per hour



## Lasers

- Just reaching the market
- Carbon Robotics
- WeedBot
- WeLASER

## Nexus 'Chevre'

- RTK-GPS guidance
- Camera for distinguish crop/weed
- Uses "pincers" to grab and remove weeds
- Monitor crop health



## Directed Electricity

- Rootwave (Small Robot Co)
- Electrocutes individual weeds



## Questions to Consider

- Size of weeds it's effective on?
- Does it need to be tilled soil?
- Is energy required based on weed size or density?
- Probably need more than one pass, can it be done timely?
- Portability between fields
- Compatibility with other tasks
  - Cameras monitor crop health

## Questions to Consider

- If discussing removing individual weeds, remember  $>2000$  seeds/ft<sup>2</sup>
- Is it compatible with other weed management tactics?
- None of these are stand alone tactics
  - Assuming preplant/at-planting tactic used
  - Or fields with very low seedbanks

## Thank you to:



Specialty Crop Block Grant Program