

UAVs for Precision Weed Management

EXTENDING KNOWLEDGE >> CHANGING LIVES

NDSU

EXTENSION

UAVs for Precision Weed Management

John Nowatzki

Extension Ag Machine Systems Specialist

NDSU

EXTENSION

Weed ID and UAS Sprayers

NORTHERN PLAINS
UAS TEST SITE

- Weed Identification
- Weed Management
- UAS Sprayers



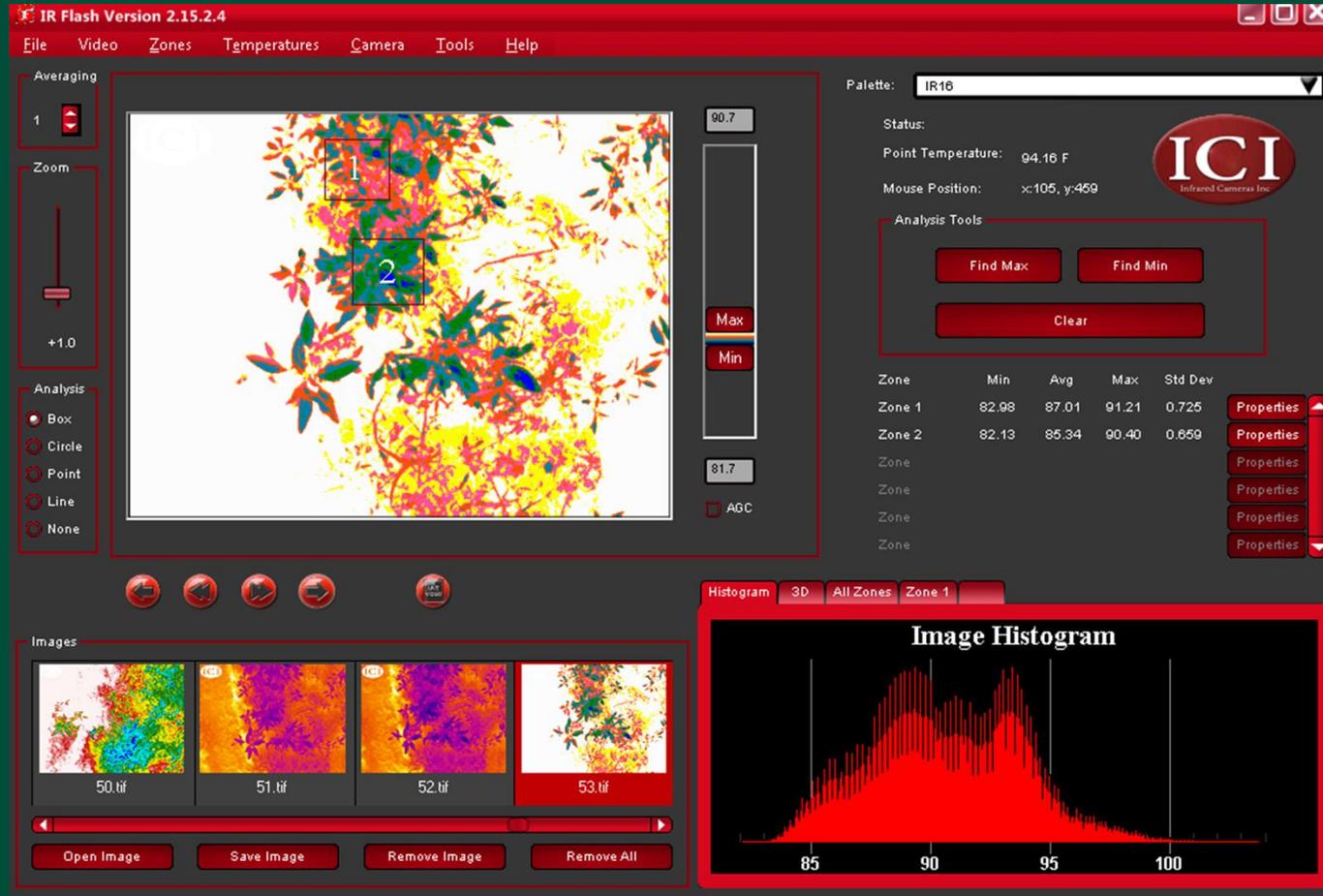
Identifying Herbicide-resistant Weeds



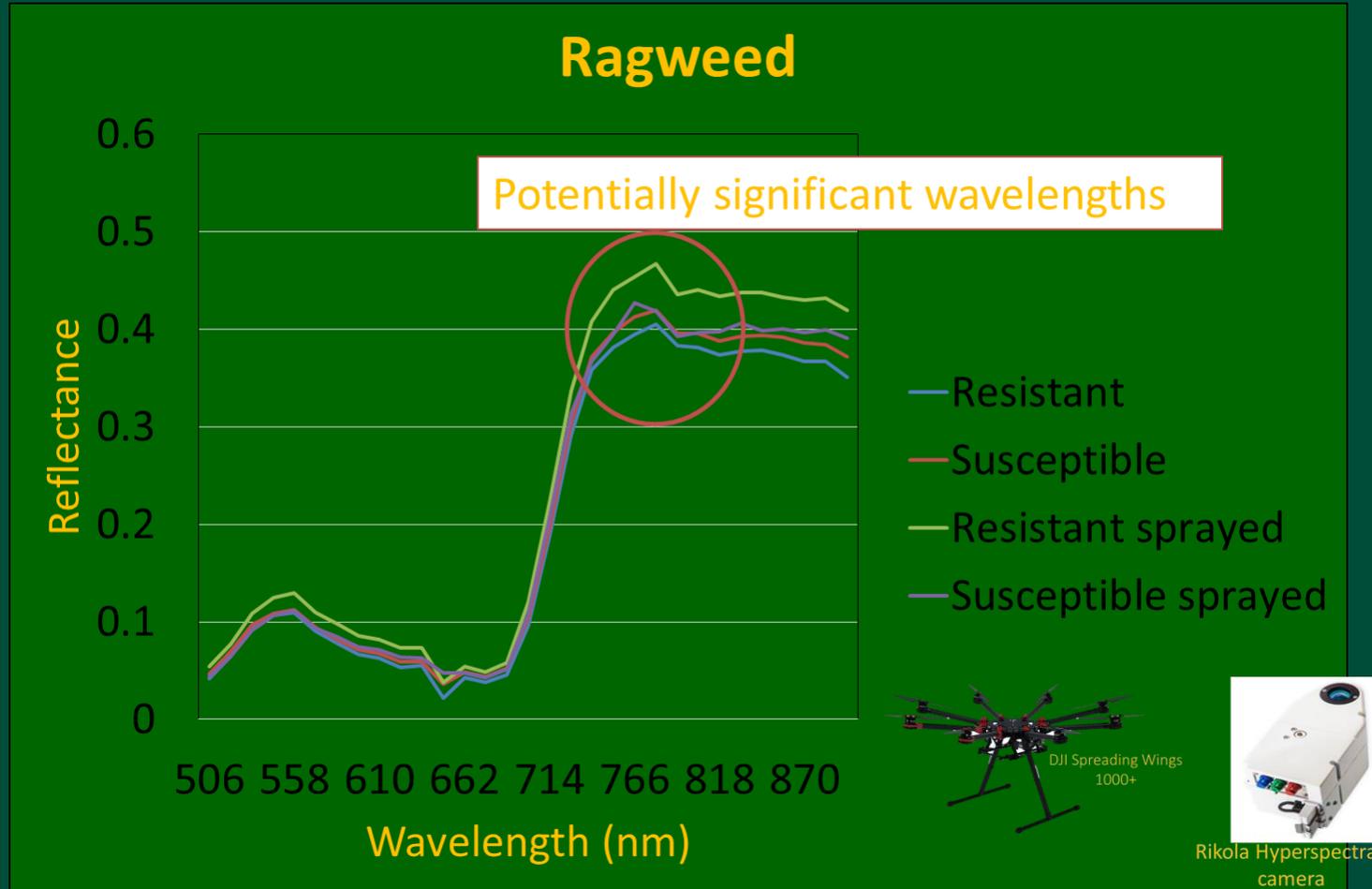
#1 Herbicide-resistant
Cooler

#2 Herbicide-susceptible
2-5 degrees warmer

Herbicide-resistant Weed Research

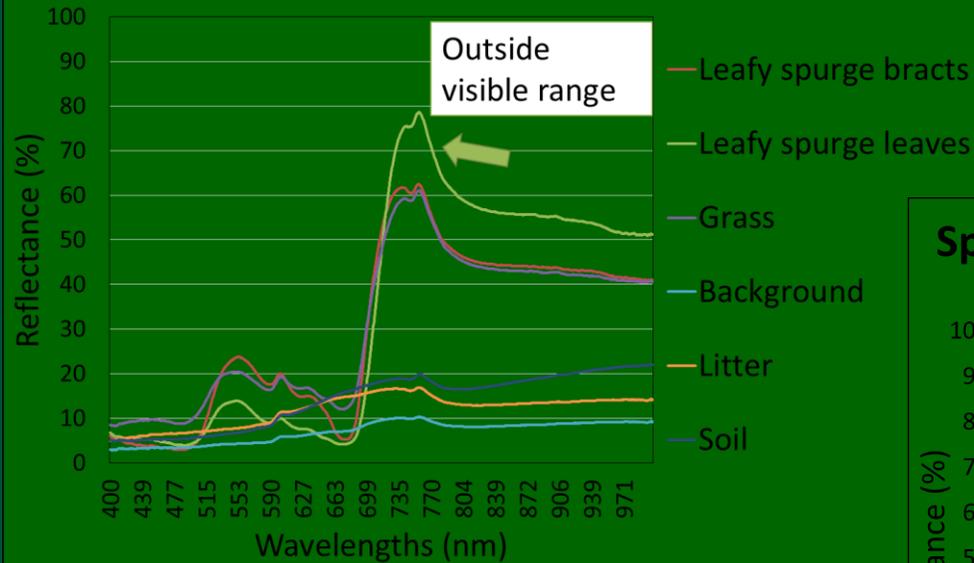


Identifying Herbicide-resistant Weeds



Identifying Noxious Weeds

Spectral signatures of leafy spurge and surroundings



UAVs:

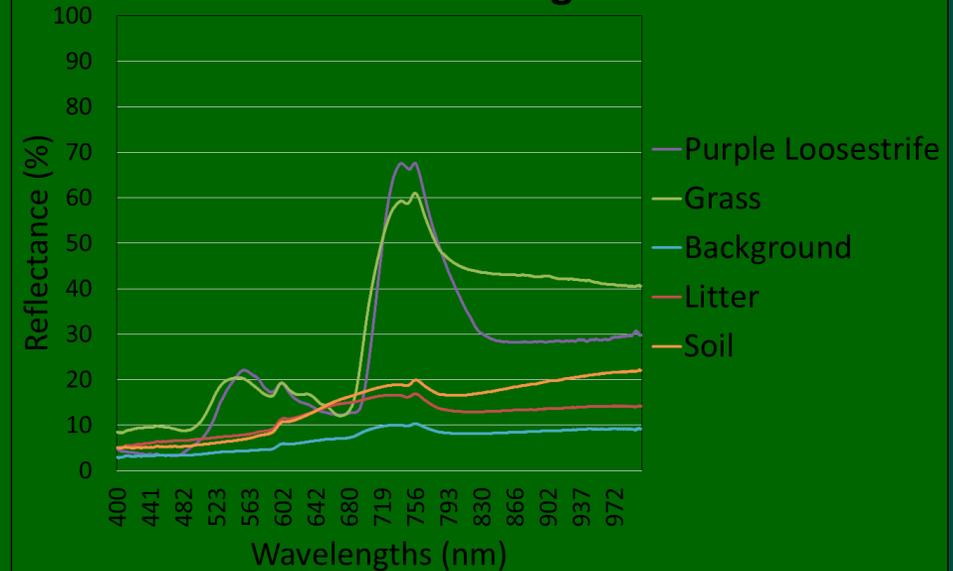
- DJI Phantom 3 & 4
- DJI Matrice 100

Cameras:

- Sentera Multispectral Cameras
- Slanrange Multispectral camera



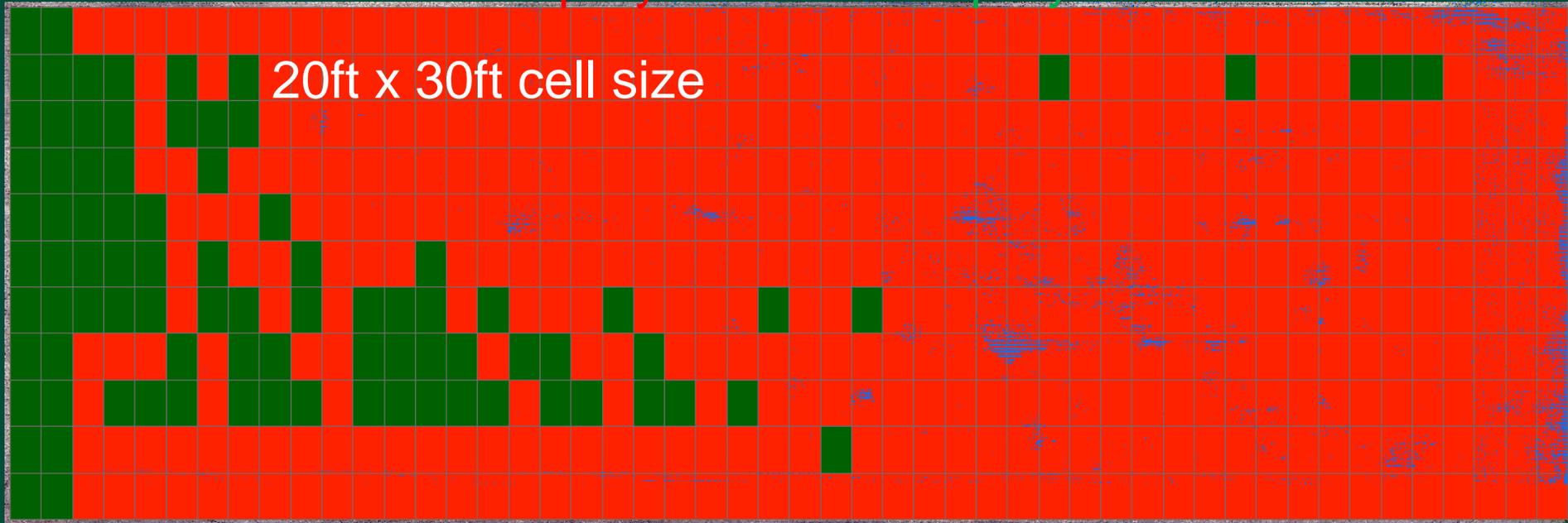
Spectral signatures of purple loosestrife and surroundings



Slanrange Camera

Weed Mapping on Corn – 120ft AGL

Red = spray Green = no-spray



UAS Sprayer





Ag Week TV
Mikkel Pates

HSE UAS Sprayer

- UAV – 27 lbs.
- Batteries – 17 lbs.
- Spray Equipment – 2 lbs.
- Liquid Capacity – 4 gallons – 33 lbs.
- Total Weight – 79 lbs.

Flight Time – 30 minutes



HSE UAS Sprayer

Total weight with 2 batteries and 2 gallons of water 54.2 lbs.

Total weight with 3 batteries and 1.5 gallons of water 54.2 lbs.

Total weight with 4 batteries and 1 gallon of water 54.2 lbs.

Total weight with 4 batteries and 4 gallons of water 79.2 lbs.

UAS Sprayer Applications

- Weed Control in Rangeland
- Weed Patches in Cropland
- Herbicide-resistant Weeds
- Horticultural Crops
- Pest Control on Livestock
- Vector Control
- Small Areas



Initial UAS Sprayer Research

- Spray Pattern
- Spray Rate Across Application Width
- Impact of Downdraft on Application
- Compare UAS with other Application Technologies
 - Effectiveness
 - Economics

AeroDrone Sprayer

Aerdrone Parameters

Cruise Speed	90 KMH / 56 MPH
Length	2.5 Meters
Wing Span	4.5 Meters
Empty Weight	70 KG / 154 Pounds
Distance for Takeoff and Landing	150 Meters
Maximum Distance to the Field	10 KM / 6.2 Miles
Climbing Rate	3 Meters / Sec.
Flight Time	1.3 Hour
Fuel Consumption	7 Liters per Hour (1.8 Galons)

Spraying Parameters

Spray Altitude	5 to 15 Meters
Maximum Area Sprayed / Flight	50 Hectares / 124 Acres
Spray Width	20 Meters
Payload Weight	50 KG / 110 Pounds
Spraying Productivity	75 Hectares / Hour (185 Acres)
Droplet Size	100 to 150 μ m
Spray rate	1-3 liters/hectare (ULV)



USDA-ARS Precision Ag Research

NDSU Agricultural and Biosystems Engineering

- \$840,000 annually for 5 years
- Four New People at ABEN Department
- Six Graduate Students
- Research Focus:
 - Weed Identification and Management and Herbicide-resistant Weeds
 - Digital Data for Crop Management

Precision Ag Major & Minor

NDSU Agricultural and Biosystems Engineering

- PAG 115 Introduction to Precision Ag (3 credits)
- PAG 215 Mapping of Precision Ag Data (3 credits)
- PAG 315 Electronic Systems in Precision Ag (3 credits)
- ASM/PAG 454/654 Principles and Applications of Precision Ag (3 credits)
- ASM/PAG 455/655 Big Data Management in Precision Ag (3 credits)
- PAG 475/675 PA Capstone (2 credits)

Questions - Comments

- Office 701-231-8213 Cell 701-261-9842
 - John.Nowatzki@ndsu.edu
- <http://www.ag.ndsu.edu/agmachinery>

