Strategies for Funding Problem Solving Research on the Alliums

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USDA-NIFA Specialty Crops Research Initiative (SCRI)

USDA Specialty Crops Research Initiative (SCRI)

- Research in plant breeding, genetics, and genomics to improve specialty crops
- Identify and address threats from pests and diseases
- Improve productivity and profitability over the long term
- Improved mechanization and technologies that delay or inhibit ripening
- Prevent, detect, monitor, control, and respond to potential food safety hazards

USDA Specialty Crops Research Initiative (SCRI)

THANKS TO YOU!!!

- Responding to "listening sessions" by federal agencies
- Providing information on specialty crops
- Continued communications with congressional delegation

USDA Specialty Crops Research Initiative (SCRI)

Requires stakeholder input into research priorities

Survey on Challenges to Sustainable Production of the Alliums (2006)

2006 Farming Challenges Survey

0% 100%

q1. Insects and Mites

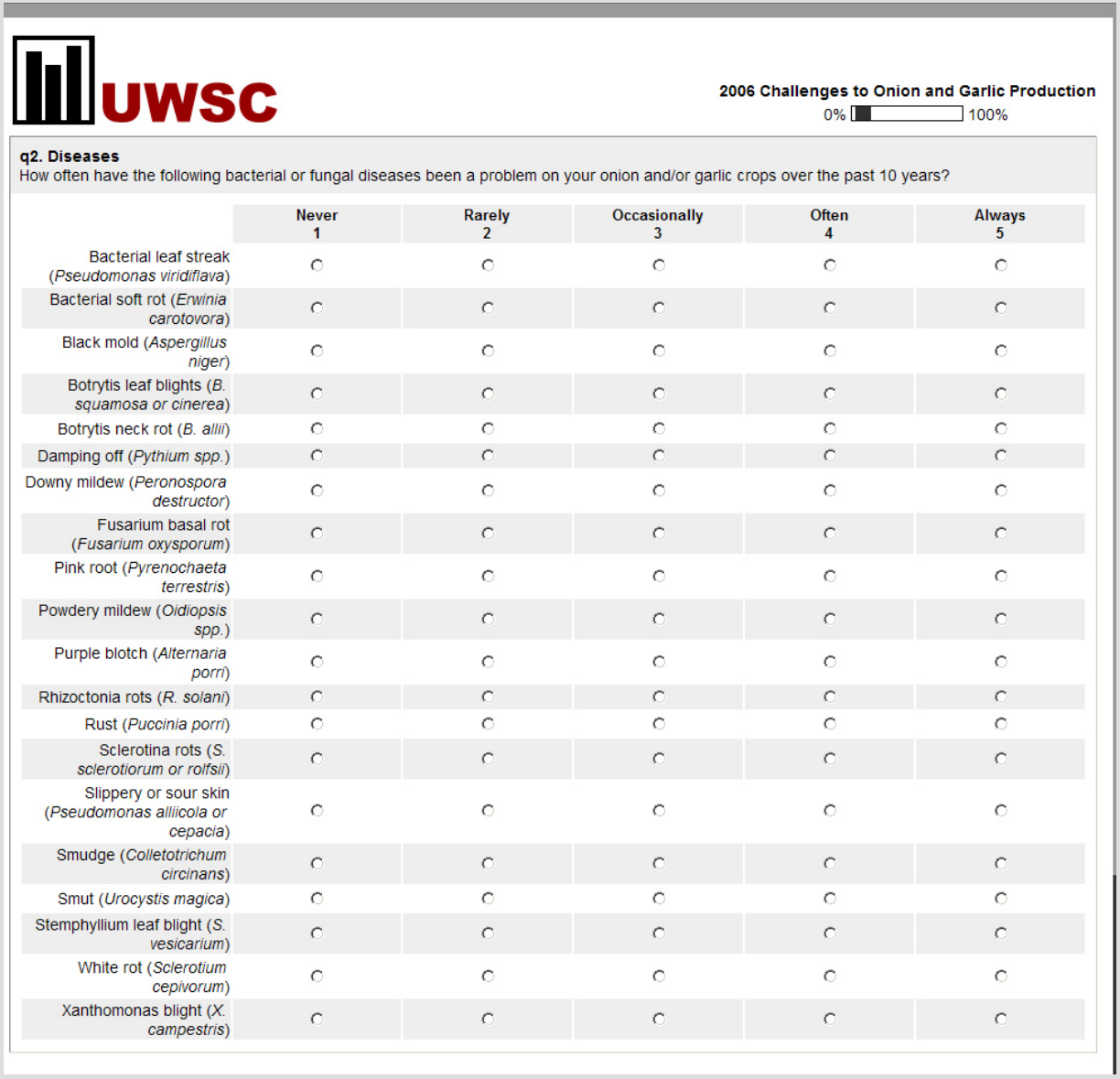
Please tell us how frequently the following insects and mites have been a stress on your onion and/or garlic crop over the past 10 years.

	Never 1	Rarely 2	Occasionally 3	Often 4	Always 5
Armyworms/Cutworms (*Spodoptera* & others)	○	○	○	○	○
Bulb mites (*Rhizoglyphus spp.*)	○	○	○	○	○
Onion maggot (*Delia antique*)	○	○	○	○	○
Onion thrips (*Thrips tabaci*)	○	○	○	○	○
Seed corn maggot (*Delia platura*)	○	○	○	○	○
Western flower thrips (*Frankliniella occidentalis*)	○	○	○	○	○
Wireworms (*Limonius spp.*)	○	○	○	○	○

[Exit and Clear Survey] << prev next >>

This survey is not currently active. You will not be able to save your responses.

Survey on Challenges to Sustainable Production of the Alliums (2006)



UWSC

2006 Challenges to Onion and Garlic Production

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q2. Diseases

How often have the following bacterial or fungal diseases been a problem on your onion and/or garlic crops over the past 10 years?

	Never 1	Rarely 2	Occasionally 3	Often 4	Always 5
Bacterial leaf streak (*Pseudomonas viridiflava*)	○	○	○	○	○
Bacterial soft rot (*Erwinia carotovora*)	○	○	○	○	○
Black mold (*Aspergillus niger*)	○	○	○	○	○
Botrytis leaf blights (*B. squamosa or cinerea*)	○	○	○	○	○
Botrytis neck rot (*B. allii*)	○	○	○	○	○
Damping off (*Pythium spp.*)	○	○	○	○	○
Downy mildew (*Peronospora destructor*)	○	○	○	○	○
Fusarium basal rot (*Fusarium oxysporum*)	○	○	○	○	○
Pink root (*Pyrenochaeta terrestris*)	○	○	○	○	○
Powdery mildew (*Oidiopsis spp.*)	○	○	○	○	○
Purple blotch (*Alternaria porri*)	○	○	○	○	○
Rhizoctonia rots (*R. solani*)	○	○	○	○	○
Rust (*Puccinia porri*)	○	○	○	○	○
Sclerotina rots (*S. sclerotiorum or rolfsii*)	○	○	○	○	○
Slippery or sour skin (*Pseudomonas alliicola or cepacia*)	○	○	○	○	○
Smudge (*Colletotrichum circinans*)	○	○	○	○	○
Smut (*Urocystis magica*)	○	○	○	○	○
Stemphyllium leaf blight (*S. vesicarium*)	○	○	○	○	○
White rot (*Sclerotium cepivorum*)	○	○	○	○	○
Xanthomonas blight (*X. campestris*)	○	○	○	○	○

Survey on Challenges to Sustainable Production of the Alliums (2006)

q5: Abiotic Problems

How often have these environmental stresses been a problem for your garlic and/or onion crops over the past 10 years?

Please choose the appropriate response for each item:

	Never 1	Rarely 2	Occasionally 3	Often 4	Always 5
Pre-mature bolting	☐	☐	☐	☐	☐
Ozone	☐	☐	☐	☐	☐
Drought	☐	☐	☐	☐	☐
Heat	☐	☐	☐	☐	☐
Flooding	☐	☐	☐	☐	☐
Cold	☐	☐	☐	☐	☐

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q6: Quality Factors

How often have the following quality factors been a problem for your onion and/or garlic crops over the past 10 years?

Please choose the appropriate response for each item:

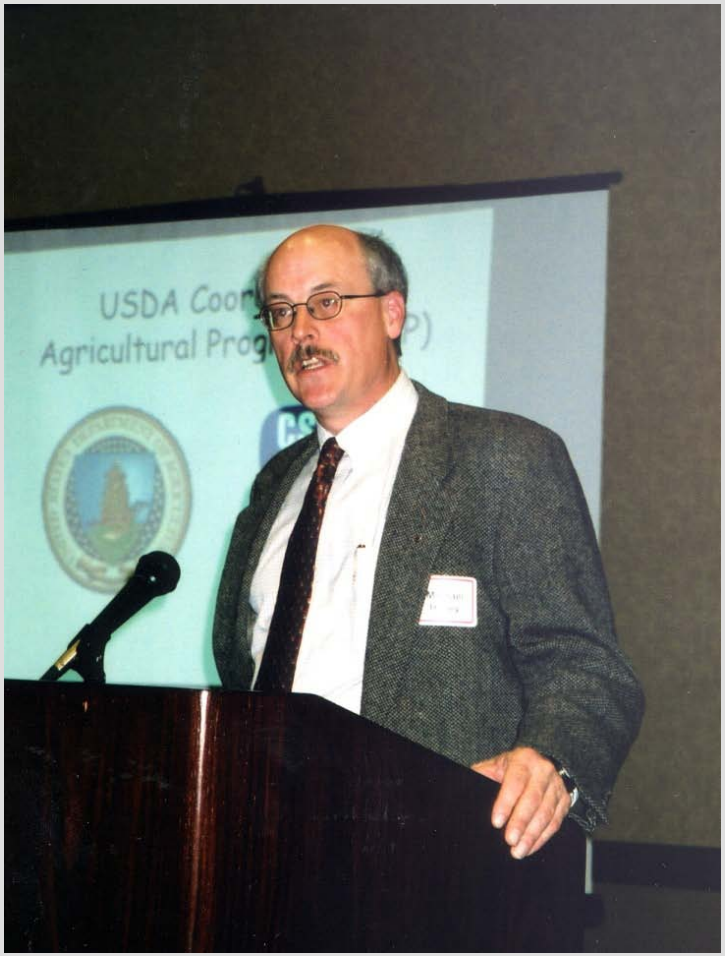
	Never 1	Rarely 2	Occasionally 3	Often 4	Always 5
Pungency	☐	☐	☐	☐	☐
Single centers	☐	☐	☐	☐	☐
Skin color	☐	☐	☐	☐	☐
Maturity	☐	☐	☐	☐	☐

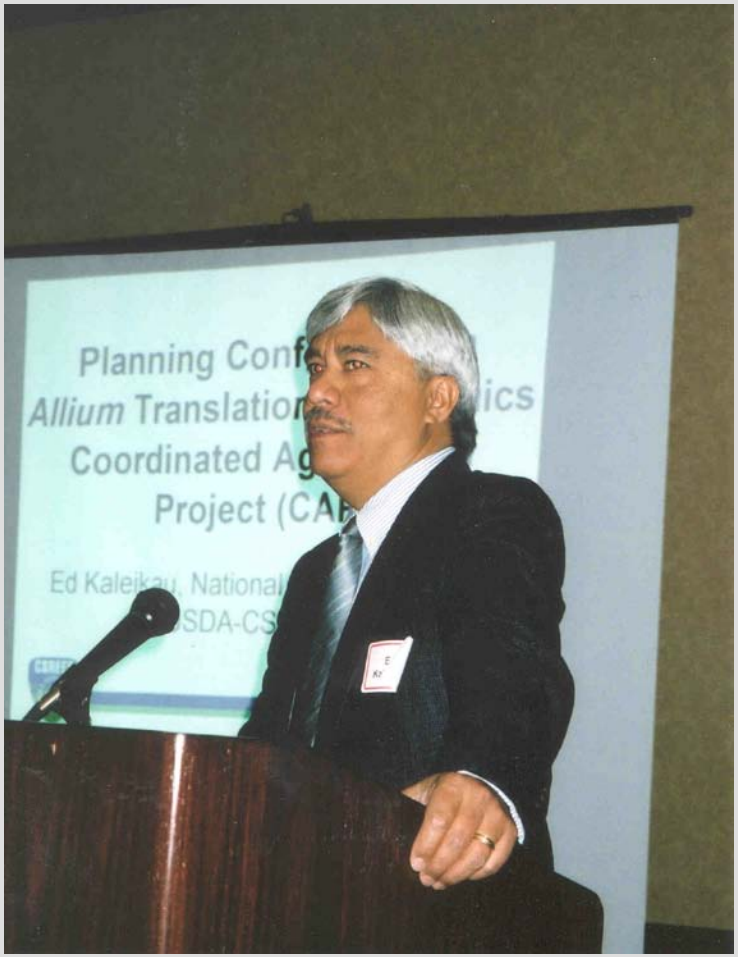
Survey on Challenges to Sustainable Production of the Alliums (2006)

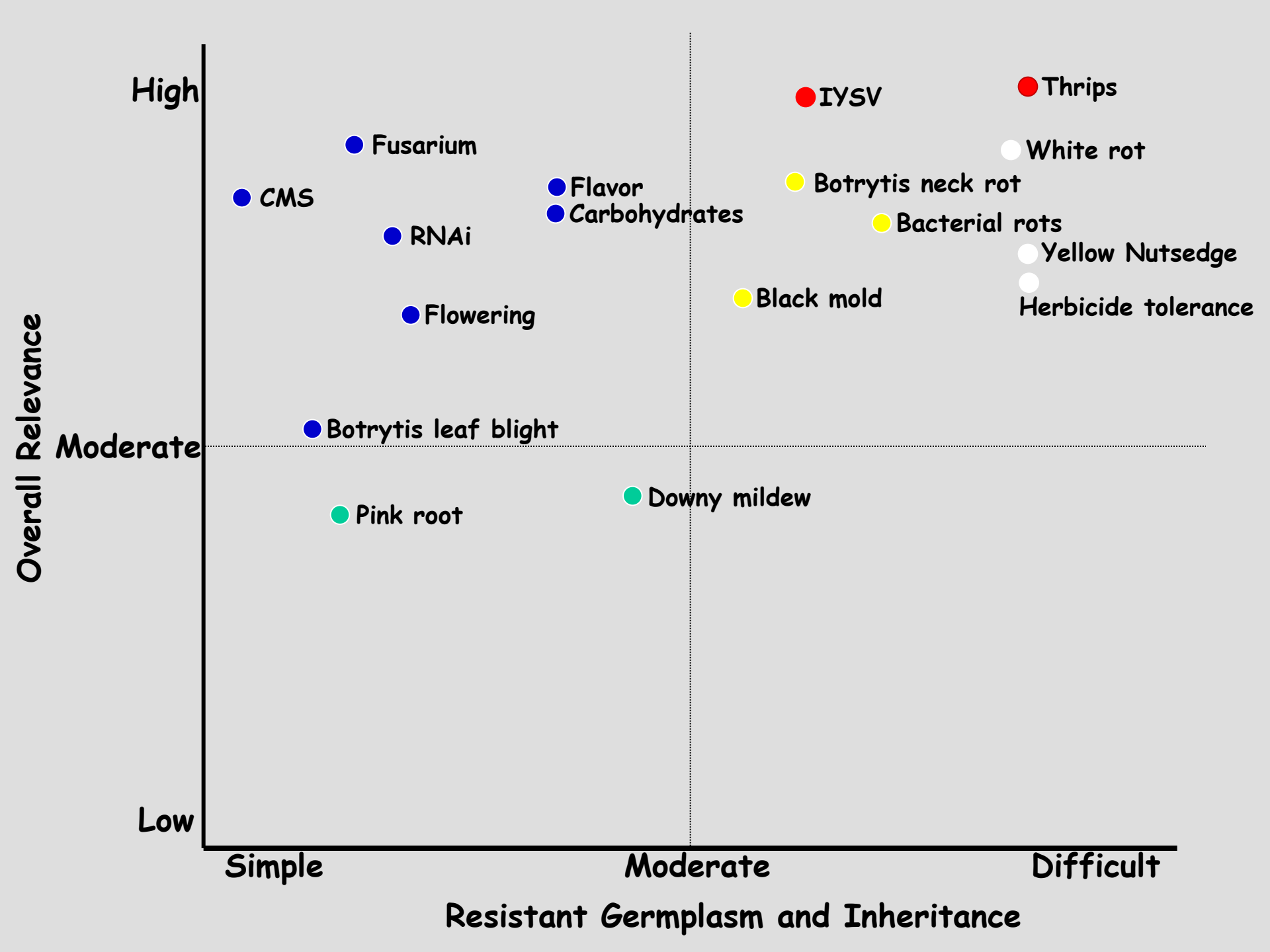
- 100+ respondents (>>onion growers)
- Top Onion Production Problems in NA:
  - Thrips
  - *Iris Yellow Spot Virus*
  - Bacterial soft rot (*Erwinia*)
  - Slippery skin (*Pseudomonas*)
  - Black mold (*Aspergillus*)
  - *Botrytis* leaf blight and neck rot
  - *Fusarium* basal rot
  - Pink root
  - Heat

Conference at 2006 NARC to Prioritize Research Foci

http://haveylab.hort.wisc.edu/cap/index.htm






High
Moderate
Low
Overall Relevance
Simple
Moderate
Difficult
Resistant Germplasm and Inheritance
IYSV
Thrips
Fusarium
White rot
CMS
Flavor
Carbohydrates
Botrytis neck rot
Bacterial rots
RNAi
Yellow Nutsedge
Black mold
Herbicide tolerance
Flowering
Botrytis leaf blight
Downy mildew
Pink root

USDA Specialty Crops Research Initiative (SCRI)

- **2008**: "Ensuring US onion sustainability: breeding and genomics to control thrips and Iris Yellow Spot Virus" (M. Havey, USDA-ARS and University of Wisconsin)
- **2009**: "Advancing onion post-harvest handling efficiency and sustainability by multimodel quality sensing, disease control, and waste stream management" (C. Li, Univ. of Georgia)
- **2010**: "IPM-PIPE and innovative disease diagnostic tools for onion growers" (H. Schwartz, Colorado State University)

Thrips

Iris Yellow Spot Virus

Photos: Fred Crowe & Hanu Pappu

USDA-SCRI Project: Breeding & Genomics for Control of Thrips and IYSV

NARC 2008

Breeding & Genomics for Control of Thrips and IYSV

Identify Desirable Germplasms

↓

Complete Crossing and Genetic Evaluations

↓

Develop Robust High-Throughput Genetic Markers

↓

Value-Added Cultivars

Breeding & Genomics for Control of Thrips and IYSV

Identify Desirable Germplasms

Field Evaluations for Thrips and IYSV Tolerance (2009-12)

Chris Cramer and Howard Schwartz

Field Evaluations for Thrips and IYSV Tolerance (2009-12)

Performing better over years and locations

- PI 258956 Chile "Calderana"
- PI 264320 Spain
- PI 546140 USA "San Joaquin"
- PI 546188 USA "YSS Winegar"
- PI 546192 USA "YSS"

Breeding & Genomics for Control of Thrips and IYSV

Identify Desirable Germplasms

↓

Complete Crossing and Genetic Evaluations

Genetic Validation of Tolerance

Selected Plants

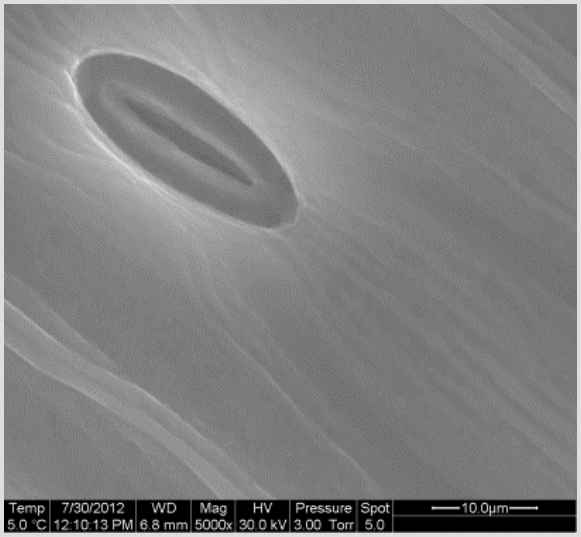
A Line ⊗

TC Family S_1 Family

Re-evalutions of progenies

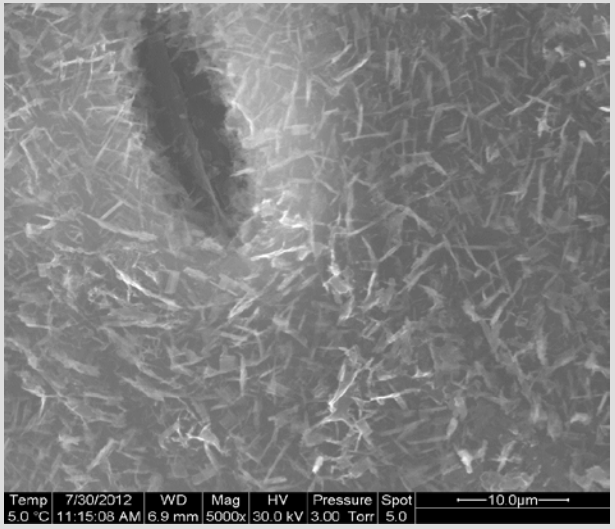
Foliage Types in Onion

Scanning EM of Leaf Surface



Glossy

Semi-Glossy



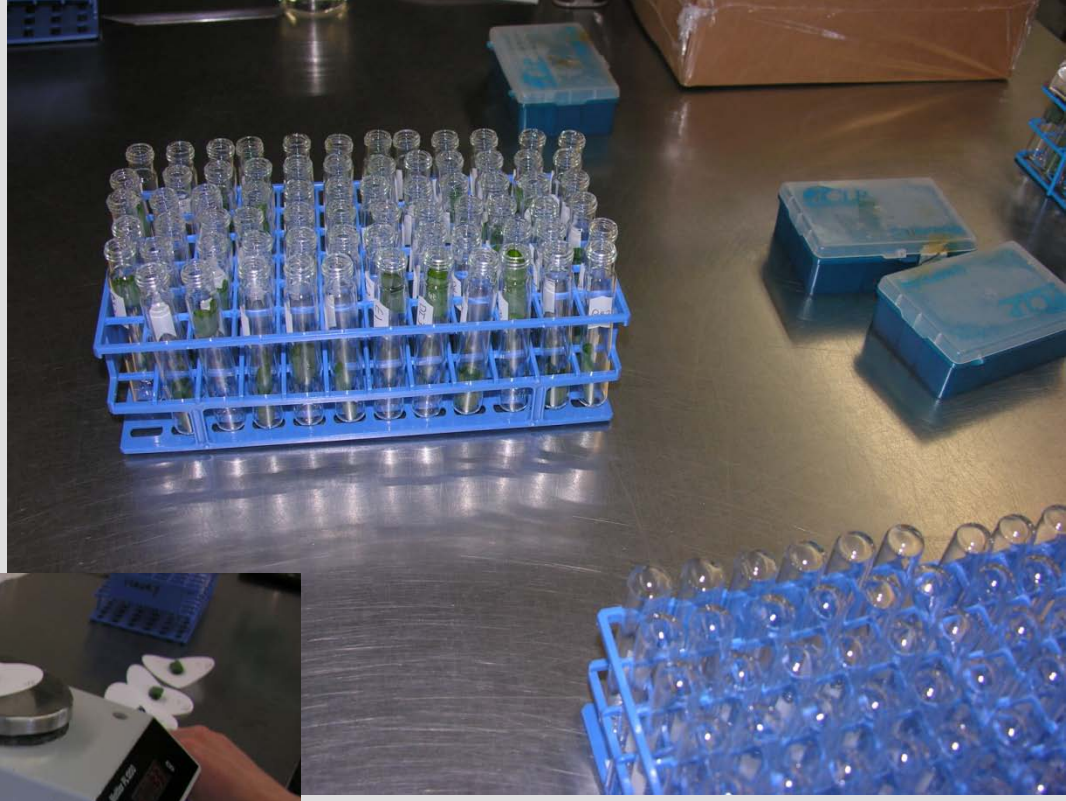
Waxy

White Onion with Waxy Foliage

X

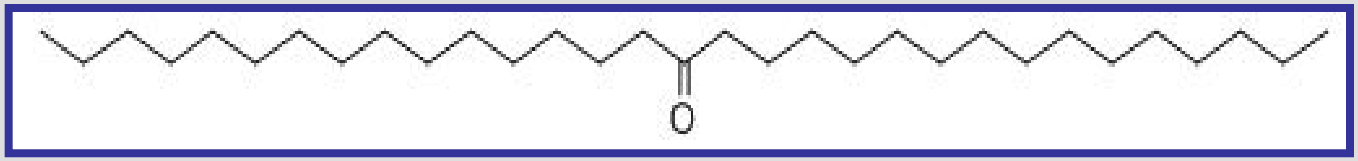
Inbred B5351 has Semi-Glossy Foliage

Tissue Sampling

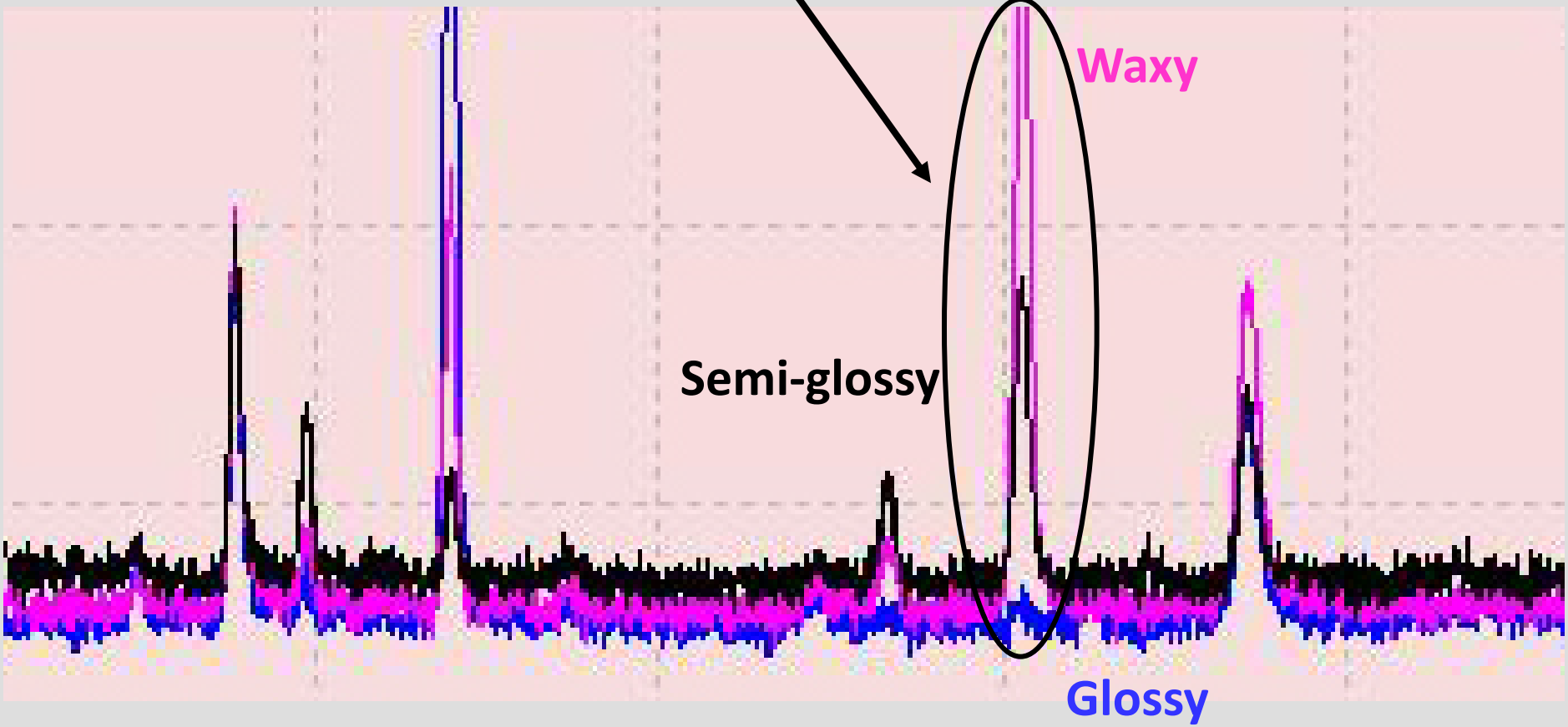


Gas Chromatography (GC)
Mass Spec (MS)

GC-MS Output



Hentriacontanone-16



Breeding & Genomics for Control of Thrips and IYSV

Identify Desirable Germplasms

↓

Complete Crossing and Genetic Evaluations

↓

Develop Robust High-Throughput Genetic Markers

White Onion with Waxy Foliage

Inbred B5351 has Semi-Glossy Foliage

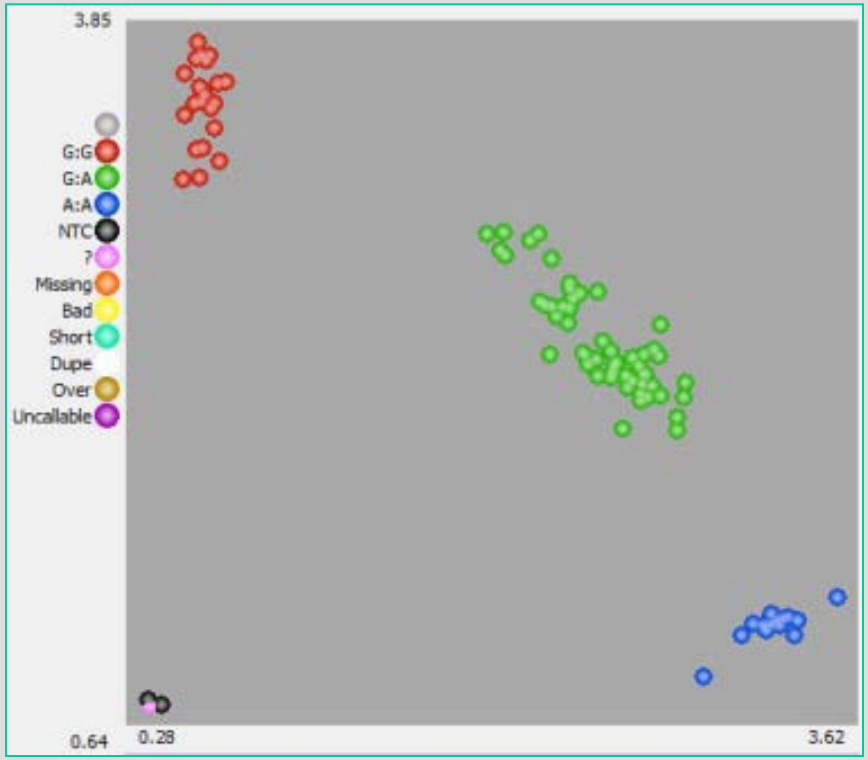
5′-TAGAAAATTGCTAACTGTTGCAGCTTGTGGGAACTGTAGTAAGGAATACTGA-3′

^^^^^^^^^^^^^^^^^^^^^^^^^G^^^^^^^^^^^^^^^^^^^^^^^^^

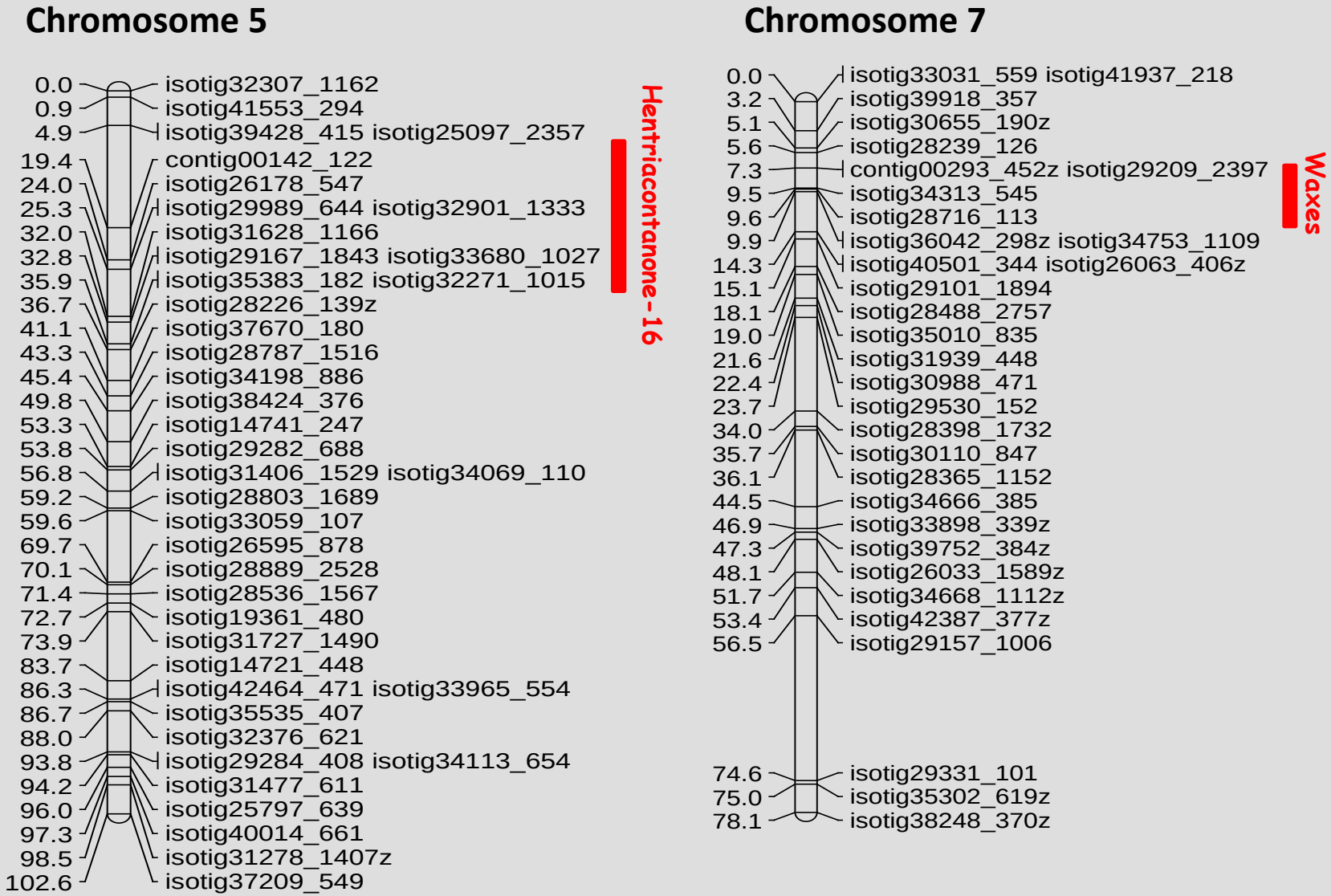
Single Nucleotide Polymorphisms (SNPs)

SNP Mapping in Semi-Glossy Family

- Isolated DNA from 120 F_2 progenies
- SNPs genotyped using KASPar platform
- Map of 324 markers



Mapping of Semi-Glossy Foliage



Foliage Types and Thrips Avoidance

- Glossy and semi-glossy are recessive to waxy
  - Specific waxes missing in glossy
  - Less of many waxes in semi-glossy
- SNPs tag major genes controlling wax quantities

Breeding & Genomics for Control of Thrips and IYSV

Identify Desirable Germplasms

↓

Complete Crossing and Genetic Evaluations

↓

Develop Robust High-Throughput Genetic Markers

↓

Value-Added Cultivars

Breeding & Genomics for Control of Thrips and IYSV

Identify Desirable Germplasms

↓

Complete Crossing and Genetic Evaluations

↓

Develop Robust High-Throughput Genetic Markers

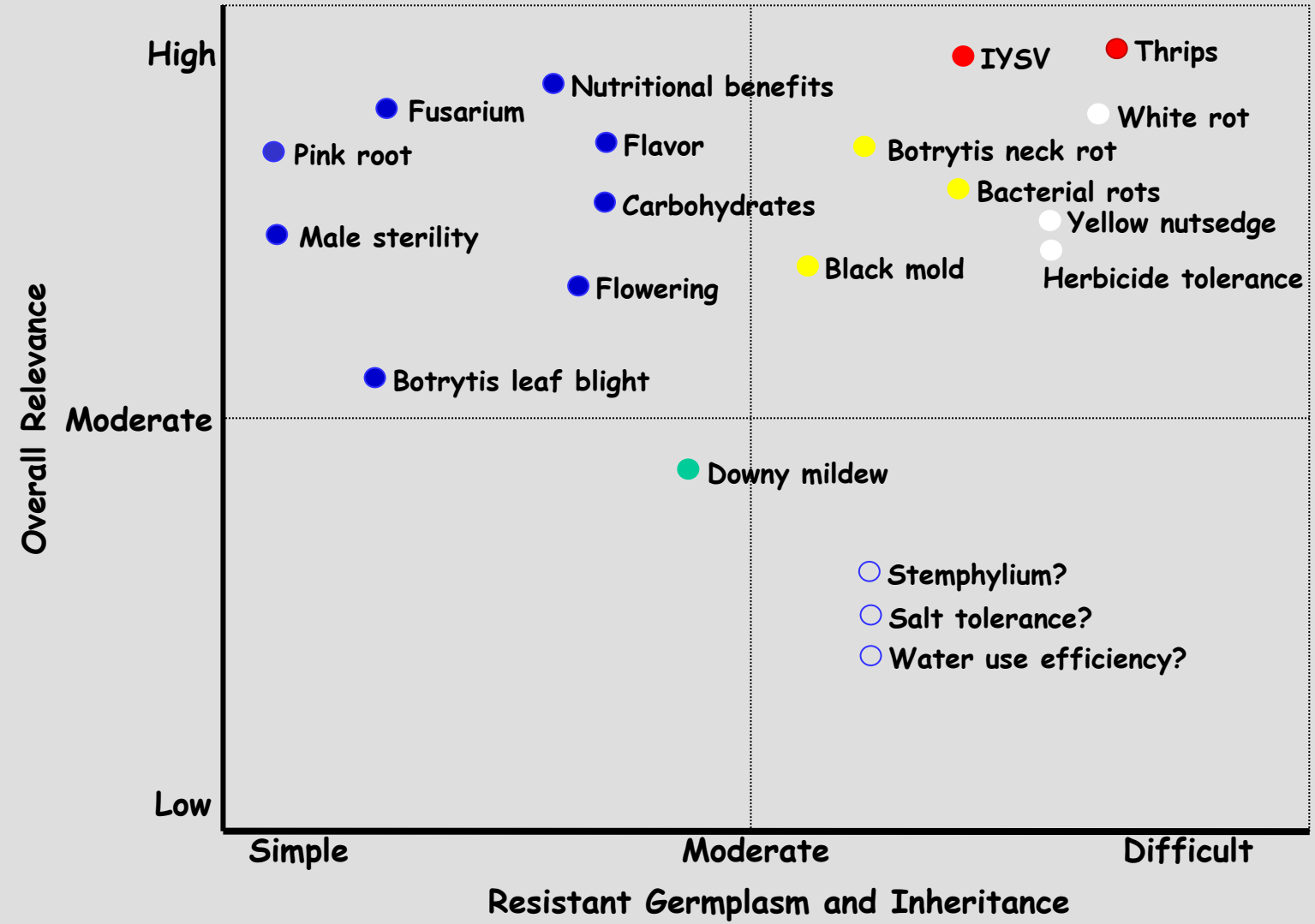
↓

Value-Added Cultivars

Contribution to integrated control of thrips/IYSV

USDA Specialty Crops Research Initiative (SCRI)

Requires stakeholder input into research priorities



- Phenotypic variation known
- No evidence of beneficial genetic variation, may need transgenic approach
- Focus of current SCRI grant (Havey et al.)
- Detection is focus of current SCRI grant (Li et al.)
- Newly added item from 2012 NARC

http://www.alliumnet.com/images/Onion research priorities from 2013 NARC.pdf