Welcome

2014 East Grand Forks - NFPT/SCRI Field Days

Oct 14th & 15th

At Northern Plains Potato Growers Association Office
& USDA / ARS Potato Research Center, EGF

UNITED STATES Potato BOARD

POTATOES GOODNESS UNEARTHED

45% Daily Supply of Vitamin C | Naturally Fat Free | Full of Vitamins and Minerals

East Grand Forks- NFPT/SCRI Field Days

Northern Plains Potato Growers Association Office
420 Business HWY 2 East, E Grand Forks, MN 56721

Tues, Oct 14th

0800-8:30:	Welcome to EGF - Marty Glynn Agenda / Introductions - Paul Voglewede Logistics of day's activities - Paul and Marty
0830-845:	Financial Update - Dawn Carey
0845-915:	SCRI Agronomic Update and NFPT Data Analysis – Yi Wang
915-945:	Break
945-1015	SCRI Update, Changes & Impact, Database Demo - Paul Bethke
1015-1045:	NFPT Update - David Parish
1045-noon:	Handouts / Rating sheets – Paul V Review / Rate clones - (USDA Facility) - Group
Noon-1230:	Lunch (NPPGA Conf. Room) Mike's Pizza – Provided by United States Potato Board
1230-1600:	Continue Review / Rate varieties (Break As Needed)
1600-1700:	Collect Ratings, Varieties Identified, Handouts.
1700-1800:	Wrap up
1900:	Group Dinner - Wild Hog – (4401 44th Ave. S. Grand Forks, 701-757-4263)

Wed, Oct 15th

0800-0830: Molecular Marker Study - Jeff Endelman

0830-0845: Clean Breeder Seed / PVY – David Parish

0845-0915: QSR Results To Date & Key Learnings – JR Simplot

0915–0945: QSR Results To Date & Key Learnings – McCain Foods

0945–1000: Break

1000–1030: QSR / NFPT Suggestions, Making the Program Stronger - Facilitated by David Parish

1030-1100 Research Needs Within and Outside Current Programs - Paul Bethke

1100-1130: Logistics & Timelines for NFPT and QSR Testing - Paul Voglewede

1130-1200 Conclusions & Wrap up - David P and Paul B

Conference room, drinks and snacks courtesy of Northern Plains Potato Growers Association President Chuck Gunnerson and his team

Pictures will be taken and posted in the web courtesy of Andy Robinson NDSU Extension Agent

East Grand Forks Facility and work provided by USDA Staff including Marty Glynn, Jeff Suttle and their team

All past NFPT information to be available on memory stick.

2014 NFPT / SCRI Clone Rating Sheet

Name:

Location #	Area	Tuber Length 1	2	3	Tuber Shape 1	2	3	Size Distribution 1	2	3	Uniformity of Tuber Shape and Size across all Areas: 1	2	3	Overall Variety Merit 1	2	3	Notes:
1	WA																
	ID																
	ND																
	WI																
	ME																
2	WA																
	ID																
	ND																
	WI																
	ME																
3	WA																
	ID																
	ND																
	WI																
	ME																
4	WA																
	ID																
	ND																
	WI																
	ME																
5	WA																
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	ME																
3	WA																
	ID																
	ND																
	WI																
	ME																
4	WA																
	ID																
	ND																
	WI																
	ME																
5	WA																
	ID																
	ND																
	WI																
	ME																

Rating by Clone

Important: The first 3 categories (clone's length, shape, and size distribution) are to be rated by specific area.

The last 2 categories (Area Uniformity and Overall Variety Merit) are to be rated as a group. This means all locations will receive one inclusive score for each clone.

TUBER LENGTH:

1- Very good
2- Marginal
3- Unacceptable (too short or too long)

TUBER SHAPE:

1- Very good
2- Marginal
3- Unacceptable

SIZE DISTRIBUTION:

1- Acceptable
2- Marginal small / too Large
3- Too many small / Large

UNIFORMITY OF TUBER SHAPE AND SIZE ACROSS AREAS:

1- All areas Uniform
2- 2-3 areas uniform
3- No uniformity between areas

OVERALL VARIETY MERIT:

1- Ideal
2- Has Promise
3- Unacceptable

Notes:

Timeline for NFPT 2014 2014-15

Testing & Analysis

Duration	Planned Harvest & Testing
30-Sep	**NFPT Harvest**
15-Oct	**EGF meeting**
10/27-12/3	**EGF 1 mo Fry**
10/27-12/3	**EGF 1 mo Sugars**
11/26-12/17	**1 mo Acryl Test**
2/2/-3/8	**EGF 4mo Sugars**
6/1-6/30	**EGF 8 mo Fry**
6/30-7/15	**EGF 8 mo Sugars**
6/8-7/13	**8 mo Acryl Test**
6/30-7/30	**8 mo Asparagine**

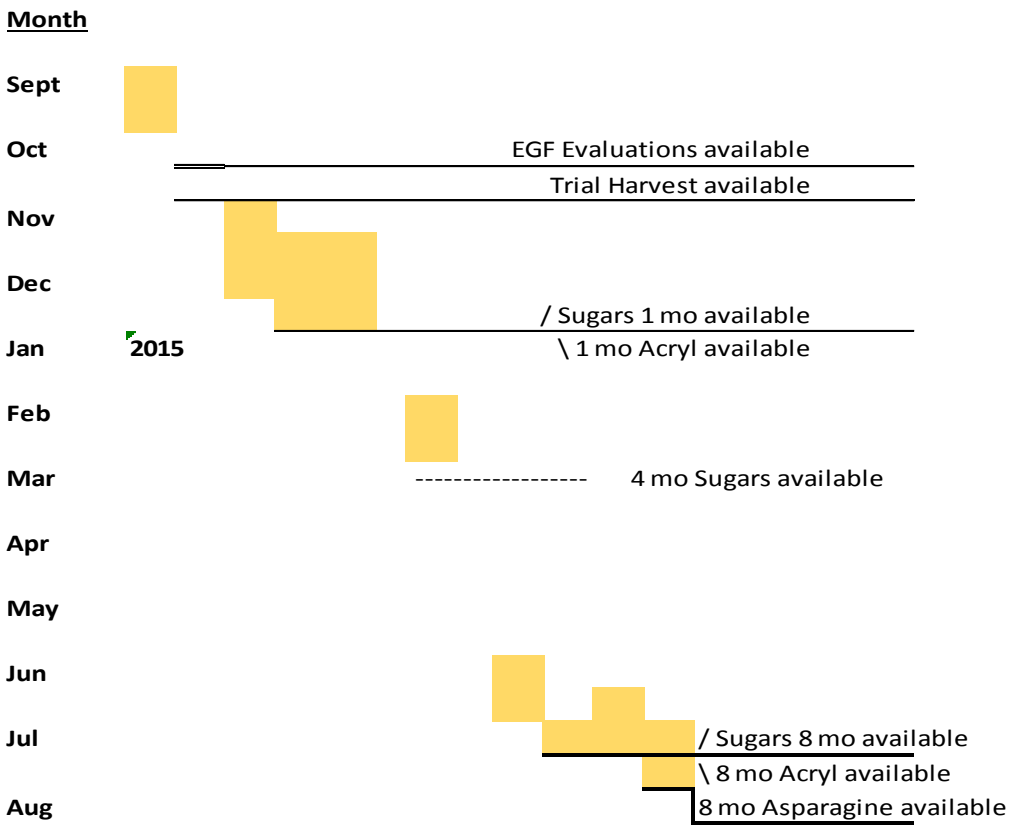
Information ava

2014-15

Timeline for NFPT 2014

Testing & Analysis **Information available**

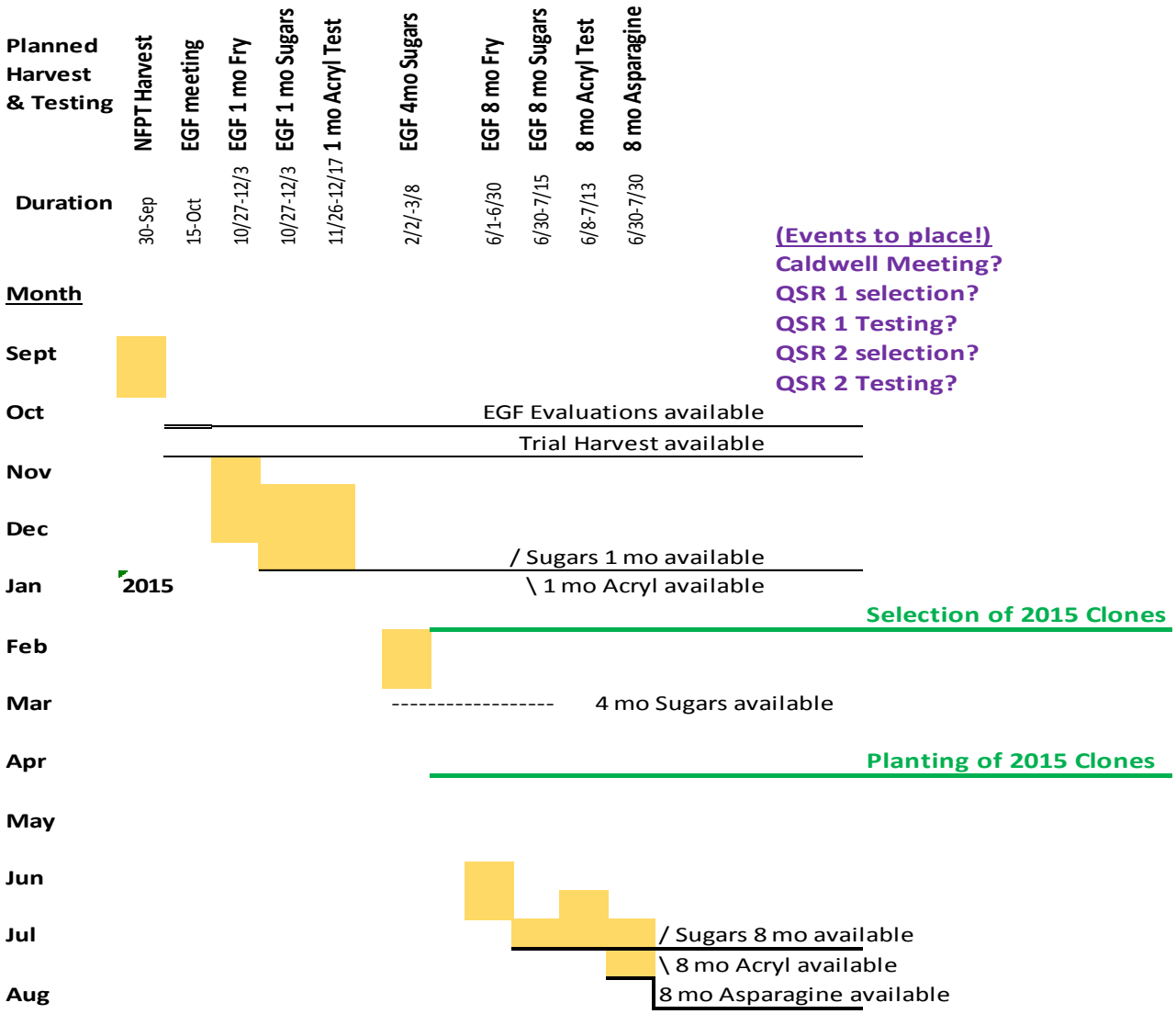
Planned Harvest & Testing	NFPT Harvest	EGF meeting	EGF 1 mo Fry	EGF 1 mo Sugars	1 mo Acryl Test	EGF 4mo Sugars	EGF 8 mo Fry	EGF 8 mo Sugars	8 mo Acryl Test	8 mo Asparagine
Duration	30-Sep	15-Oct	10/27-12/3	10/27-12/3	11/26-12/17	2/2/-3/8	6/1-6/30	6/30-7/15	6/8-7/13	6/30-7/30



2014-15

Timeline for NFPT 2014

Testing & Analysis **Information available**



2014-15

Timeline for NFPT 2014

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(Events to place!)	Suggestion
Caldwell Meeting?	Jan 13-14
QSR 1 selection?	Jan 13-14
QSR 1 Testing?	Jan 20->
QSR 2 selection?	April
QSR 2 Testing?	May 4th->

Month

Sept

Oct EGF Evaluations available

Trial Harvest available

Nov

Dec

Jan **2015** / Sugars 1 mo available

\ 1 mo Acryl available

Feb **Selection of 2015 Clones**

Mar ---------- 4 mo Sugars available

Apr **Planting of 2015 Clones**

May

Jun

Jul / Sugars 8 mo available

\ 8 mo Acryl available

Aug 8 mo Asparagine available

State & National Meetings:

EXPO	Jan 7-9
ID	Jan 20-22
WA-OR	Jan 27-29
WI	Feb 3-5
ND-MN	Feb 17-19

2014-15

Timeline for NFPT 2014

Testing & Analysis **Information available**

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(Events to place!) Suggestion

Month

Sept

Oct EGF Evaluations available

Trial Harvest available

Nov

Dec

/ Sugars 1 mo available

Jan **2015** \ 1 mo Acryl available **Caldwell Meeting?** Jan 13-14

QSR 1 selection? **Then QSR Testing - Jan 20**

Feb **Selection of 2015 Clones**

Mar ---------- 4 mo Sugars available

Apr **Planting of 2015 Clones**

QSR 2 selection? April

May **QSR 2 Testing?** May 4th->

Jun

Jul / Sugars 8 mo available

\ 8 mo Acryl available

Aug 8 mo Asparagine available

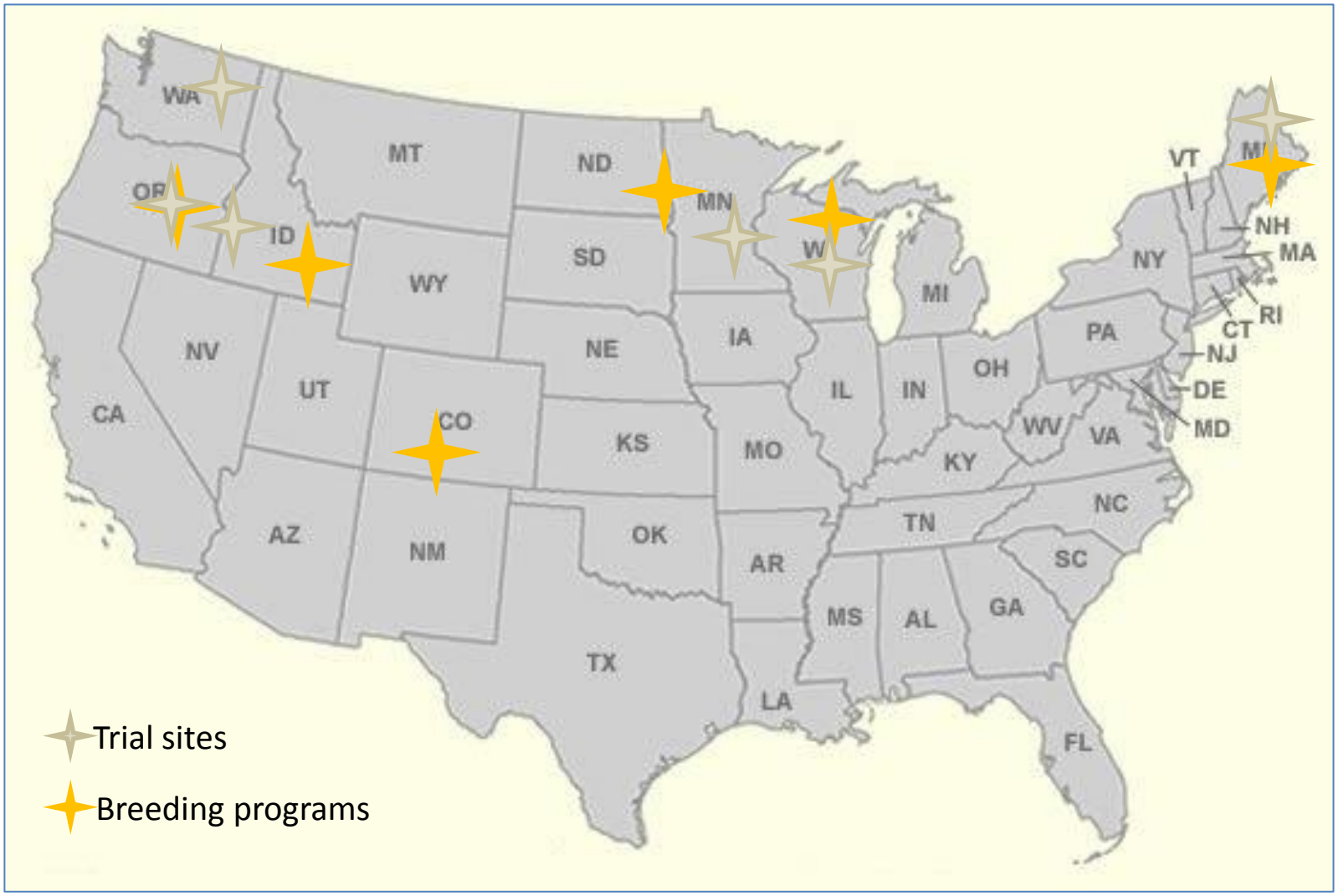
SCRI Agronomic Trial Update and NFPT Data Analysis

Yi Wang, Jeffrey Endelman,
Paul Bethke

SCRI agronomic trials further characterize promising clones

- 6 sites (ID, WA, OR, MN, WI, ME)
- Replicated plots
- Expanded evaluation
- Provide material for storage trials and multiple QSR samples

SCRI Agronomic trial locations



Clones in agronomic trials

2013

A0012-5

A0073-2

A02138-2

A02507-2LB

A03921-2

AC00395-1RU

AC99375-1RU

AF3001-6

AF4296-3

AF4342-3

AO00057-2

AO01114-4

W6234-4rus

W8152-1rus

Russet Burbank

2014

A02424-83LB

A02507-2LB

A03158-2TE

A06084-1TE

AF3001-6

AF4296-3

AF4342-3

Dakota Russet

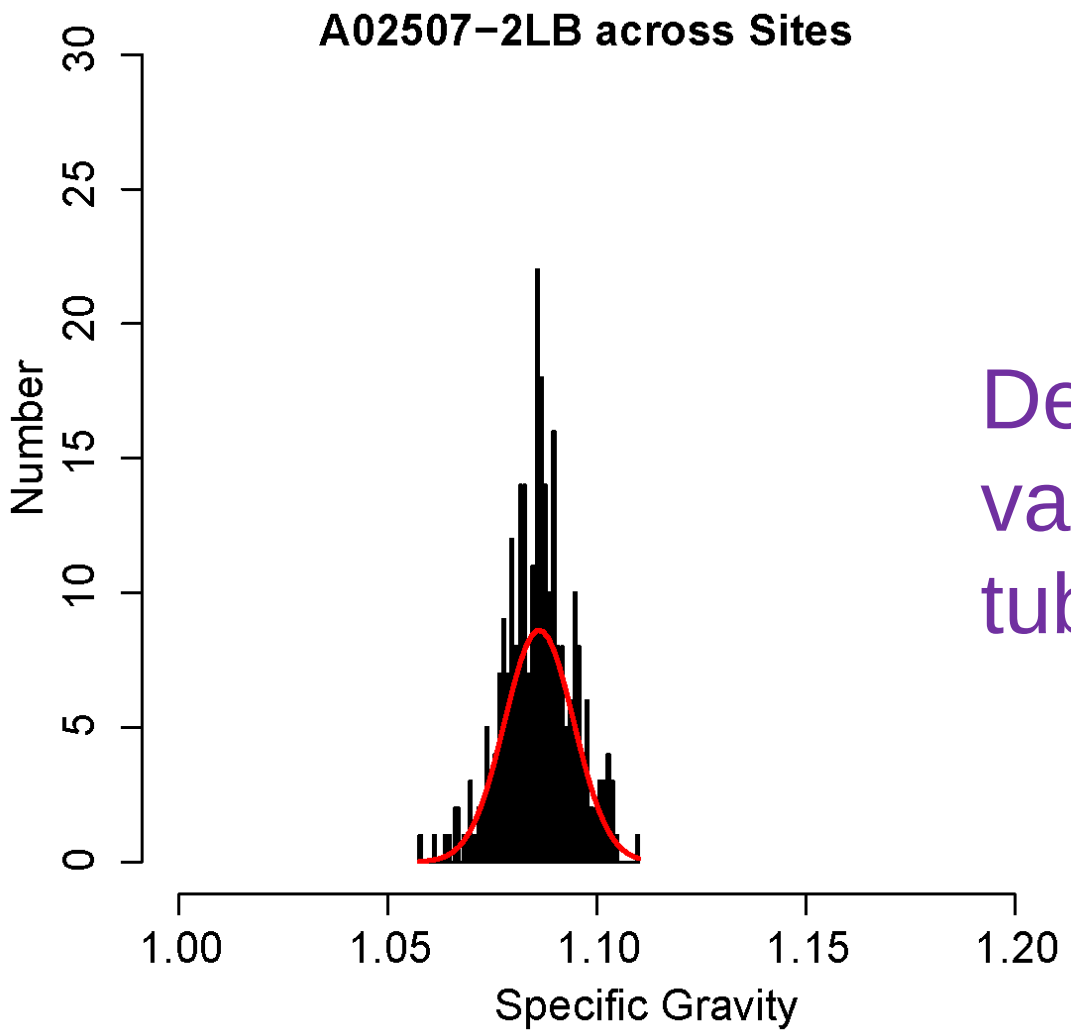
W8152-1rus

Russet Burbank

Traits evaluated

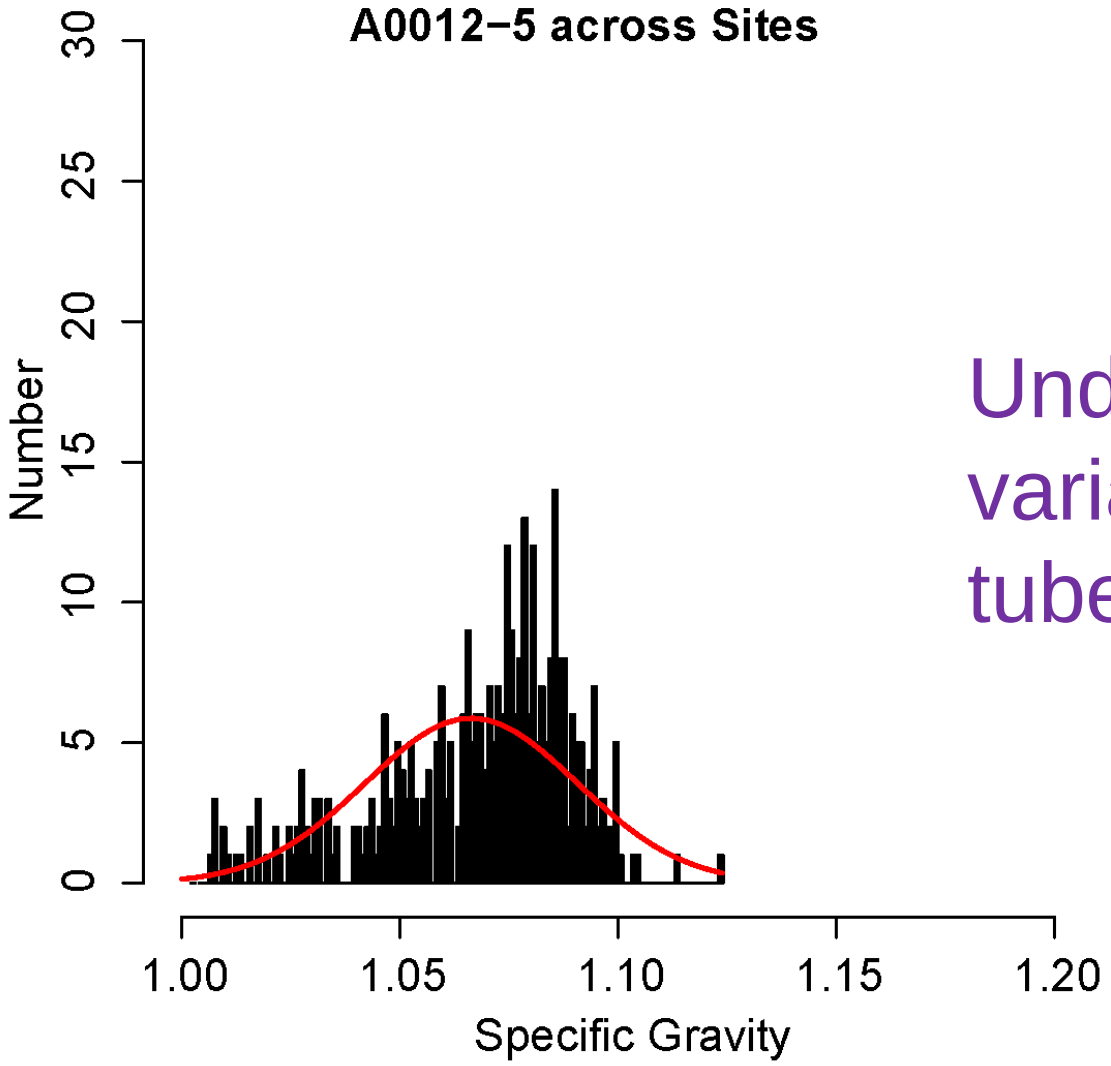
- Agronomic traits (at harvest)
  - Total yield; marketable yield%; size distribution
  - Specific gravity
  - Variability of individual tuber solids
  - Internal defects
  - Tuber shape
- Storage traits (0, 4, and 8 mo)
  - Fry color
  - Bud- and stem-end sucrose and glucose
  - Sugar end defect
- Consumer attributes (6 mo. post harvest)
  - Color variation of fries
  - Internal texture of fries (looking for fluffy and mealy internals)

Variability of tuber solids



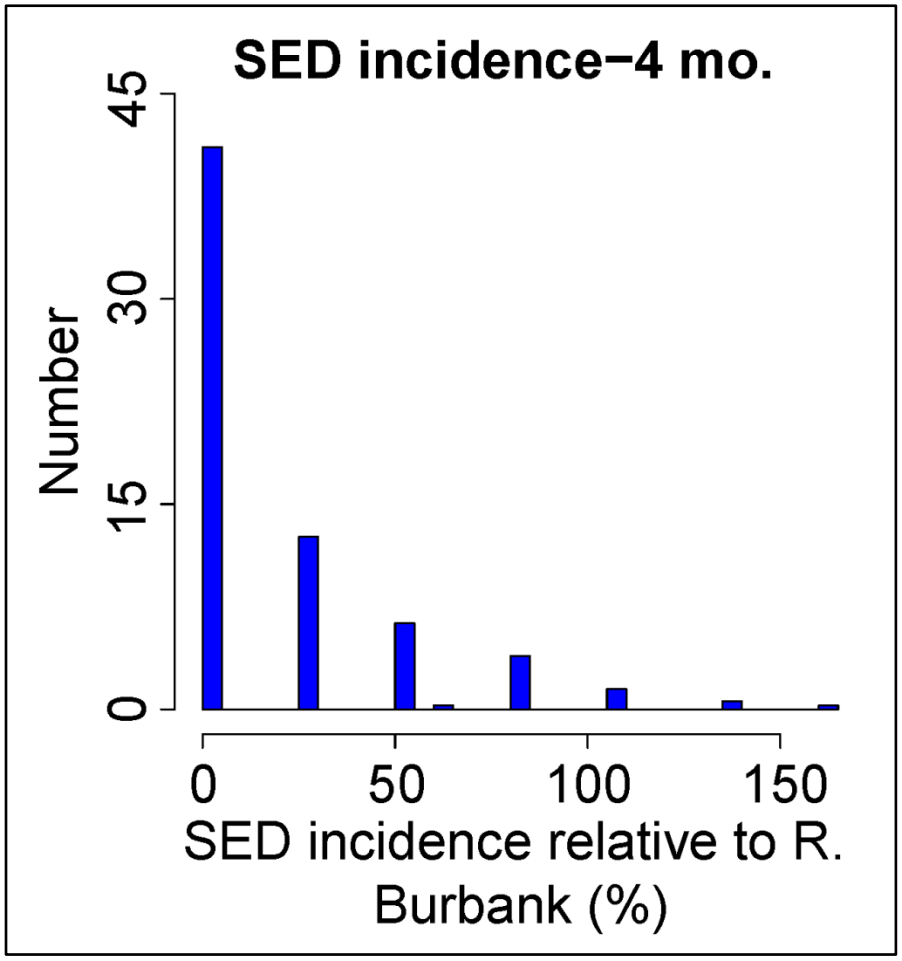
Desirable variation in tuber solids

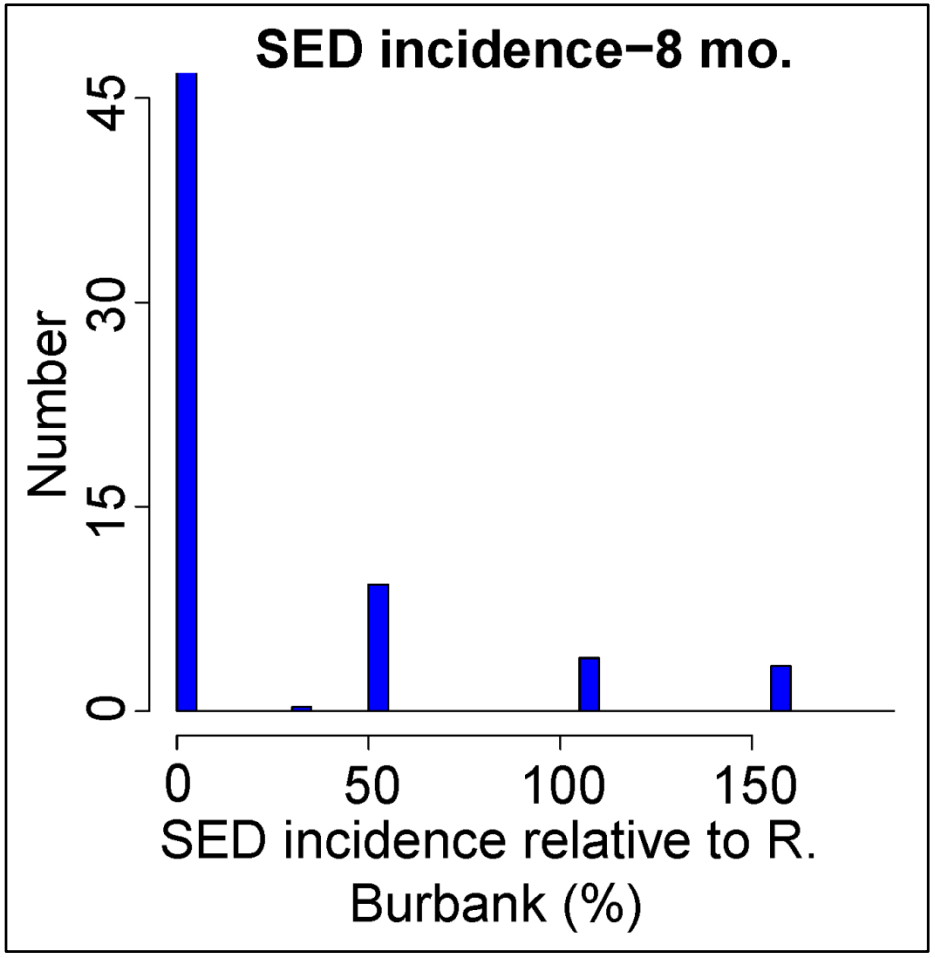
Variability of tuber solids



Undesirable variation in tuber solids

Long-term storability
sugar end defect





Heritability/Repeatability

- Measure of data quality on 0 – 1 scale
- $h^2 = r^2$ = corr(true genetic value, estimate)^2

Heritability of agronomic traits

Traits at harvest	h^2
Total yield	0.71
Marketable yield %	0.63
> 6 oz yield %	0.88
> 10 oz yield %	0.85
Specific gravity	0.92
Variability of individual tuber solids	0.60
Tuber shape	0.90

Heritability of storage traits

Traits during storage	*h^2 (0 mo.)*	*h^2 (4 mo.)*	*h^2 (8 mo.)*
Stem-end glucose	0.94	0.94	0.93
Fry color	0.92	0.93	0.96
Bud-end sucrose	0.85	0.77	0.86
Stem-end sucrose	0.81	0.46	0.83
Bud-end glucose	0.94	0.94	0.95

Heritability of consumer attributes

Consumer attributes (6 mo.)	h^2
Color variation (a)	0.58
Fluffy units (b)	0.12
Limp units (c)	0.58
Hollow units (d)	0.16
Firm units (e)	0.00

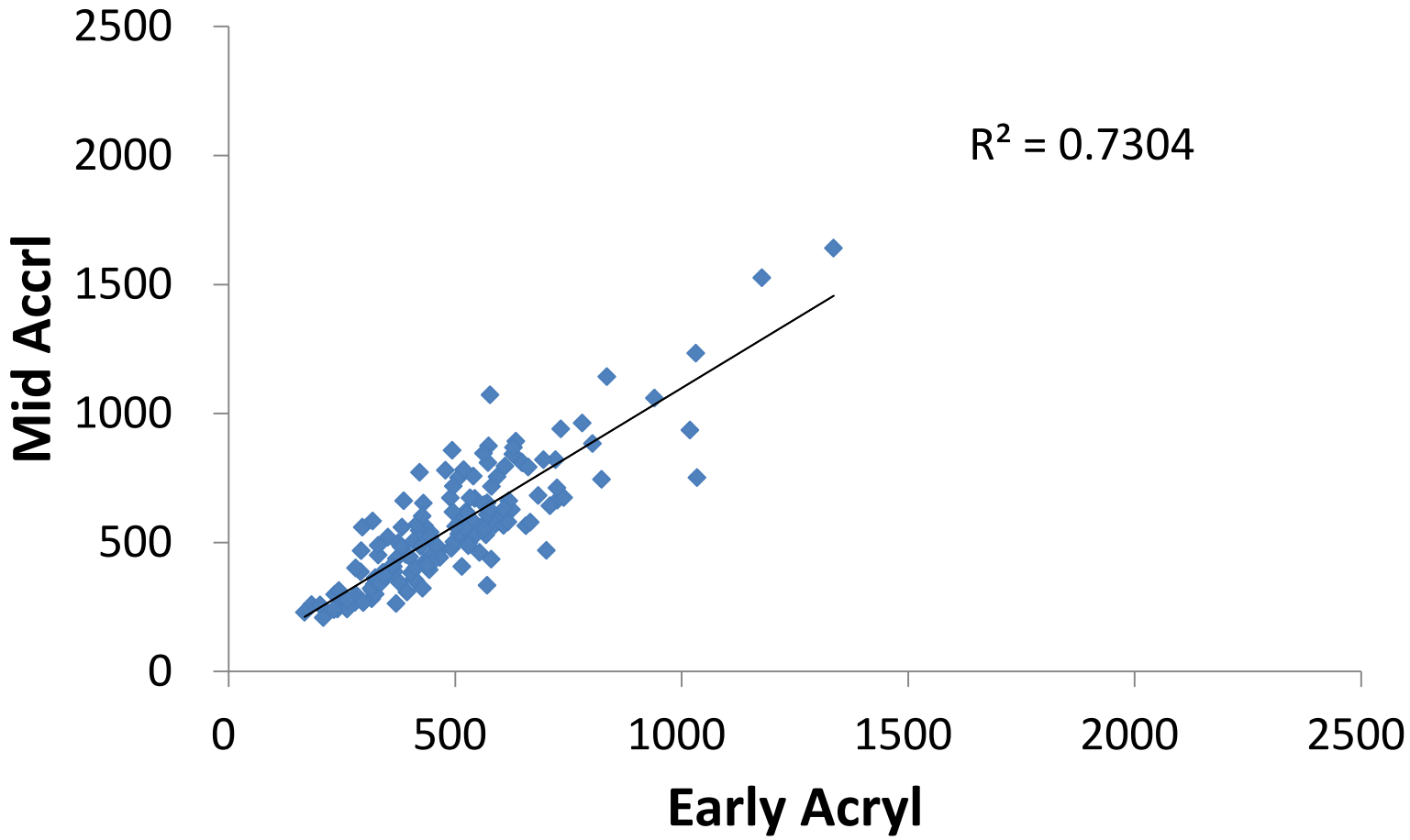
Summary so far

- AF3001-6 and A03921-2: higher yield and higher marketable yield % than R. Burbank, but specific gravity lower or higher than desired
- A02507-2LB, A0073-2: good specific gravity, small variability of tuber solids, few internal defects, and good shape
- W8152-1rus, A02507-2LB, A0073-2: good fry color and low stem-end glucose (8 mo.)
- One year of data

Analysis of NFPT data

- Beginning heritability analysis of 2011-2013 data
- Goal: Understand variation due to year, location, and replicate within location
  - Inform future decisions about resource allocation for NFPT

Correlation graphs - acrylamide



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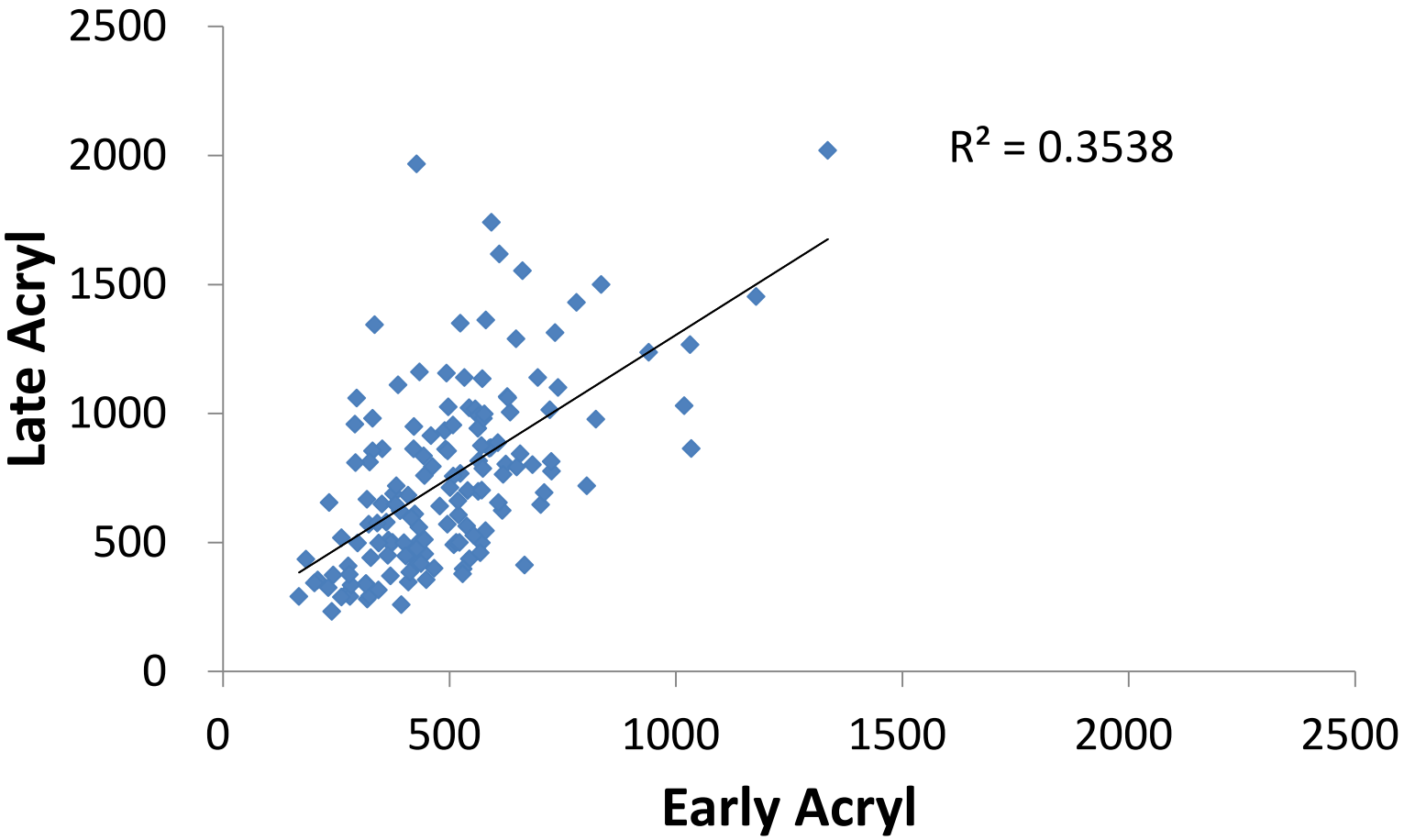


Break!

SCRI Update, Changes & Impact, Database Demo

Acrylamide in the news

European Food Safety Authority reaffirmed opinion that acrylamide is likely human carcinogen (July 2014)

Cabinet Office food safety commission (Japan) draft report concludes acrylamide is a carcinogen and mutagen (Oct. 2014)

SCRI Acrylamide project

Ends no later than August 31, 2016

All funds must be spent by that date

Minitubers of promising varieties produced in 2013 and sent to seed growers in 2014

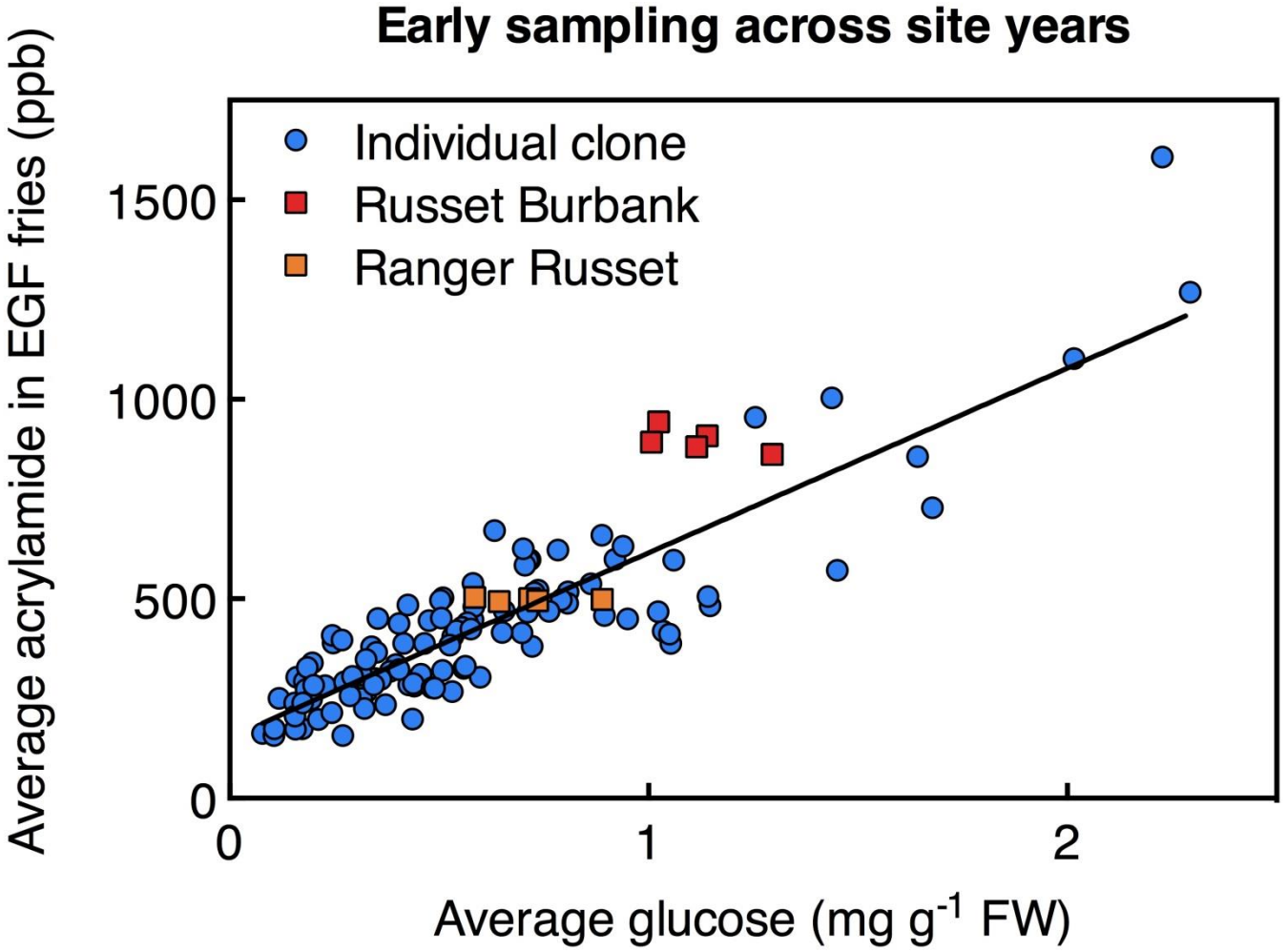
- Sklarczyk Seed Farms: AF4296-3, ND8229-3
- CSU: AC96052-1RU
- CSS: A02507-2LB

Large-scale trials begin in 2015

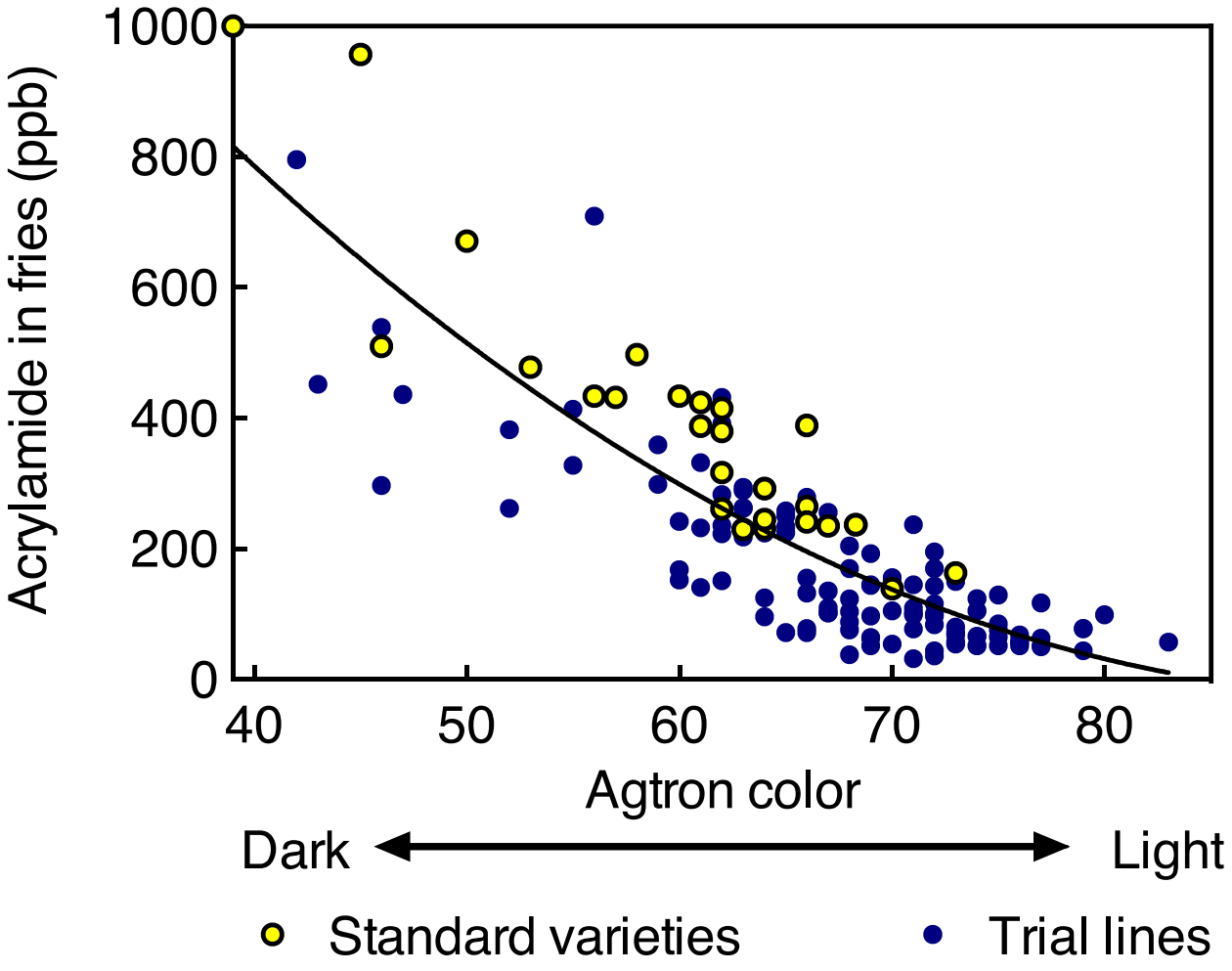
Seed for 2015

Need to decide who grows the seed and where will it be processed?

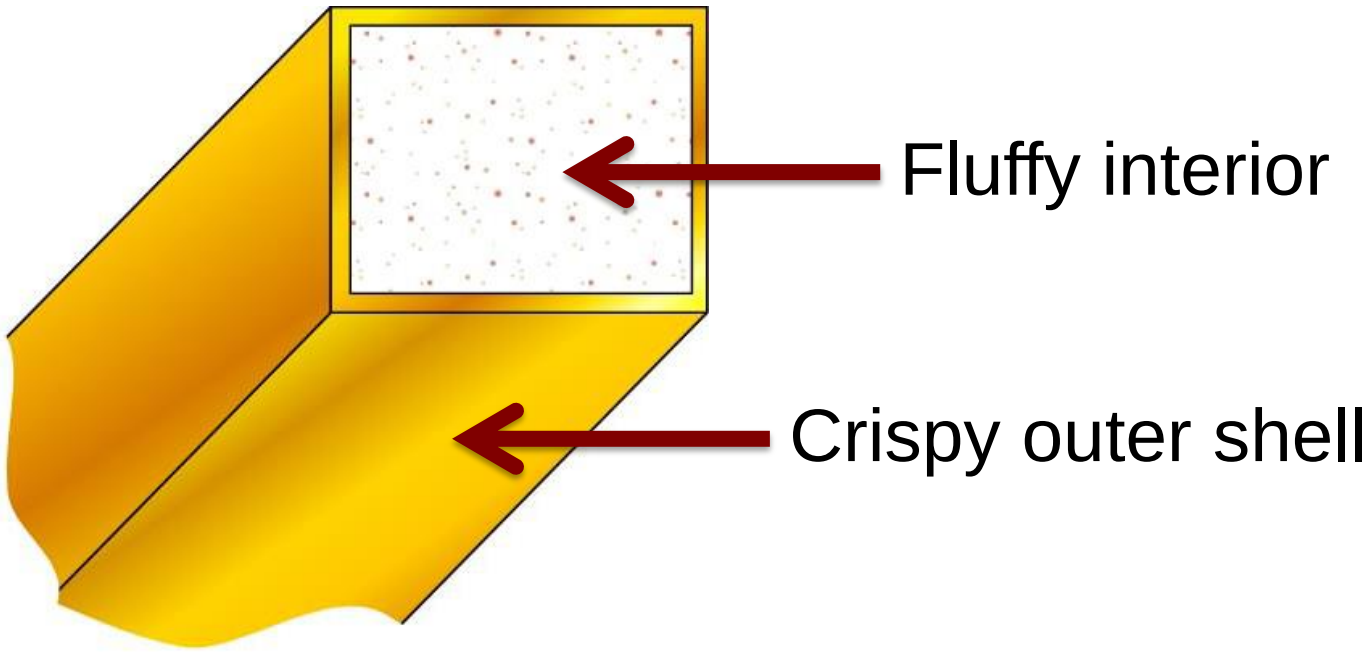
Reducing sugars drive acrylamide formation



Many clones have low-acrylamide forming potential



Fry quality sets a higher bar for commercialization of new varieties than low acrylamide



Online resources

Our website: acrylamide.vegetables.wisc.edu

Our database: hort-fms.cals.wisc.edu/fmi/webd#

National Fry Processing Trials
East Grand Forks 2014

NFPT OVERVIEW

Know Your Program

How many varieties are currently being tested including the check varieties?

PROGRAM OBJECTIVE

- **OBJECTIVE:** Identify and bring to the process industry a processor grade potato variety (French fry raw) with reduced levels of asparagine and reduced levels of reducing sugars in the raw state to reduce the levels of acrylamide in finished fried and baked French fries.

- **SPECIFIC RAW POTATO ATTRIBUTES:** This new variety must have long term storage capability sufficient to substitute for the Russet Burbank variety. The new variety must be non-genetically modified. This variety must have specific gravity and physical attributes that fall within the five year average for Russet Burbanks.

- **FINISHED PRODUCT ATTRIBUTES**: This new variety must have processing characteristics that allow for the production of a QSR type finished French fry.

TARGET PHYSICAL ATTRIBUTES

Attributes (musts)	**Target**	**Range**
Specific gravity	1.084	1.082-1.095
% six ounce weight	70%	50-80%
% ten ounce weight	32%	28 - 40%
**% high sugar	0%	0 - 2%
***% sugar ends	0%	0 - 5%
Storability	June	June
Length to width ratio	1.75:1	1.6 – 2.0:1
Asparagine level	0.1g/100g	
Reducing sugar level	0.25g/100g	
Internal defects	0%	0-2%

- Needs to be evaluated versus a US #1 grade standard

Attributes (wants)	**Target**	**Range**
Asparagine	75% Decrease	50% Minimum
Agronomics	=R. Burbank or better	
Disease		=R. Burbank or better
Bruise	80%	70% Minimum or <= Ranger

Where were the six trial locations in 2014?

Idaho, North Dakota, Washington, Wisconsin, Maine and Michigan

TRIAL LOCATIONS – MAJOR PRODUCTION ZONES

What is the annual contribution amount provided to the NFPT Program from all industry sources?

$300,000

FUNDING EXTENDED – CROP YEARS 2014-2016

2012 - $300,000

2013 - $300,000

2014 - $300,000

Total - $900,000

STATE FUNDING PARTNERS:
Maine, WVPGA, NPPGA, WSPC, IPC, OPC

In the past acrylamide was checked three times during the storage season. What is the current number of times acrylamide is checked?

Two times per season
Early and Late

NFPT PROGRAM ACTIVITIES

SIX TRIAL LOCATIONS $30,000 NFPT; SCRI $20,000

EAST GRAND FORKS $34,000

ASPARAGINE ANALYSIS – TWO AREAS X ONE ANALYSIS $15,000

ACRYLAMIDE ANALYSIS – THREE AREAS X TWO ANALYSES $45,000

FINISHED PRODUCT ATTRIBUTE EVALUATIONS W/ACRLYAMIDE $22,000

GENETIC MARKER IDENTIFICATION $22,000 (PAST AND PRESENT MATERIALS)

SHIPPING/MISC ANALYSIS $32,000

How many varieties had acrylamide levels below Russet Burbank after 8 months in storage in 2014 when processed in Caldwell, ID?

How many varieties had acrylamide levels below 200 ppb?

15

Lowest Commercial Burbank was 281 ppb

SOME TOP PERFORMERS (Not limited to this list)

- ND-8229-3
- A02507-2LB
- A02424-83LB
- AF4296-3
- ND060735-4RUS
- AC96052-1RU
- W6234-4RUS
- W9519-1RUS
- AO06070-1KF
- AF3001-6
- C005068-1RU
- A002060-3
- C005175-1RU
- A032921-2

How many representatives make up the variety selection committee for consumer attribute analysis at Simplot and McCain's?

Nine

Four Processor votes – 4

Two State votes - 2

Two Researcher votes - 2

Program Manager vote - 1

How many representatives are on the finance and oversight committee?

Eight
Four Processors
Two State Representatives
United States Potato Board
Program Manager

Questions or Comments

National Fry Processor Trials (NFPT) FY2015 - FY2017

Budget Items

July 1 through June 30

Budget Funds	FY2015	FY2016	FY2017
Funding Allocated	$ 300,000	$ 300,000	$ 300,000
funding contributors includes McCain Foods, Cavendish Farms, Lamb-Weston, J.R. Simplot, USPB, and state organizations			
Budget Expense Items			
Total Planned Expenses	$ 288,285	$ 281,500	$ 293,105
Field Trials in ND, ID, and WA *Laboratory Analysis* *Logistics, development, shipping, management* *Miscellaneous*			
+/- Budgeted Funds	$ 11,715	$ 18,500	$ 6,895

NFPT Trials Supported by SCRI Funding FY2015 - FY2017

Budget Items - SCRI Portion

July 1 through June 30

Budget Funds	FY2015	FY2016	FY2017
Funding for SCRI	$ 89,000	$ 90,360	$ 36,720
funding for trials and analysis			
Budget Expense Items			
Total SCRI Planned Expenses	$ 99,152	$ 101,736	$ 104,320
Field Trials			
Laboratory Analysis			
Miscellaneous			
+/- Budgeted SCRI Funds	$ (10,152)	$ (11,376)	$ (67,600)

NFPT and SCRI Funding FY2015 - FY2017

Budget Balances

July 1 through June 30

	FY2015	FY2016	FY2017
NFPT Program Fund Balance	$ 11,715	$ 18,500	$ 6,895
SCRI Program Fund Balance	$ (10,152)	$ (11,376)	$ (67,600)
Net Balance considering both NFPT and SCRI Programs	$ 1,563	$ 7,124	$ (60,705)

What is the amount of planned NFPT expenses for FY2015?

$288,285
and $99,152 for SCRI

Molecular markers for the NFPT

Jeffrey Endelman
UW-Madison

Goals

- Obtain genome-wide markers on NFPT lines
- Investigate structure of elite U.S. fry processing germplasm
- Combine markers with NFPT phenotypes

Goals

- Obtain genome-wide markers on NFPT lines
- Investigate structure of elite U.S. fry processing germplasm
- Combine markers with NFPT phenotypes
- For “simple” traits, identify markers linked to major genes
  - Facilitates marker-assisted selection and/or GMO variety development
- For “complex” traits, use regression models to predict phenotypes and improve breeding efficiency

2011-2013 NFPT

- 144 genotypes
- 15 no longer exist, remainder were solicited
- 13 from MN program were not sent
- 116 were sent to UW as tubers or tissue culture plantlets

DNA extraction

- Plants grown in 4” pots in greenhouse
- Young leaf tissue collected
- Optimized protocols for tissue collection and DNA extraction
  - At first doing up to 10 samples in small tubes
  - Scaled up to high-throughput 2 x 96-well plates


DO NOT PLACE ANYTHING ON HEATER/AC UNIT
DO NOT PLACE ANYTHING ON HEATER/AC
6 SEmiddle 2

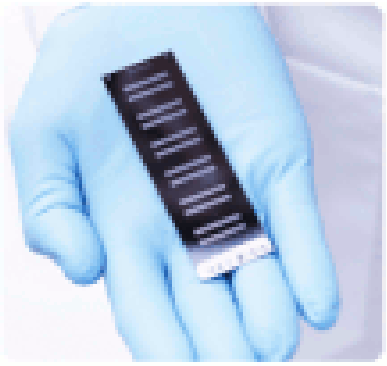

A04
A11
A10
A03
A09
A02
A08
A01
A07
A06
A05
B05
B10
B04
B09
B03
B08
B02
B01
B07
A12
B06
C04
C03
C08
C02
C07
C01
C06
B12
B11
C05
10,000
7,000
5,000
3,000
2,000
1,500
1,000
700
500
NFPT gel #1

Genome-wide markers

Pursuing two different technologies initially:

1. USDA SolCAP consortium developed array of 8303 markers, but only ~5000 called in tetraploids.

   Array expanded to 12K, expected to be available in November (2-3 months behind schedule)



Genome-wide markers

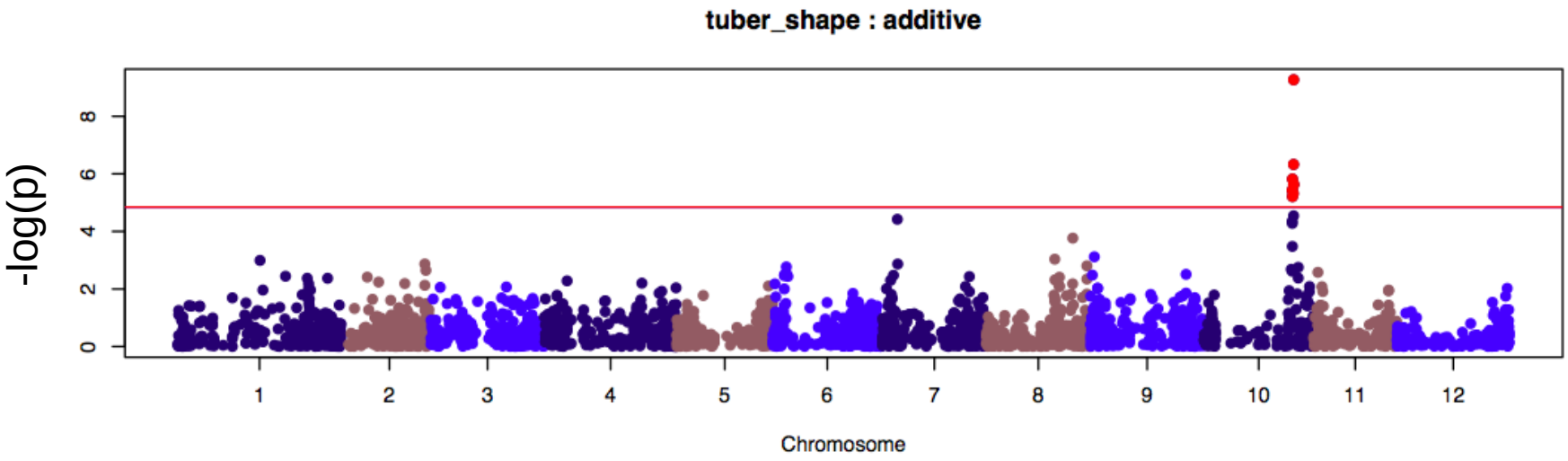
Pursuing two different technologies initially:

2. Genotyping-by-sequencing (GBS), using Cornell as service provider. Based on preliminary data in diploids, expecting 20-40K markers.

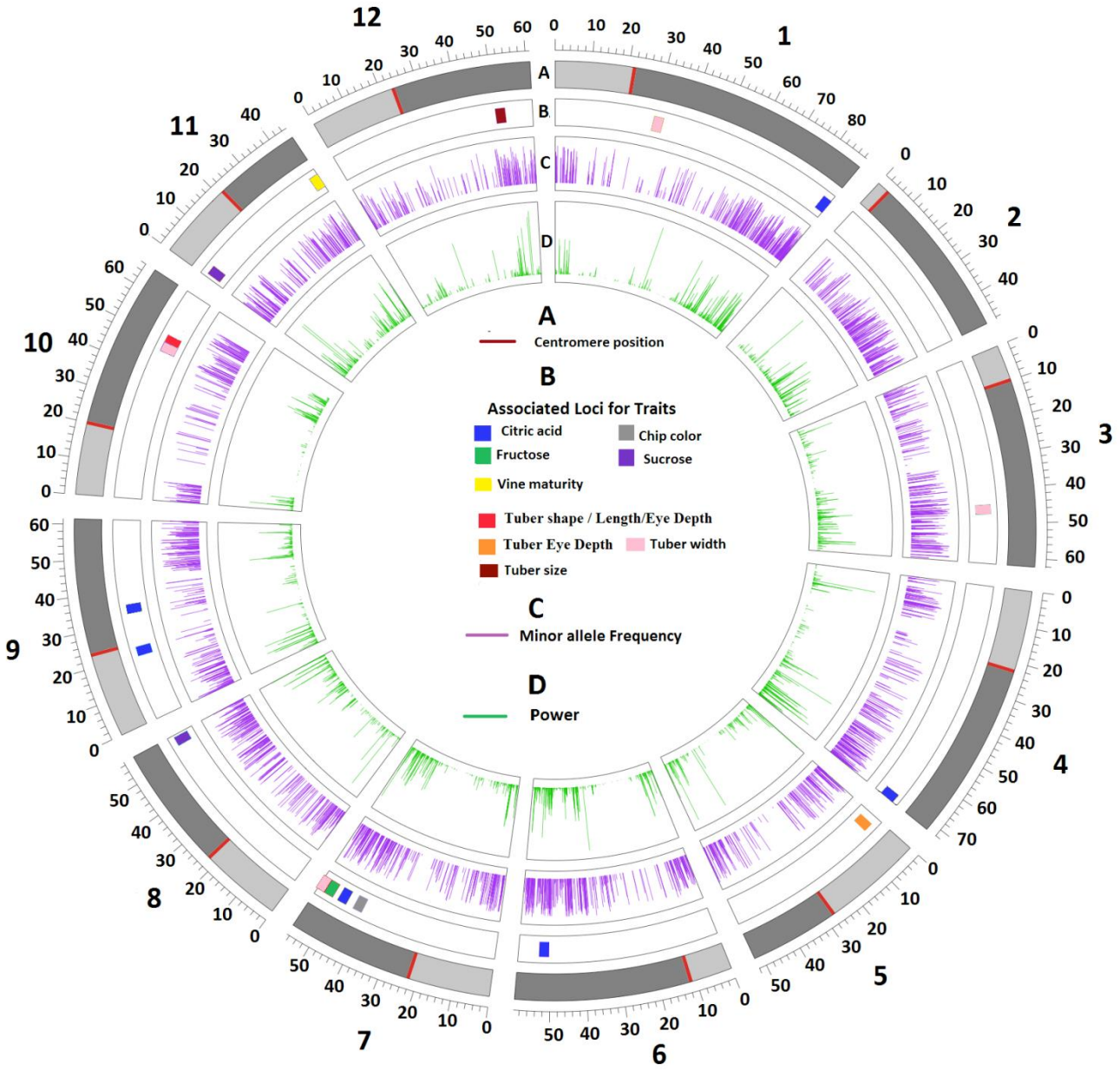
95 NFPT samples sent last month, expect results in December

GWAS = Genome-wide association study

- Method for identifying markers linked to genes in breeding populations
- Originally developed for human medicine, now routine in diploid crops, but software lacking for autopolyploids (like potato)
- We've just solved this problem



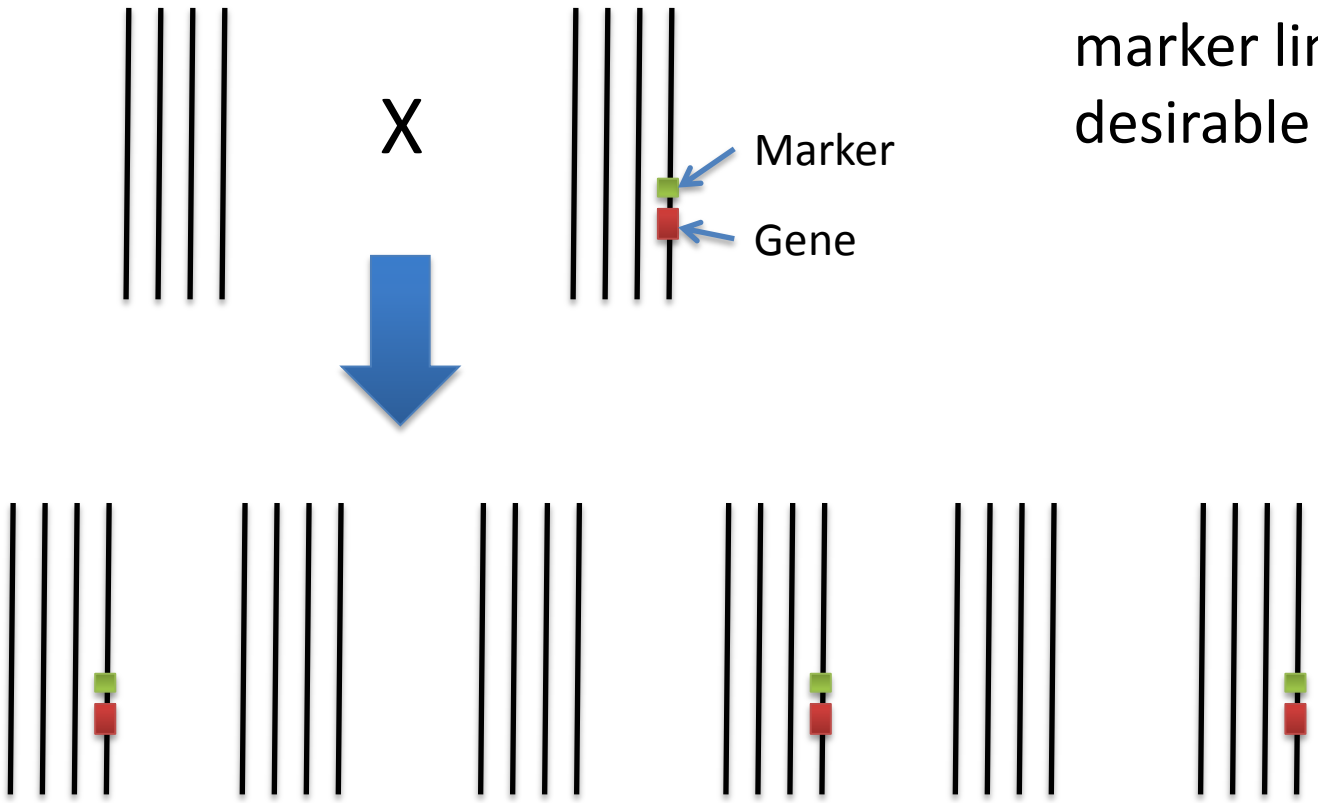
SolCAP diversity panel (N=187)


A
Centromere position
B
Associated Loci for Traits
Citric acid
Chip color
Fructose
Sucrose
Vine maturity
Tuber shape / Length/Eye Depth
Tuber Eye Depth
Tuber width
Tuber size
C
Minor allele Frequency
D
Power

Next steps

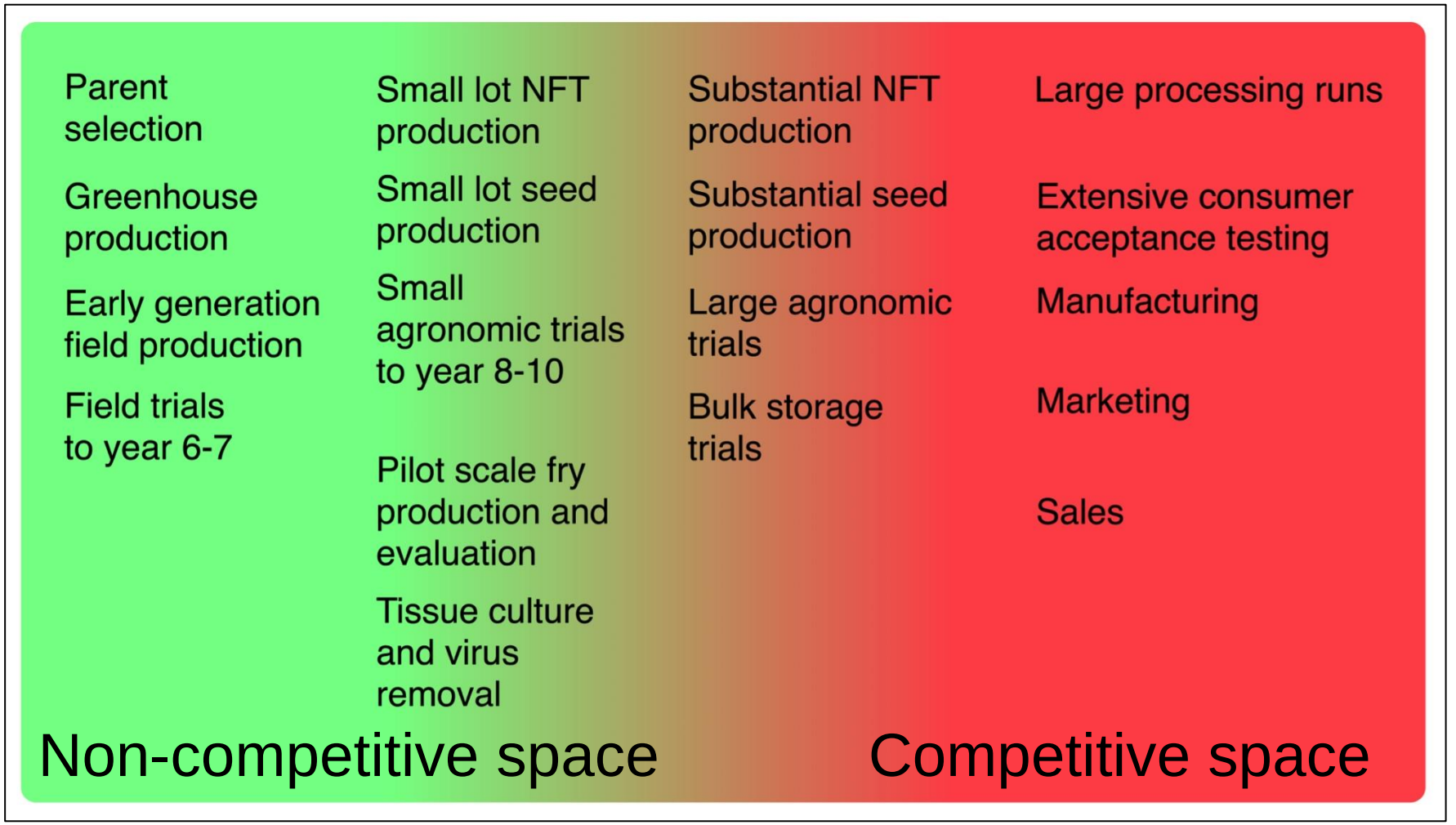
- Complete genotyping of 2011–2013 NFPT (Feb 2015)
- Solicit tuber samples for new entries in 2014 and 2015 NFPT, grow out and extract DNA (August 2015)
- Complete genotyping of 2014–2015 NFPT (Dec 2015)
- Data analysis (GWAS) slated for 2016

Marker-assisted selection



Select based on marker linked to desirable allele

Where can we cooperate to strengthen the industry?



Research needs within and outside of NFPT

Affect of raw product traits and environmental factors on consumer attributes

Genetics of tuber yield