Varieties: New innovations in Pumpkins, Winter Squash, Summer Squash, Gourds, and Melons

Brent Loy
NH Agricultural
Experiment Station

My Work on Variety Development is Totally Dependent on Collaboration with Several Seed Companies

Johnny's Selected Seeds

Hollar Seeds

Rupp Seeds

Hybrid Seeds NZ

Dr. Jodi Smith
High Mowing
Organic Seeds

Seneca Vegetable Research

Hybrid Melons for New England

(Containing NH Breeding Lines)

F_1 hybrids are comprised of two parental strains that are genetically pure.

Breeding lines released to seed company.

Seed increase of these lines by seed company.

Hybrid seed produced – hand pollination

Strain A x Strain B

Hybrid Seed

Halona

Produced by Hollar Seeds.

Classic eastern cantaloupe

Early maturity with large size.

Good vine vigor and some tolerance to sudden wilt.

Disease package:
PMR 1,2
FR 0,2

Performs will as grafted plant.

Diplomat

Produced by Hollar Seeds.

Galia/Passport type

Maturity: as early as Passport – ca. 70 d

Disease package:
PMR 1,2

Ambassador

Produced by Seneca
Vegetable Research.

Galia/Passport type

Early maturity

Disease package:
PMR 1,2
FR 0,1,2

Honey Sak

Produced by Seneca
Vegetable Research

Early Golden Crenshaw – magnificent flavor.

Second early – 75 to 77 d

Disease package:

PMR 1, 2
FR 0,1,2

Sugar Cube

Joint development with Seneca Vegetable Research

Attractive and productive small variety

Size: 2- 3 lbs.

Disease package:

PMR 1, 2
FR 0, 1, 2
ZYMV, PRSV, WMV

First Kiss

Produced by High
Mowing Organic Seeds.

First early

PMR 1,2

FR 0,1,2

True Love

Produced by High
Mowing Organic Seeds.

Scheduled for release in
fall 2017

Athena type – very
nice melon.

Disease package:
PMR 1, 2
FR 0,1,2

Shockwave

Produced by Seneca
Vegetable Research

Long shelf life variety:
harvest when yellow rind flecks appear.

Disease package:
PMR 1,2
FR 0,1,2

Maturity: ca. 80 d

On the Horizon

NH5414

Athena

NH5425

Early

Firm, excellent flavor

Long harvest window

Very Productive

PMR 1,2; FR 0,2

Yellow Summer Squash Breeding

Breeding work inspired by two observations:

1. Discovery of spineless (glabrous) mutant in 1992.

2. Terrible quality of yellow summer squash being marketed, largely caused by extreme spininess on stems.

UNH Contribution to Yellow Summer Squash – eliminate prickly nature of foliage.

Slick Pik® YS26
Introduced in 2009

Blond Beauty – Rupp Seeds

PMR, Non-warty Rind, Upright Growth Habit, Early

Blonde Beauty

Supermarket

Fortune

Introductions for Fall, 2017

Smooth Operator

High Mowing Organic Seeds

NH2130

Seneca Vegetable Research

Chilling injury (B gene)

Fortune

Blonde Beauty

NH2130

NH2170

High Yielding Crooknecks

NH2143

Developments in Fresh Market Winter Squash

Acorn group – *Cucurbita pepo* spp. *ovifera*

Kabocha group – *Cucurbita maxima*

Butternut group – *Cucurbita moschata*

Honey Bear – AAS
Winner – Johnny's

Outstanding eating
quality
bush growth habit
PMR
small size 1-1.4 lbs

Sugar Bush

PMR, 650 to 750 g

Sugar Dumpling

500 to 600 g

High Mowing Organic Seeds

Prospects for achieving ‘Sugar Bush’ quality in an acorn in the 1000 g size class?

Treatment	Ave fr. no. per plot	Ave fr wt. per plot	Ave. fr. wt. (kg)	% DW	% SS
2612	17.6	15.6	0.87± 0.14	14.0	12.4
2621	17.3 15.2	13.1	0.76± 0.16		17.4
2628 L-2	14.5	16.5	1.14± 0.22	17.5	15.2
2629 L-2	17.0 14.6	17.5	1.03± 0.14		16.3
2631	16.0	16.7	1.04± 0.18		12.2

For Squash Connoisseurs
Kabocha type

Rupp Seeds

Thunder –
- restricted vine
- high yields
- excellent eating quality

Bagheera Kabocha Squash

restricted vine, small blossom scar

High Mowing Organic Seeds

What about Butternut?

Appeal to the butternut peeling market.

Kabocha type fruit in species *C. moschata*

‘Naked Bear’

hull-less pumpkin seeds

Seneca Vegetable Research

NH2020

Changing Direction in Ornamental Pumpkins

Cargo

Joint development with JSS

Bayhorse Gold

Joint development with Rupp.

Initial Focus on Novel Rind Color

Sunlight

Moonshine

Bianco

Seneca Vegetable Research

Snowball

Hybrid Seeds NZ

Creating a diversity of striped/color phenotypes

Long Term Project Funded by JSS

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NH Agricultural Experiment Station


Questions


5415


5415


5431


5414


5771

New Variety Introductions


Gourds
5.71 each


DRUM
MAGAZINE

2130

B 1, next
2135


GLAD


1597
12/12 Mos 1-14
Group 1


5415


5415


5430

nz540

NZ557

2501**

2138

2130

2146

2138

2130


Yolk Colo


Yolk Colour Fan

1598

Wbn1-8

Prob wbn


NZ


NZ 53


4T14

5949

NZ557

NZ547**


CS
2

C. pepo ***C. maxima*** ***C. moschata***

Table Queen (acorn) Buttercup/kabocha

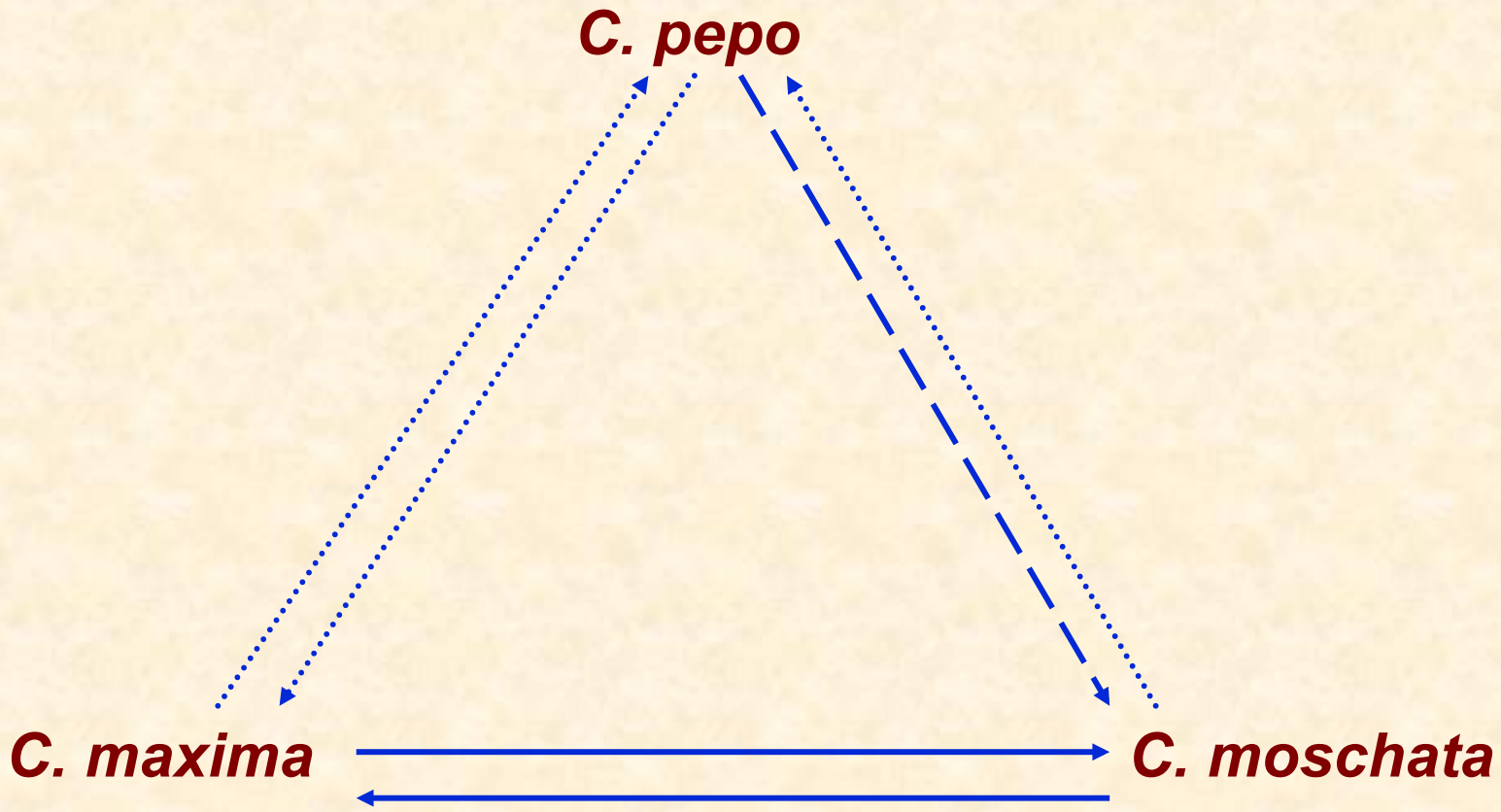
Butternut

Delicata Hubbard

Dickinson Field

Sweet Dumpling Golden Delicious

Large Cheese



Will sometimes cross with good seed, F_1 sterile.

Will rarely cross, but gene transfer possible.

Good luck!

Interspecific *C. maxima* x *C. moschata* F_1 hybrids have found some market niches.

- Afford a good root system and graft union for watermelon, melon, and some *Cucurbita pepo* cvs.
- A few varieties have become popular in scattered regions of the globe.
- In general, currently available cultivars are not considered to have good eating quality.
- No previous attempt to use interspecific hybrids for a processing squash.

Potential Benefits of Interspecific F_1 Hybrids

1) Semi-bush growth habit, with upright leaf canopy and rapid development of leaf canopy.

2) Wider adaptability due to *maxima/moschata* parentage.

3) Improved disease and/or stress resistance.

4) Higher mesocarp yield due to availability of photosynthate typically allocated to seed development.

Bush *C. maxima* breeding lines developed at the NHAES deemed useful for producing interspecific processing hybrids.

NH65

NH65 found to be compatible with most C. *moschata* cultigens in terms of fruit set, seed yield and seed fill.

Dickinson Field strain, SC936 Rupp Seeds

Long Island Cheese

Available C. moschata processing lines

2138

260

2146

NH65

NH65xLIC

Large Cheese (LIC)

NH65

NH65xSC936

SC936


NH65 x 204-3-9-6BN


NH65 x 204-3-9-16BN


NH65 x NH176-29


NH1316

Research Objectives

1) Evaluate growth traits of bush *C. maxima* x vine *C. moschata* hybrids compared with parental cultigens, including main stem and internode length, leaf areas and flowering habit.

2) Compare yield parameters of standard processing cultivars or cultigens and interspecific hybrids.

3) Determine components of fruit yield contributing to productivity.

Growth of Interspecific Hybrids

- Growth rates of *C. moschata* vine cultigens and interspecific hybrids is similar.
- Leaf canopy development in semi-bush interspecific hybrids is compact, with long petioles and cupped leaves, resulting in a dense, erect leaf canopy.
- Leaf area of interspecific hybrids is about double that of vining *C. moschata* cultivars because large leaf size.


DF
7/24/2011 – 44 DAT


NH65 x LIC
7/24/2011 – 44 DAT


NH65 x LIC
7/24/2011 – 44 DAT

2011 Study

- Compared four processing cultigens:
  - Golden Delicious (*C. maxima*)
  - Dickinson Field (*C. moschata*)
  - NH65 x Long Island Cheese (NH65xLIC)
  - NH65 x Dickinson Field (NH65xDF)

- Plant Spacing: 0.6 m x 2.4 m; transplanted onto raised beds, fitted with black plastic mulch and drip irrigation.

- Four replications of 16 plants per plot, surrounded by two guard rows and 2 plants on the front and back of each plot. No pollinator cultigen – relied on adjacent plants of *C. maxima* and *moschata.*

Fruit Yields in 2011

Cultigen	Fruit size (kg)	Fruit No.	Yield kg/plot	Yield t/ha
GD	2.8	16.3	45.6 a	20.1 a
DF	12.1	11.8	107.6 b	48.1 c
NH65xLIC	4.1	26.8	102.7 b	46.6 bc
NH65xDF	7.1	10.8	72.4 ab	
32.0 ab				

Yield Components of Fruit Harvested in 2011

(harvest at 60 to 70 days after pollination)

Cultigens	Mesocarp % DW	% Fruit composition mesocarp	% Fruit composition seed
GD	11.0 c	84.1 a	13.2 c
DF	5.6 a	89.3 b	8.5 b
NH65xLIC	9.3 bc	95.7 c	0.2 a
NH65xDF	7.7 b	95.8 c	1.0 a

Yield Components of Fruit Harvested in 2011

(harvest at 60 to 70 days after pollination)

	Yield Components t/ha		
Cultigens	Fruit	Meso FW	Meso DW
DF	48.1 c	43.0 c	2.4 b
NH65xLIC	46.6 bc	44.6 c	4.2 c
NH65xDF	32.0 b	30.7 b	3.6 bc

Partitioning of Dry Weight (g) Biomass per kg of Fresh Fruit Weight

	g DW/kg fruit FW		Percent
Cultigen	Mesocarp	Seed	Seed/total DW
DF	53.8 a	4.9 b	8.3
NH65xLIC	84.9 c	0.2 a	0.2
NH65xDF	72.7 b	0.8 a	1.1

Photosynthetic Glucose Energy Equivalents Allocated to Mesocarp and Seeds

	Kj/kg fruit FW		Percent
Cultigen	Mesocarp	Seed	Seed/total kj
DF	675	110	14.0
NH65xLIC	1065	4	0.4
NH65xDF	912	17	1.8

Field Experiment in 2012

Three Cultigens:

- SC936 – *C. moschata* inbred line (Rupp Seeds).
- NH65xLIC
- NH65xSC936

Experimental plots:

- Spacing: 0.9 m between plants; rows 2.4 m apart
- Raised, mulched beds with drip irrigation
- Two gourd rows on both sides of plots and 2 guard plants at front and back of plots.
- Three replications, 12 data plants per plot


SC936


NH65xLIC


NH65xSC936

Productivity of Interspecific Hybrids in 2012

Cultigen	Fruit FW (kg)	Mesocarp %DW	Fruit No./plot	Fruit FW t/ha	Mesocarp FW t/ha
SC936	4.3 b	5.8 a	30.5 a	50.3 a	40.7 a
NH65xLIC	3.9 a	10.8 c	31.5 a	47.3 a	40.2 a
NH65xSC936	5.8 c	8.0 b	31.5 a	70.1 a	59.6 c

Early Fruit Set Perceived as Problem

Fruit Set	Fr Wt (kg)	% DW
Fruit on bed	5.5 a	8.0 A
Fruit off bed	7.2 b	9.0 B

2013 Experiment – NH65xSC936

Objective: Determine flowering and fruiting patterns in NH65xSC936 in control plants and those in which female flowers initiated during the first 10 nodes were pruned.

Rationale: Data needed on uniformity of fruit quality and the possible adverse effect of precocious fruit set on fruit yield.

Effect of pruning pistillate flowers prior to node 11 on fruit set

Treatment	% fruit on laterals	Ave Node 1st flower	Average node 1st Fr	Average node 2nd Fr
Control	17.5	10.6	13.7	19.2
Pruned	19.2	10.4	16.4	21.0
Anova $_{0.05}$	ns	ns	*	ns

Fruit yields in 2012 and 2013

Year	% DW	Fruit FW t/ha	Meso FW t/ha
2012	8.0	70.1	59.6
2013	9.3	68.7	58.4

Are Interspecific Hybrids the "Holy Grail" for Productivity in *Cucurbita* species?

- The semi-bush, upright plant phenotype appears to have greater photosynthetic capacity than vine plants.
- The root system is probably more resistant to soil-borne pathogens than either *C. pepo* or *C. maxima*.
- Do not have to allocate photosynthetic energy to seed development.
- Plants show PMR, are not attacked by vine borer, and are not attractive to squash bugs.

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Dry Matter (1st vs. 2nd Fruit)