Raspberry Production in the Southern Climates

Great Plains Grower Conference

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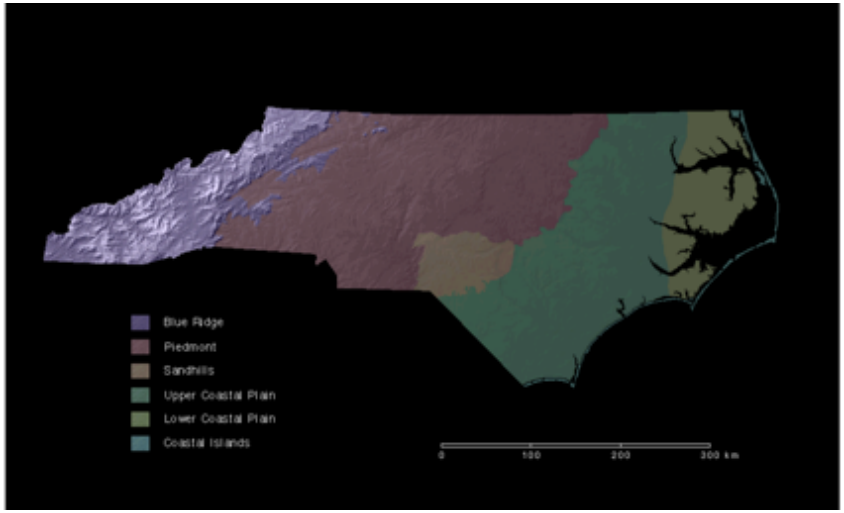
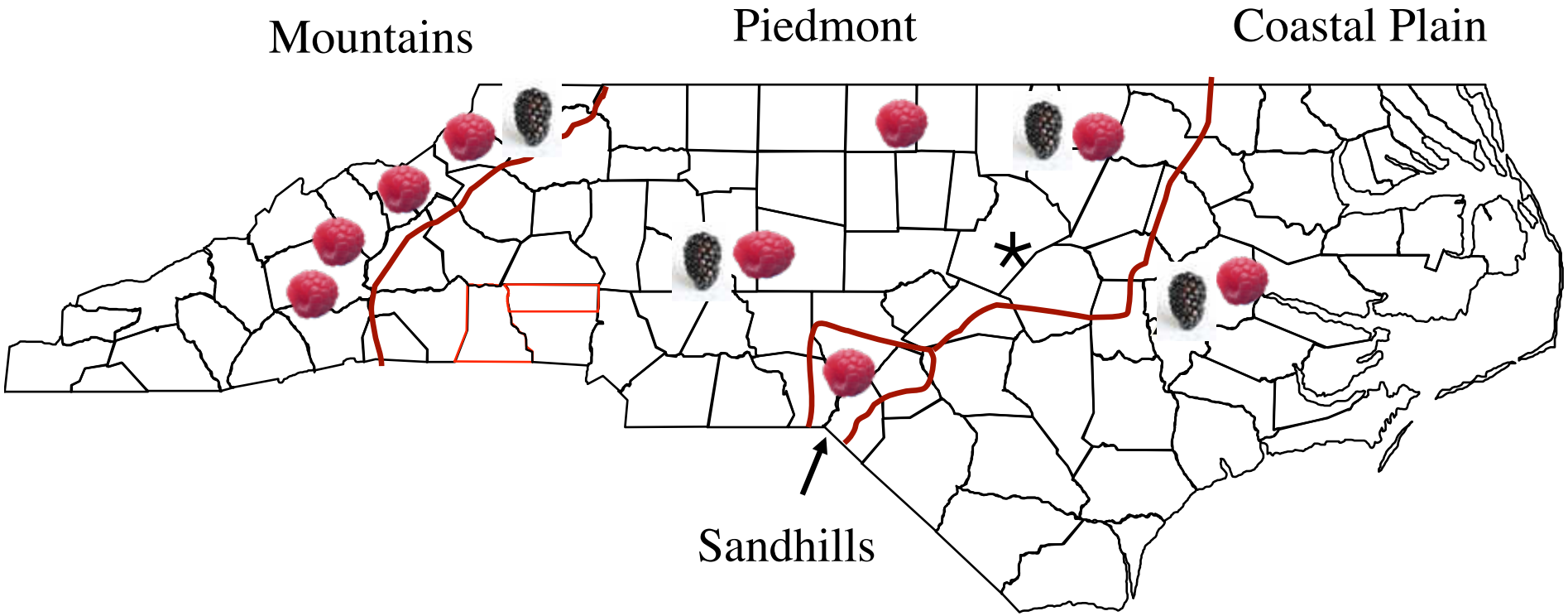
Where are we on the map?

http://geology.com/world/usa-physical.jpg



Source: http://www.ncgia.ucsb.edu/conf/SANTA_FE_CD-ROM/sf_papers/fels_john/fels_and_matson.html

Blackberry and Raspberry Trials in NC



Germplasm

Rubus ideaus struggles in the heat (Newberry)

R. parvifolius thrives (Dormanred >50%)

Vigor and floral fecundity

Stress over time

Stress over time

Multiyear screen

Mapping populations

- 2 mapping populations screened for heat tolerance
  - Red raspberry NCQ (*R. parvifolius* × 'Tulameen') x Qualicum (196 plants)
  - Black raspberry ORUS-4304 ORUS 4158-2 x (NC 84-10-3 x Jewel) (192 plants)
- Plant phenological traits (vigor, cane number)
- Fv/Fm (Fluorescence)
  - (Fv/Fm) decreases with increasing temperature
  - Fv/Fm is an indirect measurement of damage to PSII that has been shown to correlate with heat tolerance in plants

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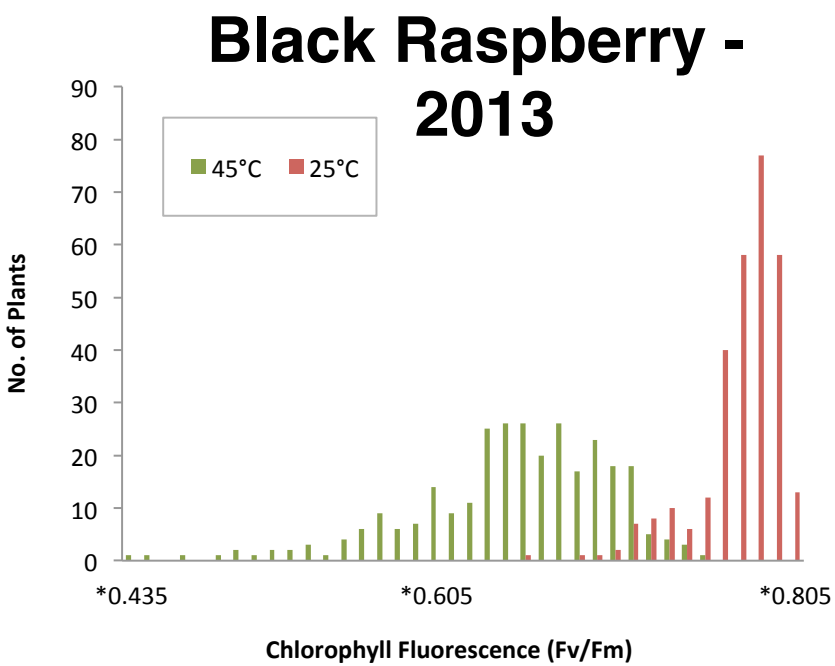
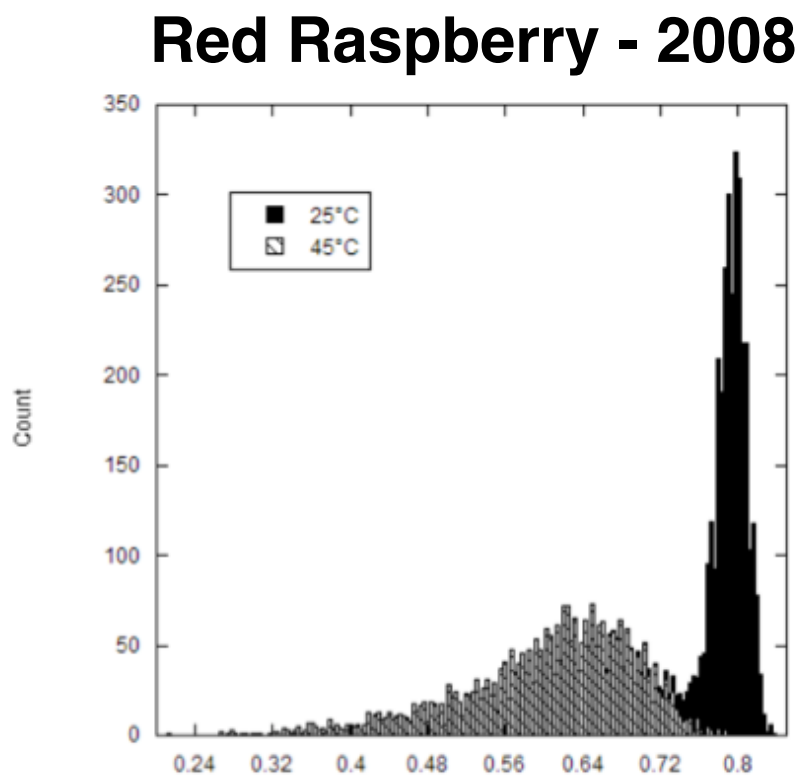
Results





Molina-Bravo 2009

Fv/Fm in black raspberry shows the same normal distribution as previous work on a segregating red raspberry population evaluated at the same location, indicating similar genetic mechanisms

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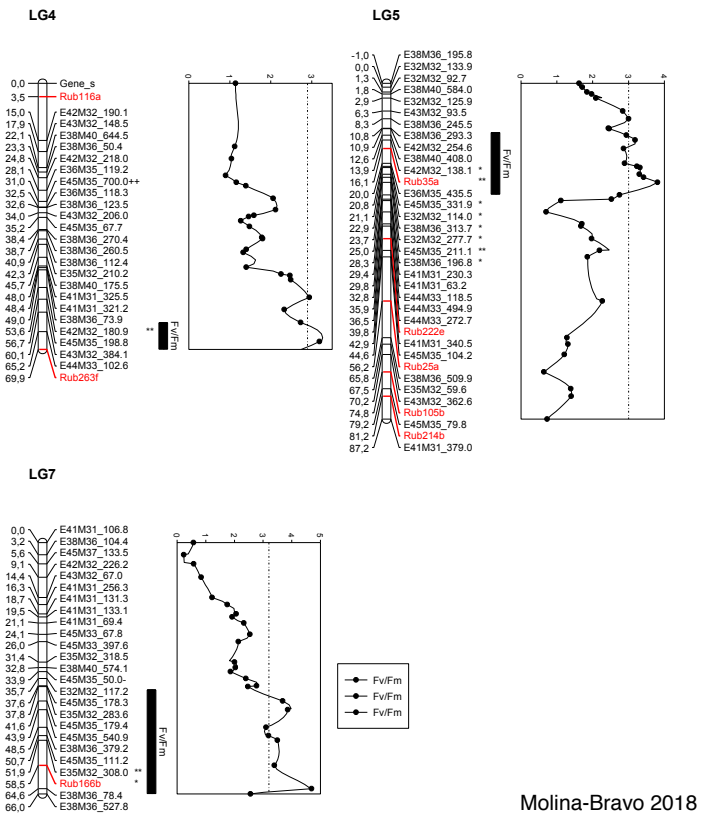
Long-Term Goals



Molina-Bravo 2018

- Determine QTL for Fv/Fm based on linkage map assembly of population 4304 from SSR and SNP anchors
- Compare red (shown) and black raspberry for Fv/Fm QTL
- Improve understanding of role of Fv/Fm as an indicator of heat tolerance in raspberry

Caneberries in NC Future?

Nantahala
NC 669
Crimson Nigl
Polka
NC 712
Crimson Gia

Future in the South?

- Breeding is long term
- Cultural practices (with breeding component)
- Industry interest

Raspberries- Summer or Fall Fruiting?

- Summer-fruiting (Floricane)
  - Advantages
    - Earlier season
  - Challenges
    - Hot summer harvest
    - Postharvest warm fruit
    - Fruit is softer than in fall
    - White drupelets
    - Pruning is time consuming (summer and winter)
    - Not adapted to Peidmont and CP
    - Loose vigor over time

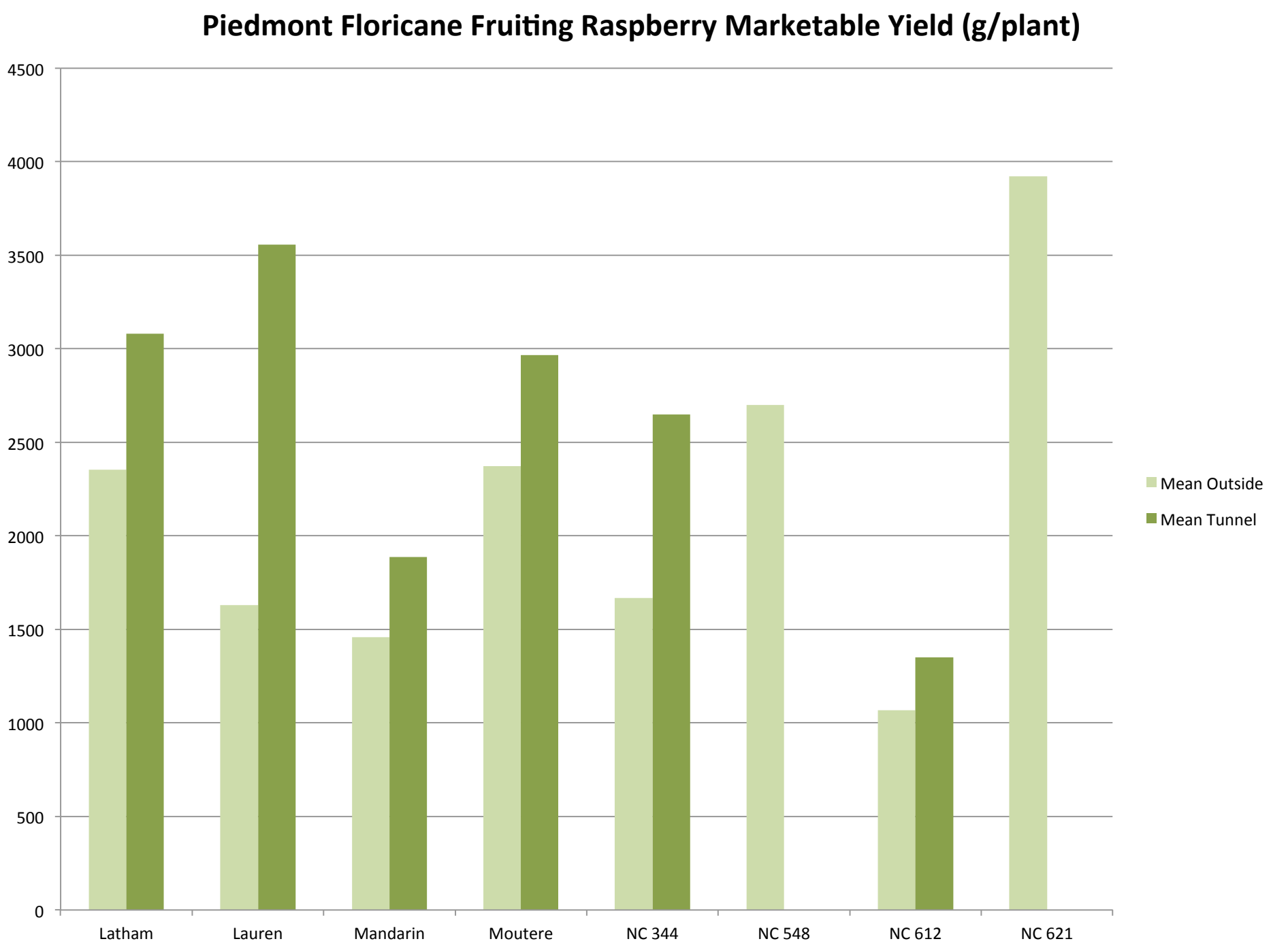
Raspberries- Summer or Fall Fruiting?

- Fall-fruiting (Primocane)

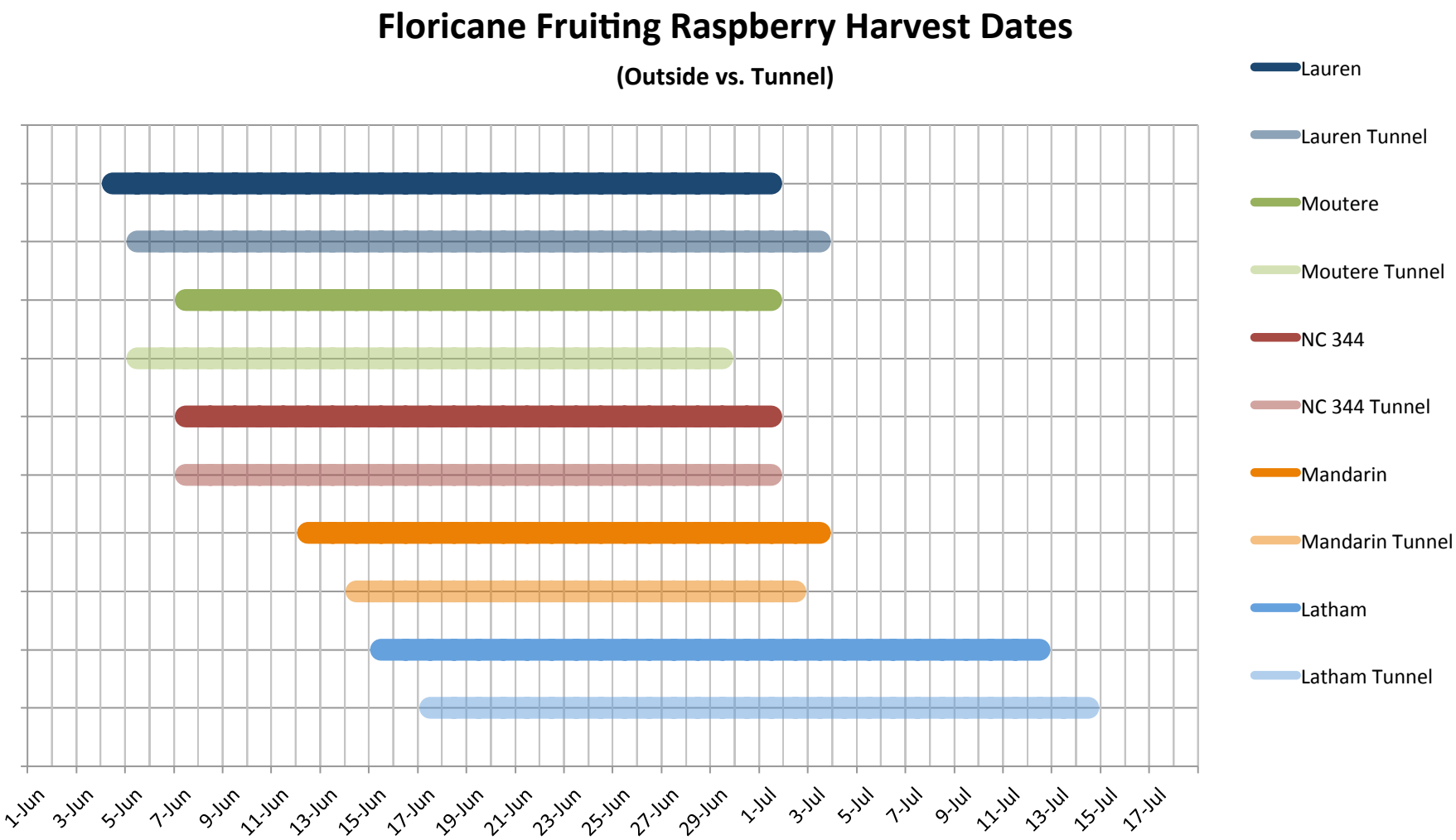
  - Advantages
    - Pruning is easier
    - Potential for 2 crops per year
    - Suited for production where summers are cool if the growing season is long
    - Many cultivars to choose from
  - Challenges
    - May need tunnel protection to protect fruit in fall
    - Harvest labor problems in fall

Floricane-fruiting raspberry trials

Tunnel Trials


Piedmont Floricane Fruiting Raspberry Marketable Yield (g/plant)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
Latham
Lauren
Mandarin
Moutere
NC 344
NC 548
NC 612
NC 621
Mean Outside
Mean Tunnel

Season Extension?



Post Harvest FF Raspberry

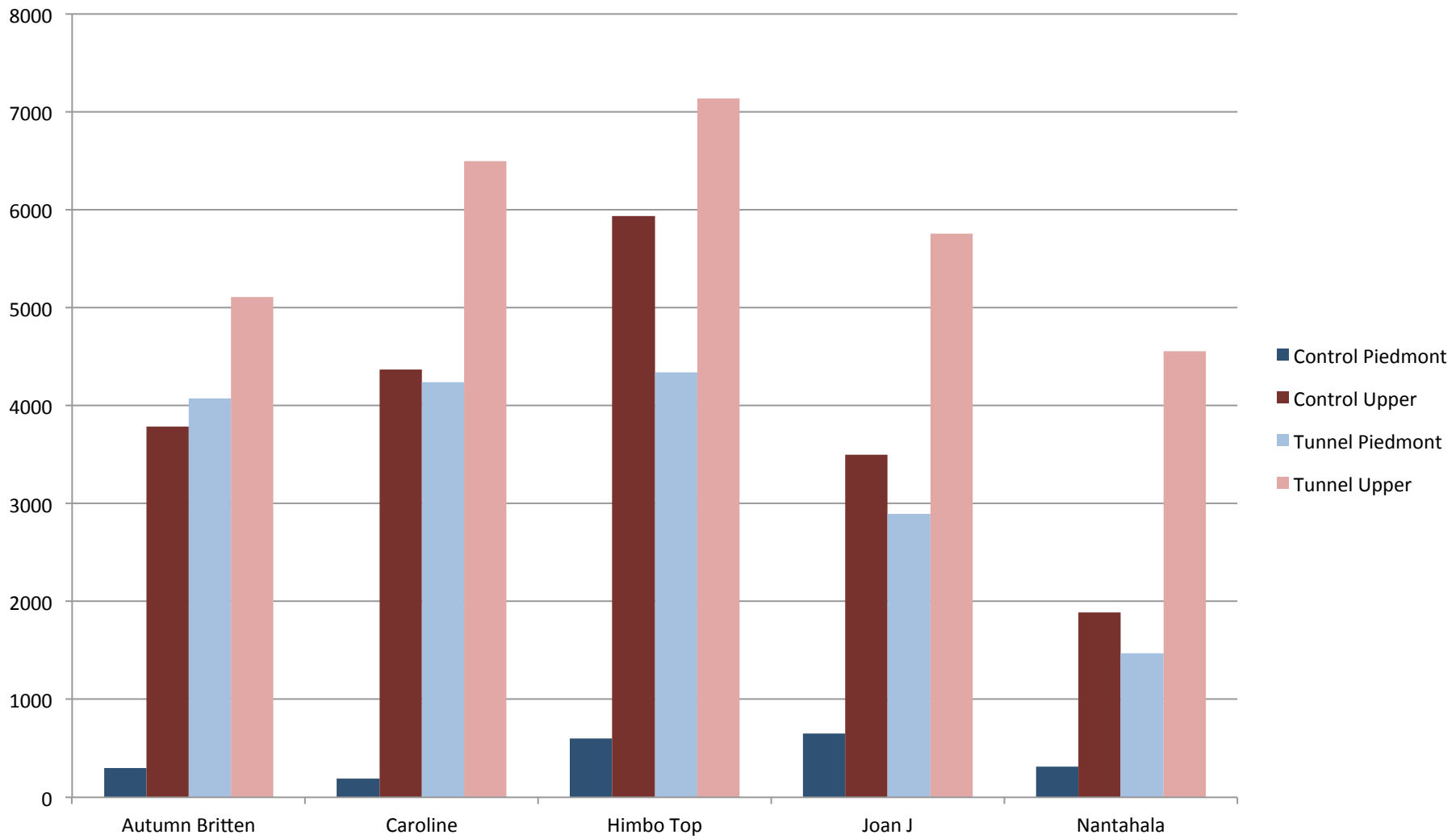
LOCATION	Cultivar	Ave berry wt (g)	Berry darkness	Berry shrivel	Weight loss (%)	Moldy berries (%)	Leaky (%)	Soft (%)	OVERALL rating
			Ratings (1-5)						
OUTSIDE									
SALS	Lauren	4	1.5	1.4	2.5	24.3	40.4	53.4	-18.1
SALS	NC605	2.9	2.4	1	2.4	23.6	28.7	49.3	-1.6
SALS	Moutere	2.9	1.7	2.3	2.3	10.2	30	39.4	20.5
SALS	NC621	3.1	0.6	2.8	4.5	2.6	21.9	52.1	23.5
SALS	NC638	3	1.3	0.9	3	16.8	18	32	33.2
SALS	NC548	3.3	1.7	1.1	2.2	18.3	12.2	30.2	39.3
TUNNEL									
SALS	Latham	2.8	2.1	1.5	2.7	9.8	29.4	53.2	7.7
SALS	NC344	3.1	1.9	2.8	2.6	19.1	23.9	31.9	25
SALS	NC612	2	2.5	2	4.4	15.7	21.7	51.4	11.2

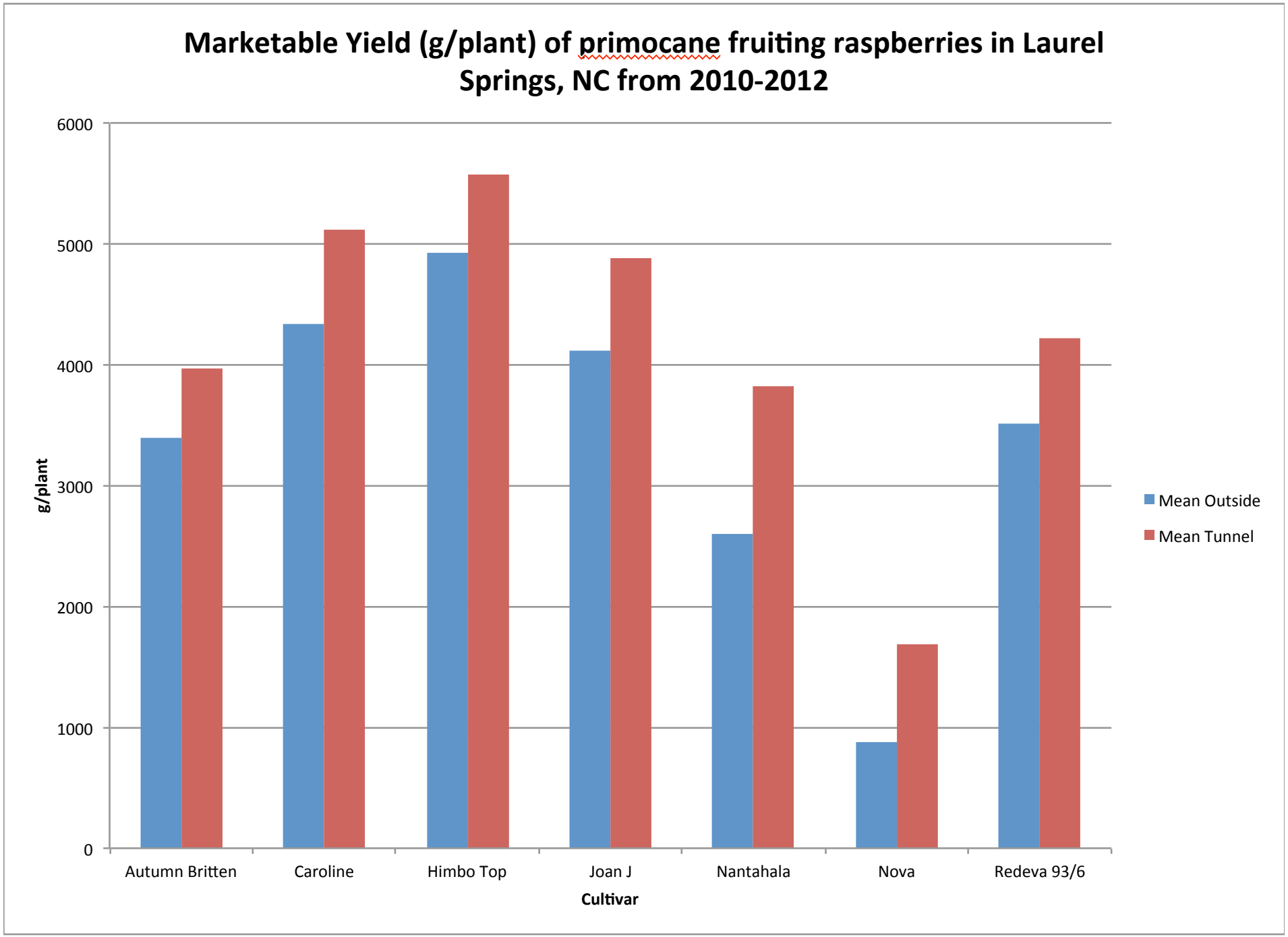
Overall rating is 100-sum(moldy+leaky+soft)
Marketable rating is 100-(sum(moldy+leaky+soft)/3)

Courtesy Dr. Penny Perkins-Veazie

Primocane-fruiting raspberry trials

Primocane fruiting raspberry second year marketable yield data at the Piedmont and Upper Mountain research stations by treatment g/plant




Marketable Yield (g/plant) of primocane fruiting raspberries in Laurel Springs, NC from 2010-2012
6000
5000
4000
3000
2000
1000
0
g/plant
Autumn Britten
Caroline
Himbo Top
Joan J
Nantahala
Nova
Redeva 93/6
Cultivar
Mean Outside
Mean Tunnel

Post Harvest
PF Raspberry

LOCATION	Cultivar	Ave berry wt (g)	Ratings (1-5): Berry darkness	Berry shrivel	Weight loss (%)	Moldy berries (%)	Leaky (%)	Soft (%)	OVERALL rating
OUTSIDE									
MR	HimboTop	2.9	1.9	1.2	1.7	27.5	53.4	63.5	-44.3
LS	A. Britten	4	2.4	1.4	2.5	37.5	44.3	51.6	-33.5
LS	HimboTop	4.2	1.9	1.4	2.3	26.7	47.9	57.9	-32.5
LS	Caroline	3.4	2.3	1.1	2.3	12.4	21.6	56.1	9.9
LS	Joan J	4.4	2.9	1.1	1.9	22	27.6	37.8	12.7
LS	Nantahala	3.4	1.9	1.2	1.7	16.8	21.2	35.9	26.1
LS	Nova	4.2	1.9	0.7	1.9	10	9.6	27.7	52.7
SALS	HimboTop	2.7	1.8	1.1	1.8	19.1	44.6	62.8	-26.5
TUNNEL									
LS	HimboTop	4.1	1.5	1.1	2.2	14.6	46.5	55.7	-16.8
LS	A.Britten	3.8	2.5	1.3	2	12.7	49.1	45.9	-7.8
LS	Caroline	2.8	2.8	1.2	1.1	23.4	25.9	53.2	-2.5
LS	Nantahala	4	1.9	1	0.9	30.7	13.1	51.4	4.8
LS	Joan J	4.5	2.4	1.3	1.9	10.2	33.5	46.4	10
MR	HimboTop	2.7	1.5	2.9	1.7	9.9	46	72.9	-28.7
MR	NC452	3.8	2.1	0.9	2.2	0	43.8	59.6	-3.4
MR	Nantahala	3.3	1.4	1	1.5	0	35.8	39	25.2
SALS	HimboTop	1.9	1.9	1.3	3.5	13.1	52.1	70.3	-35.5
SALS	Joan J	1.8	3	2.3	3.7	14.4	27.3	56.3	2

Overall rating is 100-sum(moldy+leaky+soft)
Marketable rating is 100-(sum(moldy+leaky+soft)/3)

Courtesy Dr. Penny Perkins-Veazie

Nantahala
Caroline

Raspberry varieties by NC region

- Mountains and foothills (TUNNELS)
  - **Nantahala**, Latham, **Autumn Britten,** Autumn Bliss, **Caroline**, Anne, *Nova*, Esta, Jaclyn, Josephine, *Heritage*
  - Himbo Top, Joan J?, Imara, Kweli and BP1, *others*
- Piedmont (TUNNELS)
  - Southland, Dormanred, Mandarin
  - Caroline, Moutere on trial basis
- Coastal Plain
  - Dormanred

Observations on newer cultivars

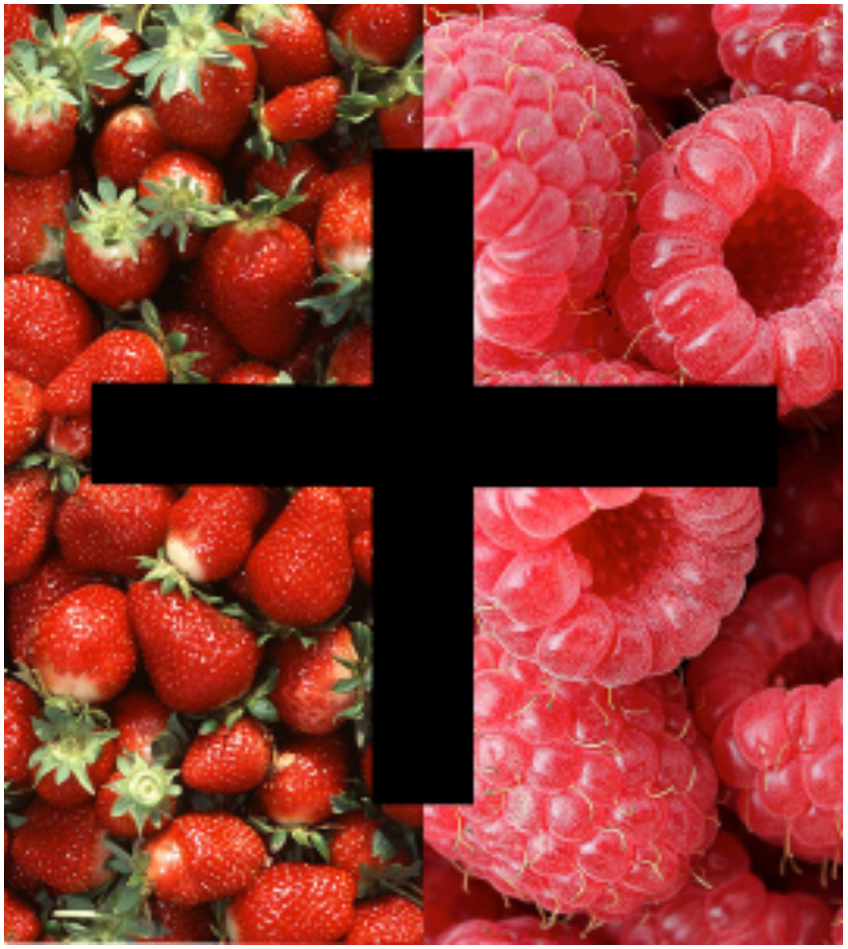
- Piedmont Research Station, Salisbury NC (near Charlotte) 4 plant plots
  - BP1: dead
  - Imara: small red fruit, not adapted, but alive
  - Kweli: Dead

Observations

- Upper Mountain Research Station, Laurel Springs NC, 3 plant plots
  - BP1: Weak plot, largest fruit of 3, flavor fair, Japanese beetle damage severe
  - Imara: Moderate vigor (least japanese beetle damage), nice flavor, high potential yield
  - Kweli: Weak plants, medium size fruit, japanese beetle damage, latest of 3

Fast track to fruiting in hotter region?

- Can we produce raspberry fruit at the same time as strawberries are harvested in eastern and other regions of NC and beyond?
- Increase fruit offerings in early spring



Upper Mountain Research Statoin

Nursery in cooler climate

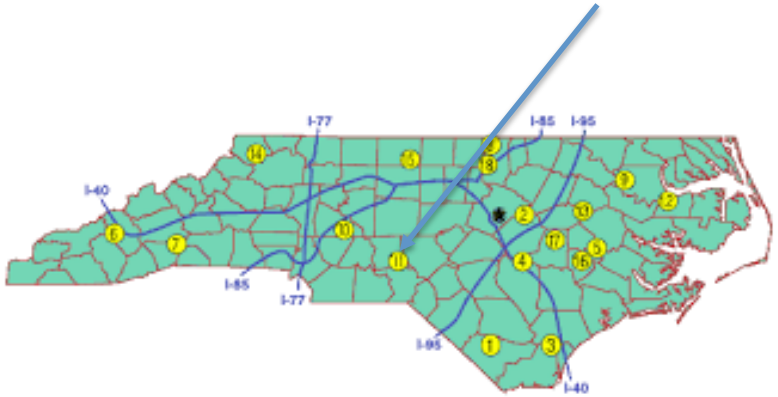
- Potted plants with drip fertigation
- Field grown plants, dug and repotted
- 36.3966° N, 81.3074° W
- 3000 ft
- Cooler climate for cane growth and bud development

Move plants
158.3 miles

Sandhills Research Station
Fruit production in warmer climate

Rimol High Tunnel

- Spring production, warms up earlier
- (lat. 35°11”, long. 79°40”; elevation, 625 ft)



Long canes-fruit production in warmer climates

- 3 reps/2 plants plot
- Floricane fruiting
  - 6 genotypes
- Primocane-fruiting (floricane crop)
  - 4 genotypes
- 2 moving dates
  - Feb and March

Long canes

Long canes

Long canes

- Weekly yield
- SWD control
- Fertigation

Floricane fruiting raspberry potted plants

	Total Yield (g/plant)		Marketable Yield (g/plant)		Average Berry Weight (g)		Harvest Dates					
							5% Yield		50% Yield		95% Yield	
	February	March	February	March	February	March	February	March	February	March	February	March
NC 548	241 NS	170 NS	213 NS	141 NS	3.3 NS	4.0 NS	3-Jun	15-Jun	17-Jun	26-Jun	1-Jul	11-Jul
Tulameen	181 NS	92 NS	158 NS	73 NS	3.0 NS	3.6 NS	28-May	5-Jun	10-Jun	26-Jun	5-Jul	12-Jul

Floricane fruiting raspberry yield
Field dug plants

	Total Yield (g/plant)		Marketable Yield (g/plant)		Average Berry Weight (g)		Harvest Dates					
							5% Yield		50% Yield		95% Yield	
	February	March	February	March	February	March	February	March	February	March	February	March
Moutere	1165	315	983	123	2.7	2.8	7-Jun	8-Jun	20-Jun	20-Jul	13-Jul	6-Aug
NC 344	530	66	491	56	2.7	2.4	8-Jun	25-Jun	22-Jun	5-Jul	9-Jul	16-Jul
NC 612	843	539	732	270	2.1	2.4	11-Jun	27-Jun	21-Jun	5-Jul	29-Jun	22-Jul
Octavia	381	442	309	296	3.7	3.5	5-Jun	1-Jul	29-Jun	7-Jul	18-Jul	2-Aug

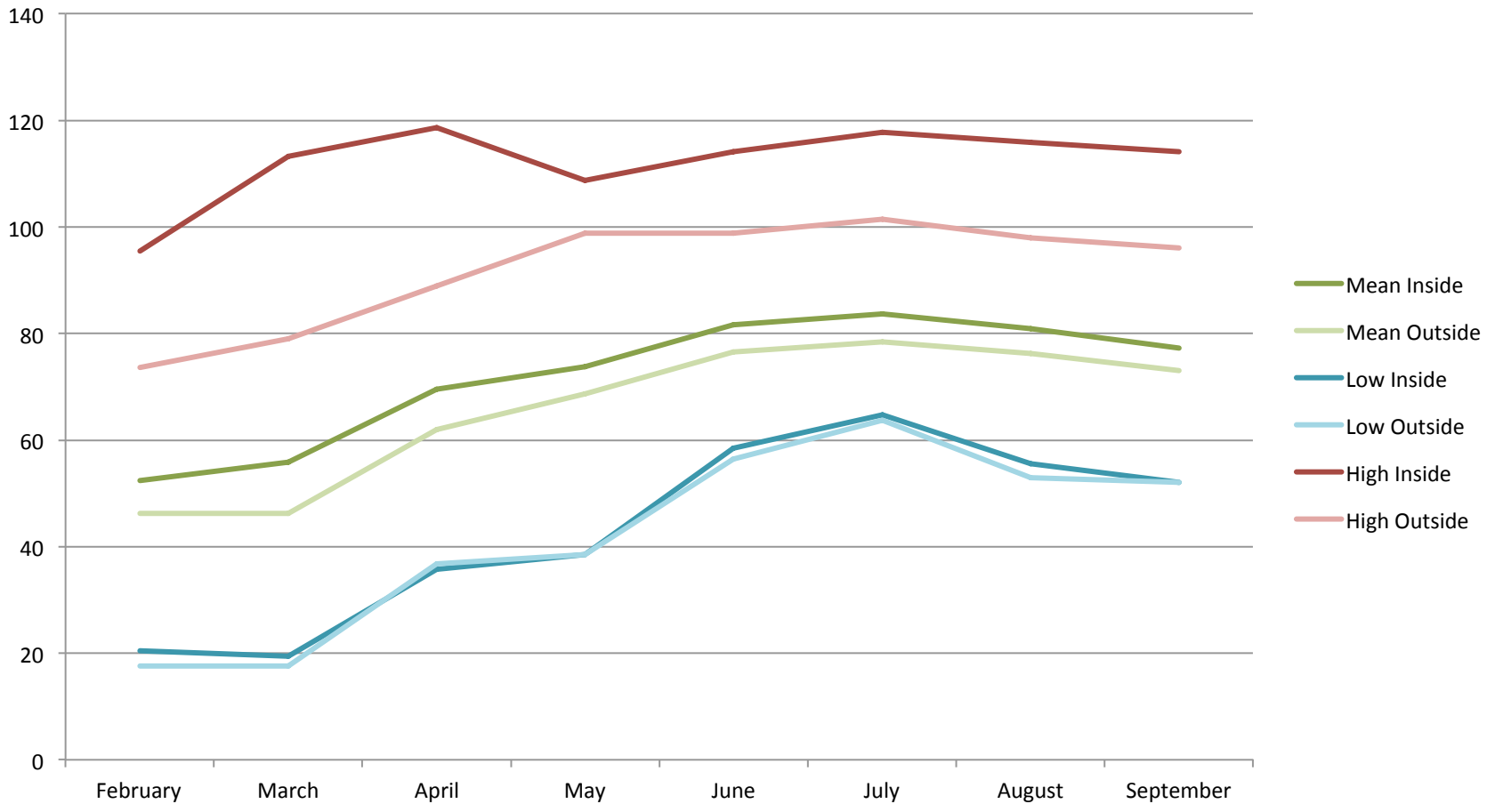
Primocane fruiting raspberry yield
Field dug plants

	Total Yield (g/plant)		Marketable Yield (g/plant)		Average Berry Weight (g)		Harvest Dates					
							5% Yield		50% Yield		95% Yield	
	February	March	February	March	February	March	February	March	February	March	February	March
Autumn Britten	1416	1292	1107	984	2.7	2.6	1-Jun	4-Jun	20-Jun	20-Jun	22-Jul	16-Aug
Caroline	488	586	186	261	1.9	2.0	6-Jun	5-Jun	19-Jun	27-Jun	20-Aug	17-Aug
Himbo Top	1250	1089	719	726	2.5	2.3	3-Jun	4-Jun	3-Jul	24-Jun	10-Aug	12-Aug
Nantahala	209	624	56	423	3.1	2.7	4-Jun	16-Jun	7-Aug	29-Jun	25-Aug	23-Jul

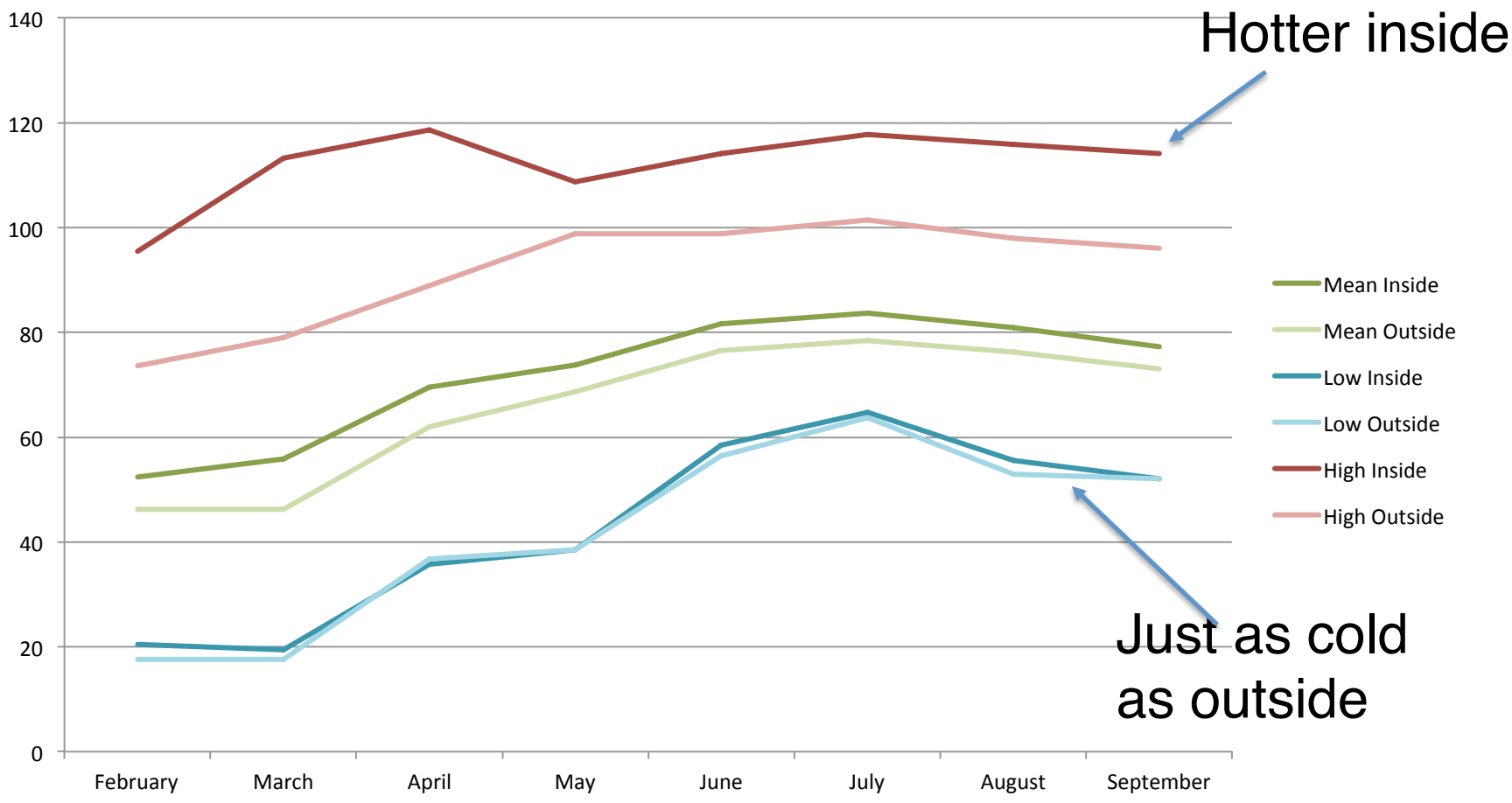
Long cane production

- Feb date higher yield most genotypes
- Field grown plants higher yield
- Potted plants peak mid June
- Field dug plants longer peak June-July
- Yields variable
- No advance of harvest greenhouse temp not well controlled at night

Long canes
Temperatures in/out



Long canes
Temperatures in/out



Long cane production?

- Feasible
- Feb move date
- Improve floral bud development in nursery to increase yield
- Control temperatures in high tunnel to advance season
- Look at more cultivars
- Economical? Niche markets, bring customers in early

Raspberries in the south?

- Heat still an issue
- Have some
- Dormanred is still the most heat tolerant
- Long canes may be a short cut
- Fruit quality in heat will be a challenge
- Breeding

Thank-you!

Absalom Shank
Christine Bradish
Ramon Molina Bravo
Rocco Schiavone

Questions