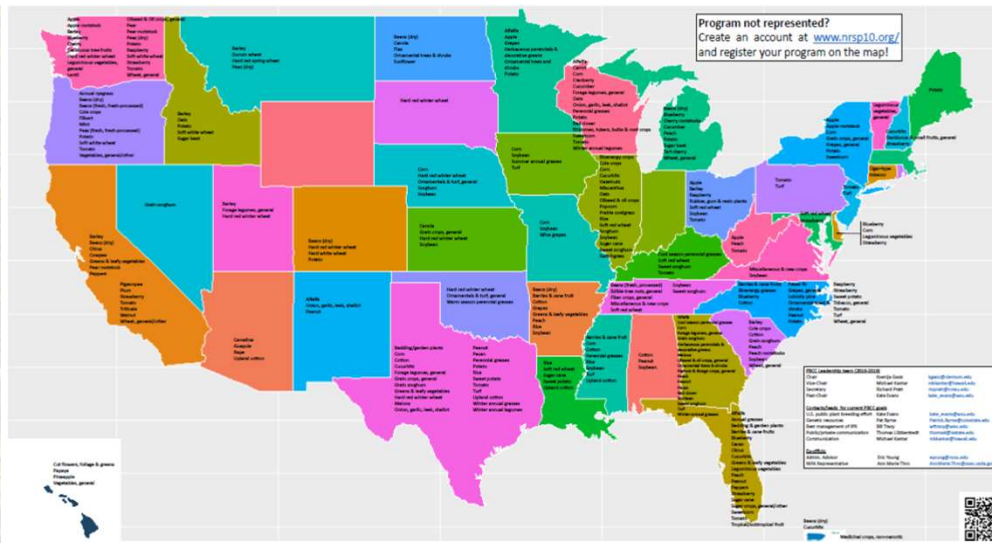


Status of Blueberry Breeding In the United States



Hamid Ashrafi

Associate Professor: Blueberry Breeding and Genomics

North Carolina State University

Portugal National Meeting of Blueberry Producers (Oct , 27th, 2023)

NC STATE UNIVERSITY

Team Vaccinium @ NC STATE



Jessica Spencer



Jenny Myers



Felicia Shepard



Nyssa Bongo



Gray Isom



Kristen Koehler



Ellen White



United States Department of Agriculture
National Institute of Food and Agriculture

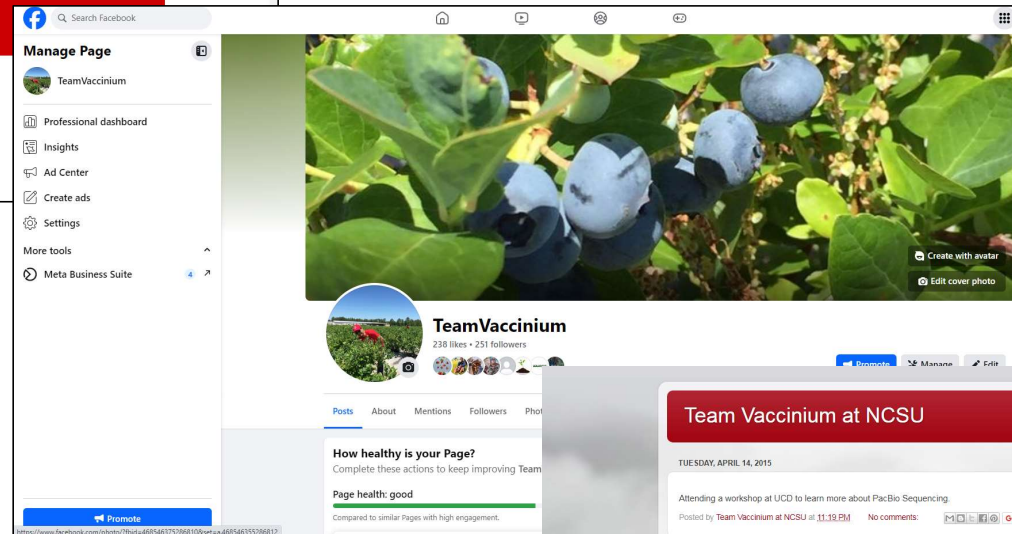
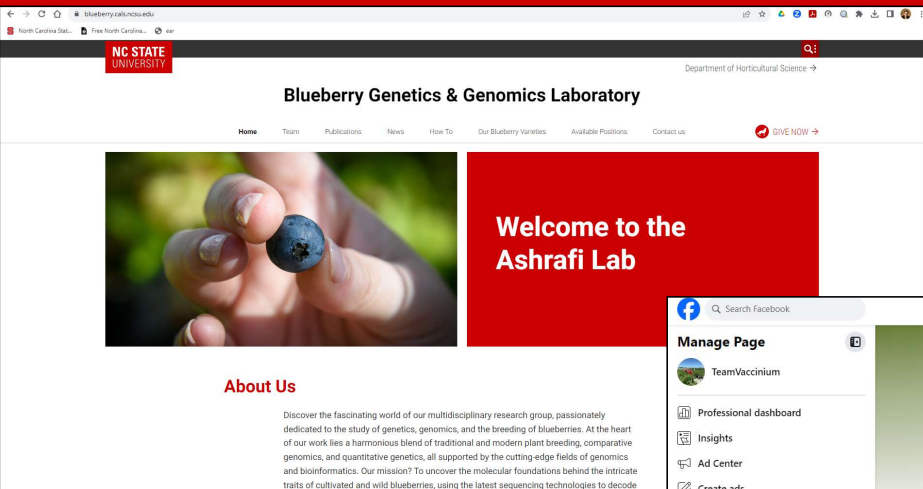
the
Southern Region
small fruit consortium

NC STATE UNIVERSITY

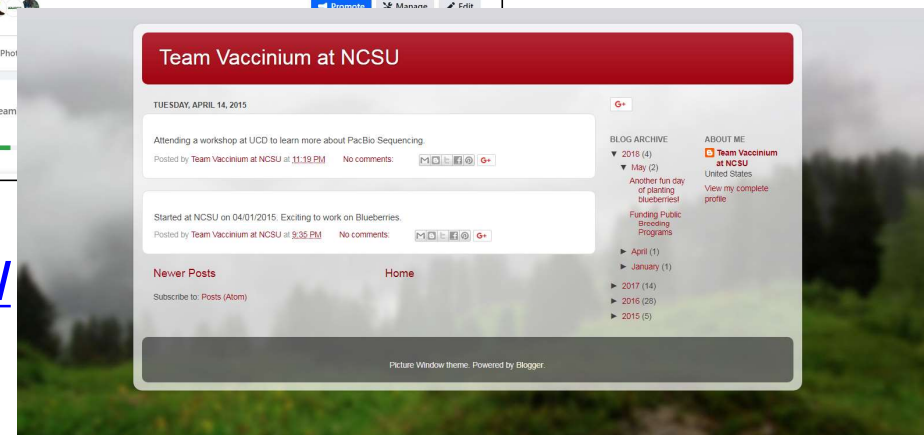
Plants for
Human Health
INSTITUTE

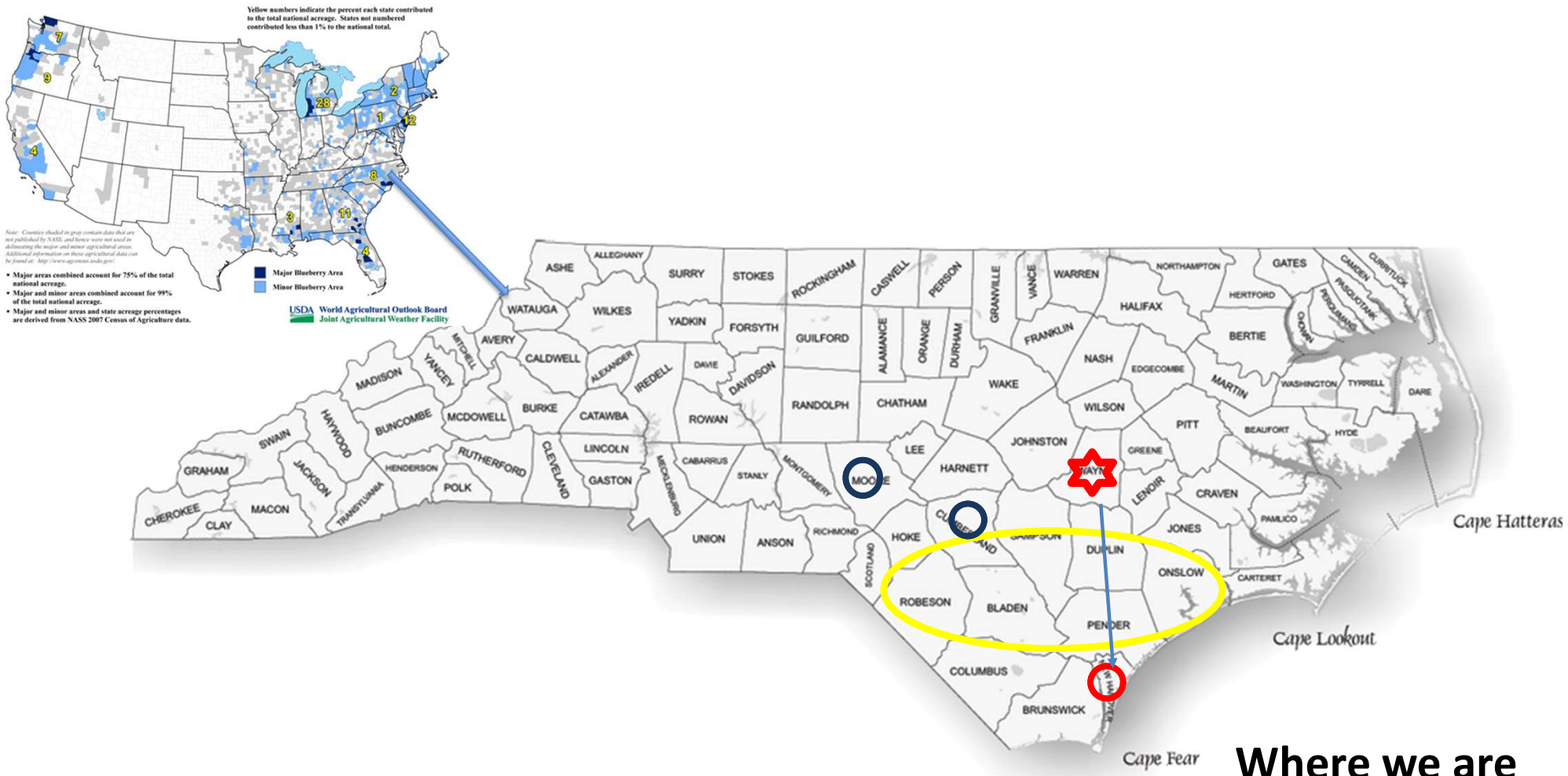


NC STATE UNIVERSITY



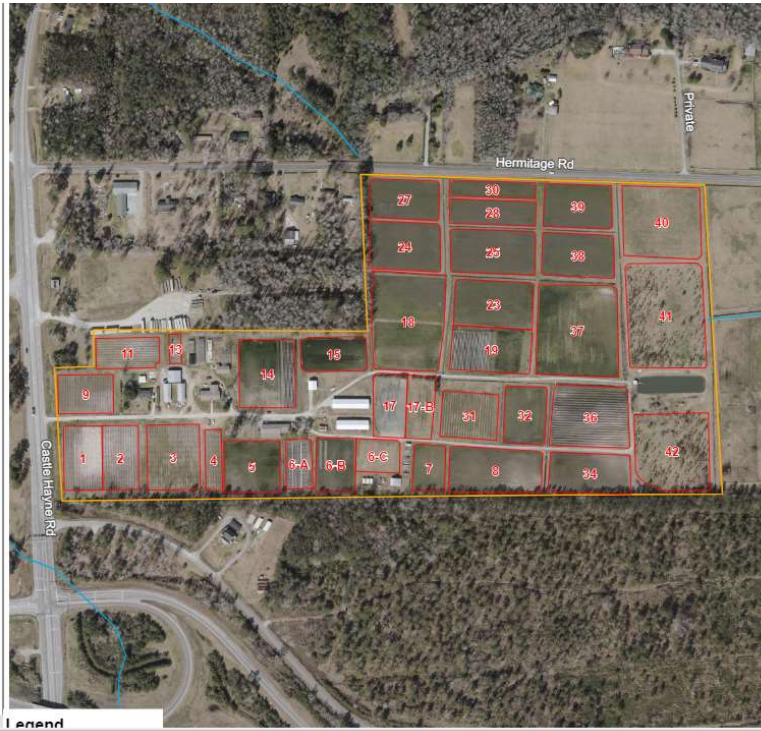
<https://blueberry.cals.ncsu.edu/>
<https://www.facebook.com/TeamVaccinium/>
<http://vacciniumatncsu.blogspot.com/>





Where we are

Horticultural Research Station in Sandhills, NC

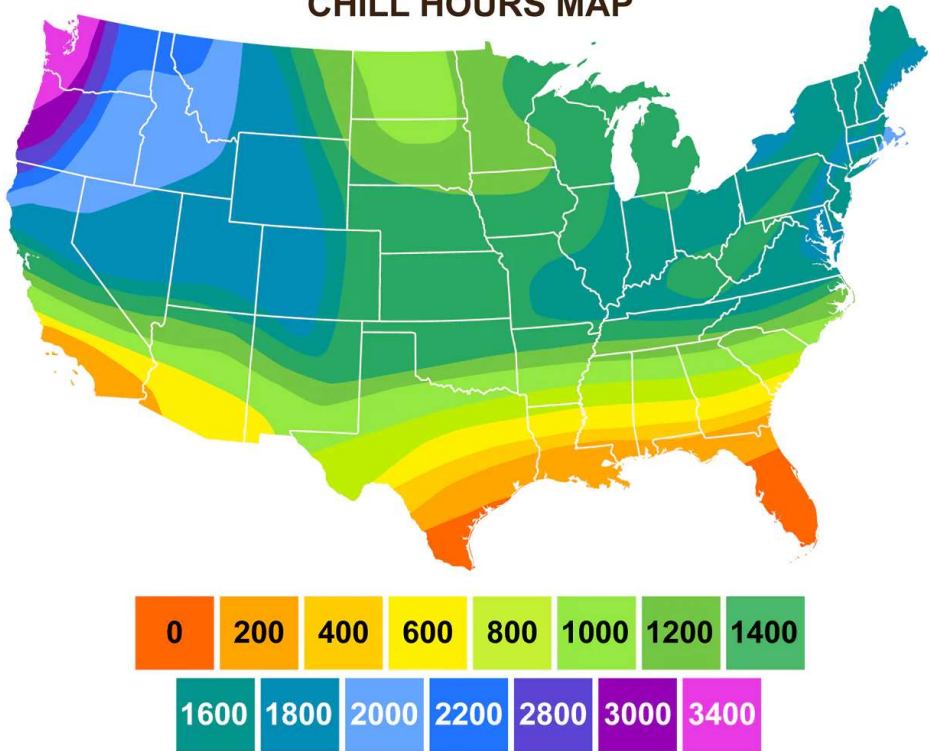


Ideal Tract Farm in Castle Hayne, NC

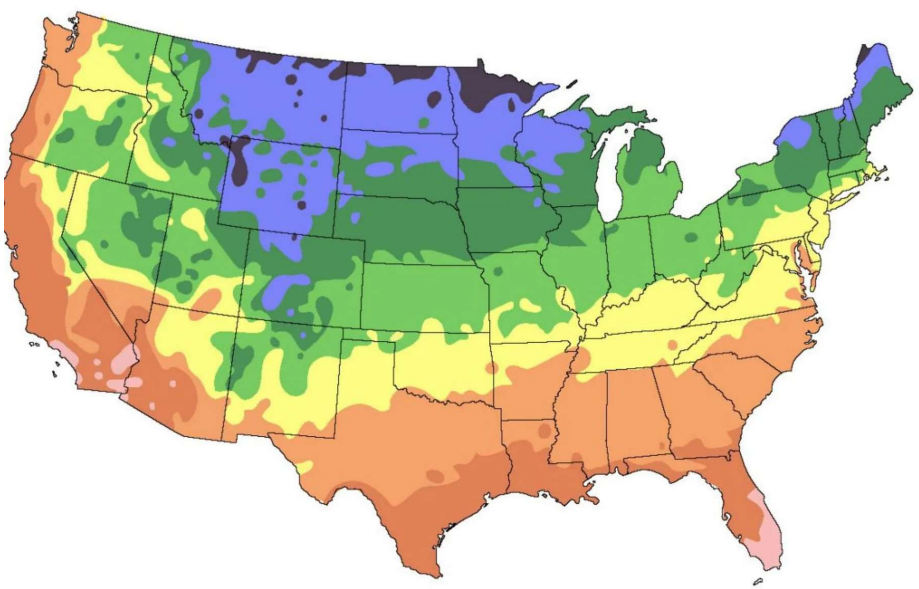


50 Acres = 20 hectares
2.47 Acres = 1 hectares

CHILL HOURS MAP












Based on data from the University of Maryland

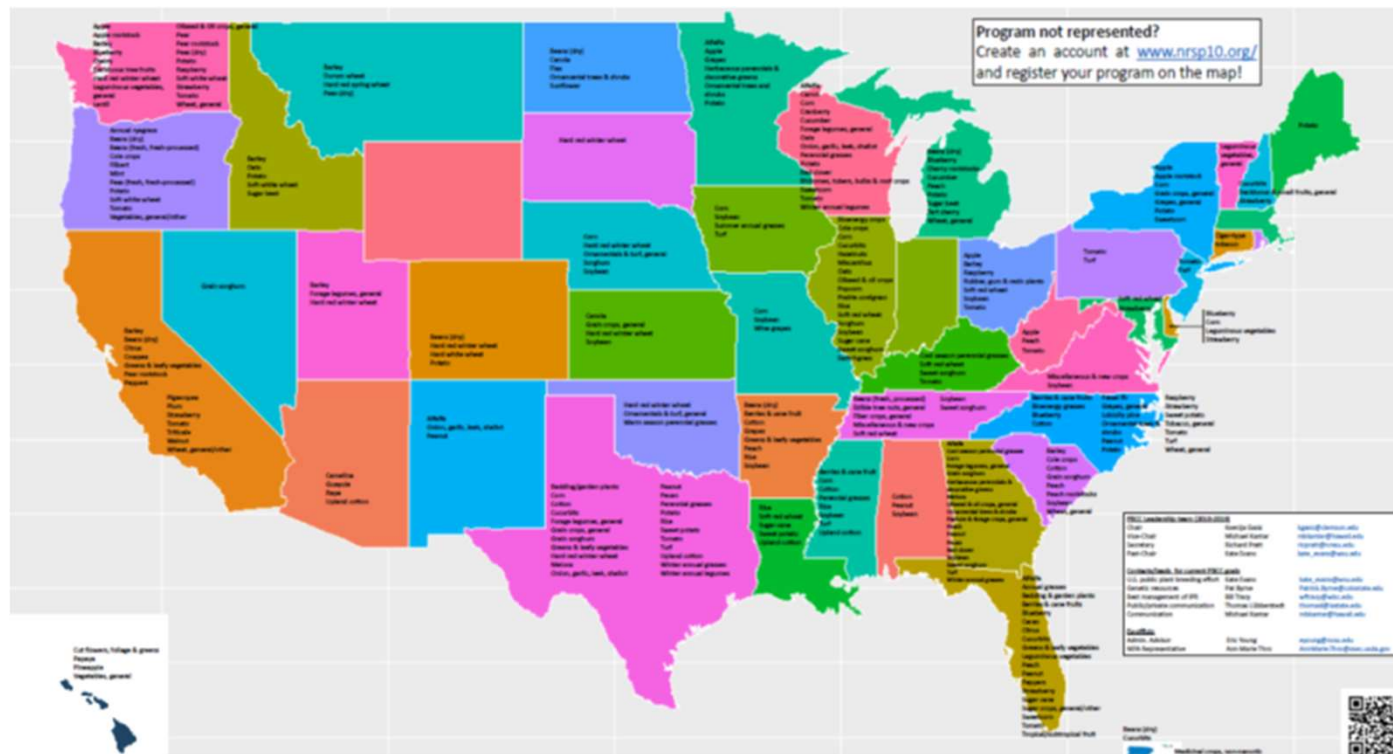


ZONES:

Top 10 Highbush Fresh Production By Country

	Country	2019	2020	2021	2022
1	Peru	125.40	162.73 	243.53 	285.58 
2	China	106.90	171.66 	223.57 	258.53 
3	United States	169.25	153.03 	177.06 	159.17 
4	Chile	136.96	138.78	123.04	101.35
5	Mexico	53.13	57.00	72.70	74.93
6	Poland	40.30	52.10	52.50	65.50
7	Spain	56.52	49.80	66.71	62.57
8	Morocco	30.60	34.20	37.07	45.07
9	Canada	39.50	31.72	33.29	32.61
10	South Africa	12.66	15.33	24.00	28.00

There are more than 366 public breeding programs in 44 States



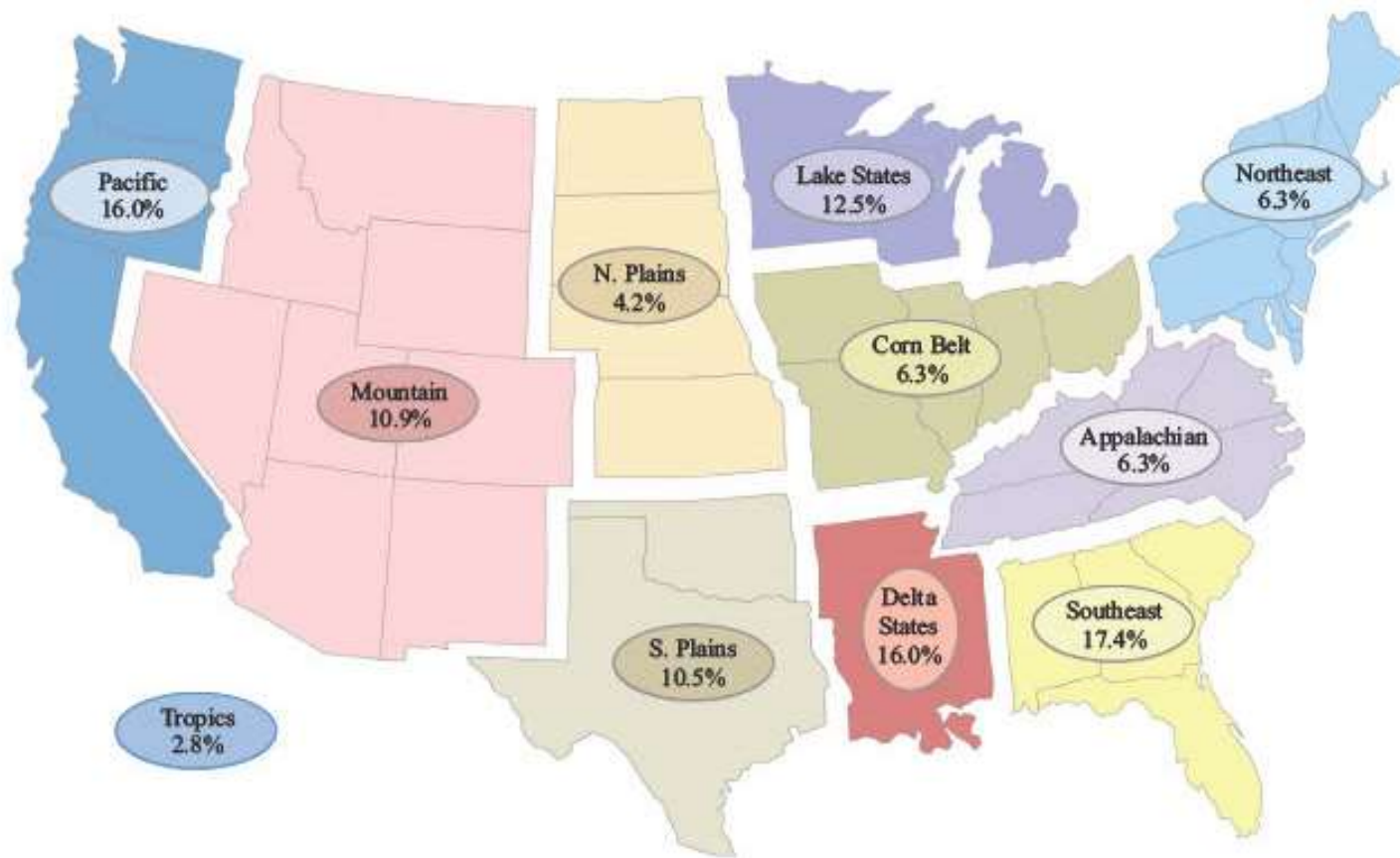
https://www.nrsp10.org/US_public_plant_breeding_capacity

Crop group representation in survey sample of U.S. public-sector plant breeding programs

Crop group	No. of programs	Percentage of the survey sample
Vegetables	71	24.7
Grain crops	58	20.2
Deciduous and small fruits	43	15.0
Oilseed and oil crops	27	9.4
Pasture and forage crops	20	7.0
Ornamentals and turf	19	6.6
Fiber crops	15	5.2
Sugar crops	8	2.8
Tropical and subtropical fruit	6	2.1
Rootstocks	5	1.7
Miscellaneous and new crops	5	1.7
Edible tree nuts	4	1.4
Tobacco	1	0.3

N = 287.

Percentage distribution of plant breeding program survey responses by state-based USDA Economic Research Services (ERS) Farm Production Regions



Age of individual breeders who responded to a survey of U.S. public

Reported age of individual breeder representing program	Frequency	Percentage of survey sample
30–34	10	3.8
35–39	27	10.3
40–44	32	12.3
45–49	30	11.5
50–54	33	12.6
55–59	41	15.7
60–64	52	19.9
65–69	24	9.2
70+	12	4.6

Current Public Blueberry Breeding Programs in the US

Investigator	University / Institution	State	Type of Blueberries
Hamid Ashrafi Jim Ballington	North Carolina State University	North Carolina	SHB - Rabbiteye
Ye (Juliet) Chu Scott Nesmith	University of Georgia	Georgia	SHB - Rabbiteye
Patrick Edger Jim Hancock	Michigan State University	Michigan	NHB
Mark Ehlenfeldt	USDA	New Jersey	NHB-Germplasm enhancement
Patricio Munoz Paul Lyrene	University of Florida	Florida	SHB
Sushan Ru	Auburn University	Alabama	SHB
Gina Sideli	Rutgers University	New Jersey	NHB

Michigan State University

Aurora	PP15185
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Liberty	PP15146
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Huron	PP21777
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Draper	PP15103
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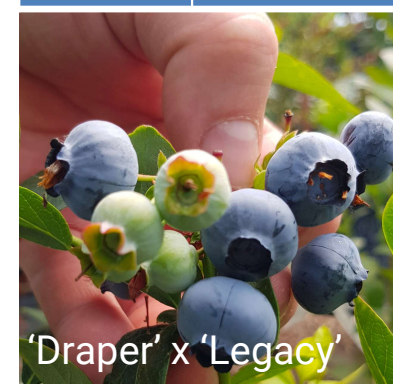
Calypso	US20150128312
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Katahdin	PP32110
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Orsono	PP26031
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USDA-USDA-ARS, Beltsville, MD / Chatsworth, NJ

Talisman

Magnolia × Elizabeth



Razz

GM-37 × CU-5



Current Private Blueberry Breeding Programs in the US

Investigator	Company / Nursery	State	Type of Blueberries
Greg and Monica Willems	California Berry Genetics	California	SHB
James Olmstead	Driscoll's	California	SHB, NHB
Paul Sandefur	Fall Creek Nursery	Oregon	SHB, NHB
Marivi Colle	MBG Marketing - Berry Blue LLC	Georgia and Michigan	SHB, NHB
	Oregon Blueberry Farm and Nursery	Oregon	NHB



Most Recent NHB Cultivars: **Berry Blue LLC.**

Affection | PP31,257



Chrisma | PP31,524



Envoy | PP30,422



Most Recent NHB Cultivars: **Berry Blue LLC.**

Intrepid | PP32,575



Keepsake | PP24,807



Medallion | PP32,574



Sensation | PP24,809



Most Recent NHB Cultivars: Oregon Blueberry Nursery

Titanium

PP26,759



Open pollination of unnamed parents

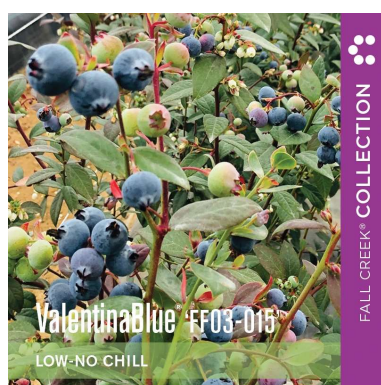
Megasblue

PP26,796



Open pollination of unnamed parents

Most Recent NHB Cultivars: **Fall Creek Farm and Nursery**



Most Recent NHB Cultivars: Driscoll's

Low Chill

Mid-Chill

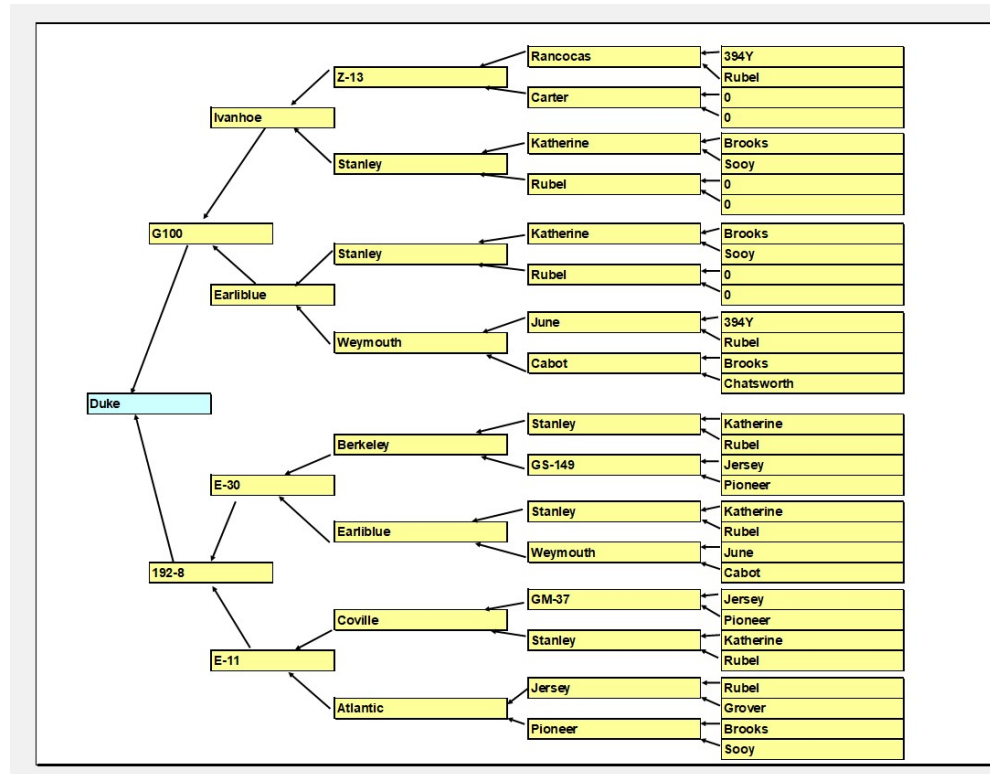
High-Chill

Evergreen

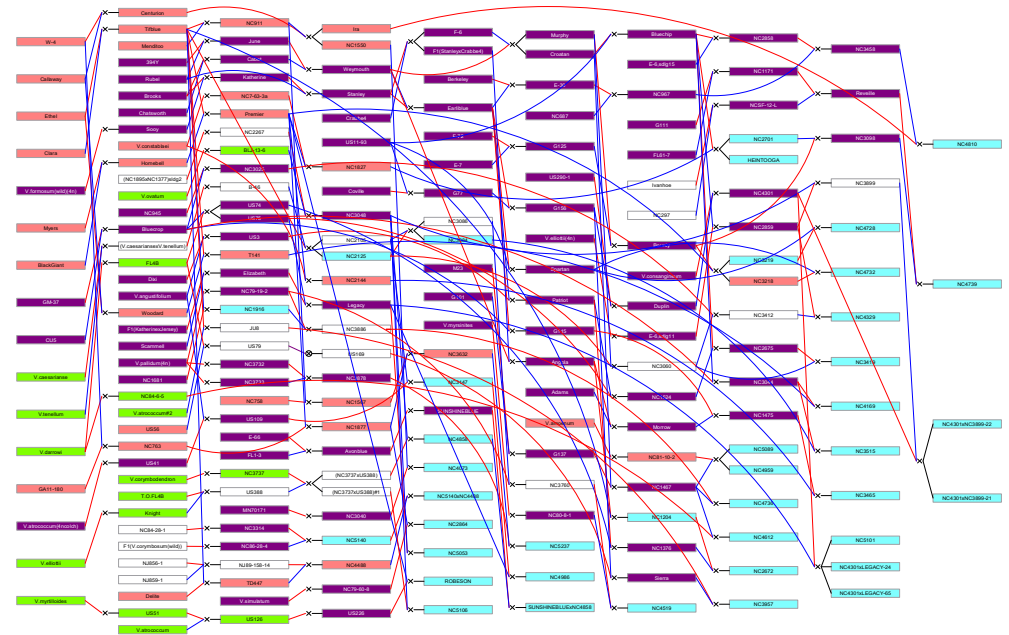
Patent #	Priority date	Publication date	Assignee	Title	Female Parent	Male Parent	Chilling Requirement
USPP20449P2	2008-04-10	2009-11-03	Driscoll Strawberry Associates, Inc.	'DrisBlueOne'	MS07	Jubilee	Low-Chill
USPP20488P2	2008-05-07	2009-11-17	Driscoll Strawberry Associates, Inc.	'DrisBlueTwo'	Magnolia	MC189	Low-Chill
USPP20436P2	2008-04-10	2009-10-20	Driscoll Strawberry Associates, Inc.	'DrisBlueThree'	FL98-11	FL 89-152	Low-Chill
USPP24407P3	2012-09-11	2014-04-29	Driscoll Strawberry Associates, Inc.	'DrisBlueFour'	FL97-26	MS139	Low-Chill
USPP24489P3	2012-09-11	2014-05-27	Driscoll Strawberry Associates, Inc.	'DrisBlueFive'	FL97-16	Windsor	Low-Chill
USPP24569P3	2012-08-10	2014-06-24	Driscoll Strawberry Associates, Inc.	'DrisBlueSix'	196H3	7J301	Low-Chill
USPP24605P3	2012-08-07	2014-07-08	Driscoll Strawberry Associates, Inc.	'DrisBlueseven'	MS122	FL 92-166 N	Low-Chill
USPP24568P3	2012-08-10	2014-06-24	Driscoll Strawberry Associates, Inc.	'DrisBlueEight'	MS315	MS122	Low-Chill
USPP26287P3	2013-10-02	2016-01-05	Driscoll Strawberry Associates, Inc.	'DrisBlueNine'	MS122	G292	High-Chill
USPP26643P3	2013-12-13	2016-04-26	Driscoll Strawberry Associates, Inc.	'DrisBlueTen'	Nui	MS122	High-Chill
USPP26537P3	2013-12-13	2016-03-29	Driscoll Strawberry Associates, Inc.	'DrisBlueEleven'	MS122	G455	High-Chill
USPP26748P3	2013-12-09	2016-05-24	Driscoll Strawberry Associates, Inc.	'DrisBlueTwelve'	Jewel	FL 95-54	Low-Chill
USPP26451P3	2013-12-09	2016-03-08	Driscoll Strawberry Associates, Inc.	'DrisBlueThirteen'	FL 84-40	FL 96-26	Low-Chill
USPP27622P3	2015-02-02	2017-01-31	Driscoll's, Inc.	'DrisBlueFourteen'	G455	MS122	High-Chill
USPP28933P2	2016-07-13	2018-02-06	Driscoll's, Inc.	'DrisBlueFifteen'	MS122	MS6	Low-Chill
USPP31685P2	2018-09-13	2020-04-21	Driscoll's, Inc.	'DrisBlueSixteen'	127D 2	DrisBlueOne	Evergreen
USPP31650P2	2018-09-13	2020-04-14	Driscoll's, Inc.	'DrisBlueSeventeen'	MS122	FL92-166 N	Mid-Chill
USPP31649P2	2018-09-12	2020-04-14	Driscoll's, Inc.	'DrisBlueEighteen'	136D 2	181C 1	Mid-Chill
USPP31698P2	2018-10-16	2020-04-28	Driscoll's, Inc.	'DrisBlueNineteen'	DrisBlueSeven	193C 4	Evergreen
USPP32744P3	2019-03-05	2021-01-12	Driscoll's, Inc.	'DrisBlueTwenty'	G455	MS122	High-Chill
USPP32267P2	2019-12-10	2020-10-06	Driscoll's, Inc.	'DrisBlueTwentyOne'	136D 2	181C 1	Mid-Chill
USPP33066P2	2020-01-23	2021-05-18	Driscoll's, Inc.	'DrisBlueTwentyTwo'	196H 3	7J301	Evergreen
USPP32876P2	2020-02-03	2021-03-09	Driscoll's, Inc.	'DrisBlueTwentyThree'	196H	75J301	Evergreen
USPP34067P2	2021-02-18	2022-03-29	Driscoll's, Inc.	'DrisBlueTwentyFour'	136D 2	8B 4	High-Chill
USPP33718P2	2021-02-18	2021-12-07	Driscoll's, Inc.	'DrisBlueTwentyFive'	90E 2	10E 1	Mid-Chill
USPP34179P2	2021-03-17	2022-05-03	Driscoll's, Inc.	'DrisBlueTwentySix'	196H3	7J301	Evergreen
USPP34316P2	2021-04-14	2022-06-14	Driscoll's, Inc.	'DrisBlueTwentySeven'	53E3	147B2	Evergreen
USPP35156P2	2022-10-06	2023-05-09	Driscoll's, Inc.	'DrisBlueTwentyEight'	DrisBlueTwentyFour	52E 3	Mid-Hill Chill

Duke is still the dominant cultivar in Pacific Northwest and many other places including Europe

USDA in Beltsville, Maryland, 1987



NCSU Blueberry Breeding Beginnings



V. darrowii



<http://www.fnps.org/plants/plant/vaccinium-darrowii>

***V. Elliottii* Champ.**



https://plants.usda.gov/gallery/thumbs/vael_005_tvp.jpg



https://plants.usda.gov/gallery/large/vael_010_lvp.jpg



https://plants.usda.gov/gallery/standard/vael_009_svp.jpg

***V. tenellum* Aiton**

Small black blueberry



https://www.discoverlife.org/IM/I_TQBH/0099/320/Vaccinium_tenellum,I_TQBH9989.jpg



<http://wildflowersearch.org/search?&tsn=23616>



V. pallidum Aiton

Blue Ridge blueberry



<https://wildridgeplants.com/wp-content/uploads/2018/08/Vaccinium-pallidum-Catalog-2018-1-450x600.jpg>



Lawrence S. Gilliam 2004

https://plants.usda.gov/gallery/standard/vapa4_002_shp.jpg

V. angustifolium



Bangordailynews.com

A series of advanced selections from NC State program are ready to get into the market

Advanced Selections	Female Parent	Male Parent	Average Firmness g.mm-1	Max yield g/plant
NC5286	NC4131	NC3104	233.3 ↑	3,336 ↑
NC5282	NC4131	NC3104	247.1	2,326
NC5288	NC4034	NC3104	254.3	1,525
NC5271	NC4034	NC3104	258.4	1,563
NC5299	legacy	O'Neal	233.6	1,408
NC5274	NC4886	NewHanover	226.4	349
NC5311	NC4131	NC3104	201.8 ↓	3,141 ↑
NC5322	NC4034	NC4404	202.7	2,629
NC5315	Reveille	Legacy	196.7	2,505
NC5285	NC4131	NC3104	258.6	1,266
NC5321	NC4122	NC3104	197.5	1,121
NC5316	Reveille	NC4511	200.2	2,822
NC5287	legacy	O'Neal	205.7	1,352
NC5301	NC4034	NC3104	209.0	2,692
NC5317	Reveille	NC4511	201.7 ↓	3,083 ↑
NC5330	NC4131	NC3104	228.6	2,69
NC5313	NC4721	O'Neal	201.5	1,401
NC5310	NC4131	NC3104	193.2 ↓	3,678 ↑
NC5323	NC4034	NC4404	214.9	1649



NC5288 -Early

- Sibling to NC5271 (**NC 4034 x NC 3104**)
- NC5288- more upright, slightly later harvest, easy to tissue culture
- Planted with growers
- In Mech Harvest trials
- Very Early
- Very large
- Very firm
- Very flavorful

NC5300- Early



NC5289 Mid-Season

- Good Size
- Great Flavor
- Small stem scar
- Very good yield



Early Mid-Season NC5303



Mid-Season NC5305



New Release

- **NC3104 / Rowan**

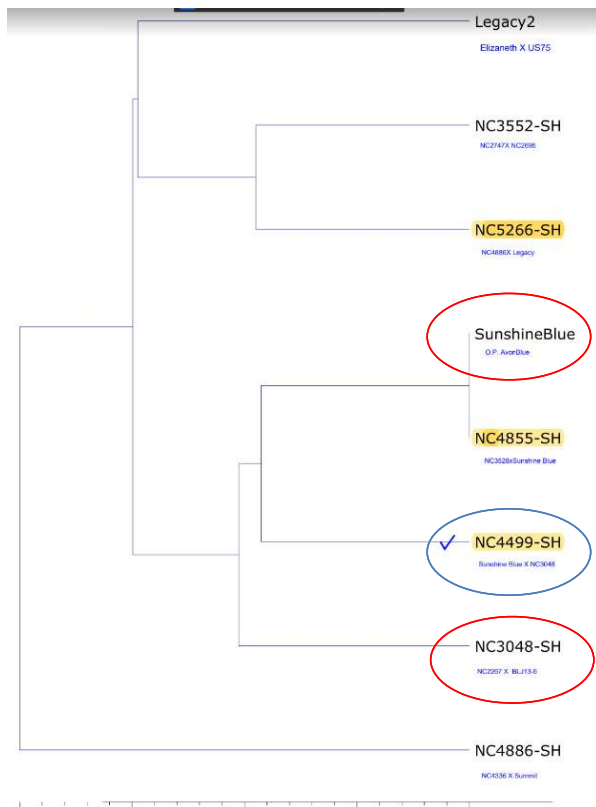
Early, medium-size, high-quality southern HB,
a replacement for New Hanover (sibling)



**New Release
Splendid Blue (NC4499)**



The use of molecular markers for IP protection and patent applications



Splendid Blue (NC4499)



Commercialization



Commercialization



**THINK
AND DO
THE
EXTRAORDINARY**



The Campaign
for NC State

NC STATE