Breeding for better blueberries

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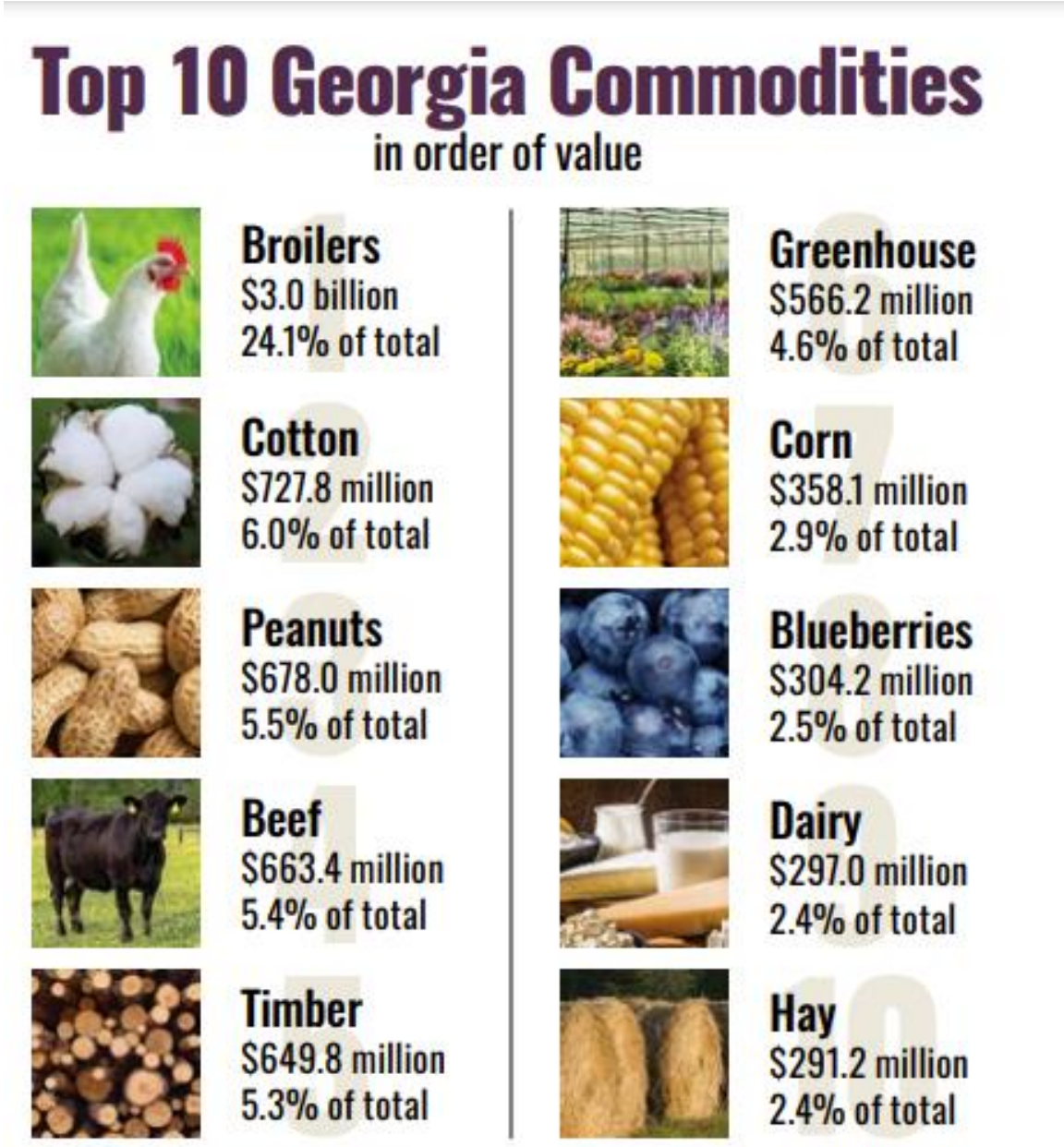
Blueberry: a wonderful healthy fruit

- Flavorful and tasty
- Rich source of polyphenols
  - Anthocyanins
  - Flavanols
  - Pterostilbene
- Benefits to human health
  - Inhibit production of pro-inflammatory molecules
  - Reduce oxidative stress
  - Reduce cellular DNA damage
  - Prevent cancer cell proliferation
  - Alleviate neurodegenerative diseases such as Parkinson's and Alzheimer's diseases
  - Improve memory function of all age
- Consumption of blueberry is recommend as part of a daily healthy eating style

Tran et al. 2021 Biomol.

Economic impact of blueberry in Georgia



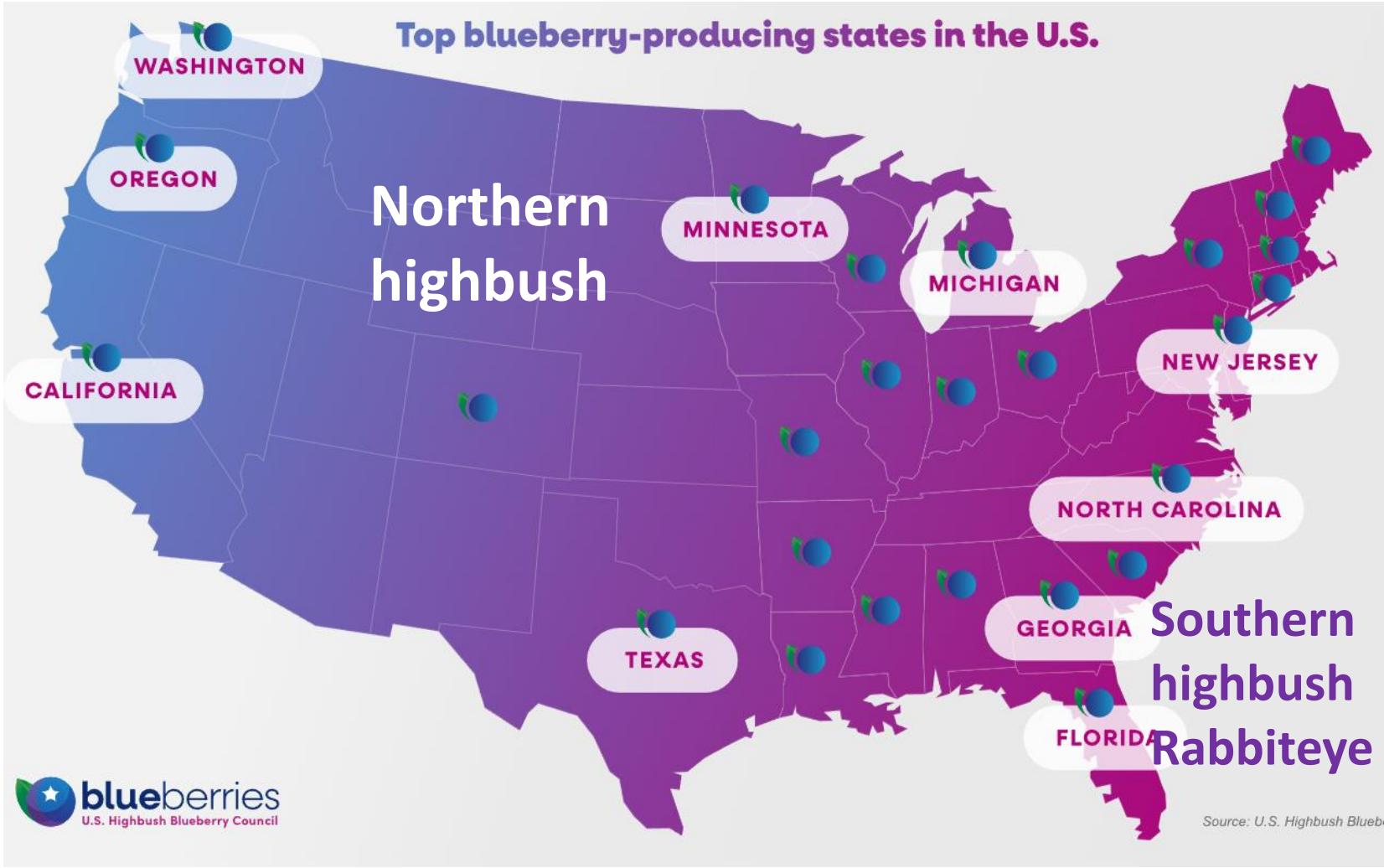
https://caed.uga.edu/content/dam/caes-subsite/caed/publications/ag-snapshots/2022CAEDAgSnapshotsWeb.pdf

Blueberry

- Family Ericaceae
- Genus *Vaccinium*
- Section *Cyanococcus*
  - 9 diploids (2n=2x=24)
  - 12 tetraploids (2n=4x=48)
  - 3 hexaploids (2n=6x=72)

Primary gene pool of cultivated blueberry

- Tetraploids (2*n*=4*x*=48)
  - **Southern highbush** (100-600 chilling hrs)
    - **Ripe early**
    - **Smooth texture**
    - **Large berries**
  - Northern highbush (600-1200 chilling hrs)
  - Lowbush blueberry (600-1200 chilling hrs)
    - Canada and Europe
- Hexaploid (2n=6x=72)
  - **Rabbiteye** (400-600 chilling hrs)
    - **Native to Georgia**
    - **Extreme vigor**
    - **Longevity**
    - **Productivity**
    - **Tolerance to heat**
    - **Low maintenance**



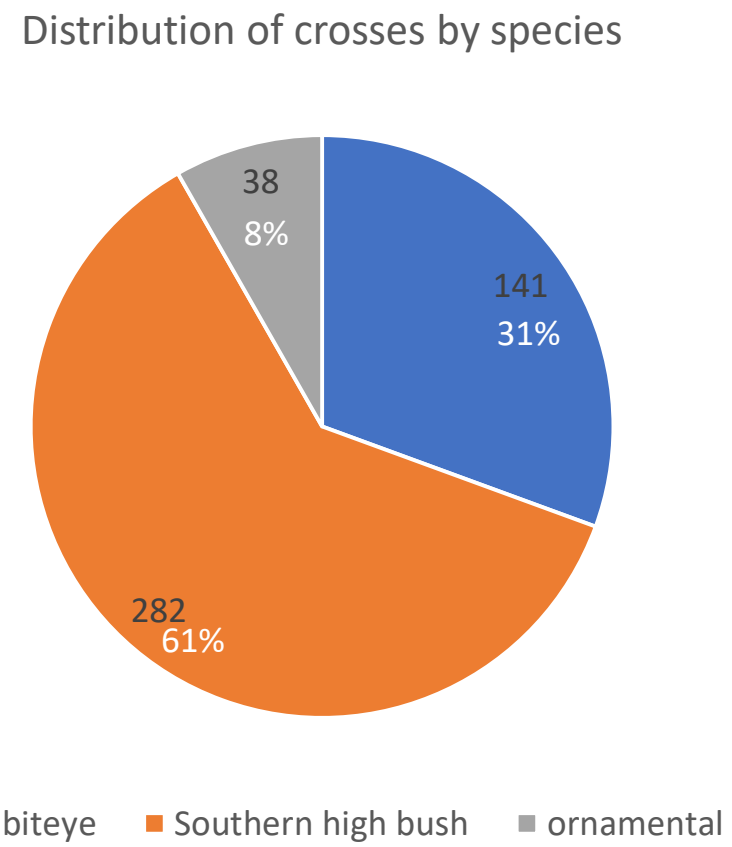
Vision for Blueberry breeding program at UGA

- In order to support the sustainability and productivity of blueberry cultivation in Georgia
  - Continue the selection and advancement of current elite breeding lines.
  - Broaden the genetic base for blueberry breeding by recruiting additional locally adapted diploid and hexaploid species.
  - Introgress vigor and local adaptability from RB to SHB via interspecific hybridization.
  - Produce a diverse set of elite blueberry cultivars adapted to local growing conditions and packaged with desirable genetic traits such as fruit size, color flavor, quality, disease resistance and mechanical harvestability.
  - Engage state-of-art genomic and genetic tools to develop molecular markers and accelerate breeding cycles.

On-going research/breeding activities……

Existing breeding lines

- Consolidated pedigree entries of 3,470 selection in UGA breeding program dated back to 1950; no inter-specifics



Germination of new crossing families

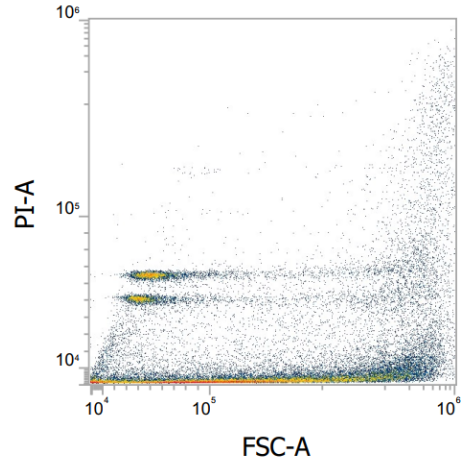
- Germinated 17 crossing families
- transplanted 2,500 seedlings to the nursery
- Transplant to the Alapaha research farm in April, 24

New crosses made in 2023

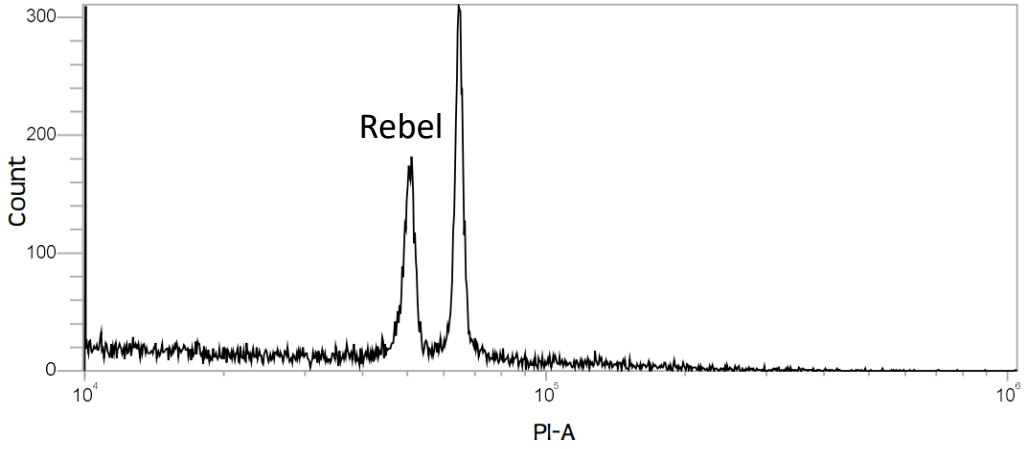
Species	combinations	ploidy level	Crossing pairs	pollination #	Crossing pair%	Pollination %
Intraspcific	RE x RE	(6x) x (6x)	15	1022	72%	55%
	SHB x SHB	(4x) x (4x)	32	1885		
Interspecific	RE x SHB	(6x) x (4x)	3	500	18%	45%
	SHB x RE	(4x) x (6x)	3	562		
	SHB x Fuscatum	(4x) x (2x)	6	661		
	SHB x Elliottii	(4x) x (2x)	6	675		
		Total	65	5305		

Over 5000 new hybrid seedlings were germinated in Tifton Campus from these crosses

Confirmation of Pentaploid hybrids



C31.F1.8=
TH-2944 x
Krewer



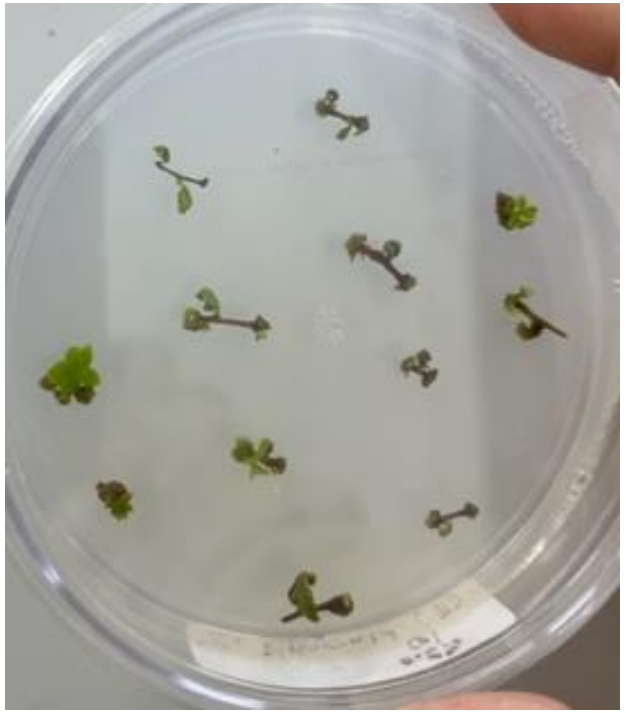
Blueberry tissue culture initiation

- Micro-propagate Rabbiteye selections to facilitate release
- Initiate diploid tissue culture for ploidy induction

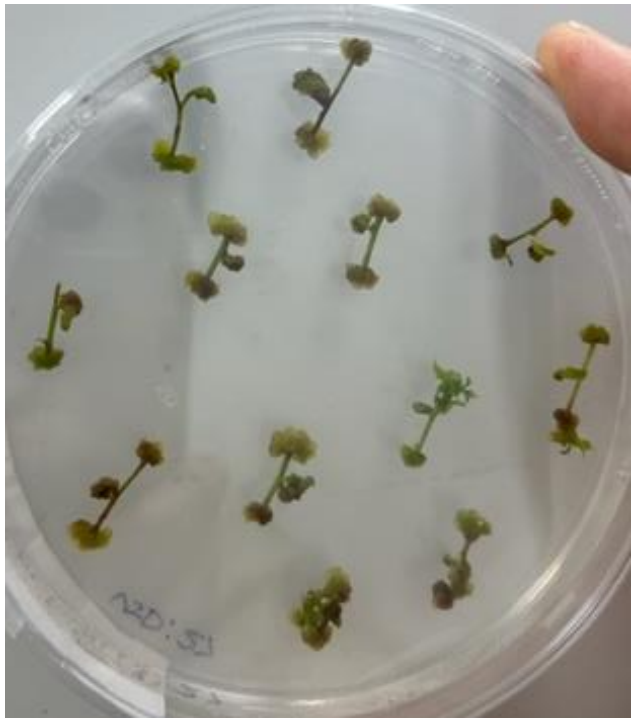
Rabbiteye selection

V. Fuscatum (diploid)

Colchicine treatment for ploidy induction



Emerald



Rebel

Tifton Nursery

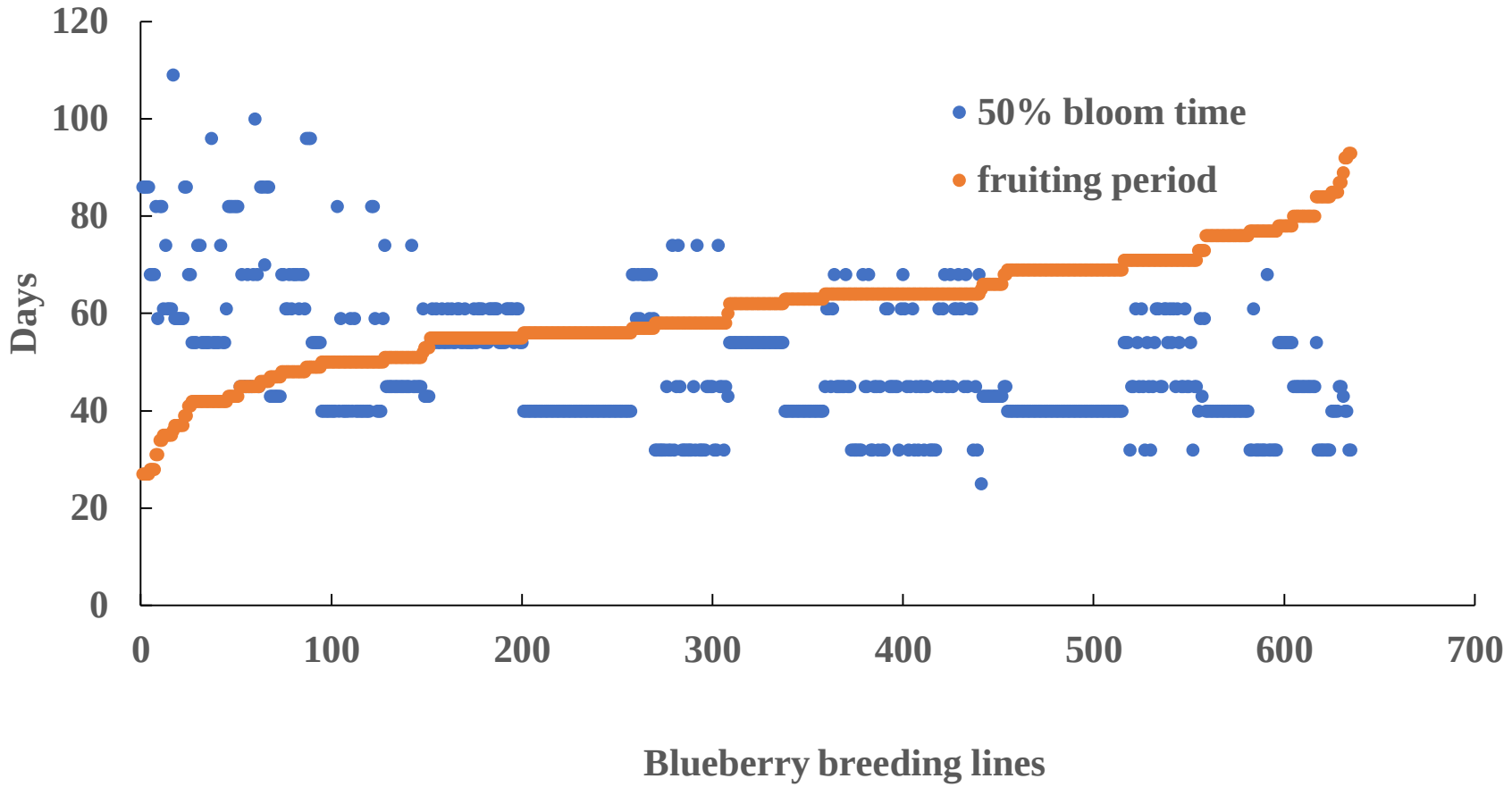
	Plant #
Total plants	1215
RE selections	199
SHB selections	990
cultivars	23

Shade house for cuttings from new selections made in 2023

Alapaha farm breeding lines for phenological data collection starting on Dec. 2022

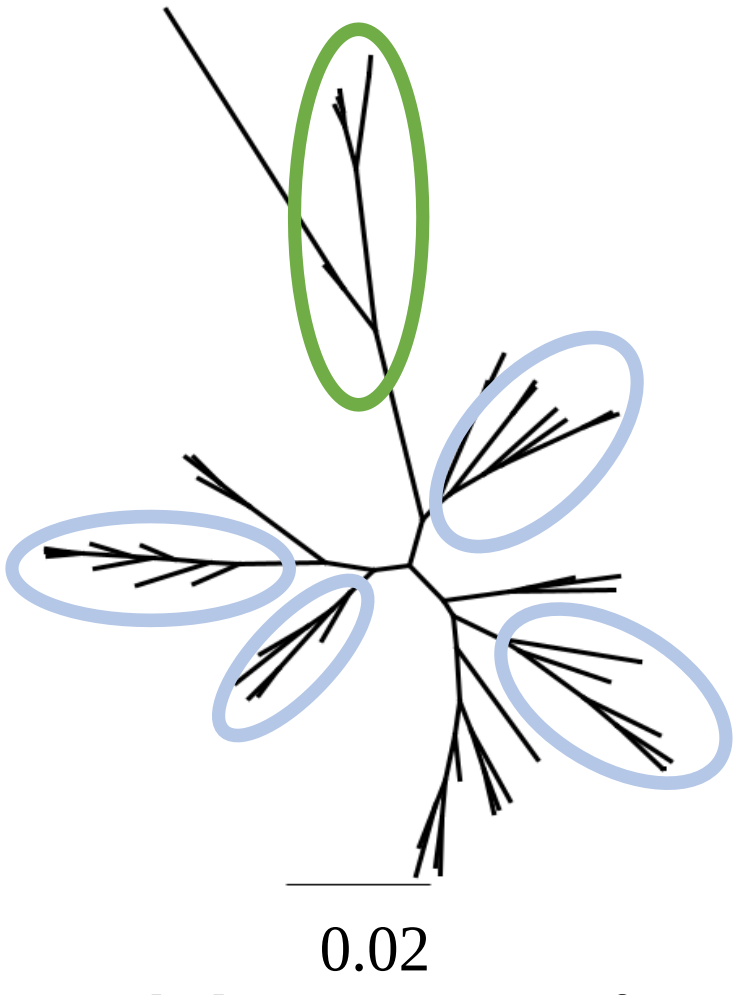
- Total number of plots: 1,425
- Bushes per plot: 5 to 10
- Planting date: 2017 to 2020; 2 to 5 year-old bushes
- Nonredundant line number: 1,242
  - Selections and advanced selections
- Nonredundant crosses: 183
- Unique parents: 132

Distribution of blooming time and fruiting period of 500 selections at Alapaha farm

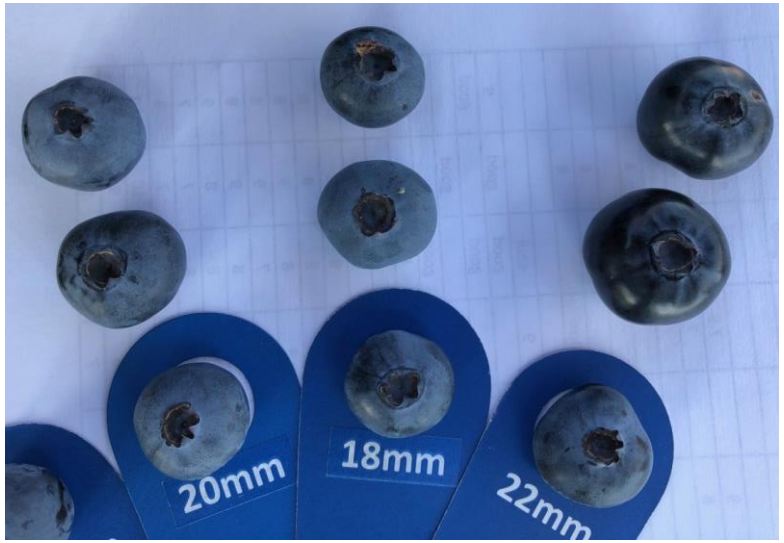


SNP marker discovery and blueberry phylogenetic analysis

- Collaboration with Dr. Josh Clevenger, Hudson Alpha Institute of Biotechnology
- Whole genome sequencing Skim-seq
- 51 blueberry genotypes
- Average depth per sample: 3x
- Total SNPs: 1.5 M
- Markers for phylogenetic analysis: 70,000

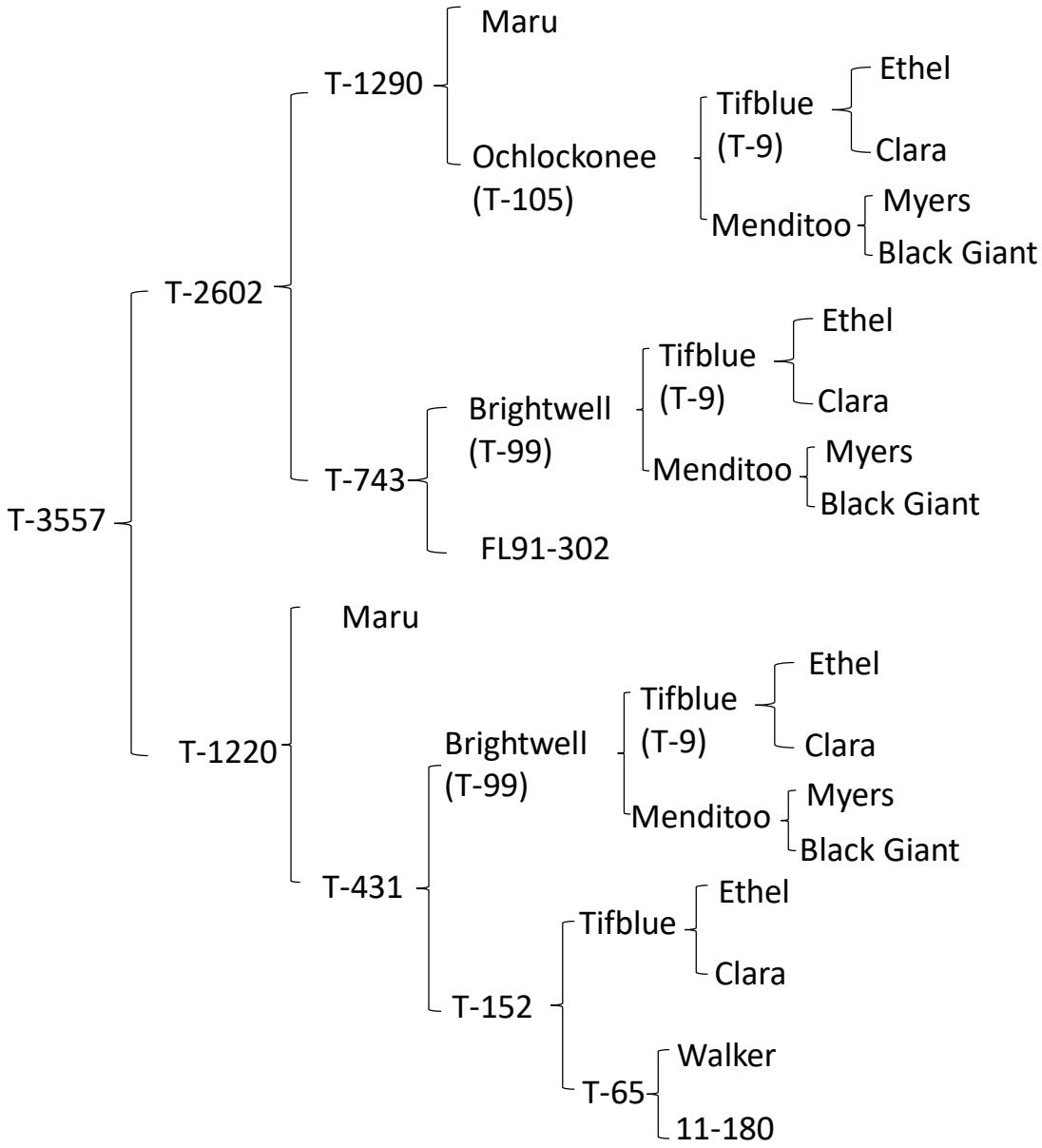


Breeding line selection: TH-1488 with jumbo fruits



T-3075: 26 mm champion in size

T-3557=T-2062 x T-1220



Selected
R12.20.2

NeSmith Professorship in Blueberry Breeding

- UGA blueberry breeder, Dr. NeSmith retired in 2019 after 30 years of distinguished career
- This endowed professorship will provide funding in perpetuity for blueberry breeding and cultivar development and student training

Give online https://t.uga.edu/9b1

Mail check (payable to UGA Foundation to:
UGA CAES
117 Four Towers
Athens, GA 30602
include "NeSmith Professorship" in memo

Thank you!