# Carolina Strongback: A Fusarium wilt and Root knot Nematode resistant Citrullus amarus rootstock for watermelon production

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# Fusarium wilt is one of the most devastating diseases of watermelon



- Causal agent: Fusarium oxysporum f. sp. niveum (Fon)
- Pathogenic races of Fon: 0, 1, 2, and 3
- Fon race 1 resistance has been incorporated into many cultivars
- There are no edible cultivars with resistance to Fon races 2 or 3

# Root knot nematode (RKN) (Meloydogyne spp.)

- RKN is the most destructive nematode of watermelon in the U.S.
- Cultivated watermelon (*Citrullus lanatus*) is susceptible to RKN.
- Commercial bottle gourd, pumpkin, and Interspecific hybrid rootstocks are susceptible to RKN

### Reniform nematode (Rotylenchulus reniformis)

- Reniform nematode causes damage on numerous cucurbits
- Found in tropical & subtropical areas
- Rio Grande Valley in Texas and throughout the southeastern U.S.
- Can reduce fruit size and lower sucrose levels

### Fusarium wilt and plant parasitic nematodes

- Fusarium oxysporum f. sp. niveum can remain viable in soil for more than 30 years.
- Most growing areas in the southeastern US have issues with southern root knot nematode.
- The loss of methyl bromide as an affordable soil fumigant has required a search for alternative control options.

# Soilborne disease and pest control options:

- Chemicals
- Biological control
- Plant host resistance
- Grafting

#### WATERMELON

- Citrullus lanatus- Cultivated watermelon
  - Sweet (High Brix)
  - Mostly red flesh
  - Mostly large fruit
  - Often susceptible to pathogens and pests

#### Citrullus amarus- Citron melon

- Not sweet (often bitter)
- Mostly green or white
- Resistance to many pathogens and pests

#### **ROOT KNOT NEMATODE**

#### Meloidogyne incognita

ROOT STOCK ID	TYPE	REACTION			
Macis	Lagenaria	Susceptible			
FR Strong	Lagenaria	Susceptible			
WMXP 3945	Lagenaria	Susceptible			
Emphasis	Lagenaria	Susceptible			
Geo Sprint	Lagenaria	Susceptible			
Ojakkyo	Citrullus amarus	Least Susceptible			
Shintosa Camel	Inter-specific Hybrid	Very Susceptible			
WR-15006	Inter-specific Hybrid	Very Susceptible			
Carnivor	Inter-specific Hybrid	Very Susceptible			
WMXP 3943	Inter-specific Hybrid	Very Susceptible			
Strong Tosa	Inter-specific Hybrid	Very Susceptible			
Gladiator	Inter-specific Hybrid	Very Susceptible			
Iron Cap	Inter-specific Hybrid	Very Susceptible			

#### Goals for a new rootstock

- Reduction in rootstock costs.
- Easy and compatible grafting characteristics.
- Fusarium wilt resistance.
- Nematode resistance.
- High yields.



USVL246-FR<sup>2</sup>

USVL252-FR<sup>2</sup>







#### **Excellent grafting qualities:**

- Uniform seedling growth
- Performs well under LED lights
- Thick hypocotyl
- 90-100% grafting "takes"
- Adapts well to newest grafting methods.





- Citrullus amarus
- Developed, PVP and Released, USDA-ARS
   & Clemson University
- High Levels of Tolerance to Fusarium oxysporum f. sp. niveum races 1 & 2
- High Levels of Tolerance to Root Knot & Reniform Nematode
- High Levels of Tolerance to Bacterial Fruit Blotch
- Produces an Abundance of Seed
- Open pollinated



# **YIELD**

			Average Fruit						
Rootstock	Fruit Number	Fruit Weight	Wt.	% Fruit Count					
<u>Treatment</u>	<u>per Plot</u>	<u>lb/Plot</u>	<u>lb/Plot</u>	<u>Under 9 Lb</u>	60 Count	45 Count	36 Count	30 Count	
Non-Grafted	<b>21.00</b> a	301.00 a	14.33 a	9.52 a	42.86 b	23.81 b	19.05 b	4.76 b	
Carnivor	<b>21.00</b> a	273.15 b	11.09 b	4.76 b	57.14 b	33.33 a	0.00 с	4.76 b	
Strong Tosa	<b>22.00</b> a	291.71 ab	13.26 a	4.55 b	22.73 c	8.09 c	59.09 a	3.57 b	
Macis	14.00 b	137.30 с	9.81 b	4.61 b	70.94 a	24.45 b	0.00 с	0.00 b	
Emphasis	15.00 b	151.41 c	10.09 b	3.98 b	68.21 a	23.82 b	3.99 с	0.00 b	
Carolina Strongback	23.00 a	380.30 a	16.53 a	0.00 c	26.09 c	34.78 a	17.39 b	21.74 a	

# **INTERNAL FRUIT QUALITY**

Treatment	Cut Length (cm)	Cut Width (cm)	Total Soluble Solids (Heart)	pH (Heart)	Heart Firmness			Locule Firmness		
Non-grafted	26.88	22.75	11.53	5.96	3.32	2.27	2.62	1.82	1.53	1.69
Carnivor	25.31	21.36	11.39	5.76	4.72	4.91	4.58	2.08	2.20	2.17
Strong Tosa	24.08	20.83	10.87	5.81	4.44	4.30	4.19	1.90	1.93	2.01
Emphasis	25.72	22.00	11.32	5.91	5.61	4.52	4.94	3.49	3.85	3.90
Macis	24.42	20.15	10.57	5.57	6.02	6.08	6.66	2.77	2.28	2.63
Carolina Strongback	25.20	21.63	11.77	5.89	4.24	4.53	4.93	2.95	1.94	2.92



# Carnivor and Carolina Strongback in nematode infested field



Triploid grafted to Carnivor Rootstock



Triploid grafted to Carolina Strongback Rootstock

# Carolina Strongback: Cucumber (Cucumis sativus)

- Preliminary study (2020) on use of Carolina Strongback for greenhouse cucumber production is promising.
- Yields were much heavier for grafted verses non-grafted (more than 2-fold)
- Fruit produced ten days earlier on rootstocks and produced longer.



# **Carolina Strongback: Issues**

 Seven to ten day lag in fruit set compared to non-grafted

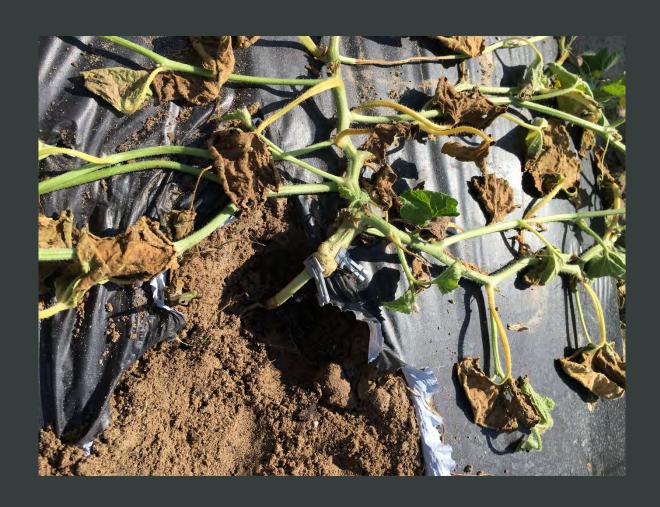
Possible causes:

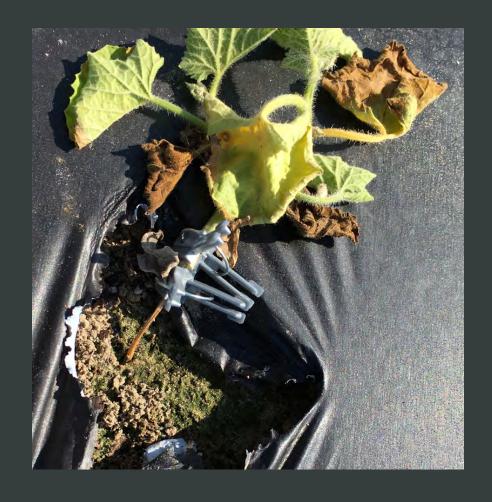
- Too vigorous vine growth
- Needs more cold soil tolerance

### **Carolina Strongback: Issues**

- Does not work with Cantaloupe (Cucumis melo)
  - Graft incompatability?
  - Genetic?
  - Physical issues?

# Carolina Strongback: Cantaloupe failure





#### **Future Citroides Rootstocks**

• Six (USVL246-FR2 x USVL114) RILs.

High tolerance to *Fon* race 1 & 2
High level of resistance to Root Knot nematode

- RILS performed well in grafting study.
- Made reciprocal F<sub>1</sub> hybrids with Carolina Strongback.
- Field testing this season in South Carolina.



# Thank you!

