

Root Growth Morphology of Container Loblolly Pine

Tom Starkey
Southern Forest Nursery
Management Cooperative
Auburn University
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Root growth & container observations from a grower perspective

- Different containers capture root mass quicker than others.
- Seedlings from some containers are more difficult to extract than from other containers.
- Some containers have low root growth (“dead zones”) in middle of individual cavities (Loblolly).
- Bottom drainage hole size differs between containers.

Root growth & container observations from a grower perspective

- Controversy abounds as to the “best” container to use. Decisions are being made by State/Federal organizations that for the most part are not based upon research but rather marketing schemes – *“The squeaky wheel gets the grease”*.

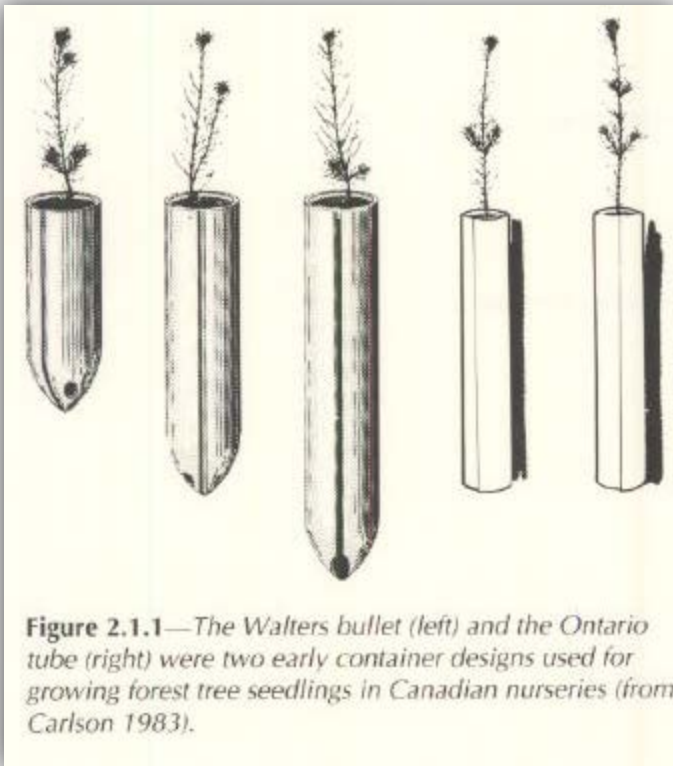
The squeaky wheel
gets the grease but
it's also the first
one to be replaced.

Many different containers have been used



Figure 2.1.2—Many different container designs have been tested in forest nurseries over the past 25 years, and a wide variety of brands and sizes is currently available (courtesy of Eric Stuewe).

Container production has changed in the last 40 years



1st Attempt - Consolidate

IPL110

Individual cells
consolidated
into a single
container

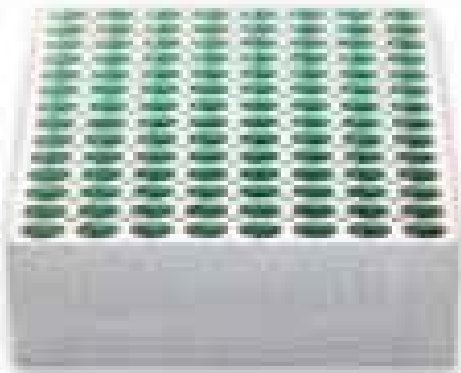
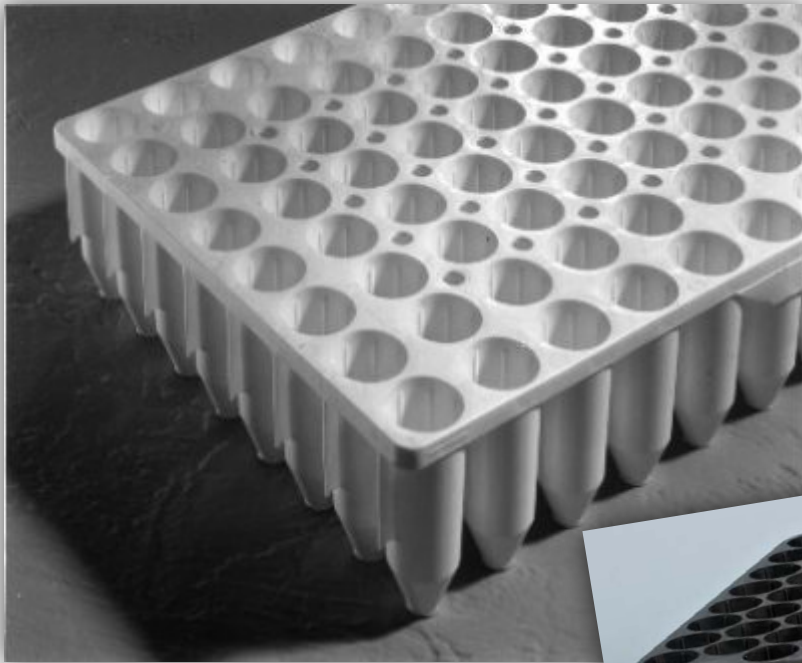


V-93



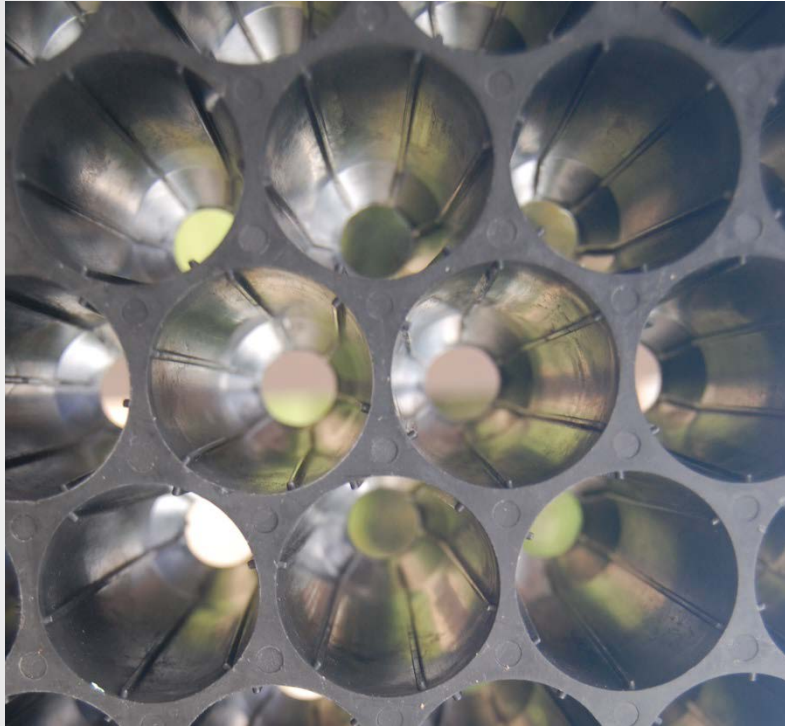
2nd Attempt - More Consolidation

Small trays were consolidated into larger containers to minimize handling & reduce cost



IPL110 = FT135
V93 = 120S and 120L

As consolidation occurred, relatively few changes were made to design of the container



First major change from basic consolidation

IFCO 128

- Square cell configuration on top
- Large bottom drainage hole
- Multiple root pruning holes on side of each cell
- Internal ribs direct roots to holes



Root Pruning Holes & Ribs



Study outline

- **Question to answer:** Do the different designs of containers used in the southern US have different root morphology characteristics?
- This could have implications for reported seedling toppling in the field
- Containers used:
 1. Copperblock 415B → Styrofoam block
 2. IFCO 128
 3. GA 6"
 4. Stuewe FT 135 Hard Plastic

Container Specifications

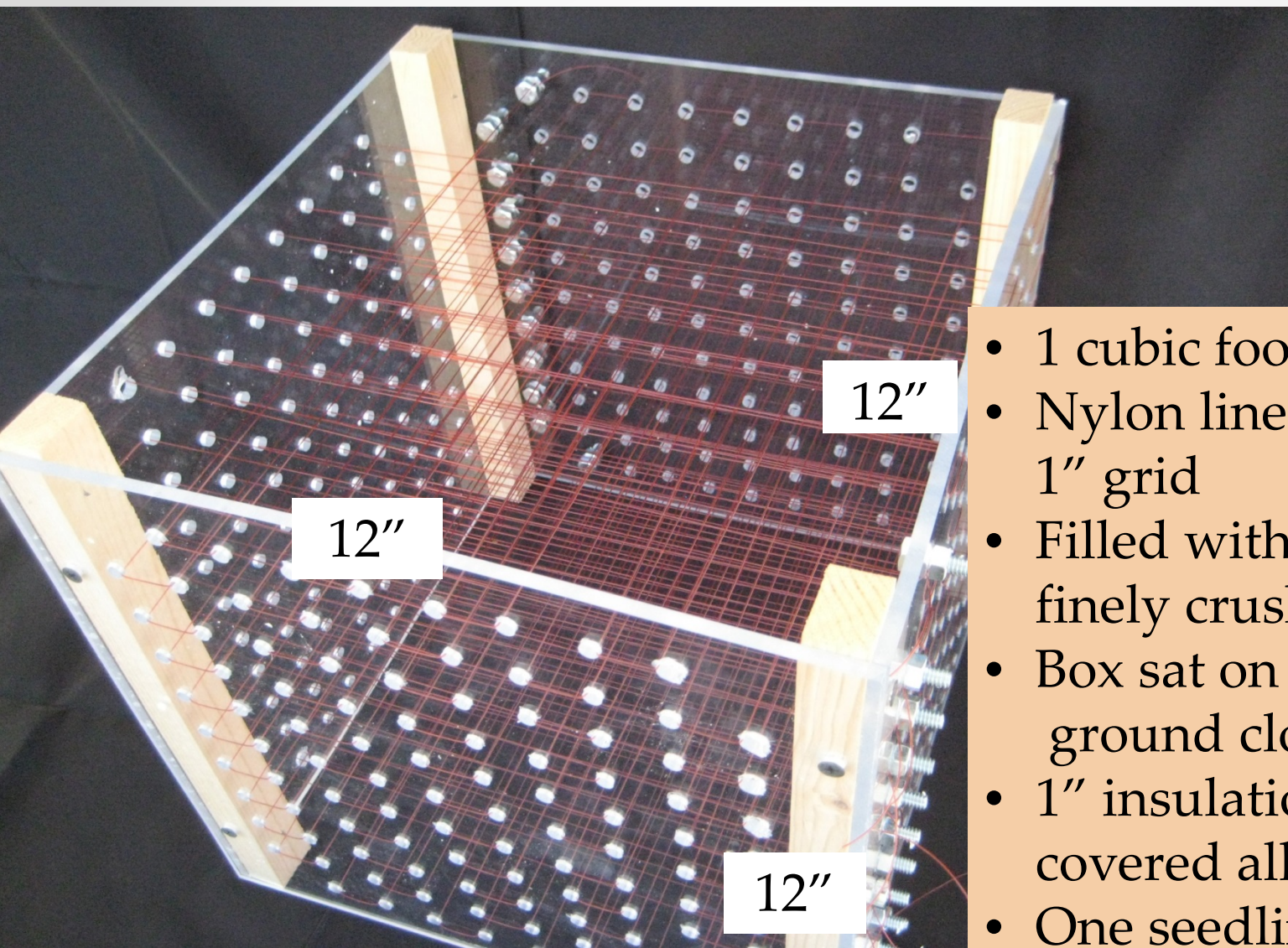
	Copperblock 415B	IFCO 128	GA 6"	Stuewe FT135
Seedling/sq foot	49.4	51.7	50	54
Cavity Diameter (in)	1.4	1.5	1.4	1.5
Cavity Length (in)	5.9	4.7	6	5
Cavity Volume (ml)	108	110	100	113
Cavities /block	115	128	112	135
Root pruning	Copper treated	Yes - holes	Yes -holes	no
# root pruning holes	0	2 levels /4 each level	1 level /3 holes	0
Location of holes	0	2", 3.7" (from top)	3.25" (from top)	0

Study outline

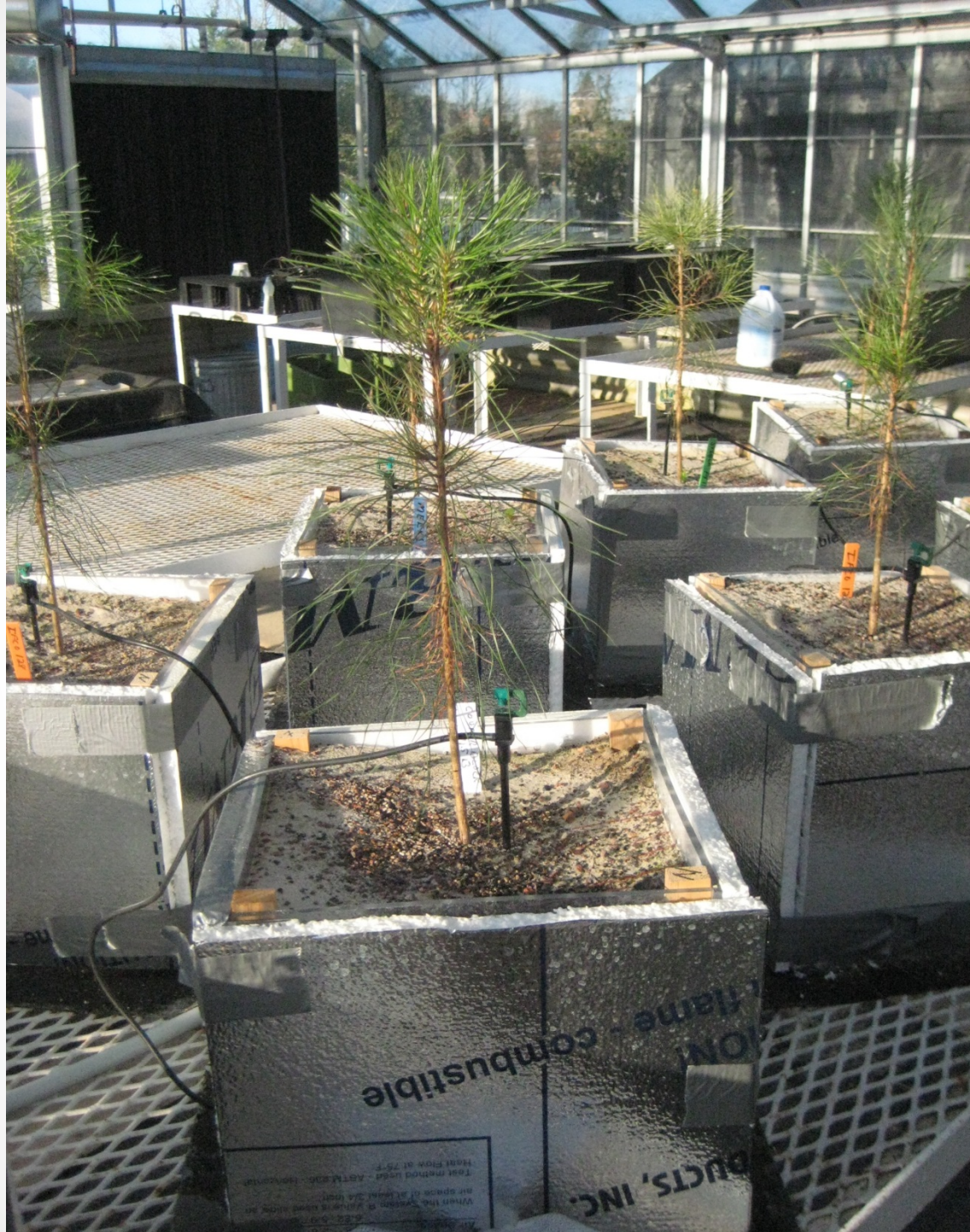
- **This study does not address survivability of containers on outplanting.**

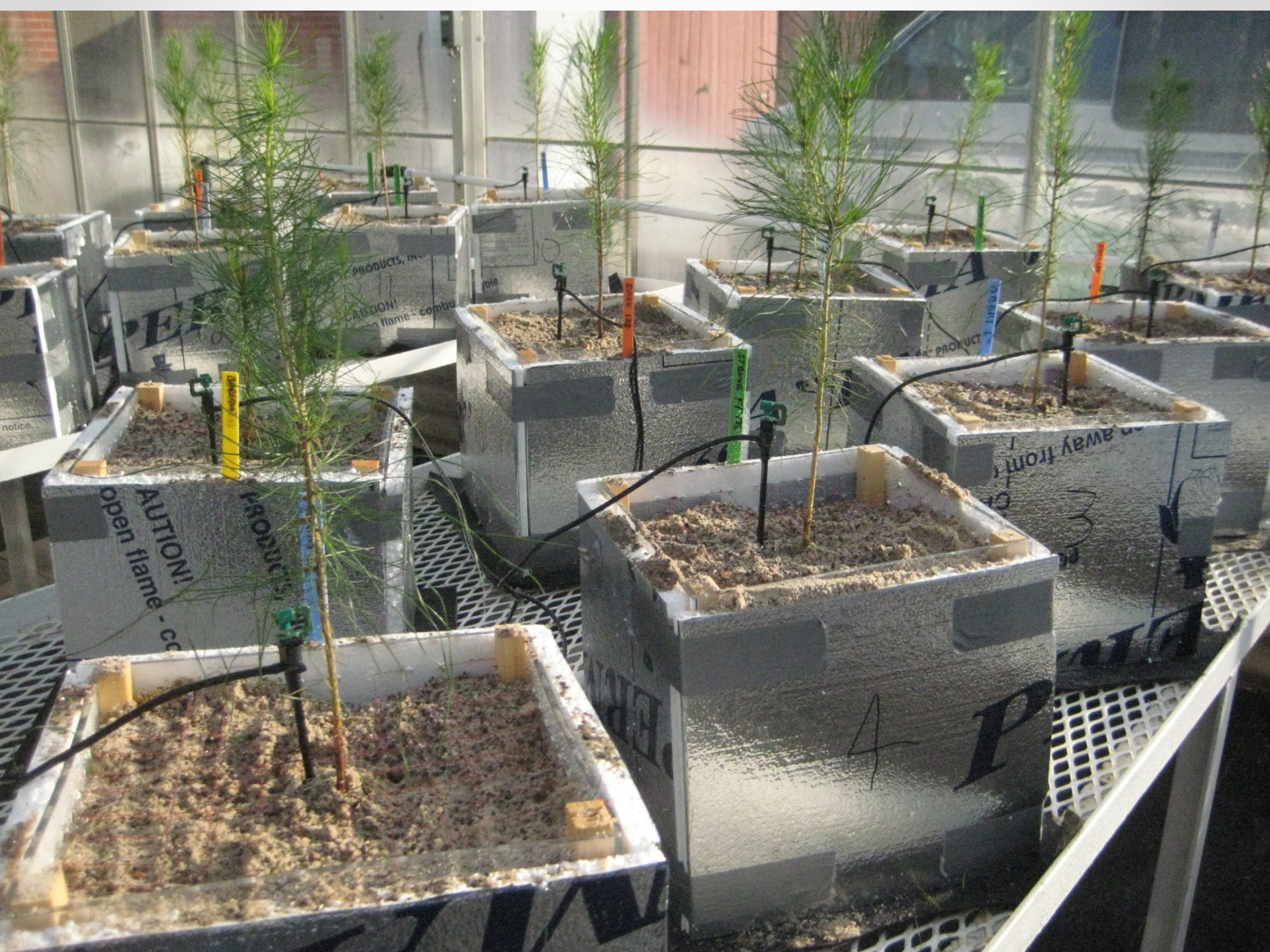
Study outline

- Seeds of 7-56 loblolly sown in each container on April 1, 2013.
- Same media and growing conditions used for all trays.
- Nov 1 , 2013 1 seedling from each container set placed in box and filled with sand mix. Replicated 4 times (Bareroot 2 times).
- April 1, 2014 boxes emptied and roots counted and weighed. (5 months in box)



- 1 cubic foot
- Nylon line strung on 1" grid
- Filled with sand, finely crushed brick
- Box sat on horticultural ground cloth
- 1" insulation sheet covered all sides
- One seedling planted in center of each box
- Irrigated and fertilized as needed

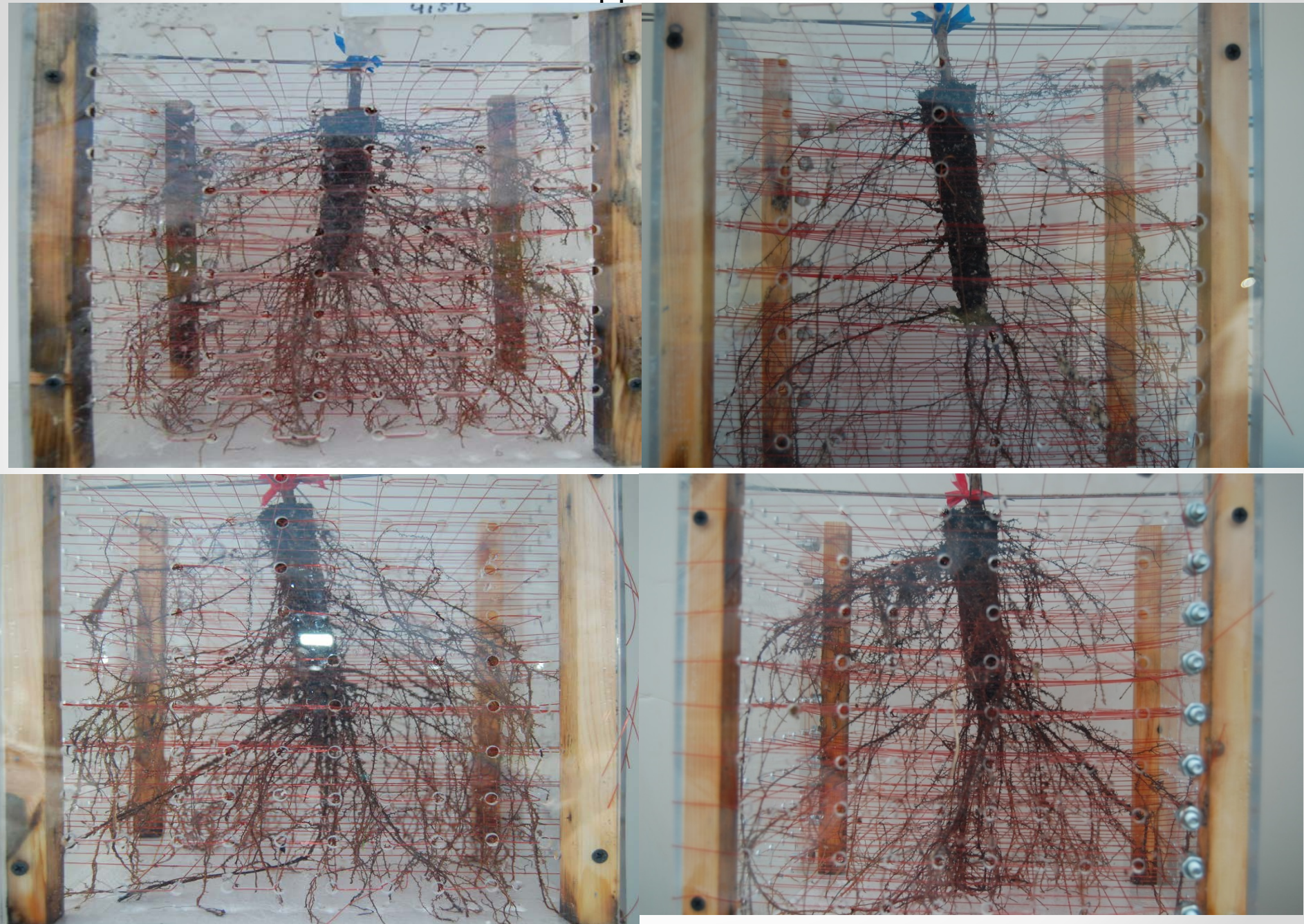




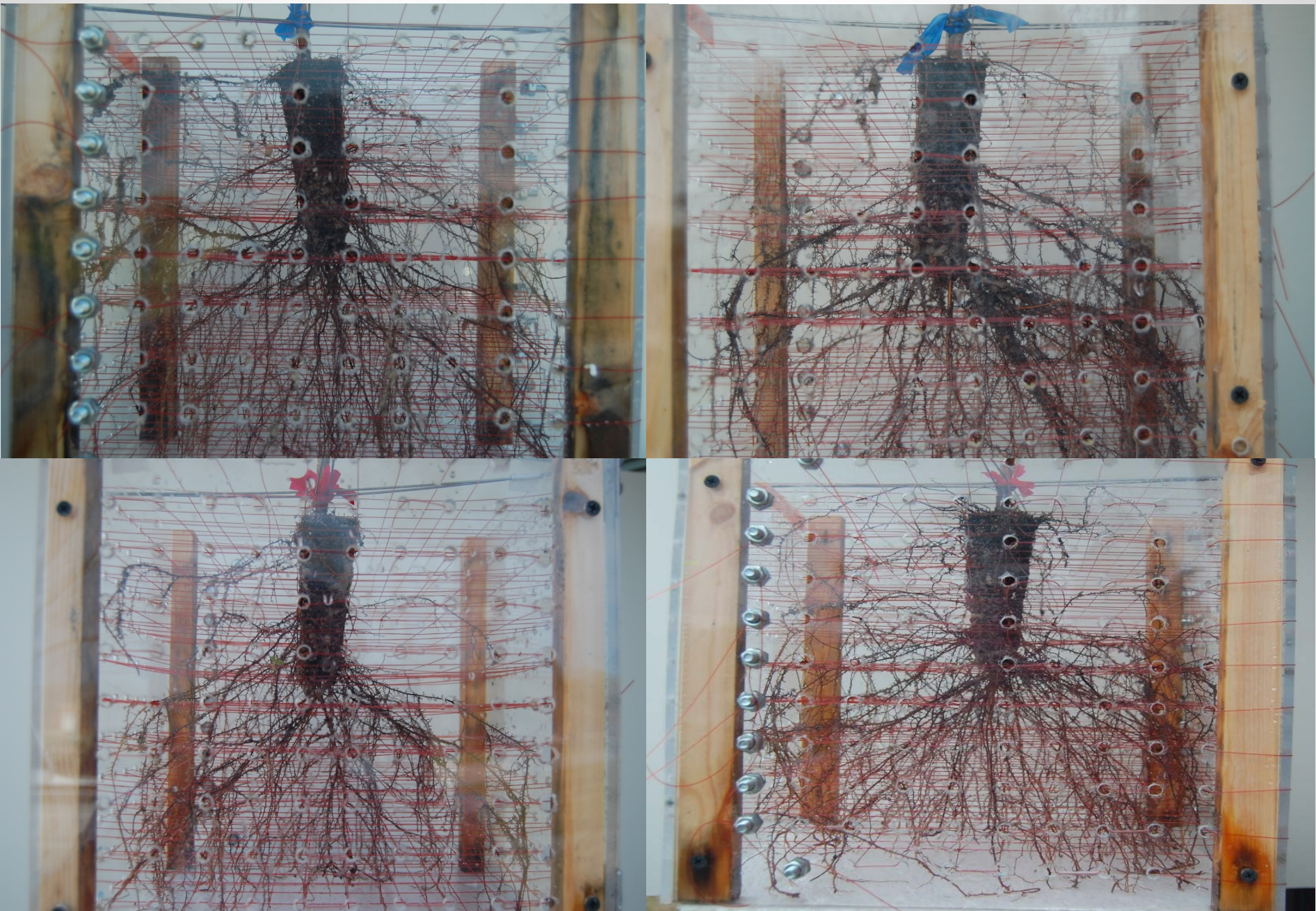
Data Collected

- Roots $> \frac{1}{2}$ " were counted in 4 quadrant (N to E, E to S, S to W, W to N) for each 1" horizontal plane, and then the number of roots coming directly out the bottom of the plug.
- All roots within each 1" horizontal plane were grouped together, dried and weighed.
- Data analyzed using SAS and JMP

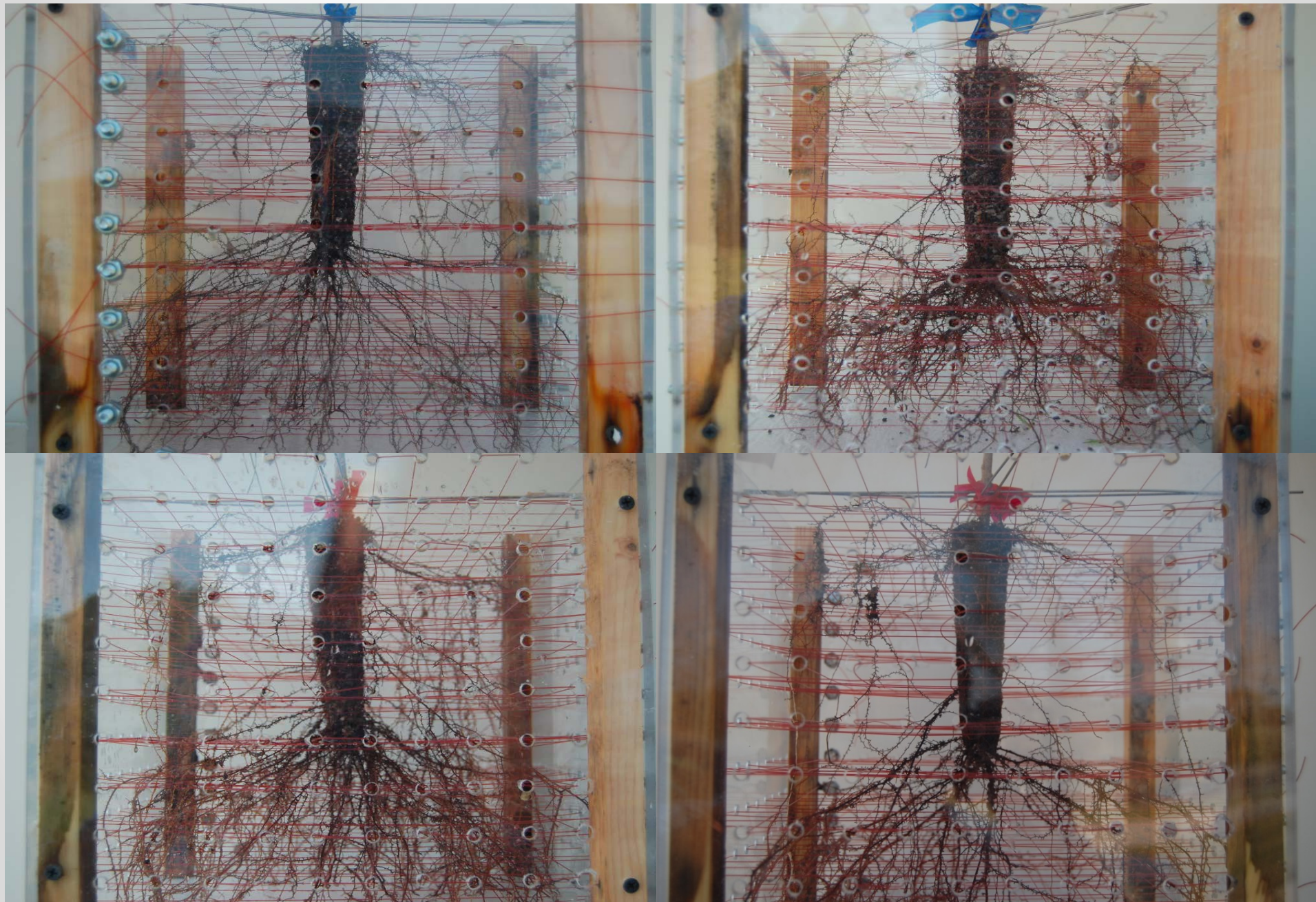
Copperblock 415B



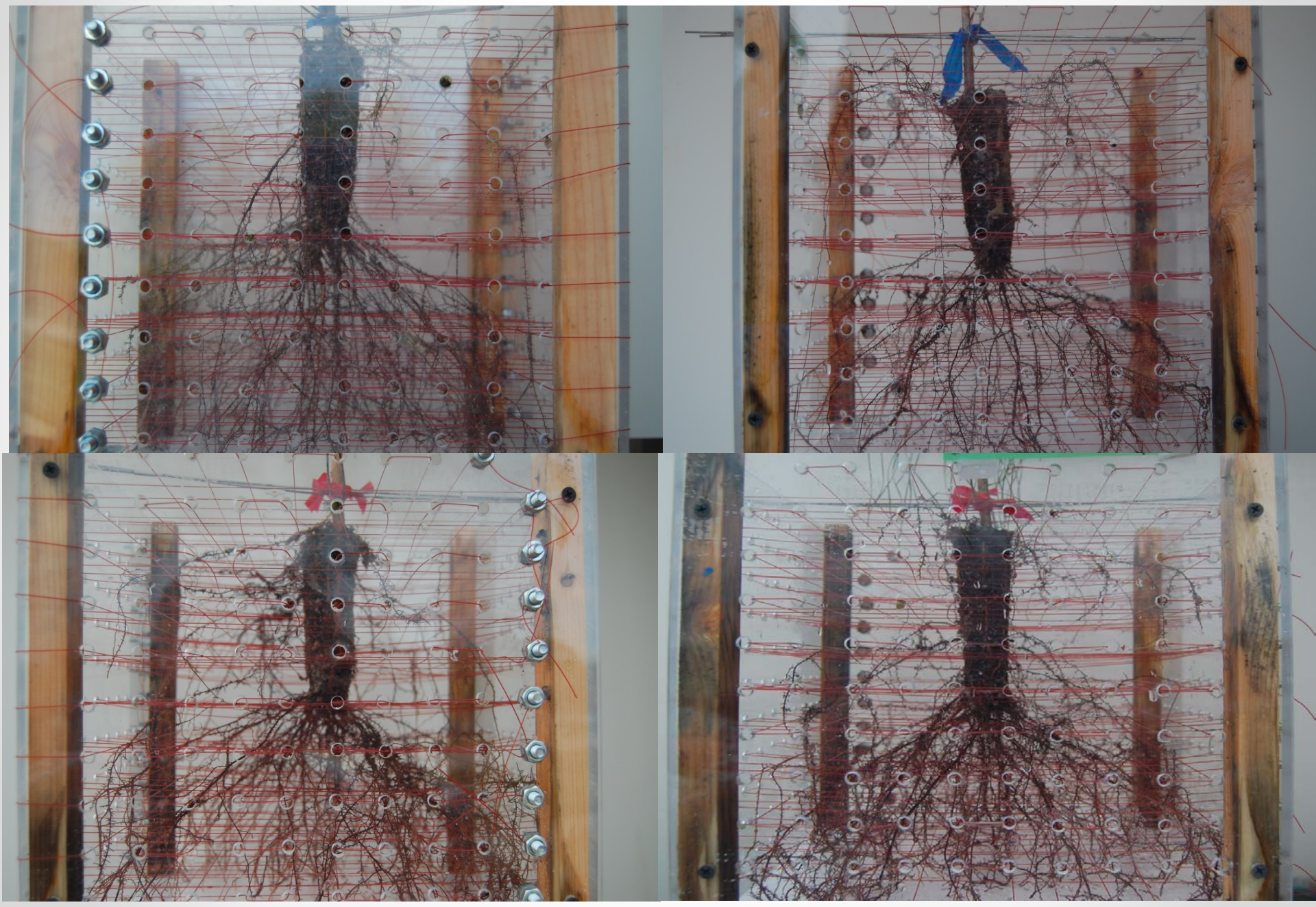
IFCO128



GA 6"



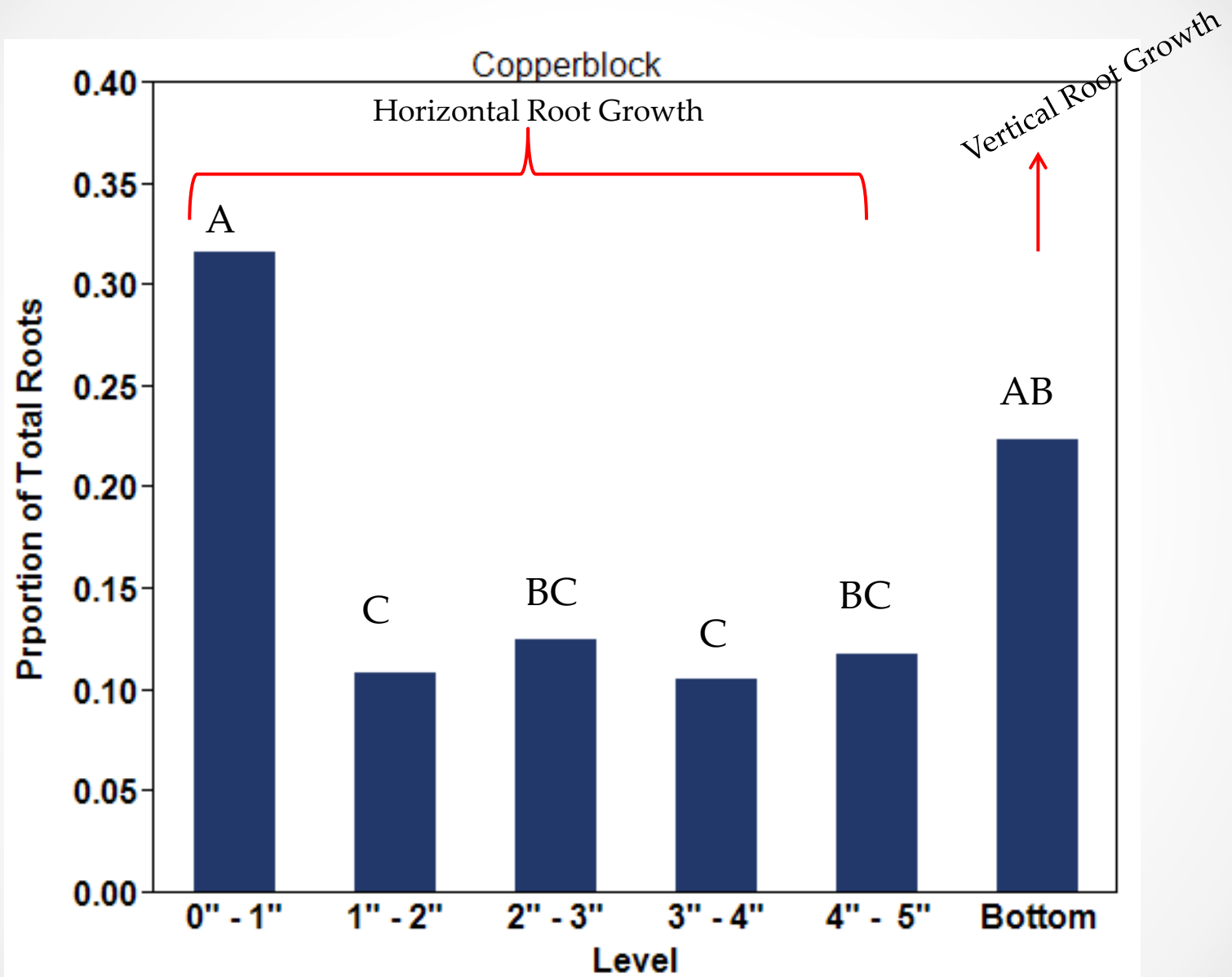
Steuwe FT135

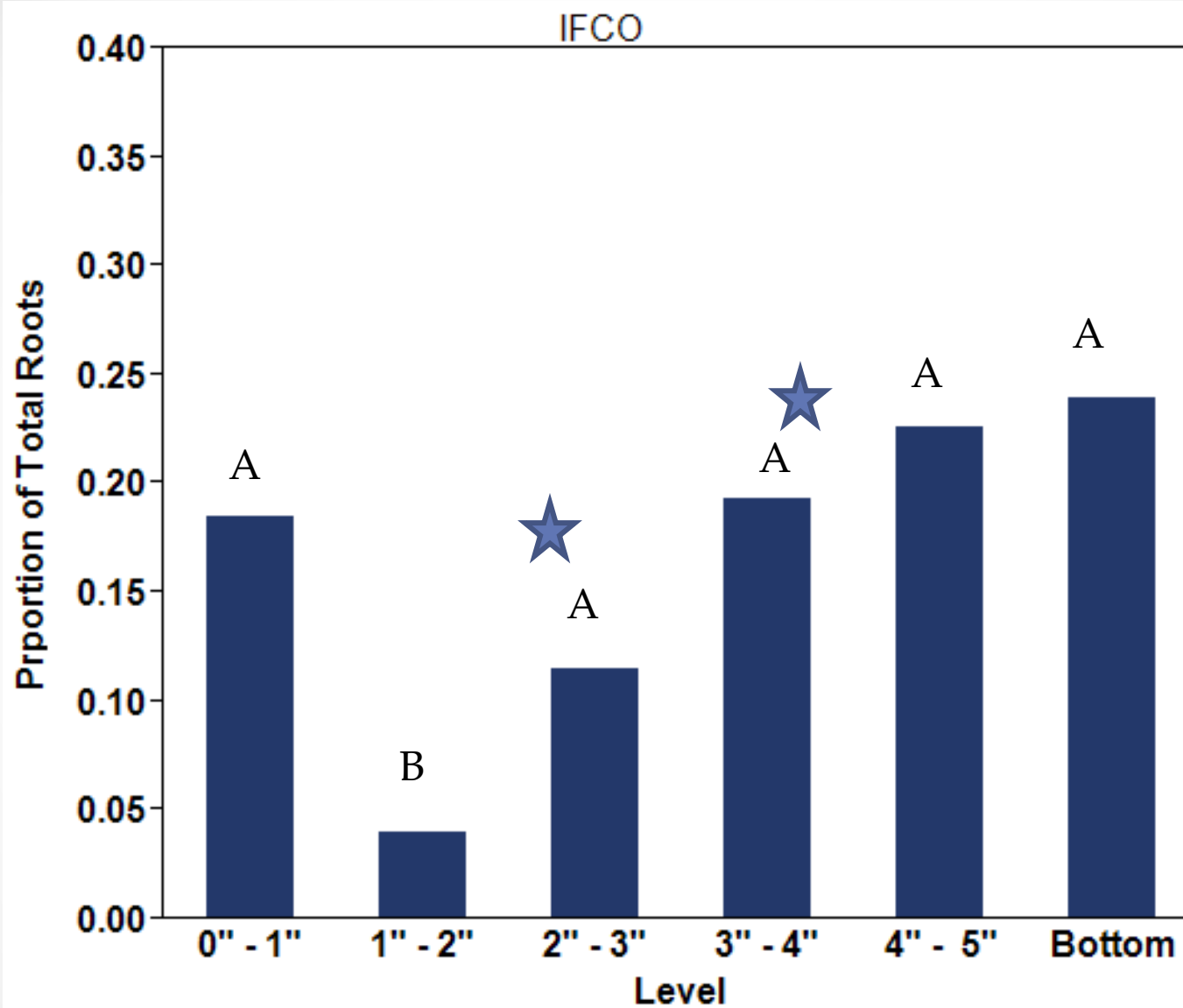


Average number of roots and root weight (plus taproot) after 5 months

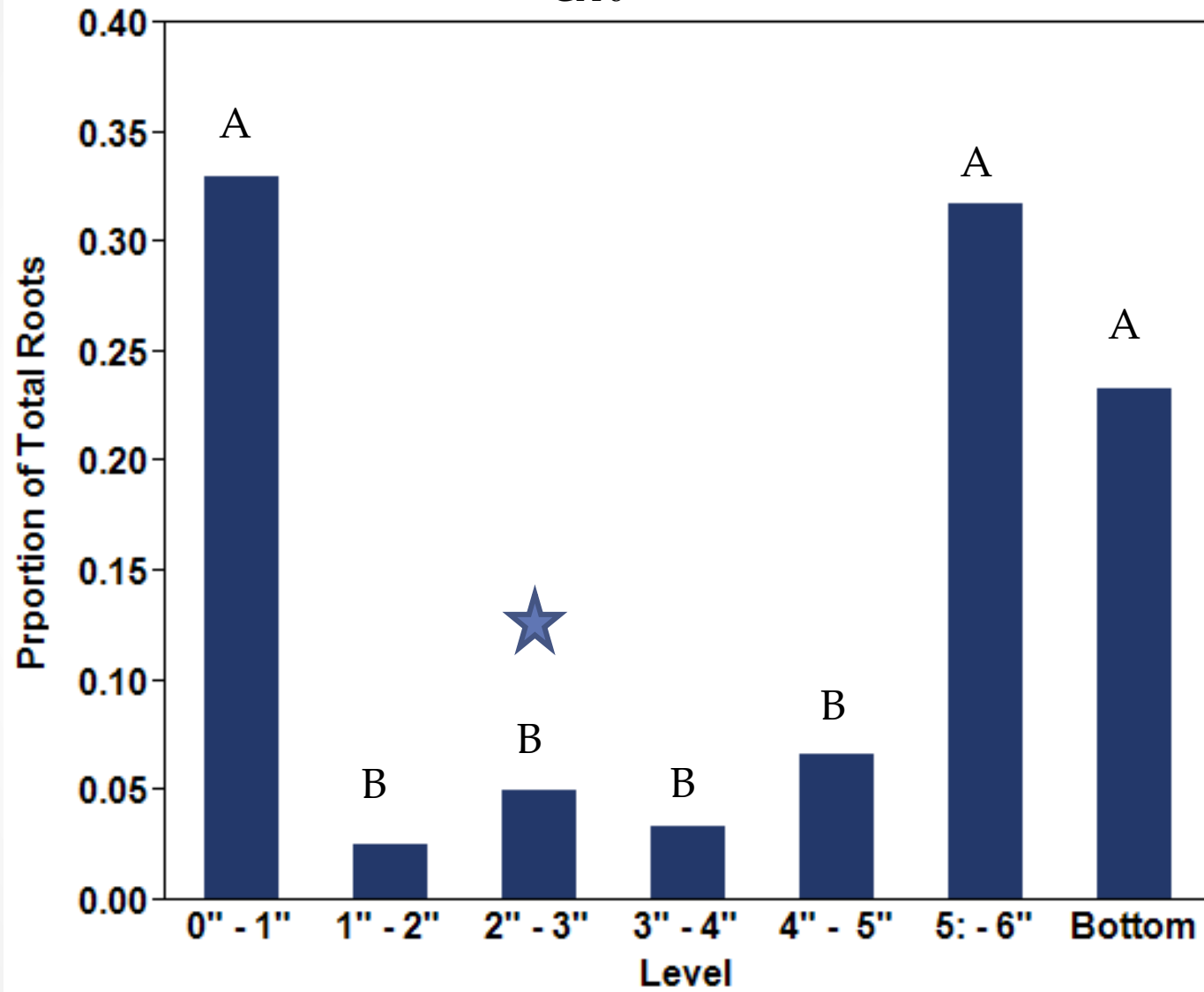
Container	Average total number of roots	Average weight of roots (g)
Bareroot	20	3.5
Copperblock	64	6.1
IFCO	82	7.7
GA 6"	82	5.3
Stuewe FT135	71	6.3

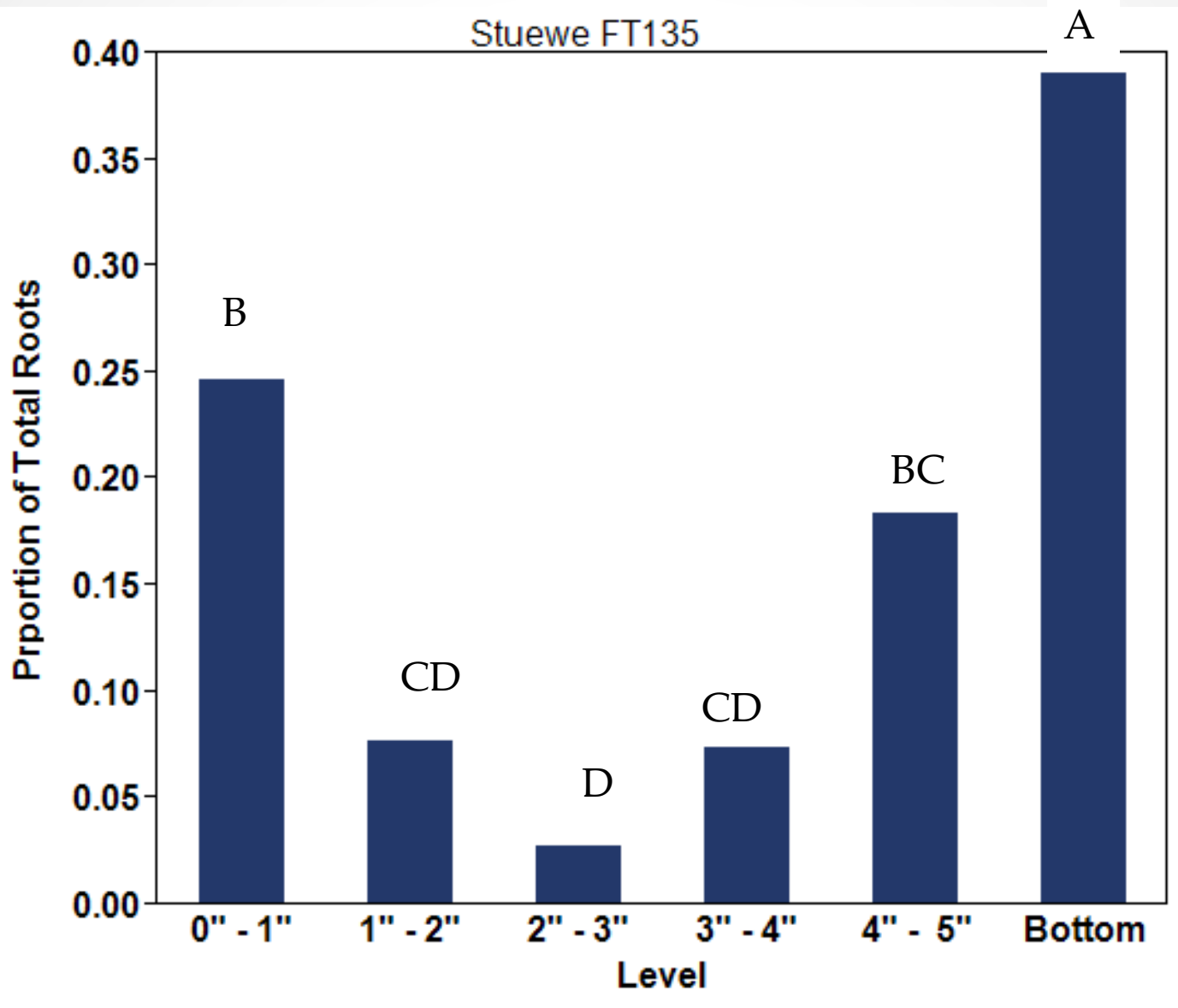
Proportion of roots by level

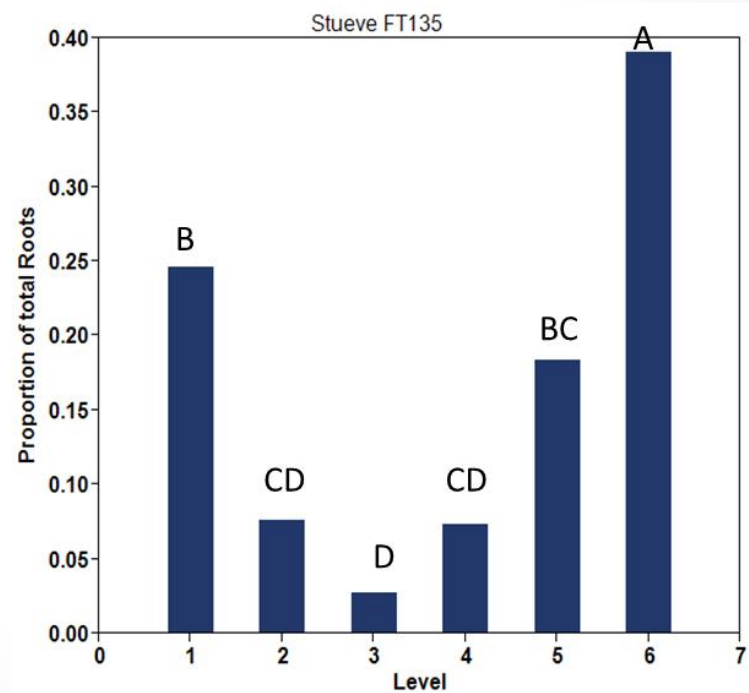
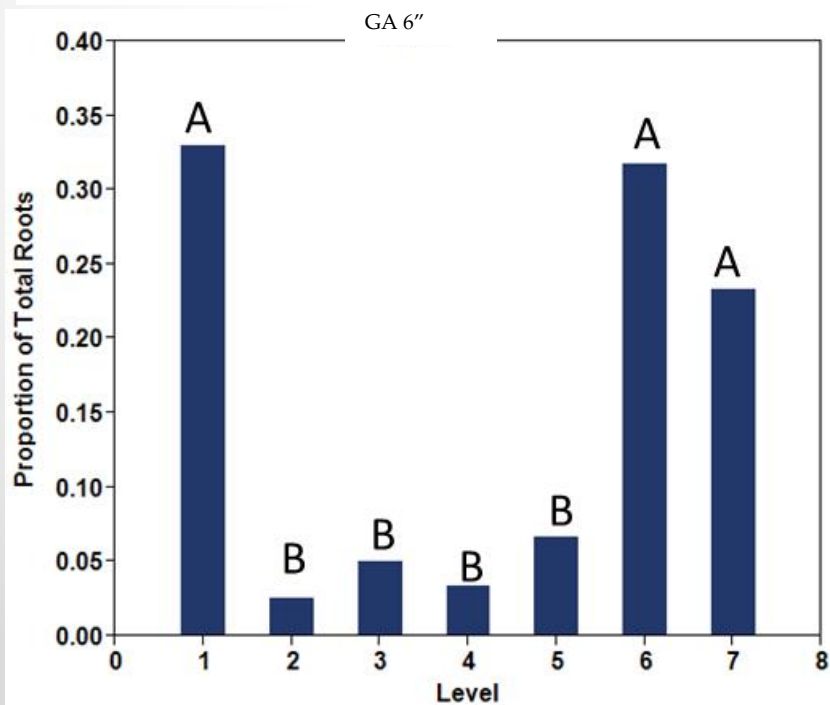
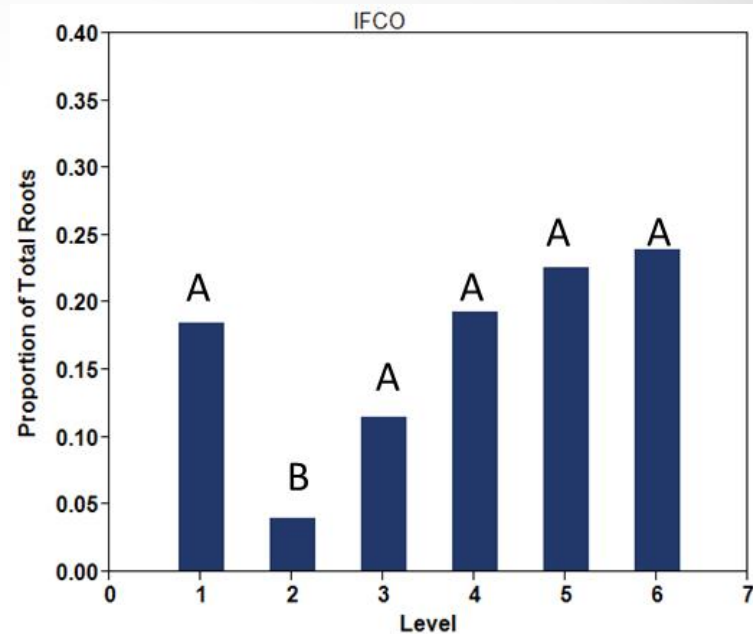
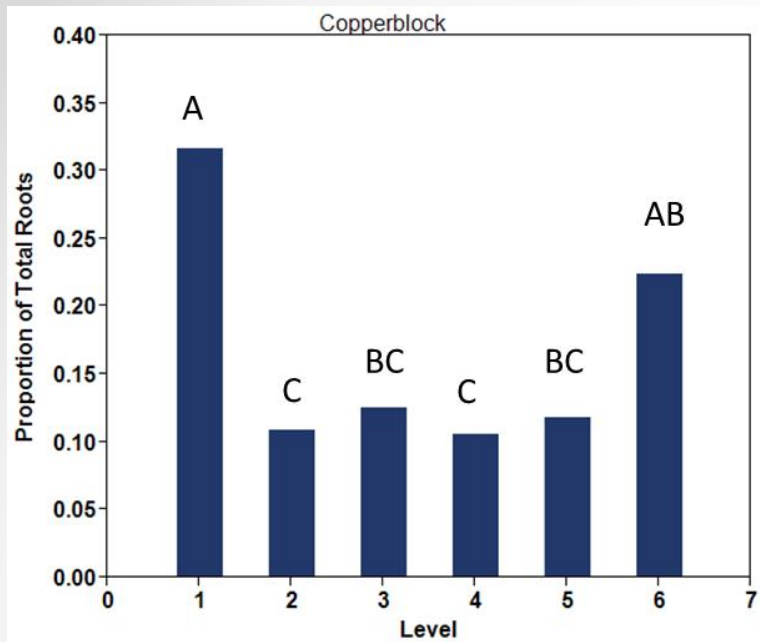




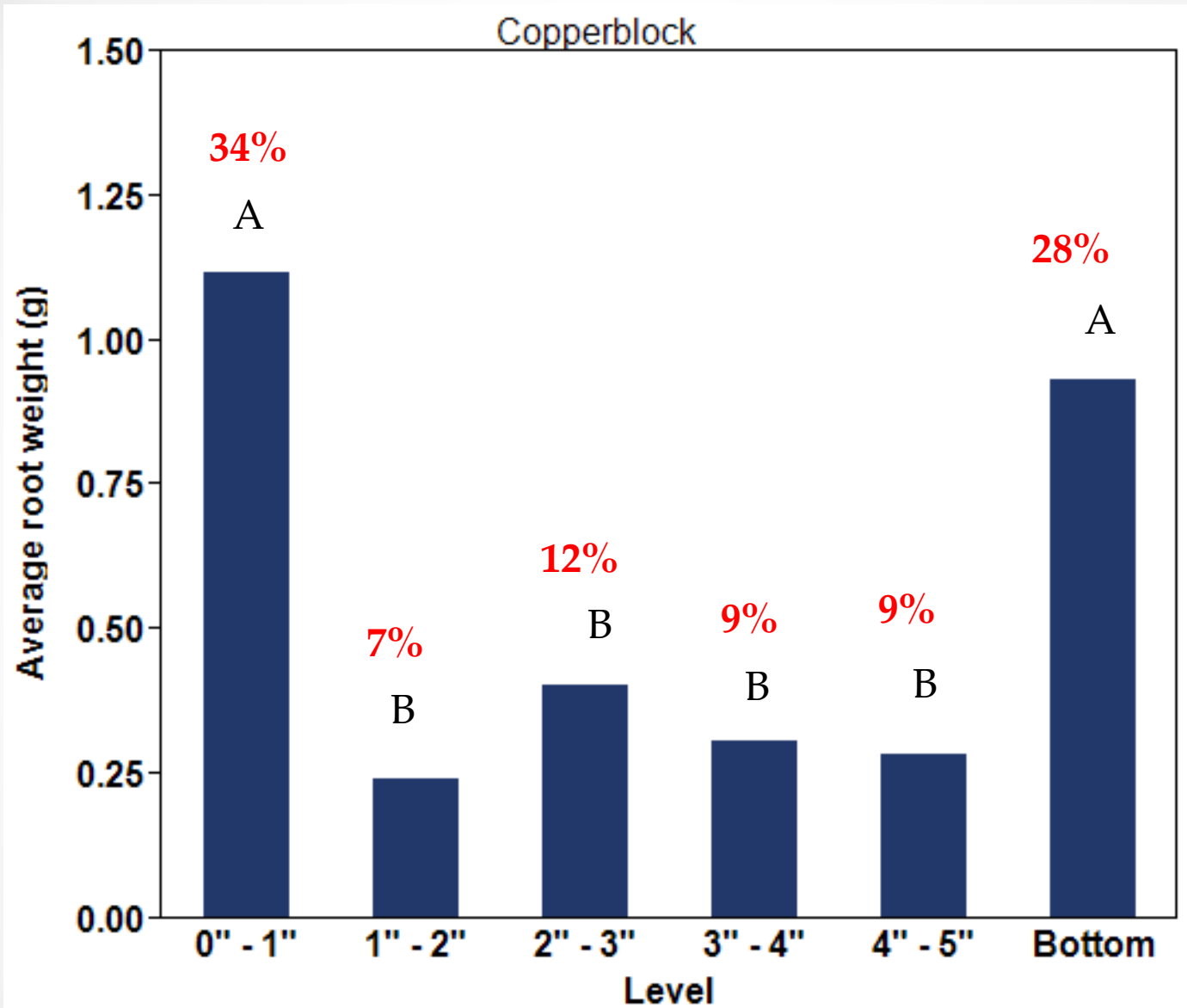
GA 6"

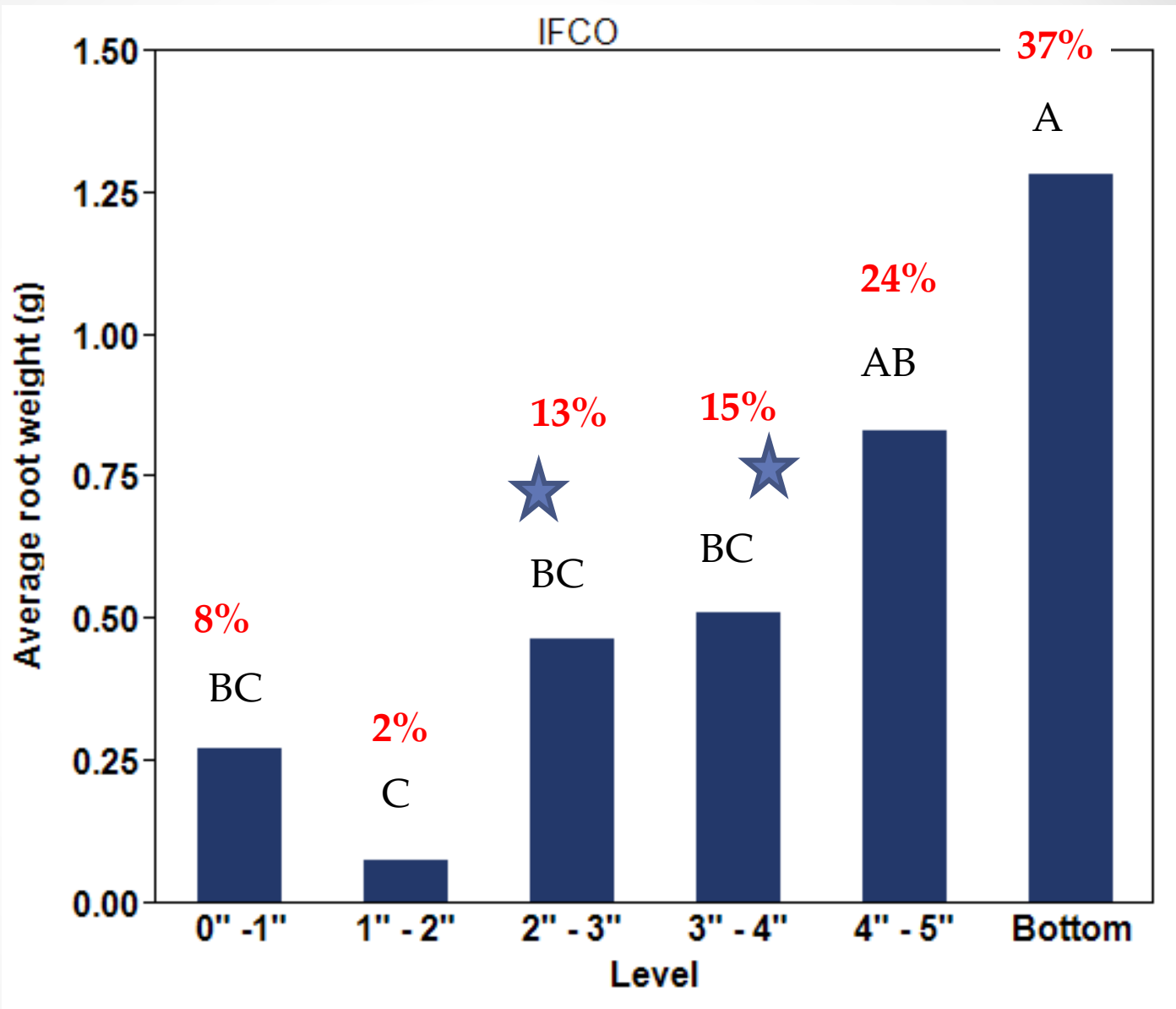


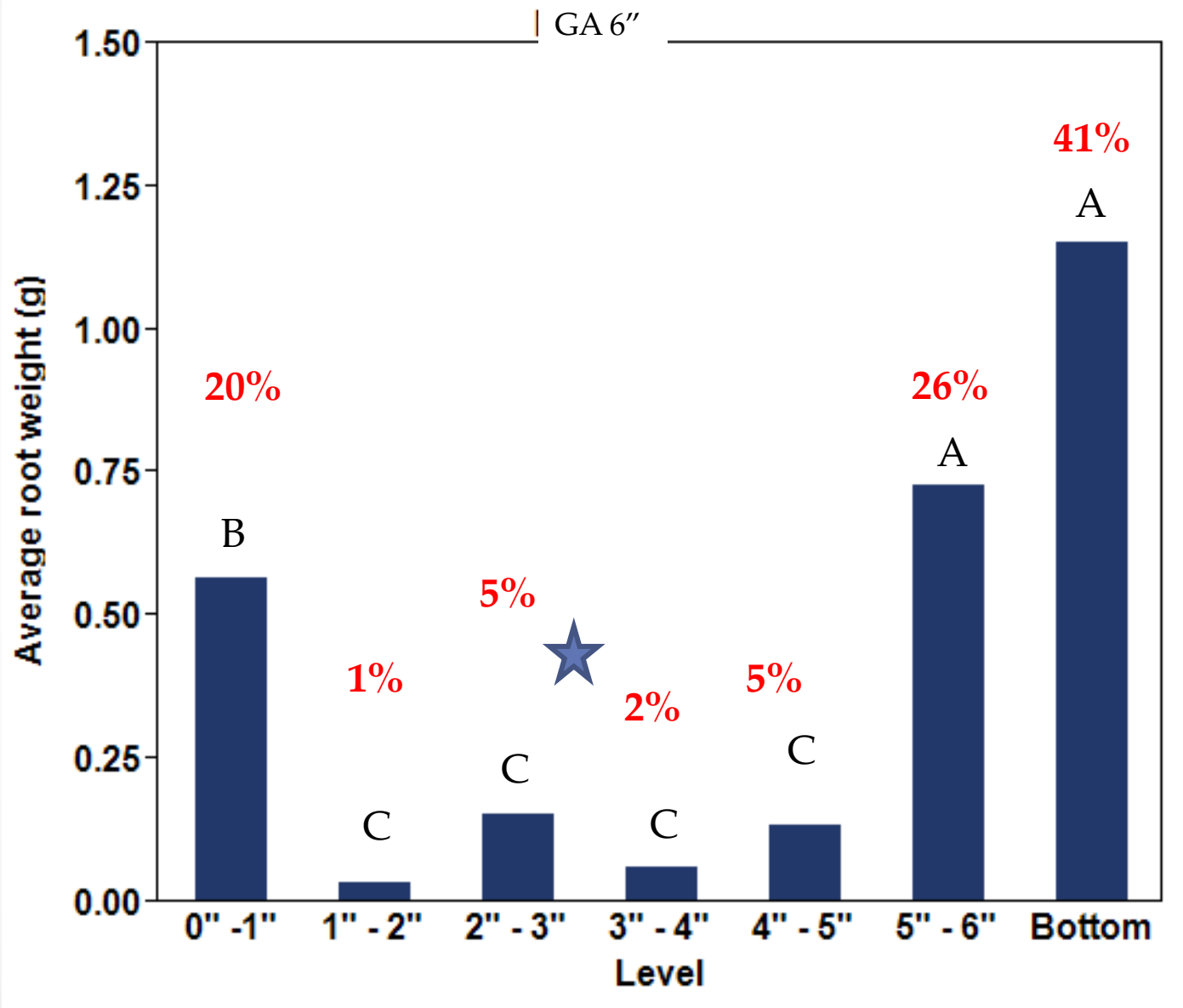


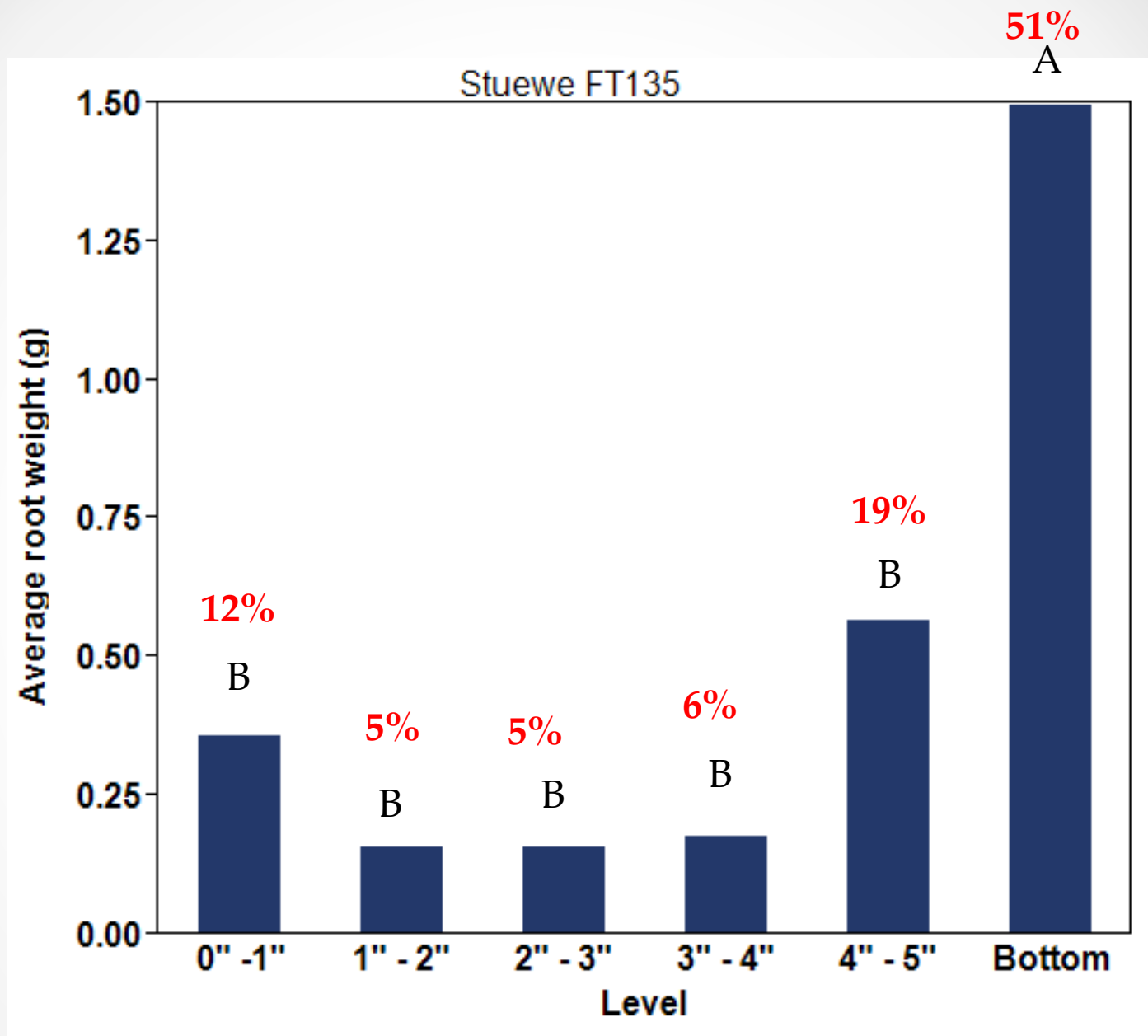


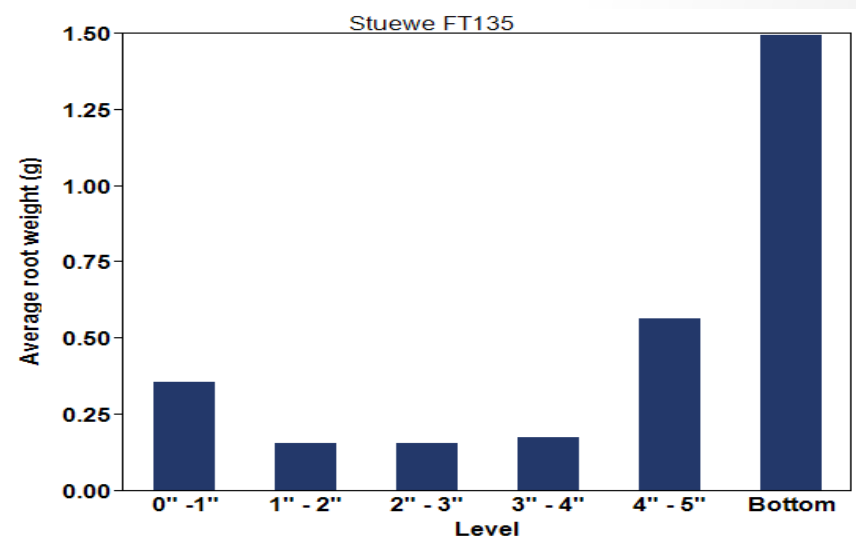
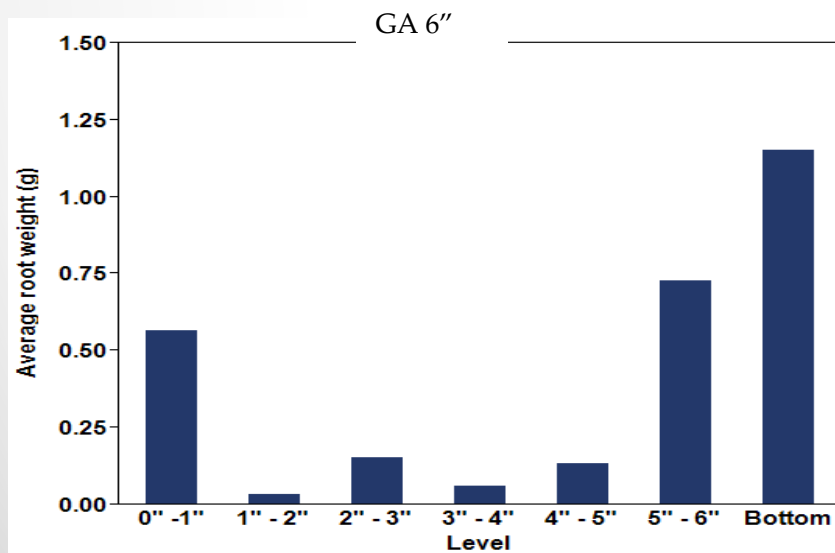
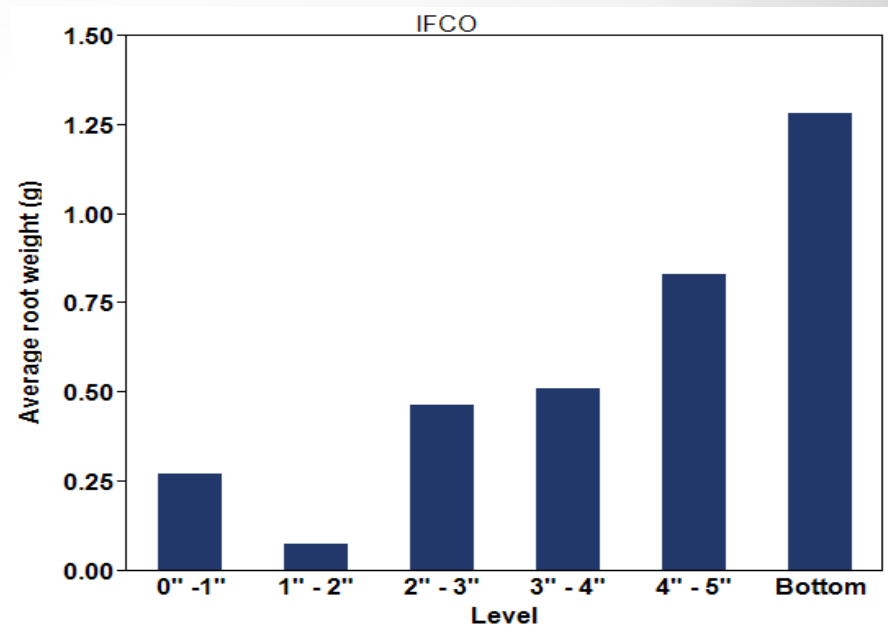
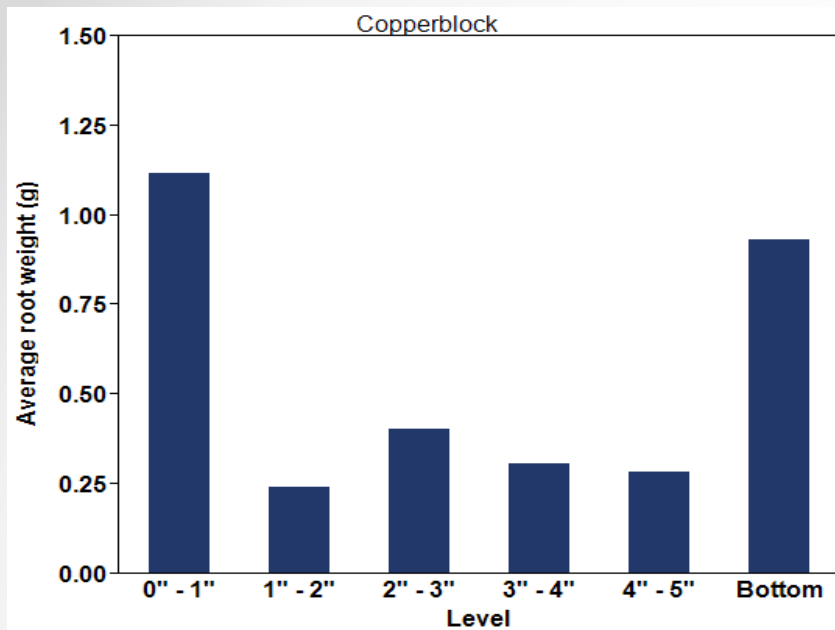
Average root weight
by level



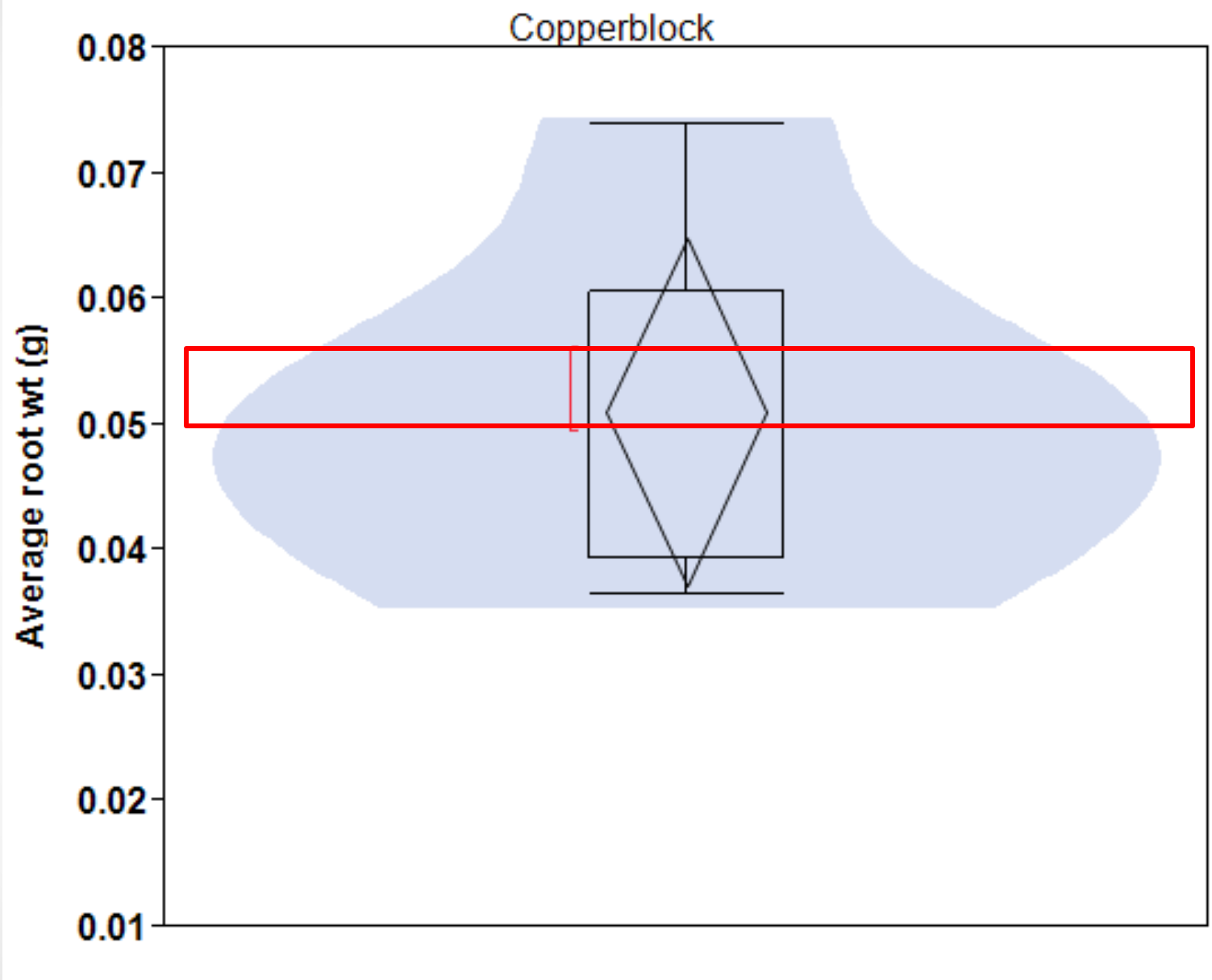


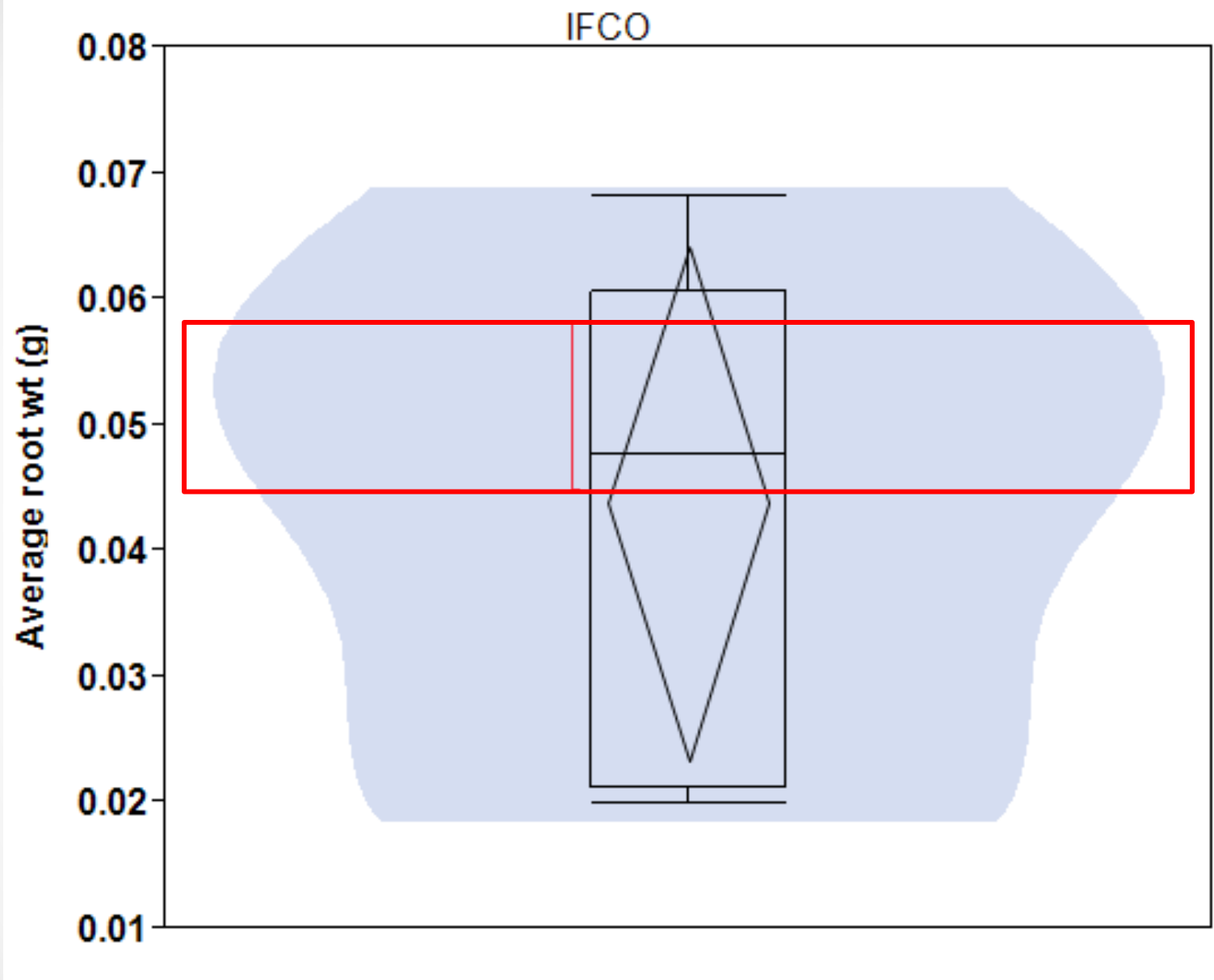




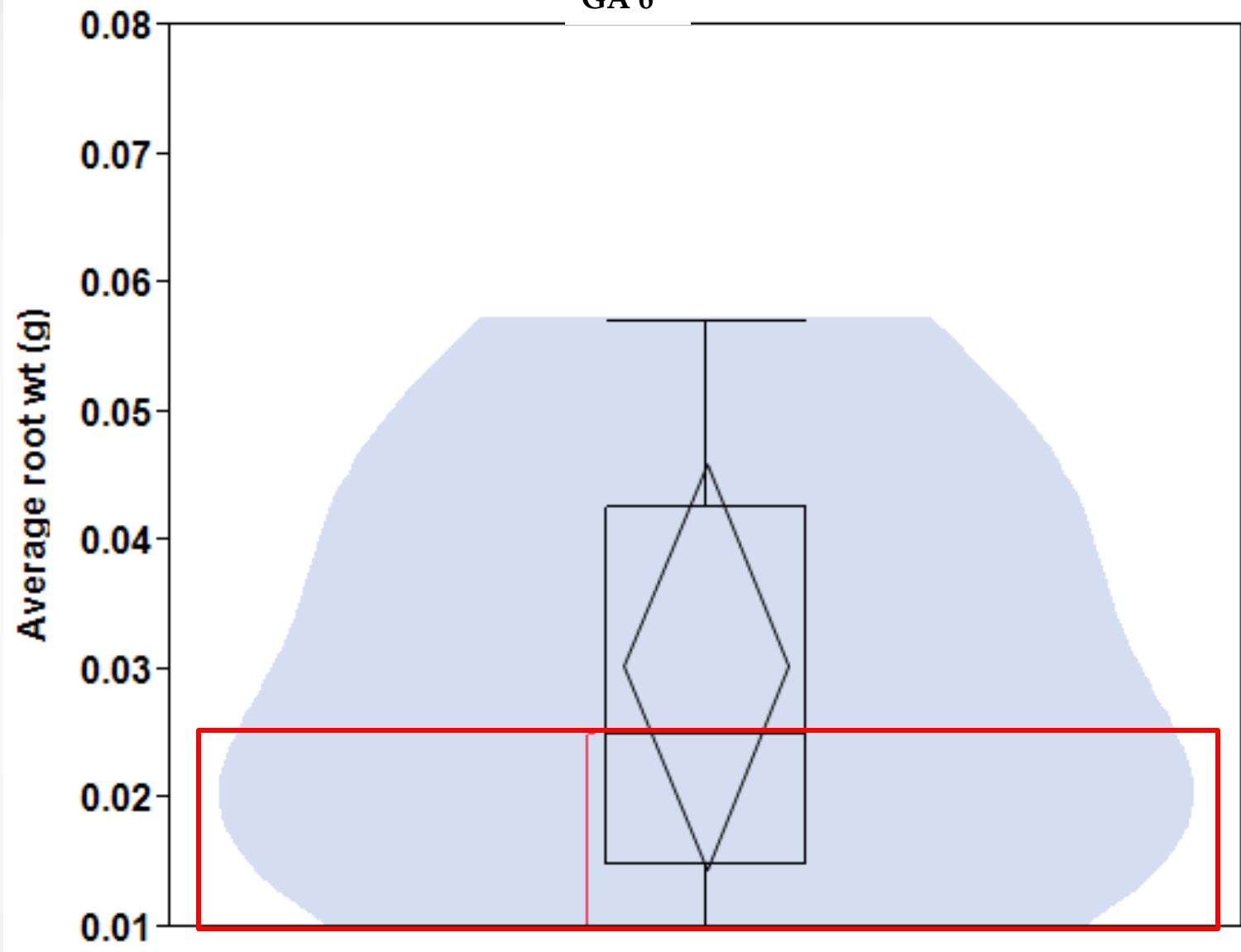


Contour graphs of root weights

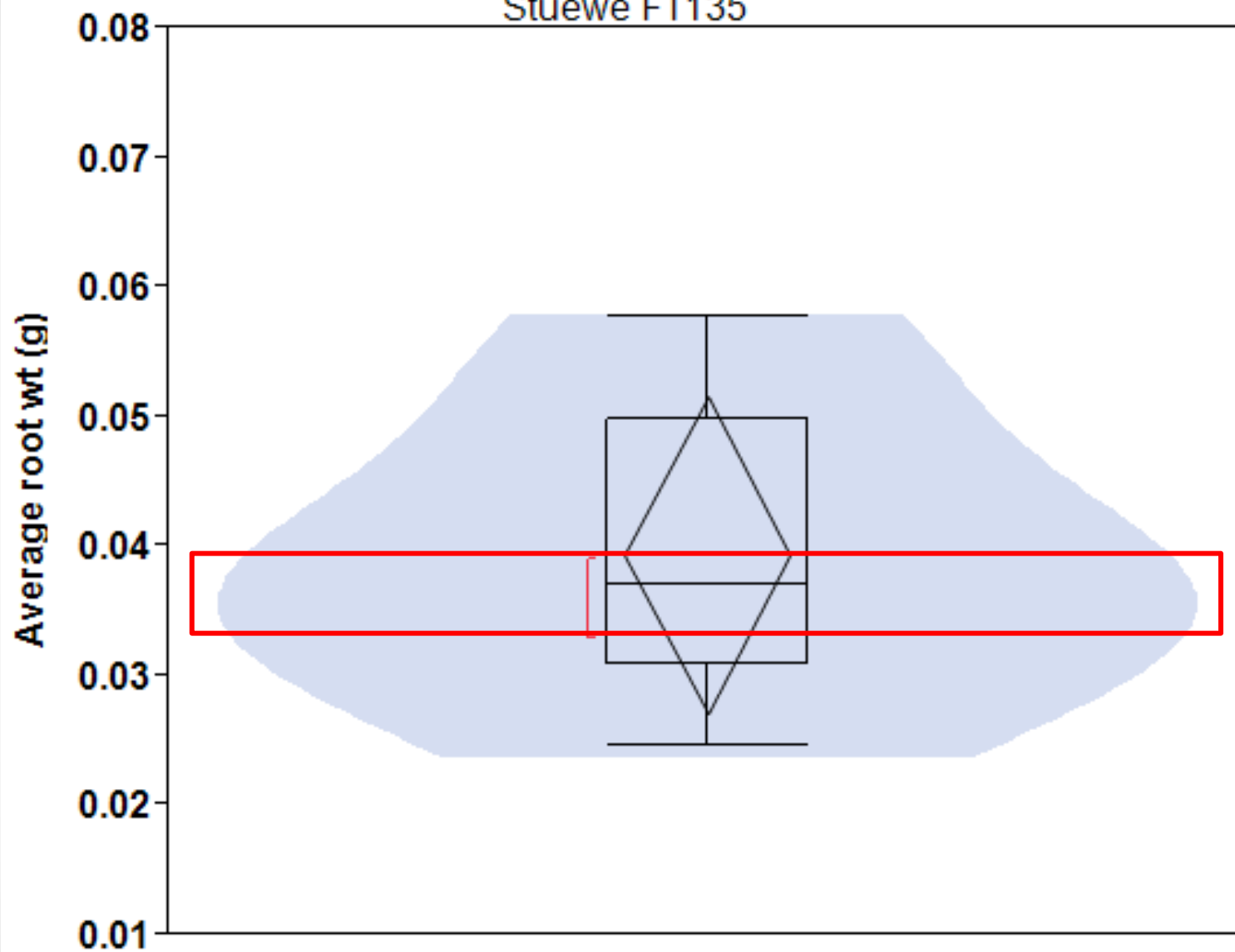


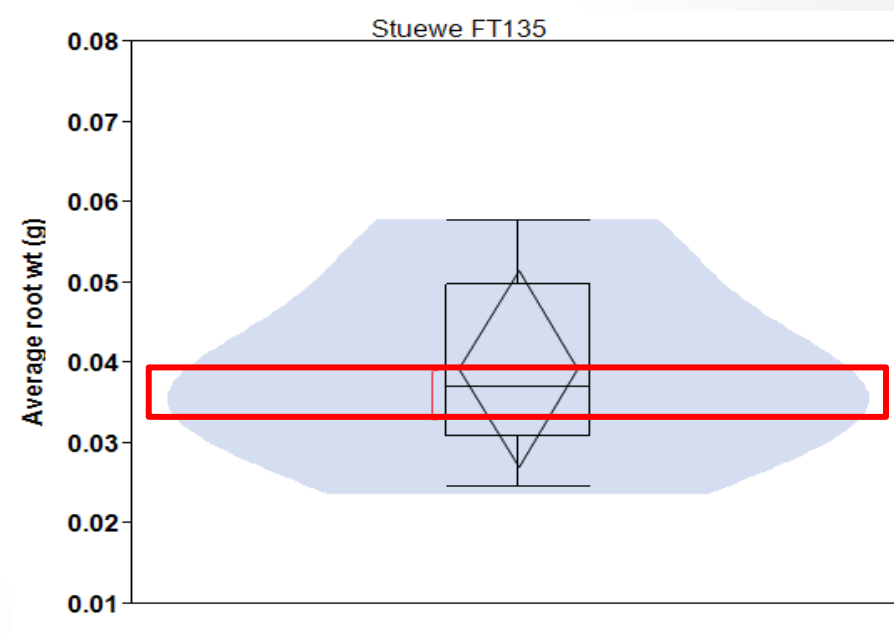
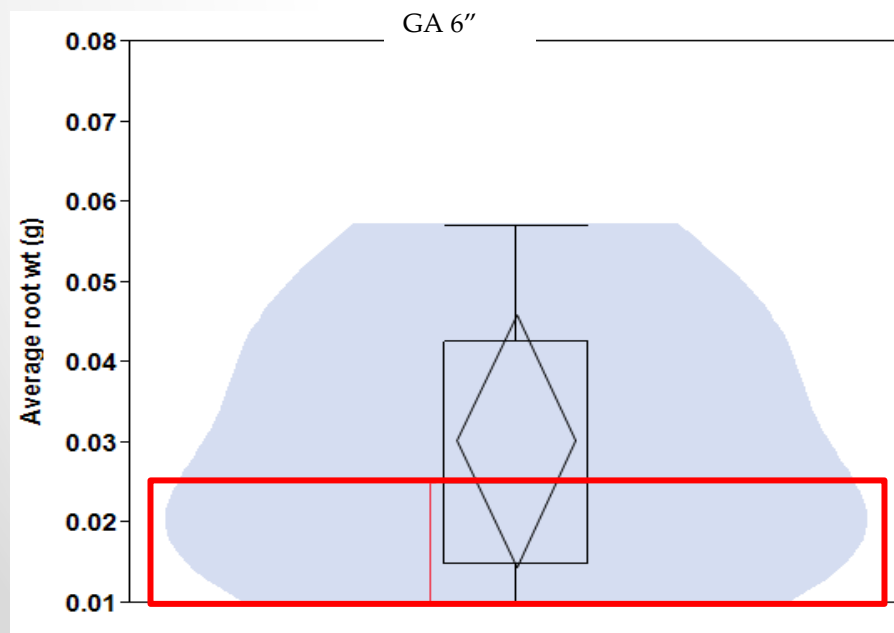
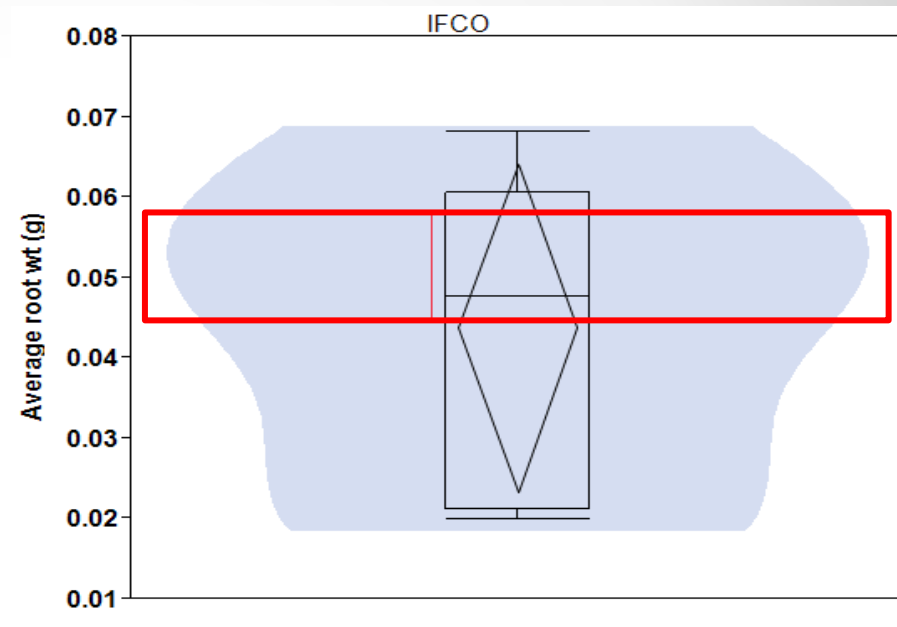
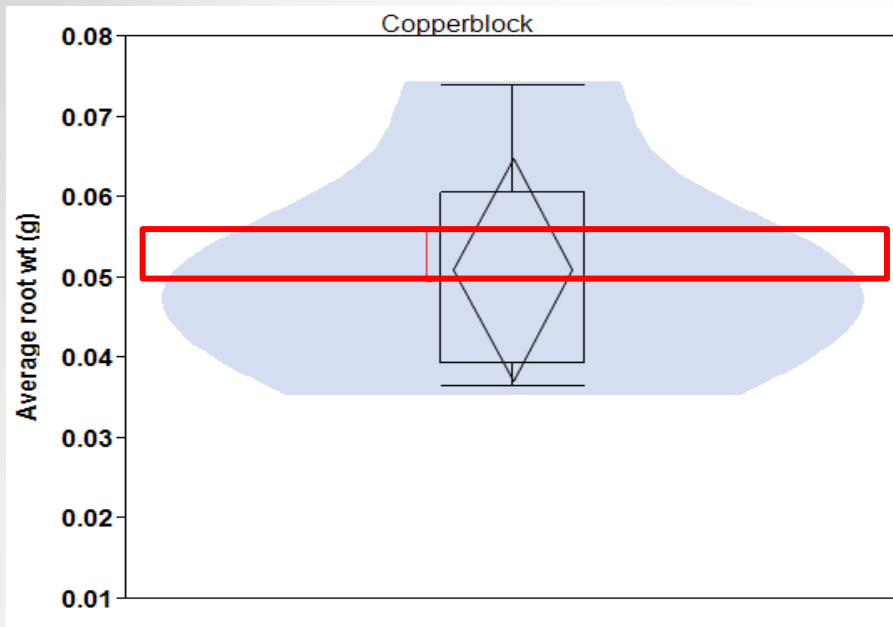


GA 6''



Stuewe FT135





The Pros & Cons

Copperblock

Pro

- Initial cost of container
- Copper treated pruning
- Horizontal roots 0-1"
- 62% RW 0-1" & Bottom

Con

- Extraction of seedlings
- Effective life of container
- Low Horizontal root growth 1-5"

The Pros & Cons

IFCO128

Pro

- Multiple side root pruning holes
- Directed ribs
- Horizontal root growth, 0-1" 2 – 3" 3-4" 4-5"
- 61% RW 4-5" & Bottom

Con

- Low Horizontal root growth 1-2"

The Pros & Cons

Ga 6"

Pro

- Horizontal root growth 0-1" 5 – 6"
- 67% RW 5-6" & Bottom

Con

- Low Horizontal root growth 2-5"
- Very low average root weight compared to others

The Pros & Cons

Stuewe FT135

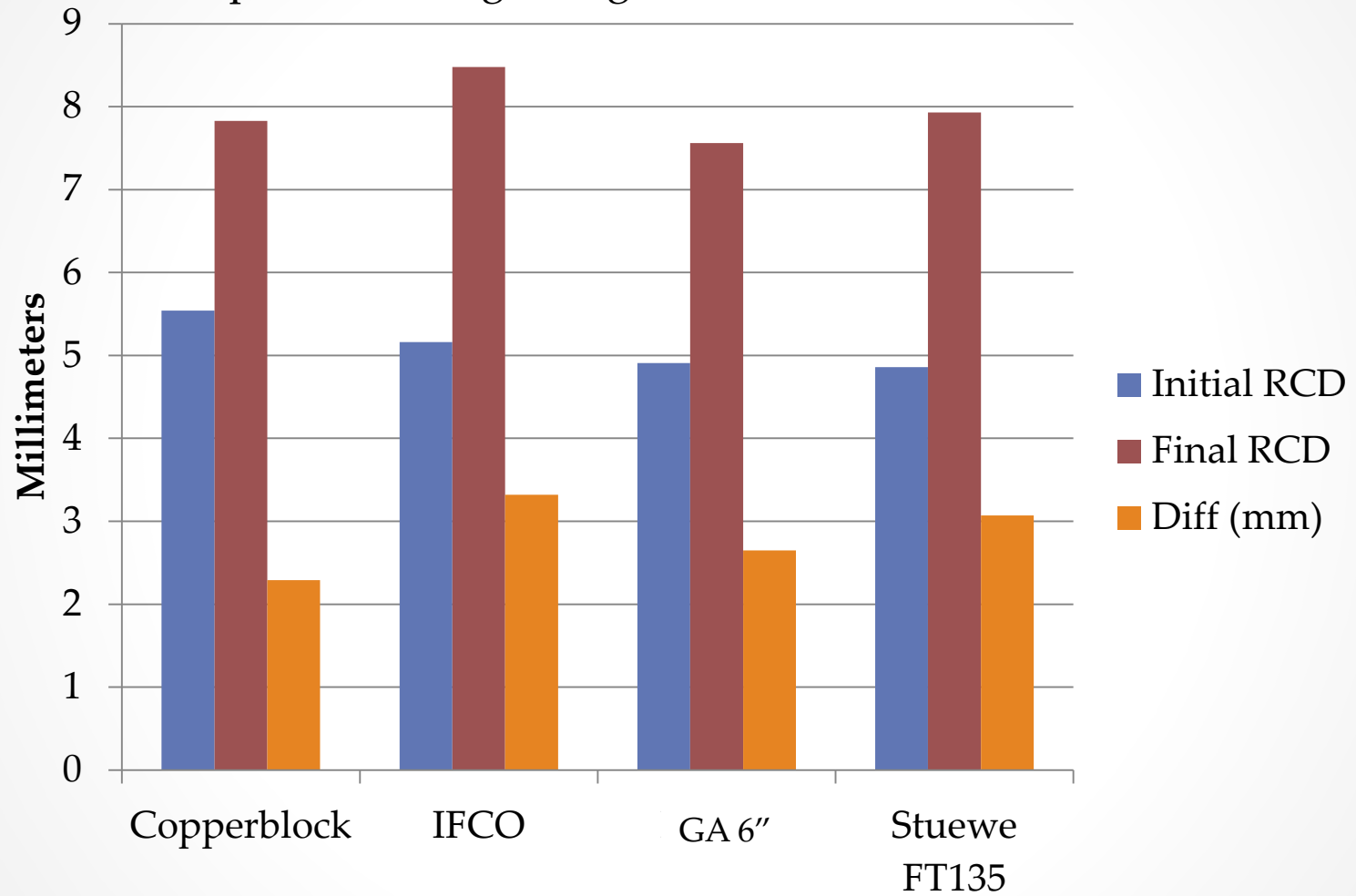
Pro

- Horizontal root growth 0-1", 4-5"
- Greatest Vertical root growth of all containers
- 51% Bottom

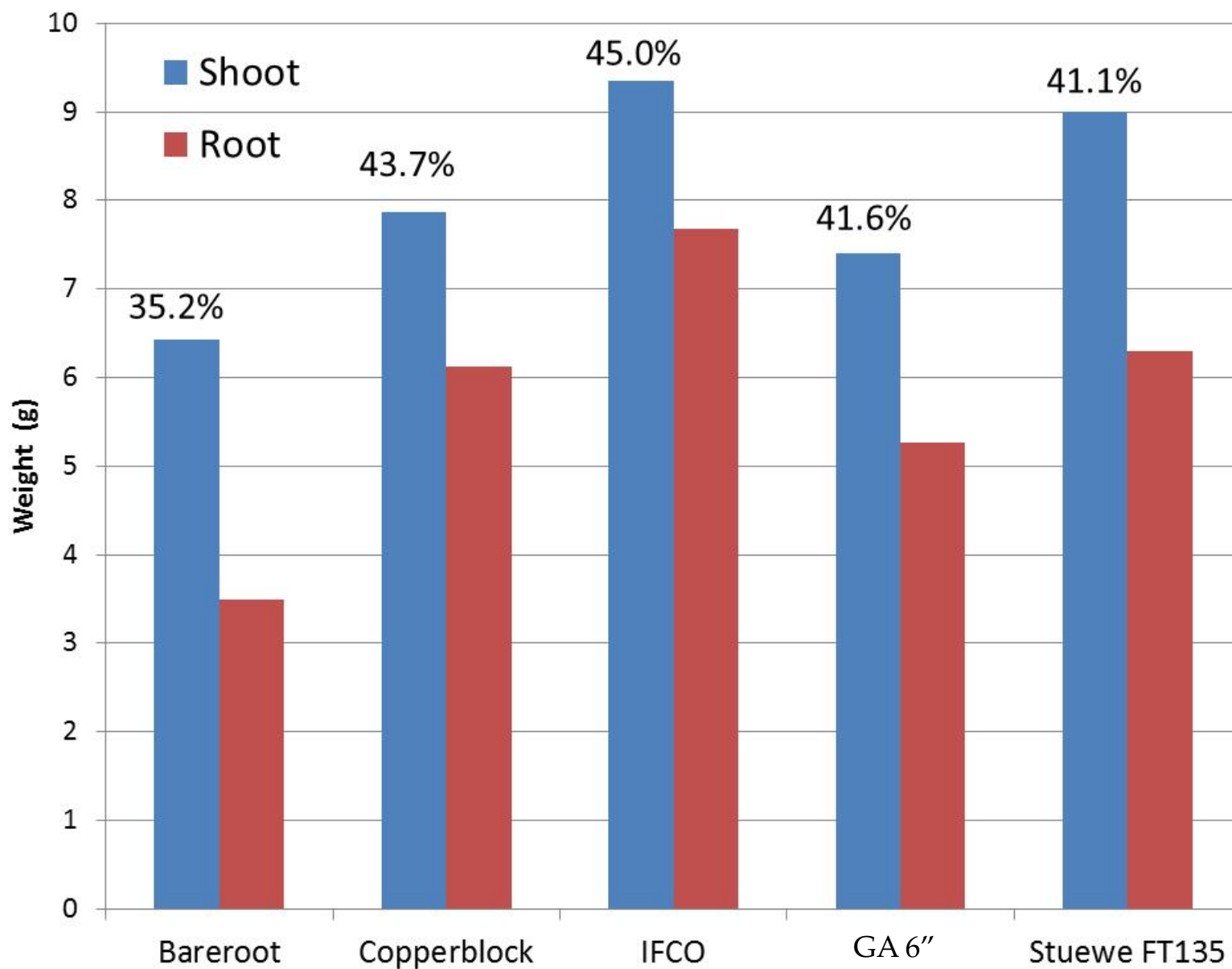
Con

- Low Horizontal root growth 1-4"
- Low root weight 0-4"

Comparison of beginning and final root collar diameters



Root and top final weight and root weight ratio



Summary

- As new containers are designed, focus should be on root morphology, not on marketing or convenience.
- In 2014/2015 this study will be repeated using longleaf pine in 5 containers (Copperblock, FT135, FT128, LTF128, IFCO 128). An outplanting component will also be done.
- I would like to see a study of these container types as they relate to the tendency to topple.

