Seedling Quality Affects Stand Establishment

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What is your first impression?

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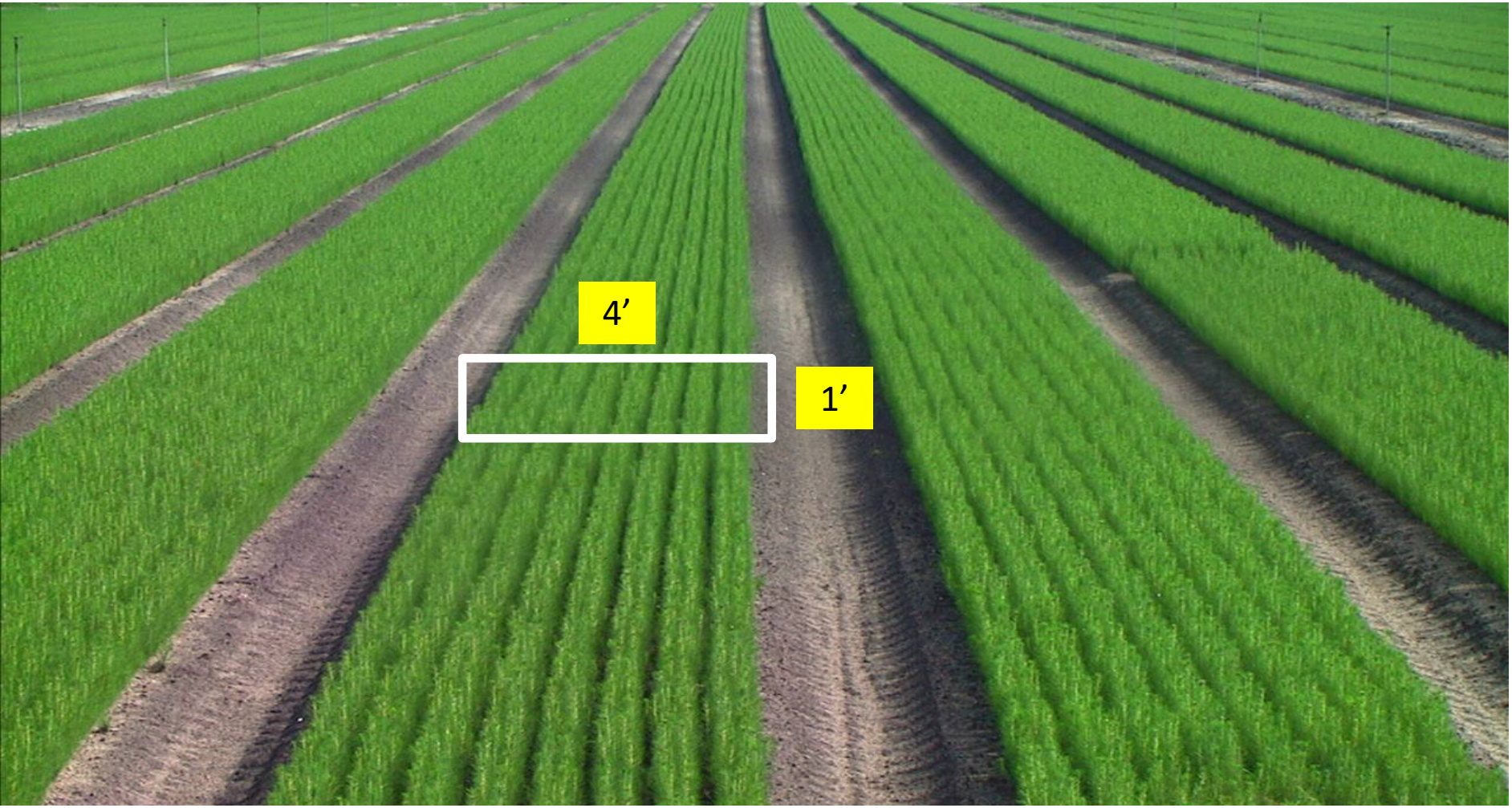
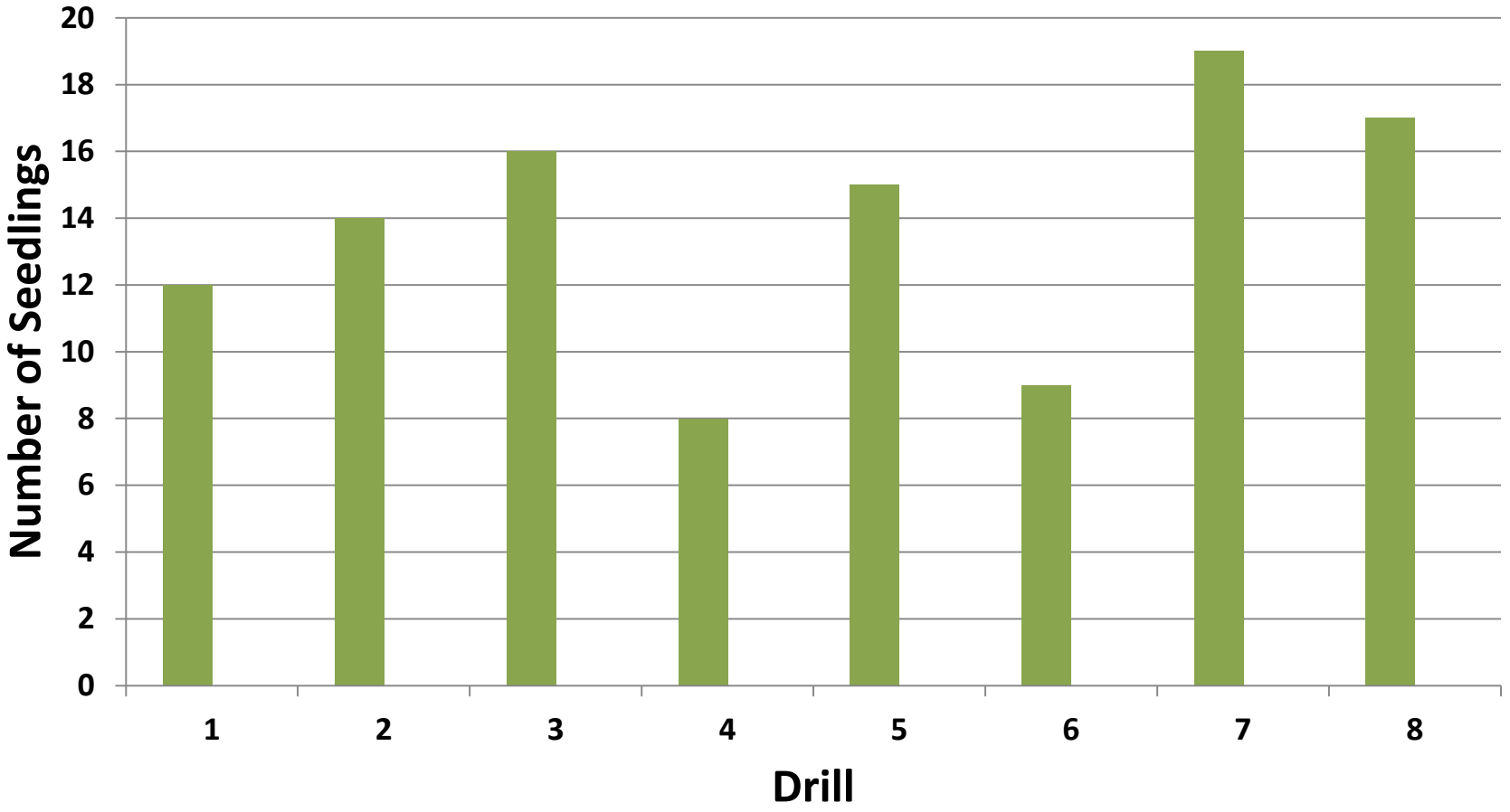
1. Color – green
2. Uniform appearance

How Uniform?

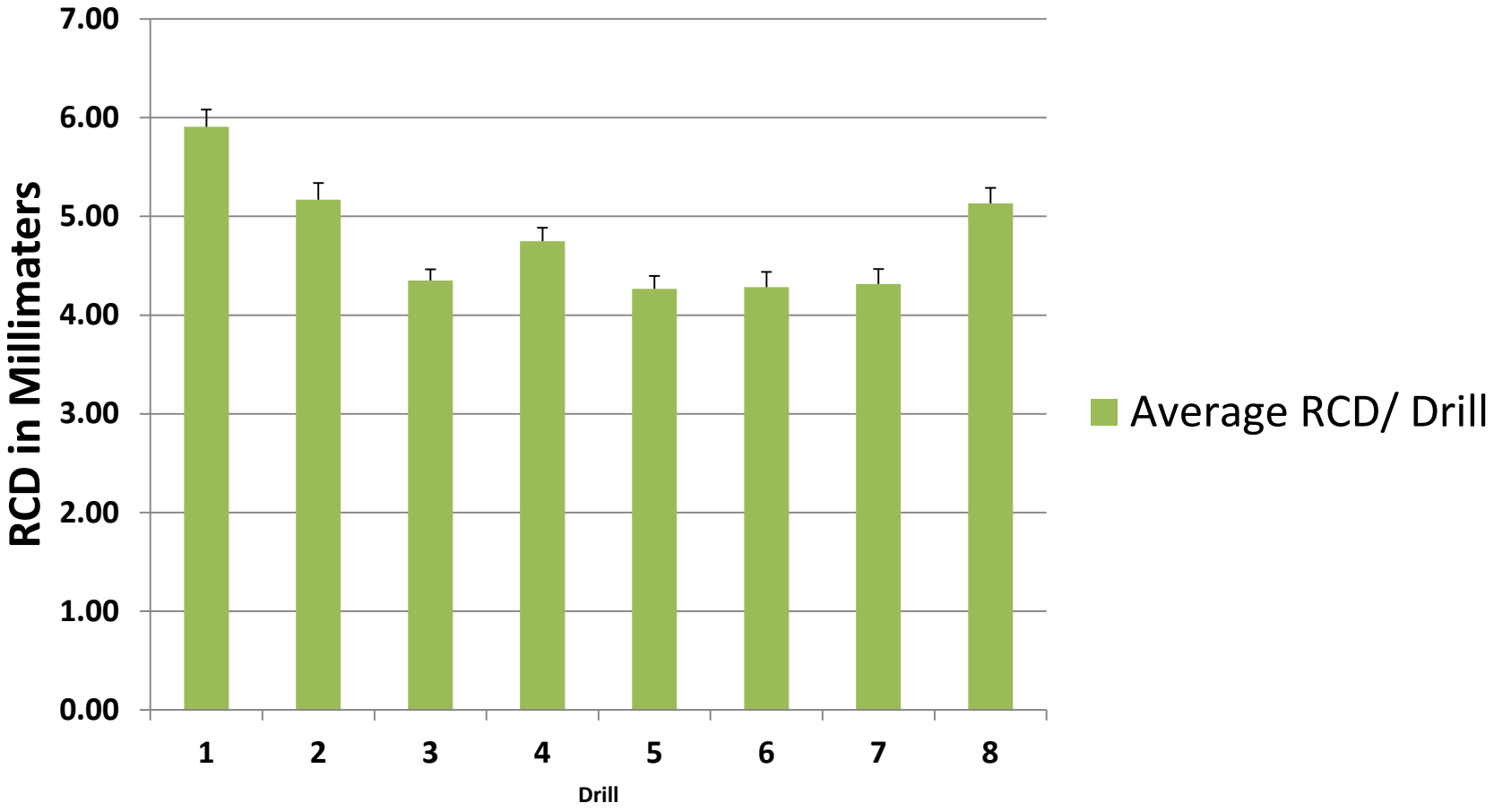


Number of Seedlings per Drill

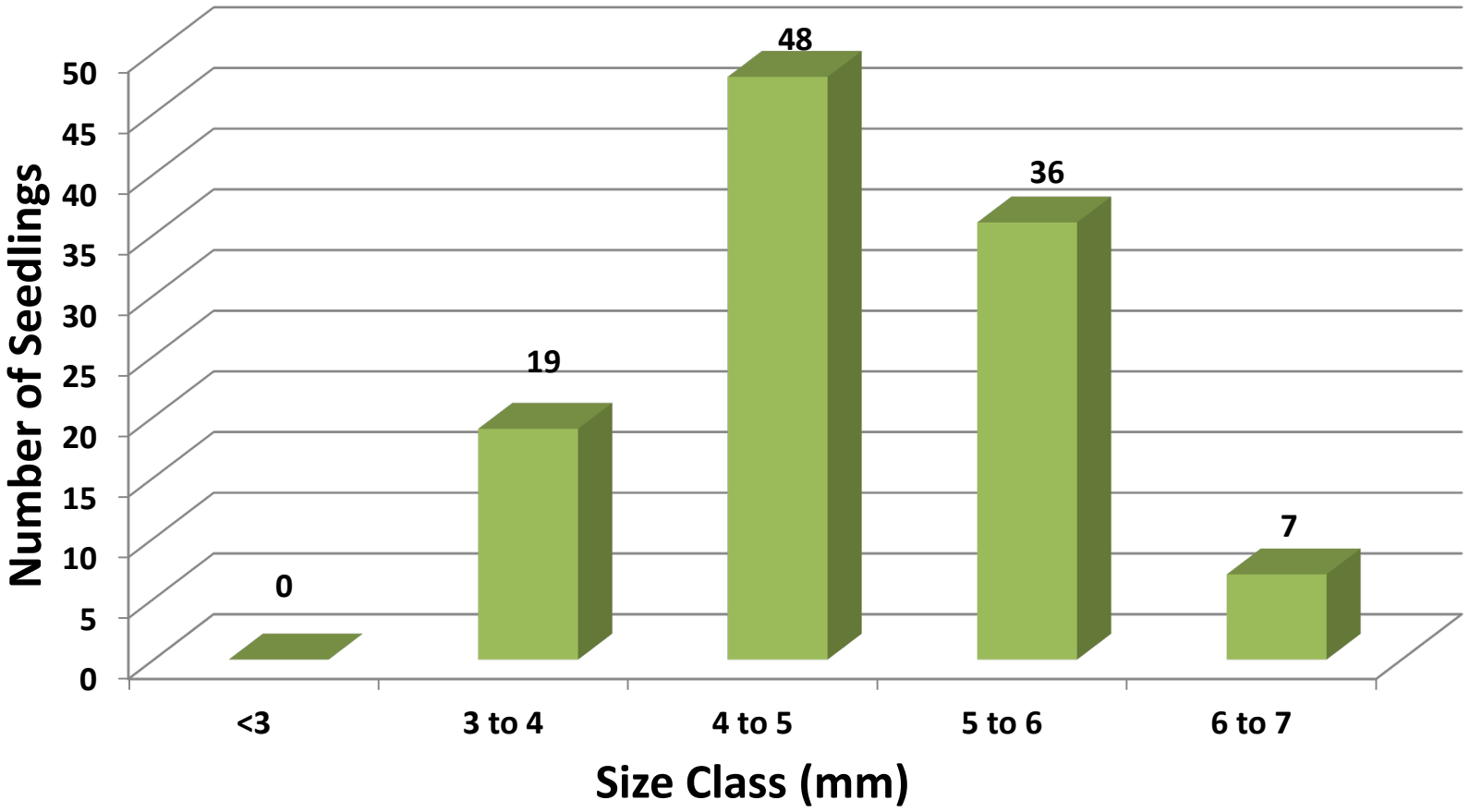


4 ft x 1 ft counting frame
seedling total = 110

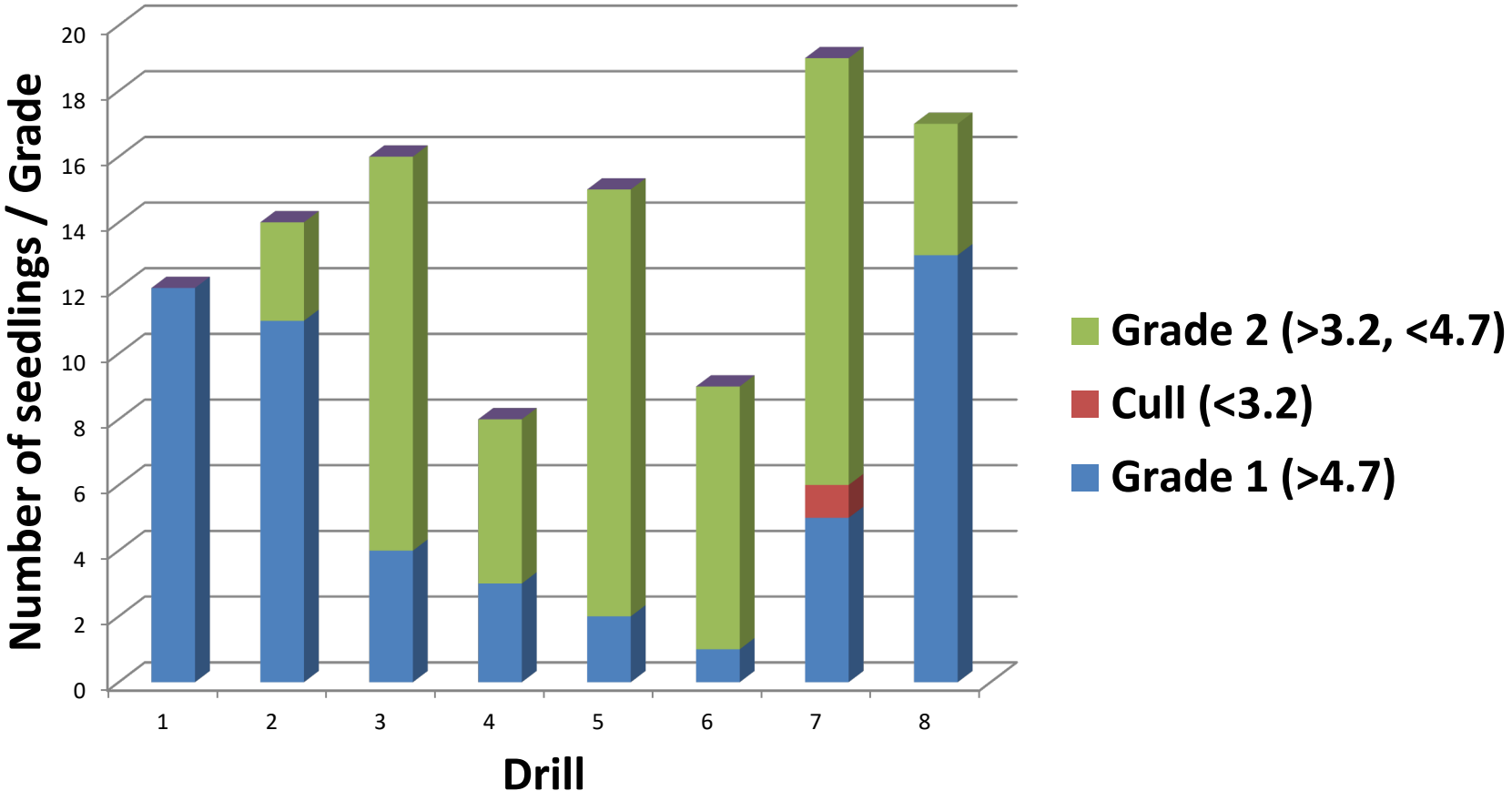
Average RCD per Drill

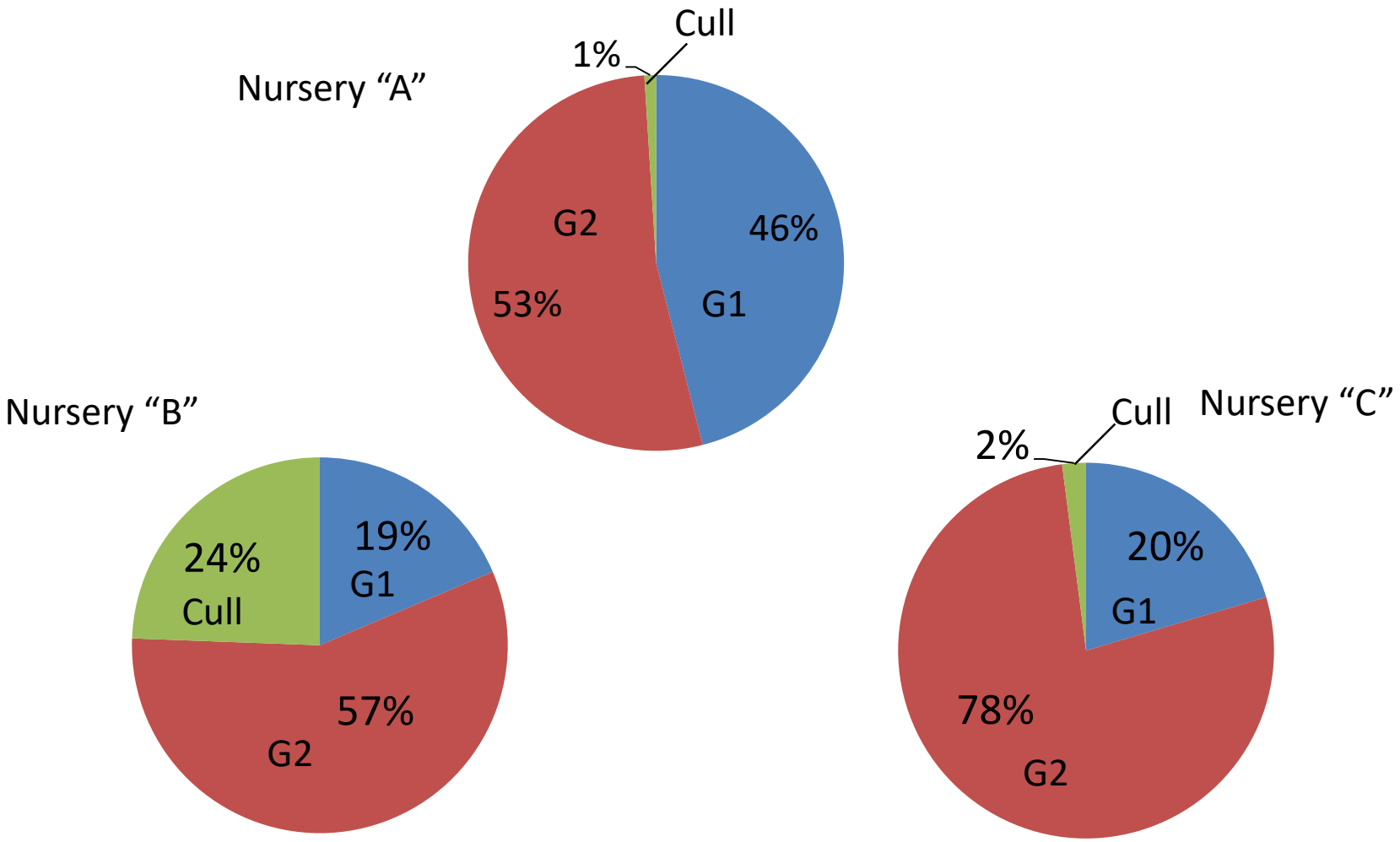


Number of Seedlings Per Size Class



Number of Seedlings per Grade by Drill





G1 – Grade 1 (>4.7 mm)

G2 – Grade 2 (3.2 – 4.7 mm)

Cull – (<3.2 mm)

Seedling Quality

- Definition:
  - A high quality seedling is one that can survive prolonged environmental stress and produce vigorous growth following out planting.

Seedling Density

- Definition – the number of seedlings grown per unit of nursery bed
  - Expressed either as:
    1. Square feet
    2. Linear bed foot (of a 4’ foot bed)

25 seedlings/sq ft = 100 seedlings per linear foot

“The quality of planting stock is the degree to which the stock realizes the objectives of management (to the end of the rotation or achievement of specified sought benefits) at minimum cost.

Quality is fitness for purpose.”

Willen and Sutton (1980)

10 characteristics of a quality seedling :

1. Free of disease
2. Lignified, single stem
3. Large RCD
4. Symmetrical crown
5. Root system free of deformities
6. Fibrous root system with white root tips
7. Balanced seedling
8. Winter color
9. Survive short drought
10. Full sunlight

Quality versus quantity

- Which is more important?

- Why a poor quality tree is poor

Early seedling grade Longleaf 1935 (Wakeley)

Grade	Usual needle lengths	Stems
1	12 to 18 inches	3/16 to ½ “ 4.76 – 12.7mm
2	Intermediate	Intermediate
3	6 to 8 inches	Very slender

Early seedling grade
Loblolly 1935 (Wakeley)

Grade	Usual heights	Stems
1	8 to 14 inches	Stout woody
2	Mostly less than Grade 1	Spindling to moderately stout
3	All less than Grade 2	Spindling succulent

Early seedling grade
Slash 1935

Grade	Usual heights	Stems
1	10 to 16 inches	Stout woody
2	Mostly less than Grade 1	Spindling to moderately stout
3	All less than Grade 2	Spindling succulent

Updated seedling grade Longleaf 1984 (May)

Grade	Usual needle lengths	Stems
1	6 to 8 inches clipped	11/16 inch 17.5 mm
2	6 to 8 inches clipped	½ inch 12.7 mm
3-cull		< ½ inch

Updated seedling grade Loblolly and Slash 1984 (May)

Grade	Usual heights	Stems
1	9 to 12 inches	3/16 – 5/16 4.8 – 7.9 mm
2	6 - 10 inches	1/8 – 3/16 3.2 - 4.8 mm
3	3 – 12 inches	< 1/8 inch <3.2 mm

Seedling Densities

1920 – 1930's

- Longleaf: 25 – 35/ sq. ft.
- Loblolly: 40 – 50/ sq. ft.
- Slash: 35 – 45/ sq. ft.
- Shortleaf: 55 – 75/ sq. ft.

Wakeley - 1935

Today

- Longleaf: 10 – 15/sq. ft.
- Loblolly: 20 – 28/sq. ft.
- Slash: 20 – 26/sq. ft.
- Shortleaf: 25 – 35/sq. ft.
- Morphologically Improved (Low Density)–
  < 20 seedlings/sq. ft.& > 5.5 mm RCD

Terminology

- **Grade 1 Seedling** – Seedling with RCD greater than 4.7 mm
- **Grade 2 Seedling** – Seedling with RCD ranging from 3.2 – 4.7 mm
- **Cull Seedling** – seedling not meeting size standards or has RCD <3.2 mm
- **Morphologically Improved (low density)** – Seedlings grown at lower densities and have an average RCD above 5.5 mm

Root Collar Diameter

2.5

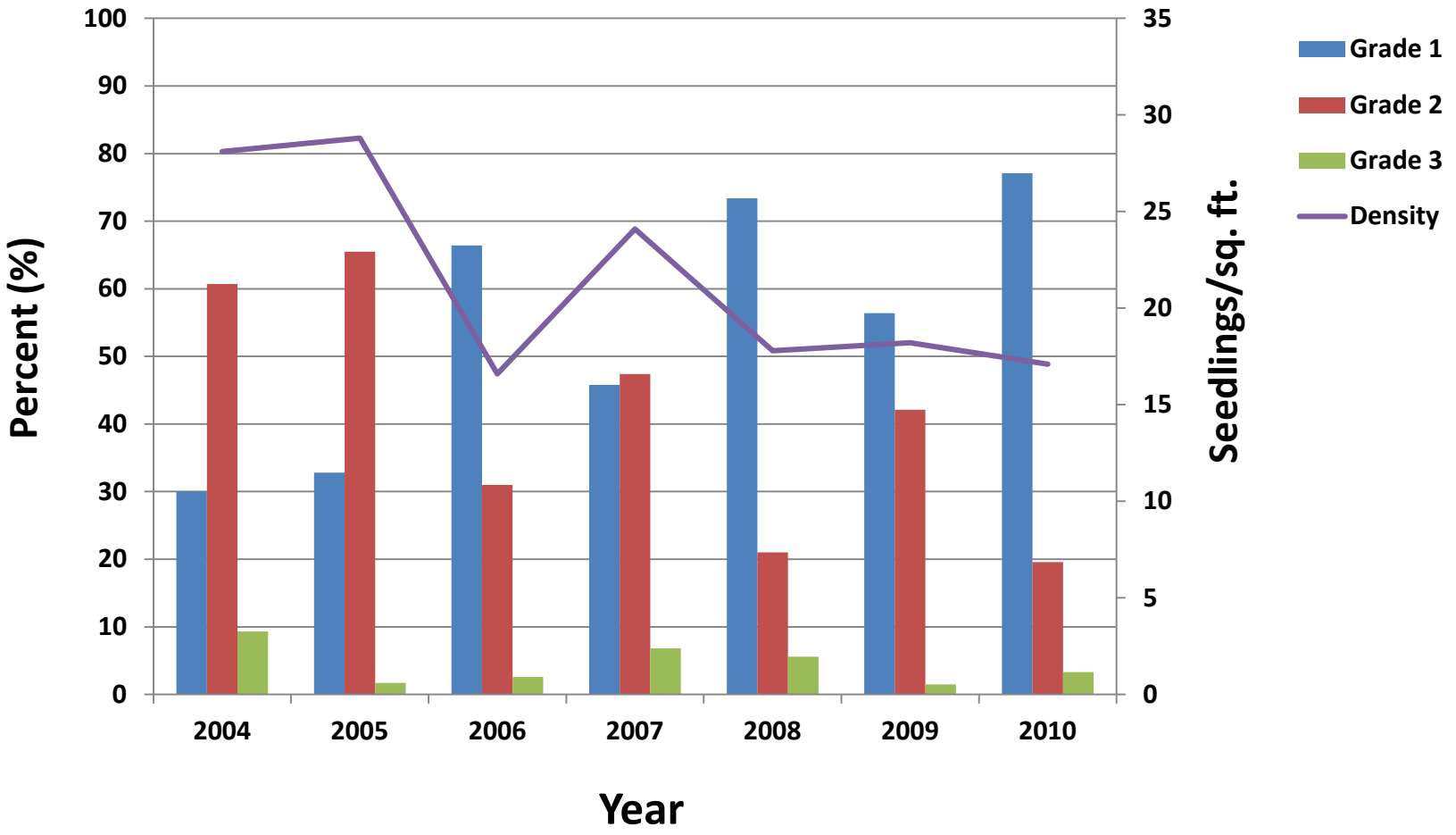
4.5

6.5

8.5

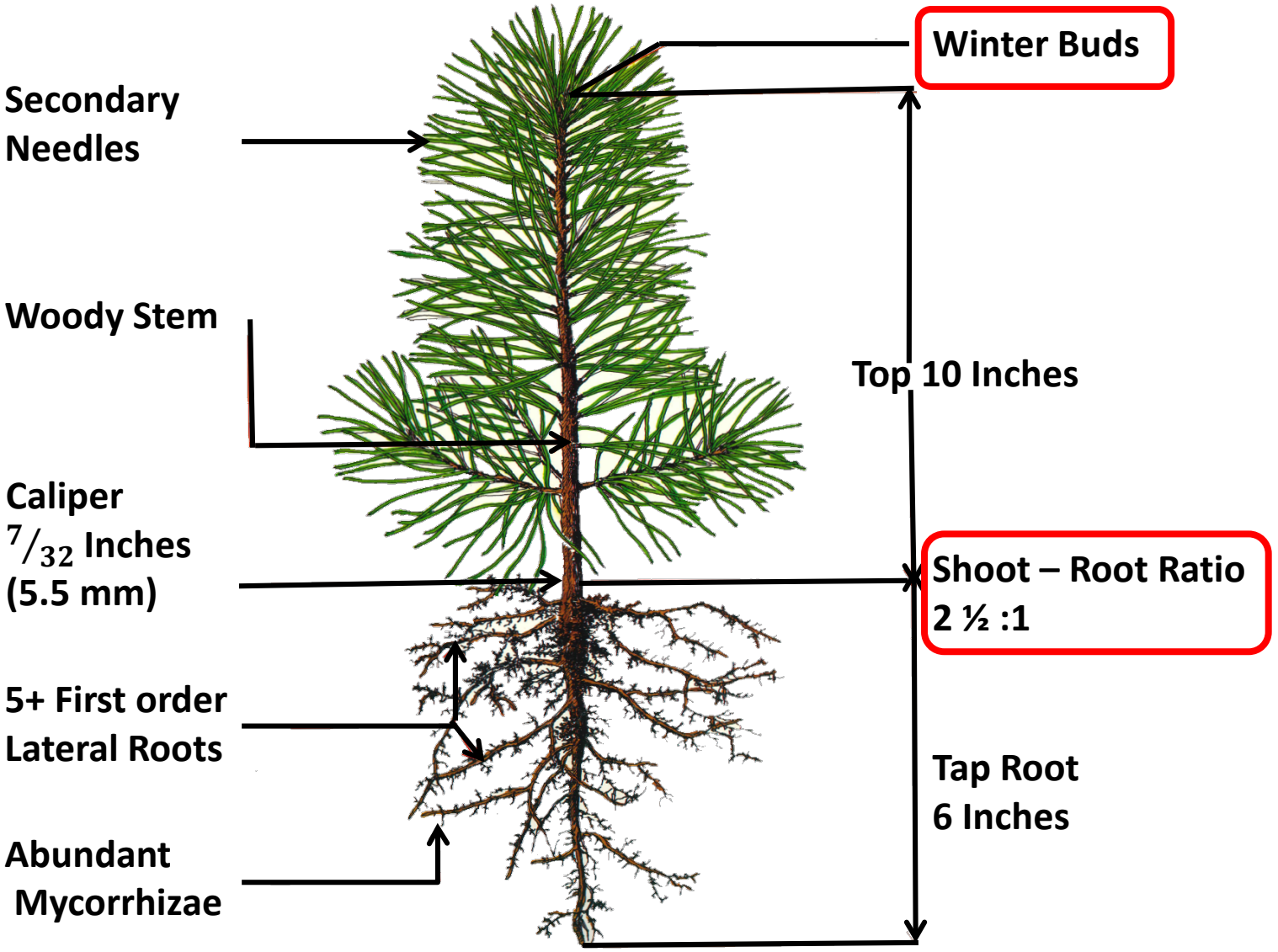
10.5

Seedling Density's Effect on Seedling Grade

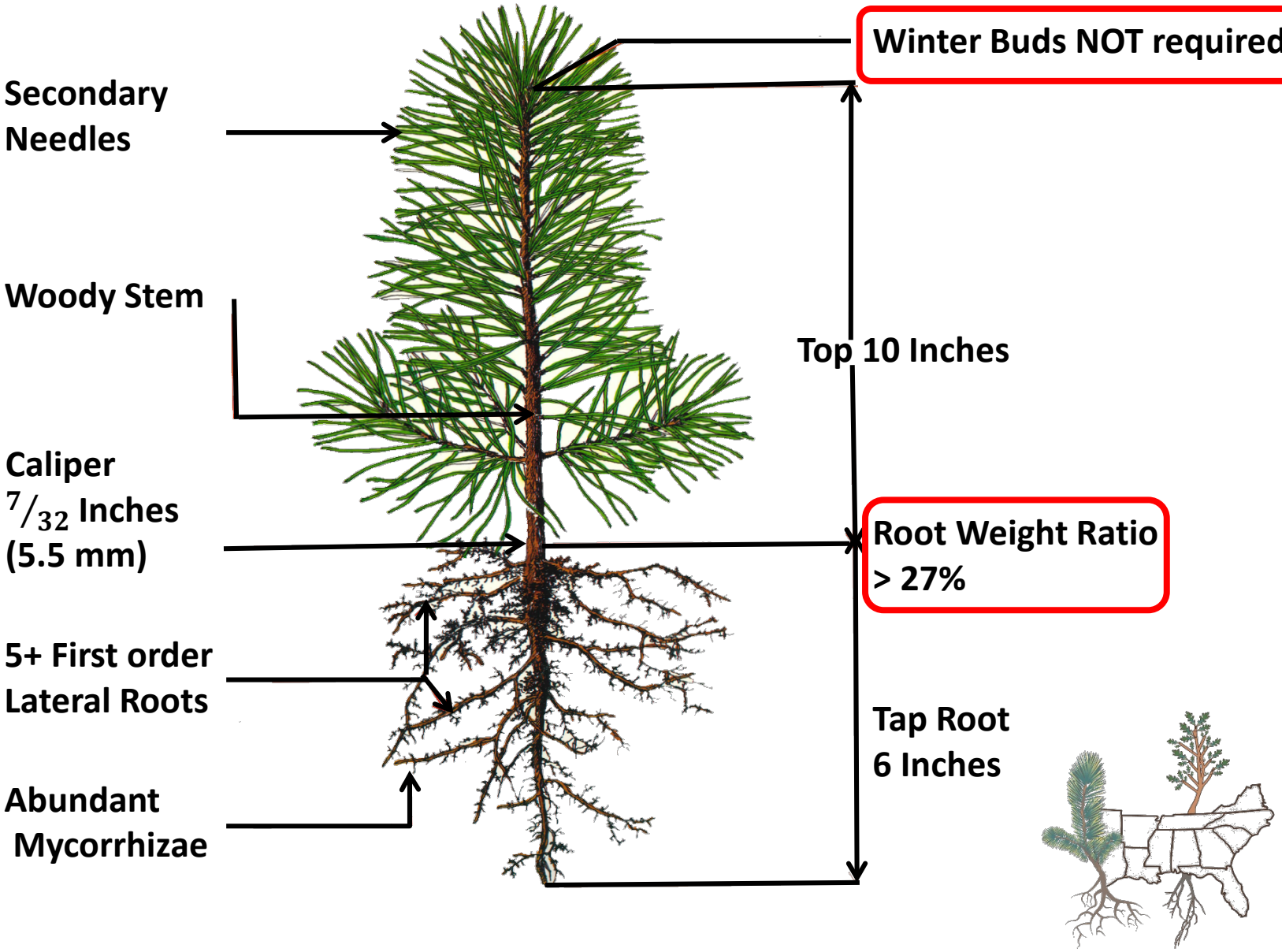


Chris Rosier

Target, Ideal or Optimum Seedling



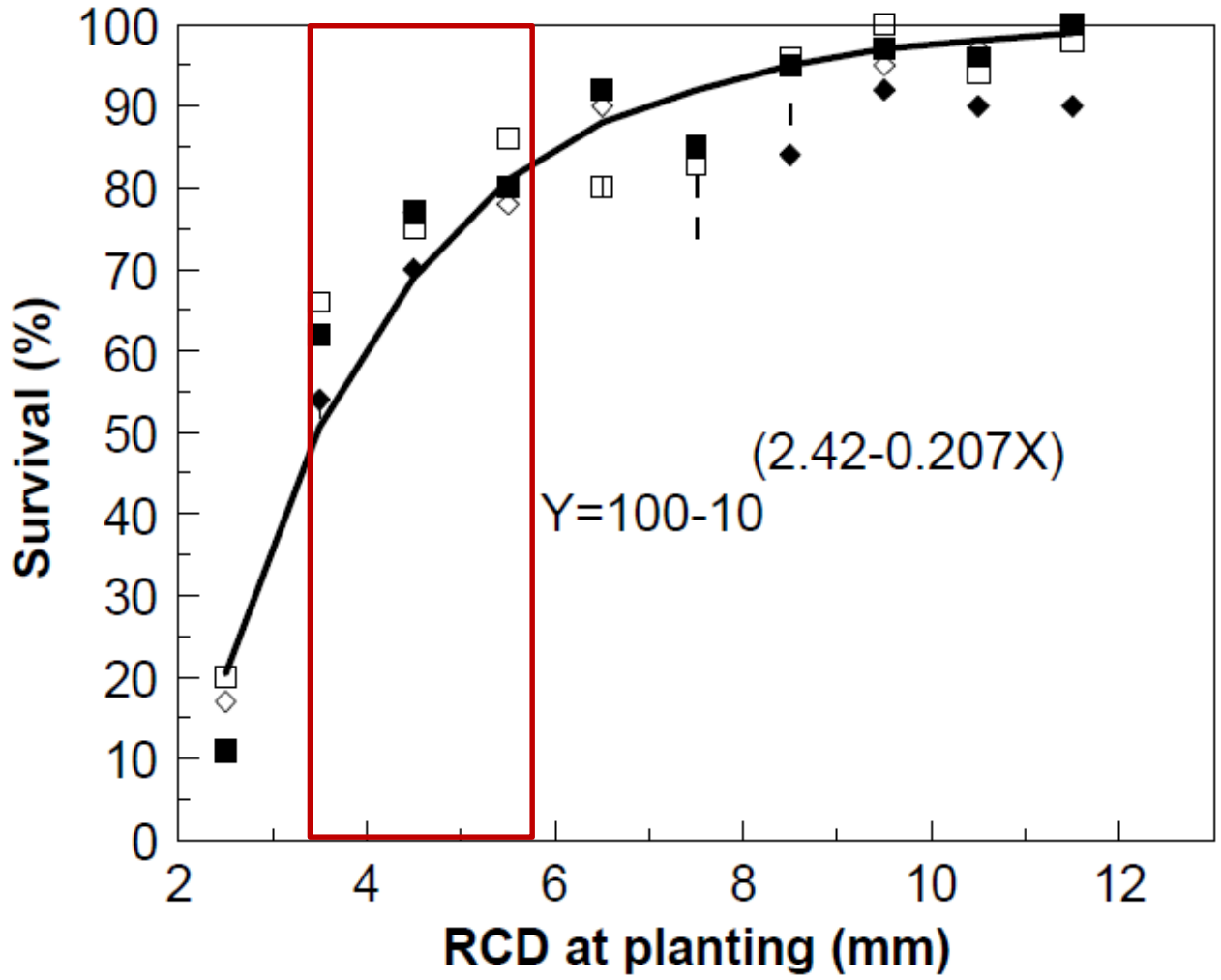
Nursery Coop modified Optimum Seedling



Measuring Seedling Quality

- Shoot Height
- **Root Collar Diameter (RCD)**
- Ratios:
  - –Shoot- Root Ratio
  - **–Root Weight Ratio**

SEEDLING SURVIVAL



South. 2000. Increasing pine survival and early growth by planting "morphologically improved "seedlings to increase survival and growth

Shoot: Root Ratio

- Volume of Shoot: Volume of Roots **OR**
- Weight of Shoot: Weight of Roots

NOT

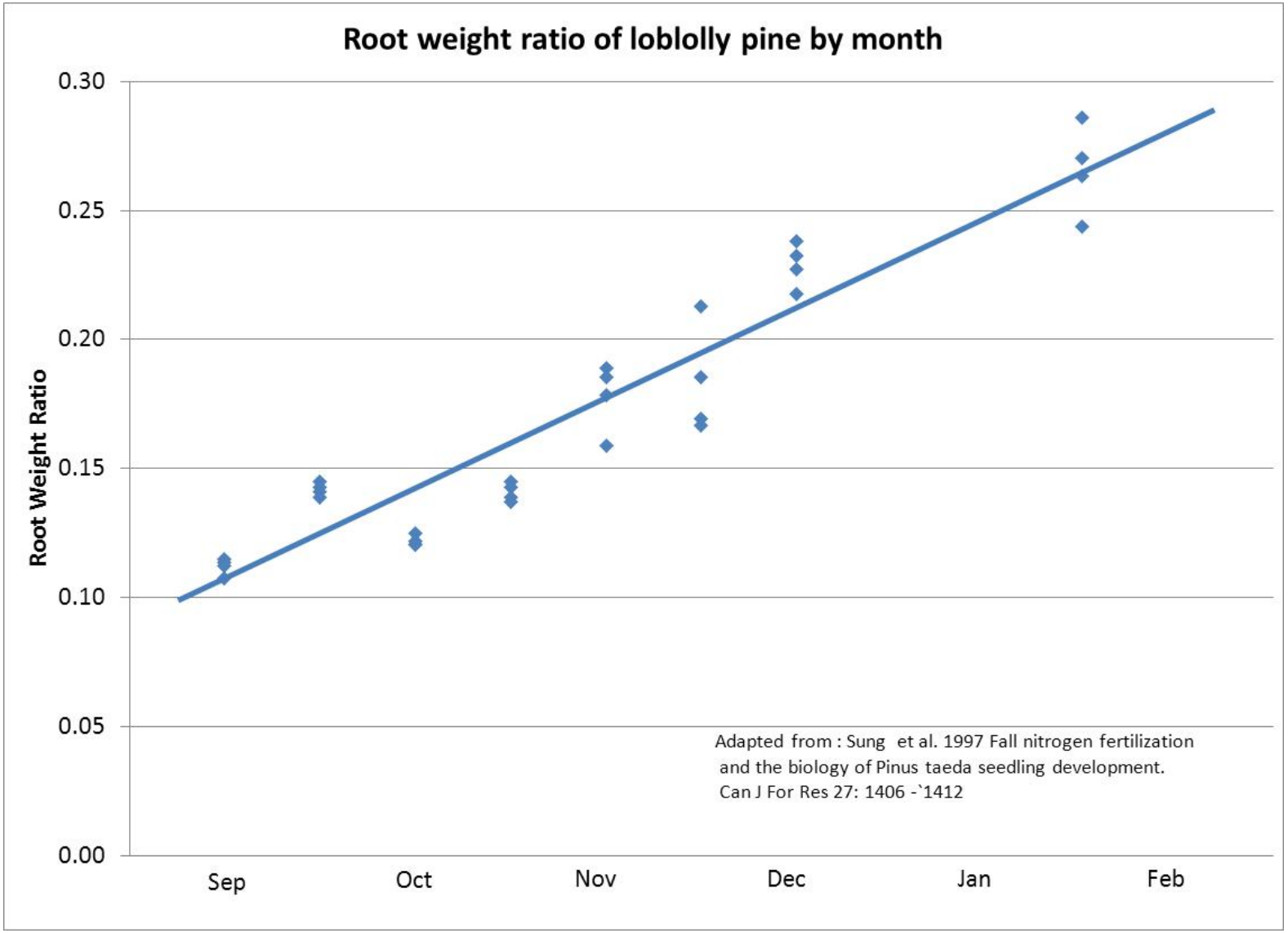
- Shoot length: Root Length
- Shoot: Root ratio **was never intended to be expressed by dividing taproot length by shoot length.**

Root Weight Ratio

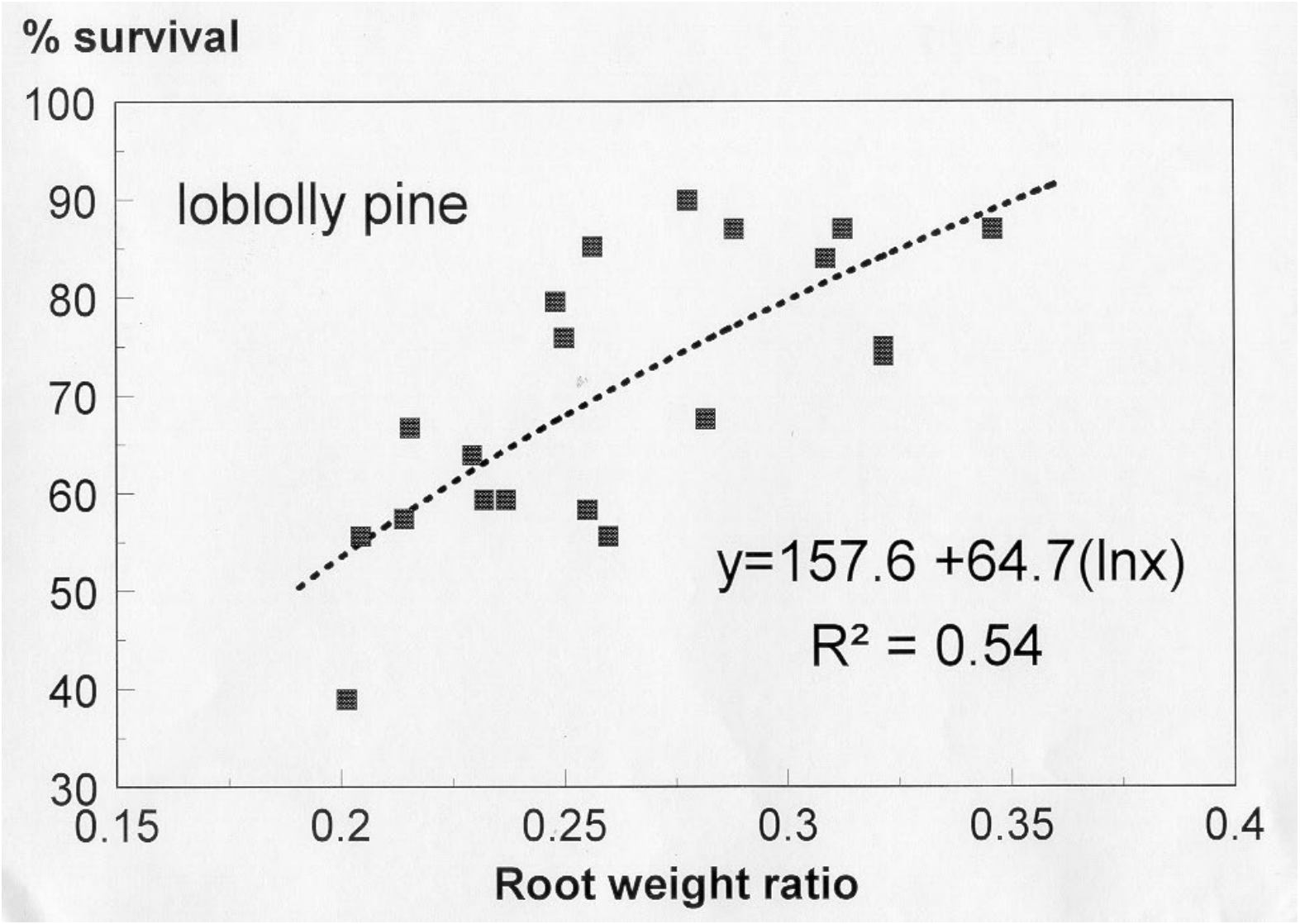
- $$\frac{\boldsymbol{Dry\ Root\ Weight}}{(\boldsymbol{Dry\ Root\ Weight + Dry\ Top\ Weight})} \times \mathbf{100} = \_\_\%$$

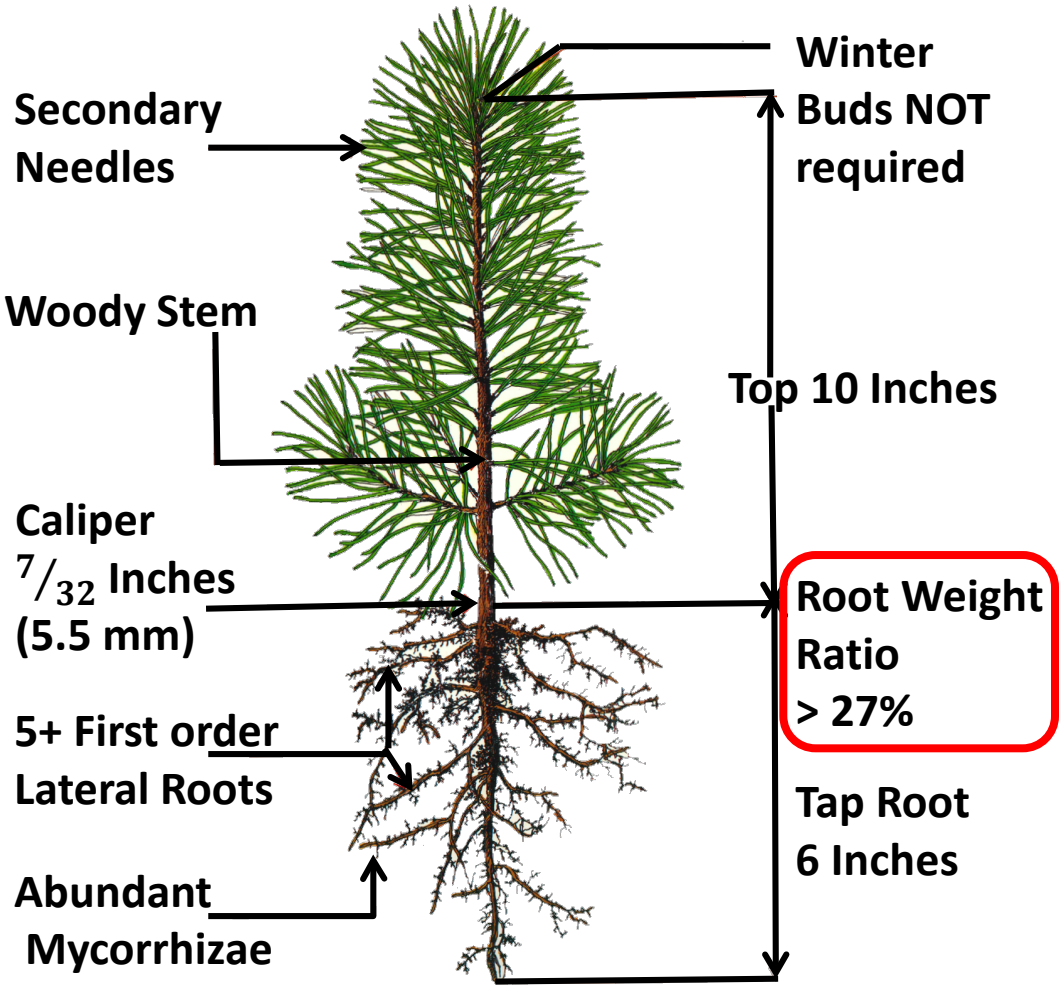
- Example: Root weight = 1g and Shoot (top) weight = 3g
- RWR = ?????

Relationship of RWR and time of lifting



Relationship of RWR to survival





How close do bareroot nurseries come to a Root Weight Ratio of >27%?

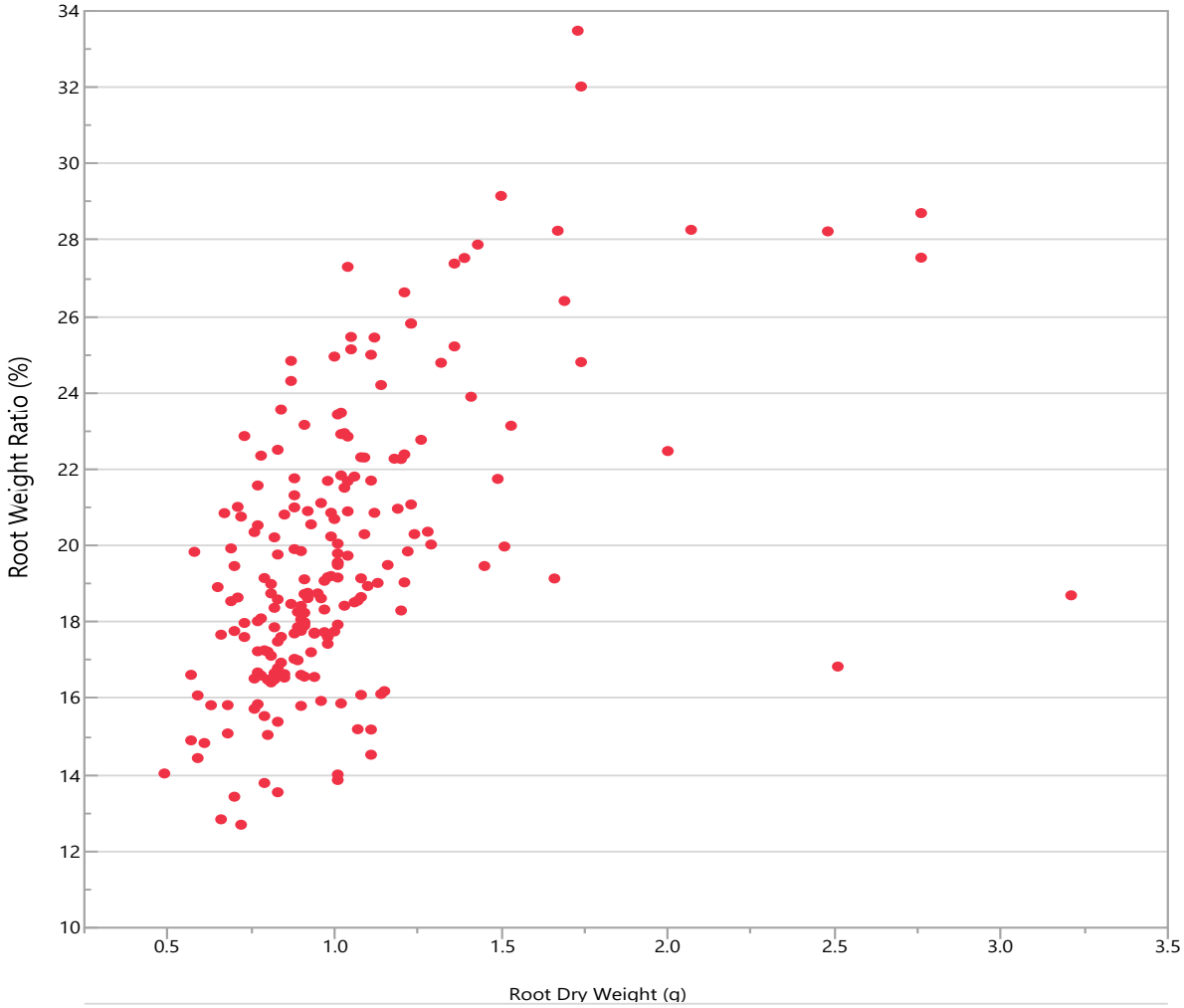
2 growing seasons

2016-2017

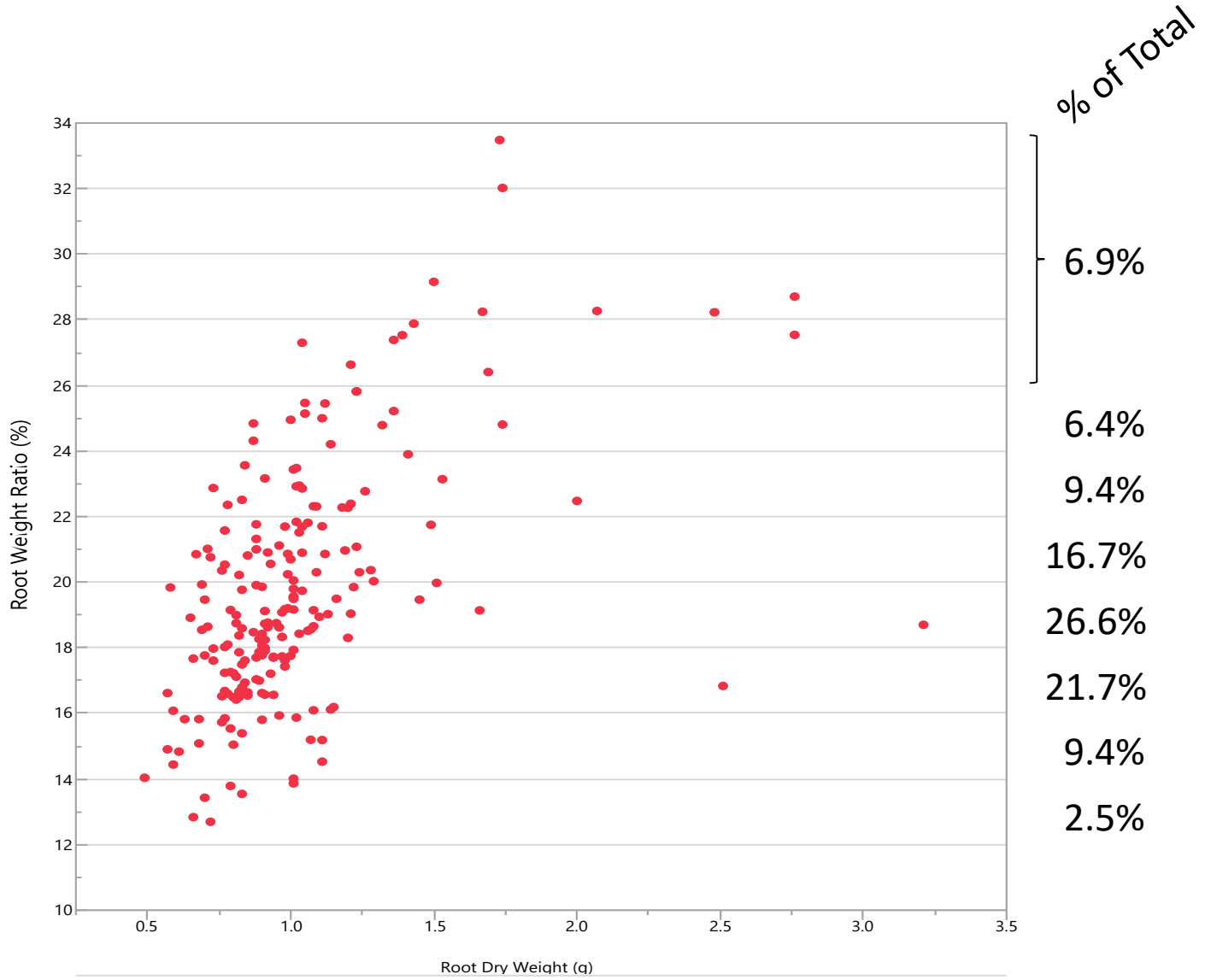
2017-2018

208 seedling evaluations

Bareroot Root Weight Ratio and Root Dry Weight



Bareroot Root Weight Ratio and Root Dry Weight



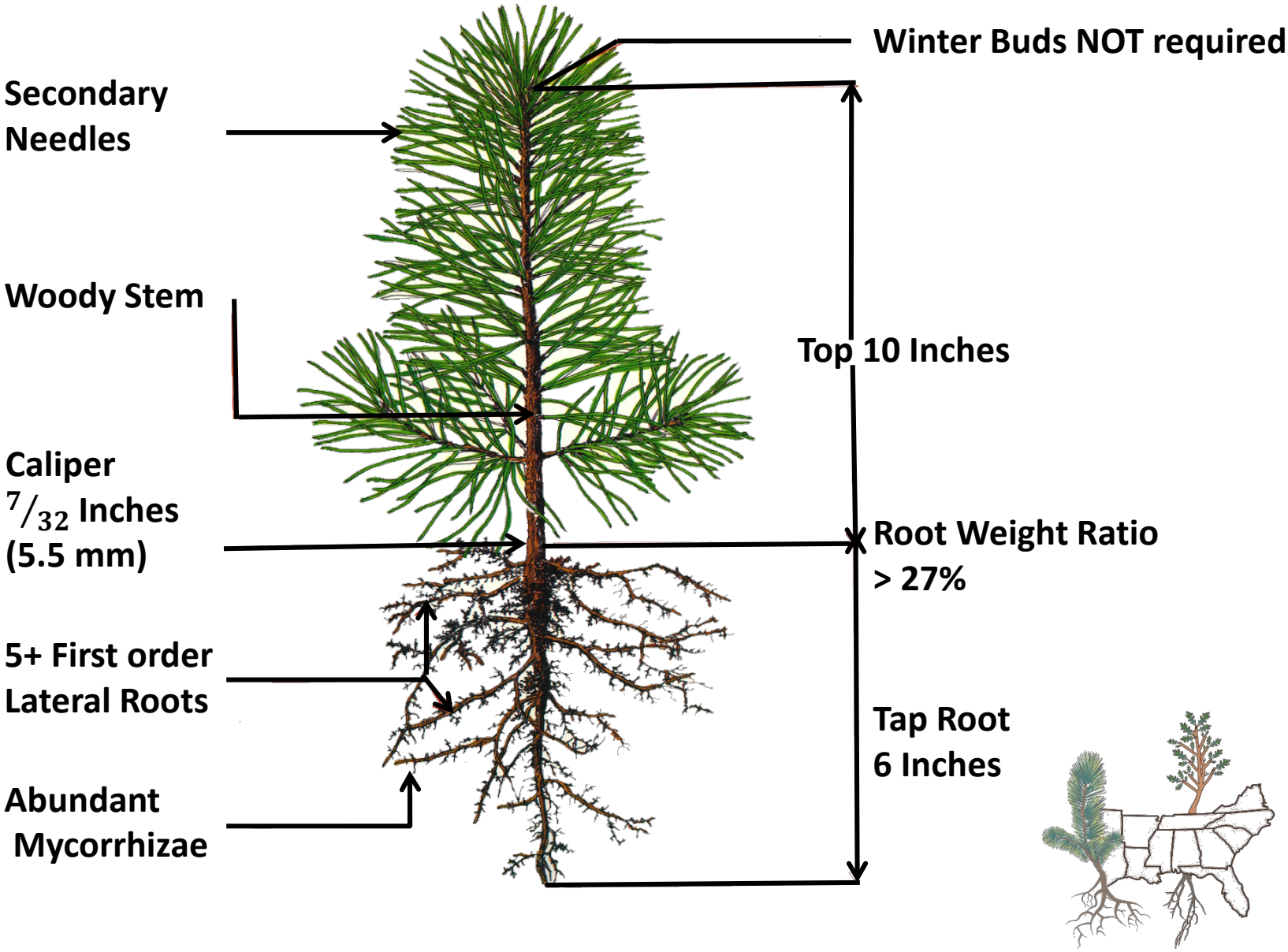
7 Factors That Effect Root Growth?

1. Time of lifting
2. Growing density
3. Irrigation
4. Fertilization
5. Genetics
6. Root and top culture
7. Time of sowing

How to negate good seedling quality

- **Nursery:**
  - Improper lifting/handling of your seedlings
- **Out Planting:**
  - Improper transportation/storage of your seedlings
  - Root pruning your seedlings
  - Root stripping your seedlings
  - Improper planting of your seedlings

Nursery Coop modified Optimum Seedling



How the Nursery Coop can help you evaluate seedling quality

- Beginning in late fall for container seedlings and January for bareroot seedling we will evaluate samples of seedlots for you.
- One sample = 30 seedlings (same seedlot/family)
- Cost – Bareroot $40/sample
  Container $45/sample
- What you will receive: 2 page report

Auburn University
Southern Forest Nursery
Seedling Evaluation Report

PAGE 1

9/1/2018

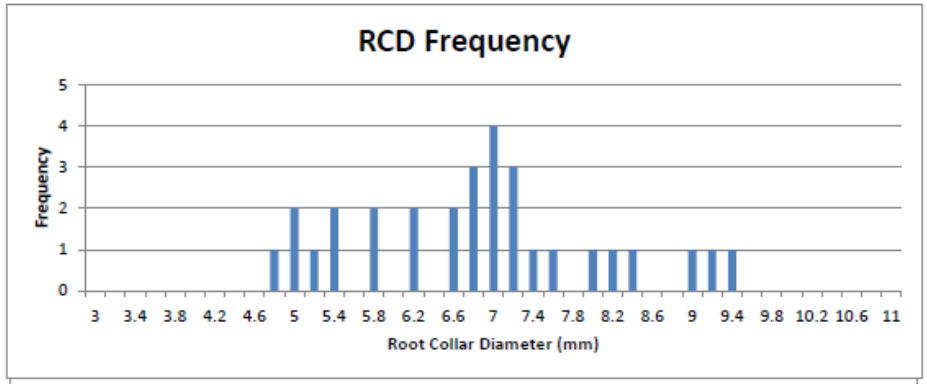
A sample

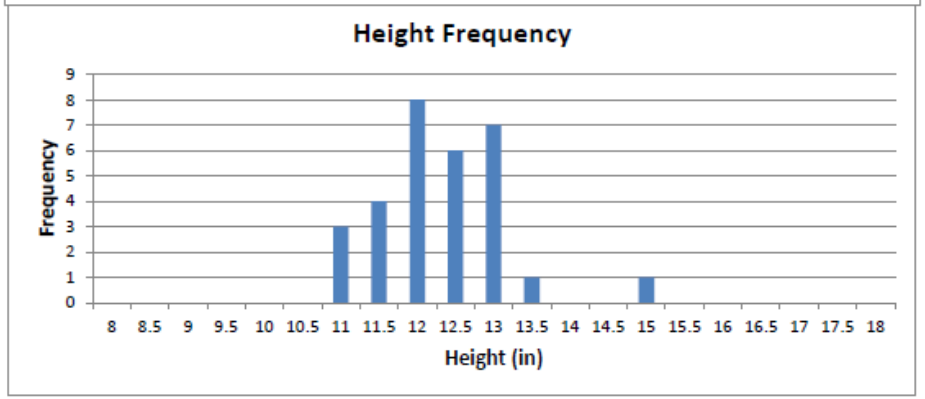
Company:	A Company	
Contact:	A Name	0
Nursery/State:	A nursery	
Species:	Lob	
Stock:	Bareroot	aname@auburn.edu
Source:	Coastal	
Genotype:	2nd	
Hand or Machine Lifted:	Hand	

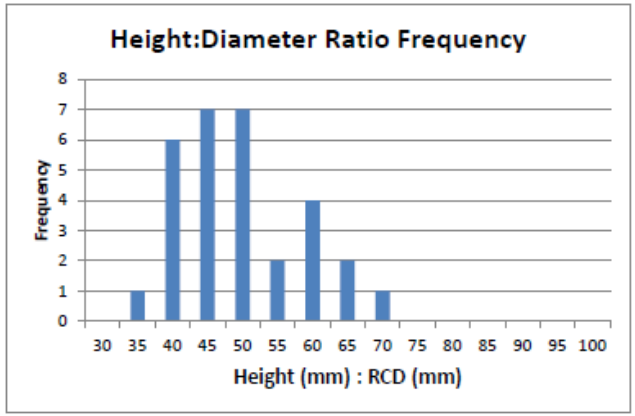
Measure of Central Tendency	
Average Height (in)	12.09
Average RCD (mm)	6.76
Median Height (in)	12.00
Median RCD (mm)	6.76

Measure of Spread (Dispersion)			
95% Confidence Interaval for RCD (mm)	6.76	±	0.44
98% Confidence Internval for RCD (mm)	6.76	±	0.53
Standard Deviation of Height (in)		0.83	
Standard Deviation of RCD (mm)		1.24	
Coefficient of Variation of Height (in)		7%	
Coefficient of Variation of RCD (mm)		18%	
Range (maximum - minimum) of Height (in)		4.40	
Range (maximum - minimum) of RCD (mm)		4.55	

Ratio	
Root Weight Ratio	22.5%
Height:Diameter Ratio (mm/mm)	47
Top Dry Weight (g) (indiv)	5.281
Root Dry Weight (g) (indiv)	1.532







H:D is a ratio of sturdiness
Height (mm):RCD (mm)
A high ratio = "spindly"
A low ratio = "stouter"

Example

RCD (mm)	Ht (in)	H:D Ratio
4.5	10	56
5	10	51
4.5	12	68
5	12	61
4.5	14	79
5	14	71

Summary

- No single characteristic
- Height alone is not a good indicator
- **A *good nursery practice is to judge seedling quality by several traits***