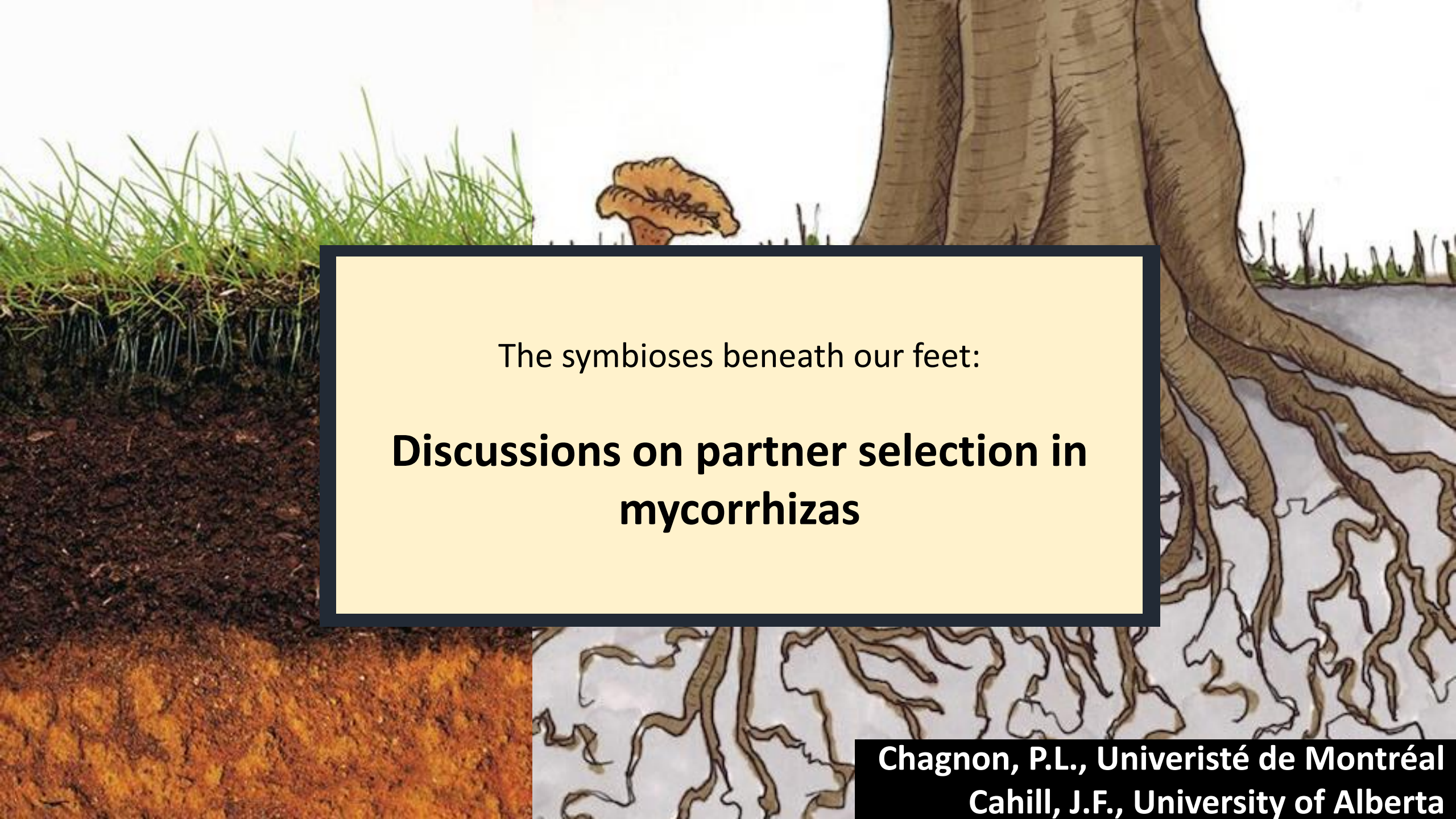
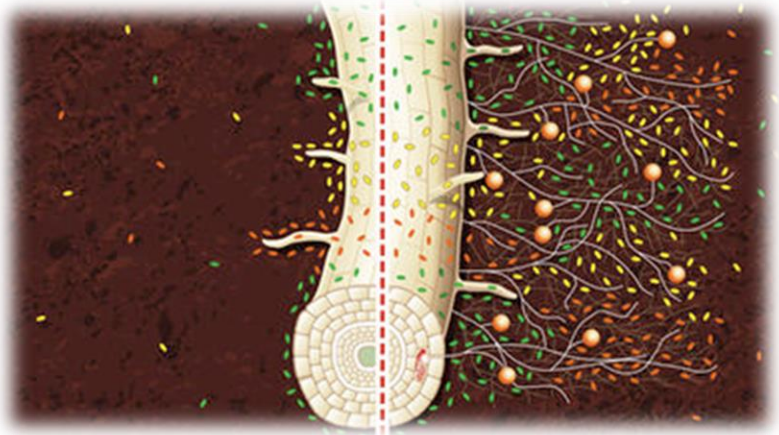


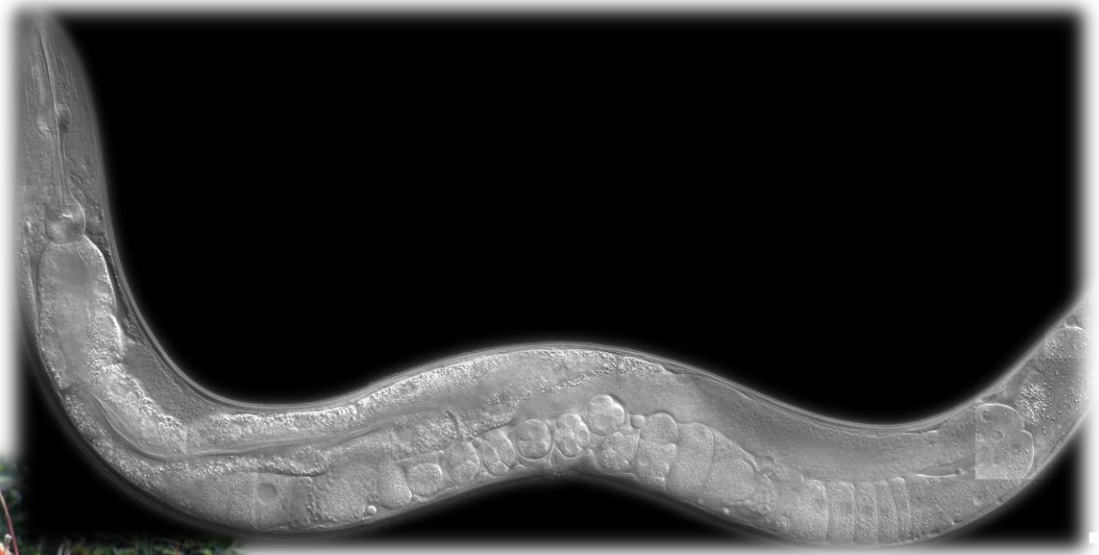
The symbioses beneath our feet:

Discussions on partner selection in mycorrhizas

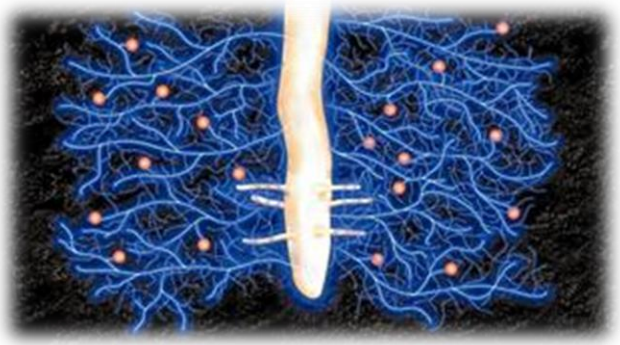
Chagnon, P.L., Univeristé de Montréal
Cahill, J.F., University of Alberta

MUTUALISMS IN SOILS





ESTABLISHING A MUTUALISM



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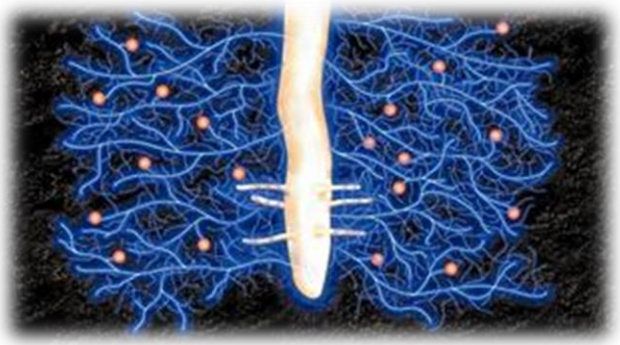

Hot Dog with Everything

Char-Broiled Chicken Sandwich

Burger

Italian Beef

Chopped Salad

Poppyseed Fruit with Chicken Salad

HOT DOGS & CHILI

HOT DOG 2.65
With everything includes: mustard, relish, freshly chopped onions, sliced red ripe tomatoes, kosher pickle and sport peppers piled onto a perfectly steamed poppy seed bun.

CHILI CHEESE DOG 3.25
Served with onions.

CHAR-GRILLED MAXWELL STREET STYLE POLISH 3.99
Grilled in the traditional way it was done on historic Maxwell Street and prepared with mustard and grilled onions.

JUMBO HOT DOG 2.99
A thicker Hot Dog with mustard, relish, freshly chopped onions, sliced red ripe tomatoes, kosher pickle and sport peppers.

JUMBO CHILI CHEESE DOG 3.55
Served with onions.

BOWL OF CHILI 3.10
Includes cheese and onions.

CHICKEN SANDWICHES

CHAR-BROILED CHICKEN SANDWICH 4.89
Our Char-Broiled Seasoned Breast of Chicken served tender and juicy on a toasted bun, with mayo, tomato and lettuce.

CHAR-BROILED CHICKEN CROISSANT 5.19
Our Char-Broiled Chicken served on a perfectly baked buttery, golden brown, flaky croissant served with mayo, tomato and lettuce.

BREADED CHICKEN SANDWICH 4.69
A lightly breaded, all white breast fillet, deep-fried in 100% vegetable oil and served on a toasted bun with mayo, tomato and lettuce.

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Deep-fried in 100% vegetable oil and served on a perfectly baked flaky croissant with mayo, tomato and lettuce.

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CHAR-BROILED BURGERS

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BURGER 4.10
Char-Broiled 1/3 pound* of Juicy Beef with mayo, crisp lettuce, a red ripe tomato slice, sliced red onion, pickles and ketchup served on our freshly toasted old fashioned style bun.

DOUBLE BURGER 6.49
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BACON BURGER 4.99
Includes mayo, lettuce and tomato.

DOUBLE BACON BURGER 7.38
Includes mayo, lettuce and tomato.

SANDWICHES with CHEESE EXTRA. ****Indicates Pre-cooked weight.***

BEEF-N-SAUSAGE SANDWICHES

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ITALIAN BEEF Our own famous recipe 5.49
Chicago's #1 Italian Beef served on perfectly baked French bread. We recommend adding hot or sweet peppers to your sandwich (additional charge.

BIG BEEF 7.29
For the larger appetite.

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COMBO BEEF & CHAR-GRILLED SAUSAGE 6.15

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A perfect combination of our famous Italian Beef layered with Cheddar cheese and served on a toasted croissant.

HOME COOKED SWEET PEPPERS ..... .59

HOT PEPPERS ..... .59

MOZZARELLA OR CHEDDAR CHEESE ..... .60

MEATLESS SANDWICHES

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Grilled yellow-fin tuna filet with lettuce, tomato, sliced red onion and our homemade tartar sauce on a toasted bun.

HALIBUT FILET SANDWICH 5.39
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GRILLED VEGETABLE SANDWICH 5.45
Select grilled vegetables, grilled portabella mushroom and Havarti cheese on grilled multi-grain Focaccia.

SIDE ORDERS

FRENCH FRIES	Sm. 1.99	Lg. 2.19
CHEESE FRIES	Sm. 2.68	Lg. 2.88
ONION RINGS		2.19
TAMALE		1.89
TAMALE IN A BOWL Served with chili, cheese and onions		3.09
CHICKEN TENDERS		4.29

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COFFEE, HOT CHOCOLATE		1.50
BOTTLED WATER		.99

**Not available in all locations.*

SALADS

CHICKEN PECAN SALAD 7.59
A mix of fresh lettuce topped with tender chicken, crunchy bacon, red cabbage, tomato, a shredded cheese blend and pecans topped with our own warmed honey dijon dressing.**

CHOPPED SALAD 7.59
A mix of fresh lettuce mixed with Ditalini pasta, chicken breast, bacon, tomato, red cabbage, Gorgonzola cheese, green onion and our House dressing.**

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It's got a bunch of junk in it! Like salami, lots of provolone cheese, radishes, onion, sweet cherry tomatoes, olives, celery, roasted red peppers, parmesan cheese, parsley and on top of all that garbage is a trashy sweet vinaigrette dressing.**

POPPYSEED FRUIT WITH CHICKEN SALAD 7.79
Our tender chicken breast served with a generous selection of strawberries, pineapples, blueberries, Mandarin oranges, all tossed together with Gorgonzola cheese and glazed walnuts in our Poppyseed dressing. A sweet deal!**

APPLE WALNUT CHICKEN SALAD 7.79
Tender baby spinach and a mix of fresh lettuce gently tossed with diced Gala apples, dried cranberries, candied walnuts and creamy Goat cheese. Topped with our freshly-sliced grilled chicken. Finished with fat free raspberry vinaigrette.**

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A mix of fresh lettuce mixed with diced chicken, chopped red cabbage, Feta cheese, Garbanzo beans, diced tomatoes, red & green onions and Kalamata olives. Tossed with our creamy Mediterranean-style dressing. Topped with freshly grated parmesan cheese.**

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A mix of fresh lettuce, BBQ chicken breast, bacon, tomato, a shredded cheese blend, green onion, black beans and corn tossed together with our own Southwest chipotle ranch dressing and topped with tortilla pieces.**

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**Salads include lemon poppy seed muffin.

SOUPS . . . 3.19

HEARTY SOUPS, featuring Chicken Noodle daily. Ask your order taker for today's other selections!

Portillo's Chocolate Cake

Chocolate Cake Shake

DESSERTS

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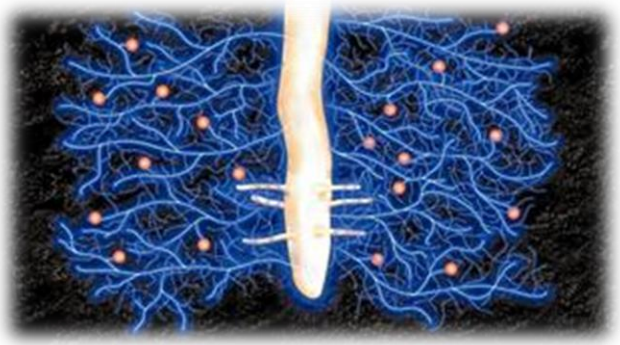

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- Species should select beneficial partners (Bull & Rice 1991)
- But what if no prior info available? (Zee & bever 2014)
- Screen for good partners? (Archetti et al. 2011, Heil 2013)
- Let anyone in and evaluate the partners' impacts?
  - Sanctions (Kiers et al. 2003)
  - Rewards (Bever et al. 2009, Kiers et al. 2011)

PARTNER SELECTION HAPPENS

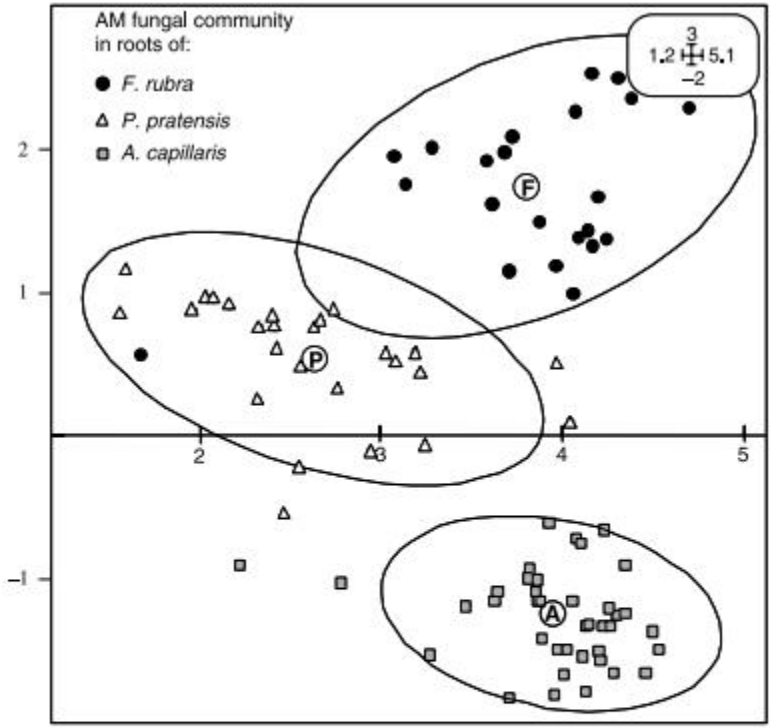

Fig. 2 Noncentred PCA analysis showing differentiation among AM fungal communities according to host plant. Each point represents the AM fungal community in a single root, characterized by T-RFLP profile. For each host–plant species, confidence ellipses ($P < 0.05$) are shown and the labelled circles indicate the centre of gravity (mean value): *A. capillaris* (A), *F. rubra* (F) and *P. pratensis* (P).

CENTRAL QUESTION IS THEN…

To what extent do plants (and fungi) have the relevent information to select their partners?

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MUTUALISMS AND THE IDEAL FREE DISTRIBUTION

Ideal free distribution (Fretwell & Lucas 1970)

Plants will interact twice more frequently with twice more beneficial symbionts (or will transfer twice more C to them)

$$\frac{N_1}{N_2} = \frac{R_1}{R_2}$$

MUTUALISMS AND THE IDEAL FREE DISTRIBUTION

Assumptions (among others):

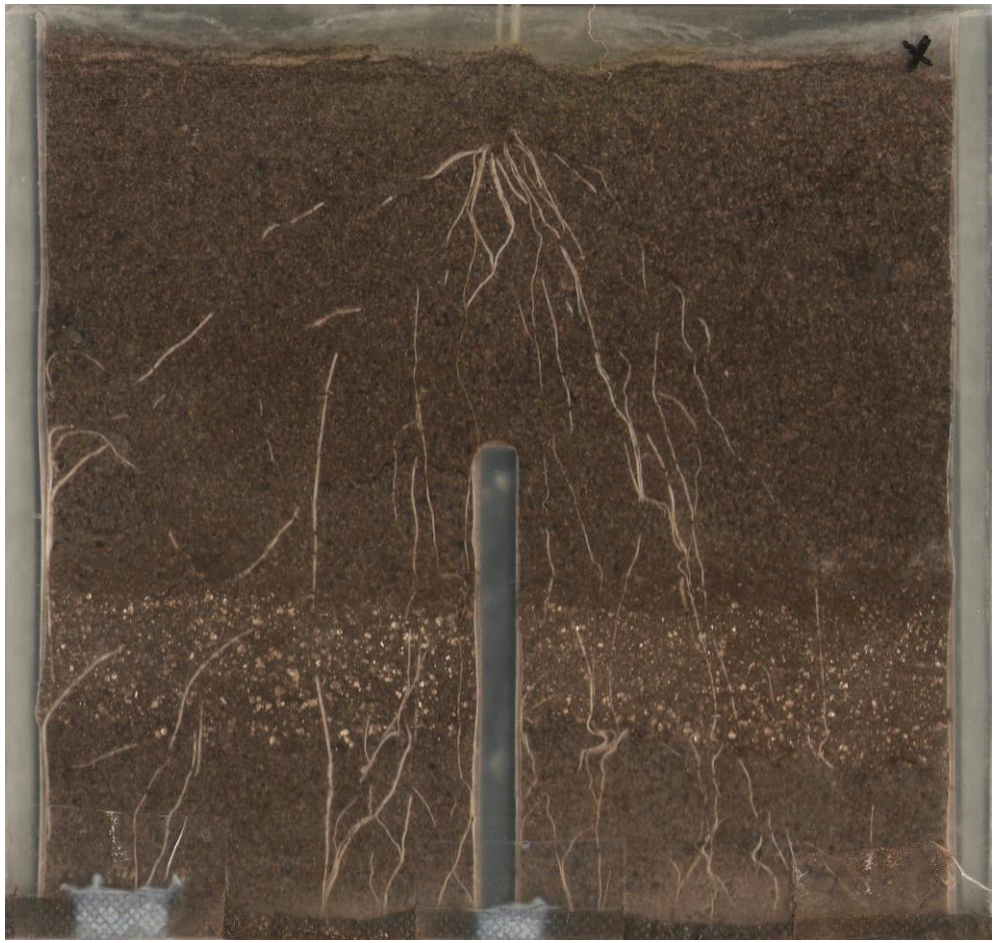
1- Organisms act to maximize foraging efficiency
2- Perfect knowledge about resource location and profitability
3- Travel costs are negligible

A BASIC TEST

HOST: Leek

DESIGN: bi-compartmented thin glass chambers

Left and right sides inoculated either with mycorrhizal fungi or a sterilized inoculum



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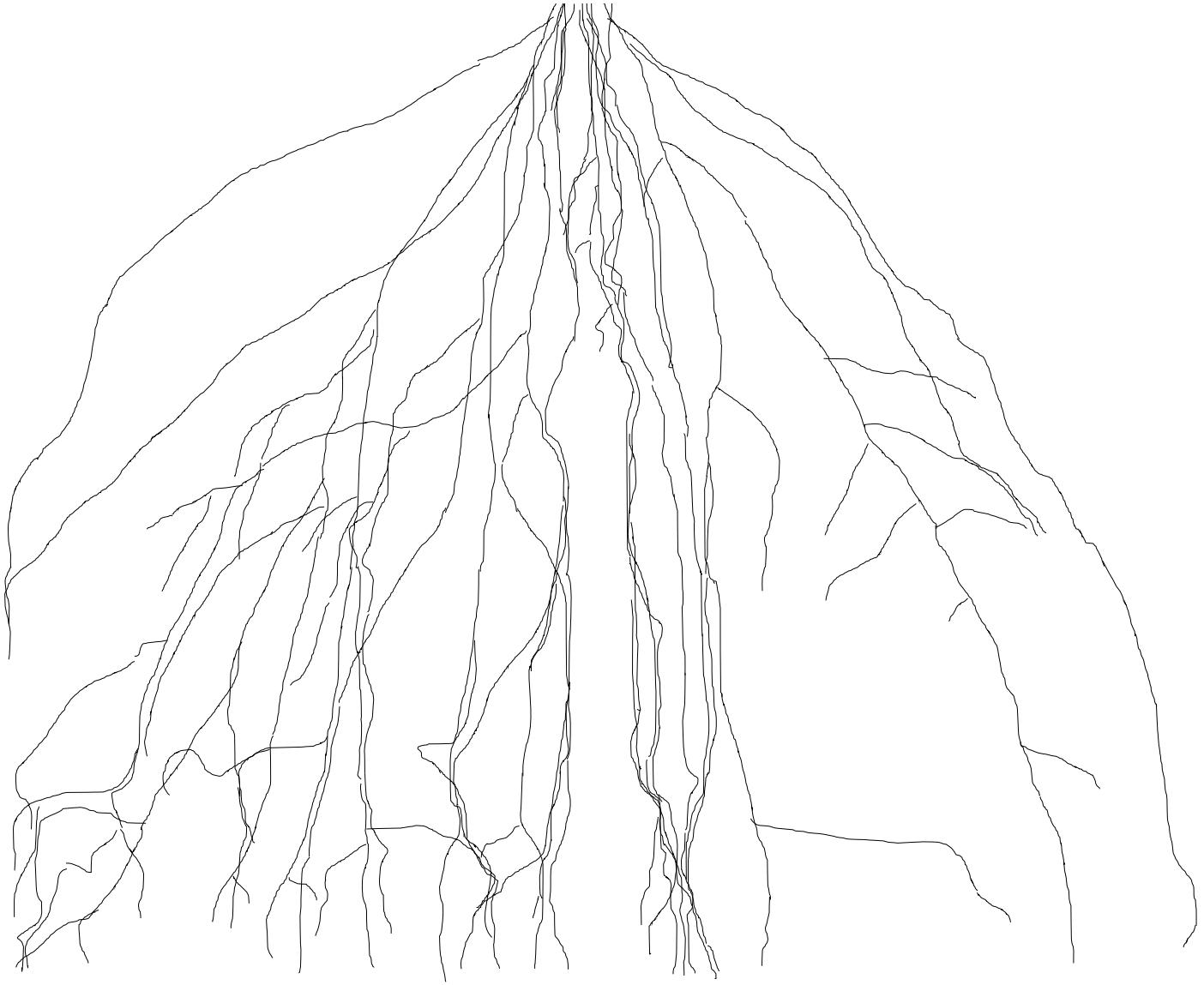

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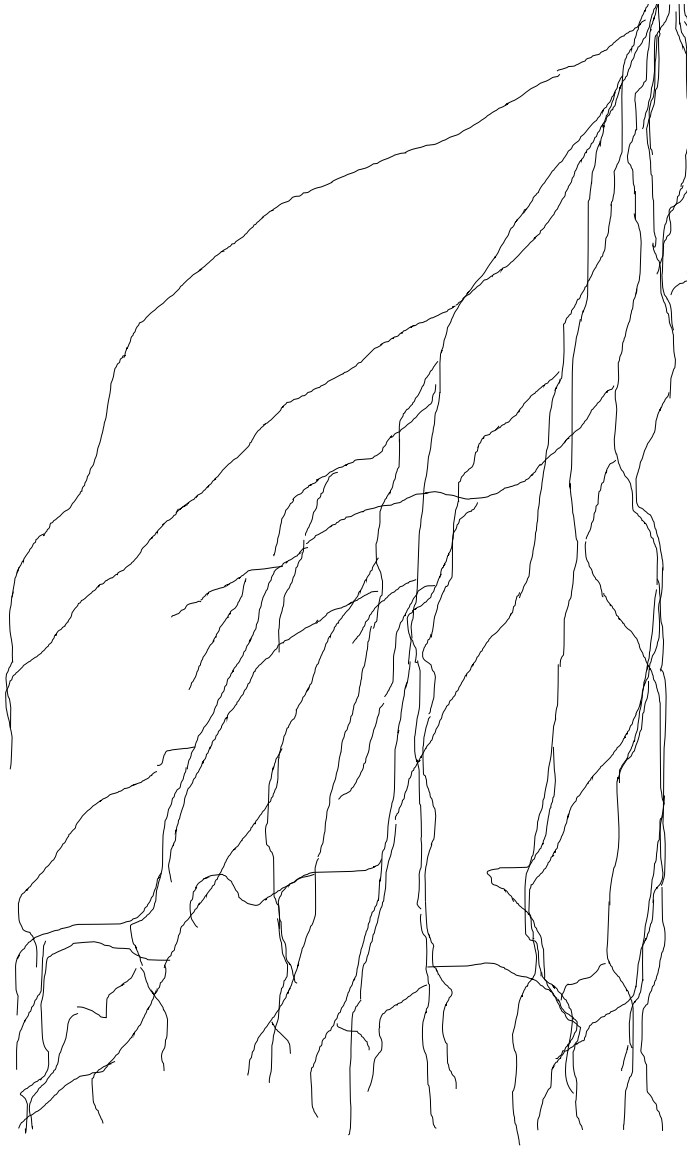

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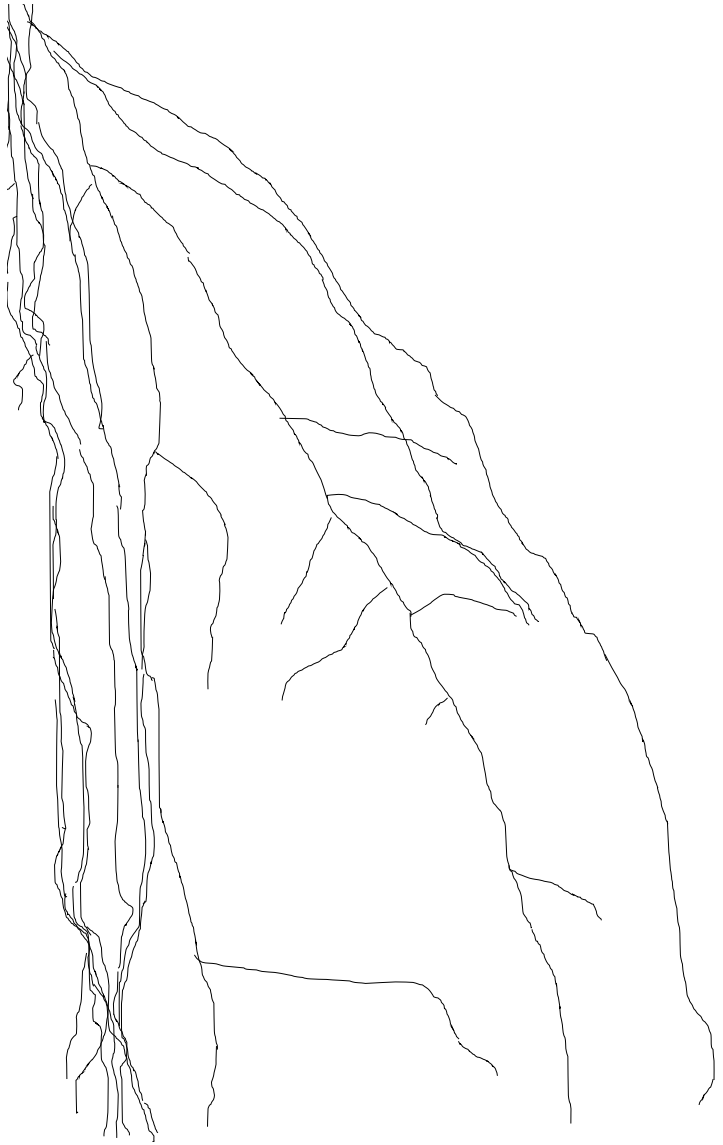

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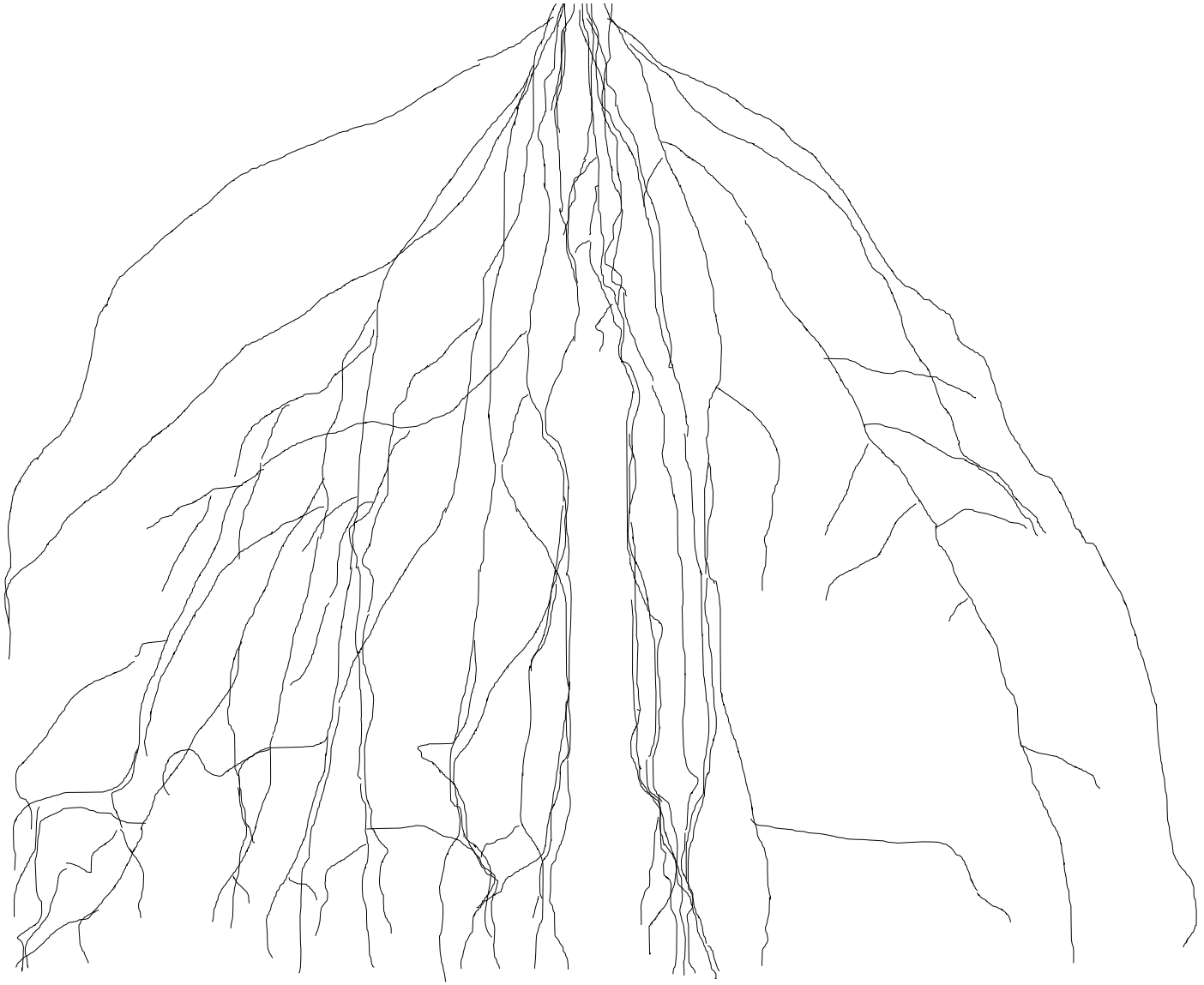
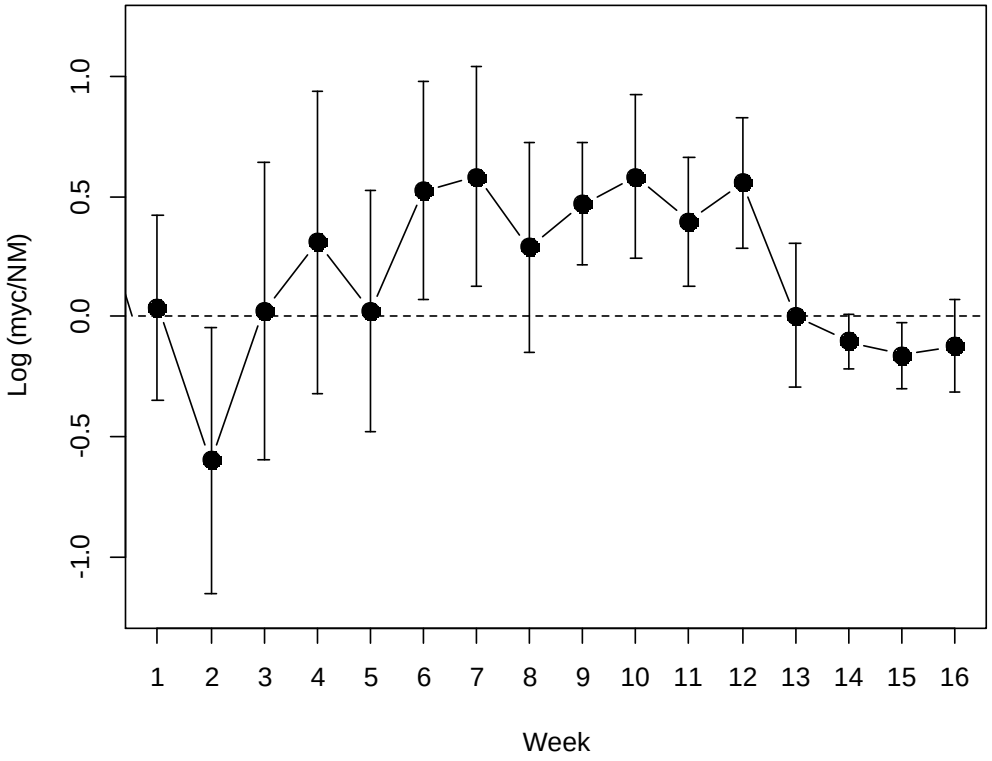
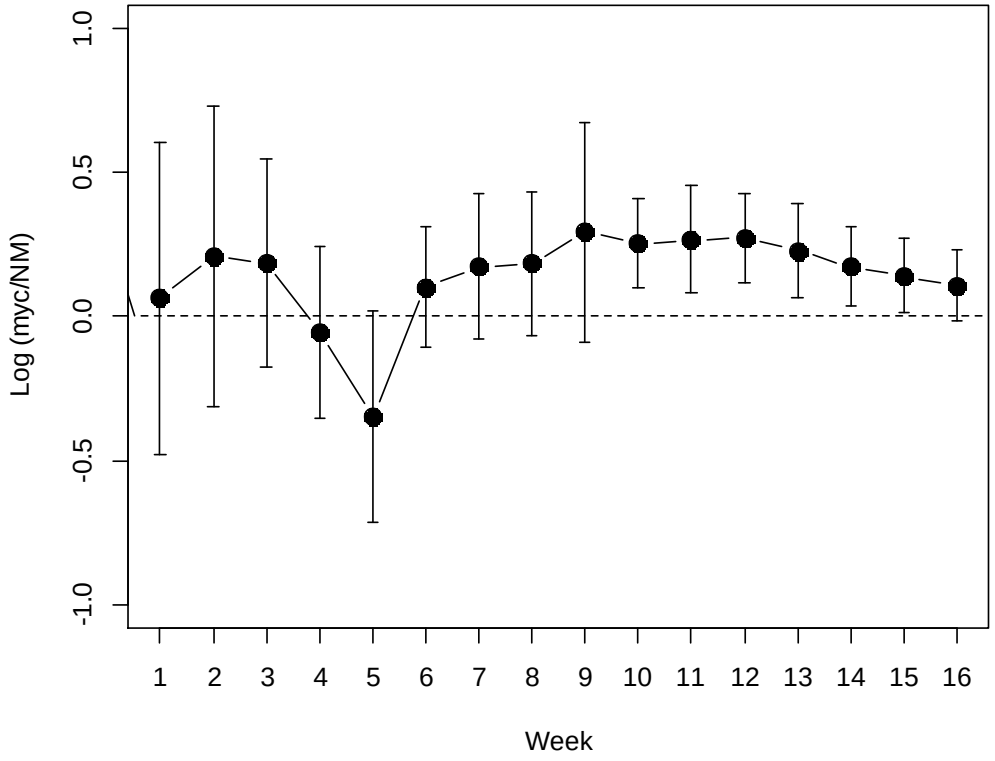


Preferential root allocation?

NEW ROOT PRODUCTION IN MYC vs. NM sides



CUMULATIVE ROOT LENGTHS IN MYC vs. NM sides



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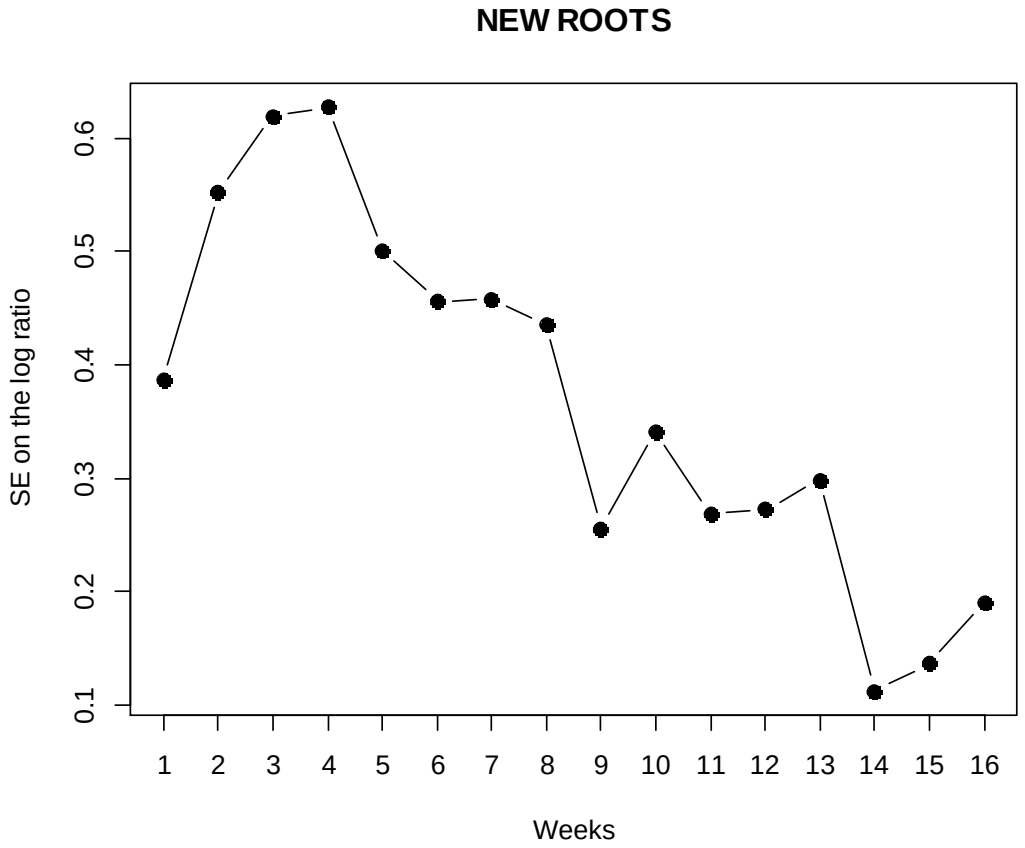
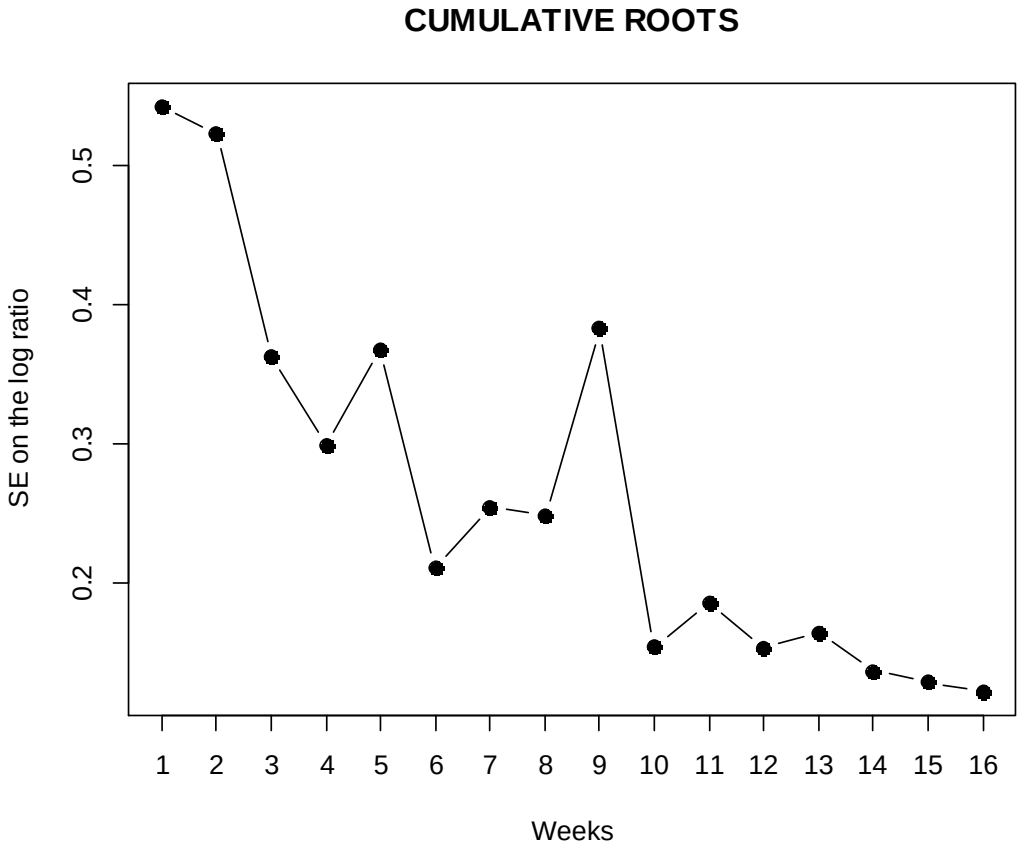
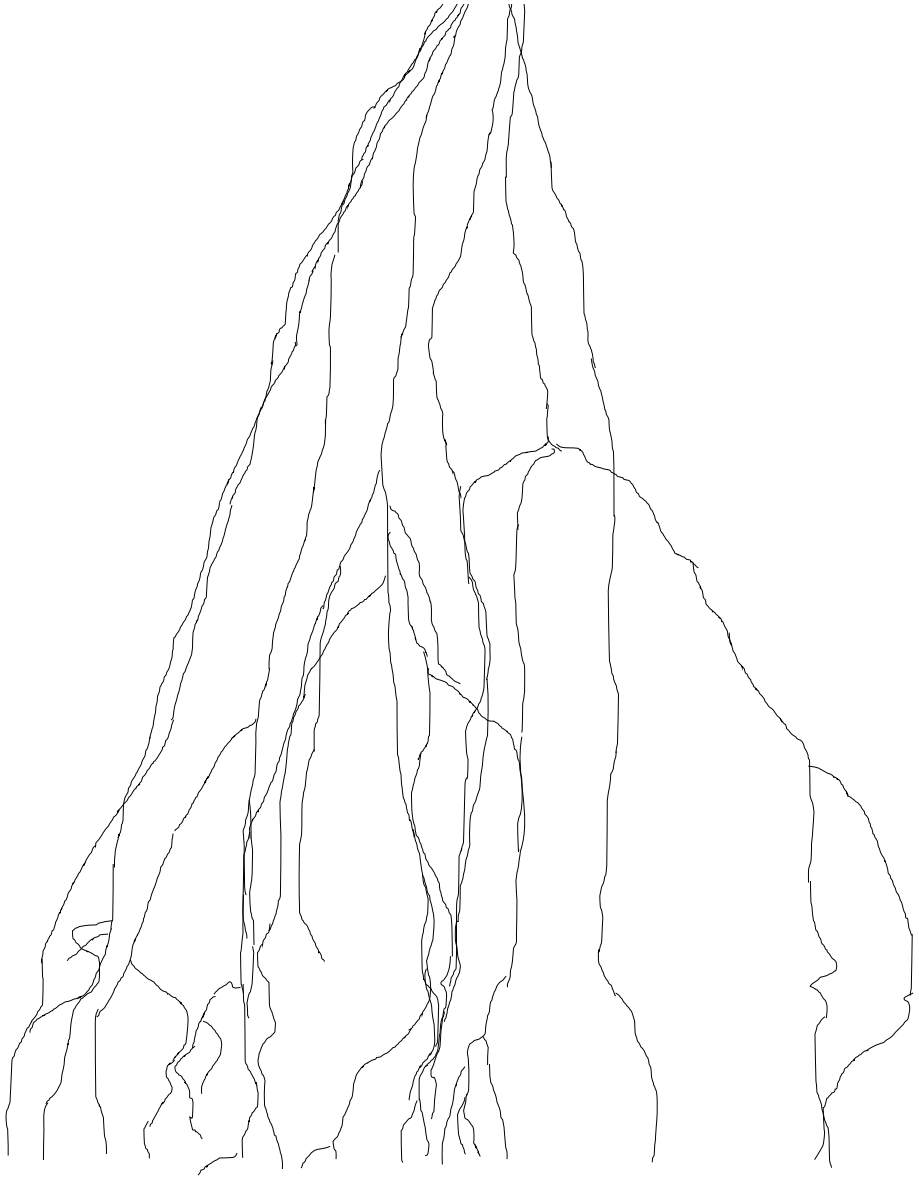




Modular growth as a constraint for behavior?



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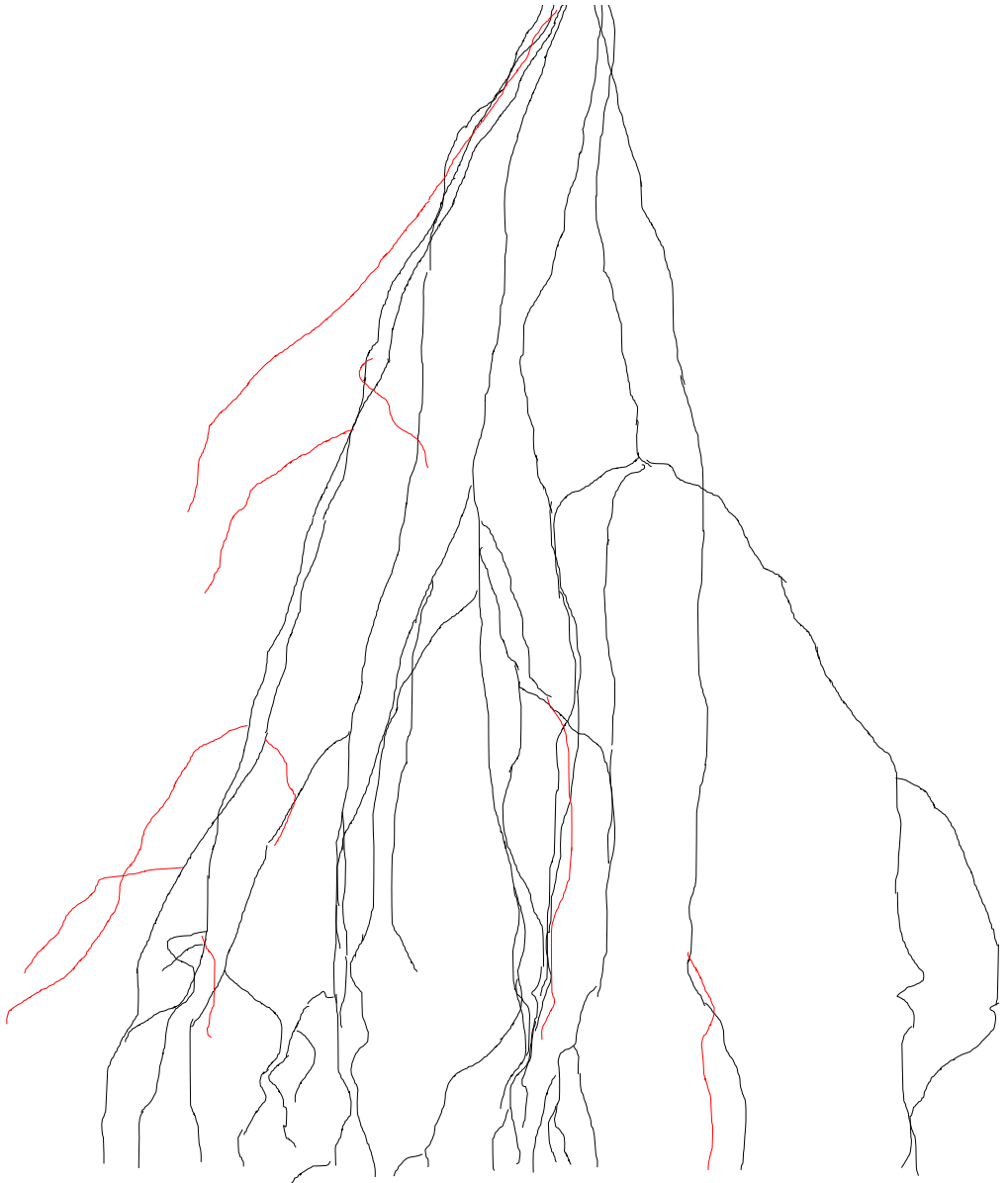
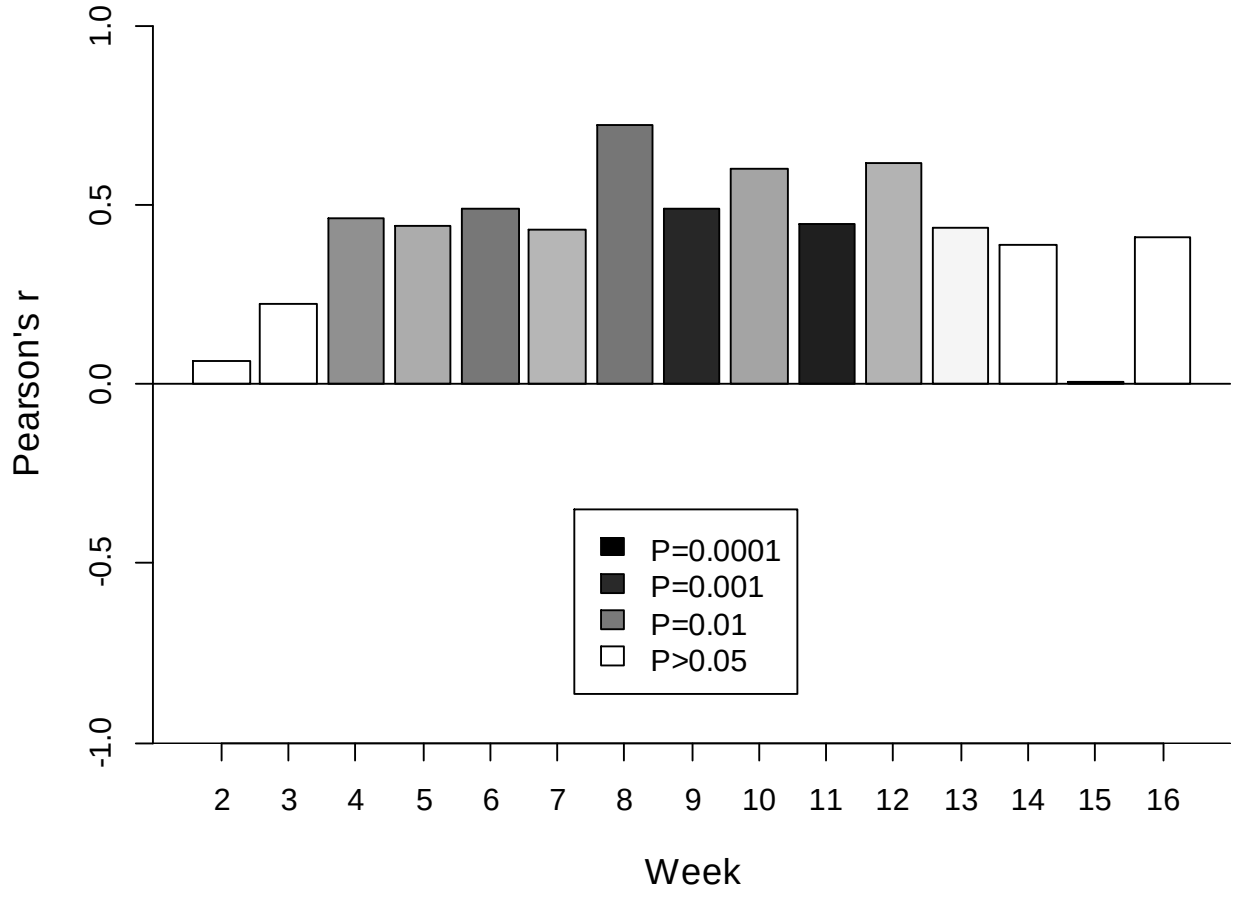
Modular growth as a constraint for behavior?



Modular growth as a constraint for behavior?



So how does leek behave?

- Leek behavioral response was non linear (dynamic through time) → challenge in pot studies

- Variance among replicates decreased over time
  - An optimization process at work? Develop. noise is adaptive?
  - Priority effects in early root system's construction may influence community assembly?

- The modular root growth IS a constraint in partner selection

SUMMARY

- SOIL is a **viscous** matrix
- Plants **CAN** make choices (Drew 1975, Chagnon et al. 2015)
- Plants need **INFORMATION** to make choices

Plants and forced weddings

Plants may not always have information do make appropriate choices!

PLANT

Opportunistic mycorrhizal fungus

Ackowledgements

JC Cahill

John N Klironomos

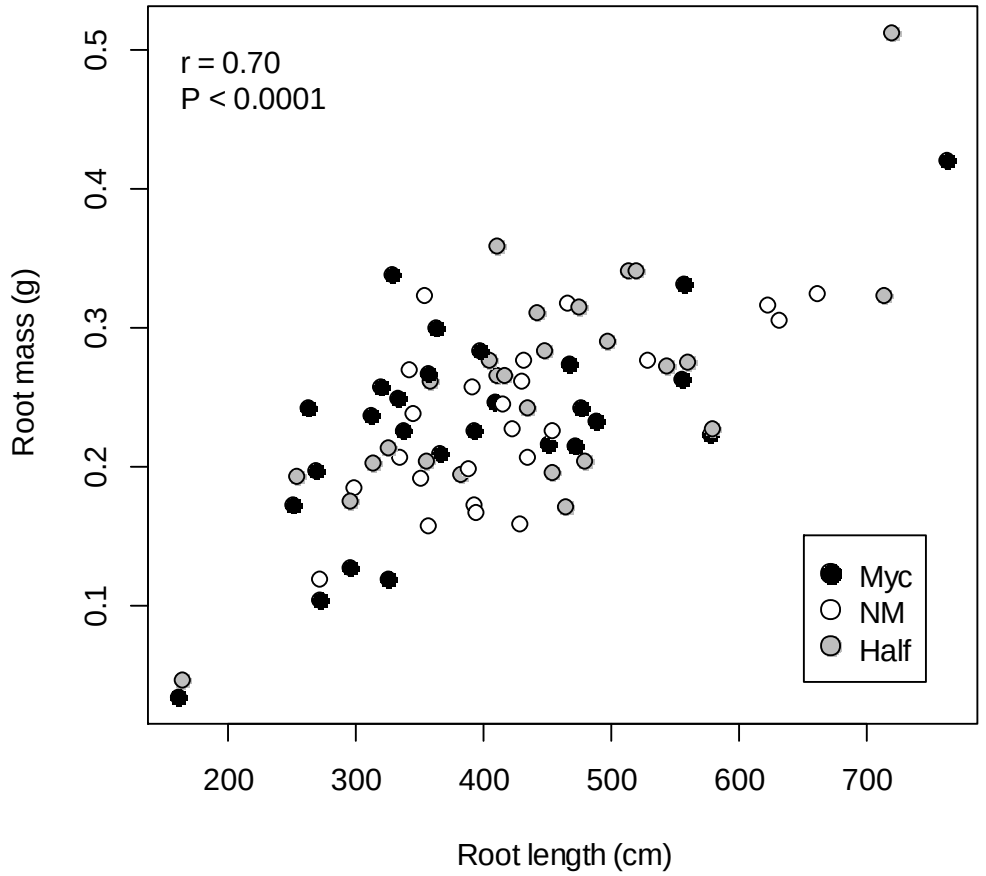
Robert L Bradley

NSERC

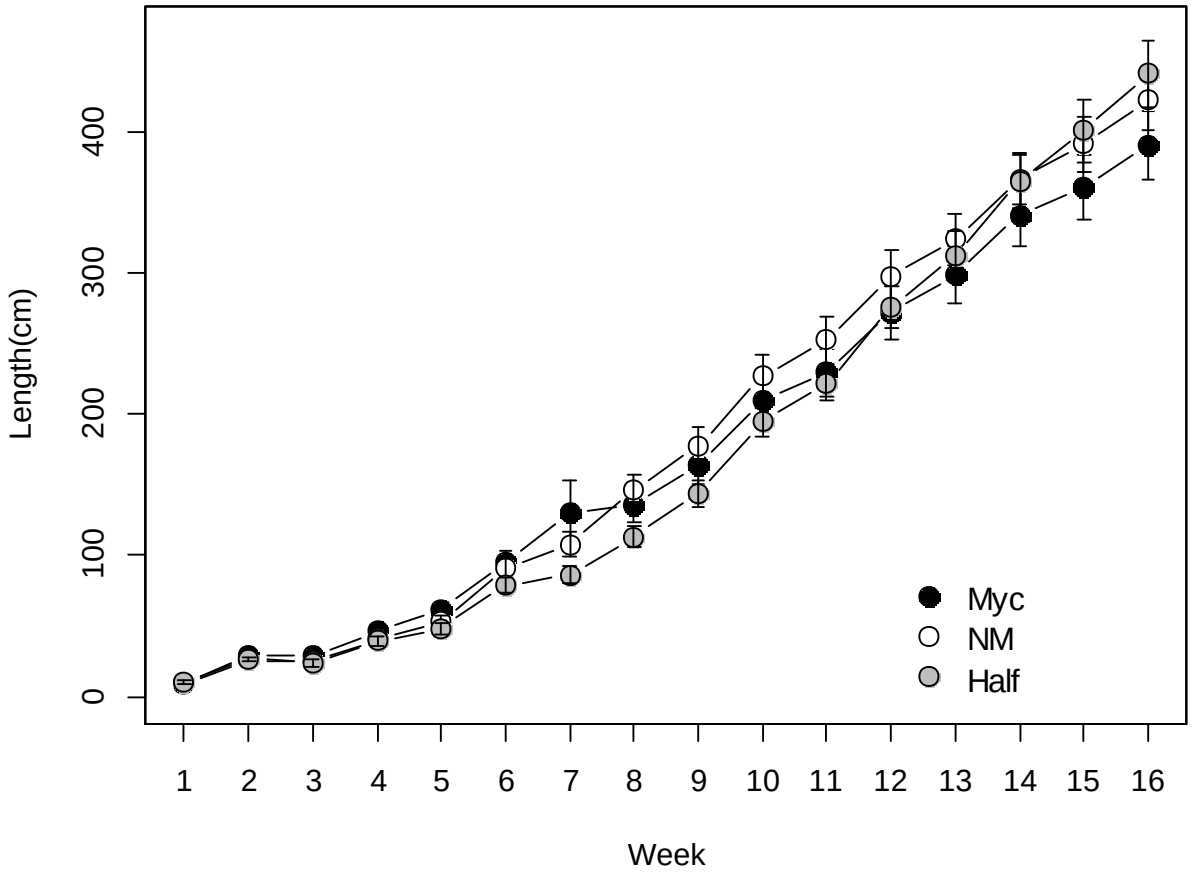
Hafiz Maherali

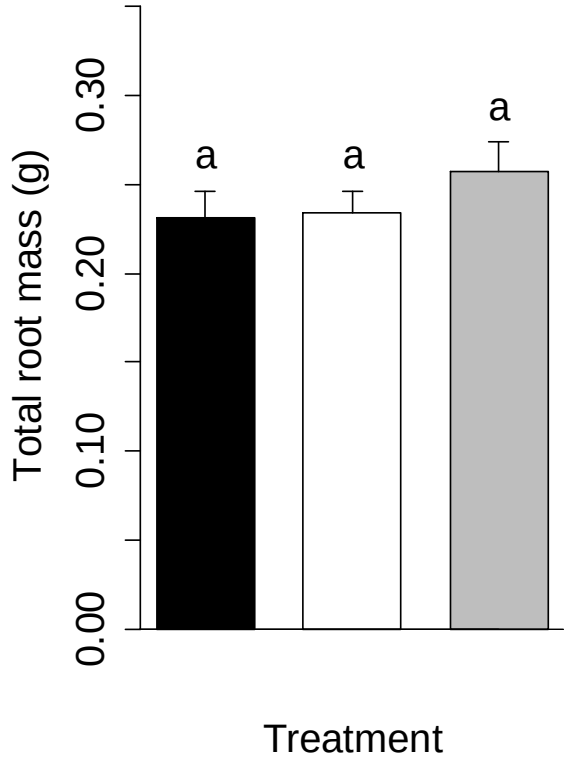
Etc. etc. etc.!!

How good is the estimate?



How mycorrhizas influence sampling?





How did the plant respond to treatments?