

# Crested floatingheart and related species in Florida



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**UF** | Aquatic and Wetland  
Plant Science  
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# Floatinghearts

*Nymphoides* spp. (Menyanthaceae)

2 native, 5 exotic

Leaves simple, floating

Small (< 2") showy flowers





# Bananalily

*Nymphoides aquatica*: native

Leaves 6", nearly round

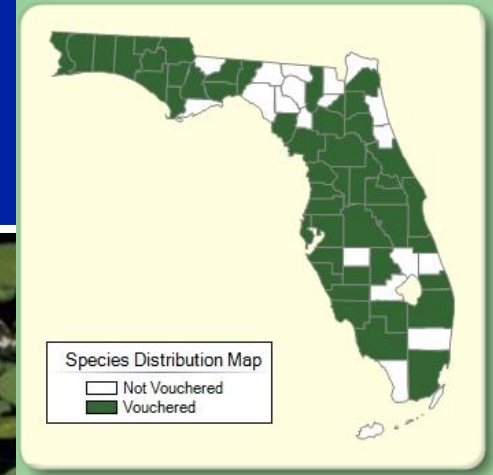
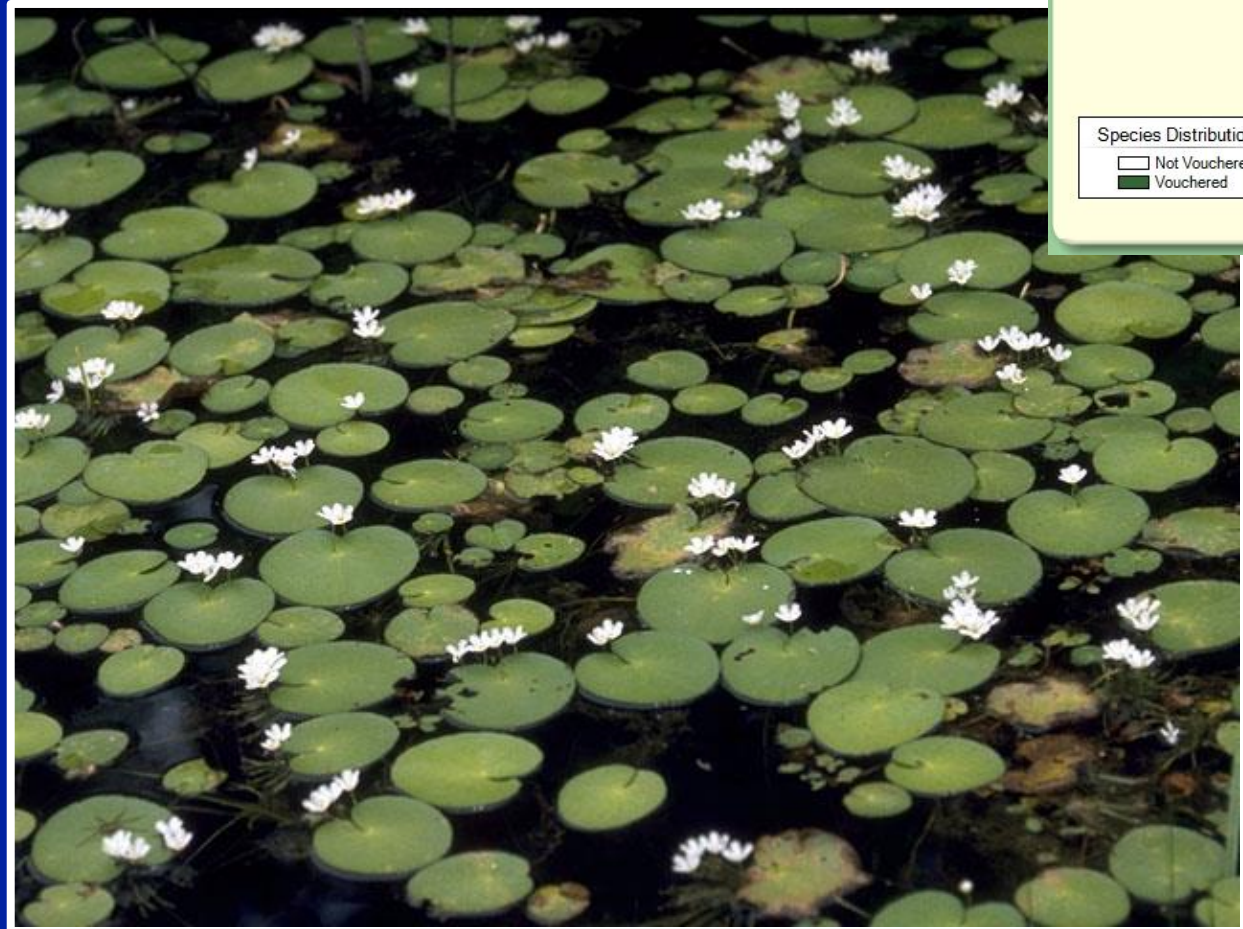
Green upper, red/purple lower

Corky

Flat white flowers

5 petals

“Banana cluster” ramets





# Bananalily



# Little floatingheart

*Nymphoides cordata*: native

Leaves < 3", cordate/ovate

Maybe variegated upper, green lower  
Smooth

Flat white/cream flowers

5 petals

“Banana cluster” ramets





# Little floatingheart



# Water snowflake

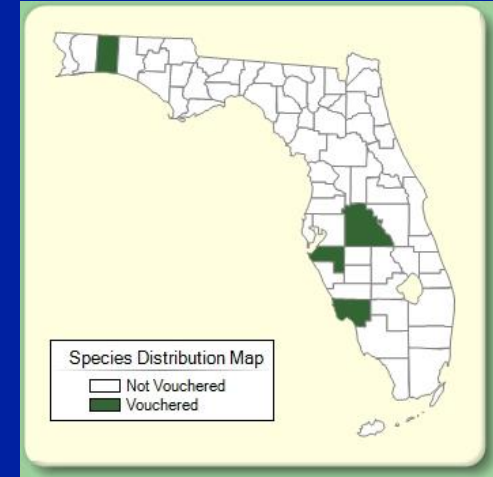
*Nymphoides indica*: Asia (not listed)

Leaves 8", round, notched  
Flat, bright green

White "fuzzy" flowers  
~5-10 petals

Small/no ramets

Copious seed production





# Water snowflake





# Floatingheart

*Nymphoides humboldtiana*: the Americas (not listed)

\*VERY\* similar to *N. indica*

Leaves 6", round, notched  
Flat, bright green, may be variegated

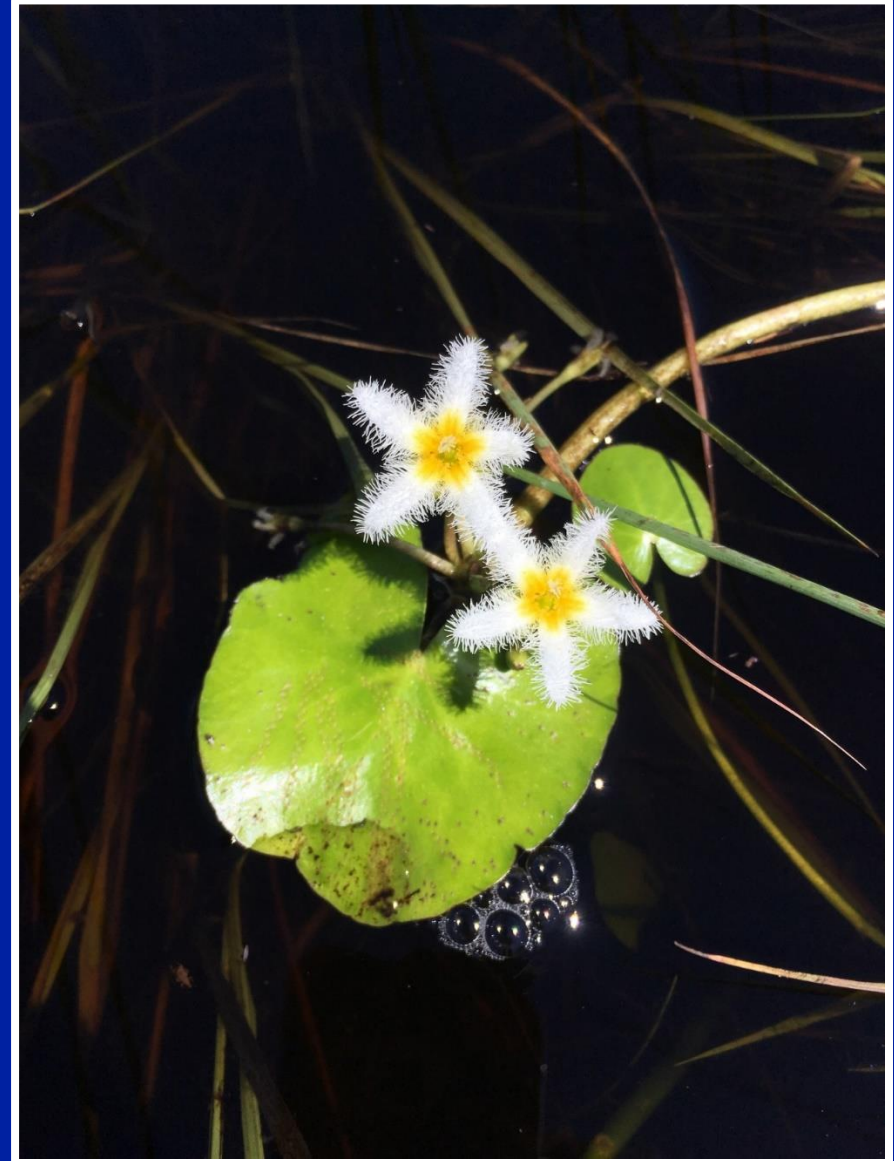
White "fuzzy" flowers  
~5 petals

Ramets?

Seed production?



# Floatingheart





# Gray's floatingheart

*Nymphoides grayana*: Cuba, Bahamas (not listed)

Leaves < 3", roundish, overlapping lobes

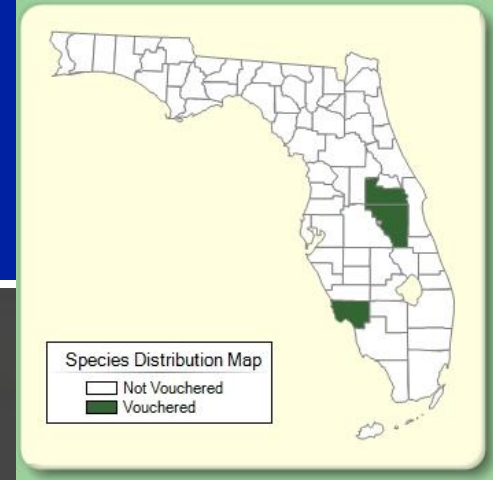
Green upper, purple lower

Yellow "fuzzy" flowers

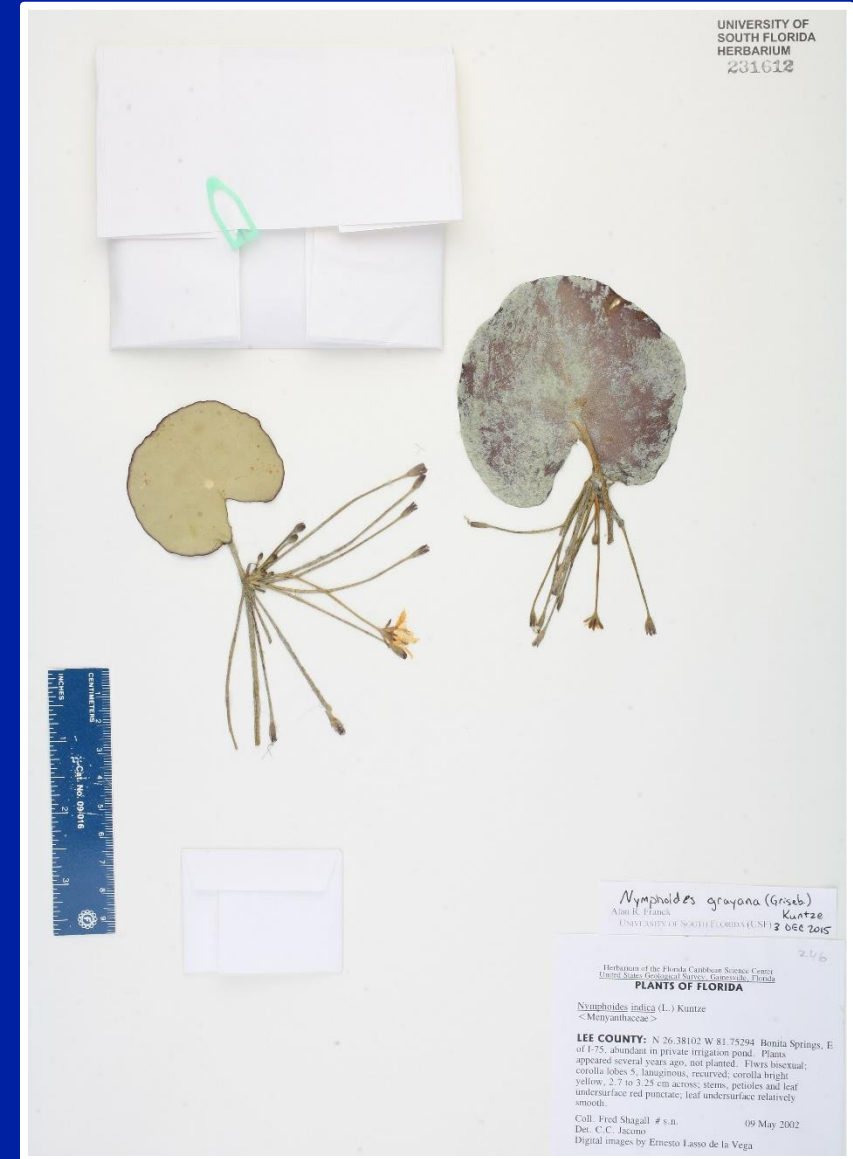
~5-10 petals

Ramets?

Seed production?



# Gray's floatingheart





# Yellow floatingheart

*Nymphoides peltata*: Asia; FL NW

Leaves 4", round to cordate

~ purple lower

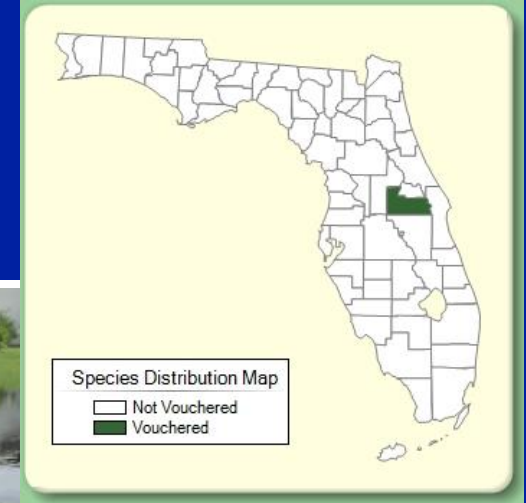
~ scalloped margin

Flat papery yellow flowers

5 petals

Small/no ramets

Copious seed production





# Yellow floatingheart





# Crested floatingheart

*Nymphoides cristata*; Asia

Ornamental – “Snowflake”

Collier County (1996)

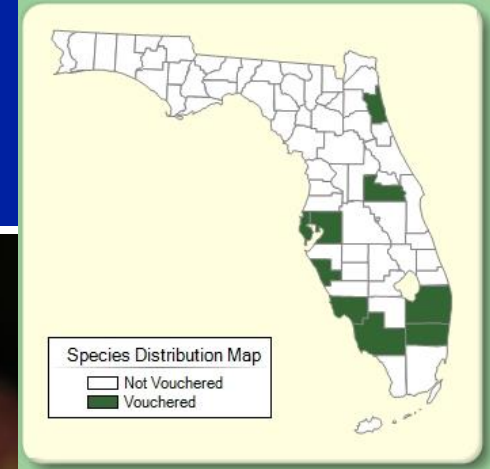
S Carolina (2006)

## Legal status

FLEPPC Category II (2005)

FLEPPC Category I (2009)

FDACS Noxious Weed List (2013)



# Crested floatingheart

Leaves 6", cordate

Dark red markings

Smooth

Ridged white flowers

~5 petals

Spikey ramet

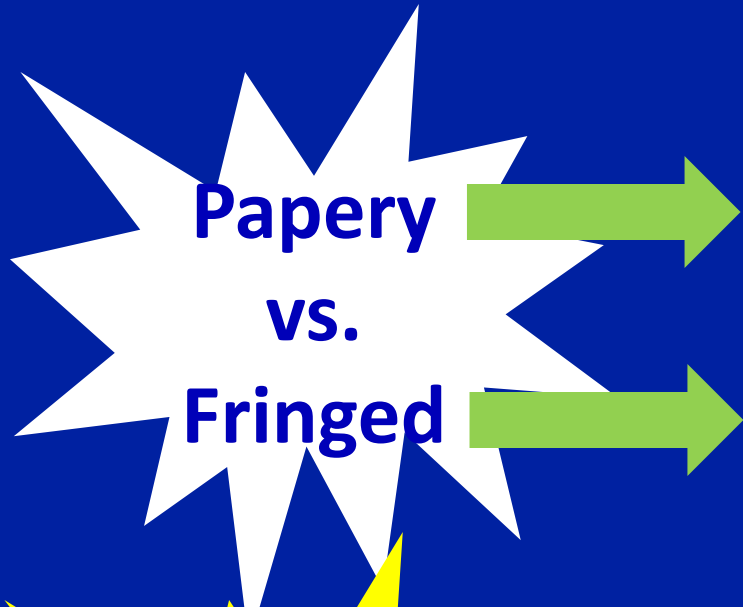




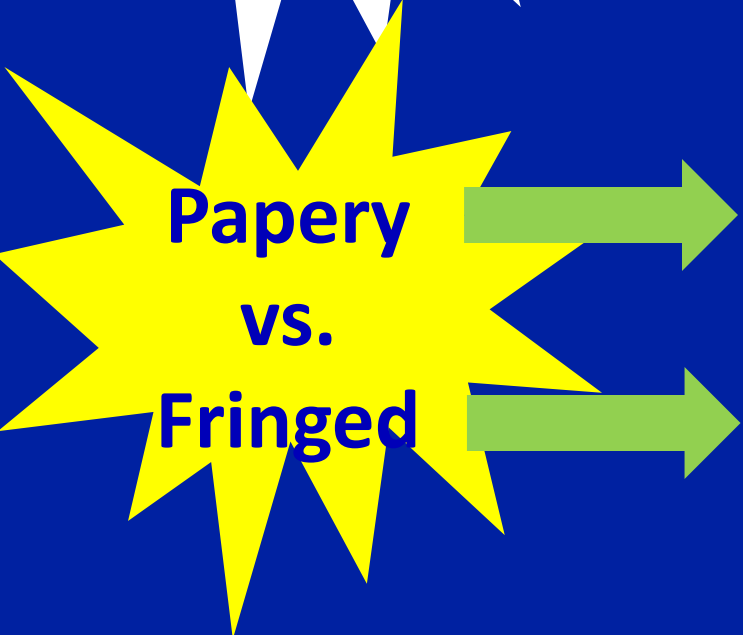
# Crested floatingheart



# Telling them apart...

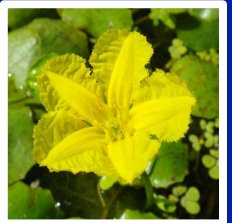


Flat: native *N. aquatica* or *N. cordata*  
Ridged: introduced *N. cristata*



Introduced *N. peltata*

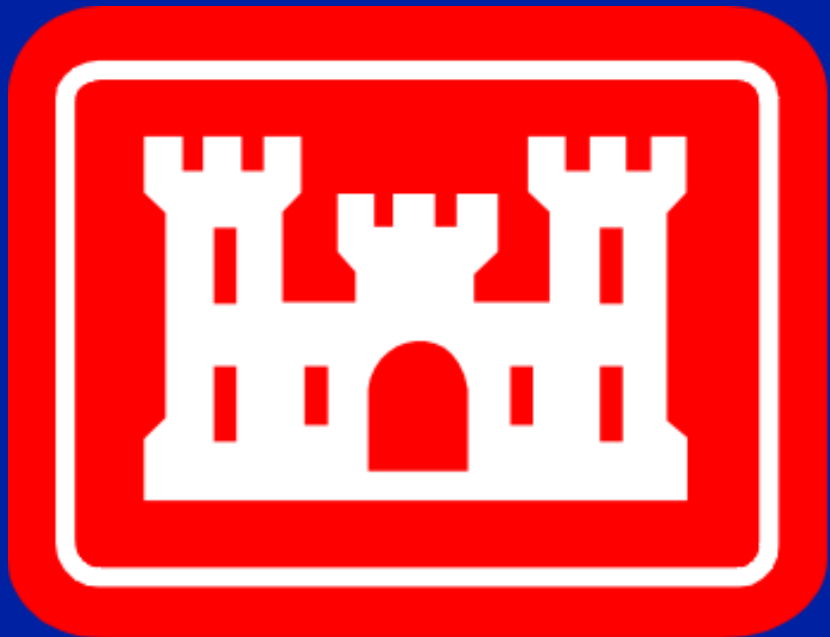
Introduced *N. grayana*





# How bad is crested floatingheart?

Canals...  
Seeds???  
Ramets??



# Ramet production

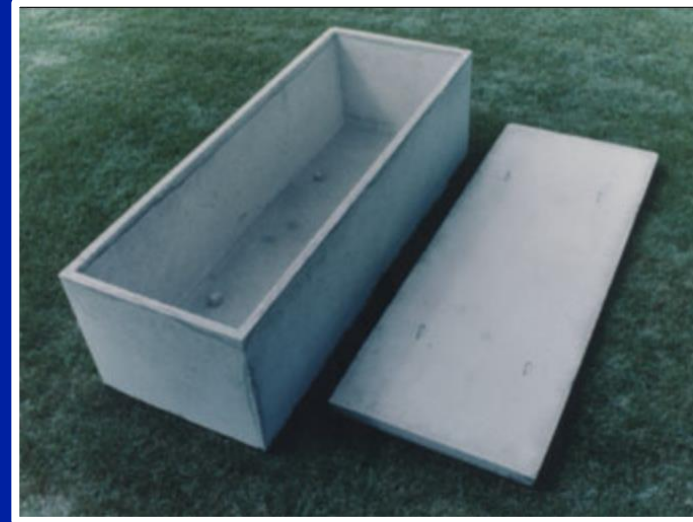
5 substrates (100% sand – 100% organic)

4 fertilizer rates (0 g/L – 4 g/L)

4 reps; single small plant

Monthly ramet counts for 6 months

4 runs (Dec/Mar/Jun/Sept)





# Ramet production

1 MAP: average 4 ramets/plant (~320 total)

All ramets removed from tanks

“Back to zero”

2 MAP: average 70 ramets/plant (~5600 total)

3 MAP: counting 2x per month



# Ramet production – results

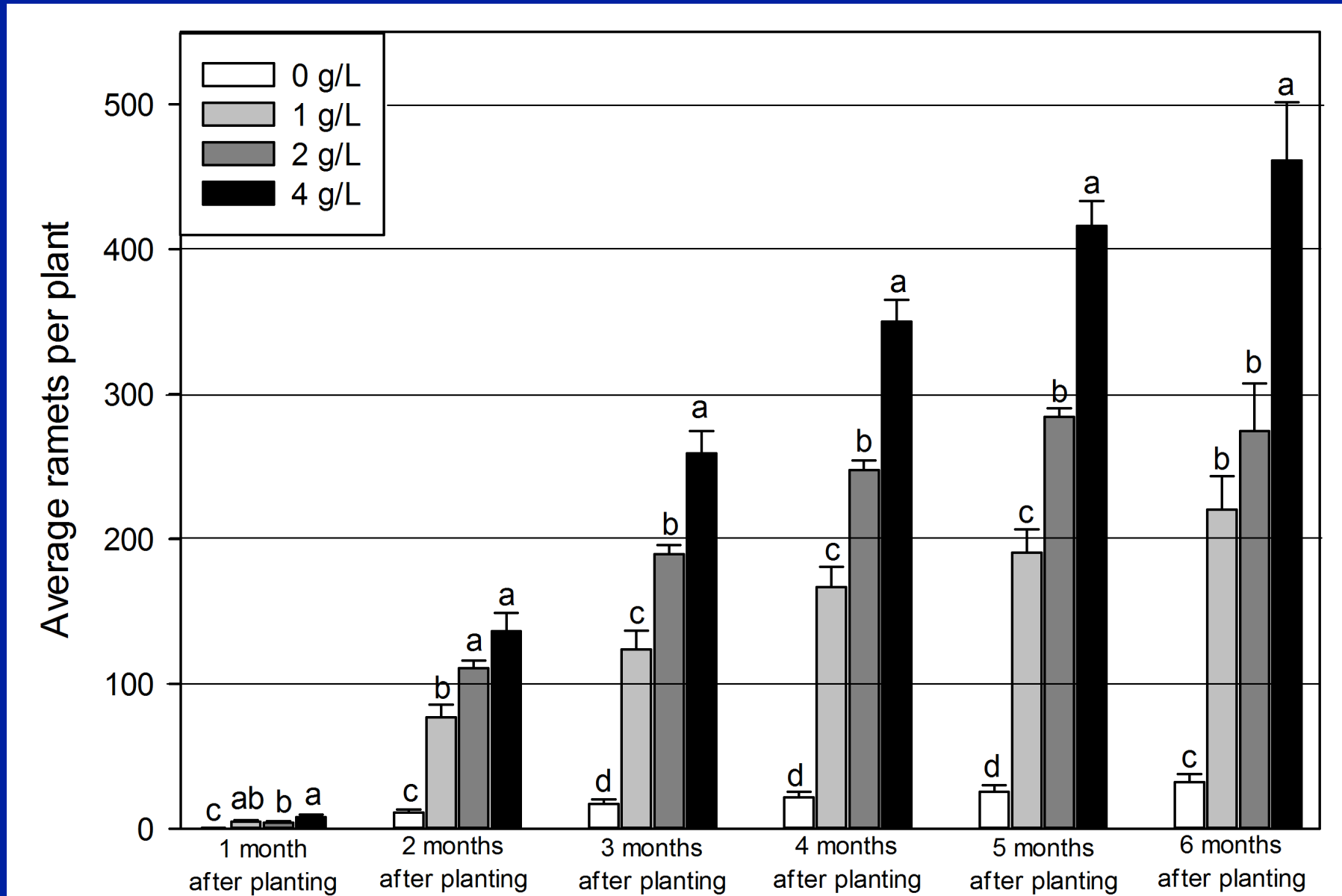
Substrates: no effect

Fertilizer: mo' better

	1 MAP	2 MAP	3 MAP	4 MAP	5 MAP	6 MAP
0 g/L	1	11	6	4	4	6
1 g/L	5	68	45	41	23	36
2 g/L	4	85	61	47	30	44
4 g/L	7	116	112	82	61	76



# Ramet production – results



# Ramet production – projection 0 g/L

Original plant:  $1+11+6+4+4+6 = 32$  ramets

Produced 1MAP:  $1*(32)= 32$

Produced 2MAP:  $11*(32)= 352$

Produced 3MAP:  $6*(32)= 192$

Produced 4MAP:  $4*(32)= 128$

Produced 5MAP:  $4*(32)= 128$

Produced 6MAP:  $6*(32)= 192$

1 plant  $\rightarrow$  1,024 ramets





# Ramet production – projection 4 g/L

Original plant:  $7+116+112+82+61+76 = 454$

Produced 1MAP:  $7*(454)= 3,178$

Produced 2MAP:  $116*(454)= 52,664$

Produced 3MAP:  $112*(454)= 50,848$

Produced 4MAP:  $82*(454)= 37,228$

Produced 5MAP:  $61*(454)= 26,697$

Produced 6MAP:  $76*(454)= 34,504$

1 plant → 205,573 ramets



## 205,573 ramets from 1!

# Does 1 ramet = 1 plant?

Sprouting study

5 substrates (100% sand – 100% organic) all 2 g/L

5 depths (surface, half-buried, covered, 2 cm under, 6 cm under)

8 reps; single ramet

Checked 3x per week for sprouting/ topping out

4 runs

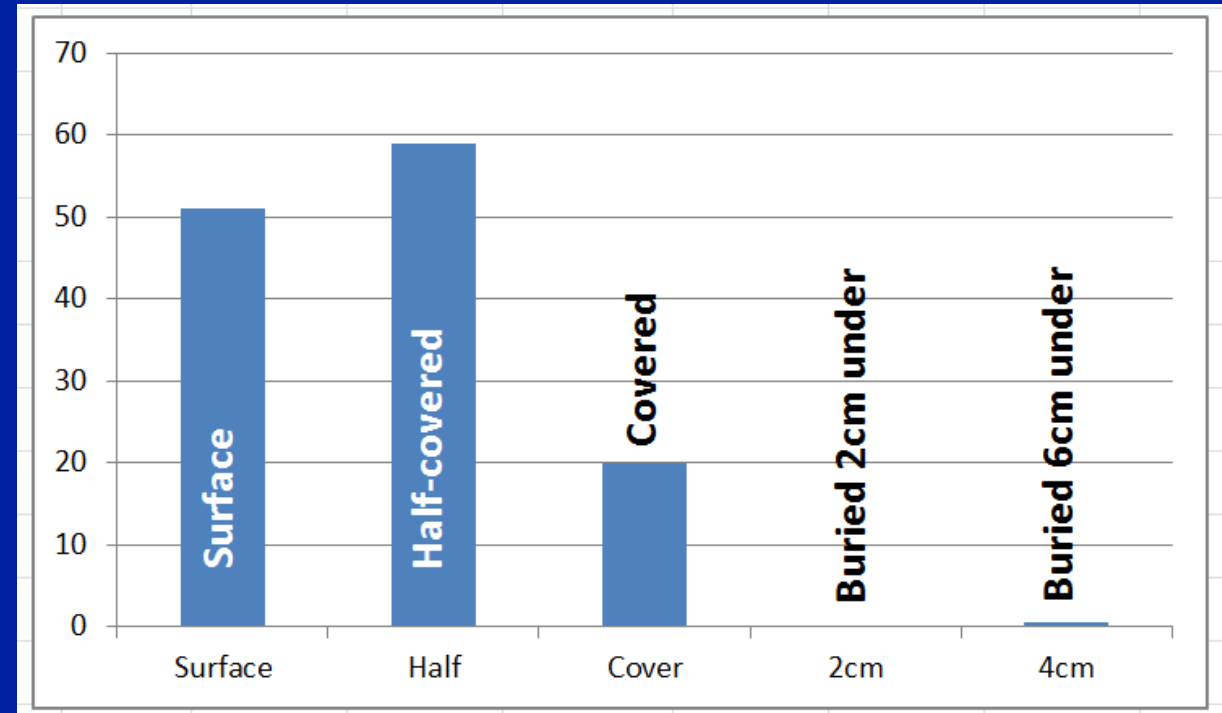
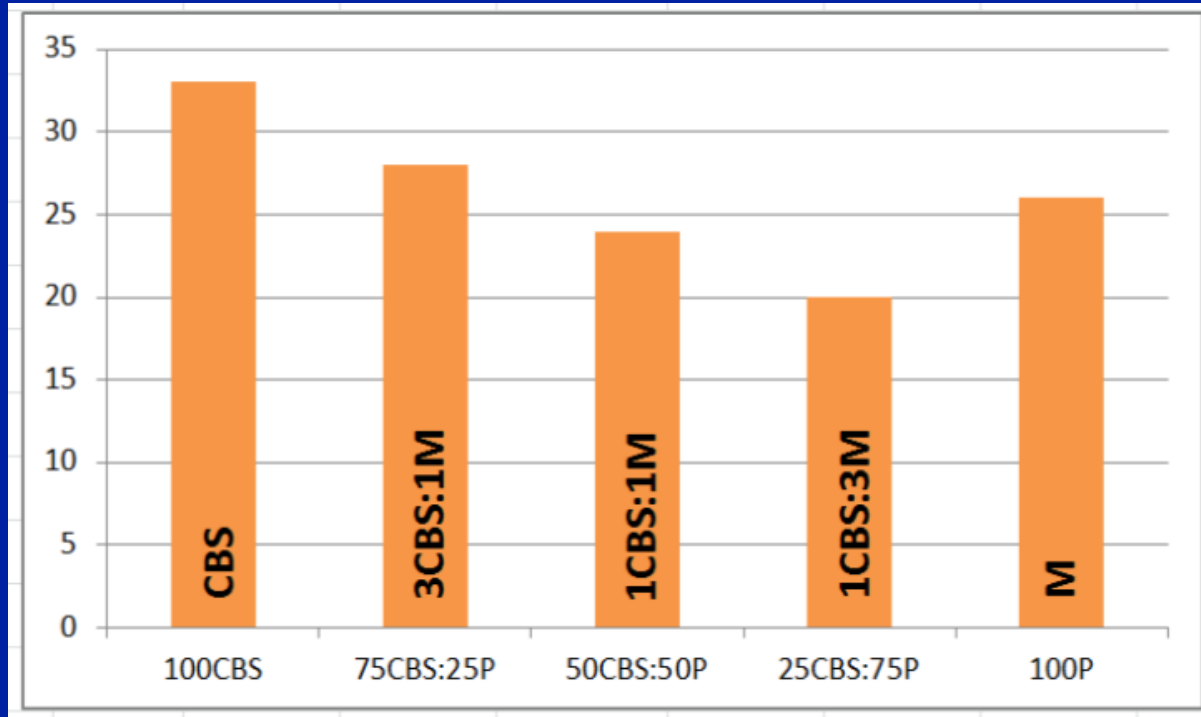




# Sprouting study – results

Substrate: no effect

Burial depth: big effect



# Sprouting study – results

So...

Covered with 2+ cm: no problem!!!

Not covered: problem :-/

On surface: 51% sprout

Half-buried: 59% sprout

Barely covered: 20% sprout

~40% of unburied ramets will sprout...





# Sprouting study – results

Recall: 0 g/L fertilizer

1 plant → 1,024 new ramets

40% of 1,024 = “only” 410 plants from 1

Recall: 4 g/L fertilizer

1 plant → 205,573 new ramets

40% of 205,573 = 82,229 plants from 1

**82,229 plants from 1 !**

# What else affects ramet viability?

Burial duration?

Dry storage (desiccation) duration?

Daylength?

100% sand

4 reps (pots), 10 ramets per pot

Checked 3x per week

2 runs (per experiment)





# Burial duration

360 ramets (280 needed) per run

7 burial durations (0 to 8 weeks)

All planted the same day

8 wk buried 8 wk before planting

6 wk buried 6 wk before planting



# Burial duration

40 randomly selected for each duration

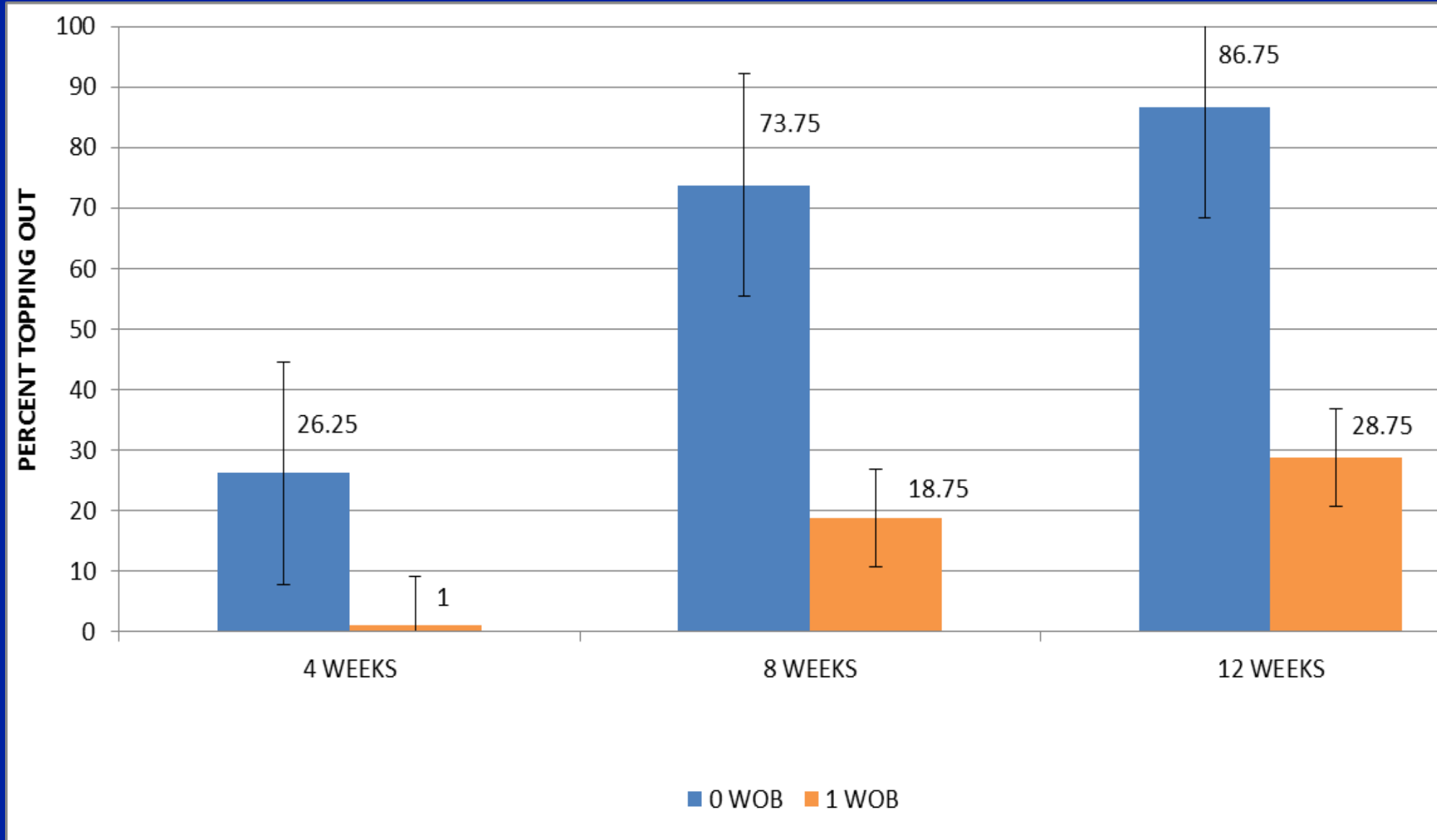
Monitored for 12 weeks

Second trial: shorter burial duration (0 to 24 d)





# Burial duration – results



# Dry storage duration

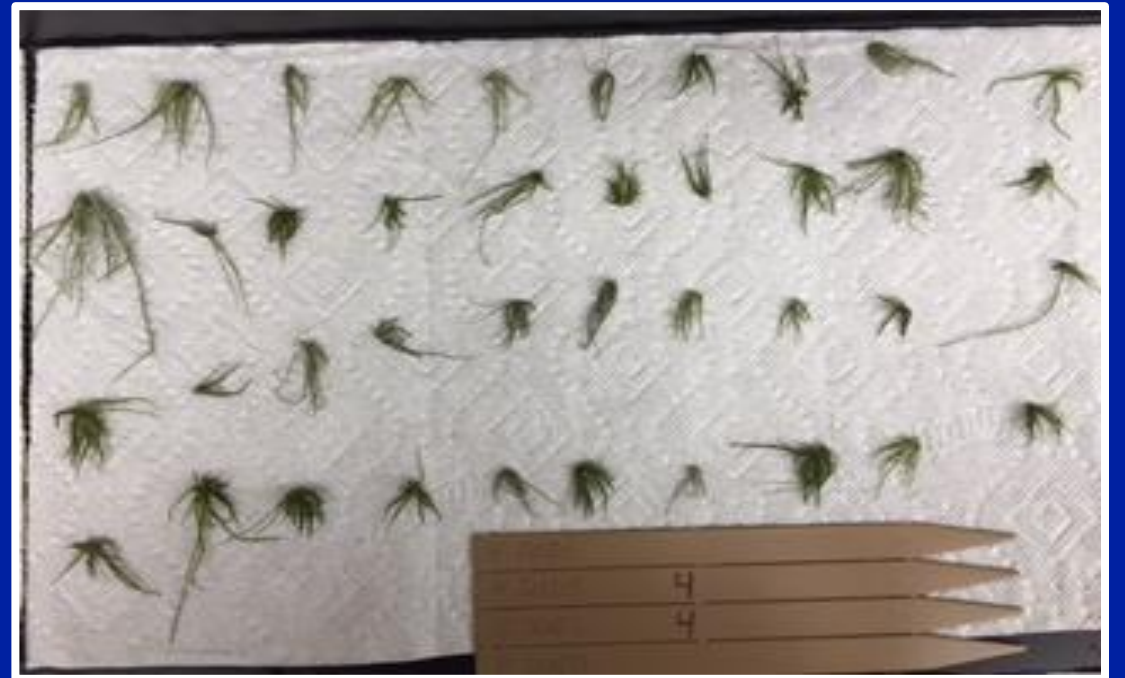
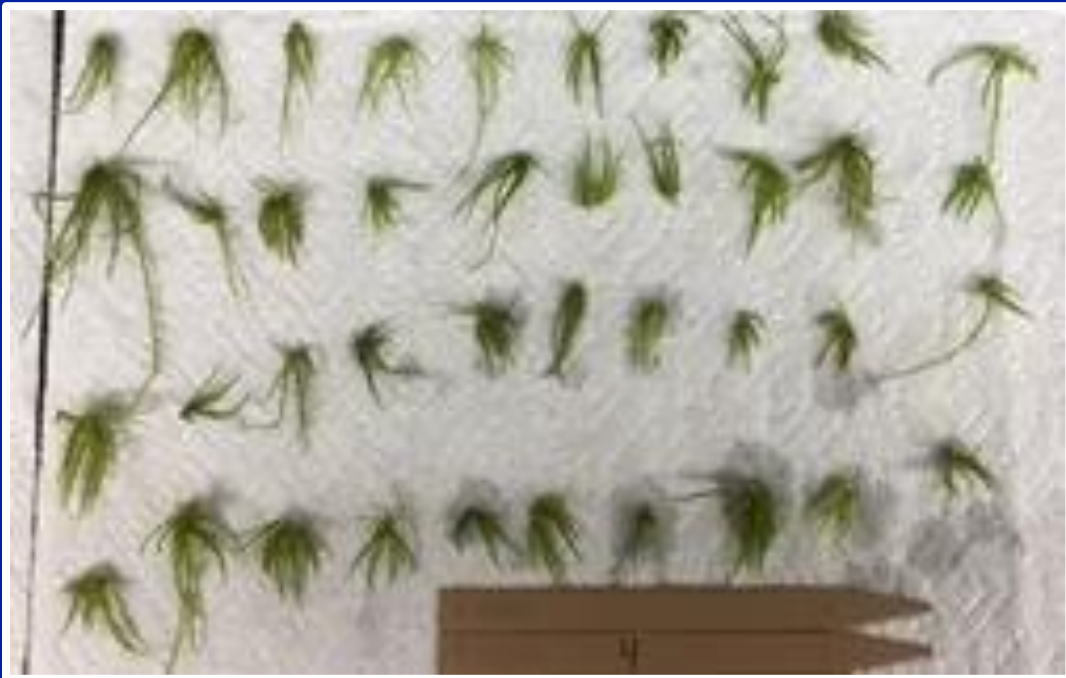
300 ramets (280 needed) per run

7 dry (lab) storage durations (0 to 10 d)

All planted the same day

10 d desiccation collected 10 d before planting

7 d desiccation collected 7 d before planting





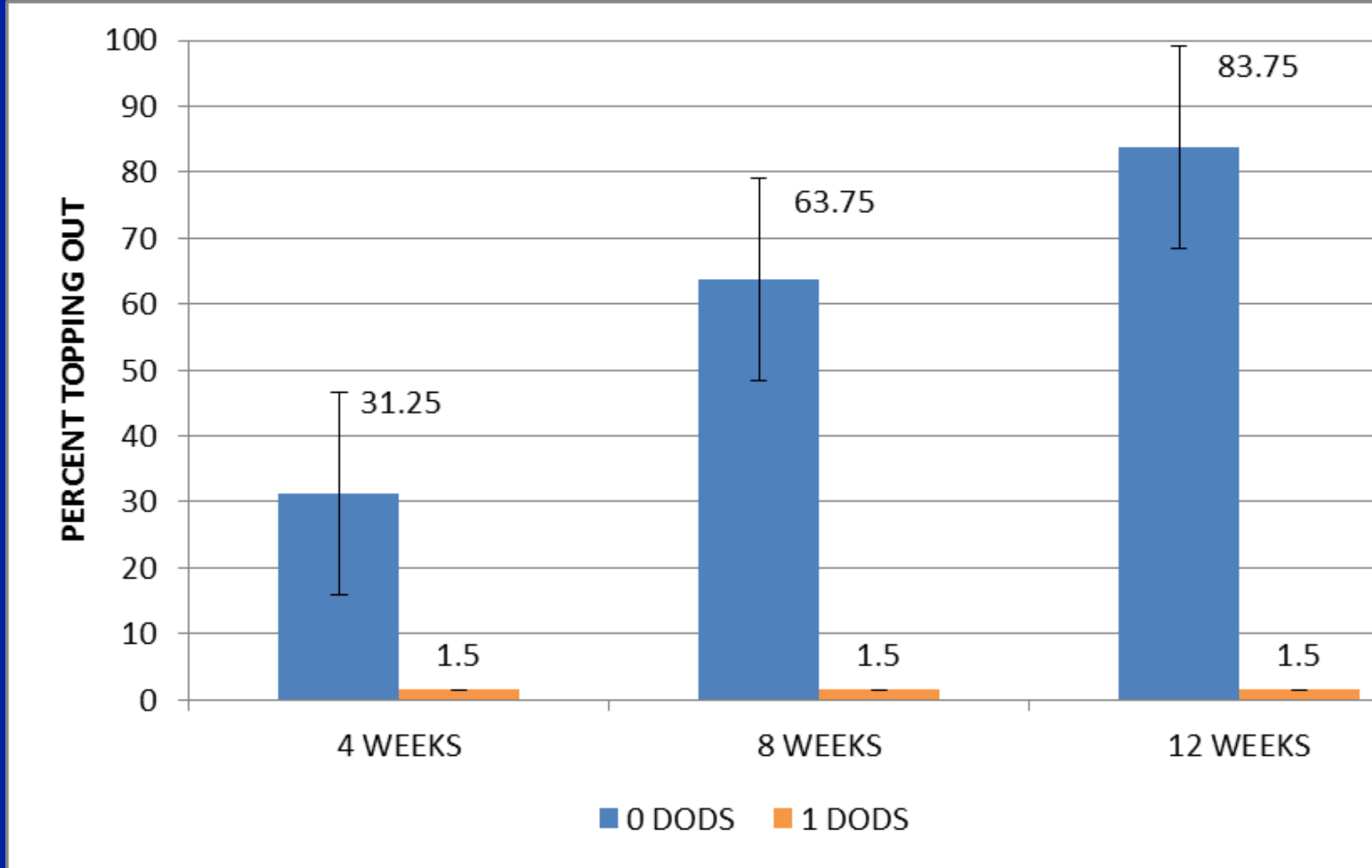
# Dry storage duration

40 randomly selected for each duration

Monitored for 12 weeks



# Dry storage duration – results



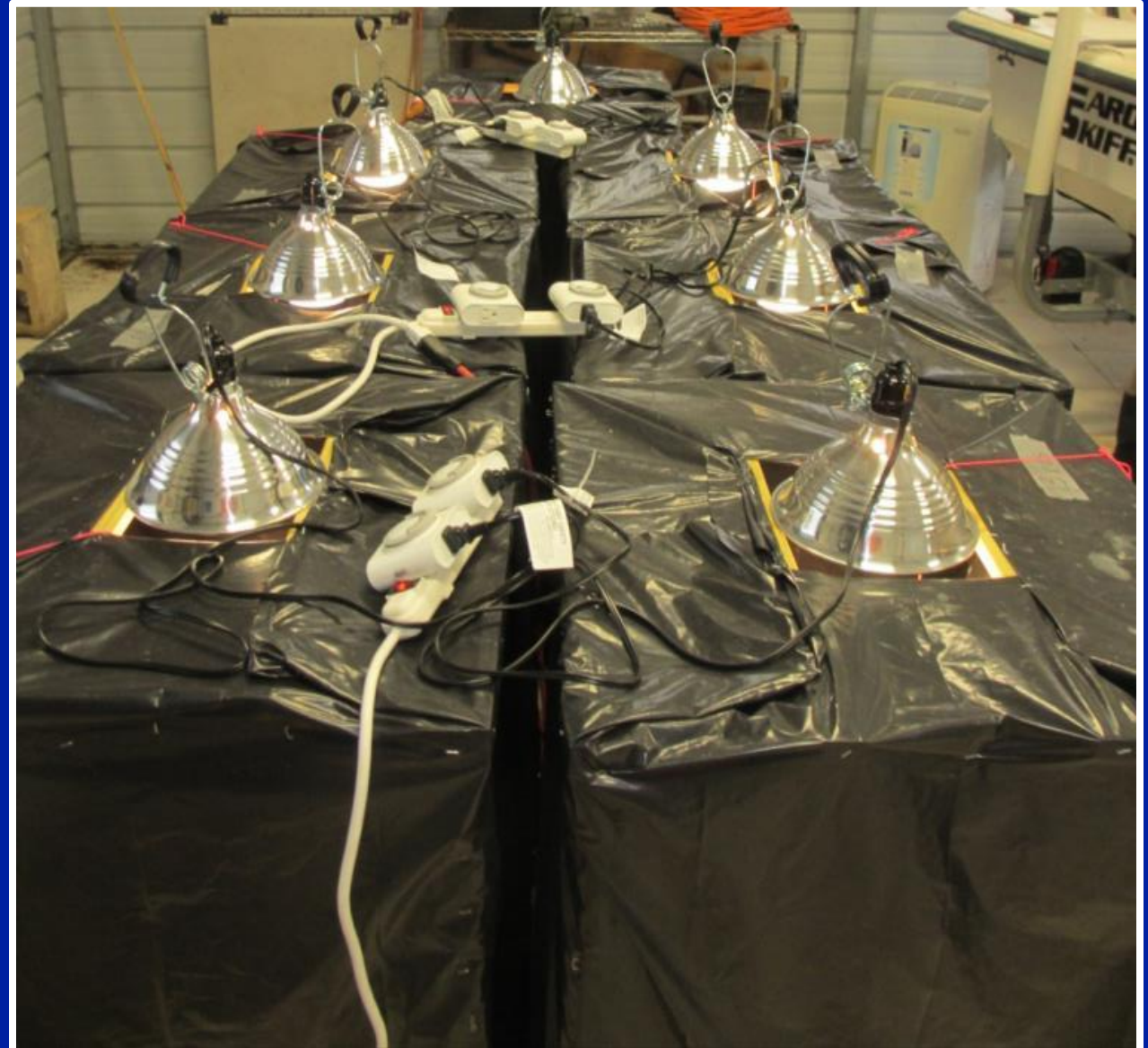


# Daylength

300 ramets (280 needed) per run

7 daylengths (9 to 15 hours)

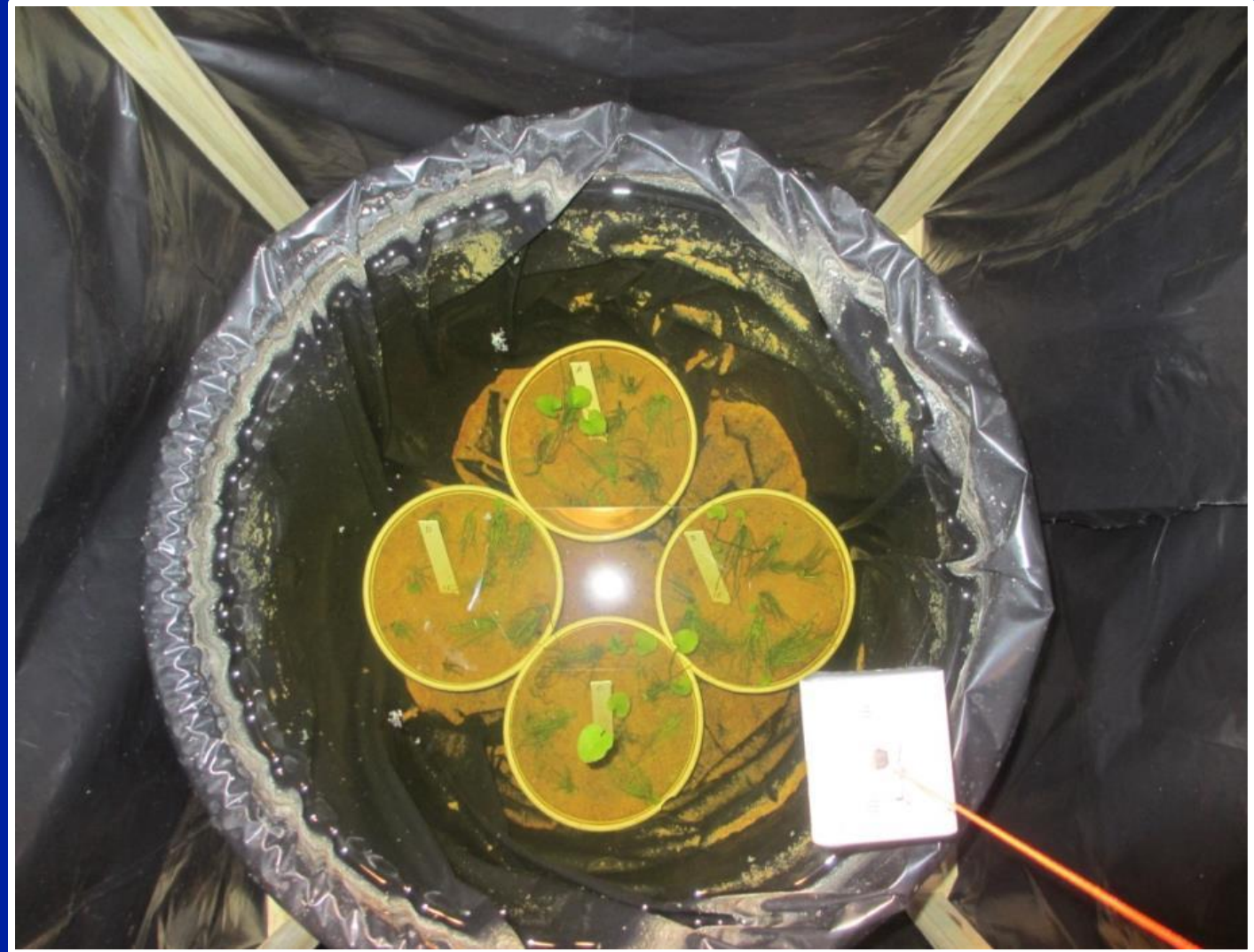
All planted same day



# Daylength

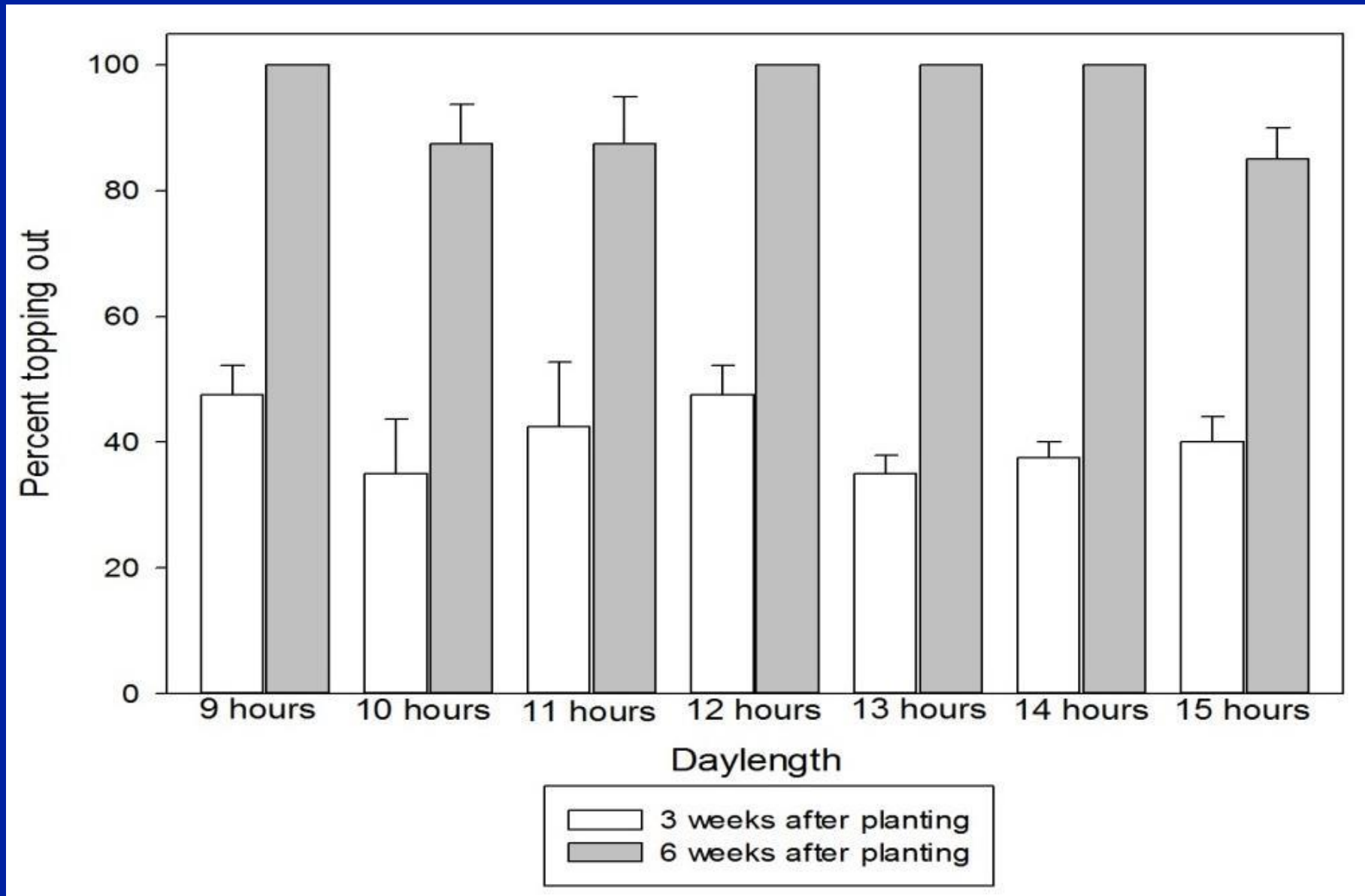
40 randomly selected for each daylength

Monitored for 8 weeks





# Daylength – results

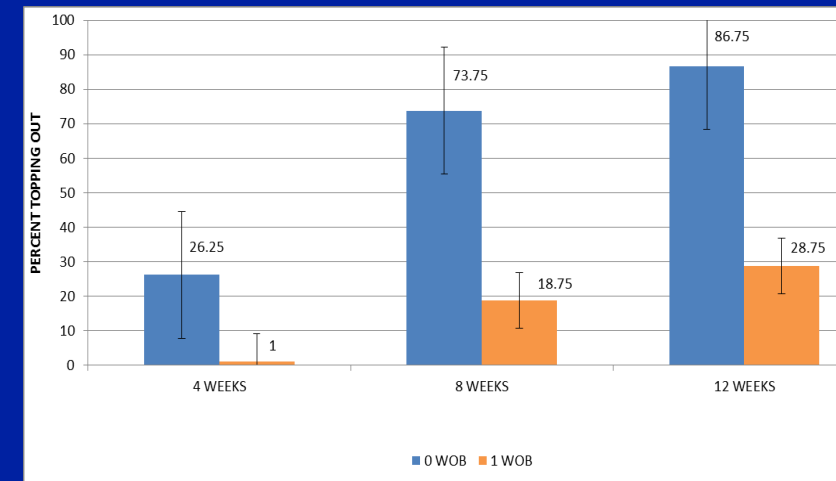
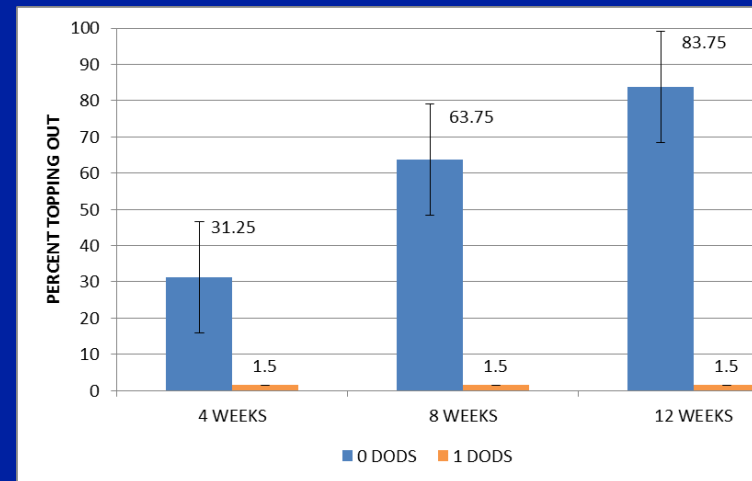
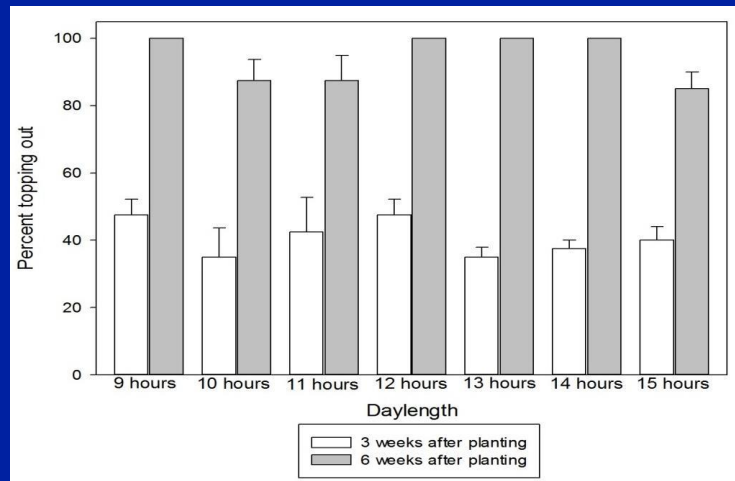


# Conclusions

Ramets significantly less viable > 1 wk of burial

Ramets not viable > 1d of desiccation

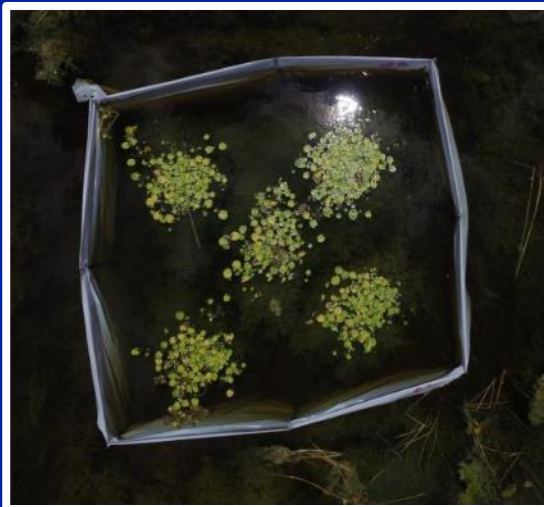
Ramets unaffected by daylength





# Control and management research

Mesocosm (submersed) and field trials (submersed, foliar)



# Mesocosm trials (35 + UTC)

## FLREC greenhouse

Class	Treatments
Auxins (6)	2ppm 2,4-D*; 2.5ppm triclopyr*; 10/20ppb Procellacor
PPO (4)	200ppb flumioxazin*; 100ppb carfentrazone*
ALS (18)	75/150ppb penox*^; 22.5/45ppb bispyr*^; 250/500ppb imox*^
HPPD (2)	25ppb topramezone*
PDS (2)	45ppb fluridone*
Other (3)	2.5ppm endothall* (H191); 370ppb diquat

\* 370ppb diquat; ^ 100ppb flumioxazin

16WAT → visual quality, DW





# Mesocosm trials results: 18/35

90% reduction in DW & quality vs. UTC 16WAT

Class	Treatments
Auxins (5/6)	2ppm 2,4-D + diquat; 2.5ppm triclopyr*; 10/20ppb Procellacor
PPO (0/4)	(None)
ALS (7/18)	75/150ppb penox*^; 500ppb imox + 100ppb flumi
HPPD (2/2)	25ppb topramezone*
PDS (2/2)	45ppb fluridone*
Other (2/3)	2.5ppm endothall (H191) + diquat; 370ppb diquat

\* 370ppb diquat; ^ 100ppb flumioxazin

# Pond trials (6 foliar + 5 sub + UTC)

STA 1W research ponds

Class	Foliar Treatments
ALS (3)	64 oz/ac imazamox, 96 oz/ac imazapyr, 5.6 oz/ac penoxsulam
ALS mix (2)	5.6 oz/ac penoxsulam + imox; + ipyr
Auxin (1)	1.5 oz/ac Procellacor
Class	Submersed Treatments
PDS/mix (2)	2.5ppm endothall (H191); + 370ppb diquat
PPO mix (1)	200ppm flumioxazin + 370ppb diquat
Auxin (1)	20ppb Procellacor
Other (1)	370ppb diquat



6MAT → coverage, regrowth



# Pond trials results: 4/11 (1/6 f, 3/5 s)

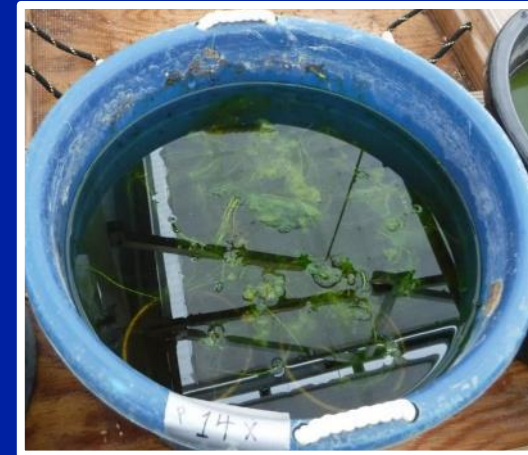
90% reduction in coverage/regrowth vs. UTC 6MAT

Class	Foliar Treatments
ALS (0/3)	None
ALS mix (0/2)	None
Auxin (1/1)	1.5 oz/ac Procellacor
Class	Submersed Treatments
PDS/mix (2/2)	2.5ppm endothall (H191); + 370ppb diquat
PPO mix (0/1)	None
Auxin (1/1)	20ppb Procellacor
Other (0/1)	None

# Control and management conclusions

Submersed treatment overlap in both trials

2.5ppm H191\*, 20ppb Procellacor



# Future research

Larger experiments

Field trials

Additional tank mixes





# Final thoughts

- CFH is highly productive and makes lots of ramets
- 40% of uncovered ramets will sprout and become plants
- Burial and drying greatly reduce ramet viability
- Herbicides may provide solutions
- More research needed for BMPs





# Thanks! Questions?



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