

The Influence of Organic Seed Treatments on Barley Seed Vigour, Establishment and Yield



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Crop Establishment

- Successful emergence of a healthy population of crop seedlings
- **Quick and uniform...**
 - ☑ Optimal crop growth, harvest & yield
 - ☑ Consistent product (grain) quality
- **Slow and erratic...**
 - ☒ Increased weed populations
 - ☒ Nutrient losses, erosion
 - ☒ Uneven / delayed maturity
 - ☒ Reduced yields

Crop Establishment

- **Good Establishment depends on...**
 - Seed Quality
 - Field “Cleanliness”
 - Seedbed Preparation
 - Seeding Rate, Depth, Timing
 - Weed Control
 - Seed Treatments
- **Organic farmers in particular rely on good establishment, and seed vigour**


Seed Treatments

- Influence microorganisms on, in or around the seed (beneficial or pathogenic)
- Stimulate germination and seedling vigour
- Offer developmental advantages to crop
- *Infrequently used in organic systems*
- Need for organic treatments...
 - ☑ Improve yields for organic farmers
 - ☑ Facilitate increased organic seed production
 - ☑ Curb conventional fungicide applications

Objective

- **To evaluate seven organic-approved commercial seed treatments**
 - Seed Vigour
 - Crop Establishment
 - Yield
- Growth Chamber Vigour Experiments...
- Field Plot Trials...

Seed Treatments Tested



Product	Microbial	Mycorrhiz.	Nutrient	SAR*	Stimulant
Acadian Seaplant			✓		✓
Biodynamic #504	✓				✓
CB-QGG			✓		✓
HeadsUp				✓	✓
MycoApply	✓	✓			
NanoGro				✓	✓
SoilBuilder	✓				

➡ SAR* = Systemic Acquired Resistance ⬅

Concept of Seed Vigour

- A measure of the strength with which a seed can grow, in spite of stresses
- Reflects seed's stage of deterioration (physiological ageing)
- *Vigour Tests offer more information on seed performance than germination tests alone*
- Vigour Tests designed to evaluate specific seed vigour attributes (may be crop-specific)

Vigour Tests – Methods

- **Cold Test**

- Seeds subjected to cool/wet conditions in presence of non-sterile field soil (7 days)
- Moved to optimal germination conditions
- % Germination recorded

- **Seedling Growth Test**

- Seeds aligned between moistened paper
- Rolls stored vertically for germination period
- Plumule length measured, averaged

Cold Test – Results



Cold Test – Results

- Soil*Seed interaction ($p=0.010$)
 - Unaged seed performed significantly better than Aged seed (*Message: Aging compromises vigour*)

Soil	Seed	% Germination	LS Means Grouping
Unsterilized	Unaged	95.9	A
Sterilized	Unaged	94.7	A
Sterilized	Aged	93.2	B
Unsterilized	Aged	90.5	C

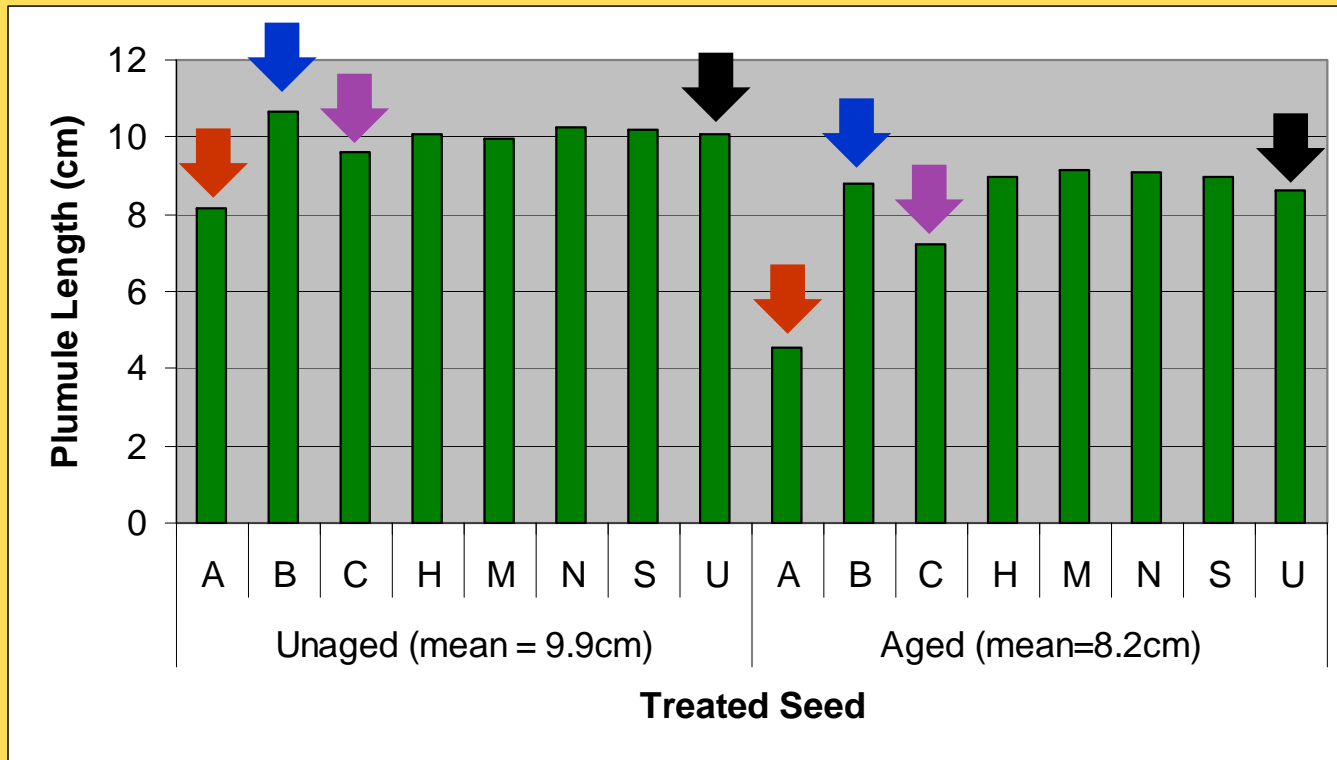
- Seed*Treatment interaction ($p=0.021$)
 - Treatments performed variably between Seed types
 - **MycoApply**, Unaged seed > MycoApply, Aged seed
 - **Acadian Seaplants** treatment germination signif. lower

Seedling Growth Test – Results



Seedling Growth Test – Results

- Seed*Treatment interaction ($p=0.0002$)



- ↓ **Biodynamic**, Unaged seed > Biodynamic, Aged seed
- ↓ **Acadian Seaplants** treatment signif. lower than most others
- ↓ **CB-QGG** Aged seed < CB-QGG Unaged seed

Vigour Tests – Conclusions

- MycoApply showed some promising results in Cold Test (Aged vs. Unaged seed)
- Biodynamic Prep #504 had beneficial effect in Seedling Growth Test
- Acadian Seaplant extract had mostly negative effect in both lab vigour tests, likely due to high nutrient concentration
- Aged seed shows loss of performance in Cold Tests relative to Unaged seed, *despite comparable germination test results*

Field Plot Trials

- 3 locations (2 in NS, 1 in PEI)
- 4 blocks of 8 treatments, at each site
- Response variables:
 - Crop Establishment
 - Vigour (Height, Dry Mass, Leaf Size)
 - Yield (t/ha)
- No significant differences among seed treatments...
 - Planting was too late to see difference?

Implications, Future Work

- Improves our understanding of the effectiveness and suitability of organic seed treatments *in barley production*
- Cost-benefit analysis... worthwhile?
- Do these (or other) organic treatments work on seed of *other* crop species?
- Can microbial organic seed treatments successfully alter the seed's micro-environment?

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