Electrical conductivity could have a role in predicting germination and vigour in Brassica spp.

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Background

Conductivity and germination:
- Single seeds: problems
- Bulk samples:

  • Mirdad and Powell (2006); SST
    - EC predicts germination in artificially aged cauliflower and cabbage

  • Demir et al (2008); SST
    - 16 commercial cabbage seed lots (2 cvs):
      EC predicts both standard germination and germination after CD (vigour)

  • Matthews, Demir, Celikkol, Kenanoglu and Mavi (2009) SST
    - 12 commercial cabbage lots (1 cv): EC before and after CD estimate emergence in modules
Objectives

1. Examine evidence from storage studies for a relationship between germination and EC within and across cultivars

2. Could EC replace the germination test that follows controlled deterioration (CD)?

3. Does EC after CD predict storage potential (vigour)?
Methods

• 4 commercial lots (cultivars) of cauliflower
• Storage: 12% MC, 25°C, 12 weeks
• Regular sampling
• Germination, CD and EC tests
• EC both before and after CD (CD/EC)
  – 4 x 100 weighed seeds, 40 ml deionised water, 20°C, 24h
Increased conductivity linked to reduced germination
Conductivity predicts normal germination within a cultivar

Cultivar differences?
\[ r = 0.88 \]

**EC (µS cm\(^{-1}\) g\(^{-1}\))**

**Normal germination (%)**

**EC (µS cm\(^{-1}\) g\(^{-1}\))**

**Normal germination (%)**

\[ R^2 = 0.77 \]

\[ P < 0.001 \]
Survival curve

Small increases in EC (A1, EL)

Large increases in EC (A4, A3)
What can we conclude so far?

• EC predicts germination within a cultivar

• Differences in leakage (EC) between cultivars relate to position on survival curve.
  – i.e. seed quality has determined the cultivar differences

• But do seed lots from different cultivars having the same seed quality differ in leakage?
  – The key question for use of EC in evaluating seed quality
2nd objective

1. Examine evidence from storage studies for a relationship between germination and EC within and across cultivars

2. Could EC replace the germination test that follows controlled deterioration?

3. Does EC after CD predict storage potential (vigour)?
Increased conductivity linked to a fall in CD germination
CD /EC predicts CD germination

A1

A3

A4

EL

r = 0.97
R² = 0.94
p < 0.001

r = 0.96
R² = 0.92
p < 0.01

r = 0.99
R² = 0.98
p < 0.001

r = 0.90
R² = 0.81
p < 0.01

CD /EC (µS cm⁻¹ g⁻¹)

CD germination (%)
$r = 0.96$

$R^2 = 0.92$

$p < 0.001$
3rd objective

1. Examine evidence from storage studies for a relationship between germination and EC within and across cultivars

2. Could EC replace the germination test that follows controlled deterioration?

3. Does EC after CD predict storage potential (vigour)?
Correlations with normal germination after storage: 4 seed lots of cauliflower

<table>
<thead>
<tr>
<th>Pre-storage assessment</th>
<th>10 weeks storage</th>
<th>12 weeks storage</th>
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</thead>
<tbody>
<tr>
<td>EC</td>
<td>-0.568</td>
<td>-0.737</td>
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<tr>
<td>CD germination</td>
<td>0.995**</td>
<td>0.975*</td>
</tr>
<tr>
<td>CD/EC</td>
<td>-0.950*</td>
<td>-0.986**</td>
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</tbody>
</table>
CD/EC predicts storage potential
Concluding comments

1. EC relates to germination within cultivars
   Seed quality determines level of leakage (EC)
   ➢ Further studies to compare cultivars – same seed quality

2. CD/EC predicts CD germination
   ➢ Possibility to reduce time for CD test?

3. CD/EC predicts storage potential
Electrical conductivity \textit{does} have a role in predicting germination and vigour in Brassica spp.