

**ISTA Vigour Committee  
2006-2007**

# Work programme

- **Proficiency tests**
  - Conductivity test for *Pisum sativum*
- **Increase species database for validated tests**
  - Conductivity test
    - *Phaseolus*, *Brassica* sp
  - Accelerated ageing test for *Zea mays*
- **Development of new vigour tests**
  - Rate of germination for *Zea mays*
- **Education on vigour**
  - Workshops: Angers (2006); Brazil (2007)
- **Handbook**

# Accelerated ageing test

- *Zea mays*
- **Working group leader: Rasha El Khadem (Austria)**
- **8 laboratories (AT, FR, IT, KR, NZ, 3 x US)**
  - **6 seed lots x 2 samples**
  - **Distributed July 06**

## Laboratory germination (% normal seedlings)

Lot	Sample number	Laboratory									Overall mean <sup>2</sup>
		1	2	3	4	5	6	7	8	Mean <sup>2</sup>	
A	4	99 <sup>a</sup>	98 <sup>a</sup>	98 <sup>a</sup>	100 <sup>a</sup>	99 <sup>a</sup>	98 <sup>a</sup>	100 <sup>a</sup>	99 <sup>a</sup>	99 <sup>a</sup>	99 <sup>a</sup>
	10	99 <sup>a</sup>	100 <sup>a</sup>	98 <sup>a</sup>	99 <sup>a</sup>	98 <sup>a</sup>	99 <sup>a</sup>	97 <sup>a</sup>	98 <sup>a</sup>	99 <sup>a</sup>	
B	5	98 <sup>a</sup>	99 <sup>a</sup>	100 <sup>a</sup>	97 <sup>a</sup>	98 <sup>a</sup>	98 <sup>a</sup>	92 <sup>b</sup>	98 <sup>a</sup>	98 <sup>a</sup>	98 <sup>a</sup>
	8	98 <sup>a</sup>	98 <sup>ab</sup>	98 <sup>ab</sup>	95 <sup>bc</sup>	98 <sup>a</sup>	98 <sup>a</sup>	93 <sup>c</sup>	98 <sup>a</sup>	97 <sup>a</sup>	
C	3	92 <sup>ab</sup>	85 <sup>cd</sup>	88 <sup>bc</sup>	94 <sup>a</sup>	89 <sup>abc</sup>	86 <sup>c</sup>	79 <sup>de</sup>	77 <sup>e</sup>	86 <sup>de</sup>	87 <sup>c</sup>
	11	92 <sup>ab</sup>	90 <sup>abc</sup>	88 <sup>bcd</sup>	94 <sup>a</sup>	89 <sup>bc</sup>	82 <sup>de</sup>	79 <sup>e</sup>	86 <sup>de</sup>	88 <sup>d</sup>	
D	2	88 <sup>abc</sup>	86 <sup>bc</sup>	91 <sup>a</sup>	85 <sup>bc</sup>	83 <sup>c</sup>	90 <sup>ab</sup>	86 <sup>abc</sup>	87 <sup>abc</sup>	87 <sup>de</sup>	87 <sup>c</sup>
	7	88 <sup>a</sup>	84 <sup>a</sup>	85 <sup>a</sup>	86 <sup>a</sup>	84 <sup>a</sup>	88 <sup>a</sup>	84 <sup>a</sup>	84 <sup>a</sup>	86 <sup>e</sup>	
E	1	91 <sup>b</sup>	91 <sup>b</sup>	96 <sup>a</sup>	94 <sup>ab</sup>	95 <sup>ab</sup>	84 <sup>c</sup>	76 <sup>d</sup>	93 <sup>ab</sup>	90 <sup>c</sup>	90 <sup>b</sup>
	9	87 <sup>bc</sup>	91 <sup>ab</sup>	93 <sup>a</sup>	94 <sup>a</sup>	93 <sup>b</sup>	84 <sup>c</sup>	76 <sup>d</sup>	92 <sup>ab</sup>	89 <sup>c</sup>	
F	6	90 <sup>bc</sup>	94 <sup>a</sup>	85 <sup>c</sup>	93 <sup>ab</sup>	93 <sup>ab</sup>	73 <sup>d</sup>	71 <sup>d</sup>	84 <sup>c</sup>	85 <sup>de</sup>	86 <sup>c</sup>
	12	86 <sup>b</sup>	89 <sup>ab</sup>	88 <sup>ab</sup>	92 <sup>a</sup>	92 <sup>a</sup>	78 <sup>c</sup>	71 <sup>c</sup>	88 <sup>ab</sup>	87 <sup>de</sup>	
Mean <sup>1</sup>		92 <sup>AB</sup>	92 <sup>AB</sup>	92 <sup>AB</sup>	94 <sup>A</sup>	93 <sup>AB</sup>	89 <sup>C</sup>	84 <sup>D</sup>	90 <sup>C</sup>		

## Accelerated ageing germination (% normal seedlings)

Lot	Sample number	Laboratory									Overall mean <sup>2</sup>
		1	2	3	4	5	6	7	8	Mean <sup>2</sup>	
A	4	96 <sup>ab</sup>	98 <sup>a</sup>	95 <sup>ab</sup>	95 <sup>ab</sup>	95 <sup>ab</sup>	88 <sup>c</sup>	93 <sup>bc</sup>	92 <sup>bc</sup>	94 <sup>a</sup>	93 <sup>a</sup>
	10	93 <sup>ab</sup>	94 <sup>ab</sup>	96 <sup>bc</sup>	89 <sup>bc</sup>	96 <sup>a</sup>	85 <sup>cd</sup>	94 <sup>ab</sup>	81 <sup>d</sup>	91 <sup>b</sup>	
B	5	99 <sup>a</sup>	97 <sup>ab</sup>	98 <sup>ab</sup>	86 <sup>c</sup>	85 <sup>c</sup>	96 <sup>ab</sup>	95 <sup>ab</sup>	93 <sup>b</sup>	94 <sup>a</sup>	94 <sup>a</sup>
	8	98 <sup>a</sup>	97 <sup>ab</sup>	97 <sup>a</sup>	90 <sup>b</sup>	93 <sup>b</sup>	100 <sup>a</sup>	90 <sup>b</sup>	91 <sup>b</sup>	95 <sup>a</sup>	
C	3	68 <sup>ab</sup>	64 <sup>b</sup>	67 <sup>ab</sup>	74 <sup>ab</sup>	75 <sup>a</sup>	46 <sup>c</sup>	71 <sup>ab</sup>	48 <sup>c</sup>	64 <sup>f</sup>	58 <sup>e</sup>
	11	61 <sup>ab</sup>	68 <sup>a</sup>	63 <sup>a</sup>	52 <sup>b</sup>	71 <sup>a</sup>	41 <sup>c</sup>	66 <sup>a</sup>	6 <sup>d</sup>	54 <sup>g</sup>	
D	2	79 <sup>ab</sup>	74 <sup>ab</sup>	79 <sup>ab</sup>	84 <sup>a</sup>	84 <sup>ab</sup>	72 <sup>b</sup>	78 <sup>ab</sup>	78 <sup>ab</sup>	79 <sup>d</sup>	78 <sup>c</sup>
	7	82 <sup>ab</sup>	78 <sup>ab</sup>	84 <sup>a</sup>	74 <sup>b</sup>	85 <sup>a</sup>	78 <sup>ab</sup>	82 <sup>a</sup>	52 <sup>c</sup>	77 <sup>d</sup>	
E	1	84 <sup>ab</sup>	89 <sup>ab</sup>	82 <sup>bc</sup>	90 <sup>a</sup>	88 <sup>ab</sup>	77 <sup>c</sup>	74 <sup>c</sup>	87 <sup>ab</sup>	84 <sup>c</sup>	82 <sup>b</sup>
	9	80 <sup>bc</sup>	86 <sup>ab</sup>	89 <sup>a</sup>	86 <sup>ab</sup>	86 <sup>ab</sup>	57 <sup>d</sup>	73 <sup>c</sup>	80 <sup>bc</sup>	80 <sup>d</sup>	
F	6	78 <sup>b</sup>	87 <sup>a</sup>	83 <sup>ab</sup>	83 <sup>ab</sup>	87 <sup>a</sup>	51 <sup>d</sup>	66 <sup>c</sup>	65 <sup>c</sup>	75 <sup>e</sup>	74 <sup>d</sup>
	12	77 <sup>c</sup>	88 <sup>ab</sup>	80 <sup>bc</sup>	84 <sup>abc</sup>	90 <sup>a</sup>	47 <sup>e</sup>	66 <sup>d</sup>	58 <sup>d</sup>	74 <sup>e</sup>	
Mean <sup>1</sup>		83 <sup>A</sup>	85 <sup>A</sup>	82 <sup>A</sup>	82 <sup>A</sup>	86 <sup>A</sup>	70 <sup>C</sup>	79 <sup>B</sup>	69 <sup>C</sup>		

# Conclusions (AA)

- **Good repeatability within and between laboratories**
- **Assessment of normal seedlings the most likely explanation for many differences**

# Rate of germination working group

- **Working group leader: Stan Matthews (UK)**
- **University of Aberdeen (UK)**
- **Plant Directorate (DK)**
- **University of Ferdowsi (IR)**
- **SNES, GEVES (FR)**
- **LaRAS (IT)**
  
- **2 comparative tests**

# Rate of germination: Comparative tests 1

- **7 seed lots**
- **Three labs**
  - **University of Aberdeen, UK (2 runs)**
  - **Plant Directorate, Denmark**
  - **University of Ferdowsi, Iran**
- **Germination in towels at 13°C (daily counts)**
  - **Just germination (JG): appearance of the radicle**
  - **Physiological germination (G): 2mm radicle**
- **Rate of germination: calculation of**
  - **MJGT**
  - **MGT**

# Mean germination time (MJGT and MGT)

- $$\text{MJGT} = \frac{\sum nt}{\sum n}$$

**n = number of seeds newly germinated (just germinated criterion) at time t**

**t = hours or days from when set to germinate.**

- **MGT and MET same calculation**

## MJGT (days) at 13°C

<b>Lot</b>	<b>Iran</b>	<b>Aberdeen 1</b>	<b>Aberdeen 2</b>	<b>Denmark</b>	<b>Mean</b>
<b>A</b>	<b>4.75 (4)</b>	<b>5.41 (7)</b>	<b>4.87 (7)</b>	<b>5.63 (6)</b>	<b>5.17 (7)</b>
<b>B</b>	<b>5.25 (6)</b>	<b>4.71 (6)</b>	<b>4.46 (4)</b>	<b>5.32 (5)</b>	<b>4.94 (5)</b>
<b>C</b>	<b>4.15 (2)</b>	<b>4.39 (3)</b>	<b>4.04 (2)</b>	<b>5.13 (2=)</b>	<b>4.43 (2=)</b>
<b>D</b>	<b>5.45 (7)</b>	<b>4.63 (5)</b>	<b>4.59 (6)</b>	<b>5.87 (7)</b>	<b>5.14 (6)</b>
<b>E</b>	<b>4.88 (5)</b>	<b>4.49 (4)</b>	<b>4.48 (5)</b>	<b>5.59 (5)</b>	<b>4.86 (4)</b>
<b>F</b>	<b>4.05 (1)</b>	<b>3.63 (1)</b>	<b>3.52 (1)</b>	<b>5.03 (1)</b>	<b>4.06 (1)</b>
<b>G</b>	<b>4.18 (3)</b>	<b>4.25 (2)</b>	<b>4.17 (3)</b>	<b>5.13 (2=)</b>	<b>4.43 (2=)</b>

## MGT (days) at 13°C

MGT	Iran	Aberdeen 1	Aberdeen 2	Denmark	Mean
<b>A</b>	<b>6.45 (4)</b>	<b>6.88 (7)</b>	<b>7.19 (6)</b>	<b>6.98 (6)</b>	<b>6.88 (5)</b>
<b>B</b>	<b>7.53 (6)</b>	<b>6.79 (6)</b>	<b>7.53 (7)</b>	<b>6.71 (3)</b>	<b>7.14 (7)</b>
<b>C</b>	<b>5.65 (2)</b>	<b>5.70 (3)</b>	<b>6.63 (3)</b>	<b>6.74 (4)</b>	<b>6.18 (3)</b>
<b>D</b>	<b>7.58 (7)</b>	<b>6.33 (4)</b>	<b>6.84 (5)</b>	<b>7.14 (7)</b>	<b>6.97 (6)</b>
<b>E</b>	<b>6.85 (5)</b>	<b>6.50 (5)</b>	<b>6.48 (4)</b>	<b>6.82 (5)</b>	<b>6.66 (4)</b>
<b>F</b>	<b>5.90 (3)</b>	<b>5.43 (1)</b>	<b>5.36 (1)</b>	<b>5.74 (1)</b>	<b>5.74 (1)</b>
<b>G</b>	<b>5.45 (1)</b>	<b>5.64 (2)</b>	<b>6.28 (2)</b>	<b>6.27 (2)</b>	<b>5.91 (2)</b>

# Rate of germination: Comparative tests 2

- **6 seed lots**
- **Four labs**
  - **University of Aberdeen, UK**
  - **LaRAS, Italy**
  - **SNES, GEVES, France**
  - **University of Ferdowsi, Iran**
- **Germination in towels at 13°C (2 test runs)**
- **Calculation of**
  - **MJGT**
  - **MGT**

# MJGT (days) at 13°C

Lot	Aberdeen		Iran		Italy		France		Mean
	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	
<b>1</b>	<b>4.86 (5)</b>	<b>4.73 (5)</b>	<b>6.16 (5)</b>	<b>4.76 (5)</b>	<b>4.34 (6)</b>	<b>4.38 (6)</b>	<b>4.80 (5)</b>	<b>4.47 (5)</b>	<b>4.85 (5)</b>
<b>2</b>	<b>3.99 (2)</b>	<b>3.78 (2)</b>	<b>3.83 (2)</b>	<b>3.73 (2)</b>	<b>3.37 (2)</b>	<b>3.48 (3)</b>	<b>3.46 (2)</b>	<b>3.20 (2)</b>	<b>3.61 (2)</b>
<b>3</b>	<b>4.44 (4)</b>	<b>3.91 (4)</b>	<b>4.66 (4)</b>	<b>3.78 (3)</b>	<b>3.37 (2)</b>	<b>3.44 (2)</b>	<b>3.85 (4)</b>	<b>3.73 (4)</b>	<b>3.90 (4)</b>
<b>4</b>	<b>3.46 (1)</b>	<b>3.33 (1)</b>	<b>3.72 (1)</b>	<b>3.40 (1)</b>	<b>3.18 (1)</b>	<b>3.10 (1)</b>	<b>3.46 (1)</b>	<b>3.11 (1)</b>	<b>3.35 (1)</b>
<b>5</b>	<b>4.15 (3)</b>	<b>3.88 (3)</b>	<b>4.28 (3)</b>	<b>4.00 (4)</b>	<b>3.50 (4)</b>	<b>3.78 (4)</b>	<b>3.49 (3)</b>	<b>3.54 (3)</b>	<b>3.83 (3)</b>
<b>6</b>	<b>5.07 (6)</b>	<b>4.89 (6)</b>	<b>6.16 (5)</b>	<b>5.66 (6)</b>	<b>3.83 (5)</b>	<b>4.22 (5)</b>	<b>5.71 (6)</b>	<b>5.12 (6)</b>	<b>5.08 (6)</b>

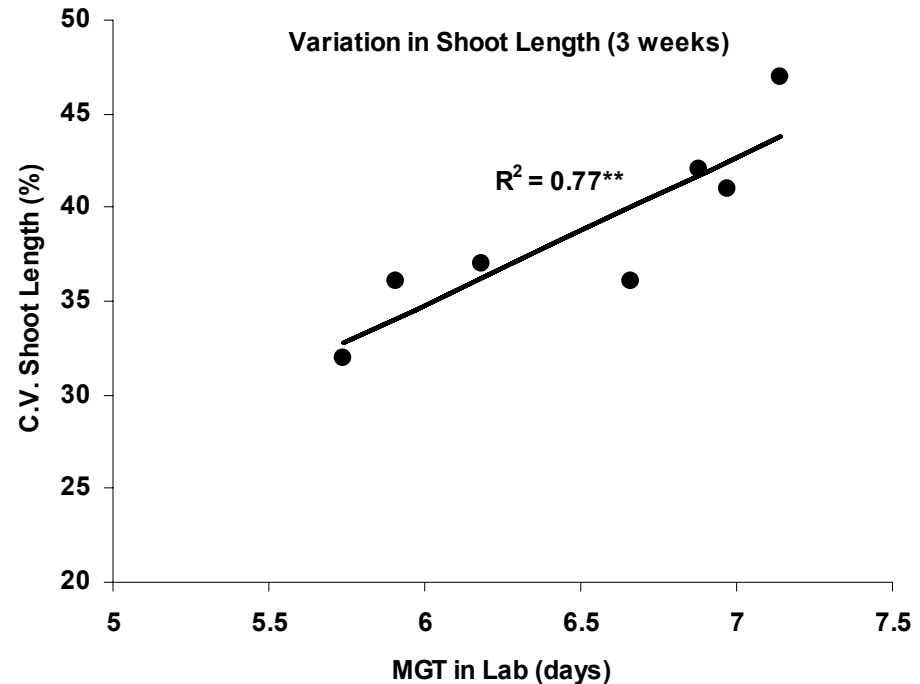
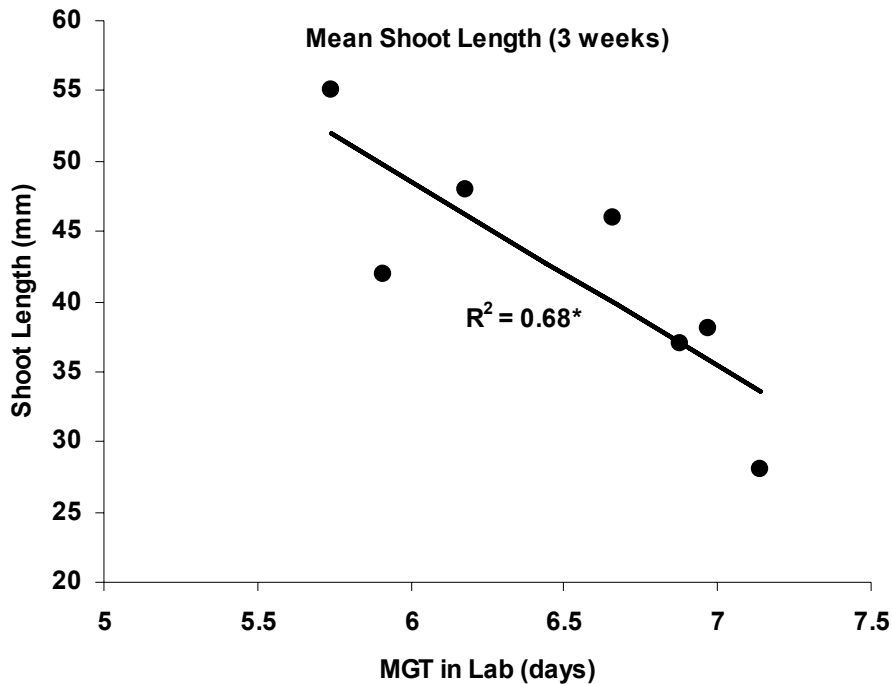
# MGT (days) at 13°C

Lot	Aberdeen		Iran		Italy		France		Mean
	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	Run 1	Run 2	
<b>1</b>	<b>6.25 (5)</b>	<b>6.55 (5)</b>	<b>8.24 (5)</b>	<b>6.61 (5)</b>	<b>5.34 (6)</b>	<b>5.38 (5)</b>	<b>5.85 (5)</b>	<b>6.04 (5)</b>	<b>6.28 (5)</b>
<b>2</b>	<b>5.10 (2)</b>	<b>4.89 (2)</b>	<b>5.51 (2)</b>	<b>5.32 (2)</b>	<b>4.37 (3)</b>	<b>4.48 (3)</b>	<b>4.52 (1)</b>	<b>4.23 (2)</b>	<b>4.80 (2)</b>
<b>3</b>	<b>6.04 (4)</b>	<b>5.65 (4)</b>	<b>6.59 (4)</b>	<b>5.61 (3)</b>	<b>4.33 (2)</b>	<b>4.44 (2)</b>	<b>5.07 (4)</b>	<b>5.05 (4)</b>	<b>5.35 (4)</b>
<b>4</b>	<b>4.48 (1)</b>	<b>4.89 (1)</b>	<b>5.10 (1)</b>	<b>5.18 (1)</b>	<b>4.18 (1)</b>	<b>4.10 (1)</b>	<b>4.61 (3)</b>	<b>4.13 (1)</b>	<b>4.58 (1)</b>
<b>5</b>	<b>5.18 (3)</b>	<b>5.10 (3)</b>	<b>5.82 (3)</b>	<b>5.76 (4)</b>	<b>4.50 (4)</b>	<b>4.78 (4)</b>	<b>4.52 (1)</b>	<b>4.77 (3)</b>	<b>5.05 (3)</b>
<b>6</b>	<b>7.17 (6)</b>	<b>6.87 (6)</b>	<b>8.55 (6)</b>	<b>7.37 (6)</b>	<b>5.09 (5)</b>	<b>5.40 (6)</b>	<b>6.97 (6)</b>	<b>6.50 (6)</b>	<b>6.74 (6)</b>

## Correlations with emergence: comparative test 1

<b>Variables</b>	<b>Correlation</b>
<b>MGT vs MET</b>	<b>-0.82*</b>
<b>MET vs emergence</b>	<b>-0.79*</b>
<b>MGT vs shoot length</b>	<b>-0.82*</b>
<b>MGT vs shoot variation</b>	<b>0.88**</b>
<b>6 day germination (13°C) vs MET</b>	<b>-0.88**</b>
<b>6 day germination (13°C) vs emergence</b>	<b>0.79*</b>

# Comparative test 1: MGT related to shoot length and variation in the field (after 3 weeks in Iran)



# Conclusions (MGT)

- **MGT indicates performance in the field (MET, seedling size and uniformity)**
- **Ranking of high and low vigour lots is consistent**
- **Physiological germination after 6d at 13°C indicates MET and final emergence**
  - **A possible vigour test?**

- **Education**

- **Workshops:**

- **Angers (FR)**
    - **Brazil 1-3 May 2007: Coodetec, Cascavel PR**



- **Handbook**
  - **Sub-committee formed**

**And finally!**

**Thank you Dennis!**

