



SEED PHYSIOLOGY COURSE  
XI EVALUATION OF SEED PHYSIOLOGICAL QUALITY

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## 1. INTRODUCTION

### IMPORTANCE OF SEED QUALITY

*SEED QUALITY RESULTS FROM GENETIC,  
PHYSICAL, PHYSIOLOGICAL AND SANITARY  
CHARACTERISTICS OF THE SEEDS*



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## 1. INTRODUCTION

### IMPORTANCE OF SEED QUALITY

*HIGH QUALITY SEEDS SHOULD HAVE:*

- ✓ CAPACITY TO PRODUCE NORMAL SEEDLINGS
- ✓ EXPECTED FIELD EMERGENCE AND UNIFORMITY
- ✓ POTENTIAL STORABILITY




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## 1. INTRODUCTION

### IMPORTANCE OF SEED QUALITY

*QUALITY EVALUATION SHOULD DETERMINE SEED LOT VALUE FOR SOWING, TO ASSURE:*

- ✓ GENETIC IDENTITIE AND PURITY OF SEED
- ✓ SEED LOTS WITHOUT CONTAMINANTS (WEED SEEDS; MICROORGANISMS AND INSECTS)
- ✓ ABILITY OF SEED TO PRODUCE VIGOROUS AND HEALTHY PLANTS



## 1. INTRODUCTION

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### IMPORTANCE OF SEED QUALITY

*QUALITY EVALUATION SHOULD DETERMINE  
SEED LOT STORABILITY*

*QUALITY EVALUATION SHOULD DETERMINE  
SEED LOT VALUE FOR TRADING*



## 2. PHYSIOLOGICAL PARAMETERS OF SEED QUALITY (VIABILITY AND VIGOR)

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*✓ SEED VIABILITY REFERS TO THE CAPABILITY OF A SEED TO GERMINATE AND PRODUCE A NORMAL SEEDLING*

*✓ SEED VIGOR COMPRISES THOSE SEED PROPERTIES WHICH DETERMINE THE POTENTIAL FOR RAPID, UNIFORM EMERGENCE, AND DEVELOPMENT OF NORMAL SEEDLING UNDER A WIDE RANGE OF FIELD CONDITIONS (AOSA, 1983)*



## 2. PHYSIOLOGICAL PARAMETERS OF SEED QUALITY (VIABILITY AND VIGOR)

*SEEDS HAVE THE MAXIMUM QUALITY AT PHYSIOLOGICAL MATURITY; AFTER THAT SEED VIABILITY AND VIGOR DEPENDS ON THE ENVIRONMENTAL CONDITIONS, HARVEST, POST-HARVEST AND STORAGE CONDITIONS*



## 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

### 3.1 SAMPLING

*OBJECTIVES:*

- **TO OBTAIN A SAMPLE OF A SIZE SUITABLE FOR TESTS;**
- **THE SAMPLE MUST REPRESENT THE QUALITY OF THE SEED LOT FROM WHICH IT IS DRAWN**



## 3. SEED PHYSIOLOGICAL QUALITY EVALUATION 9

### 3.1 SAMPLING

*SEED LOT*

**A SEED LOT IS A SPECIFIED QUANTITY OF SEED AND PHYSICALLY IDENTIFIABLE**

*SEED  
LOT  
SAMPLES*

PRIMARY SAMPLE

COMPOSITE SAMPLE

SUBMITTED SAMPLE

WORKING SAMPLE



## 3. SEED PHYSIOLOGICAL QUALITY EVALUATION 10

### 3.2 GERMINATION TEST

*OBJECTIVE:*

**TO DETERMINE THE MAXIMUM GERMINATION POTENTIAL OF A SEED LOT**

SEED GERMINATION IS THE EMERGENCE AND DEVELOPMENT OF THE SEEDLING, WHICH SHOWS POTENTIAL TO DEVELOP A PLANT UNDER FAVOURABLE SOIL AND OTHER ENVIRONMENTAL CONDITIONS



### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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#### 3.2 GERMINATION TEST

**WORKING SAMPLE** → **FROM PURE SEED**

AMBIENT CONDITIONS FOR SEED GERMINATION:  
WATER, TEMPERATURE, OXIGEN AND LIGHT,  
MAINLY FOR DORMANT SEEDS



### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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#### 3.2 GERMINATION TEST

PRESCRIPTIONS FOR GERMINATION (ISTA, 1999)


SPECIES	Prescriptions for:				Additional directions (including dormancy break)
	Substrate	Temperature °C	First county (days)	Final count (days)	
<i>Sorghum bicolor</i>	TP;BP	20-30; 25	4	10	Prechill
<i>Zea mays</i>	BP; S	20-30; 25; 20	4	7	-----




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WORKING SAMPLE – FROM PURE SEED; SUBSTRATUM PAPER, ROLLED TOWEL (BP)




GERMINATION CHAMBER: WATER, HEAT, OXIGEN AND LIGHT



GERMINATION TEST



GERMINATION TEST EVALUATION



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### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

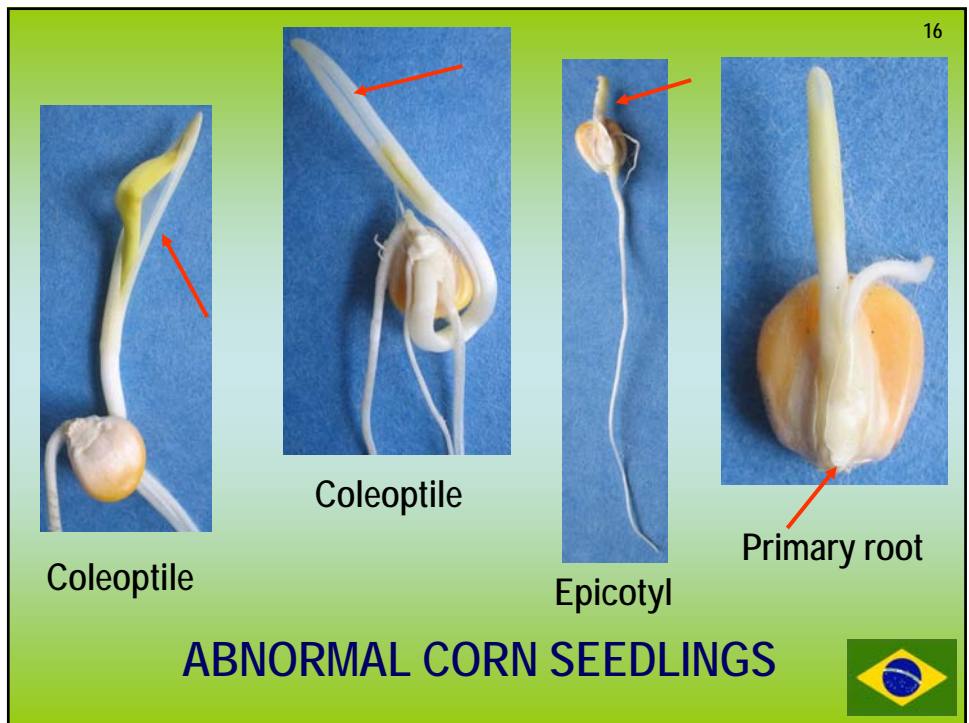
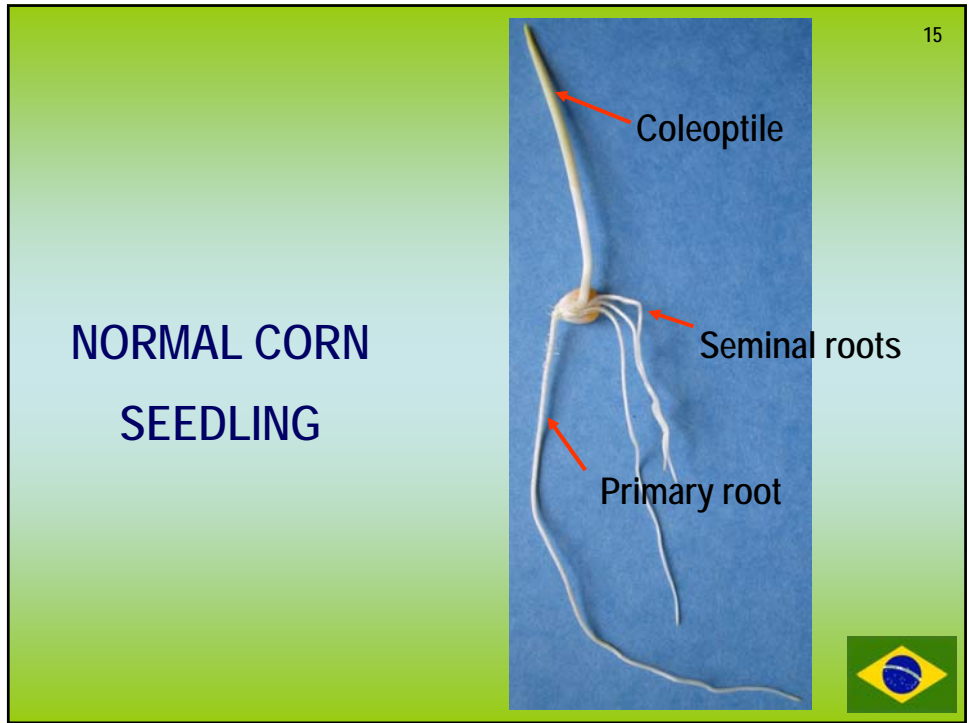
#### 3.2 GERMINATION TEST

***EVALUATION OF THE GERMINATION TEST:***

- ✓ **Normal seedlings (%)**; show the potential for continued development into satisfactory plants under favorable environmental conditions
- ✓ **Abnormal seedlings (%)** do not show the potential for continued development into satisfactory plants under favorable environmental conditions
- ✓ **Ungerminated seed: dormant, dead and other categories (%)**; seeds which have not germinated at end of the test period

Result is related to % Normal Seedlings





### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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#### 3.3 TETRAZOLIUM (TZ) TEST

*OBJECTIVE:*

**TO MAKE A QUICK ESTIMATE OF SEED VIABILITY**

*PRINCIPLE*

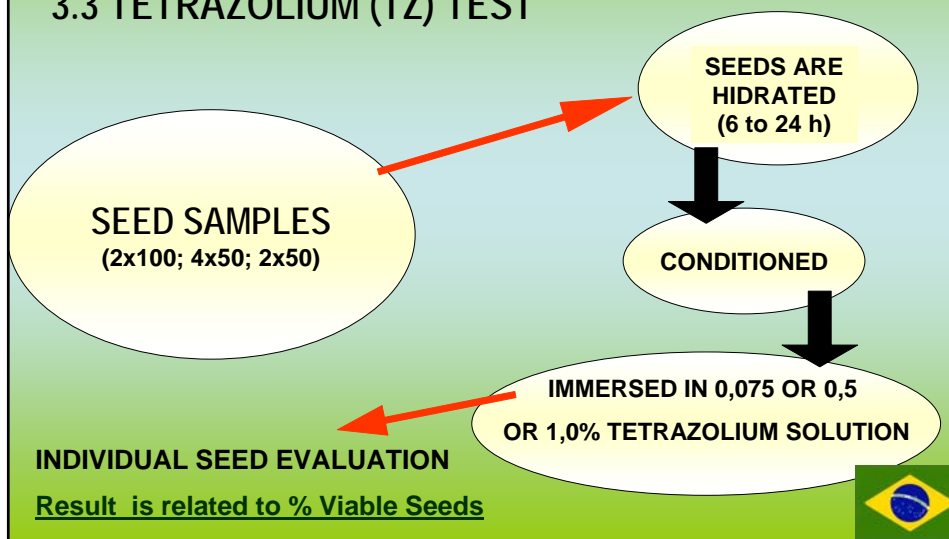
A colorless tetrazolium solution is used as an indicator producing in living cells a red, stable and non-diffusible substance, named Formazan. Thus, it's possible to distinguish the red-colored living tissues from the colorless dead ones and the seeds are classified into viable and non viable seed classes

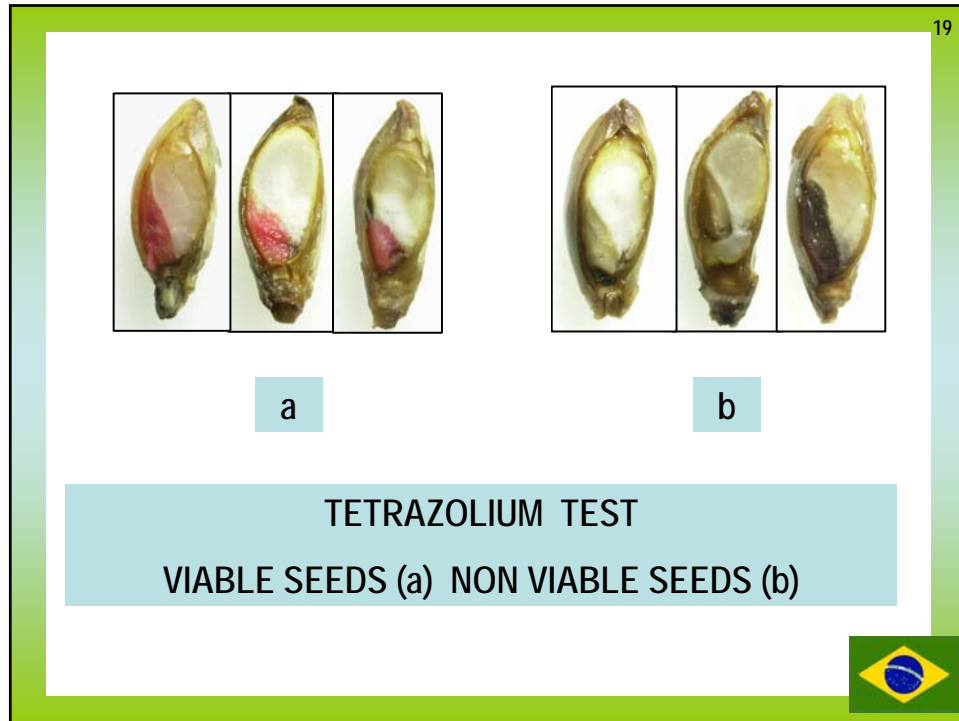


### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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#### 3.3 TETRAZOLIUM (TZ) TEST






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### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

#### 3.4 VIGOR

SEED VIGOR IS A SUM OF THOSE PROPERTIES THAT DETERMINE THE ACTIVITY AND PERFORMANCE OF SEED LOTS OF ACCEPTABLE GERMINATION IN A WIDE RANGE OF ENVIRONMENTS (ISTA, 1999)



## 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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### 3.4 VIGOR

CHARACTERISTICS ASSOCIATED WITH SEED QUALITY EVALUATION INCLUDE:

- ✓ Rate and uniformity of seed germination and seedling growth
- ✓ Ability of seeds to emerge under unfavorable environment
- ✓ Seed performance after storage, particularly retention of germinability



## 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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### RECOMMENDED VIGOR TESTS

#### *3.4.1 ACCELERATED AGING TEST (AA)*

PURE SEEDS ARE EXPOSED TO:

↑ TEMPERATURE (41°C TO 45°C)

↑ RELATIVE HUMIDITY (100% OR 76%)

24 TO 120h

SEED EVALUATION: MOISTURE CONTENT (%) AND GERMINATION (%)

Result is related to % Normal Seedlings

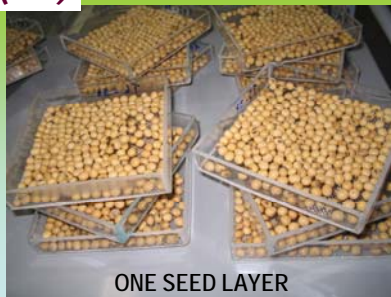


## ACCELERATED AGING TEST (AA)

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PLASTIC BOXES: 40mL  
WATER OR SALT SOLUTION



ONE SEED LAYER



AA CHAMBER



GERMINATION TEST



## 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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### RECOMMENDED VIGOR TESTS

#### *3.4.2 COLD TEST*

PURE SEEDS ARE EXPOSED TO:

↓ TEMPERATURE (10°C)

WETTED SUBSTRATUM

} 4 TO 7 DAYS

+ 7 DAYS AT NORMAL AMBIENT

SEED EVALUATION: SEEDLING EMERGENCE (%)

Result is related to % Normal Seedlings



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*COLD TEST*

SEEDLING EMERGENCE




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COLD TEST  
(TOWELL PAPER+SOIL)

GERMINATION TEST



### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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#### RECOMMENDED VIGOR TESTS

#### *3.4.3 ELECTRICAL CONDUCTIVITY TEST*

WEIGHT REPLICATES OF 25 or 50 PURE SEEDS:

DISTILLED WATER: 25, 50 or 75mL	} IMMERSE SEEDS FROM 3 TO 24h
TEMPERATURE (20°C; 25°C or 30°C)	

SEED EVALUATION: ELECTROLYTES LEAKAGE (uScm<sup>-1</sup>g<sup>-1</sup>seed); MOISTURE CONTENT (%)

Result is related to uScm<sup>-1</sup>g<sup>-1</sup>seed



### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION

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#### RECOMMENDED VIGOR TESTS

*ELECTRICAL CONDUCTIVITY TEST*



CONDUCTIVITY METER



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### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION


RECOMMENDED VIGOR TESTS

**3.4.4 SEEDLING GROWTH TESTS**

SPEED OF SEED GERMINATION

SEEDLING SIZE

DRY MATTER OF SEEDLING



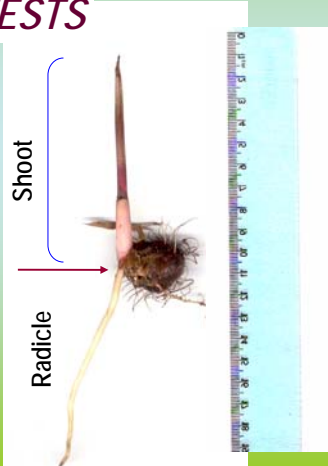
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### 3. SEED PHYSIOLOGICAL QUALITY EVALUATION


RECOMMENDED VIGOR TESTS

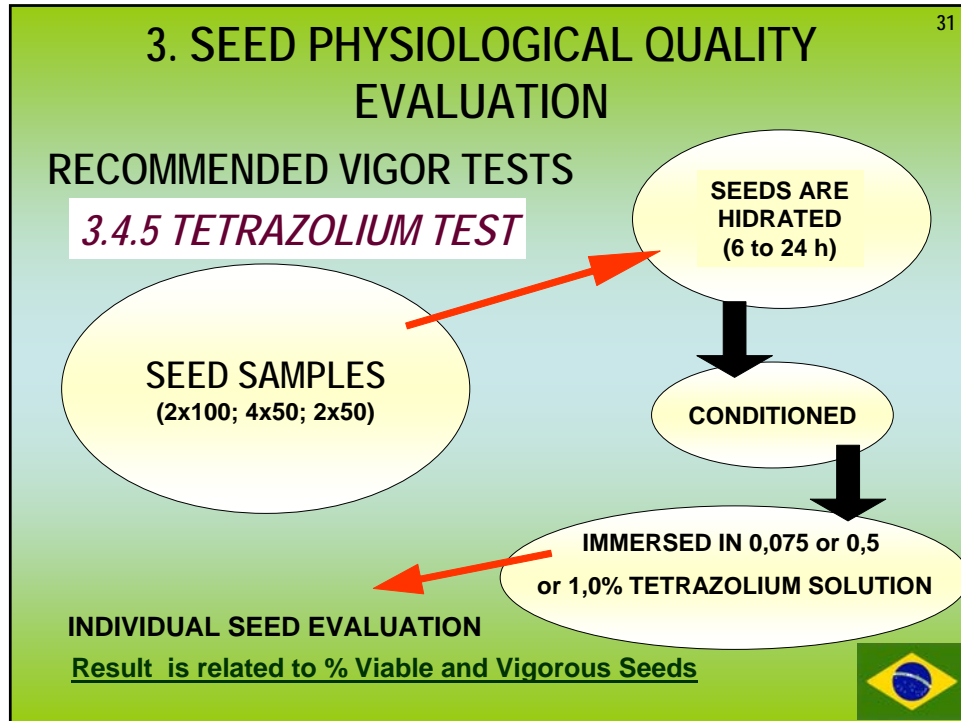
**3.4.4 SEEDLING GROWTH TESTS**

**SEEDLING SIZE**




Nascimento, 2005





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1 - Viable and vigorous tomato seed

2 - Viable and non vigorous tomato seed

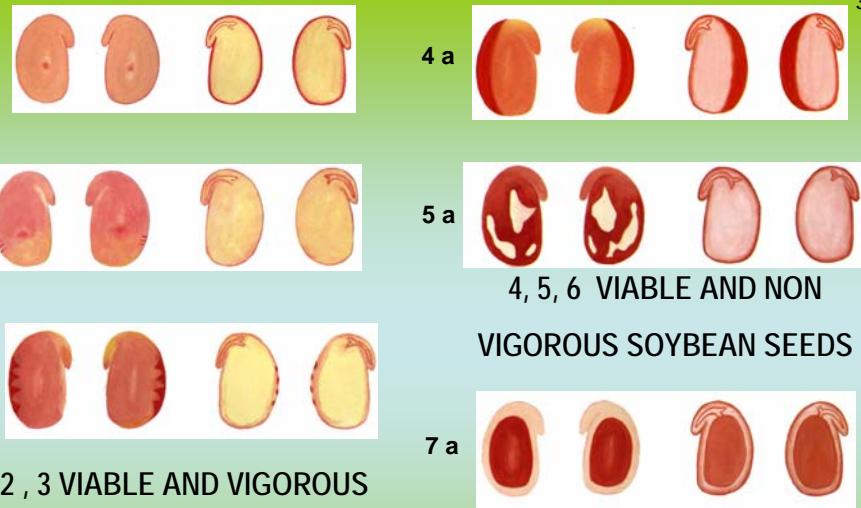
3 - Non viable tomato seeds

**TETRAZOLIUM TEST - SEED CLASSES**

(Pictures: Santos e Novembre, 2003)



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1 a

2 a

3 a

4 a

5 a

6 a

7 a

8 a

1, 2, 3 VIABLE AND VIGOROUS SOYBEAN SEEDS

4, 5, 6 VIABLE AND NON VIGOROUS SOYBEAN SEEDS

7,8 NON VIABLE SOYBEAN SEEDS

**TETRAZOLIUM TEST – SEED CLASSES**

