Seed Production

ផលិតកម្មពូជ

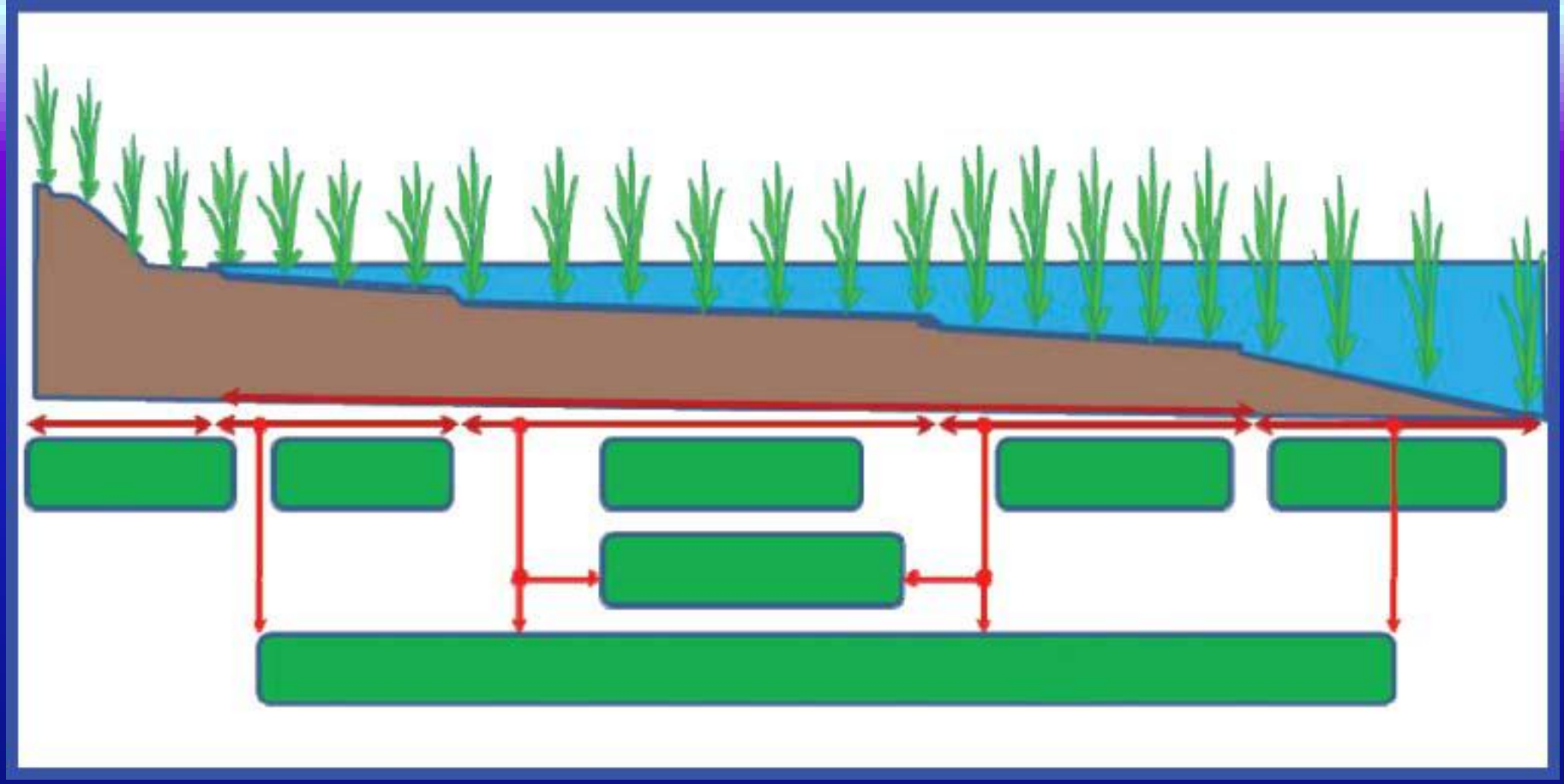
មន្ទីរកសិកម្មខេត្ត កំពង់ធំ

mal:temseng@yahoo.com

ទឹម សេង

ធញជាតិគ្រាប់

Grain Seed



ប្រភព : វិទ្យាស្ថានស្រាវជ្រាវ និងអភិវឌ្ឍន៍កសិកម្មកម្ពុជា

Seed multiplication

To multiply a good quality seed in each generation

To maintain genetic identity and purity

Class of seed certification

1. Breeder seed : ពូជគ្រឹះដំរើរវិទូ
2. Foundation seed :ពូជគ្រឹះសុទ្ធ§គ្រឹះ
3. Registered seed : ពូជសុទ្ធ§ទទួលស្គាល
4. Certified seed :ពូជសុទ្ធ§អនុញ្ញត្តិ

Breeder seed

គ្រាប់ពូជសុទ្ធជំរើសទីនេះត្រូវបានដំណើតឡើងក្រោមការត្រួតពិនិត្យថ្នាល់របស់អ្នកបច្ចាត់រុក្ខជាតិ ហើយ តំណាងអោយខ្សែស្រឡាយពិតប្រាកដនៃប្រភេទពូជ ។ គ្រាប់ពូជសុទ្ធជំរើសទីនេះ ត្រូវបានគេប្រើដើម្បីដំណើតគ្រាប់ពូជសុទ្ធក្រឹះ ហើយ ជានិច្ចកាល គេជាក់ផ្លាកពណ៌ស ។

Foundation seed

គ្រាប់ពូជសុទ្ធគ្រឹះ ៖ គឺជាគ្រាប់ពូជជំនាន់ទីមួយដែលគេបង្កាត់ចេញពីគ្រាប់ពូជ សុទ្ធជំរើសវិទ្ធូខ វាត្រូវ បានគេផលិតឡើងដោយស្ថិតនៅក្រោមការត្រួតពិនិត្យមើលផ្ទាល់នៃស្ថាប័នគ្រាប់ពូជ សុទ្ធគ្រឹះឬក៏ស្ថានីយ៍ពិសោធន៍កសិកម្ម ដើម្បីរក្សាបានអត្តសញ្ញាណនិងភាពសុទ្ធនៃសែនជាក់លាក់ខគ្រាប់ ពូជសុទ្ធគ្រឹះត្រូវបានគេប្រើដើម្បីផលិតគ្រាប់ពូជសុទ្ធដែល គេទទួល ស្គាល់ ហើយជានិច្ចកាល គេបិទផ្លាកពណ៌ ស ខ

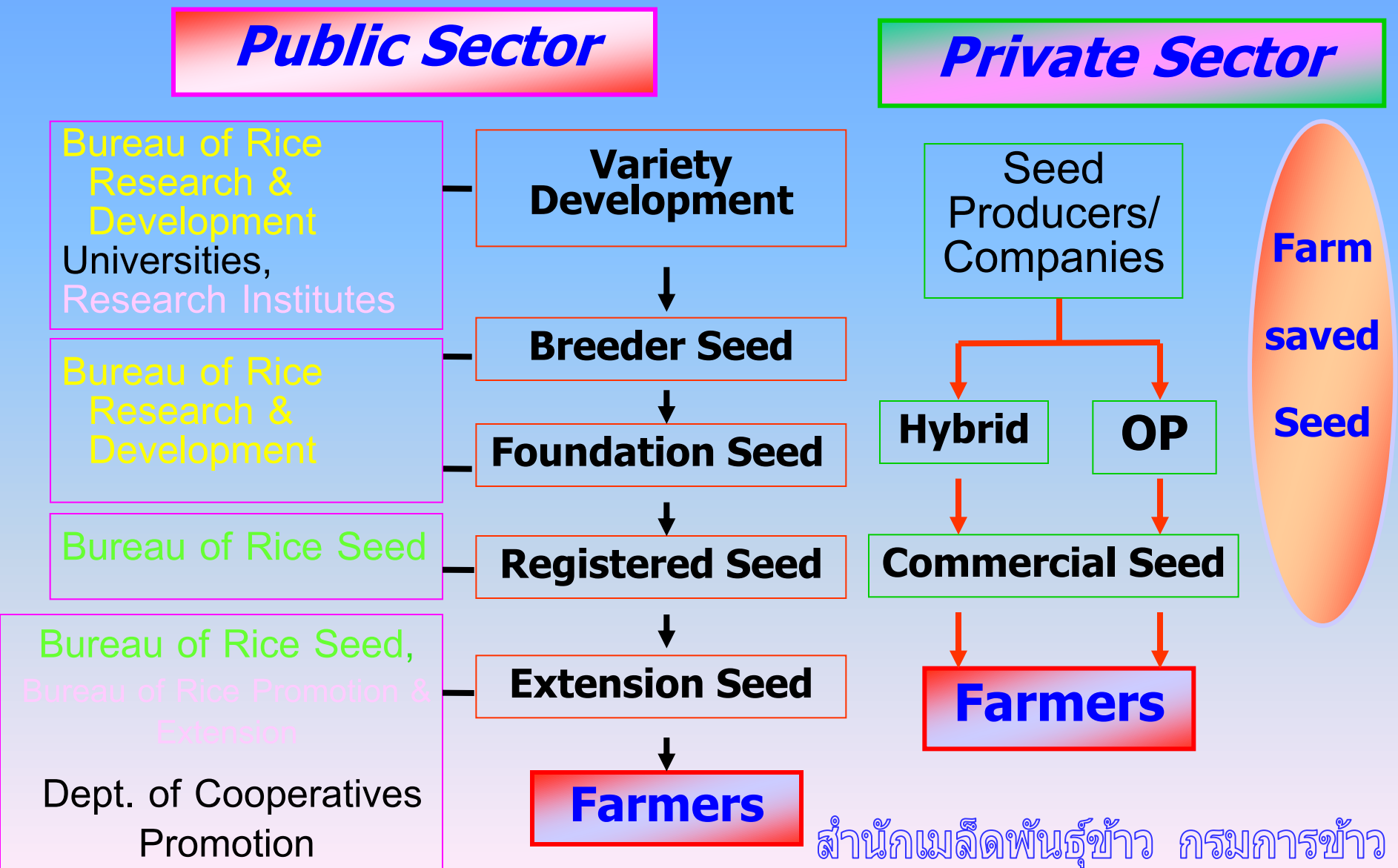
Registered seed

គ្រាប់ពូជសុទ្ធនទួលស្គាល់ ៖ត្រូវបានគេផលិតចេញពីគ្រាប់ពូជ សុទ្ធគ្រឹះហើយ គេប្រើវាក្នុងគោលបំណងបង្កើនដំនាន់មួយទៀតមុនពេលផលិតគ្រាប់ពូជសុទ្ធអនុញ្ញាតិ ដើម្បី រក្សាបាន អត្តសញ្ញាណនិងភាពសុទ្ធ របស់សែន ។ គ្រាប់ពូជសុទ្ធទទួលស្គាល់ត្រូវបានផលិតឡើងក្រោមការត្រួតពិនិត្យរបស់ទីភ្នាក់ងារដែលចេញវិញ្ញាប័ណ្ណប័ត្រ គ្រាប់ពូជ ជាផ្លូវការ ហើយជានិច្ចកាលគេបិទផ្លាកពណ៌ ស្វាយ ។

Certified seed

៤. គ្រាប់ពូជសុទ្ធអនុញ្ញាតិ : ត្រូវបានគេផលិតឡើងចេញពី គ្រាប់ពូជសុទ្ធទទួល ស្គាល់ ហើយតំណាងអ
វិញ្ញាប័ណ្ណប័ត្រ ដើម្បី រក្សាបានទុវអត្តសញ្ញាណនិងភាពសុទ្ធនៃសែនគួរ អោយពេញចិត្ត
ដូចដែលអនុម័តដោយទីភ្នាក់ងារចេញវិញ្ញា ប័ណ្ណប័ត្រគ្រាប់ពូជជាផ្លូវការ ។ ជានិច្ចកាល
គ្រាប់ពូជសុទ្ធអនុញ្ញាតិ ត្រូវបានគេបិទផ្លាកពណ៌ខៀវ ។

Rice Seed Production of Thailand



สำนักเมล็ดพันธุ์ข้าว กรมการข้าว

ឥរិយាបថសំរាប់ផលិតកម្មគ្រាប់ពូជៈកសិដ្ឋាន និងកសិករ (Thomson, ១៩៧៩)

ដើម្បីផលិតគ្រាប់ពូជ ការដាក់គ្រាប់ពូជដោយឡែកនិងទឹកដែលចេញពីគ្រាប់ពូជចាំបាច់ត្រូវតែរៀបចំគសិដ្ឋាន គួរតែមានផ្លូវចូល ទៅដល់ ដូច្នោះមន្ត្រីផ្សព្វផ្សាយអាចទៅធ្វើទស្សនកិច្ច ហើយគ្រាប់ពូជដែលប្រមូលផលបាន អាចដាយដឹកជញ្ជូនទៅរោងចក្រកែច្នៃឬ កន្លែងស្ងួតចុង ។ អ្វីដែលសំខាន់ជាងគេបំផុតនោះគឺអ្នកជាំដុះក្នុង កសិដ្ឋានឬកសិករខ្លួនឯង គាត់ត្រូវតែមានបទពិសោធន៍ក្នុងការជាំដំណាំហើយជាពិសេសមានភាពឆៀតក្នុងការយល់ដឹងពីដំណើរការពិសេសៗនិងការប្រុងប្រយ័ត្នចុងក្រោយមុនដែលចាំបាច់ក្នុងការជាំដំណាំយកពូជ មានភាពស្ងាហាប់ដោយធានាថាប្រតិបត្តិការនោះត្រូវបានអនុវត្តទាន់ពេលវេលា មានការប្រុងប្រយ័ត្នក្នុងការ សំអាតខ្លបករណ៍និងសំភារៈប្រើប្រាស់ជាកសិករគួរអោយទុកចិត្តបាននិងកត្តាក្សេត្រសាស្ត្រ ដូចជាការដាក់ជី ការស្រោចស្រព ការកំចាត់ស្មៅចង្រៃការកំចាត់ជំងឺនិងកត្តាចង្រៃជាដើម

Requirement for seed multiplication (cont.)

Farmers

Intelligent - to understand the special procedures and precautions necessary in growing crops of seed.

Energetic - to ensure that operation are carried on time.

Meticulous - to ensure through cleaning of implements and equipment.

Reliable

Requirement for seed multiplication (cont.)

Climatic factors

light, temperature, rainfall, wind, soil and season

Agronomic factors

fertilizers, irrigation, weeds control, disease and pest control

Requirement for seed multiplication (cont.)

Previous cropping

Volunteer plants of a different cultivar or species may appear derived from a previous crop in the same field.

The period between crops must be long enough (allowing for dormancy) for all the previous seeds to Germinate.

That is an interval of two cropping must be desirable.

Requirement for seed multiplication (cont.)

Planing

- Class of certified seed requirement
- Land selection
- Amount of seed requirement
- Time table of working plan or crop schedule

កត្តាផលិតកម្មគ្រាប់ពូជ ≈ គ្រាប់ដែលគេកែច្នៃ/ផ្ទៃដី

អត្រាគ្រាប់ /,ផ្ទៃដី

បរិមាណគ្រាប់ពូជសុទ្ធគ្រឹះដែលត្រូវប្រើ ≈ បរិមាណគ្រាប់ពូជដែលត្រូវការ

កត្តាផលិតកម្ម

- ចំណាត់ថ្នាក់តំរូវការគ្រាប់ពូជដែលគេបញ្ជាក់
- ជ្រើសរើសដី
- បរិមាណតំរូវការគ្រាប់ពូជ
- តារាងផែនការ និងកម្មវិធីការងារ

~កត្តាផលិតកម្មគ្រាប់ពូជ គឺជាចំនួនគីឡូក្រាមនៃគ្រាប់ពូជដែលគេប្រមូលផល ចេញពីគ្រាប់ពូជក្នុងមួយគីឡូ ដែលគេសាប ។

ឧទាហរណ៍: តើយើងត្រូវការបរិមាណគ្រាប់ពូជសុទ្ធគ្រឹះដែលត្រូវមានក្នុងស្មុកប៉ុន្មាន ?

ប្រសិនបើយើងផលិត គ្រាប់ពូជសុទ្ធទទួល ស្គាល់ចំនួន ២OOOO គ.ក នោះ

១) ប្រសិនបើកំរិតគ្រាប់ពូជសុទ្ធគ្រឹះ ឬគ្រាប់ពូជធម្មតាដែលគេសាប ≈ ៤O kg/rai

ទិន្នផលគ្រាប់ពូជសុទ្ធទទួលស្គាល់បន្ទាប់ពីកែច្នៃហើយ ≈ ៨OO kg/rai

កត្តាផលិតកម្ម ≈ ៨OO,៤O ≈ ២O kg/rai

២) ប្រសិនបើយើងចង់ផលិតគ្រាប់ពូជសុទ្ធទទួលស្គាល់ចំនួន២OOOO គ.កនៅឆ្នាំនេះ ដូច្នេះតើគេត្រូវមាន គ្រាប់ពូជសុទ្ធគ្រឹះប៉ុន្មាន នៅក្នុងស្មុក ?

បរិមាណគ្រាប់ពូជសុទ្ធគ្រឹះដែលត្រូវមាន≈ 20,000/20 = 1,000 kg

ពូជជំរើសវិទ្ធ


8 10:37 AM


9 8:13 AM


8 10:47 AM


8 10:58 AM


2:09 PM


7 10:32 AM


8 8:47 AM


ស្រែ ដលិតម្ហូប
ជំរើសចិត្ត


กข 31
ปีที่ปลูก 6600 ปี
ตกกล้า 29 มิ.ย. 51


12 8:27 AM


Foundation seed
11 10:27 AM

ការដាំដុះលើកមុន

ក្នុងដំណាំយកគ្រាប់ រុក្ខជាតិឬដំណាំផ្សេងៗអាចលេចឡើងដោយសារឆ្លងពីដំណាំលើកមុននៅក្នុងចំការតែមួយ។ការរស់ឡើងវិញនៃដំណាំលើកមុនអាចការពារបានតាមរយៈការភ្ជួររាស់ដី ១

មុននឹងធ្វើការដាំគ្រាប់ ដំណាំនៅលើដីម្តងទៀត នោះរយៈពេលដាំដុះនៃដំណាំប្រភេទដូចគ្នាត្រូវទុកអោយបានយូរគួរសម(ទុកអោយ មានដំណេកគ្រាប់)ដើម្បីអោយគ្រាប់មុនដុះឡើង ១ ត្រូវទុកចន្លោះពេលអោយសមស្របចំពោះរដូវដាំដុះ និមួយៗ (ទហ្សមស្ស៊ន្ស ១៩៧៩

Selecting good seeds

- Must be cleaned seed

- Specific gravity 1.08 or water only

(Salt 1.65 kg + water 10 ลิตร)

$$\text{Amount of seeds} = \frac{\text{seeding rate (kg/ha) x area (ha)}}{\%\text{germination x \% filled grain}}$$

Method

Transplanting

Pregerminated broadcasting

Interval of two cropping season


24 7 2007


8 10:26 AM


8 9:08 AM


7 8:58 AM

ការរៀបចំដី :

~ អោយរាបស្មើល្អ និងត្រូវមានកន្លែងបង្ហូរទឹក

~ ការចែកចាយទឹកអោយបានដូចគ្នា

Seed Preparation

Soak 24 hrs


Incubate 48 hrs
9 8:13 AM
9 8:11 AM

Seedling preparation for transplanting

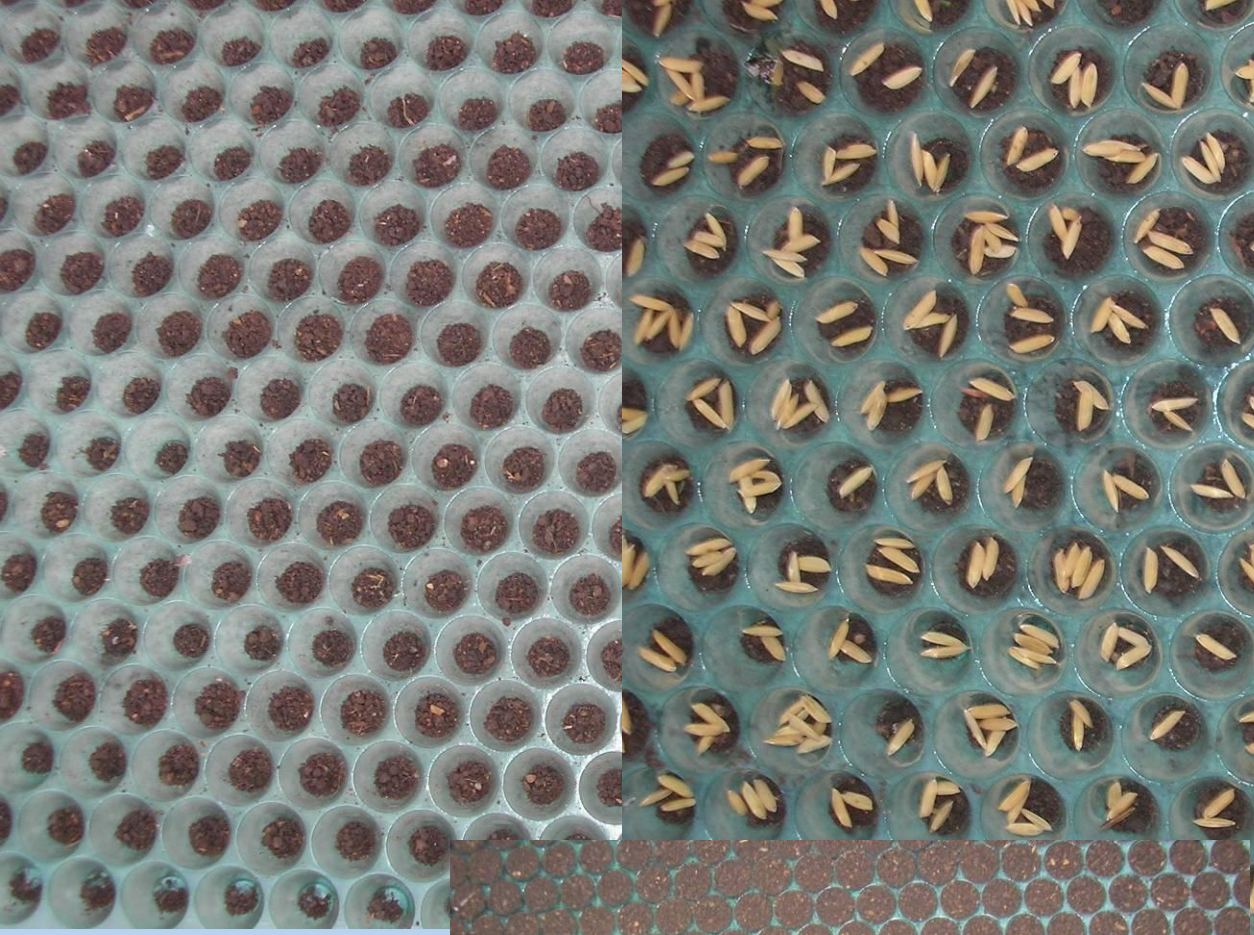
Transplanting

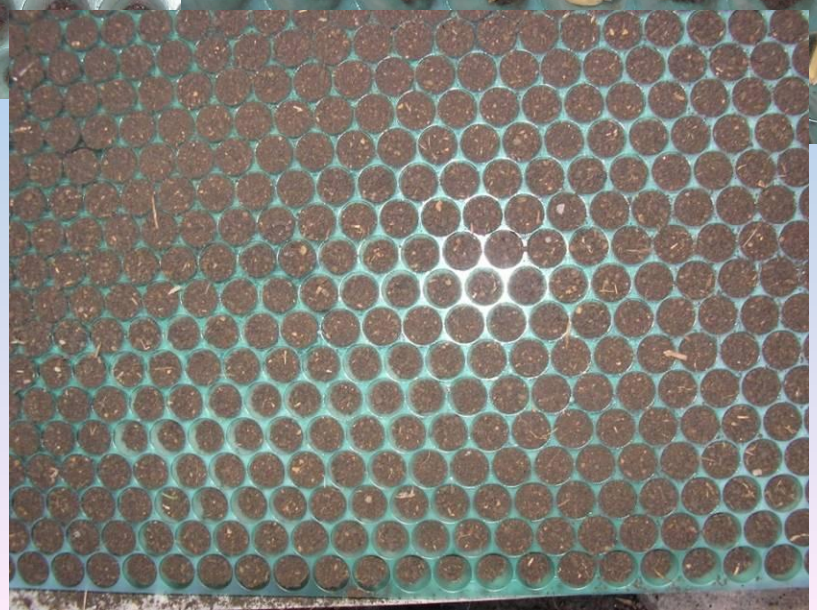

8 2 2007


13 10 2005

Broadcasting


9:06 AM





Seedling Broadcasting

ការគ្រប់គ្រង

- កំពស់ទឹក 5-10 cm.
- **Fertilizer application**

  photoperiod insensitive variety 16-20-0 20 DAS or 1 day before transplanting 156 Kg./ha Urea (46-0-0) at tillering and PI 62 Kg./ha each

  photoperiod sensitive variety 16-20-0 20 DAS or 1 day before transplanting 125 Kg./ha Urea (46-0-0) at tillering and PI 31 Kg./ha each
- **Pest control as necessary**

Requirement for seed multiplication (cont.)

Roguing

- The process of removing undesirable plants from the crop.
- The efficacy depends partly on the distinctness of the rogues and the skill of the roguers.
- A rogue can be removed only it’s distinctive enough by an experienced roguer.
- Depend on the magnitude of the difference :- Flowering, color, height and maturity


8:24 AM


8 11 2006

Roguing (cont.)

- A tall (or early) plant is outstanding in a short (or late) cultivar but a short plant in a tall cultivar is out of sight.

- Uniformity of cultivar contributes to distinctness.

- Roguing is limited in its effectiveness but it does contribute to maintain seed identity and purity.

- It is an essential operation in seed multiplication.

- Should be several times at different stage of crop development :- tillering, flowering and maturity.

Conclusion

Roguing (observe off-type plants)

- height
- heading time
- leaf, culm and grin color
- leaf angle
- panicle exsertion
- panicle type
- flag leaf angle
- grain size
- presence/absence of awns

Suggestion

The best time to rogue the crop is at heading

- max. plant height
- distinguish early maturing from late maturing varieties

Possible cause of off-type

1. Cultivar not homozygous still segregate
2. Cultivar degenerate due to continuous use
3. Impurity seeds
4. Volunteer from previous crop plant
5. Mutation occurs

Record flowering date

75-80% flowering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อายุเก็บเกี่ยว 120-130 วัน

ต้านทานเพลี้ยกระโดดสีน้ำตาล เพลี้ยกระโดดหลังขาว ค่อนข้างต้านทานโรคไหม้

อายุเก็บเกี่ยว 103-105 วัน

ต้านทานเพลี้ยกระโดดสีน้ำตาล อ่อนแอต่อบั่ว

อายุเก็บเกี่ยว 99-103 วัน

ค่อนข้างต้านทานเพลี้ยกระโดดสีน้ำตาล และโรคขอบใบแห้ง

อายุเก็บเกี่ยวประมาณ 120 วัน

ต้านทานโรคไหม้ ขอบใบแห้ง เพลี้ยกระโดดสีน้ำตาล และเพลี้ยกระโดดหลังขาว

Harvesting

Recommended harvest maturity

28-30 day after 75% flowering


TAMCO


12 8:44 AM

Threshing


ការហាលស្មៅដោយកំដៅថ្ងៃ

Driers

- High temp. and rapid drying can harm the seed because water is withdrawn too quickly.

- Slow drying may have the effect of maintaining the seed at high moisture content and a relatively high temperature and so accelerate deterioration.

- The seed must dried as soon as possible after harvest To delay seed deterioration.

- Suitable temp. and time should be recommended for driers (43-50°C).

Requirement for seed multiplication (cont.)

Prevention of mechanical contamination

- All implements and containers must be cleaned before operations :- tractors, combine harvesters, cultivating implements, treshers, diers, storage bins and so on.

Requirement for seed multiplication (cont.)

Cleaning

To remove seed impurities, mainly chaff, pieces of stem and leaf and some kind of weed seeds

Separating

To upgrade the seed lot, being the uniform size and shape.

Sizing - remove seeds larger or smaller the require size.

Grading - remove the seeds which cracked, damaged or defective.

Such seeds may reduce vigour and influence field establishment.

Requirement for seed multiplication (cont.)

Treatment

Fungicide

Packaging

- After processing, samples must be drawn by inspector and sent to seed testing laboratory.

- If the seed lot meet the standard, the bags are sealed and labeled.

Requirement for seed multiplication (cont.)

Fumigation

Phosphine 2-3 tablets/ton seed or 1-2 tablets/cm^3
Not less than 7 day

Storage

To maintain germination capacity

Storage

Seed must be

- Dry
- Clean
- Free of impurity material

Area must be

- Clean
- Safe from rodents, birds, insects and mites


8 9 2008


8 9 2008


8 9 2008

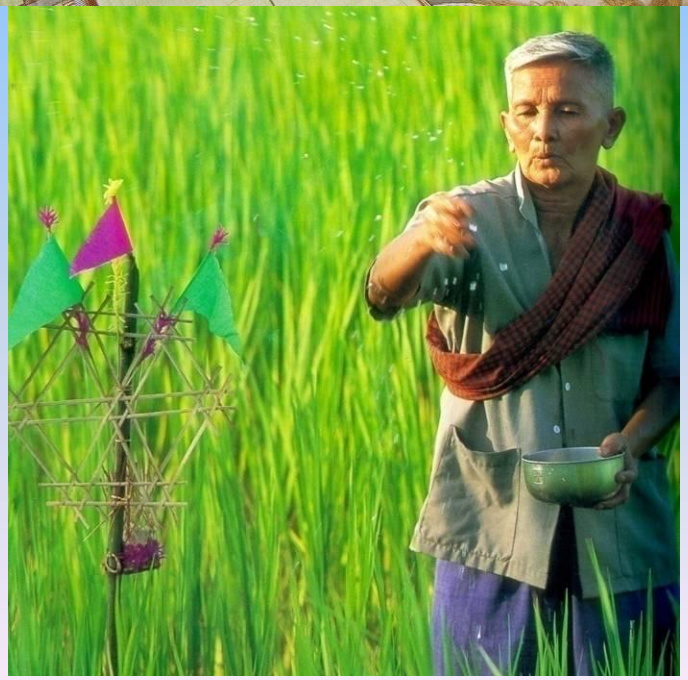

B10
8 9 2008


WM1
NEWLONG
8 9 2008


2 6 2008

Good quality seed for farmers

สำนักเมล็ดพันธุ์ข้าว กรมการข้าว



Seed certification

is seed quality control system

Objective

To maintain and make high quality seeds (genetic identity and genetic purity) available to the public.

Seed certification program

- Produced by outstanding farmers and seed men using careful quality control.
- pedigree planting stock
- Field inspection (prescribed field standard)
- Seed analysis following harvest
  (prescribed seed standard)

Seed which does not meet the standard can not be certified.

Field inspection

- Required technically trained person.

- The inspector makes an inspection and advise seed grower to rogue and remove weed seeds, other crops, other varieties.

- Poor growth, lack of uniformity, excessive weeds, presence of pests and diseases or other condition may bring the seed disfavor → reject rice field

Field standard

Maximum permitted (No of plant)	Other varieties	Red rice
Foundation seed	-	-
Registered seed	1/1000	-
Certified seed	1/500	1/1000

Rice Seed Standard of Rice Department

Factor	**Breeder seed**	Foundation seed	Registered seed	Certified seed
Pure seed (min)	98 %	98%	98 %	98 %
Other variety (max)	None	1 in 1000 g	15 in500 g	20 in500 g
Red rice (max)	None	None	5 in 500 g	10 in 500 g
Inert matter (max)	2 %	2 %	2 %	2 %
Germination (min)	80 %	80 %	80 %	80 %
Moisture (max)	14 %	14 %	14 %	14 %

Seed Quality testing

Objective

To determine quality of seed for planting

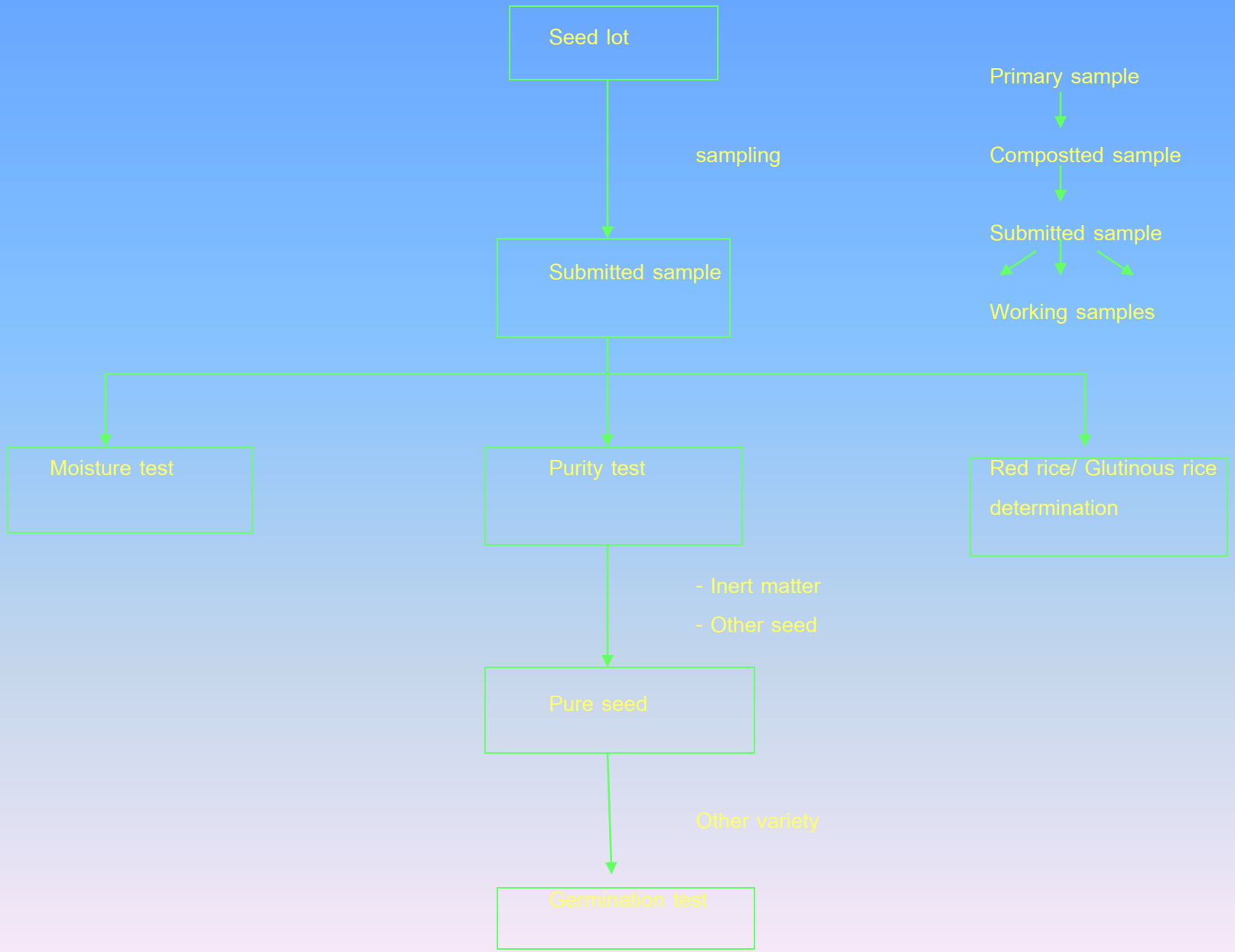
Two organization published seed testing procedures

-ISTA

(International Seed Testing Association)

-AOSA

(Association of Official Seed Analysis)


Seed lot
sampling
Primary sample
Compostted sample
Submitted sample
Working samples
Submitted sample
Moisture test
Purity test
Red rice/ Glutinous rice determination
- Inert matter
- Other seed
Pure seed
Other variety
Germination test

Seed lot : a quantity of seed, max. for rice seed/lot is 25-30 tonnes.

Primary sample: random from different positions within the lot.

Composite sample: mixing of all primary samples.

Submitted sample: reduced from composite sample. Minimum submitted sample weight is 400 g.

Working sample: reduced from submitted sample. Minimum weight of purity test is 40 g.

Seed Sampling

Objective :

To obtain truly representative of the seed lot.

Seed sampler

1. Stick or sleeve type trier
2. Nobbe type trier

Sampling Intensity

Seed lots in containers

1-4 containers : at least 3 primary samples in each container

5-8 containers : at least 2 primary samples in each container

9-15 containers : at least 1 primary samples in each container

16-30 containers : at least 15 primary samples from seed lot

31-59 containers : at least 20 primary samples from seed lot

> 60 containers : at least 30 primary samples from seed lot

No of container sampling = **5 + 10%**

of containers in each lot

Sampling Intensity

Seed lots in bulk

Lot size	Number of primary sample to be taken
< 500 kg	At least 5 primary samples.
501-3,000 kg	1 primary sample for each 300 kg, but not < 5.
3,001-20,000 kg	1 primary sample for each 500 kg, but not < 10.
>20,000 kg	1 primary sample for each 700 kg, but not < 40.

จำนวนกระสอบที่สุ่ม/ล็อต ไม่น้อยกว่า 5+10%

Submitted sample 1 kg

Equipment & methods for seed dividing

1. Mechanical divider
   - Conical divider (Boerner divider)
   - Centrifugal divider
   - Soil divider

2. Random cups methods

3. Modified halving method

4. Spoon method

Boerner divider

Seed moisture determination

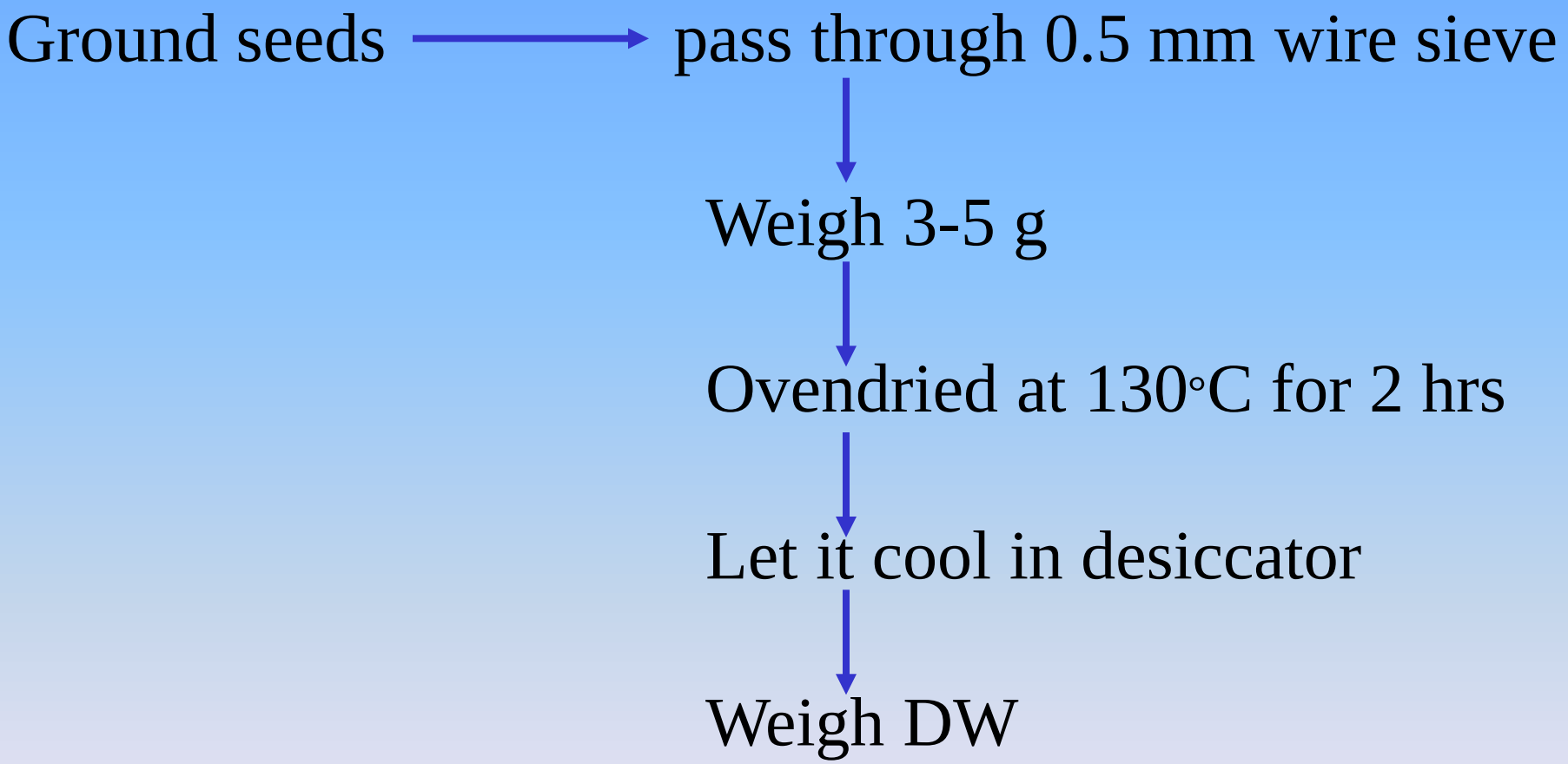
- Free water
- Bound water

Methods

- **Moisture tester - direct method**
- **Oven method at 130^0c 2 hrs.**
  - indirect method

เครื่องวัดความชื้น

Oven method


Ground seeds
pass through 0.5 mm wire sieve
Weigh 3-5 g
Ovendried at 130°C for 2 hrs
Let it cool in desiccator
Weigh DW

$$\text{Seed moisture content} = \frac{M2 - M3 \times 100}{M2 - M1}$$

(fresh weight basis)

M1 = weight (g) of container + cover

M2 = weight (g) of container + cover + contents before drying

M3 = weight (g) of container + cover + contents after drying

Red rice and glutinous rice determination

Rice husker

ข้าวแดงและข้าวเหนียวปน

Red rice and Glutinous rice

- **Search the number of red rice in 500 g dehulled rice seed**

- **Search the number of glutinous rice in 500 g dehulled rice seed**

Place broken or polished seeds in 0.1% iodine solution

Red brown → Glutinous

Blue → Non glutinous

Purity analysis

Objective

To determine the composition of sample Being tested

There are 3 components:

- Pure seed
- Inert matter
- Other seed

Seed blower

Pure seed

- All cultivars, mature, undamaged seed

- diseased or germinated seeds unless transformed into fungal sclerotia smut ball or nematode galls

- Free caryopsis or more than half of the original size

Inert matter

- Soil, sand, stone, chaff, stem, leaves, straw empty glumes.

- Broken or damaged seeds and caryopsis less than one half of original size.

- Caryopsis replaced by insect lavae & all other matter not seeds

สิ่งเจือปน

โรคดอกกระถิน

Other seeds

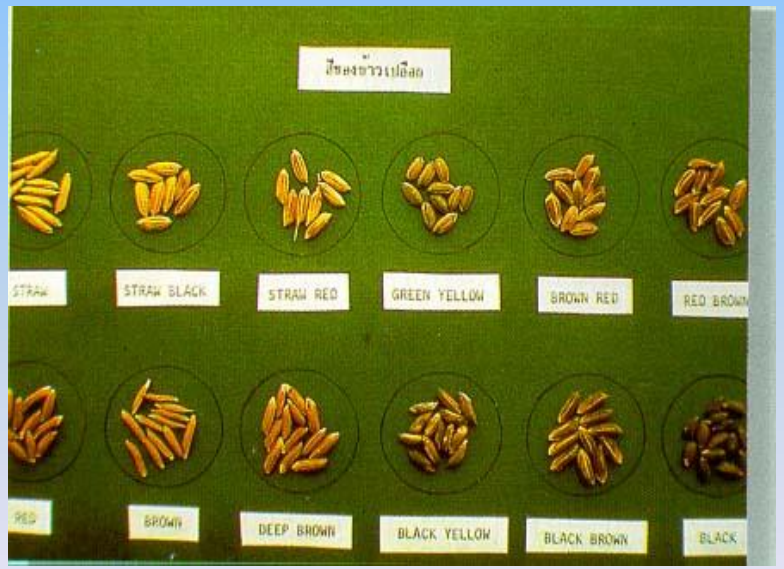
Seeds of any plant species and weed seeds

Other variety

- Varietal testing

ตรวจสอบข้าวปน


ขนาดเมล็ดข้าวเปลือก


สีของข้าวเปลือก
STRAW
STRAW BLACK
STRAW RED
GREEN YELLOW
BROWN RED
RED BROWN
RED
BROWN
DEEP BROWN
BLACK YELLOW
BLACK BROWN
BLACK

ขาวดอกมะลิ105 Vs ปทุมธานี1


ปทุมธานี1


ขาวดอกมะลิ105

ORML105


สุพรรณบุรี 1

The number of decimal place necessary for weighing

Less than 1 g	4	decimal places
1.000 g to 9.999 g	3	,,
10.00 g to 99.99 g	2	,,
100.0 g to 999.9 g	1	,,
1,000 g or more	0	,,

Germination test

To get information of the field planting value of the seed

Definition of germination

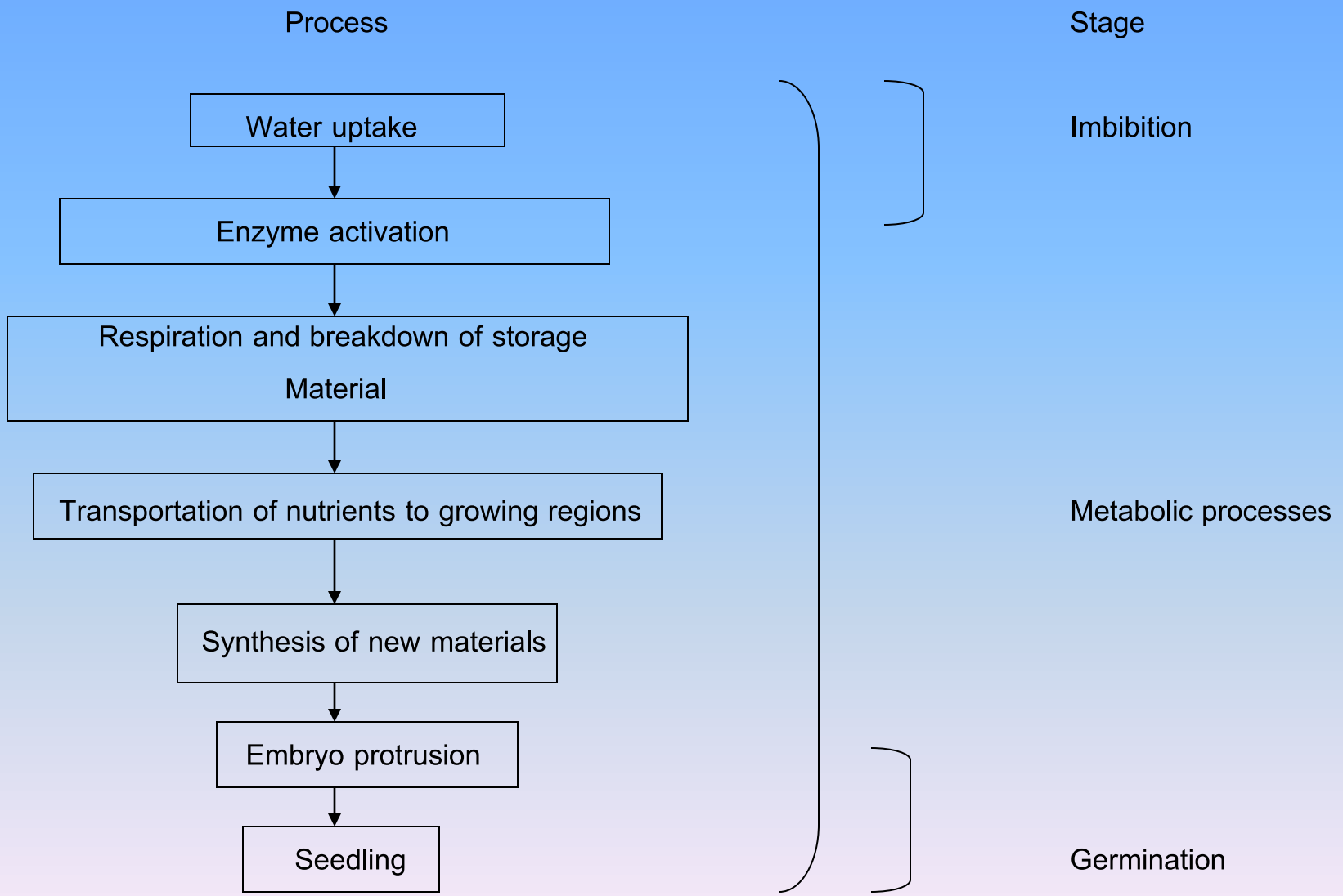
The ability of seed to develop into a normal plant under favorable condition

- random from the pure seed
- moist substrata : 25° ,30°, 20-30° C
  first count 7 d, final count 14 d
- replicates of 100 seeds
- express result as %

The external condition essential for seed germination

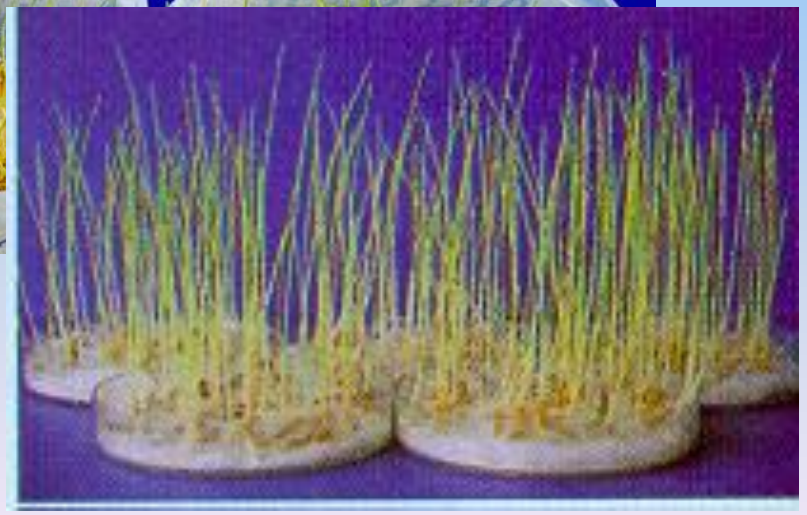
1. Sufficient water
2. Suitable temperature
3. Adequate oxygen

Germination process



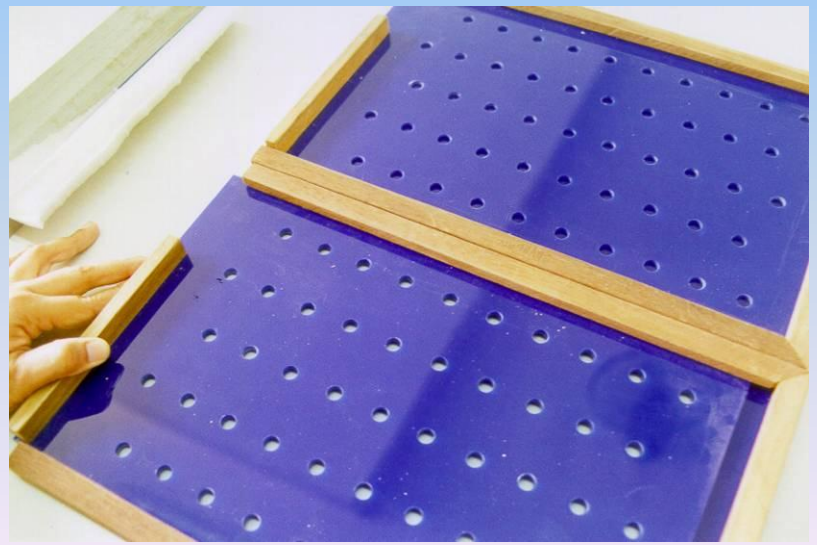
เพาะความงอก


SEED LAB




SEED LAB


GERMINATOR I



Seedling evaluation

Normal seedlings : possess essential structures that indicate the ability to produce plants.

Abnormal seedlings: all seedlings that do not permit classification as normal seedlings.

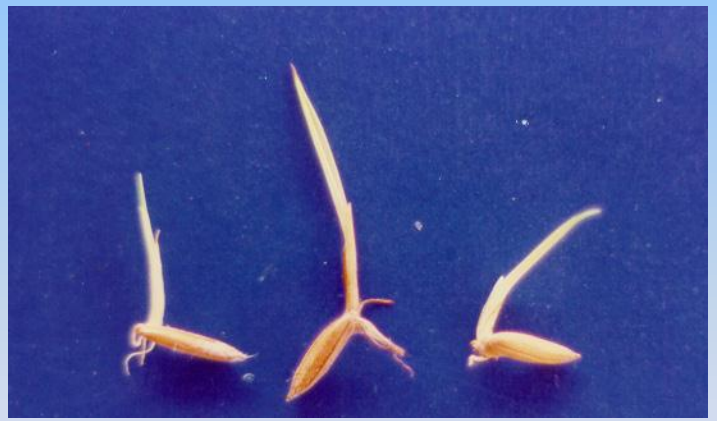
Dormant seeds: viable seeds, other than hard seeds, imbibed water but not germinate.

Dead seeds: neither hard nor fresh and have not produced normal seedlings.

ต้นสมบูรณ์

ต้นไม่สมบูรณ์

ต้นไม่สมบูรณ์



ต้นไม่สมบูรณ์

ต้นไม่สมบูรณ์

Normal seedling

Root - a long primary root, with numerous secondary root.
- primary root defect but a sufficient number of secondary root have developed.

Plumule - well developed green leaf emerged from coleoptile or extend at least half way up the coleoptile.
- coleoptile split from the tip, leaf intact, or only slight defects.

Abnormal seedling

Root - no root.
- weak primary root, with little or no secondary root.

Plumule - no leaf, only coleoptile.
- weak, watery plumule, decay grain.
- short leaf, <half way up the coleoptile
- shreded or longitudinally split leaf.
- decay plumule (at point of attacgment to grain).

Dormancy

- A resting stage that the seed is in, a stage of suspended growth.
- A dormant seed is a fully mature and viable seed that incapable of germinating under favorable conditions of temperature, moisture and oxygen.

Cause of dormancy in rice

- **Impermeability of seed coat to oxygen.**
- **Presence of germination inhibitors**

Breaking dormancy in rice seed

1. Predry at 50°C for 7 day
2. Presoak 24-48 hrs. in water at 40 °C
3. Soak seeds in 1 N HNO_3 for 24 h. prior to germination test.
4. Sundry

Advantages

1. Prevent seeds from sprouting during unfovorable conditions.

2. Seed storage - not germinate during storage.

Disadvantages

1. Lead to poor crop establishment.
2. Delay in seed testing.
3. Weed control problem.

Viability Test

Viable seeds - producing normal seedlings in a germination test after breaking dormancy

Non viable seeds - dead seeds
- abnormal development of embryo or other essential structures

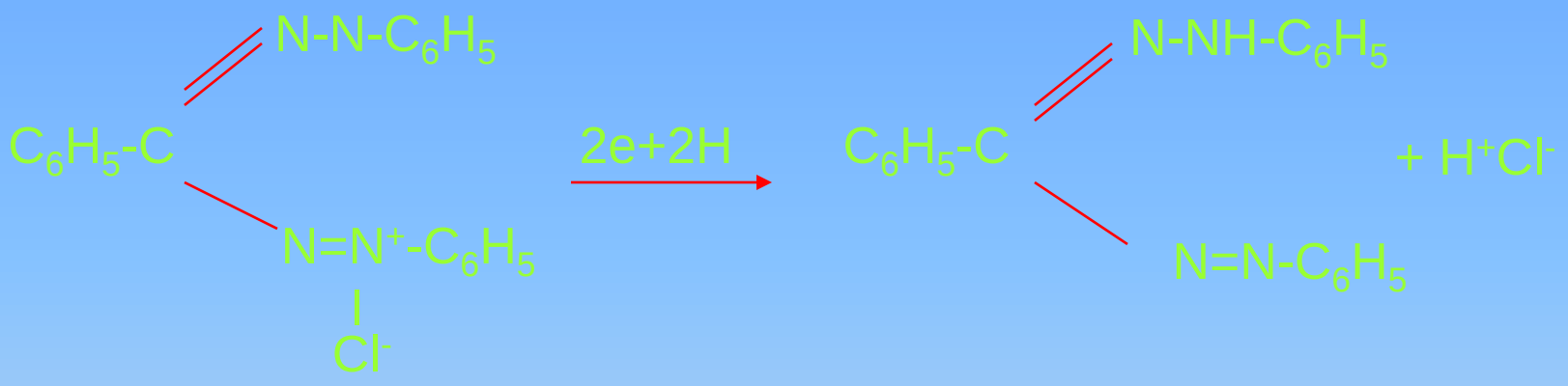
Methods

- Germination test
- Tetrazolium test

  - 2, 3, 5-triphenyl tetrazolium chloride or bromide

  Respiring cell + TZ → red color

  - dehydrogenase enzyme



2,3,5-triphenyl tetrazolium chloride

ไม่มีสี , ละลายน้ำได้,

diffusable

2,3,5-triphenyl tetrazolium formazan

สีแดง, ไม่ละลายน้ำ,

non-diffusable

GL/22
STRAIGHT-SHANK
Ø75MM

Tetrazolium test

Replicates of 100 or 50 seeds

↓

Soaking in water for 16 hrs

↓ Cut longitudinally

0.1% TZ soln. at 35^0C for 3 hrs at dark

↓

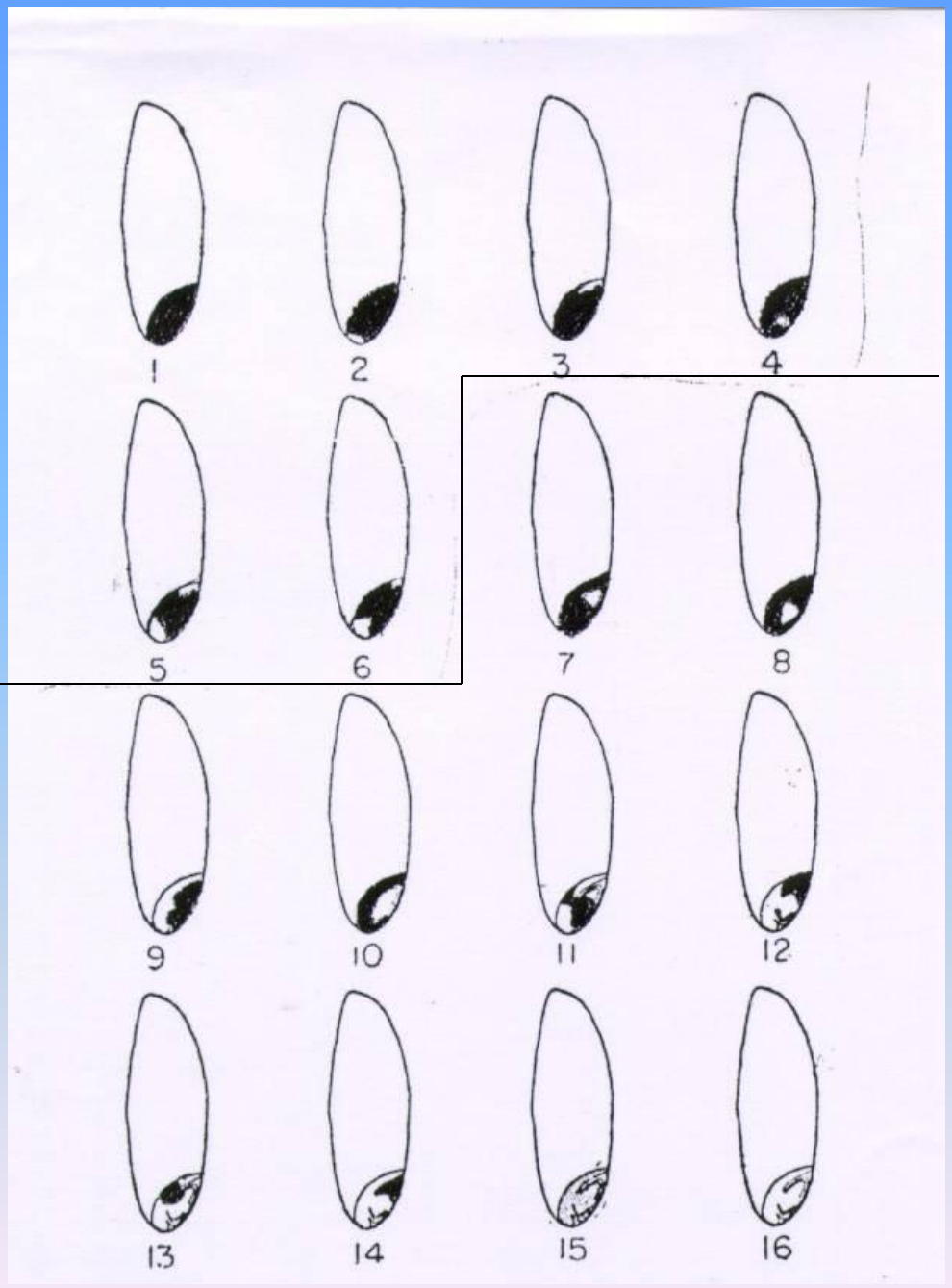
Rinse w/h water

↓

Evaluation

Tetrazolium test

Plant	Preparation	concentration (%)	Temperature (°C)	Time
Rice	longitudinally	0.1	35	2-3
Barley	longitudinally	0.1	35	½-1
Corn	longitudinally	0.5	40	½-1
Sorghum	longitudinally	0.5	35-40	½-1
Wheat	longitudinally	0.1	35	½-1
Oat	longitudinally	0.1	35	½-1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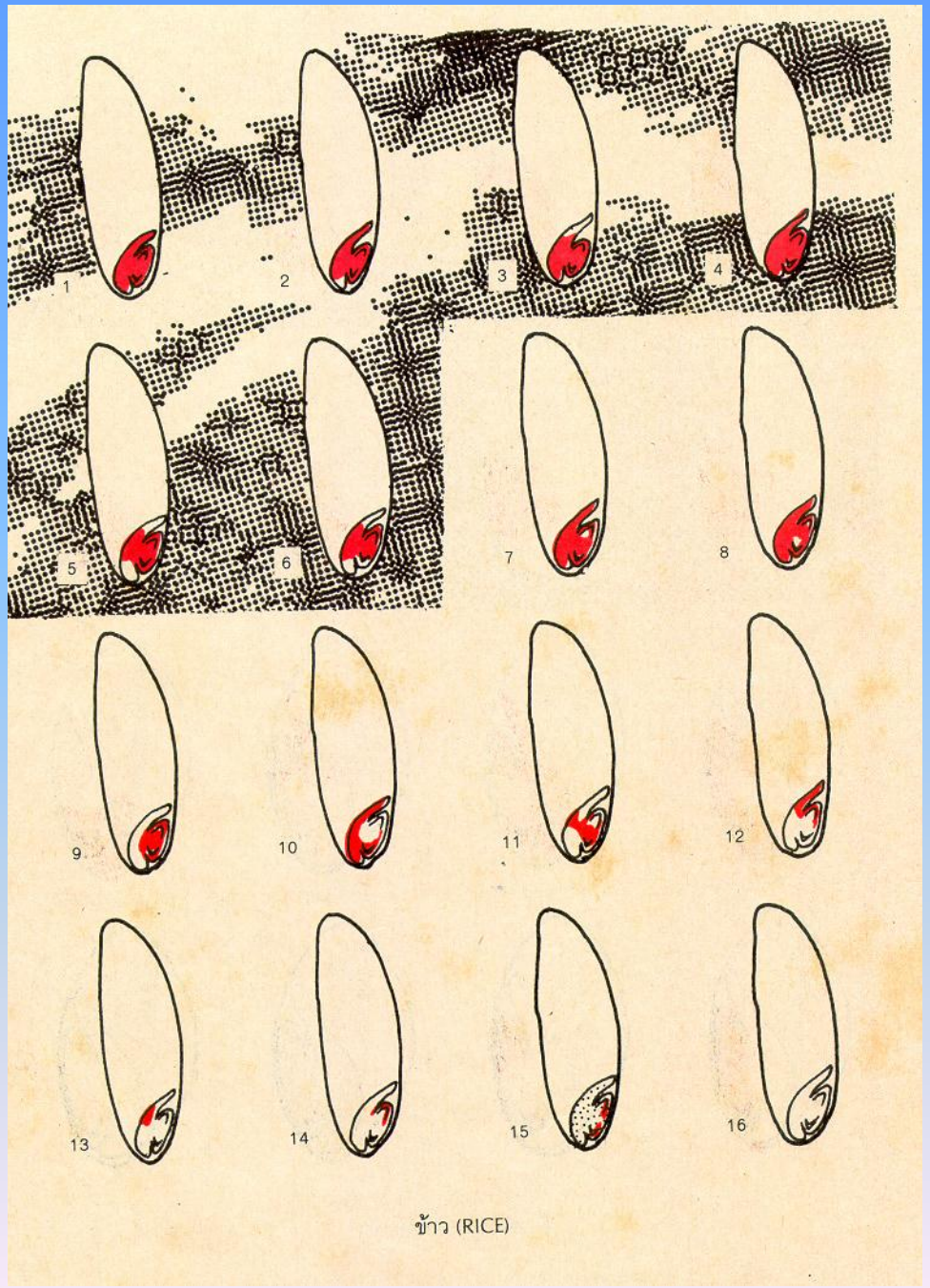
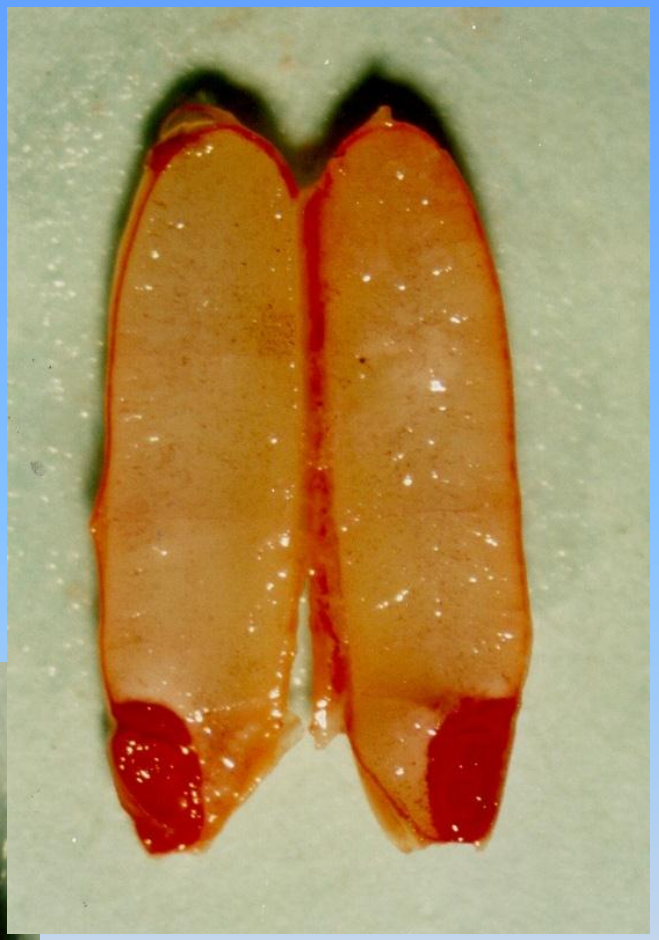
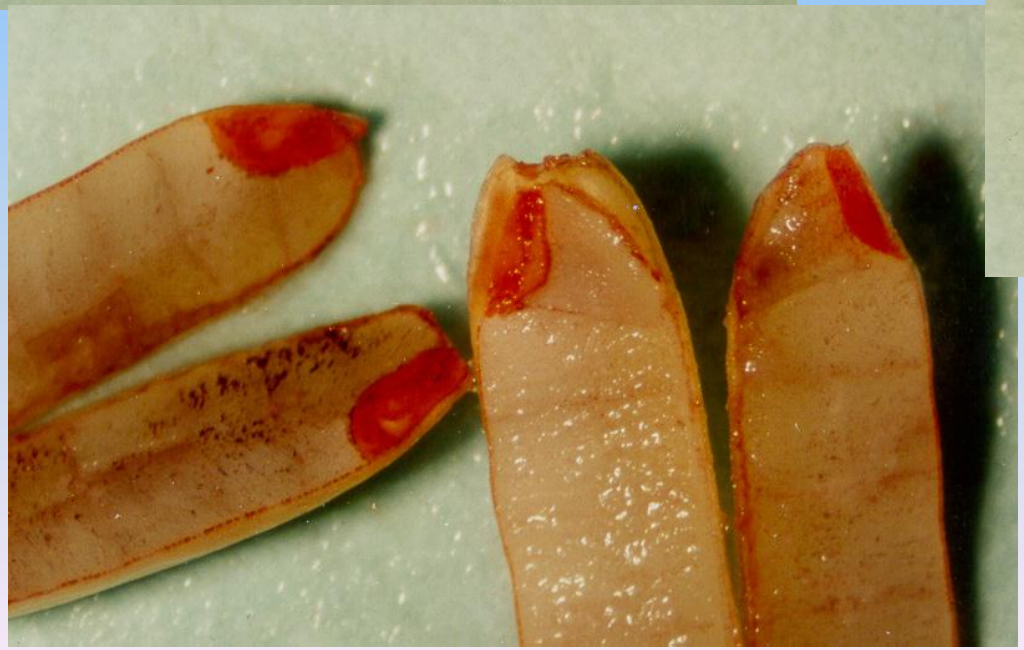


ข้าว (RICE)



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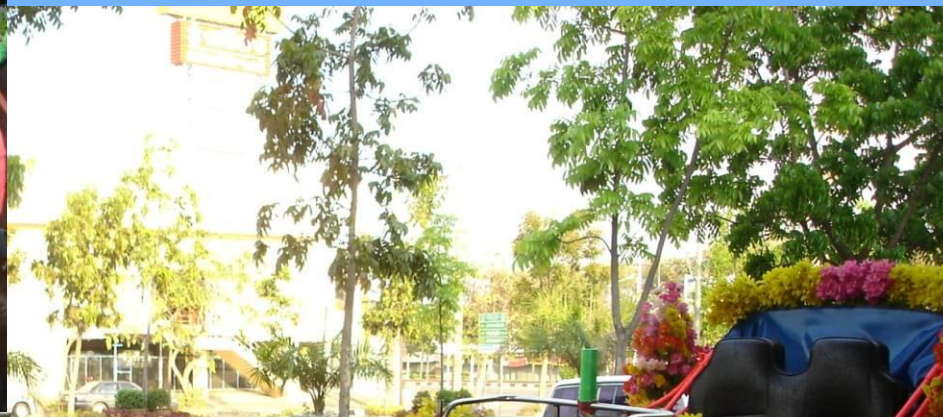


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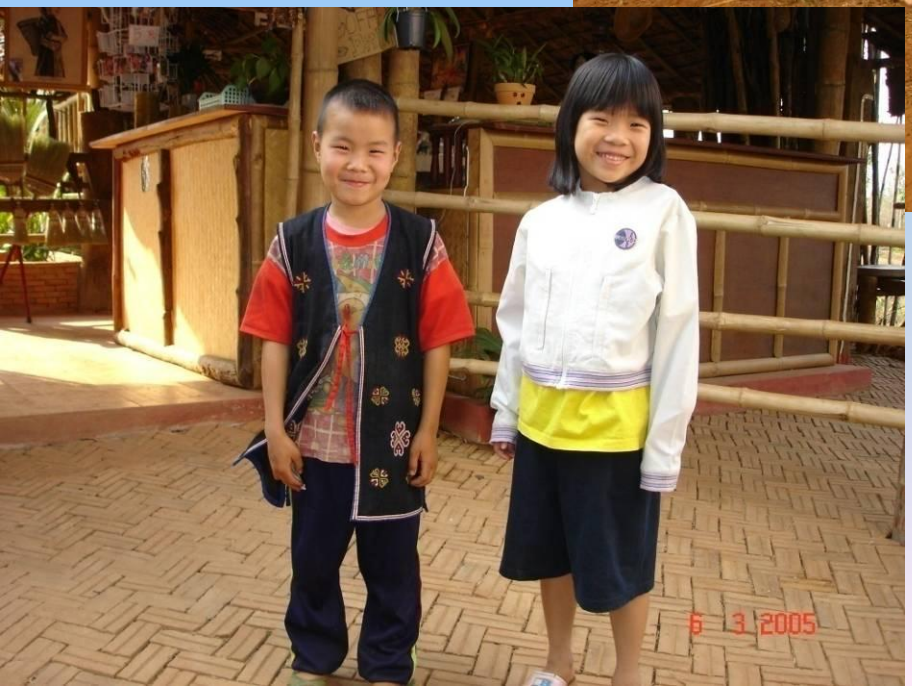
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