

“Rice Cultivation Techniques”

Farmers Field School (FFS) Operation Guide for Extension Officers

**Based on the experience gained during
the “Agricultural Productivity Promotion Project in West Tonle Sap”
(APPP)**

Dec. 2014

Battambang, Cambodia



Preface

Since the start of APPP {Agricultural Productivity Promotion Project: jointly implemented by the Ministry of Agriculture, Forestry and Fisheries (MAFF) of Cambodia and Japan International Cooperation Agency (JICA)} in October 2010, FFS (Farmers' Field School) has been the basic framework in which technical transfer and extension activities were being tried. Especially in the face of lacking technical supporting systems for farmers' production as well as institutional supporting systems for farmers' distribution of agricultural products, this FFS-based gathering of farmers were used to create farmers' group-based-activities under APPP, namely SGG (Seed Growers Groups) who were specialized in rice seed production and PG (Pilot Groups) who were to learn and apply the benefits of group-oriented farming practices including improved distribution of rice. For the matter of technical information dissemination, the farmers designated as DF(Demo Farmers) were the ones functioned as demonstrations of improved rice cultivation techniques in the project since the beginning of rainy season in 2011. Of course, only after less than 4 years' of such trials, what we have learnt were various difficulties and possibilities in the same time. The representative of the difficulties was climatic conditions that fluctuate greatly year to year in the extreme of between flooding and drought. On the other hand, however, some of the farmers and their groups worked very hard to cope with the difficulties caused by the climatic extremes. Furthermore, many of such farmers were eager to help other fellow farmers in their localities improve rice cultivation techniques. And, that was why APPP had also come to believe that the concept of FTF (Farmer To Farmer)-based technical extension system be the one important way to achieve successful rice farming development in Cambodia.

APPP has identified some techniques that can be practiced by Cambodian rice growers, as recommended techniques which are in nature very basic ones and that are laid out as the contents of FFS-based training courses in this guide book. Based on the experience of nearly 4 years long working with approximately 5,000 farmers in the provinces of Battambang, Prusac and Kampong Chhnang, APPP has gained some results that could certify the benefits which could be attained through farmers' application of the techniques into their own rice cultivation practice.

This FFS operation guide book was produced as a result of the experience and achievement mentioned above, and it is intended for the use by the people who are involved in the field of technical extension for rice production. The concepts and know-hows to organize FFS-based training courses for rice growers are described in this book. APPP hopes that by sharing the experience through the use of this book, a much greater number of farmers in everywhere in the country would have an opportunity to participate into the training courses to gain practical knowledge to improve their farming practices, and that lead to the betterment of their lives, and that eventually contribute to nation development as a whole.

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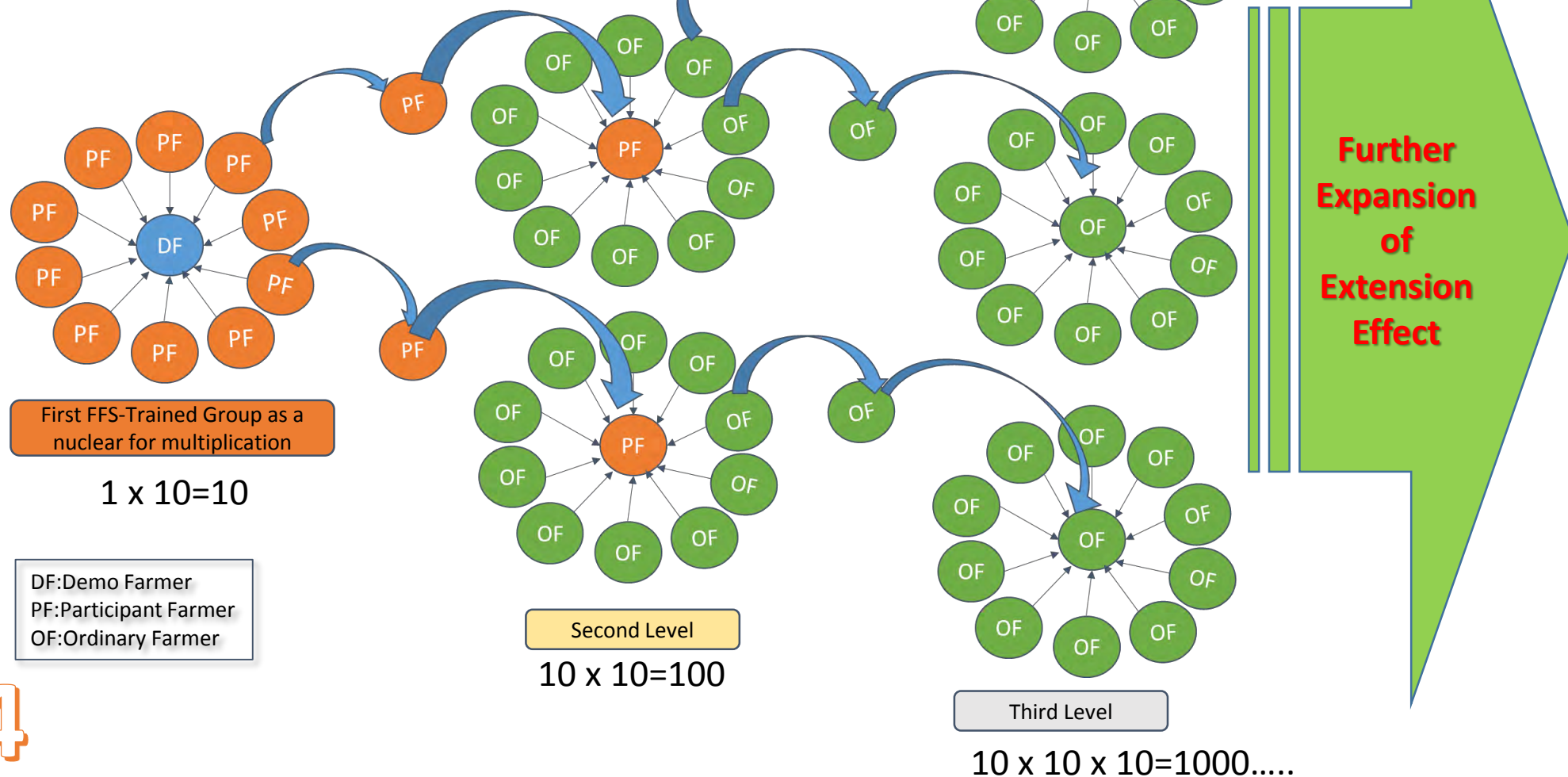
❖ **Expected roles of extension officer, demo farmers and participants farmers** → P. 45

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❖ Extension-oriented technical training course

APPP's FFS-based technical training course aims at creating a nucleus farmers' group to begin multiplication of the farmers who are to be aware of improved knowledge and be able to practice in their areas.



❖ Theory and practice all at once (Main Feature)

APPP's FFS based technical training course includes not only **theories** but also **practices** during the course that enables participant farmers to apply the learnt practical knowledge right after the course at their own paddy fields.

APPP's FFS Training course designed for rice growing farmers



A PDA* staff explaining theories to farmers using graphical chart

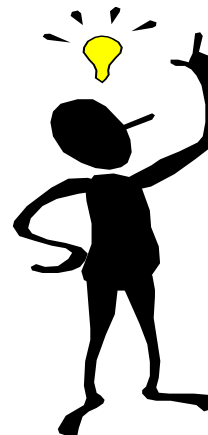


Extension staff instructing how to transplant seedlings following a line



Farmers applying line-transplanting technique for their paddy

Reflection & Self-learning



At a class, learning theories and practices(a half day)



Apply the learnt knowledge at own field (every stage)



Efficient gaining of experience (every season)

* PDA: Provincial Department of Agriculture

❖ Farmer-centered approach

Farmer as a manager of own farm, needs to be able to think and make decision for him/herself that brings successful farming income as a result. This type of capable farmer can not be trained right away. The attitude towards farmers must be sincere coupled with encouragements and respects to promote their initiative and responsibility.

One-way communication



Paying attention to problematic conditions only, farmers are ignored.



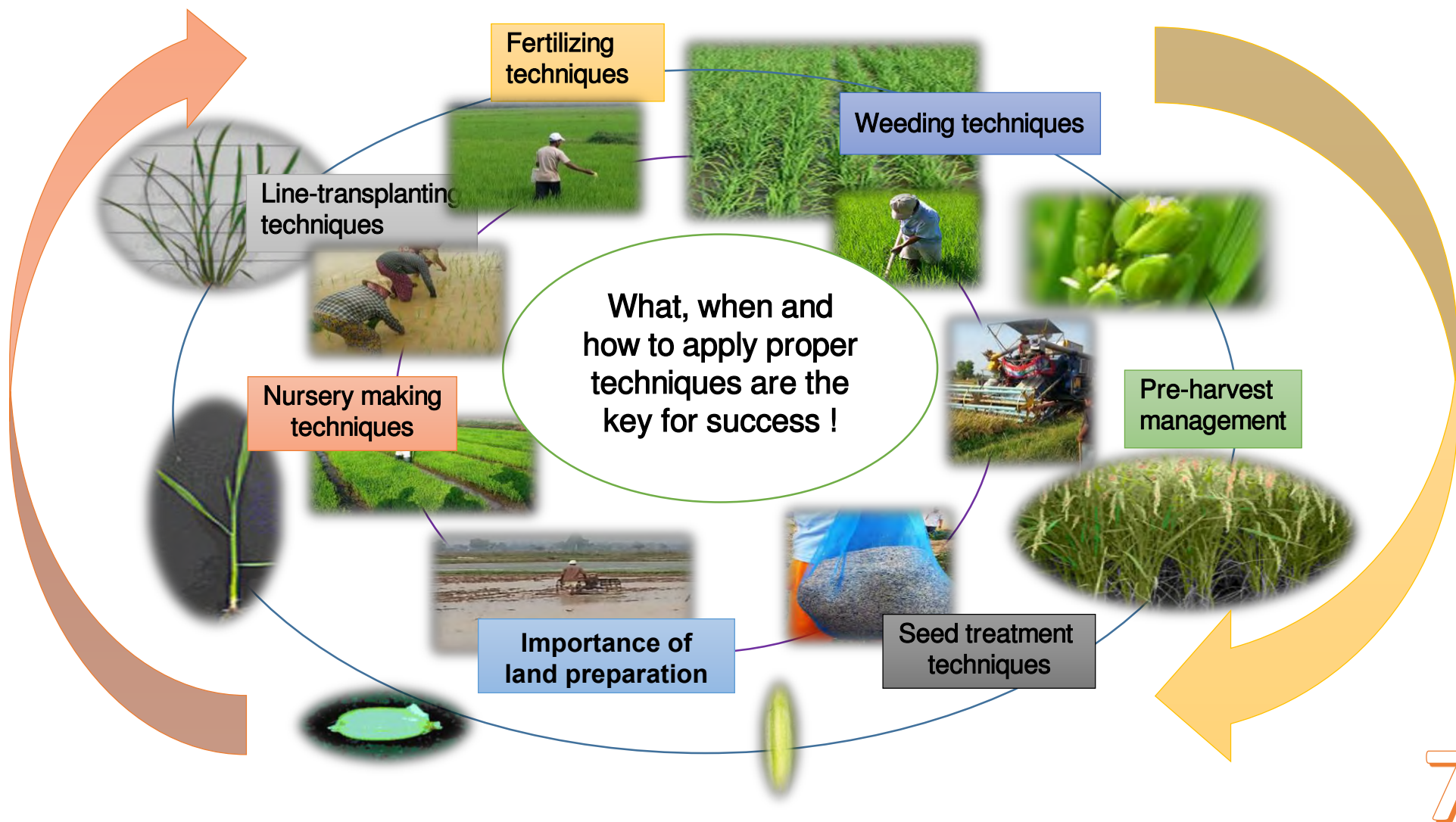
Two-way communication
(Sharing experiences)



Farmers are the first concern and are encouraged to take their own initiative and responsibility.

❖ **Applied knowledge in synchronized manner with rice growth stage**

The five staged courses include technical guidance on seed treatment, nursery making, line-transplanting/direct seeding by drumseeder, fertilizing and pre-harvest management.



❖ Technical assumptions (1)

The following points are used as technical assumptions considered as necessary aspects for improvement that are to be made between the conventional and the improved method through FFS to be conducted by APPP during the project operation period.

Aspect	Conventional rice cultivation method	Improved rice cultivation method under FFS by APPP	Purpose to achieve
Source of rice seed	Many farmers grow rice and keep some of the paddy as seed for following season.	High purity assured rice variety is used to produce certified seed and which is being used in the APPP's target areas.	To raise an awareness towards using of high quality seed.
Seed treatment	No treatment was applied.	Before seeding, rice seed is treated for selection and disinfection.	To achieve a higher germination and prevention of the diseases of self-generating.
Nursery bed	No raised bed is used and prolonged growth of seedlings with cut-off upper leaves is often used (Partially it can be understandable as measures against water-problem, both shortage and flooding).	Raised nursery bed is prepared with mixture of carbonated rice husk, and fully matured compost if available. The carbonated rice husk is used to make uprooting easy and less damage to seedling's roots. Ideally, 21 days old (three –four leaves stage) seedling is used to transplant.	To grow healthy seedlings without damage to leaves or to its roots within a physiologically ideal growth period.
Land preparation	Land surface is prepared roughly without much attention being paid to leveling and even water distribution.	Land surface is smoothly prepared with a careful attention being paid to leveling and even water distribution for achieving uniformed paddy growth.	To achieve flat and smooth land surface with good leveling that is ideal for water and weed control.

❖ Technical assumptions (2)

The following points are used as technical assumptions considered as necessary aspects for improvement that are to be made between the conventional and the improved method through FFS to be conducted by APPP during the project operation period.

Aspect	Conventional rice cultivation method	Improved rice cultivation method under FFS by APPP	Purpose to achieve
Transplanting	Random-transplanting with many(5-10) seedlings per hill is usual practice.	Line-transplanting with few (2-3) seedlings per hill is recommended.	To achieve the most efficient planting for ideal growth of seedlings.
Direct seeding	Manual broadcasting of un-germinated seeds with dry paddy consuming much seeds at the onset of rainy season.	Drumseeding by a drum seeder is actively promoted under rain-fed paddy, with minimal requirement of rainfall or water supply availability coupled with leveled land.	To improve productivity by seeding in line with less density to grow healthy seedlings.
Fertilizing	No definite timing, kinds and amount of fertilizers are understood.	Simple and clear standard for the use of fertilizers including an effective timing of fertilizing are recommended.	To make use of fertilizer at its best efficiency to promote growth of rice.
Weeding	Manual weeding is too tough to practice as paddy size become larger or due to labor shortage. Herbicide is often used.	Coupled with good land preparation, effectively controlled water level can minimize weed growth thus maximize rice growth.	To be aware of importance to prepare land as well as water control for weeding.
Pre-harvest	No special attention is being paid.	In order to improve rice quality which affect on sale price, some techniques like removal of different varieties and prevention of lodging are urged in this stage.	To take necessary cares to maintain good rice conditions till harvesting.



❖ Seed Selection & Disinfection

Purpose

- Separate poor quality seeds to select good ones
- Disinfect seed to prevent disease

What to prepare

1. Seed
2. Net bag
3. Thermometer
4. Salt or Urea
5. Fresh egg
6. Plastic Pale
7. Scale
8. Drumtin or large cooking pan
9. Water
10. Fire wood

When to do

- Few weeks to 3-4 days before sowing

How to do

Theoretical Explanation Part (30-60 min.):

- 1) Check attendance, optimize lecture settings
- 2) Explanation of purpose, benefits of the technique
As rice plant start developing from the seeds, obtaining quality seeds is first of all important concern. In addition, by applying this seed treatment method, the treated seeds can be more productive as they are selected and disinfected.
- 3) Principal of the techniques including floating method and heating method
 - ❖ Floating method for selecting good quality seeds using specific gravity solution
 - ✓ How to make the floating solution to separate seeds,
 - ✓ Specific gravity level checking method by floating egg,
 - ✓ Meaning of floated seeds and non-floated seeds.
 - ❖ Heating method for disinfecting seeds
 - ✓ Meaning of disinfection by heated water,
 - ✓ Importance of level of temperature 60°C and length of time 10 min.

Actual Practice Part (around 60 min. with good preparation):

- 1) Seeds are put in net bags
- 2) Heating(fire) place is prepared and water is pre-heated (saving time)
- 3) Measure Salt or Urea to prepare floating solution
- 4) Conduct seed selection first(remove floated seed, put non-floated seed into net bag and wash it thoroughly by water)
- 5) Conduct disinfection of the seed (selected seed) by hot water (maintained at 60 °C for 10 min. exactly)
- 6) Cool the heated seed quickly by water to avoid heat accumulation damage to seed
- 7) Keep the treated seed dry or start incubation for germination and seeding

Training Reflection Part (10 min): Reflect lessons learnt (from theory and practice)

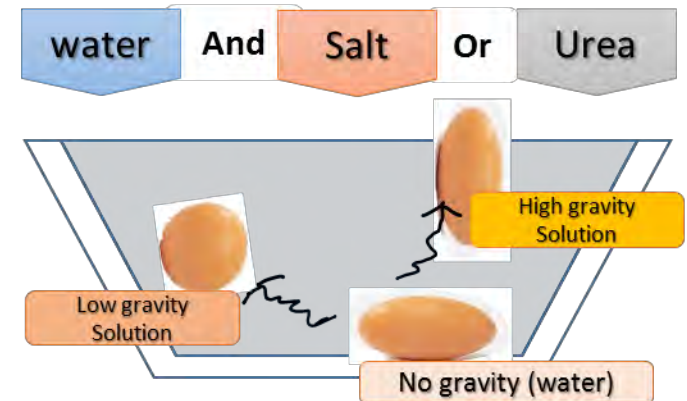
❖ Seed Selection

Step1. Approx. amount to make floating solution by degree of specific gravity

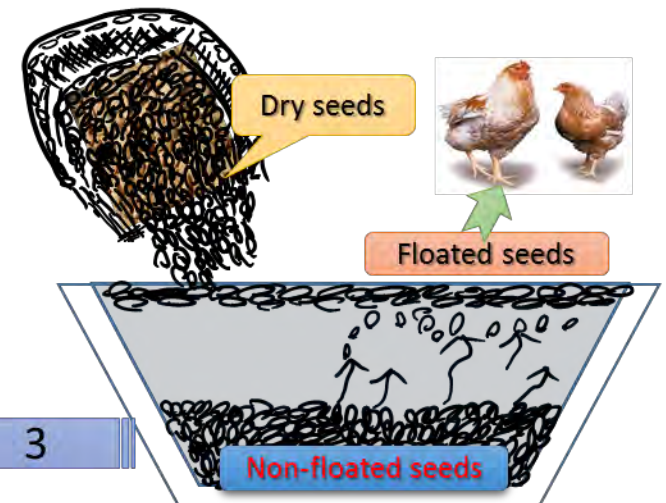
Solution material / Level of Floating Power	Water	In case of Salt	In case of Urea
No Specific Gravity: (No float power, only very light seed may float up)	10 Litter	0 kg	0 kg
Low Specific Gravity: (Weak float power, some un-filled seeds may float up)	10 Litter	1.1 kg	2.5 kg
High Specific Gravity: (Strong float power, most un-filled seeds may float up)	10 Litter	2.0 kg	5.0 kg



Step2. How to estimate degree of specific gravity by floating egg



Step3. Application of floating solution to select good quality seed



Step4. Wash off salt or urea by fresh water to avoid poor germination



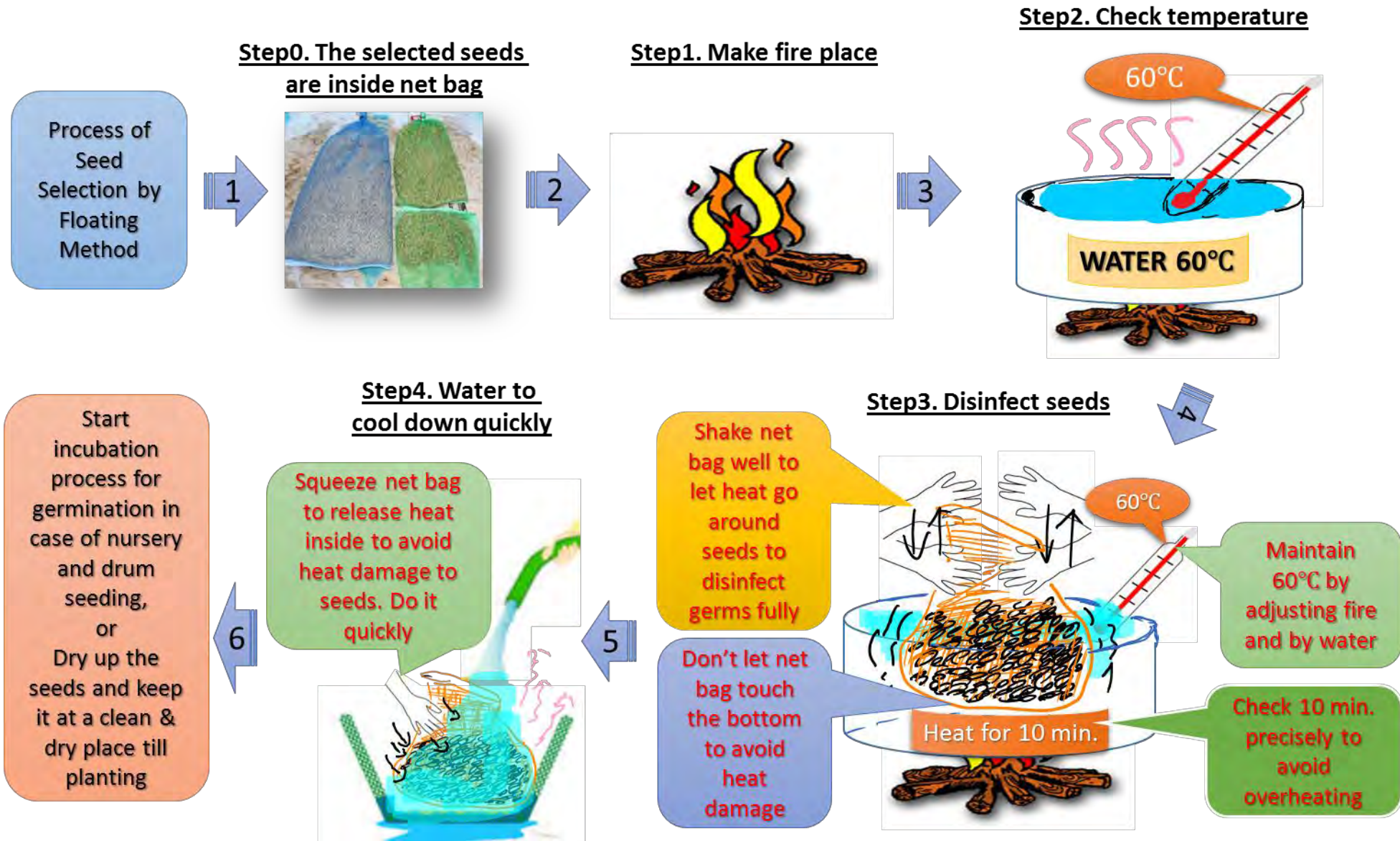
Step5. Place seeds in net bag



Process of
disinfection
by heat



❖ Seed Disinfection



❖ Incubation for Germination

Purpose

- To start growing seedlings with uniformity
- Uniformly germinated seeds can be developed to seedlings of uniformed conditions leading to an efficient growth of seedlings

What to prepare

1. The treated seeds
2. Net bag
3. Thermometer
4. Plastic Pale
5. Water
6. Bags as container

When to do

- 2-3 days before sowing in nursery or by drumseeding

How to do

Theoretical Explanation Part (30 min.):

- 1) Check attendance, optimize lecture settings
- 2) Explanation of purpose, benefits of the technique
Germinating seeds is the very first point of starting to achieve uniformity In growth that can affect all the way up to harvesting. So, paying attention to the conditions to enable germination at once should be tried first of all.
- 3) Principal of the techniques including soaking and incubation method
 - ❖ 24-48 h soaking in clean water of normal temperature (20-25 °C)
 - ✓ Meaning of soaking in water is to absorb water enough to cause germination,
 - ✓ Water temperature is not necessarily so high (20-25 °C maybe ideal) to avoid random start of germination .
 - ❖ 24 h incubation at the temperature of around 30°C or more
 - ✓ Meaning and purpose of incubation by higher temperature is to start germination at once in an uniformed condition,
 - ✓ Degree of germination ideal for sowing seed is to make seed's shape become until pigeon-breasted. This is to minimize damage to overgrown roots.

Actual Practice Part (around 30 min. with good preparation):

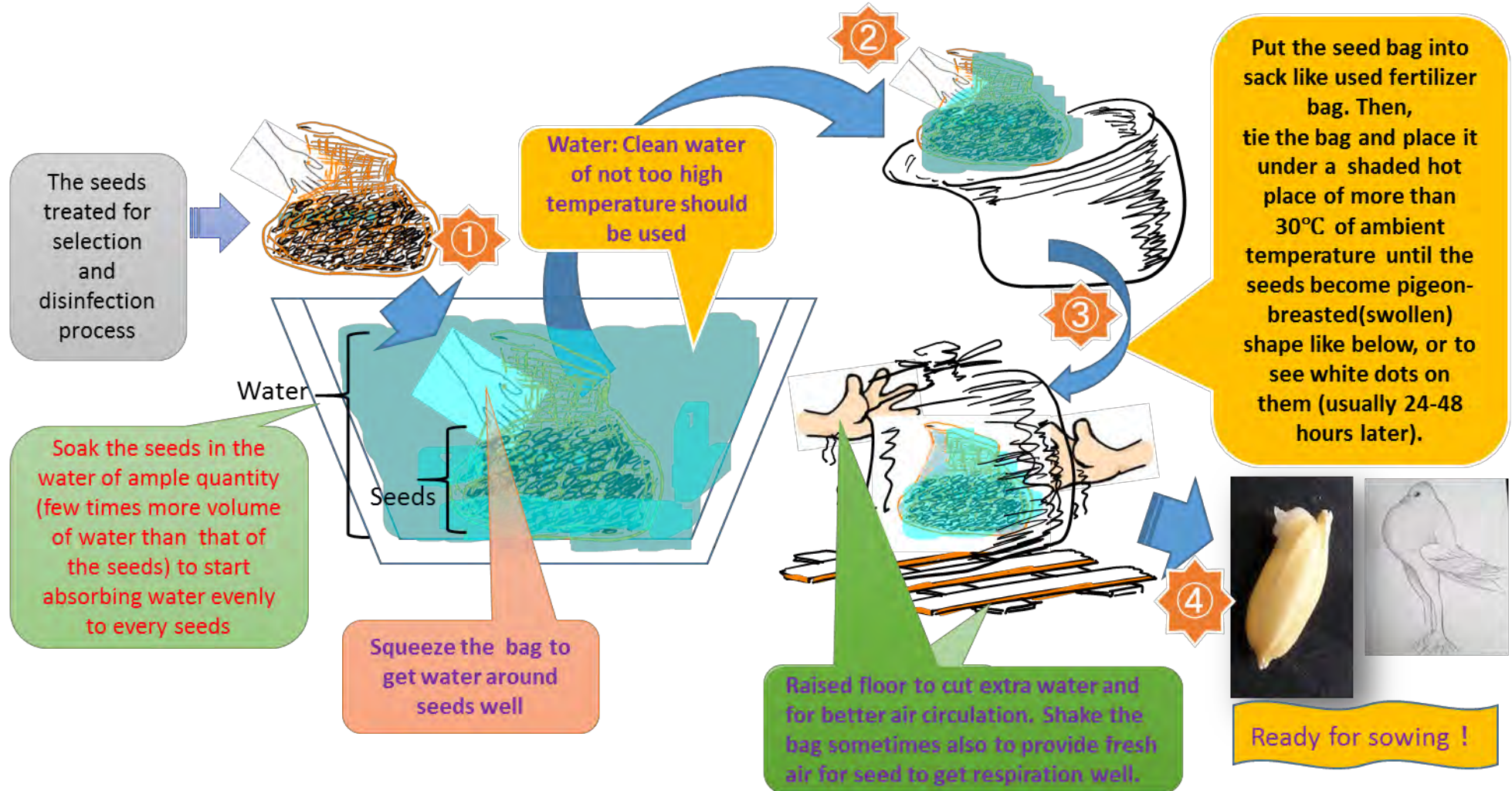
- 1) Seeds are put in net bags (if available) for easy handling,
- 2) Soak the seeds in normal temperature water (20-25 °C) of ample quantity,
- 3) Squeeze the net bag or stir the seeds well to get water filled all around the seeds,
- 4) After 24h (hot seasn), or 48 h (cool season), take the seeds out of water and place it in a bag such as used and cleaned fertilizer bag for 24 h incubation,
- 5) The surrounding temperature should be kept constant at around 30°C or more to achieve uniformed sprouting,
- 6) Check the shape of the seeds to become pigeon-breasted,
- 7) Slowly dry the seeds up until ideal for sowing by hand or drumseeding.

Training Reflection Part (10 min): Reflect lessons learnt (from theory and practice)

❖ Incubation for Germination

Step1: Let seeds absorb water well for 1-2 days to break seed dormancy

Step2: Incubation for germination under high temperature (30-35°C)



Which is better the germinated seeds of different degree?

Overly sprouted seeds (a long time passed after the germination)



- ✓ Physical damages to the roots such as being cut, broken can be made easily
- ✓ Not good for drum-seeding as the seeds might get stuck
- ✓ Poor seedling stand due to wasting seed nutrients
- ✓ Difficult to broadcast evenly
- ✓ Simultaneous sprouting with high germination rate such as more than 85% is more appropriate to overly grown roots with unevenness

Proper stage of sprouting (formed the shape of pigeon-breasted)



- ✓ Easy to handle, less chance of being damaged physically
- ✓ Germination rate can be checked easily anyway by observation and counting
- ✓ Suitable for drumseeding
- ✓ Save time and avoid depleting nutrients from seed itself



Nursery Preparation Method (Stage 2)

❖ Nursery Preparation (Wet Seedbed)-Transplanting Seedlings of 21 days (3 weeks) old-

Purpose

- To grow strong and healthy seedlings with uniformed growth for transplanting

What to prepare

1. Seedbed, an area of paddy with water irrigation and drainage facility
2. Equipment for land preparation
3. Carbonated Rice husk (charcoal)
4. Basal Fertilizer
5. Pre-germinated seeds

When to do

- 20-25 days before transplanting in case of medium varieties

How to do

Theoretical Explanation Part (30 min.)

1) Check attendance, optimize lecture settings

2) Explanation of purpose, benefits of the technique

Selected, disinfected and properly pre-germinated seeds are used to grow in a properly managed nursery which can ensure their initial growth into very healthy and strong state thus Reestablishment followed by vigorous tillering in main paddy are to be possible after transplanting.

3) Basic requirements to achieve good results in growing seedlings in nursery

- ❖ Water availability: Constant supply of water by securing source of water
- ❖ Nursery bed size: An area of roughly 1 (nursery) to 20 (main field) in ratio is needed
- ❖ Nursery bed shape: Trapezoid shape raised by paddy soil
- ❖ Seeds amount per 1 ha paddy (density): around 40-50 kg seeds per 500 m² nursery
- ❖ Basal Fertilizer: Around 10g as DAP per 1m x 1m (1SQM), 5kg in case of 500 m²
- ❖ Use of carbonated rice husk charcoal: The charcoal improves soil condition to grow seedlings and make them easy to uproot minimizing damage to roots
- ❖ Nursery growth period: Grow up to 21 days or 3 weeks old before transplanting

Actual Practice Part (around 30-60 min. with good preparation in advance):

- 1) Conduct land preparation 2-3 days before the practice day
- 2) Gather soil to raise the bed using tool or manually as high as 5-10 cm
- 3) Mix compost and basal fertilizer with the soil on the bed surface
- 4) Distribute rice husk (charcoal) evenly to all the surface of the bed
- 5) Flatten, level and smooth the bed surface
- 6) Seed pre-germinated seeds in one(1) layer as keeping in a proper density: (80-100g/SQM)
- 7) Spread the charcoal one more layer to keep being moist and avoid bird from picking seeds

Training Reflection Part (10 min): Reflect lessons learnt (from theory and practice)

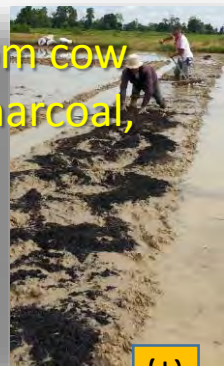
❖ Nursery Preparation (Wet Seedbed) -Transplanting Seedlings of 21 days(3weeks) old-



1



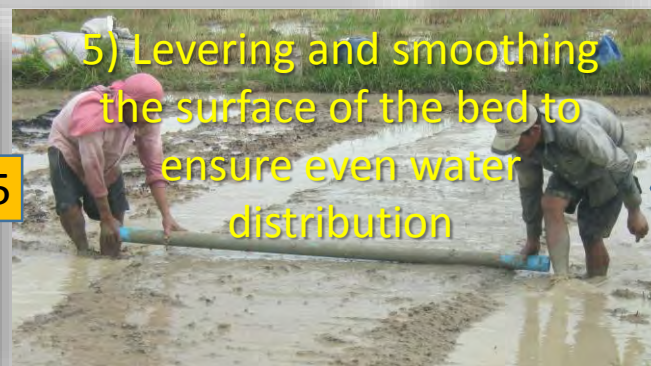
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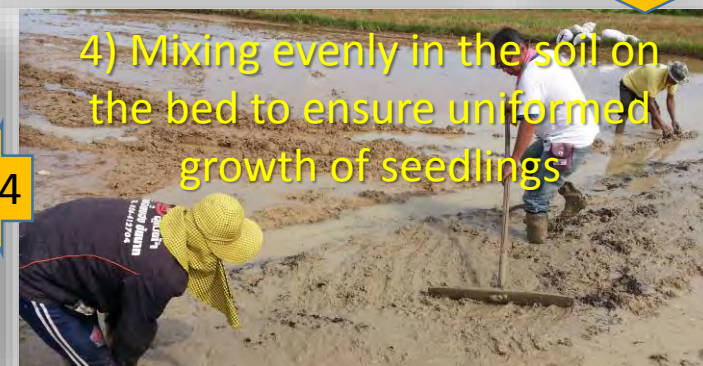
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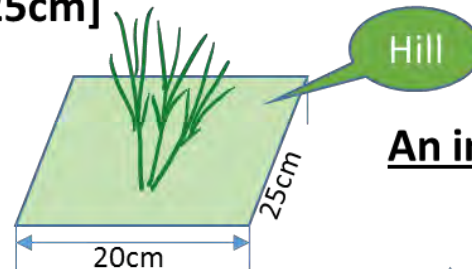
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❖ Nursery Preparation (Wet Seedbed) - Transplanting Seedlings of 21 days(3weeks) old-

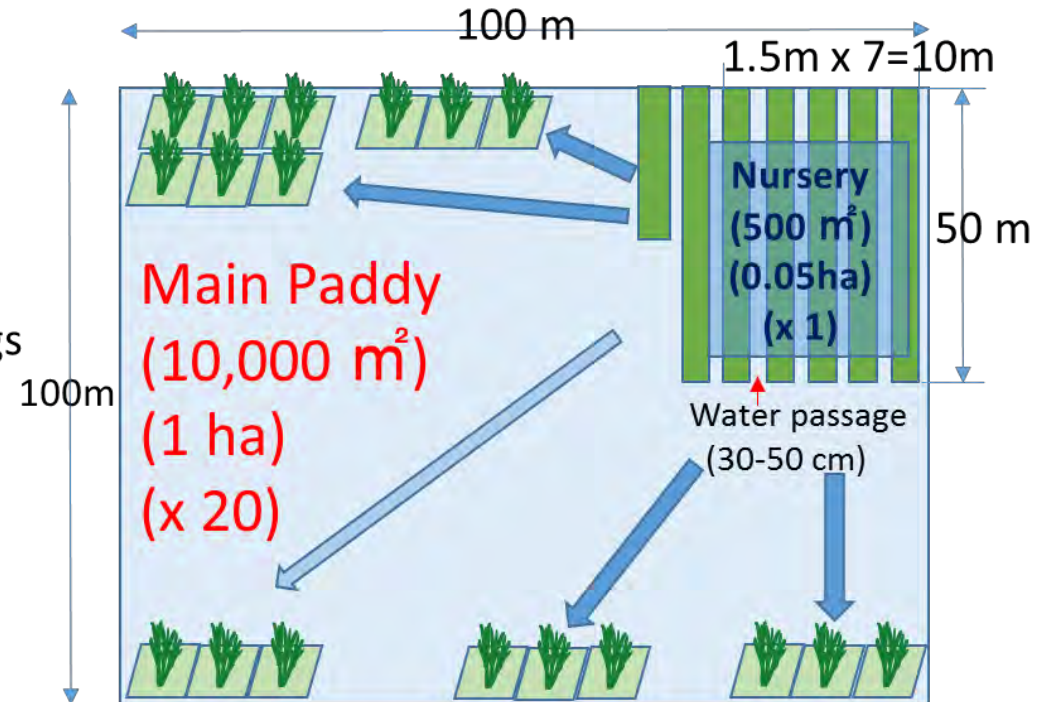
[Estimating Seed Amount per 1 hectare (100 m x 100 m) in case of planting 3 seedlings per hill with the space of 20cm x 25cm]

- 1) Start: As a target,
3 seedlings per hill



- 2) How many hill per 1 ha?:
 $10,000\text{m}^2 / (20\text{cm} \times 25\text{cm}) = 200,000$ hills
- 3) How many seedlings per 1 ha?:
 $200,000 \text{ hills} \times 3 \text{ seedlings} = 600,000$ seedlings
- 4) So, how many seed?: 600,000 seeds
- 5) So, how much in kg?: 100 seeds \approx 3g (PRD)*
 $600,000 / 100 \times 3\text{g} = 18,000\text{g} = 18\text{kg}$
- 6) Considering seed germination rate as 70%:
 $18\text{kg} / 0.7 = 26\text{kg}$
- 7) Considering seedling survival rate as 70%:
 $18\text{kg} / 0.7 = 37\text{kg} \approx 40\text{kg/ha}$

An image as ratio between nursery and main paddy

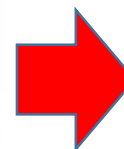
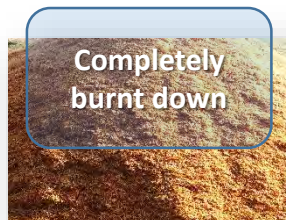


Around 40 kg(80g/1SQM) of seed may be sufficient to grow seedlings in the nursery of 500 m² to transplant in one (1) hectare

* 100 seeds of Phk Romudul (PRD) are estimated as 3g.
The data is based on CARDI (Cambodian Agricultural Research and Development Institute)

❖ Nursery Preparation (Wet Seedbed) – Effectiveness of Carbonated Rice Husk (Charcoal)-

Rice husk
harvested at millers



Ash

- ✓ Less effect on root system development
- ✓ Less moisture retainment effect
- ✓ Less aeration
- ✓ Less nutrients

Carbonated Rice Husk (Charcoal) making

1) Long Lasting Firing materials



2) Make sure fire is caught on firmly



3) Attach chimney to cover



4) Pile up rice husk around the heating device



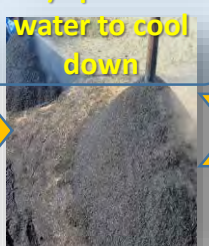
5) After blackish burned parts appears, cover them with unburned husk to continue



6) It is almost done



7) Sprinkle water to cool down



8) Spread over to further cool down and dry up



Husk Charcoal

- ✓ Soften soil
- ✓ Develop root system
- ✓ High moisture retainment effect
- ✓ High aeration
- ✓ More nutrients



❖ Line-transplanting method

Purpose

- To transplant seedlings into main paddy in straight-line

What to prepare

1. Seedlings of 21 days old properly grown in a nursery
2. A main paddy with properly puddled and leveled
3. Basal Fertilizer
4. String tool for line transplanting

When to do

- Main paddy preparation: few days before the transplanting
- Transplanting: At the seedlings' age of 21 days (3-4 leaves' stage)

How to do

Theoretical Explanation Part (30 min.)

- 1) Check attendance, optimize lecture settings
- 2) Explanation of purpose, benefits of the technique
 - Planting in straight line: Balanced growth conditions is equally attained to every seedlings leading to uniformed growth thereafter for high productivity as a whole.
 - Spacing by hill size: Maximize ventilation by fresh air flowing through and around seedlings for ideal growth environment while keeping maximum exposure to sun lights for advancing photosynthesis to grow plant body.
 - Limiting no. of seedlings to plant per hill: Efficient use of nutrients available in soil and water by each seedling to grow vigorously.
 - Managing weeds: Removal or control of weed minimize the loss of nutrients that can be utilized by rice plant instead.
- 3) Basic requirements to achieve good results in line-transplanting method
 - ❖ Importance of Land preparation(main paddy area): Properly prepared paddy field is a must for establishing uniformed rice plant to maximize its yield.
 - ❖ Water control: Sufficient level of water should be kept in the paddy field by controlling supply and drainage.
 - ❖ Hill size (spacing): 20cm(Hills) x 25cm(Rows) are recommended.
 - ❖ No of seedlings to plant par a hill: 2-3 seedlings per hill are recommended.
 - ❖ Basal Fertilizer: 40-50 kg of DAP per 1 hectare is used.

Actual Practice Part (around 30-60 min. with good preparation in advance):

- 1) Conduct land preparation 2-3 days before the practice day
- 2) Uproot carefully and transfer seedlings from nursery to main paddy field
- 3) Set leading line by the string tool
- 4) Plant seedlings to set first leading row as line at first
- 5) Plant to fill the inner lines by following the leading rows (lines)

Training Reflection Part (10 min): Reflect lessons learnt (from theory and practice)

❖ Line-transplanting method – “Land preparation for main paddy”

1. Plowing



2. Paddling



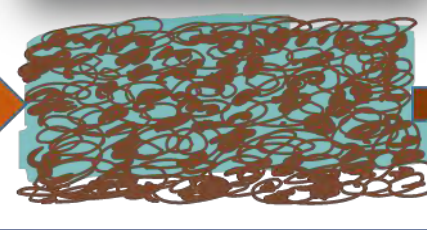
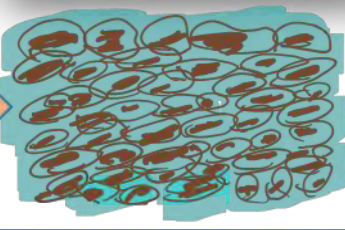
3. Rough Leveling



4. Final Leveling



Soil
Form &
Water



Retain
Water

Water retainment capacity becomes higher to save more water

Leveling

Good leveling can distribute water in the paddy evenly

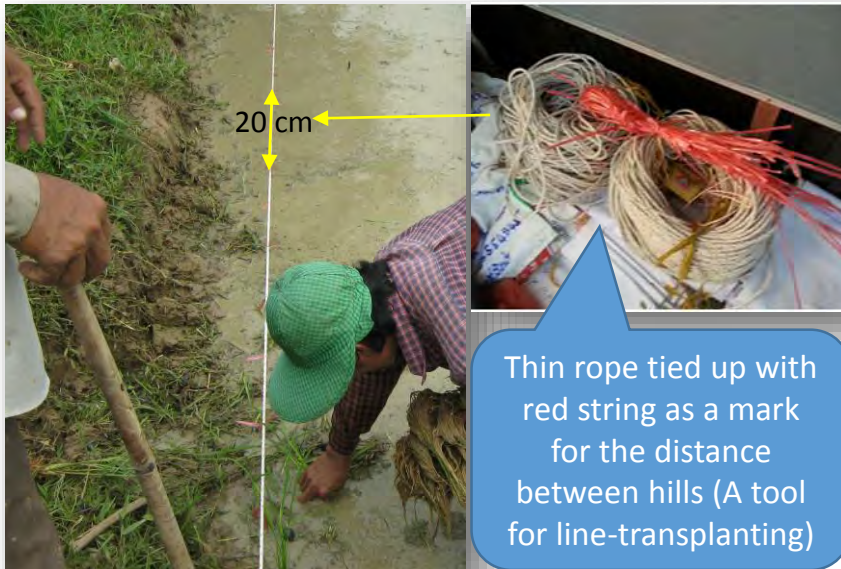
Weed & Mixed
Variety Control

Plowing weeds and dropped seeds from previous cropping into soil and retained water on them can prohibit the growth of both weeds and different rice variety

Rice Plant
Establishment

Well paddled soil in water and the nutrients solved in it can create an ideal environment for rice seedlings to establish themselves as soon as transplanted

❖ Line-transplanting method- How to transplant in straight line-



1



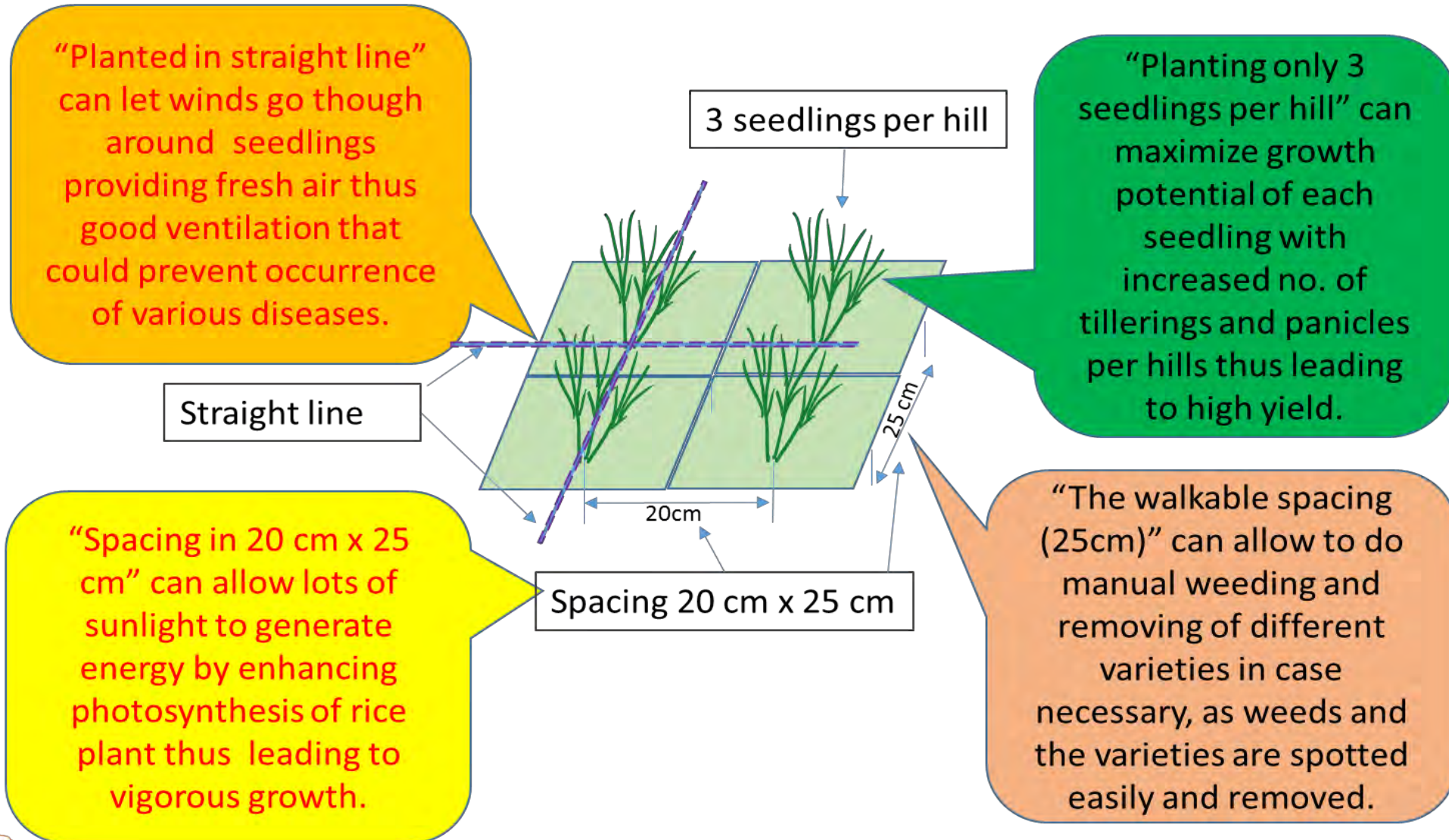
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3

❖ Line-transplanting method

[Benefits to be expected by the line-transplanting method]





❖ Drum-seeding method (Direct seeding in wet paddy)

Purpose

- To use drum-seeder properly to reduce cost yet improve productivity by skipping nursery and seeding in line with spacing

What to prepare

1. A unit of drum-seeder
2. Treated and pre-germinated seeds
3. Properly land prepared main paddy
4. String tool for leading line

When to do

- After main paddy preparation

How to do

Theoretical Explanation Part (30 min.)

- 1) Check attendance, optimize lecture settings
- 2) Explanation of purpose, benefits of the technique
Learn the benefits by comparison between drum-seeding and nursery-transplanting.
- 3) Basic requirements to achieve good results in Drum-seeding method
 - ❖ Importance of land preparation: High level of land preparation is still necessary because of direct seeding that requires even water distribution to control weeds.
 - ❖ Finding a best timing to do drumseeding: Onset of rainfall and available source of water are carefully checked to decide timing of the seeding.
 - ❖ Managing weeds: Proper land preparation coupled with good water control as well as preparation of possible use of chemicals are in need of consideration.
 - ❖ Taking care of drum-seeder: Proper usage of the seeder every time and how to keep it in good conditions during no use period should be well understood.
 - ❖ Degree of pre-germinating seeds: Degree of pre-germination affects on seed dropping.
 - ❖ Avoiding too wet seeds: Too wet seeds make difficulty in dropping.
 - ❖ Proper Seed dropping amount: Properly adjust holes to drop seed 70-80 kg/ ha.
 - ❖ Drum-seeding in straight line: Use leading string to do seeding in straight line.

Actual Practice Part (around 30-60 min. with good preparation in advance):

- 1) Conduct land preparation 2-3 days before the practice day
- 2) Explain on drum-seeder/how to use & how to maintain
- 3) Setting holes on drums to adjust dropping amount of seeds
- 4) Feeding pre-germinated seeds into drum-seeder
- 5) Set a first leading line in the paddy to follow
- 6) Practice drum-seeding as drawing in straight as possible following the leading line
- 7) Check to confirm proper amount of seeds being dropped
- 8) Control water level low enough to keep land surface wet until seedlings firmly stand by themselves before introducing water to start controlling weeds (5-7 days)

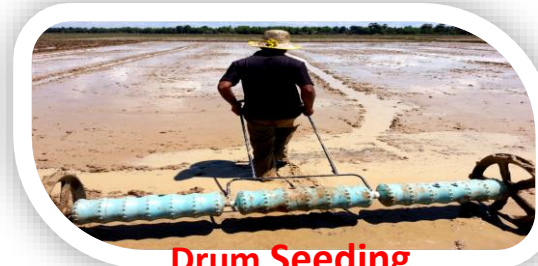
Training Reflection Part (10 min): Reflect lessons learnt (from theory and practice)

❖ Drum-seeding method (Direct seeding in wet paddy)

Wet paddy sowing by different methods



Nursery-Transplanting



Drum Seeding



Direct Seeding

Method	Nursery (Transplanting is required)	Drum Seeding (Direct)	Manual broadcasting (Direct)
Characteristics of the each method	Seedling growth is more secured as they are grown at their first stage of 20 days on the specially prepared nursery. When seedlings are line-transplanted in a main field, their progressed growth is further secured and promoted.	In this method, nursery stage is skipped, and a main field is used as if it is a large nursery. It can still sow in line keeping good effect of line planting, such as good circulation of air (ventilation) and an easiness in weed management.	Just after preparation of land, seeds (germinated) are sown manually. Seeding density is largely affected by the seeder. This is random planting.
Growth of rice	The best growth environment is secured.	Good growth is expected if weed is well controlled.	Seedlings may grow thinly as they are grown in high density leading to little yield.
Weed Management	Easy to control weed due to a space between seedlings which is made by line-transplanting method.	Rather easy to control as planted in line with certain distance in between. The distance can be adjusted.	Difficult to control weed without water and a good effective use of weed-killer (chemical).
Cost-Profit Aspect	Very economical as minimal inputs (seeds, fertilizer) may lead to high yield, but it is labor intensive and time consuming that could result in high cost.	If a Drumseeder is purchased at reasonable price, it could reduce labor cost effectively and contribute to increase profit.	Sowing is easy but may face weed problem, more fertilizer and possible logging that might end up with low yield.



Attention: Each sowing method has advantages and disadvantages, so it needs to be decided based on the every specific conditions of ones' socio-economic situations, especially on labor availability. Even, simple-looking manual broadcasting method as well requires careful handlings in several aspects to increase yield such as seeding density and weed control.

❖ Drum-seeding method (Direct seeding in wet paddy)

All the details of how to use Drum-seeder, refer to the “Drumseeder Manual” below:



The image shows a person wearing a straw hat and a dark shirt, walking through a wet paddy field. They are operating a drum seeder, which is a long, cylindrical metal device with two large wheels at each end. The seeder is being pushed through the muddy water, creating straight rows of seed in the field. The background shows a line of trees under a clear sky.

“Drumseeder Manual”

Index

1. Drumseeding's merits...
2. Think of strategies
3. Land Preparation
4. What is “Drumseeder” ?
5. Seed Treatment
6. Seeding Adjustment
7. Line-drumseeding
8. Risk Management
9. Caring the tool..
10. How to obtain..

Agricultural Productivity Promotion Project (APPP/JICA)

2nd Top-dressing Method (Stage 4)



❖ Fertilizing method- Especially for the timing of 2nd Top-dressing-

Purpose

- To supply nutrients at right times to maximize growth and yield of harvest

What to prepare

1. Fertilizers for 2nd Top-dressing (UREA)

When to do

- After confirmation of Panicle Initiation (P.I.) as indicator for 2nd Top-dressing

How to do

Theoretical Explanation Part (30 min.)

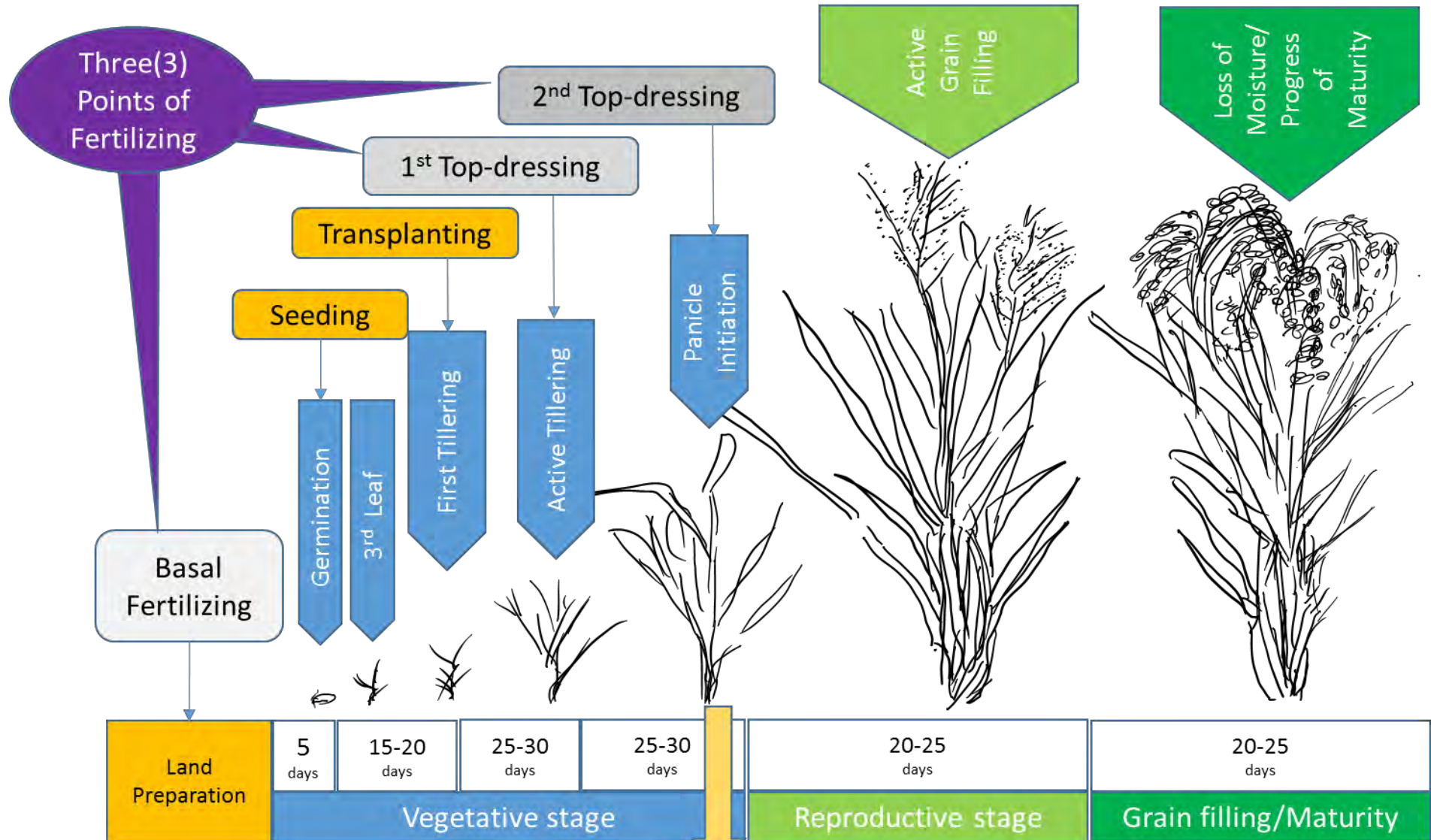
- 1) Check attendance, optimize lecture settings
- 2) Explanation of purpose, benefits of the technique
Raise an awareness on deciding timing of fertilizing to best fit to physiological growth of rice plant resulting in developing their plant body (vegetative stage of growth) and grain production (reproductive stage of growth). By knowing these correct timing of fertilizing, there is an increased chance of obtaining higher yield while avoiding making loss such as lodging.
- 3) Basic requirements to achieve good results in growing seedlings nursery
 - ❖ Timing of fertilization:
 - Basal fertilizing: at the time of main paddy preparation.
 - First fertilizing (1st top-dressing): 20-30 days after transplanting or 40-50 days after drum-seeding.
 - Second fertilizing (2nd top-dressing): By confirming panicle initiation of 1-2 cm in length.
 - ❖ Kinds and amount of fertilizer: DAP 50kg/ha for basal fertilizer, UREA 50kg/ha for 1st Top dressing, UREA 50kg/ha for 2nd Top dressing.

Actual Practice Part (around 30-60 min. with good preparation in advance):

- 1) Cut out some seedlings as sample for checking Panicle Initiation (P.I.)
- 2) Show the participants how to remove sheath to check the P.I. (see P.34)
- 3) Decide the amount of UREA to broadcast based on the size of the paddy (50kg/ha)
- 4) Make sure the paddy is being filled with water (No water, No fertilizing !)
- 5) Practice broadcasting as evenly as possible

Training Reflection Part (10 min): Reflect lessons learnt (from theory and practice)

❖ Fertilizing method-Timings for fertilizing-



See P. 34

❖ Fertilizing method- How to check “Panicle Initiation” for 2nd Top-dressing

① Cut out one seedling at its bottom



Panicle initiation is a sign of starting reproductive development of rice plant that requires more nitrogen thus this is an ideal indication to do 2nd top-dressing.



② Remove sheath by cutting into half-depth in the stem



③ Remove the sheath all up to the way around 10 cm



⑤ Confirm panicle initiated around 0.5 cm in length



④ Observe panicle initiation at the top of node and remove sheath all around it





❖ Pre-harvest observation and learning

Purpose

- To observe and understand the conditions of rice growth and learn what was good and what was not to apply the learnings to improve rice cultivation practice for next production season

What to prepare

1. PVC pipes (2 pcs of 1 m long pipe and 1 pcs of 1.41 m long pipe) for yield survey by “cutting method”
2. Learning materials like Farmer Calendar and APPP’s charts for FFS

When to do

- Few days before harvesting

How to do

Theoretical Explanation Part (60 min.)

- 1) Check attendance, optimize lecture settings
- 2) Explanation of purpose, benefits of the technique

This stage is all about reflection of all the process of rice cultivation based on the observation of rice paddy grown into different states that are result of applied rice cultivation techniques as well as farmer’s management skill. The participants shall visit the demo paddy which was managed by a demo farmer and also to other paddies nearby in order to make comparison for possible learnings. And that learnings will be applied as practical knowledge for next rice cultivation to be further improved. An extension officer as a trainer should be able to point out some important aspects of rice growth and yield over the observation then reflect what happened in every stage of rice cultivation in the season.

- 3) Some important aspects for reviewing of the rice cultivation in the season

- ❖ Estimation of rice yield: Estimate rice yield by cutting method and discuss if the yield was as much as expected as a result of applying all the techniques.
- ❖ Weeds: Observe if weed control has been effectively done and how.
- ❖ Mixed variety: Check if different varieties of rice were spotted at early stage and managed properly in case there were.
- ❖ Lodging: Observe the degree of lodging if it affected yield and quality.
- ❖ Disease: Discuss any disease cases occurred and affected otherwise how to control.
- ❖ Others: Find any other issues affecting yield and quality of rice in the season.

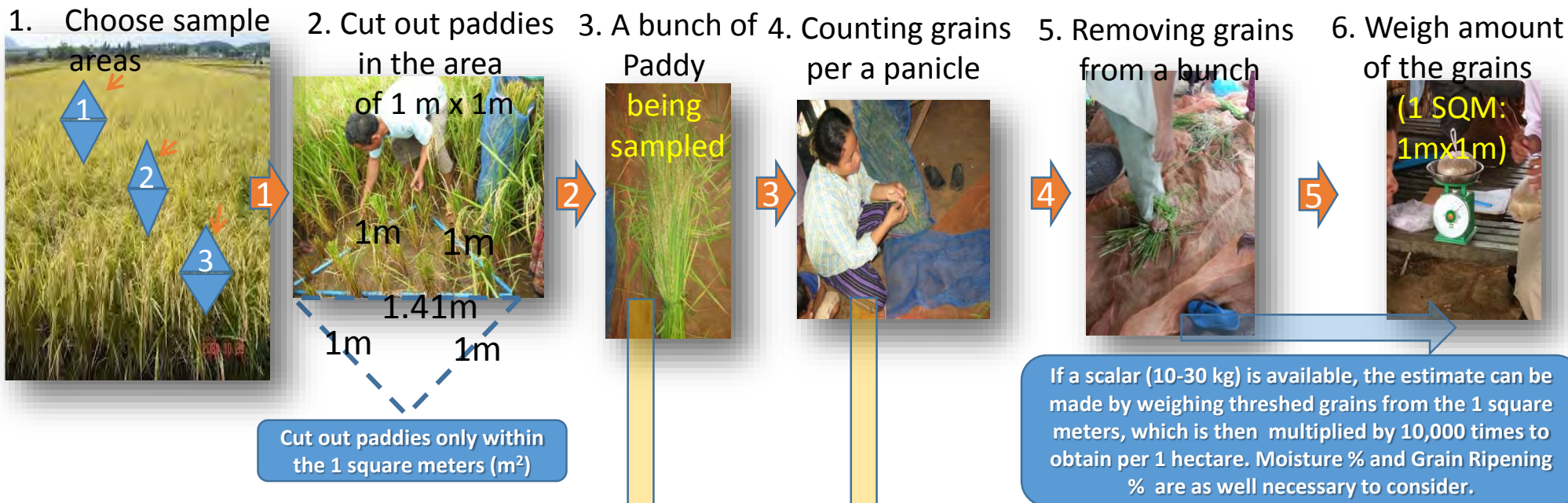
Actual Practice Part (around 60 min. with good preparation in advance):

- 1) Visit to the demo paddy and others around
- 2) Conduct observation and discussion over the growth performance of the different paddies including pointing possible causes to the performance
- 3) Sample (by Cutting method) paddies for estimation of yield
- 4) Estimate yield per 1m x 1m (SQM) thus per hectare

What is good rice?

- ➔ Uniformity In Growth
- ➔ Highly Filled Grain
- ➔ No Disease
- ➔ No Mixed Variety
- ➔ No Lodging
- ➔ No weed

❖ Pre-harvest observation and learning- Estimating rice yield by “Cutting method”



Calculation table based on the counting of grains per 1 square meters (Example)

Sample Spot	(1)No. of bunches /m ²	(2)No. of panicles / bunch	(3) No. of panicles / m ² {(1) X (2)}	(4) No. of grains/panicle	(5)Percentage of filled grain	(6) 1000 grain weight (g) at 13% moisture	(7) Estimated yield (kg/ha)
1	20*	8	160	113	80%**	30g***	4,339 kg/ha
2	20	7	154	120	80%	30g	4,435 kg/ha
3	20	8	152	131	80%	30g	4,778 kg/ha

Calculation Formula: (1) x (2)=(No. of panicles per 1 m²),
 (No. of panicles per 1 m²) X (4) x 0.8=(No. of filled grains per 1 m²),
 (No. of filled grains per 1 m²)/1000 x30g=(Yield of rice per 1 m²)
 (Yield of rice per 1 m²) x 10000 / 1000 = Yield (kg) of rice per 1 ha

Estimated Yield: 4,339 ~4,778 kg/ha

- * In case line-transplanted precisely at 20 cm x 25 cm, 20 bunches are sampled per 1 m²
- ** This ratio is variable by degree of ripening
- *** This figure is an estimated weight of indica rice variety

❖ Pre-harvest observation and learning- Uniformity in growth-

?

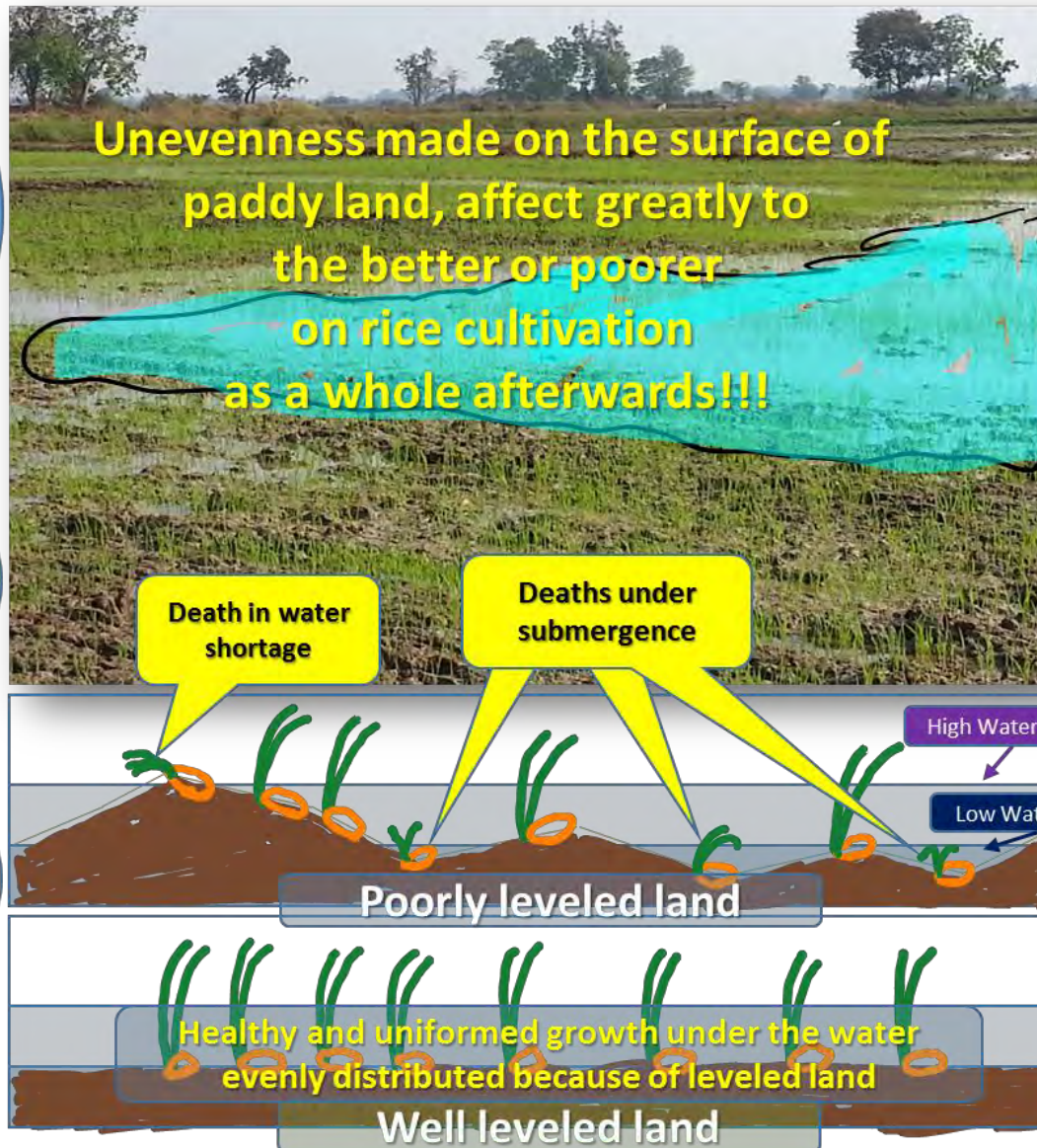
What happened in this rice cultivation?

Learnings to improve for next

Is nursery grown properly for uniformity?

Is Land preparation done properly?

Is water controlled properly?



Nursery as a starting point, seedlings grown in an uniformity or not, may affect greatly afterwards.

Well plowed, paddled and leveled land can be a foundation for rice growth.

Improved water control can maximize growth of rice and minimize weeds.

❖ Pre-harvest observation and learning- Weed control-

?

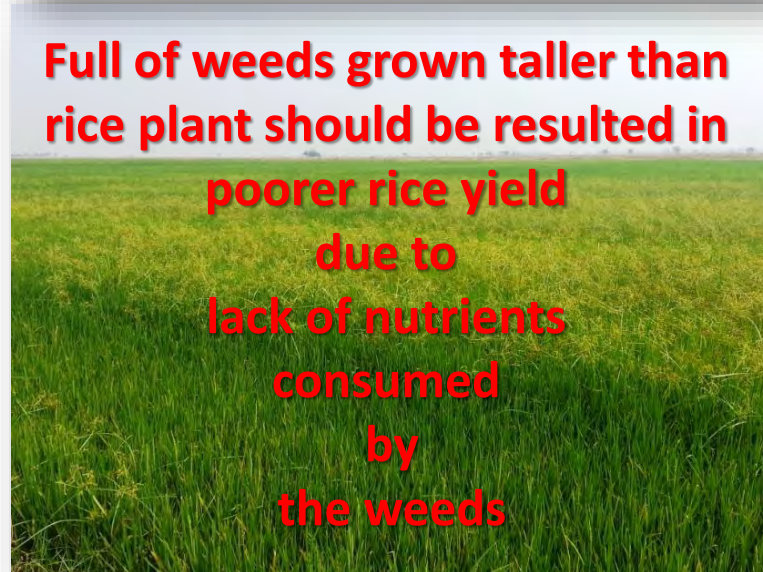
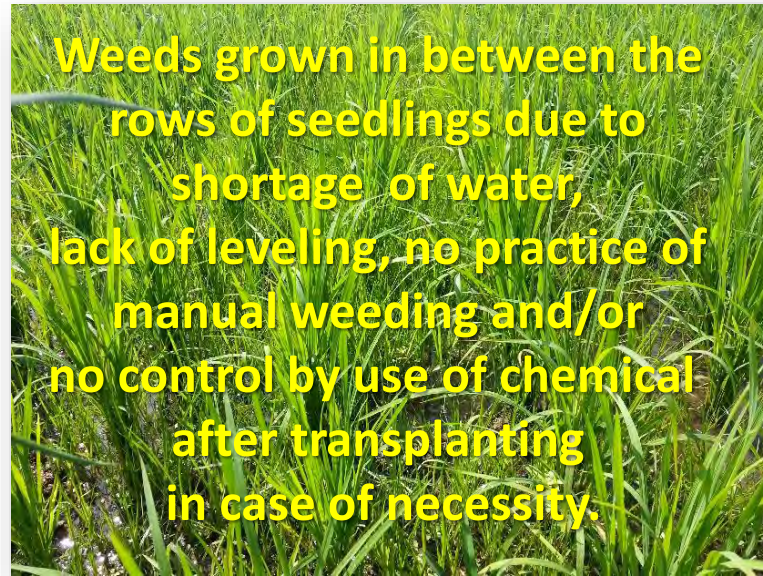
What happened in this rice cultivation?

Is Land preparation done properly?

Is water controlled properly?

Is manual weeding practiced?

Is chemical used properly?



Learnings to improve for next

Well plowed, paddled and leveled land can prohibit growth of Weeds.

Improved water control can maximize growth of rice and minimize weeds.

Manual weeding at early growth stage of rice is more effective.

Use of herbicide to control weeds should be considered at proper discretion.

❖ Pre-harvest observation and learning- Avoidance of Mixed Varieties-

?

What happened in this rice cultivation?

Learnings to improve for next

Is Land preparation done properly?

Are the seeds properly produced used ?

Is manual removing Practiced?



Result In Lowered Sale Price

Proper plowing of the dropped paddies (as seeds) from previous cropping to place under soil, can prevent them from growing out in the followed cropping.

Looking for the true source of high quality and purity seeds is the start of securing good rice cultivation.

If different varieties are found at early stage of rice growth, remove them carefully out of the rice paddy.

❖ Pre-harvest observation and learning- Avoidance of Lodging Conditions-

?

What happened in this rice cultivation?

Learnings to improve for next

Is fertilizing practiced properly?

Is manual binding practiced?

Is water controlled properly?

Long-time-lodged rice should be resulted in great loss in terms of damaged grain (low sale price) and raised cost of harvesting (more expenses) and even leading to the problem of mixed varieties in next cropping.



Practice of properly mannered and timed fertilizing for preventing lodging



Practice of holding rice to stand by binding for emergency

Practice of properly mannered fertilizing including 1) Basal, 2) 1st top-dressing and 3) 2nd top-dressing are one of the keys to avoid serious lodging conditions.

If lodging started at an early stage of grain maturity, binding several bunches together to stand them can minimize further loss.

Improved water control can minimize the occurrence of rice in lodging, even it is very hard to practice in reality.

❖ Pre-harvest observation and learning- Avoidance of Disease Occurrence-

?

What happened in this rice cultivation?

Learnings to improve for next

Is seed treatment done properly?

Is close observation practiced to find diseases at their early stages?

Is chemical used properly?



Preventive treatment



Seed Treatment including disinfection of germs by 60 °C for 10 min. is effective for some diseases to be controlled. Practice the treatment properly and keep the seeds in healthy conditions.

Disease cases could occur caused by various factors unfortunately. In any cases, it is important to make careful and regular observation to notice the onset of the disease to be able to respond to it at its early stage to minimize the damage.

Use of chemicals to control diseases should be considered at proper discretion, usage and timing.

❖ Pre-harvest observation and learning- A need of good practice at each stage-

?

What happened in this rice cultivation?




Learnings to improve for next

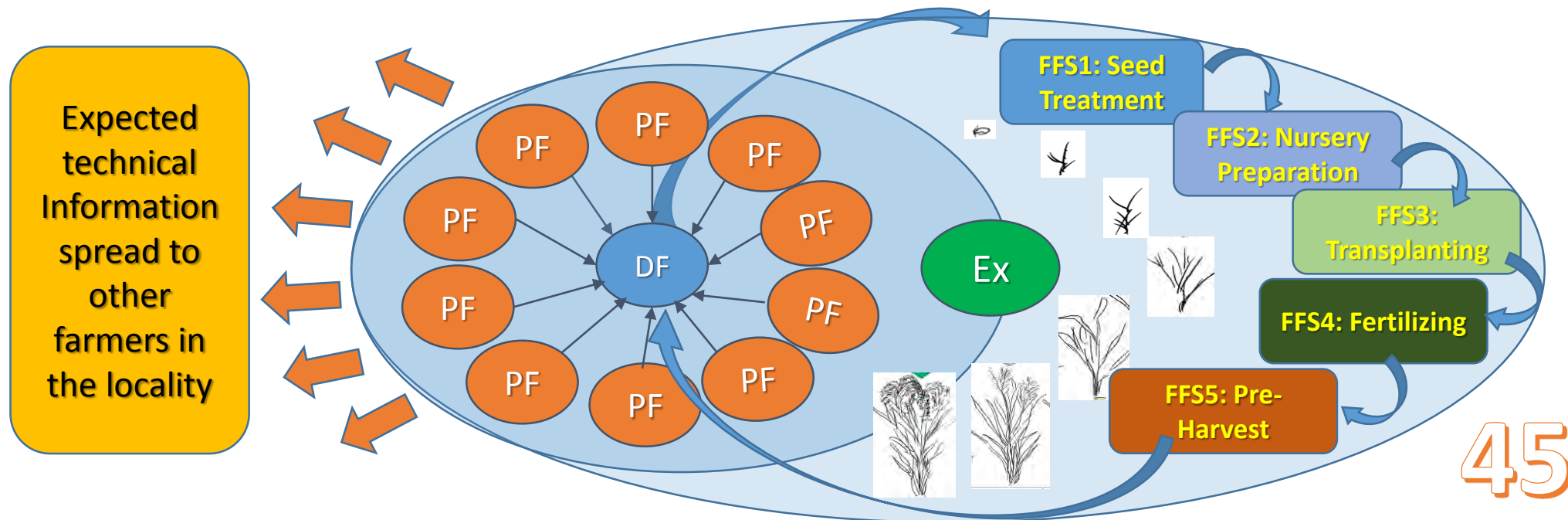
Is every stage of rice cultivation practiced properly as a whole, leading to the best result?



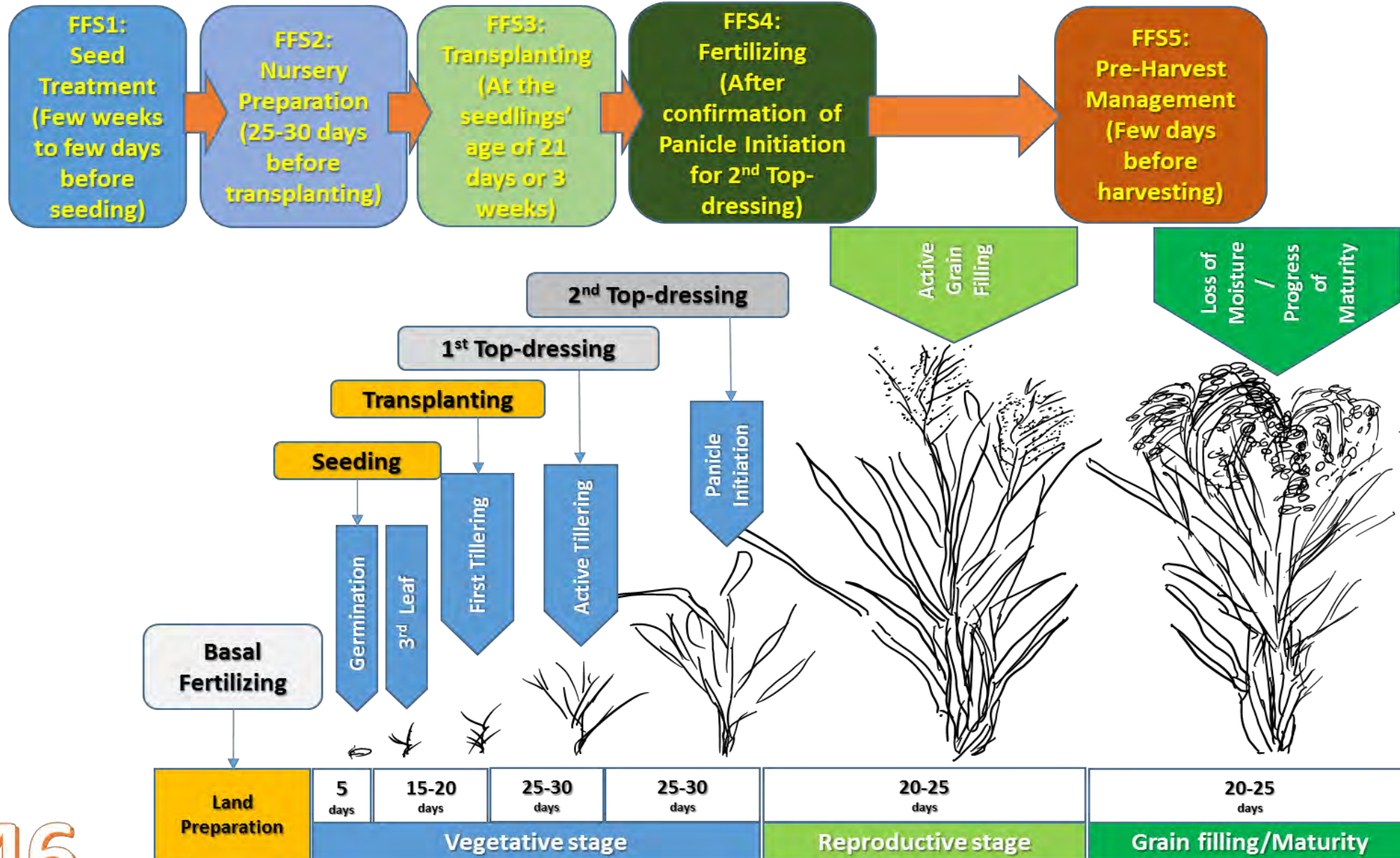
Every stage of rice cultivation techniques relates to each other in forwarding manner, thus achieving the best result in the each stage will lead to achieve the best results in terms of rice yield and quality to gain higher profit out of the farming as a whole.

Expected Role of Extension Officer, Demo Farmer & Participant Farmers

 Extension Officer	The extension officer (EX) makes arraignments of training site for both theories and practices together with demo farmers. The dates of FFS training will be announced to potential participant farmers in the vicinity of the site. EX needs to function as trainer, coordinator and facilitator.
 Demo Farmer	The demo farmer(DF) provides training sites for participant farmers. DF practices every rice cultivation techniques recommended by APPP through the instruction of EX.
 Participant Farmers	The participant farmers (PF) are there to get practical knowledge through FFS and expected to apply them in their actual rice cultivation practice. PFs could become a force of FTF (Farmer to Farmer) based extension system.



Scheduling of FFS Training Courses



In order to learn other agronomical view points, refer to the technical manual below, which is made generally for farmers, including some contents intended for extension officers .

Step up your knowledge on Rice Cultivation (Ver. 2)



Agricultural Productivity Promotion Project in West Tonle Sap
(APPP)



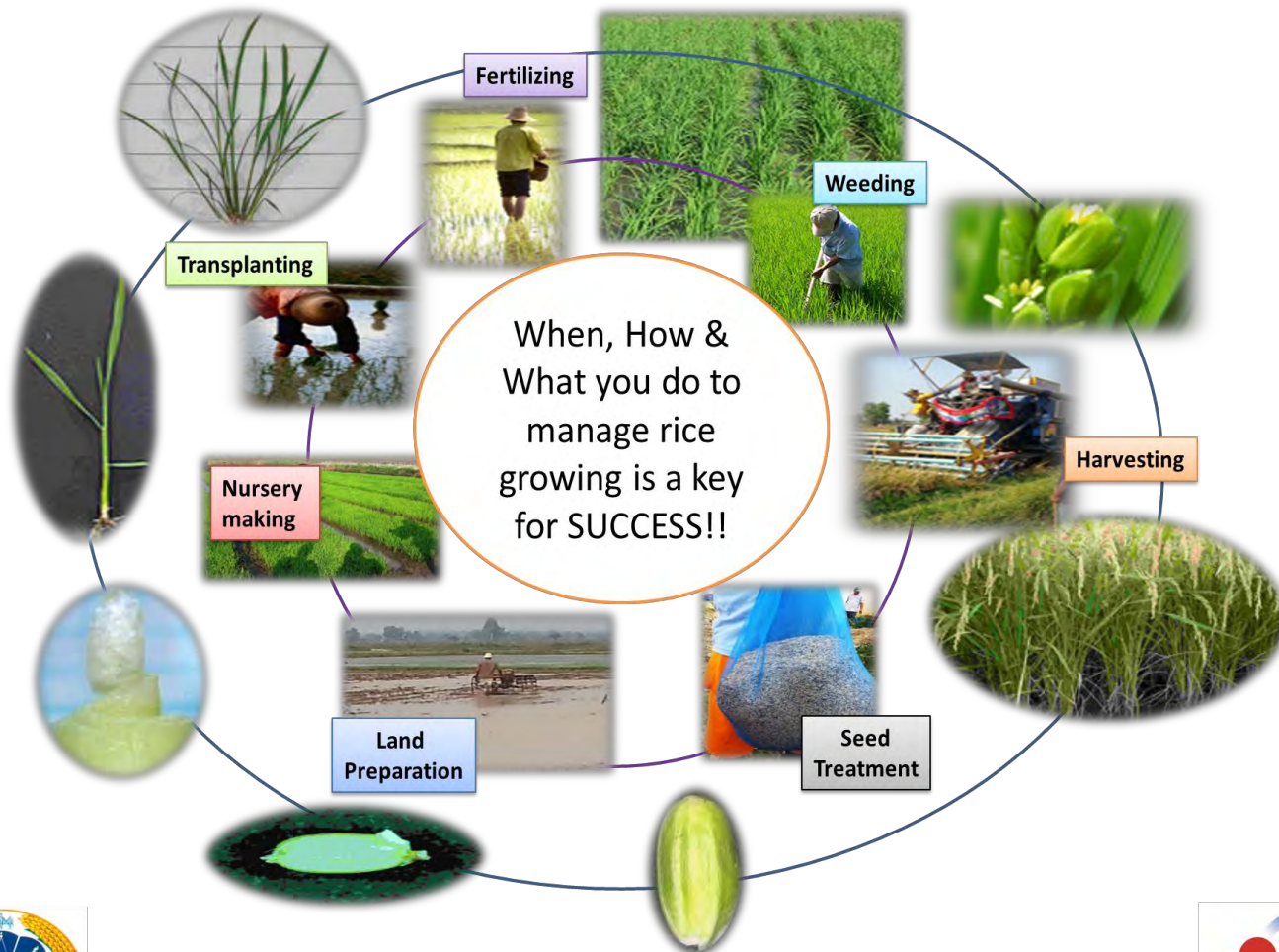
APPP-Charts for FFS training course



An extension officer (right in standing) giving a lecture using the charts (printed on PVC materials) to farmers attending in FFS training course conducted at a demo farmer's site

Effective Rice Cultivation Techniques

Farmers Field School(FFS/APPP)



Cover Chart

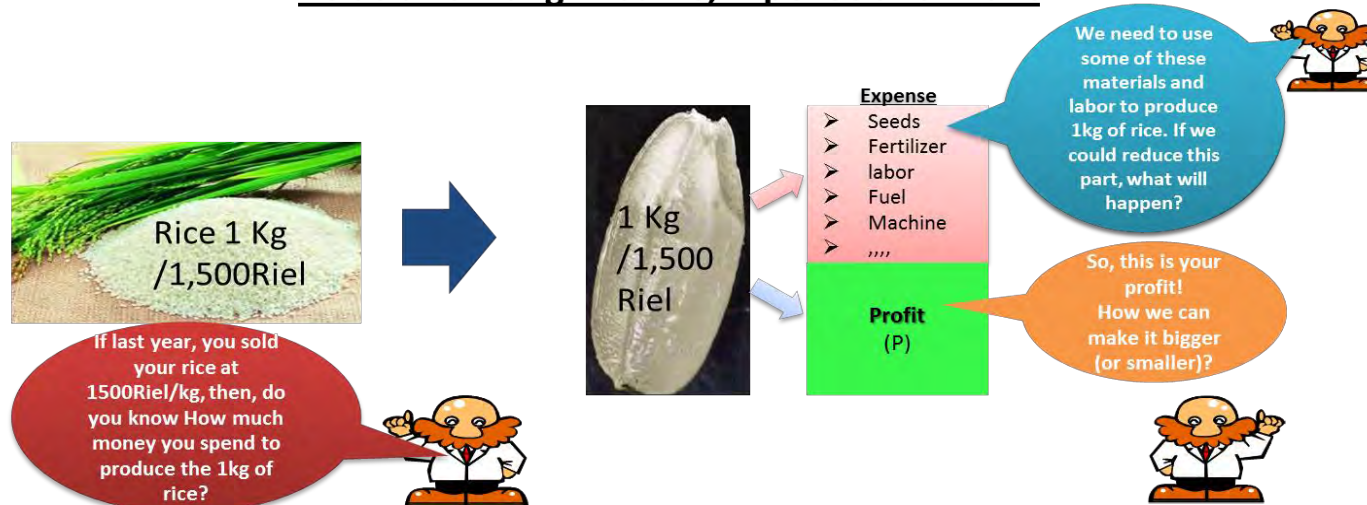
Show a whole flow of rice cultivation cycle as an interaction between farmer and rice plant. Notice how important it is to properly manage on each plant's growth stage of significance.



Agricultural Productivity Promotion Project in West Tonle Sap
(APPP/JICA)

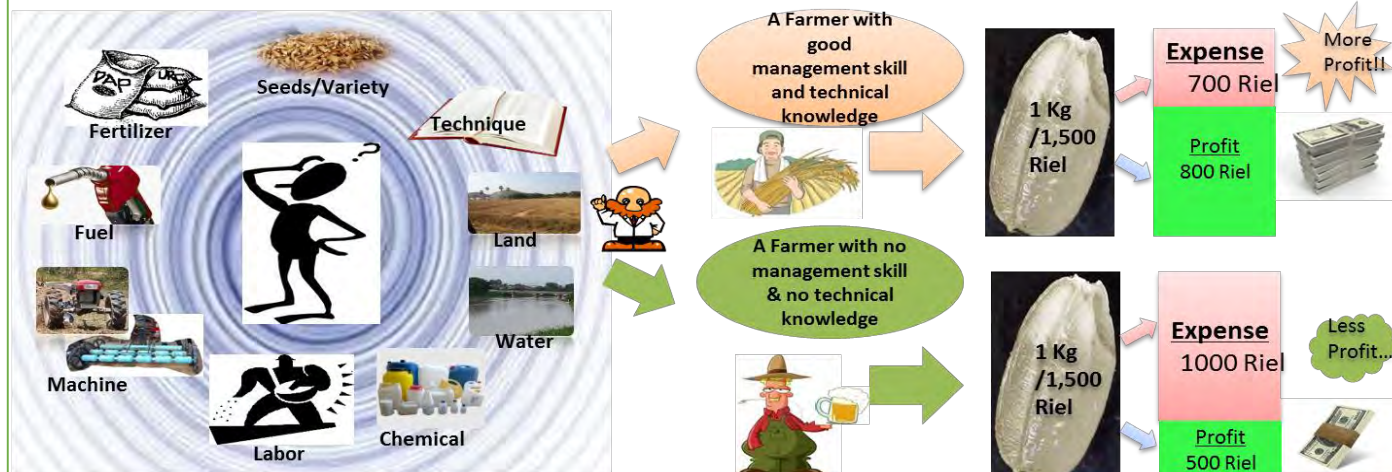


Relation among Income, Expense and Profit



Explain the relationship among Income, Expenditure and Profit. Understand how different farmer may make different financial management and decision makings over farming practice, leading to very different results.

Farmer as a "Manager" what you can do?

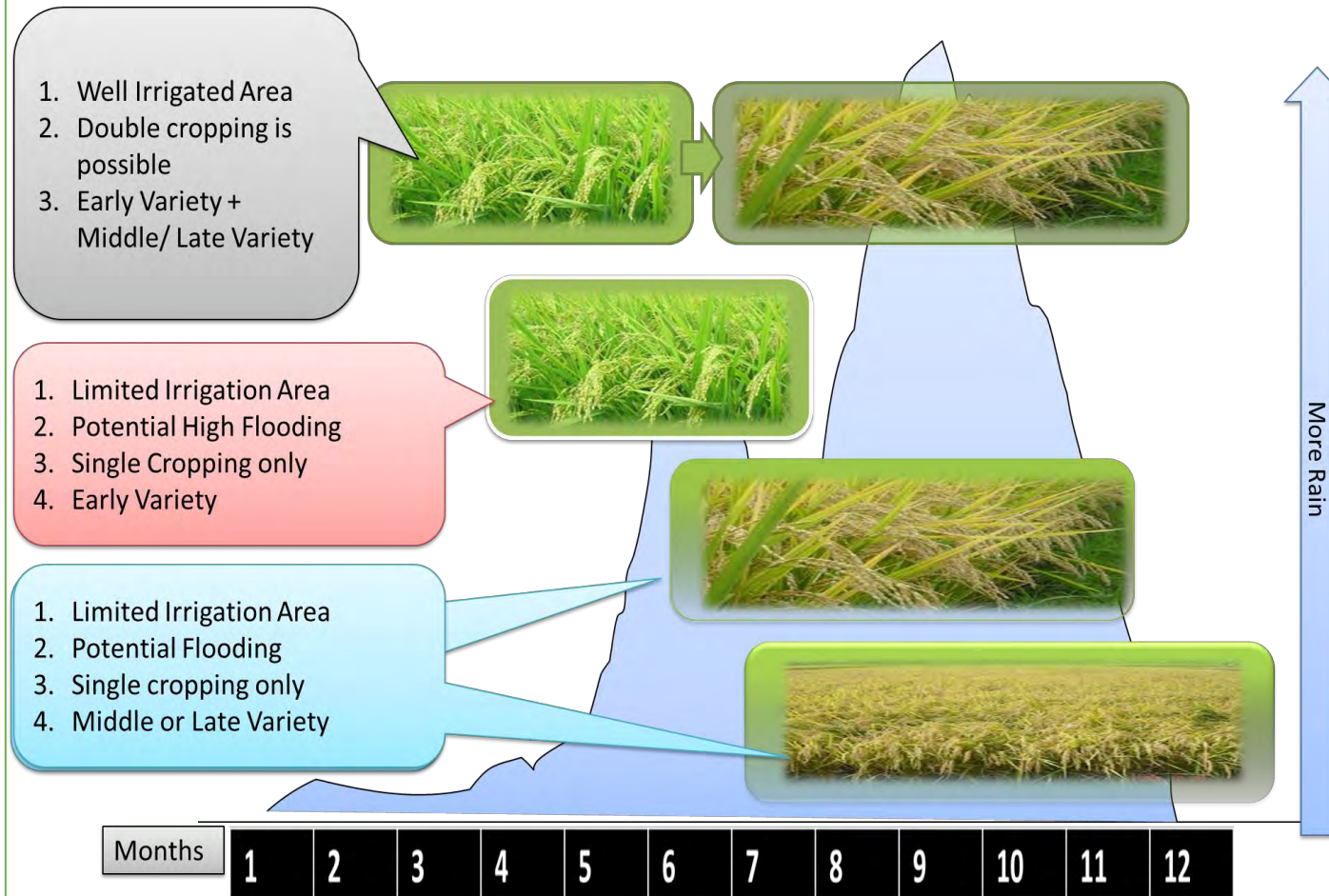


Rice Cultivation Strategy (FFS1)

FFS1-2

FFS1-Topic 2

Explain how the rainfall pattern may affect the choice of rice farming system. Learn in which area of characteristic, the farmer is located.



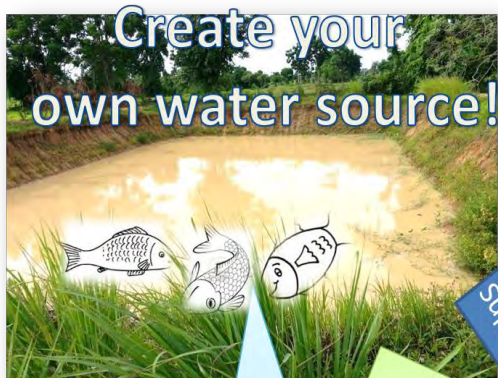
Think of a strategy for rice growing based on rainfall pattern & irrigation levels in your areas !!

Importance of water management

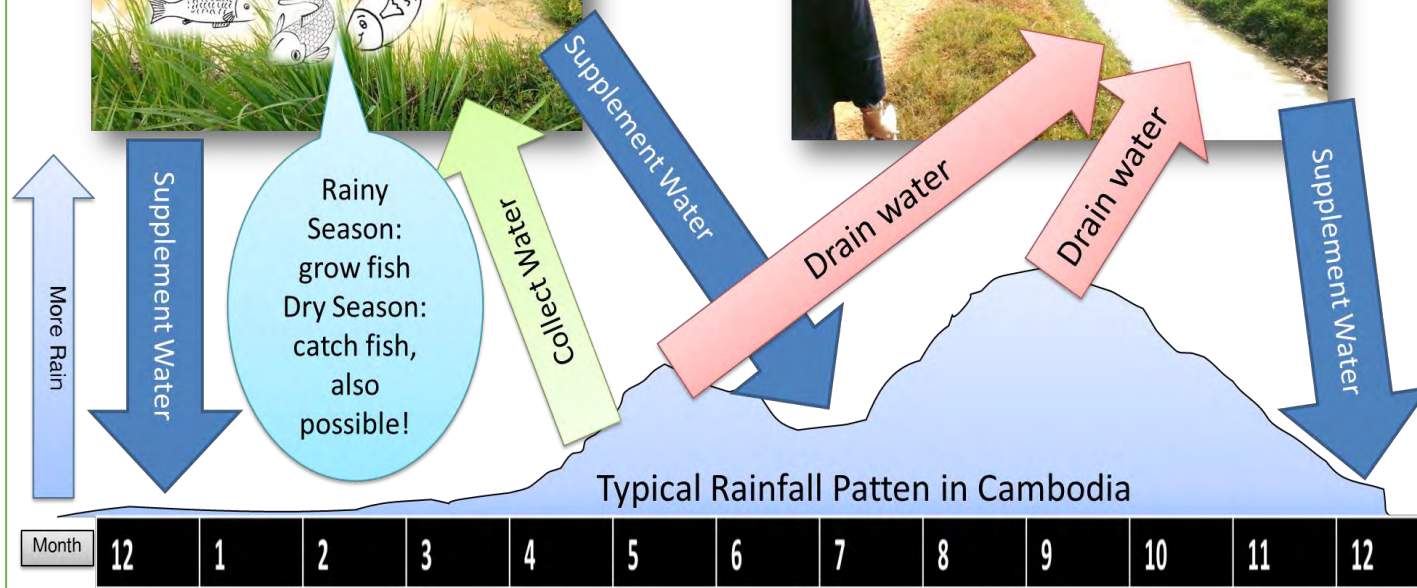
FFS1-3

FFS1-Topic 3

Under No Irrigation



Under Available Irrigation



Show how water supply system can function under dry and rainy season. Ask farmer, if they can improve their water supply system in anyway.



Try to improve your water supply system during DRY SEASON!! Because it is easy to manage due to no rain.

How to treat seed for good growth in two step practice using the urea solution

FFS1-4

FFS1-Topic 4

Step 1. Good Seed Selection

Step1.

Put seeds in Net bag

Step2.

Make floating solution
Water: 40kg
Urea: 20kg

Check gravity by floating
fresh eggs

Step3.

Shake to soak the seeds
well

Remove the floating
seeds

Step4.

Rinse in clean water

Step 2. Seed Disinfection

Step1.

Make a fire place

Heat water to 60°C

Step2.

Soak the bag into the
hot water for 10 min.

Check the time exactly
for 10min. Then, take
the bag out

Step3.

Rinse the seeds in clean
& cold water hurriedly

Step4.

Place the seeds in clean
& dry place

“Control a timing
for seeding”

Keep
soaking
seeds in
clean water
to promote
germination
in two
days(2) for
seeding
soon

Or ,

Dry seeds up
to 12-13% of
moisture
content, seed
can keep up
to 3 months

Explain the purpose of
conducting these seed
treatments and why
they are necessary.
Learn each step and be
able to practice carefully
and precisely.

Nursery bed making(3-4 weeks before transplanting)(1)

FFS2-1

FFS2-Topic 1

Explain how to carry out seed treatment and nursery preparation in a timely manner.

Keep soaking seeds in clean water to promote germination in two days(2) for seeding soon

Seed Treatment

Day 1

Day 2



Seed Selection & Disinfection



1 Day soaking In water



1 Day Incubation

Day 3

Nursery bed Making in Advance (Start few days before the seed treatment)

Nursery bed making & sowing pre-germinated seeds



1



2



3



4



5

Nursery bed making(3-4 weeks before transplanting)(2)

FFS2-2

FFS2-topic 2

Show the basic steps of preparing nursery bed for seeding. Point out clearly that nursery should be prepared at the place where water supply is assured.

Raising bed



Adding organic matters if available



Adding Rice Husk Charcoal



Fertilizing Bed(DAP)



Leveling surface of bed



Mixing soil on bed



Sowing germinated seed



400-500m² of nursery area may be needed for 1 ha.
Estimate of 40-50kg of good seed is needed for 1ha of main paddy.



Pls. maintain water level ideal 2-5cm of seedlings, no drying up. Observe well to find out disease symptoms.

Main Land Preparation & Leveling(1week before transplanting)

Explain the importance of land preparation as it provides a basis of successful rice growing conditions including water and weed control.



Plowing Paddy



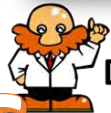
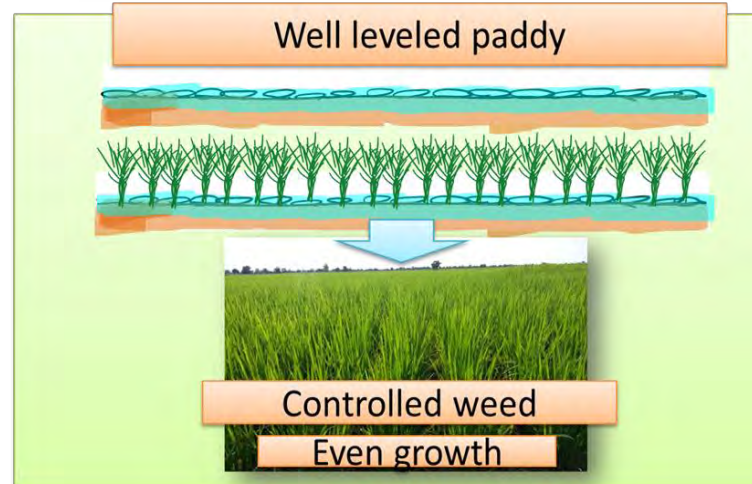
Tillering in water



Rough Leveling

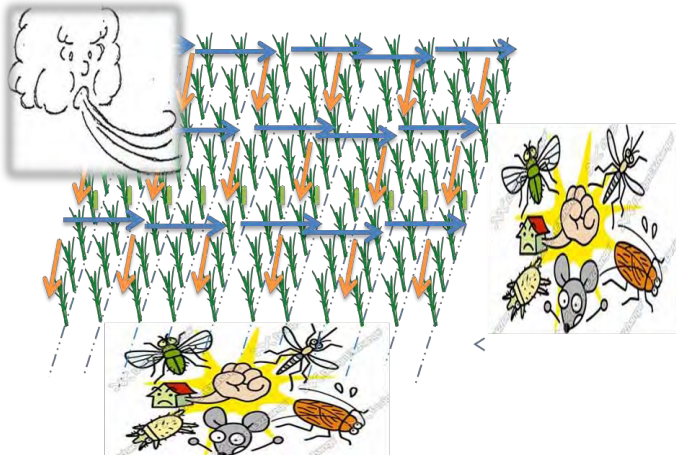
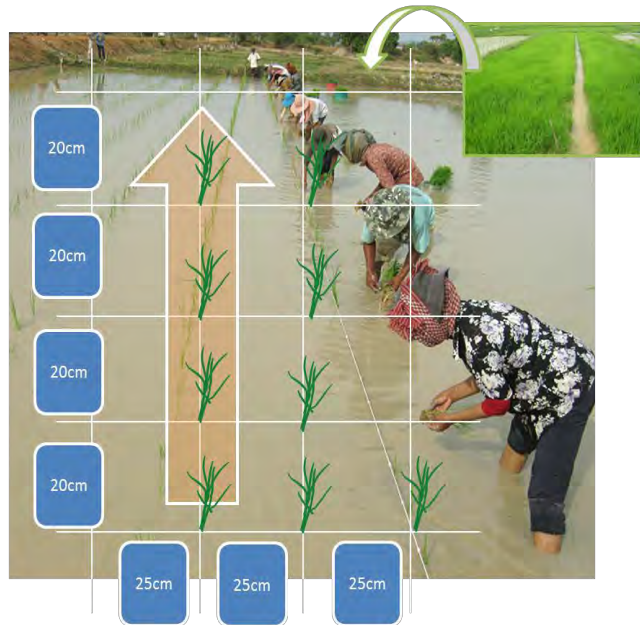


Fine Leveling



Distribute water evenly to control weed and achieve uniformed growth of paddy!!

Line-transplanting Method



Proper planting method

- Use properly grown seedlings from nursery (21days growth),
- Use a line to plant straightly,
- Keep plant-to-plant spacing at 20cm x 25 cm,
- Plant 2-3 seedlings per hill, not many such as 4-10 seedlings.

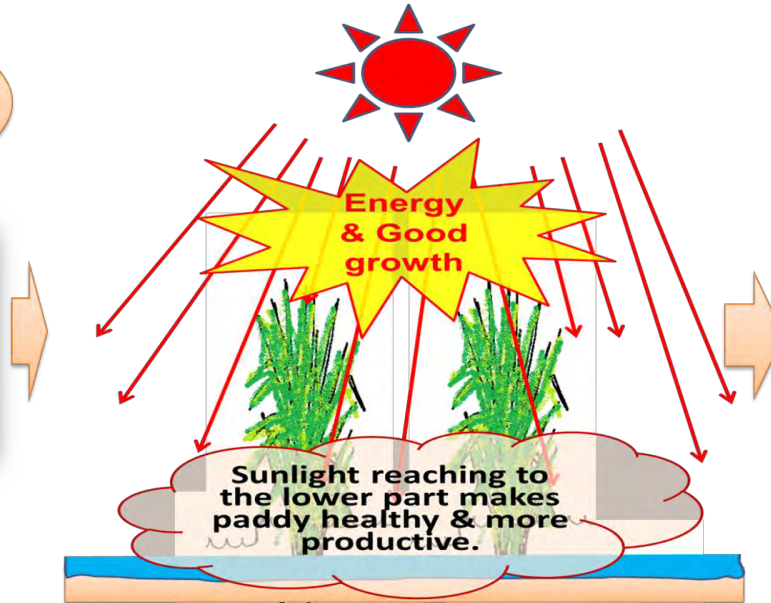
Effect of line-transplanting

- Seedling grow well in a best spacing by line-planting,
- Good ventilation for preventing disease agents, effective use of fertilizer, fast growth of seedling,
- Easy to do weeding to promote rice growth.

Explain the importance of achieving ideal planting space by line transplanting method, promoting healthy rice growth thus leading to high yield.

Importance of weeding

A Farmer with
Proper weeding
practice



More
Profit!!



A Farmer with
No weeding
practice



Less
Profit...



Explain the importance of weed management. Proper management methods can be informed, including manual weeding, water management to control weed, and possible use of chemical in some cases.

Fertilizing the main paddy to promote growth

FFS4-1

FFS4-Topic 1

Explain the three timings and importance of timely fertilization to maximize the growth of rice, thus high yield and minimize the risk of lodging.

Pls. make sure paddies are filled with water



Basal Fertilizer during land preparation

DAP
50kg/ha



1st additional UREA at 30 days later the Transplanting

UREA1
50kg/ha

Check PI to decide the best timing to fertilizing!



2nd additional UREA after Panicle initiation (PI)

UREA2
50kg/ha



Think of the best timing for fertilizing to maximize the growth of your rice!!

Explain how losses are made by the condition of lodged rice. Increase awareness on this conditions and talk about possible measures to tackle the conditions.

Managing the lodging rice

Lodged Paddy



Difficult harvesting



Loss by damage



High Cost

Less yield

Less Profit...



If you don't want this.....

Preventive method

Symptomatic method



Practice proper fertilizing method for amount and timing!

Practice paddy binding soon after lodging paddy appearing!

Prevent and/or minimize loss

Secure Profit!!



This is a critical stage for managing good quality rice before harvesting soon. So, it needs to manage it!

Estimating yield by simple cutting method

1. Choose sample areas



2. Cut out paddies in the area of 1 m x 1 m (1m²)



3. Paddies being sampled



4. Removing paddies from a bunch



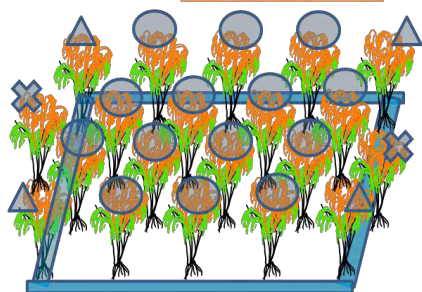
5. Weigh the grain amount from (1mx1m) to estimate the whole area



Cut out paddies only within the 1 square meters

If a scalar (10-30 kg) is available, the estimate can be made by weighing threshed grains from the 1 square meters, which is then multiplied by 10,000 times to obtain per 1 hectare. Moisture % and Grain Ripening % are as well necessary to consider.

Points of Sampling



✕ : No sampling (close but totally outside)

Δ : Sample half of the bunch as overlapping to the pipe

● : Sample whole (totally inside)

In case line-transplanted precisely at 20 cm x 25 cm, 20 bunches can be sampled per 1 m² as there are 20 hills in it.

Calculation Tables (Example)

Sample Spot	(1)No. of bunches /m ²	(2)Weight of collected grain from 1 m ²	(3)Percentage of water content at the time of cutting	(4)Estimated weight after dried to 13%**	(5) Estimated yield (kg/ha)
1	20	500 g	25%*	440 g	4,400 kg/ha
2	22	600 g	25%	528 g	5,280 kg/ha
3	19	480 g	25%	422 g	4,220 kg/ha

Estimated Yield: 4,220 ~ 5,280 kg/ha

Calculation Formula:

(Weight of grain per 1 m² at 13% moisture down from 25% moisture): $(2) - \{(2) \times (25 - 13) / 100\} = (4)$,
(Yield (kg) of rice per 1 ha: $(4) \times 10,000$ (kg).

* An approximate moisture % of wet paddy

** 13 % moisture content is considered as sufficient for preservation

In advance, prepare these figures before the day of FFS 5. So that on the day, demo participants can learn on the estimated yield as a result of FFS techniques.

Importance of renewing paddy by properly grown seeds

FFS5-2

FFS5-Topic 2

Discuss how to avoid a case of mixed different variety and/or any other poor qualities of rice that may result in lowered sale price.

A Farmer with regular paddy renewal practice by using legitimately-sourced seeds



- High purity (no mixing with other varieties)
- High resistance to disease
- High Germination Rate

More Profit!!

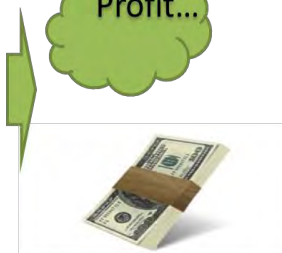


A Farmer with continuous use of own paddy as seed for coming years



- Low purity (mixed with other varieties)
- Poor resistance to disease
- Poor Germination Rate

Less Profit...



At least, renew your paddy every 2-3 years to avoid risk of deteriorated quality and poor productivity of paddy resulting in lowered profit!

Contact Information of APPP/JICA Supported Seed Growers

Province	Name of SGG	Contact Person & Tel. No
Battambang	 SAMAKI SEED in Banan	Mr.Tong Simon : 088-488-8523 Mr.In Suon: 053-662-9696
	 SAMAKI SEED in M. Russei	Mr.Moul Meun: 089-359-995 Mr.Hou Pen : 053-631-1889 Ms. Pheung Vy: 092-875-673
	 SAMAKI SEED in Bavel	Mr.Houl Khlim: 012-675-589 Mr.Seun Buntheun: 012-402-381 Mr.Srey Kov: 092-954216
Pursat	 TAS-PDA	Mr.L. Chendamony: 012-879-877 Mr.H.Chandara: 012-635-409
K. Chhnang	 Phnom Touch SAMAKI SEED	Mr.Meas Soeurn: 012-681-523 Mr.Kheb Bou: 092-358-997 Ms.Kae Khan: 017-435-165

Introduce APPP supported Seed Growers Group (SGG) to demo participants, to encourage them to renew their seeds for next year by explaining how SGG produce quality seeds.

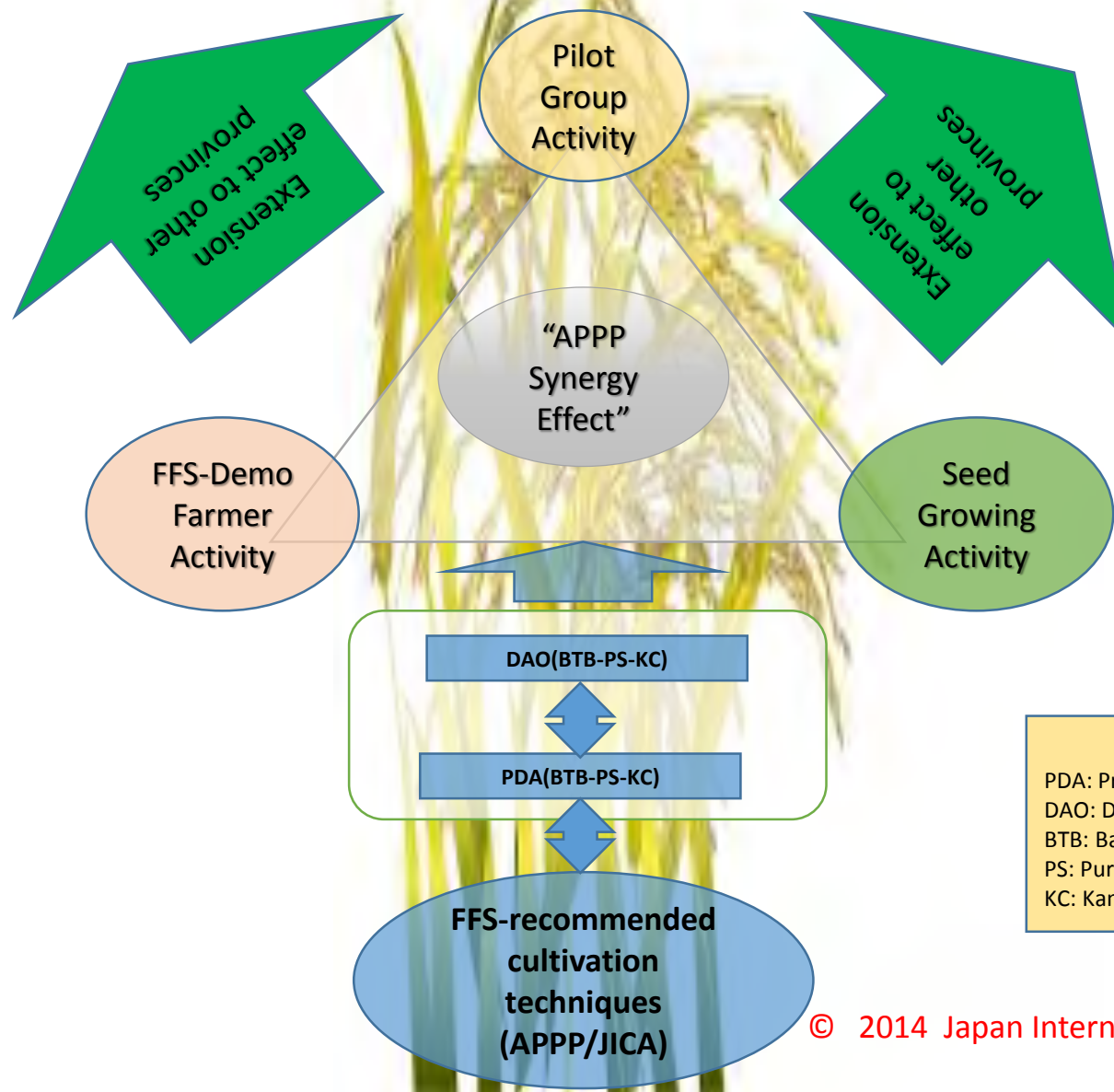


These seed growers all follow the seed production guideline introduced by APPP/JICA and use legitimate rice variety lines originally obtained from CARDI*. You can contact them to get your new seeds. *CARDI: Cambodian Agriculture Research and Development Institute



APPP/JICA

from 2010.10 to 2015.03



-Abbreviations-

PDA: Provincial Department of Agriculture
DAO: District Agricultural Office
BTB: Battambang Province
PS: Pursat Province
KC: Kampon Chhnang Province