TECHNICAL GUIDELINE
RICE CULTIVATION REDUCES COSTS, IMPROVES EFFICIENCY, ADAPTS TO CLIMATE CHANGE IN THE RED RIVER DELTA
(Issued together with Decision No. 236/QD-TT-CLT dated June 2023 of the Director of the Department of Crop Production)

A. GENERAL INTRODUCTION

The Department of Crop Production coordinated with the International Rice Research Institute (IRRI) in Vietnam to develop this technical guideline.

1. Basic to develop technical guideline

The guideline is developed on the basis of:

- Technical guideline (Technical package) of advanced farming to improve rice production efficiency for the Red River Delta (RRD) according to Decision No. 321/QD-TT-CLT dated 11/12/2020 of the Director of the Department of Crop Production.

- Up to date research results in rice production (mechanization of tillage, planting, harvesting; alternate wet-dry (AWD) irrigation and reasonable water management; efficient use of fertilizers, increased use of organic fertilizers, circulation use of straw and rice by-products; integrated plant health management-IPHM, ...).

- Contribution from experts and the Department of Agriculture and Rural Development in the RRD provinces.

2. Scope of application

- Rice-producing provinces in the RDD.

- This is a general technical guideline in the RRD, RRD provinces develop appropriate guidelines for rice cultivation base on the specific conditions of their areas.

B. TECHNICAL GUIDELINE

I. Land preparation

1. Winter - Spring season

a) Land preparation

- For fields where winter crops are not planted:

+ Plow to "till" or dig-up and overturn the soil early when the soil is still wet enough, bury weeds, stubble, fallow;

+ Low-lying, often submerged fields: harrowing to break the soil clods into smaller mass and incorporate plant residue as soon as possible.

- For fields where winter crops are planted: Plow and break the beds right after harvesting winter crops, plow 15-20 cm deep, then harrowing to incorporate plant residue.

b) Harrowing

- Carrying out harrowing by machine combined with land leveling boards before transplanting at least 5-7 days.

- Let the sludge settle after 1 day or overnight for soil with heavy mechanical composition, then sowing/transplanting. For soil with light mechanical composition, it is necessary to sow/transplant immediately after harrowing.

2. Summer season

- Incorporating stubble and spraying microbial culture after harvesting the Winter-Spring rice as soon as possible.

- Before sowing/planting: Harrowing combined with leveling boards.

3. Land leveling

For uneven fields, it is recommended to apply laser land leveling (LLL) after the harvest of the summer rice, every 5 years. Pay attention not to lose the plow base layer, when the height difference in the field is large

(Refer to details in the section 1 of the appendix)

II. RICE VARIETIES

1. Using officially authorized rice varieties, have good market for consumption, prioritize the selection of rice varieties with short growing time (for late Spring season and early Summer season), high yield, good quality; resistance to pests, diseases and adverse conditions.

- Alluvial soil of Red river, Thai Binh river: Using rice varieties suitable for high intensive farming

- Coastal alluvial soil (salty, alum areas): Use rice varieties resistant to saline acid, hybrid rice, and specialty rice.

- Infertile ancient alluvial soil: Using rice varieties with wide adaptability, suitable for medium intensive farming

2. Use certified rice seeds. The amount of seed used is 30-40 kg/ha.

(Refer to details in the section 2 of the appendix)

III. Sowing and transplanting, Direct seeding

1. Seed treatment and soaking

1.1. Seed treatment and soaking

The amount of water to soak seeds in the ratio 1:5 (1 kg of seed soaked with 5 liters of water), specifically as follows:

- Winter-spring season: soak the seeds for 10-15 minutes in 52 - 53 ^{o}C water (mix 3 parts of boiling water with 2 parts of normal water), then soak in clean water for 24 - 48

hours. During the soaking process, every 10-12 hours: pick up the flat, badger seeds, wash and change the water, when the seeds are full of water, wash the seeds, clean, drain and then incubate.

- Summer season: Seeds are soaked in clean water for 18 - 20 hours, every 6 - 8 hours: pick up the flat and badger seeds, wash them off and change the water, when the seeds are full of water, wash the seeds, clean, drain and then incubate.

In summer season conditions, seeds can also be soaked in mix water- 3 parts of boiling water with 2 parts of normal water (about 52 - 53 ^{o}C), soaking seeds for 10 - 15 minutes like for the Winter- Spring season to eliminate fungal diseases on seeds as well as stimulate and make seeds absorb water quickly.

- For new harvested seeds, dormancy seeds: Soaking time is about 40 - 44 hours, follow 2 steps:

Step 1: Dissolve 0.5 kg of Superphosphate (Lan Thao phosphate) in 10 liters of clean water, decant the clear water to soak for 6 - 7 kg of rice seed within 24 hours (without changing the water), then wash thoroughly, continue to soak with clean water in step 2.

Step 2: Continue to soak the seeds in clean water for 16 - 20 hours, every 6-8 hours: pick up the flat, badger seeds, wash and change the water, until the rice is full of water, then wash and incubate.

Note: For F1 hybrid rice seeds, during soaking change the water every 4-5 hours.

1.2. Seed incubation

To ensure a high and even germination rate, keep the temperature of the incubated heaps at about 33 - 35 ^{o}C. After incubation for about 24 hours, check if the rice is dry, add water to keep it moist enough, let it dry and then incubate again;

when the seeds begin to germinate, keep the temperature about 26 - 28 ^{o}C for germination. Check if the seed sprouts meet the standards, then sow.

2. Seedbed preparation and transplanting

2.1. Sowing time

- Winter -Spring season:

+ Early Winter-Spring season (applicable only to areas with specific conditions): Sowing from November 25 previous year to January 5, transplanting when seedling has 5 - 6 leaves.

+ Late Winter-Spring season: Sowing from January 25 - February 10, covered with nylon to prevent cold stress, transplanted when seedling has 2.5 - 3 leaves.

- Summer season:

+ Early summer season: Sowing from June 1 - 15, transplanting when seedlings are 10 - 12 days old (Low-lying fields: 15 - 20 days old seedlings).

+ Middle summer season: Sowing from June 15 - 25 (transplanting completely before July 20).

+ Late summer season: Sowing June 10 - 20, transplanting when seedlings are 25 - 30 days old (mainly using rice varieties with short-day light response).

2.2. Seedbed preparation for transplanting

a) Seedbed on hard ground (modified mat nursery)

- Preparation:

+ Sowing mud: Take mud from where there is sunshine and water in and out, don't take mud from stagnant ponds, under the shade of perennials; prepare mud 2 - 3 days before sowing to release toxic gas and add 0.5 kg of Superphosphate for a seedling area enough for transplanted field (360 m^2).

+ Sowing ground: Choose a concrete or a leveled garden floor. Use bricks, banana tree trunk, bamboo or soil to create a bed frame with 1.5 - 2 m wide. Spread the nylon sheet very flat and the nylon must go through the bank (poke a hole in the nylon to drain the water, the nylon must not be torn).

+ Black net to reduce direct sunlight: prepare an area of black net suitable for the area to be sown.

- Sowing:

+ Put the mud into a bucket or pot and then stir until there are no lumps then pour it into the bed and roll it flat. The mud layer is about 1.5 - 2 cm thick (one knuckle of an index finger). The seedling area is from 4-6 m^2 for 360 m^2 of transplanted field.

+ Sprinkle germinated rice seeds when the mud is drained, lightly sprinkle the seeds on the mud surface, sow uniformly. It should be sown in the cool afternoon.

+ Cover the black net about 1.5 - 2 m above the ground.

- Care of seedlings:

+ In the first 2-3 days, water 2-4 times in the morning and evening (do not water at midday, especially when the seedling is wilting).

+ When the seedling begins to grow straight up: Remove the black net for seedling growth; Water the seedling, but do not flood the seedling.

+ When seedlings have real leaves, keep water for seedling beds.

+ When seedlings are ready, but transplanted fields are not ready, it is necessary to fertilize more to seedlings (Use superphosphate to soak with water, dilute and water for seedlings; we can mix phosphorus with straw ash and sprinkle evenly for seedlings). Keep moist before transplanting.

b) Seedbed on fields (Wet-bed)

- Preparation:

+ Land preparation: If we don't have specialized land for rice seedlings, we should choose a sowing field in a place away from the wind, especially the northeast wind, remove weed, stubble; plowing and harrowing thoroughly, and leveling; and add 0.5 kg of Superphosphate of seedling area enough for 360 m^2 transplanted field.

+ Make a bed with a width of 1.2 - 1.4 m (the bed is wide or narrow depending on the width of the covering nylon), the furrow is 30 cm wide.

- Sowing:

Divide the amount of rice seed to sow again and again to be evenly distributed, sow the seeds forcefully so that the seeds are deeply submerged into the soil.

- Care of seedling:

+ Covering with nylon: In the winter-spring crop, it is necessary to cover the seedbeds with nylon to prevent cold for the seedlings; prepare in advance bamboo slats for arches with an average length of 2.0 - 2.2 m, bamboo slats with a width of 2.5 - 3 cm; nylon has a width of 1 m or 1.5 m.

Insert bamboo slats across the bed to form a frame of a sewer arch, cover the frame with nylon, and use mud to cover the sides and ends of the bed with mud.

+ If it is very cold, it is necessary to cover the seedbed with nylon for the seedling to grow well, to limit the seedling death. If the weather warms up, open the nylon at the ends of the bed, open during the day, cover at night. When seedlings have 2.5 - 3 leaves, the outdoor temperature is over 18^oC, open the entire nylon cover on the bed so that the seedlings get used to the environment.

+ When seedlings have real leaves (leaves with sheaths, leaf blades), Superphosphate soak with water, dilute and water for seedling; Superphosphate can be mixed with kitchen ash and sprinkle evenly for seedling.

+ When seedlings have 1.5 - 2 leaves, water enough to cover the field surface, do not apply nitrogen to seedlings.

c) Seedbed on hard ground or fields (Use a shovel or a sickle to remove the seedling for transplanting)

- Preparation:

Sowing ground: choose garden, leveled ditch or field for sowing; for garden or ditch, it is needed to prepare mud, black net. To add 0.5 kg of superphosphate to the seedling area enough for 360 m^2 transplanted field.

- Sowing:

+ For field floors, make beds, sow similar to the section of "*b) Sowing on fields*" mentioned above.

+ For garden or ditch floors: After preparing the floor, put the mud into the bucket and stir well until there are no lumps, then pour the mud on the floor. Make the layer of mud 2-3 cm thick. Sowing area is from 10 to 12 m^2 for 360 m^2 transplanted field.

+ When the mud is drained, it is time to sow: Lightly sprinkle apricots to send seeds on the surface of the mud, sow evenly. It should be sown in the cool afternoon.

Cover the black net about 1.5 - 2 m above the ground for garden or ditch floors

- Care of seedlings:

+ For seedlings sown on the garden floor, ditch banks: In the first 2-3 days, water 2-3 times a day in the morning and evening (do not water at midday, especially when the seedling is wilting). When the seedlings start to grow straight up, remove the black net.

+ For seedlings sown on the field floor: depending on the moisture of the field to decide the number of watering times.

+ When seedlings have1 - 2 leaves, add nutrients using Super phosphate soaked in water, dilute and irrigate the seedling; can mix phosphorus with kitchen ash and sprinkle evenly).

+ When seedlings are ready for transplanting, use a shovel or sickle to remove the seedling for transplanting.

d) On-tray seedbed (for machine transplanting)

- Preparation:

+ Use field soil or soil on hills with pH_{KCl} 4.5-5.5.

+ The soil is sieved (passing through the 4 x 4 mm sieve) to remove large soil particles and impurities that affect the growth of seedlings.

+ Prepare a mixture of soil, sawdust, coconut, rice husk ash and add 0.5 kg of super phosphate for seedlings area enough for 360 m^2 transplanted field.

- Sowing:

+ Spread seeds evenly on the trays by hand or machine to ensure uniform distribution of seeds on the tray (2.5 kg of soil mix/tray (size 60 x 30 cm), soil layer 2 cm thick).

+ The soil on the tray must be moistened enough by watering 1 - 1.5 liters of water/tray before sowing. Spread 200 g of germinated rice seeds in a tray and covered with soil.

- Care of seedlings:

Make sure to provide enough moisture for the seedling to grow by spraying 1 - 1.5 liters of water per tray in the morning (from 8:00 to 10:00 am), especially need to spray regularly when the weather is hot.

(Refer to details in the section 3 of the appendix)

2.3. Transplanting

- Density of hand transplanting: 30-40 hill/m^2, 2- 3 seedlings/hill.

- Density of machine transplanting: 25 - 30 hill /m^2

Prioritize the use of tray-sown seedlings for mechanical transplanters have built-in trays.

3. Direct seeding

- Applies only to areas with active irrigation systems.

- Prioritize the use of mechanization: hill seeder, row seeder or unmanned aerial vehicles (drone).

- Time of sowing:

+ Winter -Spring season: February 10 - 20 (only applicable for late Winter -Spring season).

+ Summer season: June 10 - 20.

(Refer to details in the section 4 of the appendix)

IV. CARE OF RICE FIELD

1. Water Management

a) Prioritize the application of alternating wet and dry (AWD) water management

- Stage from 7 - 10 days after sowing (DAS): Keep the field surface covered with water (saturated). Keep water in the field until the first fertilizer application.

For transplanted rice: Keep the field surface covered with water (saturated) from transplanting (0 day after transplanting- DAT) to 15 DAT so that the rice quickly takes root and turns green and prevents weeds from growing.

- Drain after the 2^{nd} fertilizer application until pre-flowering: when the water depth to drop to 15 cm below the surface or soil surface is cracked, irrigate to get 5 cm submerged field

- Keep field flooded 3 - 5cm from 7 days before flowering to 7 days after flowering, then only irrigate when the water depth to drop to 15 cm below the surface or soil surface is cracked.

- Drain 7 to 10 days before harvesting.

b) Mid-season drainage (if alternating wet and dry irrigation cannot be applied)

- Drain at least once in the middle of season (irrigate when the soil is cracked) at the times of 10 days after sowing, 7 days before and after flowering.

- Drain 7 to 10 days before harvesting.

** Note:*

alternate AWD techniques in the area where the irrigation system has been completed.

Do not apply AWD techniques in acid and saline soils.

For summer season, actively drain at the end of the season.

(Refer to details in the section 5 of the appendix)

2. Fertilization

Fertilize according to the 4 correct principle (type, dose, time, method).

a) Amount of fertilizer

Apply 1-1.5 tons/ha of compost or processed organic fertilizer. If using mineral organic fertilizers, then balance the amount of NPK accordingly. Encourage the use of organic fertilizer from rice straw and other by-products.

For infertile ancient alluvial soil:

- Winter-spring season: Amount of fertilizer (kg/ha): 80-90 N : 40-50 P_2O_5 : 70-80 K_2O

- Summer season: Amount of fertilizer (kg/ha): 70-80 N : 35-45 P_2O_5 : 60-70 K_2O.

For alluvial soil of Red river, Thai Binh river:

- Winter -Spring season: Amount of fertilizer (kg/ha): 80-90 N : 40 - 50 P_2O_5 : 50-60 K_2O (For alluvial soil of Thai Binh river, increase by 10 - 15% of phosphate fertilizer).

- Summer season: Amount of fertilizer (kg/ha): 70-80 N : 35-45 P_2O_5 : 45-50 K_2O.

For coastal alluvial soil (salty, alum areas):

- Winter-Spring season: Amount of fertilizer (kg/ha): 80-90 N: 40-50 P_2O_5 : 45-50 K_2O.

- Summer season: Amount of fertilizer (kg/ha): 70-80 N : 35-45 P_2O_5 : 40-45 K_2O.

b) Method of fertilizer application

- Basal application: 100% organic fertilizer and phosphate fertilizer, 15-20% nitrogen fertilizer, 15-20% potassium fertilizer.

- First application: When rice plants have new roots and grow greenly, apply 65 - 70% nitrogen fertilizer, 20 - 30% potassium fertilizer

- Second application: at early reproductive phase (panicle initiation to booting), apply the remaining amount of fertilizer.

For infertile soil, light mechanical composition soil:

- Basal application: 100% organic fertilizer and phosphate fertilizer, 15-20% nitrogen fertilizer, 30-35% potassium fertilizer.

- First application: When rice plants have new roots and grow greenly, apply 65 - 70% nitrogen fertilizer, 20 - 25% potassium fertilizer.

- Second application: at early reproductive phase (panicle initiation to booting), apply the remaining amount of fertilizer.

For Direct seeding:

- Basal application: 100% organic fertilizer and phosphate fertilizer, 25 - 30% nitrogen fertilizer, 15 - 20% potassium fertilizer.

- First application: After sowing 7 - 10 days, 55 - 60% nitrogen fertilizer, 20 - 30% potassium fertilizer.

- Second application: at early reproductive phase (panicle initiation to booting), apply the remaining amount of fertilizer.

(Refer to details in the section 6 of the appendix)

Some other notes on fertilizer use:

- Increase the use of organic fertilizers and reuse by-products in the direction of a circular economy.

- Encourage the use of specialized, complex, mixed, slow-release, controlled-release fertilizers and other new-generation fertilizers (use according to the manufacturer's instructions).

- Apply more fertilizer in the early stages and less fertilizer in the final stage, and reduce times of application (maximum 3 times).

- Use Leaf Color Chart or other similar tools.

- For hybrid rice: the amount of nitrogen and potassium fertilizers increased by 10% compared to inbred rice.

- When rice has organic poisoning:

+ Weeding, stirring mud;

+ Drain, let the field dry for 2-3 days (the soil is cracked).

+ After irrigation, apply phosphate and burnt lime.

+ Stop fertilizing nitrogen through soil, and apply foliar fertilizer.

+ When the rice plants recover, take care as usual.

- For the winter-spring season:

+ When cold damage persists after transplanting: do not apply N, increase to potassium, apply foliar fertilizers.

+ In case of warm weather, there is a risk of early flowering, apply additionally 25-30 kg urea/ 360 m^2.

3. Pest management

Applying integrated pest management (IPM) on the basis of Integrated Plant Health Management (IPHM):

3.1. Insect and disease management

- Carrying out surveys and forecasting for early detection and timely prevention of pests and diseases.

- Apply the 4 correct principle in the use of pesticides (type, dose, time, method). Encourage the use of biological origin pesticides, herb pesticides, and use resistant varieties.

- To encourage the application of pesticide spraying technology by engine sprayers and unmanned aerial vehicles (drone).

3.2. Weed Management

- It is recommended to apply mechanical weeding in the case of direct seeding by hill seeders or row seeders.

- In case of herbicide use: Alternate use of herbicides with different modes of action.

3.3. Management of other pests

- Prevention of harmful rats must be community-based rat control, focusing on killing rats at the beginning of the winter-spring season:

+ Use barrier controls combined with crop traps.

+ Manual measures (trapping, fumigating rat burrows, catching with nets after harvest), biology, ...

- For golden apple snail: Apply a combination of many controls: manual, farming; golden snail killer drug of biological and herbal origin. Use the drug according to the 4 correct principal, follow the manufacturer's instructions on the packaging.

(Refer to details in the section 7 of the appendix)

V. Harvesting and postharvest

1. Harvest time:

Harvesting should be done when 80−85% of the grains are ripen/ straw colored (i.e., yellow-colored).

2. Harvesting:

Priority use combine harvesters.

(Refer to details in the section 8 of the appendix)

3. Drying

- Rice needs to be dried within 24 hours after harvesting.

- Drying to reach 14% moisture content (MC) for commercial rice and 12% MC for seed rice.

- It is recommended to use drying technologies such as:

+ Re-circulating batch dryer: Static drying of horizontal griddle reverses the air.

+ Two-stage drying system: including fluidized bed drying and circulating tower drying, is suitable for industrial scale.

(Refer to details in the section 9 of the appendix)

4. Storage

- The stored rice must have a moisture content of less than 14% MC (commercial rice) and 12% MC (seed rice).

- Rice is cleaned before storage.

- Warehouses, silos, tanks, or bags preserved rice must be cleaned and disinfected before adding rice to avoid pathogens and insect eggs.

- Stacking rice in the warehouse must be properly, ensuring that the temperature in the rice pile is not increased, avoiding dew that increases humidity, causing mold, reducing the quality of rice, etc. Avoid stacking rice bags touching the wall of the warehouse. Paddy piles must be placed on a well-ventilated wooden pedestal. A pile of rice with closely spaced bags is usually not more than 2.5 m high to ensure ventilation.

(Refer to details in the section 9 of the appendix)

5. Rice straw management

- Do not burn rice straw.

- Do not incorporate raw rice straw in the submerged soil.

- Collect straw out of the field and use it to produce straw-based products such as straw mushrooms, animal feed, bio-fertilizer, biochar, etc.

- For stubble, it is advisable to incorporate in the condition that the field is not submerged, with the application of microbial culture to accelerate the decomposition of organic matter.

(Refer to details in the section 10 of the appendix)

APPENDIX

RELATED TECHNOLOGIES AND STANDARDS

1. Laser land leveling (LLL)

Laser land leveling (LLL) a laser-guided technology used to level fields by removing soil from high points of the field and depositing it in low points of the field. LLL increases productivity and efficiency of use of water, fertilizer and supports management of weed, golden apple snail. The main technical requirements for applying laser leveling:

Apply LLL when the field is dry, every 5 years

LLL accuracy: elevation difference between positions in the field is not more than 3 cm.

The laser leveling unit is pulled by a wheeled tractor, not using a crawler to avoid damage to the field

If the difference in elevation or inclination angle of the field is larger than the plowing layer, it must form two fields with two different heights (rice terraces) or move the top soil layer and return it after leveling to avoid loss of the plowing layer.

more details refer to the document "Mechanization and Postharvest Management Support Sustainable and Low Emission Rice Production", Section 2.1, pages 5-8.

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2. Certified Seed

Using certified rice varieties according to the national technical regulations on quality of rice seeds issued by the Ministry of Agriculture and Rural Development.

3. Technology of on-tray seedbed (for machine transplanting)

Mechanized rice transplanting consists of two stages: (1) to prepare on-tray seedlings, then about 12-15 days old seedlings are transplanted by mechanical transplanters in the field.

- On-tray seedling machines: there are many types of sowing machines on trays, but the main principle is that the tray is driven on a conveyor belt and the seeds are sown through the dosing unit from the hopper. Sowing productivity can reach 800 trays/hour, enough for 0.5 ha transplanted field.

- Mechanical transplanters: the types of transplanters commonly used in Vietnam can be classified as follows:

+ Follow the movement like the following walking machine, 3-wheel drive transplanter, 4-wheel self-propelled transplanter.

+ According to the number of transplanting rows such as 4-row, 6-row or 8-row transplanter, ...

In addition, the distance between rows can be adjusted as required to suit the field size.

For details, refer to the document: Good Practices for Rice Production in Vietnam, part III, pp. 113-143.

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4. Technology of direct sowing by machine

Direct sowing by machine can be classified as follows:

- Sowing in dry and wet fields.

- Follow the movement like a walking seeder, a 3-wheel drive seeder, a 4-wheel self-propelled seeder.

- According to the distribution of seeds in the field: such as seed sprayers (broadcasting), row seeders and hill seeders. Row seeder and hill seeder include 6-rows, 8-rows, 16-rows seeder...

In addition, the distance between rows can be adjusted as required to suit the field size.

For details, refer to the document "Mechanization and Postharvest Management Support Sustainable and Low Emission Rice Production", Section 2.2.2, pp. 10-13.

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5. Alternating wet and dry (AWD) irrigation

- After sowing: Drain the water until it is completely dry, just keep the soil moist but not saturated, to avoid the young rice plants being killed by flooding.

- Stage from 7 - 10 days after sowing (DAS): Keep the field flooded 1-3 cm of water, then the first fertilizer application. Keep water in the field until the second fertilizer application (18 - 22 DAS) to suspend weed growth but avoid water levels higher than 3 cm at this stage to limit damage by snail.

- From the second fertilizer application to pre-flowering: Once the water level has dropped to 15 cm below the surface, re-flood the field to a depth of 5 cm above the surface, in order to limit the growth of ineffective shoots.

- From 7 days before flowering to 7 days after flowering: the field should remain flooded 5 cm of water and keep that water level continuously for 2 weeks.

- After flooding for 2 weeks: Continue to manage water level in the rice fields in the style of "AWD" is that the water level can drop to 15 cm below the surface before re-flooding.

- Before harvesting: Drain 5 to 7 days before harvest (for high fields), from 10 to 15 days (for lowland fields) to promote ripening, prevent excess nitrogen absorption and easy to apply mechanization in harvesting.

- To monitor the water level in the field can use PVC pipe, diameter 15 cm and 30. long cm. Around the plastic pipe, section 20 cm below the ground cut rows of small holes 0.5- 1cm in diameter (hole to hole is 5 cm). Plastic pipes are placed 20 cm under the ground. Take out all the soil inside the plastic pipe, the holes around the plastic pipe will make it easy for the water to come in and out, so the water level inside the pipe and outside the field is equal.

For details, refer to the document: "Good Practices for Rice Production in Vietnam", section IV-2, pp. 48-50.

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6. Principles of fertilizer application

Fertilize application according to the needs of rice plants in the main growth stages (tillering, panicle initiation) with the principle of "4 correct".

Depending on the cultivation conditions, the season, and the rice variety duration, the dose of fertilizer and the time of fertilizer application can be changed accordingly.

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+ Basal application: Organic fertilizers need to be applied soon after tilling. In addition, apply burnt lime with a suitable dose after the first tillage, depending on the acidity of the soil. For alkaline soils, after applying burnt lime, then basal application of all phosphate fertilizers when harrowing and transplant, to limit the fixation of phosphorus in the soil to help the roots develop better.

***Note**:*

- Seedlings be transplanted to fill out empty space (if any) before the 2nd fertilizer application for rice to grow more evenly.

- The amount of fertilizer should be calculated in accordance with the recommended formula as in the technical guideline or consulted with local technical staff.

7. Integrated Pest Management (IPM)

Integrated pest management helps reduce costs, reduce toxicity, pesticide residues in rice products, used straw and conserve biodiversity. IPM includes implementing both prevention and control measures throughout the season.

The main principles of IPM are:

- Integrated prevention by farming methods that combine natural biology such as crop rotation, correct water and nutrition management, flowerbed rice fields, etc. and physical or mechanical options such as tillage thoroughly, ...

- Check the field regularly, understand the growth and development of crops; Pest; weather, soil, water... to take timely measures.

- Use appropriate control measures depending on the level of pests and parasitic natural enemies at each stage.

- Control of pests/diseases: Prioritize the use of biological (such as bacteria/biological products) and mechanical methods such as mechanical weeding, to protect beneficial organisms. If using pesticides, use only those on the list of local permits.

For details, refer to the document: "Good Practices for Rice Production in Vietnam", section II-5.4, pp. 16-40.

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8. Harvest and postharvest technology

Harvest time is important to reduce losses in both quantity and quality. Paddy loss in the field can occur when the rice falls and is caused by pests such as birds, rodents and insects. Early harvesting or so-called young rice harvesting will lead to a higher percentage of suspended grains, reduced overall yield, increased grain breakage during milling, and affected grain quality. Late harvesting will increase the rate of field shedding and rice breakage during milling. Harvest time can also affect the viability of rice seeds in seed production.

The combine harvester combines cutting, threshing and cleaning into a one-time operation. The grain is temporarily stored on the combine harvester before being transferred to a container or bag. Proper use of combine harvesters can greatly reduce losses during and after harvest by avoiding losses during transport between different cutting and threshing stages as well as from late harvesting.

Please refer to the document for details "Mechanization and post-harvest management support sustainable and low-emission rice production", Section 3.1, pp. 15-17.

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9. Drying and storage

Drying is the process of reducing the moisture content of seeds, which is the most important step after harvesting, so slow drying or incomplete drying will reduce grain quality. Drying and storage should be considered as related activities and, in some cases, can be combined in milling plants. Storing seeds with high humidity will reduce quality.

Drying should begin as soon as possible after harvest because even short-term storage of seeds with high moisture content can reduce quality. The ideal drying process is within 12 - 24 hours after harvest. For good storage, drying must reach 12% MC for seed rice while drying must reach 14% MC for commercial rice.

Some popular and suitable drying technologies for Vietnam include:

- Re-circulating batch dryer: capacity 4 - 30 tons/batch. The drying air temperature is in the range of 42 - 45 ^{o}C for commercial rice drying and 40 - 42 ^{o}C for seed rice drying.

- Two-stage drying system: including fluidized bed drying and circulating tower drying, is suitable for industrial scale. Wet rice is dried by fluidized bed dryer in stage 1, usually to reduce 2 - 4% MC and clean seeds, then dried by the circulation tower in stage 2 until the required humidity is reached, meeting the storage standards.

Storage is a very important step to keep the quality of the rice grain and maintain a stable supply when the rice is produced seasonally. There are many storage methods such as ventilated warehouses, outdoor and indoor silos, cold storage, closed storage, etc.

For details, refer to the document "Mechanization and postharvest management support sustainable and low emission rice production", Section 3.2, pp. 18-24.

https://drive.google.com/file/d/1zq7EmFPqRHLyupixOsEaGA0uRIrQM1As/view?usp=sharing

10. Straw management

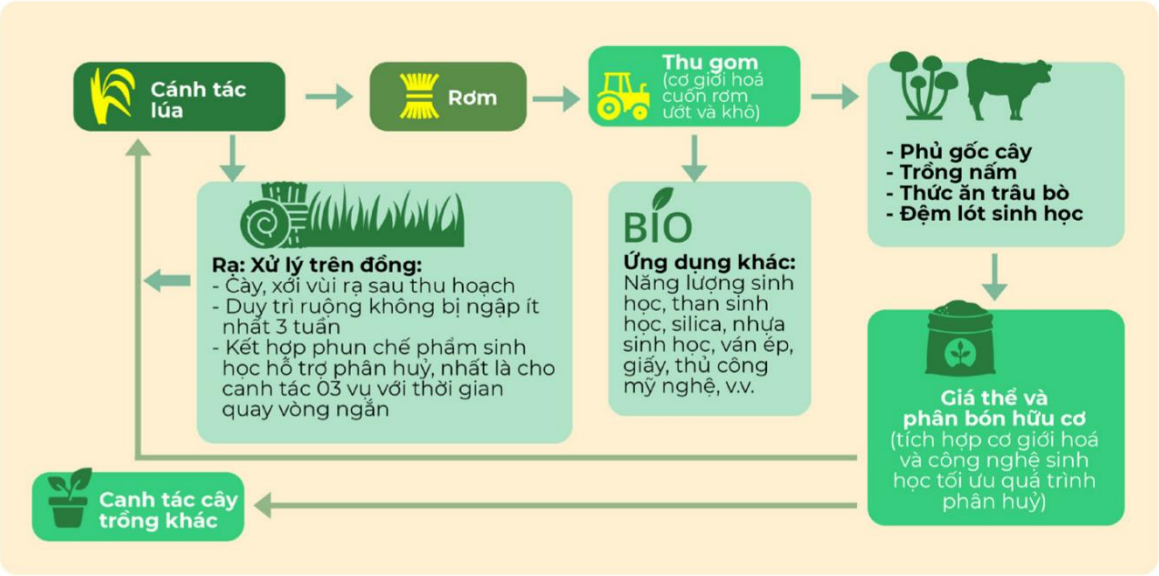
Managing straw in the direction of circular agriculture to make the most of organic matter and nutrients contained in straw, increase the value of straw, thereby avoiding open-field burning and straw incorporation in flooded fields, avoiding biodiversity loss, reduce environmental pollution, reduce greenhouse gas emissions and increase income for rice growers and related commercial and production services.

- Do not burn straw to avoid loss of organic matter and nutrients, reduce environmental pollution, maintain biodiversity and ensure sustainable standards in rice production.

- Do not incorporate raw rice straw in submerged fields to reduce CH_4 emissions.

- Collecting straw out of the field and using it to produce straw-based products such as straw mushrooms, animal feed, bio-fertilizer, biochar, increase income from straw by at least 5% and reduce gas emissions greenhouse at least 10% compared to traditional farming by burning straw or incorporating straw in flooded fields.

Maximize circulation of by-products in production, leaving only main products in agricultural production.



Solution of circular agriculture based on rice straw

For details, please refer to the document "Mechanization and Postharvest Management Support Sustainable and Low Emission Rice Production", Section 4, pp. 27-33.

https://drive.google.com/file/d/1zq7EmFPqRHLyupixOsEaGA0uRIrQM1As/view?usp=sharing

References:

1. Ministry of Agriculture and Rural Development (2016). *Manual for the application of water-saving management process for rice from Japan*. Ministry of Agriculture and Rural Development.

2. Ministry of Agriculture and Rural Development (2020). *On the continued implementation of the Integrated Pest Management Program (IPM) on key crops with high economic value and export potential*. Issued under Directive No. 8141 /CT-BNN-BVTV dated November 24, 2020 of the Minister of Agriculture and Rural Development

3. General Statistics Office (2018). *Results of the 2016 Rural, Agriculture and Fisheries Census*. Statistical publisher.

4. General Statistics Office (2021). *Statistical Yearbook 2021*. Statistical publisher.

5. Field Crops Research Institute (2010). Report on topics and topics: Studying *the impact of climatic factors on winter-spring rice production and solutions to ensure stable production of winter-spring rice season in the Red River Delta*. Field Crops Research Institute, Vietnam Academy of Agricultural Sciences.

6. Nguyen Tri Hoan, Nguyen Van Dung, Dang Thi Ha Giang, Dao Quang Nghi and Doan Thi Phi Yen (2021). *Technical manual of rice cultivation adapting to climate change, Hanoi, Agricultural Publishing House*.

7. Nguyen Huu Huan, Pham Sy Tan, Pham Van Du, Nguyen Van Nhiu, Pham Van Quynh, Tran Van Hai, Ho Van Chien, Le Van Thiet (2005). *Technical measures (three reductions, three increases) to increase the efficiency of high yielding rice in the Mekong Delta*. Issued under Decision No. 1579 QD/BNN-KHCN dated June 30, 2005 of the Minister of Agriculture and Rural Development

8. Nguyen Thi My Phung, Nguyen Van Hung, Alex Stuart, Grant Singleton, Martin Gummert, (2020). *Good practices for rice production in Vietnam.* https://drive.google.com/file/d/1EkEXqIiweOHW7MU8pId4NE99G7cYHiS_/view?usp=sharing .

9. Nguyen Van Hung, Nguyen Thanh Nghi, Nguyen Van Hieu, Tran Thi Cam Nhung, Carlito Balingbing, Joseph Sandro, Martin Gummert, Virender Kumar (2023). *Mechanization and post-harvest management support sustainable and low-emission rice production*.
https://drive.google.com/file/d/1zq7EmFPqRHLyupixOsEaGA0uRIrQM1As/view?usp=sharing

10. Phan Thi Thanh, Nguyen Trong Khanh, Duong Xuan Tu, Nguyen Van Khoi, Do The Hieu, Nguyen Thi Anh, Nguyen Thi Sen et al (2020). *Advanced farming techniques (Technical Package) improve rice production efficiency for the Red River Delta*. Issued under Decision No. 321/QD-TT-CLT dated 11 Dec 2020 of the Director of the Department of Crop Production, Ministry of Agriculture and Rural Development.

QUY TRÌNH
CANH TÁC LÚA GIẢM CHI PHÍ, NÂNG CAO HIỆU QUẢ, THÍCH ỨNG VỚI BIẾN ĐỔI KHÍ HẬU VÙNG ĐỒNG BẰNG SÔNG HỒNG

(Ban hành kèm theo Quyết định số 236/QĐ-TT-CLT ngày 30 tháng 6 năm 2023 của Cục trưởng Cục Trồng trọt)

A. GIỚI THIỆU CHUNG

Cục Trồng trọt phối hợp với Văn phòng Viện nghiên cứu Lúa Quốc tế (IRRI) tại Việt Nam xây dựng Quy trình này.

1. Căn cứ xây dựng

Quy trình được xây dựng dựa trên cơ sở:

- Quy trình kỹ thuật (Gói kỹ thuật) canh tác tiên tiến nâng cao hiệu quả sản xuất lúa cho vùng Đồng bằng sông Hồng (ĐBSH) theo Quyết định số 321/QĐ-TT-CLT ngày 11/12/2020 của Cục trưởng Cục Trồng trọt.

- Kết quả nghiên cứu mới trong sản xuất lúa (cơ giới hóa làm đất, gieo cấy, thu hoạch; tưới ướt khô xen kẽ và quản lý nước hợp lý; sử dụng phân bón hiệu quả, tăng sử dụng phân bón hữu cơ, tuần hoàn rơm rạ, phụ phẩm từ cây lúa; quản lý sức khỏe cây trồng tổng hợp,...).

- Ý kiến góp ý của các chuyên gia và Sở Nông nghiệp và Phát triển nông thôn các tỉnh ĐBSH.

2. Phạm vi áp dụng

- Các tỉnh sản xuất lúa vùng ĐBSH.

- Quy trình này là khung kỹ thuật, các tỉnh căn cứ điều kiện cụ thể của địa phương mình để xây dựng quy trình canh tác lúa phù hợp.

B. NỘI DUNG QUY TRÌNH

I. LÀM ĐẤT

1. Vụ Đông Xuân

a) Cày lật

- Đối với đất không trồng cây vụ Đông:

+ Cày lật đất sớm khi đất còn đủ ẩm, vùi cỏ dại, gốc rạ, phơi ải;

+ Đất ruộng trũng, thường xuyên ngập nước, thực hiện làm dầm, cày bừa sớm, ngâm dầm ngấu.

- Đối với đất có trồng cây vụ Đông: Cày lật phá luống ngay sau khi thu hoạch cây vụ Đông, cày sâu 15 - 20 cm sau đó lồng sơ bộ để vùi phụ phẩm.

b) Lồng bừa

- Tiến hành lồng bừa bằng máy kết hợp bộ phận trang đất trước khi cấy ít nhất 5 - 7 ngày.

- Để lắng bùn sau 1 ngày hoặc qua đêm với chân đất có thành phần cơ giới nặng rồi mới tiến hành gieo cấy. Với chân đất nhẹ cần tiến hành gieo cấy ngay sau khi lồng đất.