Manual of Good Agricultural Practices (GAP) for Lowland **Rice Production**

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Introduction

The Lao People's Democratic Republic (Laos), believed to be near the center of origin of "glutinous" or "waxy" rice, is home to a rich diversity of rice varieties. The country has the highest production and consumption of "glutinous" or waxy rice in the world (IRRI, 2014). One unique feature of the many traditional glutinous and non-glutinous varieties in the country is the aromatic character, which for many years, has been consciously as among the criteria used by the farmers to select the varieties that they grow and consume.

In recent years, there has been an increasing demand and growing market for special rice varieties in the global market. In addition to providing security for the domestic rice market, the government has set its vision of bringing the Laos rice to the global market in the next 5 to 10 years, as stated in the Development Strategy of the Crop Sector 2025 and Vision 2030. To achieve this vision, the government has adopted clean agriculture in at least 20% of the total cop planted area to produce priority crops, including rice, for food, agro-processing and commercialization as required by the local and international markets (MoAF, 2015).

Rice remains to be a major agricultural crop for the country and production has been increasing over the years. In 2018, according to USDA, the total rice production was 3.28 M mt from a total harvested area of 985, 000 ha (Rice Stat, 2018). The country registered a significant 1 M mt ton increase in its annual paddy production of 2.2 M mt from 855,000 ha. Growth in the harvested area is due to the increase in irrigated rice areas. By 2025, it is targeted that some 1.5 M mt of paddy will be produced for the international and local market for rice varieties such as Khao Kum (Black grained rice), Khao Kai Noi and jasmine rice. Improved rice varieties such as Tadokkam, Thasano, Phongam and other jasmine rice types will also be promoted. These varieties will be promoted to be grown in the seven main lowland areas , including the small and medium scale rice plains in Xayabouly and Luangnamtha, using Good Agriculture Practices.

Why Good Agricultural Practices (GAP)?

Good Agricultural Practices (GAP) are a set of principles, regulations and technical recommendations applicable to production, processing, and food transport, addressing human health care, environment protection, and improvement of worker conditions and their families (FAO, 2007). It codifies the suite of crop management practices that guides farmers to produce safe crops, and of high quality. GAP enables farmers to grow healthy and quality food for better nutrition and nourishment of their families, generate value-added in their products through better access to markets. Also, consumers will enjoy better quality and safe food, with sustainable production.

Adoption of GAP in farms will help farmers develop a production system that is sustainable and ecologically safe, produces harmless products of higher quality,

contributes to food security and better incomes through the access to markets, and a safer environment and working conditions for the producers and their families (Figure 1).

The rolling out of GAP will pave the way for the transformation of subsistence-based rice production to modernized, export-oriented rice production in the country.

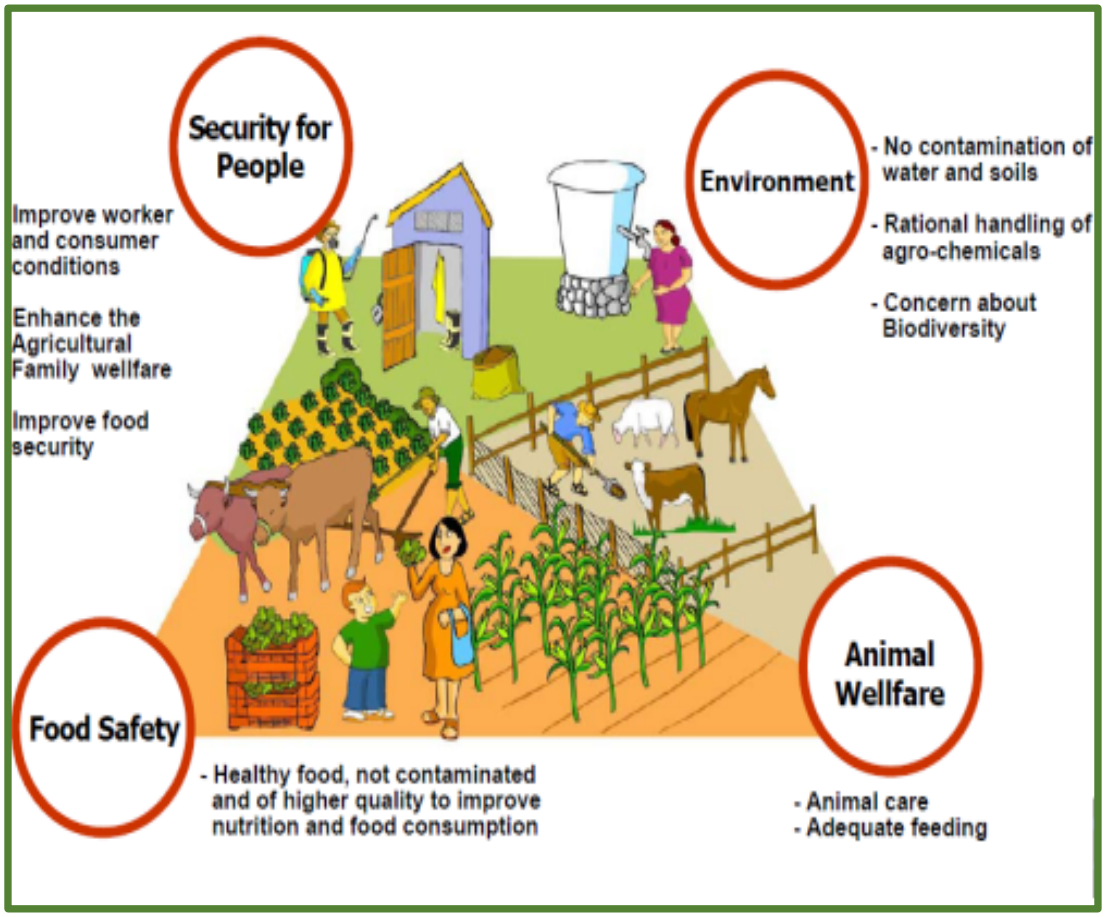

Figure 1. Benefits of GAP to farmers, farm animals, consumers, and the environment (Adapted from Departmental Program for Food and Nutritional Security, Colombia and FAO, 2007)

About the manual

The manual was prepared by the International Rice Research Institute (IRRI) and partners at the Ministry of Agriculture and Forestry (MoAF) through the Laos Agriculture Competitiveness Project (LACP), a collaboration between The government of Lao PDR, and The World Bank.

The purpose of this manual is to provide a reference for rice farmers and extension staff on the Good Agricultural Practices for Lowland Rice Production. This manual explains the step by step guide to lowland rice production focusing on the good practices covering pre-cropping management, in-field crop management, and post-harvest management and covers the four aspects of worker safety, food safety, product quality, and environmental management.

Pre-cropping management includes an assessment of the location of the rice field and adjoining sites for hazards and land-use history. The farm environment and structures are also examined to assess the soil status, water source, and quality and the status of the farm facilities used in rice production and storage.

Infield crop management includes good agricultural practices on variety selection and seed quality, land preparation, crop establishment, fertilizer management, water management, insect pest, rodent, disease and weed management and harvesting.

Post-harvest management includes paddy drying, cleaning, and storage.

Farm management includes GAP on worker's health and safety practices such as the provision of personal protective equipment and supplies for emergencies and minor accidents, training to improve skills of the farmer and workers on crop management, operation of farm tools, equipment, and machinery and personal hygiene practices. Documents and farm record keeping includes keeping the registry of the field and production sites for each variety, expense and income, farming practices as well as input use and application information for traceability, and health and training records of field workers and the farmer.

A dedicated section on review of practice is included to enable farmers to check which GAP was not implemented or adopted and plan the corrective actions for the next cropping season. This section will ensure that farmers regularly check on their practices and thus adhere to the GAP standards for rice production.

The annex section contains the information about sources of contamination of paddy, safe limits of metals and chemicals in the soil, water, and product as well as other forms and templates to be accomplished by the farmers as required for GAP compliance.

The Good Agricultural Practices are discussed for each of the 16 key areas. The key areas are grouped into four major sections:

1) Pre-crop Management

GAP 1 Farm location

GAP 2 Farm environment

GAP 3 - Farm structure and facility maintenance

2) In-field Crop Management

GAP 4 Variety and seed selection

GAP 5 Land preparation

GAP 6 Crop establishment

GAP 7 Fertilizer management

GAP 8 Water management

GAP 9 Insect pest, rodent, weed, and disease management

GAP 10 Harvesting

3) Post-harvest management

GAP 11 Drying, cleaning, and storage

4) Farm Management

GAP 12 Product traceability and recall

GAP 13 Worker's health and safety

GAP 14 Training

GAP 15 Documents and Farm Record Keeping

GAP 16 Review Practices

5) Summary of GAPs

6) Annexes

The manual contains information on the importance of the practices relative to other crop management operations and its effect on growth and yield. The good agricultural practices are mapped with the crop management areas, crop development stage and GAP areas such as food safety, environmental management, workers' health and safety and product quality.

A GAP check is also included for the key areas to enable farmers to check if they have adopted the recommended GAP or not. This checking allows the farmer to review what practices were or were not adopted, which he can correct in the following cropping season to comply with the GAP standards.

PRE-CROP MANAGEMENT

GAP 1. The location of the rice farm is far from the source of contaminants

Importance:

- Factories, mines, industrial centers and facilities, urban centers, and cemeteries, among others, are sources of contaminants in the field
- Contaminated fields pose health hazards to the farmer, field workers, and consumers

Good Agricultural Practices:

- The location of the field, adjoining sites, and farms is evaluated for its suitability to rice production.
- If the history of land use is not known, get secondary information from local land-use office, village heads, and others
- A farmer can be accompanied by a team of evaluators during the assessment

GAP Checks:

1.1 Factories, mines, landfills, industrial plants, cemeteries, other contaminating industries and urban areas are far from the location of the rice field. Farms located very near these areas may not be eligible for certification subject to the assessment of the evaluators (The ASEAN GAP, Thai and Philippines GAP did not set an arbitrary distance/km but if Laos GAP desires to set it, this can be decided by the MoAF officials in charge of GAP)

1.2 The field was not used for industries and facilities that can potentially leave contaminants in the soil

GAP 2. The farm is declared safe from contaminants

Importance:

- Safe food production begins with a field that is declared as safe from contaminants such as heavy metals, toxic chemicals, micro-organisms, and physical contaminants such as broken glasses, plastics, and others (See Table 1 for possible sources of contaminants)
- Uncontaminated field minimizes health hazards for farm workers and consumers

Good Agricultural Practices:

- Before planting, soil samples are taken from the field and subjected to laboratory analysis by government-accredited laboratories for heavy metals (Lead, Arsenic, Cadmium, Mercury, and Chromium)

and soil fertility status (pH, organic matter, phosphorus, potassium, zinc, sulfur).

- The soil analysis for nutrient status from an accredited laboratory or soil test kit will be used to generate fertilizer recommendations for rice.
- The water source for irrigation and other farm operations is identified
- The water is analyzed for possible contaminants. The baseline data shall be used as a basis for future analysis based on the presence of contaminants and hazards
- If contaminants are found, the farmer implements mitigating or preventive measures such as phytoremediation or the use of plants to chelate the heavy metals or remove the chemical contaminants

GAP Checks:

2.1 Heavy metals, chemical and biological contaminant levels found in the soil and water do not exceed the safety limits (See Table 2 for safety limits for heavy metals)

2.2 Soil and water analysis is done in accordance with the periods set by the government or GAP accreditation bodies

2.3 Farmer has provided mitigating measures if contaminants are observed

GAP 3. The farm facilities and structures are maintained in good condition and the farm is kept clean at all times

Importance:

- Clean farm and well-maintained farm facilities minimize hazards and provide a safe working place for the farmer and farmworkers

Good Agricultural Practices:

- Farm facilities and structures are constructed and designed to provide adequate protection to the farm equipment andmachinery supplies, and harvested grains
- All farm structures and facilities are cleaned regularly to minimize pests and maintain optimal conditions.
- All farm equipment and machinery are cleaned after use and checked regularly to ensure that these are in optimal running condition
- Sewerage and water systems, as well as waste disposal systems, are constructed to minimize the risk of contaminating the production area with hazardous chemicals and wastes
- Irrigation canals are regularly cleaned and maintained to ensure

effective delivery of water to the rice fields

- Livestock and other farm animals are prevented from entry to the rice fields.
- Animal and pest-proofing is done in storage facilities
- Toilets are provided for the workers, properly cleaned and maintained, and situated at a safe distance from the water sources and production and processing areas to avoid contamination of the produce

GAP Checks:

3.1 Farm facilities are clean and well maintained.

3.2 Farm supplies in stores are organized and labeled properly

3.3 Farm equipment and machinery maintenance registry indicate that these are in good running condition

3.4 Irrigation canals are free from trashes, weeds, and other materials that may block the water flow

3.5 No stray animals in the field and its surroundings while the crop is growing

3.6 No rodents and other pests are observed in the storehouses

IN-FIELD CROP MANAGEMENT

GAP 4. Select the right variety and plant good quality seeds

Importance:

- Good yields begin with high-quality seeds of rice varieties recommended for the area
- Recommended varieties have better yields and tolerance to biotic and abiotic stresses
- High-quality seeds produce vigorous seedlings and provide a good head start for the rice crop
- High-quality seeds reduce seeding rate
- High-quality seeds and recommended varieties provide stable and better yields

Good Agriculture Practices:

- Use rice varieties recommended for the area. These have better growth performance, stable yields and preferred by farmers and consumers
- Obtain high-quality seeds from accredited or reputable seed sources.
- Plant high-quality seeds (certified seeds) to ensure a good start for the rice crop. High-quality seeds have high varietal purity, few weed seeds, free from seed-borne diseases, full and uniform in size, and have greater than 85% germination

GAP Checks:

4.1 The variety is in the list of recommended rice varieties released by the government

4.2 The seeds are obtained from reputable seed source and with valid seed tags indicating seed class, moisture content, percentage germination, purity, weed seed content, red rice, and other inert materials

4.3 The variety selected has the desired characteristics such as suitability to the rice-growing environment, tolerance to abiotic and biotic stresses prevalent in the area, stable yields during the last 2 cropping seasons, and high market demand

GAP 5. Prepare the land properly

Importance:

- A well-prepared field is necessary to achieve good crop establishment and growth
- Good land preparation helps achieve the following:
    - efficient water management
    - better weed control
    - efficient fertilizer management
    - better crop establishment and more uniform seedling emergence in direct-seeded rice
    - uniform crop growth and maturity
    - efficient use of farm machineries

Good Agricultural Practices:

- Clean and repair the dikes or bunds before starting the land preparation. Maintain smaller bunds (no more than 30 cm width) to destroy or minimize rat burrows and prevent water loss through seepage
- Clean ditches to facilitate field draining of excess water
- Apply organic fertilizer to provide soil nutrients for the rice plants and to keep the soil healthy
- Provide sufficient time for land preparation to decompose weeds, rice stubbles, and straw. The time needed to sufficiently decompose the weeds and crop residues about three weeks
- Plow the field while it is still dry. Harrow the field twice with sufficient water then followed by leveling. Allow a one-week interval for each operation.
- The first harrowing should be along the plowing direction and the second harrowing is along the crosswise direction
- After the final harrowing, level the field using wooden planks or other suitable materials. There should be 5 cm water level in the field during leveling
- Ensure that there are no high and low spots in the field after the final leveling
- For direct-seeded rice, construct small canals at suitable intervals to provide a path for excess water

GAP Check:

5.1 Dikes/bunds and ditches are cleaned and repaired

5.2 Sufficient time was devoted to land preparation

5.3 Land leveling was performed at the last harrowing

5.4 There are no visible soil mounds above the water surface (2 – 5 cm water depth)

5.5 There are no weeds and undecomposed rice stubbles after land leveling

5.6 Small canals constructed in the field before direct seeding

GAP 6. Practice synchronous planting and use the recommended seeding rate

Importance:

- Synchronous planting facilitates efficient use of irrigation water and helps minimize pest and disease outbreaks
- Planting the recommended seeding rate helps farmers save on seed costs and helps achieve the optimum plant population
- Raising seedlings in well-prepared nursery beds results in healthy and vigorous rice plants
- Transplanting of vigorous seedlings results in better survival and uniform growth of rice plants

Good Agriculture Practices:

- Know the cropping calendar in the community
- Plant within the recommended planting period to synchronize with other farmers. All fields must be planted within 30 days
- Use the recommended seeding rate (60 kg for transplanted rice; 60 to 80 kg for direct-seeded rice
- Establish the crop as recommended:
    - For direct-seeded rice
        - Clean the seeds using the seed floatation method to discard any unfilled seeds
        - Pre-germinate the seeds before planting (24 hr soaking, 24 hr incubation) depending on the variety
        - Seeds are ready to sow when radicle emerges
        - Sow seeds in the well prepared and saturated field for better seedling establishment
    - For Transplanted rice
        - Prepare the seedbed area properly. Apply organic matter before land preparation. Weeds and crop residues should be properly decomposed or cleaned
        - Produce rice seedlings in seedbeds. Seedbeds are 1 to 2 m wide and length follows the length of the field. Seedbeds have a distance of 30 cm apart.
        - Sow pre-germinated seeds at 50 to 70 g/m2. Soak seeds for 24 hr and incubated for 24 to 48 hr depending on the variety and weather condition. Seeds are ready for sowing in the seedbed when the radicle has emerged.
        - Transplant 15 to 25 days old seedlings at 2-3 seedlings/hill. Plant spacing is at 20 x 20 cm or 25 x 25 cm depending on the soil fertility.
        - Replant missing hills within 7 days after transplanting

GAP Checks:

6.1 Followed the recommended seeding rate

6.2. Transplanted seedlings have 2-3 tillers/plant

6.3 Ensured establishment of 25 seedlings/m^2 for transplanted rice and 225-300 plants/m^2 for direct-seeded rice

6.4 Plants are healthy, have uniform leaf color and plant height, and have no pest and disease damage

GAP 7. Feed the rice plant with the right amount of fertilizer at the right time

Importance:

- Proper nutrition of the rice plant at tillering, early panicle initiation, and flowering stages ensure good crop growth and uniform panicle development
- Sufficient fertilizer application ensures attainment of the variety's yield potential
- Excessive fertilizer application increases the susceptibility of the crop to insect pests and diseases and results in lodging of rice plants. It also contributes to soil pollution

Good Agriculture Practices:

- Know the amount of fertilizer to be applied to the crop. Consult the extension staff for advice or use tools that will help generate the fertilizer recommendation for rice
- Apply decomposed organic fertilizers at 5-10 t/ha at one week before the first plowing.
-
- Apply fertilizer the right amount and type of fertilizer at the critical crop stages. Use Leaf Color Chart (LCC) to determine when to apply the top dress fertilizer.

    - For rainfed environment
        - Apply 150 kg of ammonium phosphate (16-20-0) and 50 kg of muriate if potash (0-0-60) as basal fertilizer at last harrowing. Incorporate the fertilizer with the soil
        - Apply 50 kg of urea (46-0-0) and 50 kg 16-20-0 at 25 DAT and another 50 kg at 45 DAT
        - Sow 10-20 kg/ha of green manure crop (legumes) after harvest

    - For irrigated environment

        - *Wet season crop*
        - Apply a mixture of 100 kg ammonium phosphate (16-20-0) and 50 kg muriate of potash (0-0-60) as basal at last harrowing. Incorporate the fertilizer with the soil
        - Apply 50 kg of ammonium phosphate (16-20-0) at 10 days after transplanting
        - Apply 50 kg of urea (46-0-0) at 25 DAT
        - Apply 50 kg of urea (46-0-0) at 45 DAT
        - Sow 10-20 kg/ha of green manure crop (legumes) after harvest

        - *Dry season crop*
        - Apply a mixture 100 kg 16-20-0 and 50 kg muriate of potash (0-0-60) as basal at last harrowing and incorporate fertilizer with the soil
        - Apply 50 kg of ammonium phosphate (16-20-0) at 10 DAT
        - Apply 100kg of urea (46-0-0) at 25 DAT
        - Apply 50 kg of urea (46-0-0) at 50 DAT

- Remove weeds before applying the fertilizers
- The field should have a 2-5 cm water level at the time of fertilizer application to minimize losses and for even distribution
- Observe the field regularly for signs of nutrient deficiency or toxicity (Refer to IRRI Rice Knowledge Bank and Rice Doctor (http://www.knowledgebank.irri.org/))
- Apply the fertilizer when the leaves are dry and during a cooler time of the day to avoid leaf burning and minimize nitrogen losses

- Use fertilizers bought from credible agricultural supply stores

GAP Checks:

7.1 Leaves have a uniform, green color and appear healthy

7.2. Plants have uniform growth

7.3 No visible symptom of nutrient deficiency or toxicity is exhibited by the plants

7.4 Achieved at least 300 panicles for transplanted rice and 350 panicles for direct-seeded rice per square meter

GAP 8. Apply the right volume of water when needed by the rice plant

Importance:

- Good water management promotes better nutrient uptake and better weed management.
- It also promotes uniform growth and maturity, and efficient farm operations
- Insufficient water results in drought stress and poor growth leading to low yields
- Excessive irrigation leads to more expenses for irrigation, nutrient imbalance, increases susceptibility to some diseases and plant lodging, and low yield
- Too much water in the field contributes to more greenhouse gas emissions

Good Agriculture Practices:

- Maintain the water level in the field as required at each stage of crop growth especially at flowering and grain filling. Achieve 2-3 cm water level at vegetative stage and 3-5 cm water until panicle initiation, and 5 cm water at flowering until the ripening stage *(Water level needs to be checked with the DOA BMP recommendation)*
- Excessive water application or drought stress is avoided at any crop stage to avoid negative effects on growth and yield
- Drain the water at 7-10 days before harvest
- Check for symptoms of drought stress or excessive irrigation water at the vegetative stage
- In areas with limited water, alternate wetting and drying (AWD) can be practiced with the aid of a field water tube. This practice saves water by as much as 30% without a yield penalty. To implement AWD, the following steps are done:
    - The field water tube can be made of bamboo, PVC pipes, or other indigenous materials
    - The bamboo or PVC pipe (at least 15 cm diameter) is cut into 40 cm length and marked at 20 cm from the bottom.
    - Holes are drilled in the tube at 20 cm from the bottom. The holes are 0.5 cm in diameter and spaced at 2 cm away from one another.
    - The tube with holes is buried into the soil up to 20 cm. The soil inside is removed until the bottom of the tube is seen. Allow the water to flow inside the tube.
    - Check that the water inside and outside the tube is of the same level

- The water level in the tube is measured and observed daily
- When the level of water in the tube reaches 15 cm below the soil surface, irrigation water is applied

GAP Checks:

8.1 No symptoms of drought stress are visible at vegetative, panicle initiation, flowering until ripening stage

- Check for visible symptoms of drought stress at the vegetative stage. Drought stress is happening if there are deep cracks in the soil for more than 3 consecutive days
  - Leaf rolling
  - Leaf tip drying
  - Stunted growth
- Check for visible symptoms of drought stress at panicle initiation, flowering to ripening
  - Leaf rolling
  - Leaf tip drying
  - Reduced panicle exsertion
  - Many unfilled spikelets

8.2 No visible symptoms of excessive water stress at vegetative stage

- Check for visible symptoms of excessive water stress at the vegetative stage
  - Reduced tillering (<10 tillers per hill)
  - Smaller leaf area
  - Roots are dark-colored. Normal roots are reddish-brown or lighter

GAP 9. Manage the pests and diseases to avoid significant yield loss

Importance:

- Weeds, insect pests, rodents snails, and diseases can cause significant yield loss if these are left uncontrolled. Early weed control is necessary to avoid competition from weeds and provide a good head start to the rice plants.
- Red rice and other variety mixtures can compete with rice and reduce the quality of milled rice. Hence, these need to be controlled as well.
- Knowing how rice interacts with weeds, insect pests, and diseases within the ecosystem help in making good pest management decisions
- Correctly identifying insect pests, weeds and diseases and the natural enemies helps in designing control strategies
- Integrated pest management helps farmers reduce pesticide use and sustain a healthy rice ecosystem
- Integrated Pest Management (IPM) helps farmers to produce safe rice

Good Agricultural Practices:

- Use recommended varieties with resistance to pests and diseases prevalent in the district
- Practice synchronous planting within the village to avoid the presence of crops at different stages. Rice growing at different stages creates continuous host and food supply for pests and diseases
- A minimum of 30-day rest or fallow period is observed in between cropping seasons to break the pest and disease cycle
- Conduct regular field monitoring to check for the presence of insect pests and diseases and natural enemies for timely pest management actions (See Table 3 and refer to IRRI Rice Knowledge Bank and Rice Doctor (http://www.knowledgebank.irri.org/))
- Conserve natural enemies by minimizing insecticide applications. Natural enemies help to keep insect pest populations from reaching damaging levels (See Table 4 and refer to IRRI Rice Knowledge Bank and Rice Doctor and http://www.knowledgebank.irri.org/)
- Practice preventive disease management and conduct monitoring at crtical crop stages to assess disease development (See Table 5). Practice field sanitation to eliminate weeds that serve as hosts of diseases
- Insecticide application is practiced as a corrective measure when other management options were not successful to bring population levels down. Spot application or selective deployment minimizes damage to natural enemies
- Do not apply any of the banned pesticides in Laos (see Table 6) or in the importing country
- Weed control is implemented during the first 0-45 days after crop establishment. A combination of weed management practices including field sanitation, good land preparation, use of high quality, weed-free seeds, water management, and spot weeding provide a good head start for the rice plants
- Practice roguing at maximum tillering, flowering stage, dough stage, and before harvest to remove red rice and other variety mixtures
- Practice timely integrated and sustained community-wide control for rodents
- If pesticides are applied, follow the recommended rate as indicated in the product label. Pesticide containers are disposed of properly and left-over chemicals are stored in an enclosed area.

GAP Checks:

9.1. Farmer practiced regular field monitoring of weeds, insect pests, diseases, and natural enemies as indicated in the calendar of farm activities

9.2 No application of banned pesticide in Laos and the importing country

9.3 Farmer practiced integrated pest management as indicated in the calendar of farm activities

9.4 Weed cover is observed in less than 5% of the area at 0-40 days after planting (DAP) for direct-seeded rice and in less than 10% of the area at 15-40 DAP for transplanted rice

9.5. Rat damage is observed in less than 5% of the area from maximum tillering to maturity

GAP 10. Harvest at the right time

Importance:

- Timely harvesting ensures high-quality rice that leads to higher marketability, price, and consumer acceptance
- Harvesting too early results in yield reduction and low milling recovery
- Harvesting too late results in yield reduction due to grain shattering and low head rice recovery

Good Agriculture Practices:

- Know the flowering date and record when plants reach 80% flowering. Harvest at 25-35 days after this period
- Drain the field 7-10 days before harvest
- Use mechanical harvesting such as rice combine, if available. Contact the service provider early to ensure that the harvester can service the rice at the scheduled date
- Ensure that the combine harvester is cleaned thoroughly before harvesting to minimize contamination of other varieties
- Complete the harvesting at the shortest possible time especially during the wet season. Ensure that the harvested rice is not contaminated with soil or mud
- If manual harvesting is done, avoid piling the harvested crop in the field for more than one day to prevent heat build-up which leads to grain discoloration and low-quality grains
- If a moisture meter is available, harvest the grains when the moisture content is at 18-21% in the dry season and 20-25 % in the wet season
- Thresh the harvested crop by variety. Ensure that the threshing machine is cleaned after each variety and the threshing area is thoroughly cleaned
- Haul the harvest immediately after threshing. The transport facility for the paddy rice should be clean and dry

GAP Checks:

10.1 Rice is harvested when most grains are golden yellow

10.2 Rice is threshed not later than one day after harvest in the wet season and not later than two days after harvest in the dry season

10.3 Harvesting and threshing is done separately for each variety.

POST-HARVEST MANAGEMENT

GAP 11. Dry, clean, and store the paddy properly

Importance:

- Proper drying, cleaning, and storing of grains help reduce post-harvest losses and maintains high grain quality.
- Proper post-harvest management prolongs storability of grains for milling or seeds
- High grain quality ensures better marketability, consumer acceptance, and higher price in the market

Good Agricultural Practices:

- Dry the paddy uniformly within 12-24 hours after harvest to achieve a 12-14% moisture content using mechanical dryers
    - If no mechanical dryer is available, sundry the paddy within 48 hours after harvest on clean, concrete pavements or suitable materials.
    - The paddy is stirred every 30 minutes to ensure uniform drying.
    - Avoid drenching the drying grains under the rain
- Place the dried paddy on pallets to avoid the damping of grains while waiting for the cleaning.
    - Line the pallets with plastic or sacks before the stacking the sacked paddy
    - If there is more than one variety, label the lot properly
    - Avoid mixing of the varieties in a lot
- Clean the dried grains 2-3 days after harvest to remove chaff, unfilled grains, straw, and other materials. If grain cleaner is used, regulate the speed to minimize losses. Clean the machine every after use to minimize contamination of other varieties (especially for seeds)
- If grains are not sold immediately, store the grains in a waterproof, pest-proof, and well-ventilated storehouse.
    - Sanitize and keep the storehouse safe from pests such as birds, rodents, and insects.
    - Arrange the pallets for easy stacking or retrieval of sacks in the paddy lot.
    - Paddy lots are labeled properly
    - Check the stored grains for heating by lifting the top bag and feeling the bags below for any increase in temperature
    - Inspect the bags regularly to check for damage by pests or moisture. Stained bag indicates re-wetting of the grains
    - Always keep the storage area clean
    - Do not store the paddy together with fertilizers and other agricultural chemicals

GAP Checks:

11.1 Paddy harvest is dried within 12-24 hours after harvest

11.2 Paddy in the store has 12-14% moisture content

11.3 No visible grain damage due to insect pests, rodents, birds, or moisture

11.4 No pests are seen in the storehouse.

11.5 Paddy lots are labeled and stacked properly

FARM MANAGEMENT

PRODUCT TRACEABILITY AND RECALL

GAP 12. Identify the production site and paddy lots and record paddy destination

Importance:

- Unsafe products pose health hazards to consumers
- An effective system of identifying, tracing, and recalling a product is needed to ensure that the produce can be recalled and the cause of contamination can be identified.
- Actions to eliminate the cause of contamination are implemented to prevent re-occurrence in the future

Good Agriculture Practice:

- Identify each production site by label or code
- Identify each paddy lot and provide information such as variety, date of harvest, production site or source, and destination
- Keep well maintained and updated record of farm operations
- Develop procedures for recall of produce and document investigation of the problem and corrective actions implemented

GAP Checks:

12.1 A registry of production sites, paddy lots with all the pertinent information is available and updated regularly

12.2 Farm records are available and updated regularly

12.3 Guide and procedures for product recall and investigation is available

12.4 When a product recall occurred, incident report and actions taken to correct the problem are documented

WORKER'S HEALTH AND SAFETY

GAP 13. Always ensure the safety and health of the farmer and workers

Importance:

- Healthy farmer and workers ensure timely and efficient implementation of farm operations
- Personal Protective Equipment (PPE) protects the farmer and workers from exposure to hazardous chemicals and other farm-related risks
- Well maintained equipment, tools, and machineries used during field operations reduce risks and hazards to the farmer and workers
- Training of farmers and workers on safe pesticide applications ensures compliance with pesticide application protocols.
- Training on the proper use of machineries, equipment, and tools ensures the safety of operators during farm operations
- Training of farmer and workers on personal hygiene practices minimizes contamination of produce and health risks to farmers, workers, and consumers

Good Agricultural Practices:

- Only trained workers apply pesticides or other chemicals on the farm
- Store pesticides and other hazardous chemicals properly in a well maintained, secure, lighted, and ventilated storehouse. Dispose of used containers properly
- Provide facilities and first aid measures to treat workers in case of emergency
- Toilets and wash areas available and well maintained
- Farmers and workers are trained on personal hygiene practices and safe handling of produce and farm machinery operation
- Maintain farm machineries, equipment, and tools regularly to ensure that these are in good working condition
- Only workers of legal age are employed in the farm
- PPEs are worn during application of pesticides and fertilizers and when operating farm machineries and equipment

GAP Checks:

13.1 Training on safe pesticide use, personal hygiene, and farm machinery and equipment operation are recorded and copies of certificates of training are compiled

13.2 Facilities and first aid kits are available

13.3 Toilets and wash areas are available and well maintained

13.4 Farm machinery and equipment maintenance registry is available

13.5 Storehouse of space for pesticides and other farm chemicals is well maintained

TRAINING

GAP 14. Improve your farming and your worker's skills through training

Importance:

- Training helps improve skills in farming and other farm operations which leads to better farming efficiency, higher productivity, safe crop production, better access to markets
- It helps in promoting worker's health and safety in the farm

Good Agriculture Practices:

- Attend trainings on rice production to learn about new technologies and practices that lead to more efficient use of inputs, better productivity, safe crop production, farm safety, and environmental sustainability
- Train workers to have appropriate knowledge and skills relevant to good agricultural practices in their assigned area such as safe pesticide use, farm machinery, and equipment operation, accident and emergency procedures, and personal hygiene
- Farmer and workers apply the skills and knowledge learned from trainings

GAP Checks:

14.1 Certificate of trainings are compiled

14.2 Record of training of the farmer and workers is available

14.3 Farmer and workers can demonstrate the skills and knowledge learned

FARM RECORD KEEPING AND DOCUMENTATION

GAP 15. Keep an updated record of farm operations and other information about the farm

Importance

- Farm record keeping enables farmers to keep track of activities, farm inputs and labor used and crops harvested, stored and delivered paddy for milling
- It enables farmers to review and determine if they adopted the good agriculture practices for each farm operation
- It also enables the farmer to determine possible causes of paddy contamination, if this is detected in the field or the paddy
- Keeping all important documents related to the farm in an organized manner helps in locating these when needed
- Recording all activities, inputs, outputs, and other information related to the farm and farming practices soon after implementation or application minimizes errors

Good Agriculture Practices

- Always keep an organized and updated recording of farm activities, inputs, harvests, stored and withdrawn paddy and its destination
- Organize all farm-related documents in folders or envelopes and stored in a safe place
- Keep a record of good agricultural practices for a minimum period of 2 years or longer depending on the requirements of the GAP certifying office of the government
- Keep a record of findings of deficiencies or non-compliance in food safety, environmental management, worker's safety, and product quality and corrective actions implemented
- Discard out of date documents. Keep and use only current versions

GAP Check

14.1 Farm practices are recorded and updated

14.2 Farm records and documents are organized and kept in a safe place

14.3 Only current versions of documents and GAP are kept and used in the farm

GAP 16. Review farm practices after each cropping season

Importance:

- Reviewing practices at the end of each cropping season ensures that these are done correctly, helps in correcting identified deficiencies or if changes occur in government regulations
- Reviewing of farming practices helps farmers comply with the GAP certification requirements

Good Agricultural Practices:

- Review farming practices after each cropping season to check if these are done correctly and to correct deficiencies or if there are updates in government regulations
- Keep a record of review events and any corrective actions taken to correct deficiencies or complaints
- Take action to correct complaints or deficiencies related to food safety, environmental management, worker health and safety, and product quality

GAP Checks:

15.1 Records of review events of farming practices and corrective actions taken are available

15.2 Record of complaints or deficiencies related to food safety, environmental management, worker health and safety, and product quality and corrective actions taken to resolve these are available

SUMMARY OF THE GOOD AGRICULTURAL PRACTICES

Mapping of the 16 Good Agricultural Practices with the crop management areas, crop development stages and GAP areas

Crop Management Areas	Crop Development Stage							Good Agricultural Practice (GAP)	Mapping with key GAP Areas*
	Pre-Crop	Land Preparation to Crop establishment	Seedling to Mid-tillering	Maximum Tillering to Panicle Initiation	Flowering to Grain filling	Maturity to Harvest	Post-harvest		
Pre-crop management									
1. Farm Location								GAP 1- Location of the farm is far from sources of contaminants	1, 2, 3, 4
2. Farm Environment								GAP 2- The farm is declared safe from contaminants	1, 2, 3, 4
3. Farm structures and facilities maintenance								GAP 3- Farm facilities and structures are maintained in good condition and the farm is kept clean at all times	1, 2, 3, 4
In-field Crop Management									
4. Variety and seed selection								GAP 4- Select the right variety and plant good quality seeds	1, 4
5. Land preparation								GAP-5 Prepare the land properly	1, 4
6. Crop establishment								GAP-6 Practice synchronous planting and use the recommended seeding rate	1, 4
7. Fertilizer Management								GAP-7 Feed the rice palnt with the right amount at the right time	1, 2, 4
8. Water Management								GAP 8- Apply the right amount of water when needed by the rice plant	1,2, 4
9. Insect pest, rodent, weed and disease management								GAP-9 Manage pests and diseases to avoid significant yield loss	1, 2, 3, 4
10. Harvesting								GAP 10- Harvest at the right time	1, 4

Post-harvest Management									
11. Drying, cleaning and storage								GAP 11- Dry, clean and store the paddy properly	1, 4
Farm Management									
12. Product traceability and recall								GAP 12 - Identify the production site and paddy lots and record paddy destination	1, 4
13. Worker's health and safety								GAP 13- Always ensure the safety and health of the farmer and workers	1, 3, 4
14. Training								GAP 14 Improve your farming anf your worker's skills through training	1, 2, 3, 4
15. Farm record keeping and documenta-tion								Keep an updated record of farm operations and other information about the farm	1, 2, 3, 4
16. Review Practices								Review farm practices after each cropping season	1, 2, 3, 4

*GAP Areas: 1- Food safety ; 2 - Environmental management; 3 – Worker's health and safety; 4: Product quality

References:

ASEAN Australia Development Cooperation Program. 2006. Good Agricultural Practices for Production of Fresh Fruit and vegetables in the ASEAN Region. 32 p.

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Shepard, BM. AT Barrion and JA Litsinger. 1987. Helpful insects, spiders and pathogens. International Rice Research Institute. 138 p.

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Table 1: Common sources of chemical hazards and natural toxins (Adapted from ASEAN-Australia Development Cooperation Program. 2006. Good Agricultural Practices for Production of Fresh Fruit and vegetables in the ASEAN Region – Food Safety Module. 69 p.)

Chemical Hazard	Sources of Contamination
Agrochemical residues in paddy exceeding maximum residue limits (MRL)	• Agrochemical residues in paddy exceeding maximum residue limits. See Pesticide MRL Online database* • Agro-chemicals not registered for rice (zero MRL) • Failure to follow label instructions resulting in incorrect mixing and the concentration being higher than the recommended rate • Withholding period not observed • Spraying equipment is faulty or not calibrated correctly or not cleaned properly after the last use or used for multiple purposes • Spray drift from adjacent plots • Chemical residue from soil from previous use • Chemical residue in sacks or other harvest containers • Improper dumping, accidental spillage, or seepage of chemicals into soil or water sources due to poor storage conditions • Improper disposal of containers in the field or irrigation canals
Non-agrochemical contaminants (fuel, lubricants, cleaners, sanitizers, chemicals to control pests such as rodents)	• An inappropriate chemical used for cleaning or sanitizing equipment or used at the wrong dosage • Inappropriate application of chemicals – for example, chemicals sprayed near paddy lots in storage areas) • A chemical spill in paddy or cross-contamination of chemical in transport or storage • Oil leaks, grease, paint on equipment in contact with paddy • Soil contaminated with persistent chemicals from war activities
Heavy metal residues exceeding maximum limits	• High levels of heavy metals present in the soil, whether occurring naturally or from previous use or from leakage from industrial sites • Continued use of fertilizers with heavy metals • Development of soil conditions conducive to uptake of heavy metals by crops- for (example acidity, salinity, zinc)
Natural plant toxins	• Unsuitable drying and storage practices, for example, Aflatoxin (*Aspergillus flavus*) and other mycotoxins
Allergenic agents	• Traces of chemicals that cause an allergic reaction in susceptible consumers (?)

* http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/

Table 2. WHO permissible limits for heavy metals on plants and soil

Elements	*Target value of soil (mg/kg)	***Permissible value of plant (mg/kg)
Cd	0.8	0.02
Zn	50	0.60
Cu	36	10
Cr	100	1.30
Pb	85	2
Ni	35	10

*Target values are specified to indicate desirable maximum levels of elements in unpolluted soils
Source: Denneman and Robberse 1990; Ministry of Housing, Netherlands 1994
***Source: WHO (1996)

https://www.omicsonline.org/articles-images/2161-0525-5-334-t011.html

Table 3. Major insect pests, critical levels and management actions at each crop development stage (Source: PhilRice Palay Check, 2020)

Insect Pest	Seedling	Tillering	Panicle Initiation	Heading/Flowering	Ripening/Maturity
1. Stemborer	Destroy egg masses Critical level for yield loss = > 5 egg mass/m2	Manual egg collection Critical level for yield loss = >1 egg mass/m2 ▶ Collect egg mass and let the egg hatch. If more parasitoids emerge than larvae, no action is required <30% deadheart, no action needed >30%, control action required ▶ Maintain at least 1 cm water and apply 10 kg N/ha then maintain water at saturation to enhance tillering ▶ No action at panicle initiation		No intervention needed Too late for chemical control Critical level for yield loss =>20 white head/m2 ▶ Plow under stubbles and rice straw	
2. Leaf hoppers (Green leaf hoppers, brown plant hoppers, zigzag leaf hoppers, whitebacked planthoppers)	Observe for green leaf hoppers and tungro incidence	No intervention needed if no disease is observed even if there are nymphs and adults are observed BPH critical level for yield loss = ≥25 nymphs and adults/hill		No intervention needed even if nymphs and adults are observed BPH critical level for yield loss = ≥50 nymphs and adults/hill	
3. Rice hispa	Low to moderate infestation can be tolerated by rice Natural enemies help control rice hispa				

	Critical level for yield loss = >2 adults/seedbed				
3. Rice bug				Critical level for yield loss = 5-10 nymphs and adults/m2 Use baits (rotten snails, crabs or shrimps) to trap rice bug population	

Table 4. List of insect pests and their corresponding natural enemies at various growth stages (Source: Shepard et. al., 1987)

Insect Pest	Stage Attacked			
1. Stem borer	Egg	Larvae	Pupa	Adult
Parasitoids	Tetrastichus (wasp) Trichogramma (wasp) Telenomus (wasp)	Temelucha Stenobracon Bracon Charops wasp	Tetrastichus (wasp)	
Predators	Conocephalus	Lycosa Micraspis Opionea Ants Microvelia Mesovelia Limnogonus	Lycosa	Lycosa (wolf spider) Oxyopes (Lynx spider)
2. Leaf hoppers and lant hopper	Egg	Nymph		Adult
Parasitoids	Oligosita Anogrus	Pseuduogonatapus Cyrtorhinus Lycosa Microvelia Synharmoni Paederus		Pseuduogonatapus Cyrtorhinus Lycosa Microvelia Synharmoni Paederus
Predators	Cyrtorhinus			
3. Leaf folder	Egg	Larvae	Pupa	Adults
Parasitoids	Cobidosopomopsis Trichogramma	Temelucha Cotesia Trichogramma	Tetrastichus Xantopimpla Trichomma	
Predators	Conocephalus Cyrtorhinus Micraspis	Lycosa Micraspis Opionea Ants Water bugs		
4. Rice Hispa	Egg	Larvae		Adults
Parasitoids	Leuchnomid wasps Trichogramma	Brachonids		
Predators				

5. Rice bugs	Egg	Larvae		Adults
Parasitoids				
Predators	Solenopsis (fire ants)			Solenopsis (fire ants)

Table 5. Major diseases associated with significant yield loss (for 120-day variety) Source: PhilRice Palay Check, 2020)

Growth Stage	Rice blast (leaf, neck, panicle)	Sheath blight	Bacterial leaf blight	Other Diseases
Nursery	≥20% of seedbed with leaf blast	None to negligible	Negligible	
Seedbed				
Mid to maximum tillering/Panicle initiation	≥30% of field with leaf blast	≥40% of filed with leaf blast	≥30% of field with BLB and undeveloped spikelets	
Flowering	≥10% of filed with neck blast		≥30% of field with BLB on flag leaf	
Milk	≥10% of field with panicle balst		≥30% of field with BLB and unfilled spikelets	
Grain filling		≥40% of field with SB and >10 of unfilled grains		
Maturity				

Table 6. List of banned pesticides in Laos

No.	Insecticides and Acaricides	Fungicides	Rodenticides	Herbicides	Fumigants	Others
1	Aldrin	Binapacryl	Chlorobenzilate	2,4 5 T	EDB	Arsenic compound
2.	BHC	Captaphol	Sodium fluoacetate	Dinozeb	Ethylene dioxide	Calcium arsenate - insecticide, herbicide, rodenticide, molluscicide
3.	Chlordane	Cyclohexamide		Dinozeb acetate/ Dinitrobutyphenol	Methyl bromide	DBCP- nematodicide
4.	Chlordimeform	Mercury and Mercury compounds		Paraquat		Dimniocide- plant growth regulator
5.	Chlorfenvinphos	MEMC		Sodium chlorate		Fluoroacetamide- insecticide, rodenticide
6.	Chlorthiphos	PMA				Oxamyl – insecticide, acaricide, termiticide
7.	Cyhexatine	Selenium compound				Phosphamidon- insecticide, nematodicide
8.	DDT					Sodium arsenite – insecticide, fungicide, herbicide, rodenticide
9.	Dieldrin					Thallium- sulfate – rodenticide, insecticide
10.	Dimefox					
11.	Dinitrocresol					
12.	Demeton					
13.	Endrin					
14.	Endosulfan					
15.	Ehtyl parathion					
16.	EPN					
17.	Heptachlor					

18.	Hexacholoro cyclohexane					
19.	Leptophos					
20.	Lindane					
21.	Methamidophos					
22.	Methomyl					
23.	Methy; parathion					
24.	Monocrotophos					
25.	Pholychlor-camphene					
26.	Phorate					
27.	Schradan					
28.	TEPP					
29.	Toxaphene					

FARM RECORD OF PRACTICES

Farm Record 1: Farmer and Farm Details

Field No:	Production year:	Cropping Season:	Area (hectare):
Farmer Identification No:		Plot No:	
1. General Information on the Farm Owner			
Name of Farmer :	Surname:	First Name:	
Home Address:			
Telephone:	Email Address:		
2. Farm Address:			
3. Farm Map:			

4. History of farm use for the past three years		
Year 1:	Crop:	Variety:
Year 2:	Crop:	Variety:
Year 3:	Crop:	Vareity:
5. Water Source:	1 – rain 2- irrigation system 3 – underground water	4 – pond 5 – river, creek, spring
Paddy site 1		
Paddy site 2		
Paddy site 3		
Paddy site 4		
6. Soil type:	1 – clay 2 – loamy	3- sandy loam 4 - sandy
Paddy site 1		

Paddy site 2		
Paddy site 3		
Paddy site 4		

Farm Record 2: Crop Management Practices

A. Variety and Seed Source

Paddy Site No.	Area (ha)	Variety	Seed source	Total seed used (kg)	Seeding rate (Kg/ha)	Cost of seeds

B. Land Preparation

1. Soil Type

1 - clay	2 - loamy	3 – sandy loam	4 - sandy	5 – others (specificy)

2. Land preparation equipment

1 - Machine	2 - Animal	3 – others specify

3. Land preparation period

1 – 2 weeks	2 - 1 week	3 -less than 1 week	4 – 1 day (plow, harrow, level in 1 day)	4 – no tillage

4. Land preparation practice

Activity	Date of activity	Describe practice	Number of hours used	Cost of labor
First plowing				
Second plowing				
First Harrowing				
Second harrowing				
Leveling				
Other operations				

C. Crop establishment

Paddy Site No.	Area (hectare/rai)	Variety	Planting method 1- tranpslanted 2 – wet direct seeded 3 – dry seeded	Date of Planting	Plant spacing (for transplanted only)	Hours used	Cost of labor

D. Fertilizer management

Application	Type of fertilizer/formulation	Source 1 – purchased 2 – own produce	Application time (DAT/DAS)	Application date (dd/mm/yr)	Total fertilizer applied for the whole farm (bags)	Fertilizer applied per hectare (bag/ha)	Cost of products	Operator	Number of hours worked	Cost of labor
	1. Chemical fertilizer									
First application										
Second application										
Third										

application										
	2. Organic fertilizer									
First application										
	3. Foliar fertilizer									
First application										
Second application										
Third application										
	4. Others (Pls specify)									
First application										
Second application										

E. Pest Management

1. Weed Control Practices

a. Handweeding

Activity	Date of handweeding	Crop stage/ DAS/DAT	Number of weeders	Number of hours weeding	Cost of labor
First handweeding					
Second handweeding					
Third handweeding					

b. Rotary weeding

Activity	Date of Rotary weeding	Crop stage/ DAS/DAT	Number of operators	Operator Names	Number of hours weeding	Cost of labor
First						
Second						
Third						

c. Herbicide application

Activity	Herbicide Name	Formulation	Source/ supplier	Target weeds	Time of Application (DAS/DAT)	Date of Application (dd/mm/yy)	Total amount applied (L or kg) in the field	Amount applied/ha (L of kg)	Cost of labor	Hours used	Operator name	Personal Protective equipment Use 1 – yes 2 - No
First application												
Second application												
Third application												

d. Rouguing (Off types and red rice)

Activity	Off type and/or red rice Density/m^2	Date of handweeding	Crop stage/ DAS/DAT	Number of weeders	Hours used	Cost of labor
First handweeding						
Second handweeding						
Third handweeding						

2. Insect Pest Management

a. Insect Pest Monitoring and Conservation of Natural Enemies

Monitoring Activity	Time of Monitoring (DAT/DAS)	Date of Monitoring (dd/mm/yy)	Natural enemies observed (Number/10 sweeps)	Insect Pests (Number/10 sweeps)	Management Action 1 – do nothing, many natural enemies 2 – spray insecticide 3 – others, specify	Hours used
First						
Second						
Third						

Fourth						

Low =

Medium =

High =

b. Insecticide Application

Activity	Insecticide Name	Formulation	Source/supplier	Target insects	Time of Application (DAS/DAT)	Date of Application (dd/mm/yy)	Total amount applied (L/kg) in the field	Amount applied/ha (L/kg)	Cost of products	Cost of labor	Hours used	Operator name	Personal Protective equipment Use 1 – yes 2 - No
First application													
Second application													
Third application													

c. Other Management Practices

Management Practices	Target insects	Time of Application (DAS/DAT)	Date of Application (dd/mm/yy)	Description of the Practice	Hours used

3. Disease Management

a. Disease monitoring

Monitoring Activity	Time of Monitoring (DAT/DAS)	Date of Monitoring (dd/mm/yy)	Disease Observed	Disease incidence level 1- low 2 – medium 3 – high* (see formula below)	Management Action 1 – do nothing 2 – spray fungicide 3 – others, specify
First			1.		
			2.		
			3.		
			4.		
			5.		
Second					
Third					
Fourth					

*Refer to Nancy Castilla

Low =

Medium =

High =

Disease incidence (%)= number of plants infected/ Total number of plants assessed x 100

b. Fungicide Application

Activity	Fungicide Name	Formulation	Source/supplier	Target Disease	Time of Application (DAS/DAT)	Date of Application (dd/mm/yy)	Total amount applied (L/kg) in the field	Amount applied/ha (L/kg)	Cost of products	Cost of labor	Hours used	Operator name	Personal Protective equipment Use 1 – yes 2 - No
First application													
Second application													
Third application													

4. Other Pests (Omit if none is observed in the field) * To be verified as to standard

a. Monitoring

Monitoring Activity	Time of Monitoring (DAT/DAS)	Date of Monitoring (dd/mm/yy)	Pest Observed	Pest Incidicence* 1- low 2 – medium 3 – high*	Management Action 1 – do nothing, 2 – apply chemicals 3 – others, specify
First			1.		
			2.		
			3.		
			4.		

			5.		
Second					
Third					
Fourth					

b. Pesticide Application for Other Pests

Pest Observed	Chemical Name	Formulation	Source/supplier	Time of Application (DAS/DAT)	Date of Application (dd/mm/yy)	Total amount applied (L/kg) in the field	Amount applied/ha (L/kg)	Cost of products	Hours used	Cost of labor	Operator name	Personal Protective equipment Use 1 – yes 2 - No
1. Rodents												
2. Birds												
3. Golden applie snail												
4.												

5. Harvesting and Threshing Practices

a. Manual Harvesting and Threshing

Practice	Field Observation	Monitoring Date (DAS/DAT)/dd/mm/yr	Hours used	Cost
Crop maturity	1 – 80-85% of grains mature 2 – <80-85% of grains mature 3 – grains overmature			
Water drainage	1 – water drained 10-15 days before harvest 2 – water drained <10-15 days before harvest 3- No draining done			
Harvesting condition	1 – Dry field 2 – Wet field			
Field drying/stacking	1 – 1 day 2 – 2 days 3 - ≥ 3 days			
Threshing	1 – Manual 2 – Animal 3 - Thresher			
Total harvest				
Shared to Harvesters/Threshers)				
Net Harvest				
Harvest sold in the field (tons)				

b. Machine Harvesting

Practice	Field Observation	Monitoring Date (DAS/DAT)/dd/mm/yr	Hours used	Cost
Crop maturity	1 – 80-85% of grains mature 2 – <80-85% of grains mature 3 – grains overmature			
Water drainage	1 – water drained 10-15 days before harvest 2 – water drained <10-15 days before harvest 3- No draining done			
Harvesting condition	1 – Dry field 2 – Wet field			
Total Harvest (tons)				
Harvesting Fee (kg)				
Net harvest (tons)				
Harvest sold in the field (tons)				

FORM 3. Post-harvest Management Practices

6. Drying and Cleaning

Practice	Field Observation	Monitoring Date (DAS/DAT)/dd/mm/yr	Operator	Hours used	Cost
Drying	1 – sun dried in pavement 2 – sundried in mats 3 – mechanical dried				
Drying condition	1- sunny 2- cloudy 3 - rainy				
Frequency of turning /mixing of grains					
Thickness of grains (cm) in the drying pavement					
Drying duration (days/hours)					
Material to cover the grains (if left in the pavement at night					
Cleaning of drying machine	Name of last variety dried in the machine: Was the dryer cleaned before drying the next batch? 1 – Yes 2 – No 3 – Don't know Operator Name:				
Paddy Cleaning	1 – manual 2 – Machine 3 – no cleaning				
Machine Cleaning	Name of last variety cleaned in the machine: Was the machine cleaned before the next batch ? 1 – Yes 2 – No 3 – Don't know Operator Name:				

7. Storage (Omit this section if paddy is sold wet)

a. Monitoring

Plot Number/Paddy lot Number	Location of Paddy Store	**No. of bags/paddy lot**	**Total weight (tons)**	Packaging material	Stacking of Paddy Lots 1- stacked in pallets 2 – stacked without pallets or lining material 3- stacked using other floor lining material	Condition of stored paddy 1- visible damage due to pests and moisture 2 – no visible damage	Condition of store house 1 – well maintained, clean and ventilated 2- not well maintained, unclean and poorly ventilated	Date of Monitoring

b. Storage Pest Control Practices

Pest Observed	Chemical Name	Formulation	Source/ supplier	Time of Application (DAS/DAT)	Date of Application (dd/mm/yy)	Amount applied/ha (L/kg)	Operator name	Personal Protective equipment Use 1 – yes 2 - No
1. Rodents								
2. Birds								
3. Insects								
4.								

c. Other Storage Pest Management Practices

Target Pest	Date of Application (dd/mm/yy)	Description of the Practice
1. Rodents		
2. Birds		
3. Insects		

8. Source of Produce

Plot No./Paddy Lot no.	Rice Variety	Weight (kg)	Harvesting date	Farm Owner	Address

Name of Recorder:	Date