

ISSN 0117-9799

#99

# RICE 2022 TECHNOLOGY BULLETIN

DA-PHILIPPINE RICE RESEARCH INSTITUTE



**Best Management Practices for  
Reduced Postharvest Losses and  
Improved Rice Product Quality**

# Rice Technology Bulletin Series

- 1 Released Rice Varieties (1968-1994)
- 2 Pagpaparami at Pagpupuro ng Binhi sa Sariling Bukid (1<sup>st</sup> Edition)
- 3 Paggawa ng Maligaya Rice Hull Stove
- 4 PhilRice Micromill
- 5 PhilRice Flourmill
- 6 PhilRice Drumseeder
- 7 PhilRice Rototiller
- 8 Rice Food Products
- 9 PhilRice-UAF Batch Dryer
- 10 Integrated Management of the Malayan Black Bug
- 11 SG800 Rice Stripper-Harvester
- 12 Dry-Seeded Rice-Based Cropping Technologies
- 13 Maligaya Rice Hull Stove
- 14 10 Steps in Compost Production
- 15 Rice Tungro Virus Disease
- 16 The Philippine Rice Seed Industry and The National Rice Seed Production Network
- 17 10 Hakbang sa Paggawa ng Kompost
- 18 10 nga Addang ti Panagaramid iti Kompost
- 19 Characteristics of Popular Philippine Rice Varieties
- 20 Rice Stem Borers in the Philippines
- 21 Rice Food Products (revised edition)
- 22 Leaf Color Chart (English)
- 23 Leaf Color Chart (Ilocano)
- 24 Leaf Color Chart (Pilipino)
- 25 Equipment for Rice Production and Processing
- 26 Use of 40kg Certified Seeds per Hectare
- 27 Rice Wine
- 28 Management of Field Rats
- 29 Controlled Irrigation: Saving water while having good yield
- 30 Minus-one Element Technique: Soil Nutrition Deficiency Test Made Easy
- 31 Management of the Rice Black Bug
- 32 Management of Zinc-deficient Soils
- 33 Management Options for Golden Apple Snail
- 34 Use of Evaporation Suppressant
- 35 Pagpaparami ng Purong Binhi ng Palay (2<sup>nd</sup> Edition)
- 36 Management of Sulfur- Deficient Lowland Rice Soils
- 37 Management of Planthoppers and Leafhoppers
- 38 Management Options for Ricefield Weeds
- 39 Use of Indigo as Green Manure
- 40 Management of Salt-affected Soils for Rice Production
- 41 Wet-Seeded Rice Production
- 42 Matatag Lines
- 43 Hybrid Rice Seed Production
- 44 Metarhizium anisopliae: Microbial Control Agent for Rice Black Bug
- 45 Integrated Nutrient Management for Rice Production
- 46 Management of Armyworms/Cutworms
- 47 Carbonized Rice Hull
- 48 Rice-based Microbial Inoculant
- 49 Integrated Farm and Household Wast Management
- 50 Rice Postproduction Practices
- 51 Ecological Rice Farming
- 52 Modified Dry Direct Seeding Technology
- 53 Palayamanan: Making the Most out of Rice Farms
- 54 Practical Guidelines in Predicting Soil Fertility Status of Lowland Rice Soils
- 55 Bakanae: The Foolish Disease of Rice
- 56 Management of Rice Blast Disease
- 57 Root-knot Management in Rice-Onion Cropping System
- 58 Management of Yellow and White Stem borers
- 59 The PhilRice Dapog Technology
- 60 Rice Straw-Based Nutrient Management in Irrigated Lowland Rice
- 61 Biofertilizer Production: Vesicular Arbuscular Mycorrhizae (VAM)
- 62 Trichoderma: Biofungicide for vegetables
- 63 Barayti ng Palay handog ng PhilRice 2007-2009
- 64 Management of Zinc-deficient Soils (revised edition)
- 65 Soil Series: Improving Agricultural Productivity in Pampanga
- 66 Soil Series: Improving Productivity in Tarlac
- 67 Laboy tiller: Improving deep muddy and swampy rice lands
- 68 B&S Rice mini-combine harvester
- 69 Rice Disease Diagnostic Kit
- 70 Reducing Methane Emissions from Irrigated Ricefields
- 71 Rice Hull Gasifier Engine-Pump System
- 72 Kontroladong Pagpapatubig
- 73 Saclob: Airtight Storage for Rice Seeds
- 74 No Tillage Technology in Irrigated Rice Production
- 75 Mangement of Yellow and White Stem borer (2011)
- 76 Management Options for Ricefield Weeds (2011)
- 77 Management of Salt-Affected Soils
- 78 Pangangasiwa ng Dilaw at Puting Aksip
- 79 Metarhizium: Ang mikrobyo sa pagsugpo ng atangyang itim
- 80 Minus-One Element Technique (MOET): Pagsusuri ng Sustansiya sa Lupa
- 81 Rice Husk Gasifier Stove
- 82 PalayCheck System for Upland Rice Farming
- 83 Sistemang Reduced Tillage para sa Palayang may Patubig
- 84 Mushroom Production
- 85 Postharvest Management Protocol
- 86 PhilRice Rototiller (2<sup>nd</sup> Edition)
- 87 PalayCheck System for Highlad Rice Production
- 88 PalayCheck System for Upland Rice Farming (2<sup>nd</sup> Edition)
- 89 Brown Rice Machine
- 90 Gabay sa Pagtatanim ng Palay: Pagpaparami ng dekalidad na binhi sa sariling bukid (4<sup>th</sup> Edition)
- 91 Multicrop Reduced-till Planter
- 92 Mechanized Hybrid Rice Cultivation
- 93 PalayCheck System for Highland Rice Production
- 94 Pamamahala ng mga Damo sa Palayan
- 95 Management Options for Rice field Weeds (revised version)
- 96 Gabay sa Paghahanda ng Punla para sa Mekanikal na lipat-tanim ng Palay (Dapog Technique)
- 97 Multicrop Reduced Till-Planter (for rice, corn, and mungbean)
- 98 Mechanical Transplanting of Rice

# FOREWORD

One of the outcomes targeted in the Strategic Plan (2017-2022) of the Department of Agriculture – Philippine Rice Research Institute (DA-PhilRice) is improved rice trade through efficient postproduction, better product quality, and reliable supply, and distribution system. Improving harvest and postharvest facilities and operations is a priority research area due to high postproduction losses in rice. The Philippine Center for Postharvest Development and Mechanization (PHilMech) found that postproduction operations from harvesting to milling incurred an average loss of 16.47% (Salvador et al., 2012). Through improved postharvest facilities and efficient harvest and postharvest operations, total postproduction losses can be reduced to 10%. Harvesting losses can be minimized from 4 to 2%, drying and storage losses from 6 to 4%, and milling losses from 6 to 4%.

DA-PhilRice through its Rice Engineering and Mechanization Division developed a rice postharvest management protocol in 2016. Results showed that timely harvesting using a combine harvester, which is one of the protocol's operational checks, can reduce harvest losses from 5.6 to 1.4% (Regalado and Ramos 2018). Moreover, drying and storage losses were minimized from 9 to 1% while milling recovery improved from 59 to 63% through mechanical flatbed dryer and DA-PhilRice SACLOB (hermetic plastic enclosure).

The harvest and postharvest operational checks were validated in farmer's fields from 2018 to 2020. Results showed that total losses arising from the conventional methods of manual harvesting, mechanical threshing, sun-drying, ambient storage, and single-pass milling can be reduced from 17.9 to 11.8% through improved methods of combine harvesting on time, mechanical drying, hermetic storage, and multi-pass milling.

This rice technology bulletin also covers improved conventional postproduction practices based on study results and enhanced PalayCheck System's postharvest management key check. This will serve as a reference for farmers, traders, millers, and operators on reducing postharvest losses and achieving better quality *palay* and milled rice that meet market standards.



**JOHN C. DE LEON**  
Executive Director





# TABLE OF CONTENTS

INTRODUCTION	2
HARVESTING AND THRESHING	3
Manual Harvesting and Threshing	3
Combine Harvesting	5
PRE-DRYING STORAGE	6
DRYING	7
Manual Drying	7
Mechanical Drying	8
CLEANING	10
STORAGE	11
Storage at ambient air condition	11
Storage using PhilRice SACLOB	13
MILLING	15
PACKAGING	16
REFERENCES	17
ACKNOWLEDGMENT	21





## INTRODUCTION

Achieving significant improvements in the harvest and postharvest facilities is one of the challenges that our country tries to address. The passage of Republic Act 10601 (Agriculture and Fisheries Mechanization Law of 2013) supports the interventions in this area. RA 10601 mandates the development, promotion, and adoption of modern, appropriate, cost-effective, and environmentally safe agricultural and fisheries machinery and equipment. This is to enhance farm productivity and efficiency, achieve food security and safety, and increase farmers' and fisherfolks' income.

The first edition of the Postharvest Management Protocol introduces the key checks to reduce postharvest losses. For this new edition, postharvest management protocol was revalidated to further reduce postharvest losses. It also increased recovery and quality of rice milling.

Recommendations for improving manual and mechanized methods from harvesting to drying were introduced to cover all postharvest management practices. Proper management on seed production was also included for the seed growers.



## HARVESTING AND THRESHING

### *Manual Harvesting and Threshing*

- Drain the field 1-2 weeks before the expected date of harvest to: (1) attain uniform and timely ripening of the grains; (2) prevent wetting of the grains during harvesting; and (3) facilitate harvesting operation. For heavy textured clay soils, drain the field 10-14 days before harvest and for light textured soils, 7 days before harvest.
- Harvest the paddy when most of the grains are golden yellow or when the *palay* is 85-90% matured (for manual harvesting). Checking the moisture content (MC) of the palay is also recommended. Use a grain moisture meter when available. Harvest the crop when grain MC is 18-21% during dry season and 20-25% during the wet season.
- Use a sickle to cut the stalks. Cut closer to the ground if the crop will be threshed using a hold-on type thresher. Cut crop length should be shorter than usual when using a throw-in type thresher. When laying the cut crop bundles in





the field, ensure that the panicles stay dry and are off the ground.

- Reap and thresh within the day of the scheduled harvest date or the following day.
- Use a thresher with the correct machine settings.
- For seed production, clean the thresher before and after use to maintain seed purity.
- Pile the harvest for not more than a day to avoid heat build up, which leads to grain discoloration and reduces the quality of milled rice.
- Use underlay (canvass, laminated sack, or net) to catch shattered grains and to protect the pile from ground moisture.
- Adjust blower air inlet to provide good initial cleaning of the harvest. A high airflow rate results in higher grain loss while a low airflow rate increases the number of impurities in the grain.





## HARVESTING AND THRESHING

### *Combine Harvesting*

- Harvest the *palay* when the crop reaches 95-100% maturity.
- Harvest the crop when the morning dew or moisture on the plants has dried off.
- Use a combine harvester with the correct machine settings.
- For seed production, clean the harvester before and after use to maintain seed purity. If available, use a high pressure, high velocity air blower for cleaning the interior parts of the combine.
- Use new and clean woven plastic sacks for the combine harvester's bagging section.



## PRE-DRYING STORAGE

- Classify and sort the *palay* according to variety, seed type, moisture content, discoloration, and damage.
- Stack bags of *palay* with sufficient space for natural aeration. Wet grains or grains with high moisture content should be prioritized in drying. If available, use a high pressure, high velocity air blower for cleaning the interior parts of the combine harvester.
- Pre-drying storage should only be at most overnight, especially during the wet season.



## DRYING

### *Manual Drying*

- Dry the paddy immediately after threshing. As alternative, aerate fresh *palay* by spreading thinly under shade on concrete pavement, tarpaulin, plastic net, or canvas.
- Make sure that the drying area is free from impurities such as pebbles, sand, and other debris.
- Spread the grain 2 - 4cm thick and stir every 30min.
- For drying seeds under the sun, use mats, plastic sheets, canvas or fish nets underlay (*sapin*) and dry only in the morning until 2 p.m. to avoid high ambient temperatures of more than 50°C.
- Dry the paddy until it reaches 13-14% MC. Seeds may be dried to a lower 11-12% MC.
- Avoid drying *palay* on roads to reduce loss, grain breakage, and contamination. Avoid getting the dried paddy drenched with rain.



### *Mechanical Drying (Flatbed Dryer)*

- Dry the paddy immediately after combine harvesting. As alternative, air-dry the fresh paddy using the flatbed dryer until skin dried.
- Before heated air drying, especially when the paddy is wet, operate the dryer with ambient or unheated air for about 1 hour to equilibrate the grain temperature. By doing so, grain fissure can be minimized.
- For seed production, clean the mechanical dryer before and after use to maintain seed purity.
- When using a mechanical dryer, dry the *palay* following the recommended drying air temperature:

	Flatbed/Reversible Dryer (°C)	Recirculating Dryer (°C)
For seed production	41-43	55-60
For commercial milling	not more than 55	70-80

- When the moisture of grains reaches 14%, turn from heat drying to air drying for at least an hour to cool off the grain and stabilize its temperature.
- The recommended grain % MC for storage is 14%. The storage duration range with the corresponding paddy MC requirement are the following:

1-3 month storage	13% MC
4-6 month storage	12% MC
7-12 month storage	11% MC

- While waiting for cleaning, the dried paddy should be placed in sacks or stacked on top of pallets to protect from floor dampness. Use clean sacks or containers with proper labels.
- For temporary storage prior to cleaning, the dried paddy should be kept no longer than three days.



Reversible Airflow Dryer



Recirculating Dryer





## CLEANING

- Clean the paddy rice using a blower, fan, or seed cleaner. Use appropriate airflow adjustment and grain feeding rate.
- For seed production, clean the seed cleaner before and after use to ensure and maintain seed purity.
- Use only clean and properly labelled sacks or containers for the cleaned paddy or seed.
- Clean the paddy rice within three days after drying to further remove impurities such as chaff, unfilled grains, and straw. These might have higher MC which cause hot spots inside the sack or storage bin.





## STORAGE

### *Storage at ambient air condition*

- Never store clean and dried grains together with agricultural fertilizers, chemicals, or cement in the same area.
- Storage area should be clean, orderly, free from leaks and holes, and not prone to flooding.
- Use pallets and sacks that are free from residual infestation.
- Do not drag paddy or seed sacks during transporting to prevent damage. Use either a sack barrow or trolley, if available.
- To prevent pests, spray insecticides on the walls, floors, and beams of the storage area before storing paddy.
- Provide adequate space (about 1m) from walls and in-between piles for ventilation, cleaning, and pest control.



## STORAGE

- Windows and exhaust fans should be screened to prevent the entry of birds and rodents.
- Conduct regular monitoring for pest infestation.
- While at storage, check grains for heating by lifting the top bag and feeling the bag below.
- Tag and label piles correctly (i.e., date of piling, weight, variety, grain classification, and pest control measures applied).
- For seeds, do not mix varieties in one stock or pile. Do not also mix old and new stocks in the file.
- The pile should be built up to the edge of the pallet. Bended piles are more stable.
- The acceptable pile height is around 6-7 bags.



## STORAGE

*Storage using DA-PhilRice Saclob* (local plastic hermetic storage container)

- The Saclob should only be used for indoor storage.
- Use pallets and sacks that are free from residual infestation.
- The space to be occupied should be free from sharp objects (small stones and metals), which may puncture or damage its bottom side.
- Rice seeds to be stored must be properly dried (12% MC or lower).





- Before using, check its sides to ensure that it is free from puncture or holes.
- The use of the Saclob needs to be complemented with oxygen ( $O_2$ ) meter for monitoring. Without holes, an  $O_2$  level of 2-4% is usually attained within one week from the time the Saclob is closed.
- If  $O_2$  meter is unavailable, the filled Saclob must be checked regularly for punctures or damages that may lose its hermetic condition.



## MILLING

- Milling machines should be operated by a trained and skilled operator. Use machines that can produce at least 65% milling recovery and 80% head rice on a milled rice basis. Machine condition is also crucial in producing high-quality milled rice.
- Make sure that the paddy to be milled are of good quality, clean, properly dried, and free from impurities such as stones, chinks, and rice straws to produce clean and high-quality milled rice. It also protects the machine from bogging down.





## PACKAGING

- Use a durable packaging material. Follow the recommended color-coded packaging to indicate quality: blue (special or fancy rice), yellow (premium), white (grade 1-5 with 1 having 90% head rice and 5 having 55%).
- Vacuum packing is also recommended to preserve the quality and prolong the shelf-life of milled or special rice.

## REFERENCES

- Orge, R.F. and J.E.O. Abon. (2011). Saclob Airtight Storage of Rice Seeds. Rice Technology Bulletin. Science City of Muñoz, Nueva Ecija: Department of Agriculture - Philippine Rice Research Institute.
- Philippine Rice Research Institute (PhilRice). (2020). PalayCheck System for Irrigated Lowland Rice. Science City of Muñoz, Nueva Ecija: PhilRice.
- Regalado, M.J.C. and P.S. Ramos. (2018). Field testing of a rice postharvest management protocol for reduced post-production losses and improved product quality. Rice-Based Biosystems Journal 4: 31-40.
- Regalado, M.J.C., J.A. Ramos, T.C. Juganas, M.M. Rañeses and J.R. Waliwar. (2019). Field Validation of Rice Postharvest Management Protocol for Reduced Losses and Improved Rice Quality. Philippine Rice R&D- RFMM Highlights. Science City of Muñoz, Nueva Ecija: Department of Agriculture - Philippine Rice Research Institute.
- Salvador, AR., M.R. Domingo, V.E.B. Camaso, R.Q. Gutierrez, and R.R. Paz. (2012). Assessment of the state and magnitude of the paddy grains postproduction losses in major production areas. PHilMech Journal 2(1): 19-37.

**NOTES:**



# ACKNOWLEDGMENT

**W**e would like to thank the authors of the PalayCheck System for Irrigated Lowland Rice whose work on Postharvest Management Key Checks inspired the revalidation of the protocol on postharvest management. We also acknowledge Mr. Roy C. Nagar for lending a portion of his farm during the 2018-2019 field validation, Nagkakaisang Magsasaka Agricultural PMPC for the milling facility model, and the researchers and technical advisors who have helped identified, selected, and revalidated the rice postharvest management key checks and best practices.

**Authors**

Dr. Manuel Jose C. Regalado  
Engr. Tyrone C. Juganas  
Engr. Joel A. Ramos  
Engr. Maricar M. Rañeses  
Engr. Julius R. Waliwar

**Managing Editor**

Engr. Tyrone C. Juganas

**Language Editor**

Charisma Love B. Gado-Gonzales

**Design and Layout**

Engr. Tyrone C. Juganas

**Photographers**

Engr. Tyrone C. Juganas  
Engr. Jessica P. Jimenez  
Engr. Rodolfo S. De Gracia, Jr.

**Assistant Editor**

Hannah Hazel Mavi B. Manalo

**Editorial Advisers**

Dr. John C. de Leon  
Dr. Eduardo Jimmy P. Quilang  
Dr. Ronan G. Zagado

***Readers are encouraged to reproduce the content of this bulletin with acknowledgment.***



We are a government corporate entity (Classification E) under the Department of Agriculture. We were created through Executive Order 1061 on 5 November 1985 (as amended) to help develop high-yielding and cost-reducing technologies so farmers can produce enough rice for all Filipinos.

With our "Rice-Secure Philippines" vision, we want the Filipino rice farmers and the Philippine rice industry to be competitive through research for development (R4D) work in our central and seven branch stations, including our satellite stations, collaborating with a network that comprises agencies strategically located nationwide.

We have the following certifications: ISO 9001:2015 (Quality Management), ISO 14001:2015 (Environmental Management), and OHSAS 18001:2007 (Occupational Health and Safety Assessment Series).

## CONTACT US:

---



0917-111-7423



philrice.gov.ph  
pinoyrice.com



DA-PhilRice



PhilRiceTV



prii.mail@philrice.gov.ph



### DA-PHILRICE CENTRAL EXPERIMENT STATION

Maligaya, Science City of Muñoz, 3119 Nueva Ecija  
Tel: (44) 456-0277 • Direct line/Telefax: (44) 456-0354

### BRANCH STATIONS:

DA-PHILRICE BATAC, MMSU Campus, Batac City, 2906 Ilocos Norte  
Telefax: (77) 772-0654; 670-1867; Tel: 677-1508;  
Email: [batac.station@philrice.gov.ph](mailto:batac.station@philrice.gov.ph)

DA-PHILRICE ISABELA, Malasin, San Mateo 3318 Isabela  
Mobile: 0908-895-7955; 0927-437-7769;  
Email: [Isabela.station@philrice.gov.ph](mailto:Isabela.station@philrice.gov.ph)

DA-PHILRICE LOS BAÑOS, UPLB Campus, Los Baños, 4030 Laguna  
Tel: (49) 536-8620; 501-1917; Mobile: 0920-911-1420;  
Email: [losbanos.station@philrice.gov.ph](mailto:losbanos.station@philrice.gov.ph)

DA-PHILRICE BICOL, Batang, Ligao City, 4504 Albay  
Tel: (52) 284-4860; Mobile: 0918-946-7439;  
Email: [bicol.station@philrice.gov.ph](mailto:bicol.station@philrice.gov.ph)

DA-PHILRICE NEGROS, Cansilayan, Murcia, 6129 Negros Occidental  
Mobile: 0949-194-2307; 0927-462-4026;  
Email: [negros.station@philrice.gov.ph](mailto:negros.station@philrice.gov.ph)

DA-PHILRICE AGUSAN, Basilisa, RTRomualdez, 8611 Agusan del Norte  
Telefax: (85) 343-0768; Tel: 343-0534; 343-0778;  
Email: [agusan.station@philrice.gov.ph](mailto:agusan.station@philrice.gov.ph)

DA-PHILRICE MIDSAYAP, Bual Norte, Midsayap, 9410 North Cotabato  
Telefax: (64) 229-8178; 229-7241 to 43;  
Email: [midsayap.station@philrice.gov.ph](mailto:midsayap.station@philrice.gov.ph)

DA-PHILRICE FIELD OFFICE, CMU Campus, Maramag, 8714 Bukidnon  
Mobile: 0916-367-6086; 0909-822-9813

LIASON OFFICE, 3rd Floor, ATI Bldg, Elliptical Road, Diliman, Quezon City  
Tel/Fax: (02) 920-5129

### SATELLITE STATIONS:

MINDORO Satellite Station, Alacaak, Sta. Cruz, 5105 Occidental Mindoro  
Mobile: 0917-714-9366; 0948-655-7778

SAMAR Satellite Station, UEP Campus, Catarman, 6400 Northern Samar  
Mobile: 0948-754-5994; 0929-188-5438

ZAMBOANGA Satellite Station, WMSU Campus, San Ramon, 7000 Zamboanga City  
Mobile: 0910-645-9323; 0975-526-0306