Rice Technology Bulletin Series

1. Released Rice Varieties (1968-1994)
2. Pagpaparami at Pagpupuro ng Binhi sa Sariling Bukid
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
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 Waste 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. Management 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
87. PalayCheck System for Highland Rice Production
88. PalayCheck System for Upland Rice Farming
89. Brown Rice Machine
90. Pagpaparami ng Purong Binhi ng Palay sa Sariling Bukid
91. Multicrop Reduced-Till Planter
Labor spends majority of the costs incurred in rice production. This high labor cost is aggravated by the problem on labor scarcity. Thanks to the use of machines and improved transplanting methods, the drudgery of farming could be lightened to make our farmers’ lives easier.

This technology bulletin introduces mechanized and step-by-step management practices in hybrid rice production to help respond to issues on high labor costs, labor scarcity, and drudgery of producing rice.

The use of mechanical transplanter is featured here. The modified wet dapog, seedling tray methods using natural mud, and other seed-to-seed technologies are also discussed.

It is hoped that this bulletin will be used as reference by farmers who will be encouraged to grow hybrid rice using these technologies that collectively aim at pulling down the cost and easing drudgery of producing rice.

SAILILA E. ABDULA
Acting Executive Director
1. Varietal selection

Choose a hybrid rice variety that is locally adapted with high-yield potential, market demand, and resistance to current pests and diseases.

The use of high-quality seeds results in healthy seedlings that grow fast and uniformly thus contributing to a 5-10% yield increase.

- The seeds of your chosen hybrid rice variety must have a tag provided by the National Seed Quality Control Services, or must come from reliable sources such as accredited seedgrowers.

### Public Hybrid Rice Seeds for Commercialization

<table>
<thead>
<tr>
<th>Variety</th>
<th>Average Yield (t/ha)</th>
<th>Maximum Yield (t/ha)</th>
<th>Height (cm)</th>
<th>Maturity (Days after sowing/DAS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mestizo 1 (PSB Rc 72H)</td>
<td>5.4</td>
<td>9.9</td>
<td>97</td>
<td>123</td>
</tr>
<tr>
<td>Mestiso 19 (NSIC Rc 202H)</td>
<td>6.7</td>
<td>10.7</td>
<td>108</td>
<td>110</td>
</tr>
<tr>
<td>Mestiso 20 (NSIC Rc 204H)</td>
<td>6.4</td>
<td>11.7</td>
<td>112</td>
<td>111</td>
</tr>
<tr>
<td>Mestiso 73 (NSIC Rc 446H)</td>
<td>6.6</td>
<td>11.6</td>
<td>107</td>
<td>107</td>
</tr>
</tbody>
</table>
2. Land preparation

Land preparation should be done 3-4 weeks before seeding or transplanting to allow decomposition and recycle plant nutrients.

Well-prepared and levelled soil allows more uniform water distribution and easier drainage, more efficient fertilizer application, lesser weed incidence, better snail management, uniform crop maturity, and timely harvesting.

- Clean and repair dikes and ditches to prevent seepage, ensure even water distribution, and reduce pests.
- Plow the field with a depth of 10-15cm using a power tiller or rotavator to incorporate weeds and stubbles.
- Submerge field for 1 week or until harrowing.
- Harrow the field one week after plowing to break the clogs and incorporate stubbles into the soil. Keep the field submerged until the next harrowing. Harrow the field after a week to further incorporate and decompose stubbles and volunteer plants into the soil.
- Level the field using a wooden plank or leveler attached to a power tiller or handtractor 2-3 days before transplanting.
- Maintain 2 to 3-cm water level during final levelling. There should be no visible mounds above the water surface after final levelling.
3. Crop establishment

Sowing the right amount of seeds and transplanting the right amount of seedlings are important in ensuring healthy seedlings that can compete better against weeds and have better root growth, better nutrient uptake, and more efficient use of nutrients.

- Sow 20-25kg seeds per hectare.
- Grow healthy seedlings using seed trays or modified wet dapog system.
- Transplant with the walk-behind or riding-type transplanter. Use 3-5 seedlings/hill setting.
- Replant missing hills within 7 days after transplanting.
- Apply molluscide immediately after transplanting to prevent snail infestation.
Advantages of mechanical transplanting

1. Transplanting of seedlings at the optimal age (12-18 days)
2. Uniform spacing and optimum plant density (22-48 hills/m with 2-3 seedlings per hill)
3. Higher productivity (0.5-0.7t/ha)
4. Less transplanting shock, early seedling vigor, and uniform crop stand
5. Less stress, drudgery, and health risks for farm laborers
6. Better employment opportunities for rural youth through the development of custom service business
7. Smaller seedbed area (80-100m²)
8. Less irrigation water requirement
9. Addresses the problem of labor scarcity as it uses less labor
10. Fast and efficient operation
11. Increases farmers’ net income
Benefits of modified wet dapog and seedling tray method using natural mud in the seedbed as replacement for garden soil

1. Viable alternative method of seedling preparation

2. Seedlings are adapted to field condition because seedbed and seedling preparation are done in the actual field

3. Less stress to seedlings because of minimal transport of seedling mats in the field

4. More economical as it uses locally-available and recyclable materials

5. No soil crushing and soil sieving compared with the seedling preparation using mechanical transplanter
Selecting the seedbed site

- Near a water source
- With good drainage
- Far from fields infected with tungro and other diseases
- Away from light source
- Protected from rats, birds, and snails
- Not shaded
- No or very minimal stones in the seedbed area

Preparing the seedbed

1. Clean bunds and dikes.
2. Plow once.
3. Harrow twice.
4. Level the seedbed area. Final levelling should be done 2 days before seed sowing.

5. Prepare the land thoroughly because the soil to be used as soil medium will be collected from the seedbed site.

**Seed Soaking and incubation**

1. Wash the seeds before soaking.

2. Soak the seeds (20-25kg/ha) in clean water.

3. Change the water every after 5-6h.

4. Remove the seeds from the soaking water after 12-24h, and rinse.

5. Incubate the seeds in a safe dry place for 24-36h.

6. Maintain the temperature (not lower than 30°C) of the incubated seeds, and keep it moist and well aerated. Add minimal amount of water every 12h.

7. Ensure that seeds are ready for sowing. This is when seeds start to break and the roots have extended to 1mm.
Modified wet dapog

This should be done 12-18 days prior to the anticipated date of transplanting.

Materials

- 20-25kg of hybrid rice seeds per hectare
- Punching stick, metal, or common nail
- Plastic films/sheets (plastic liner of feeds or fertilizer, laminated sacks, or plastic mulch; 0.65m wide x 80-100m long)
- Wood or angle bar, flat bar, or any material can be used as frame guide (170-cm long x 0.58-cm wide x 2-cm tall).
- Hand float
- Rice straw, jute sacks, cogon grass, net, or plastic

Preparation of plastic film

- Select plastic film/sheet that is elastic enough to hold 1 to 2-cm soil (eg. laminated sacks, fertilizer/feed plastic lining, PVS plastic sheet, plastic mulch).
• For a hectare of farm, the width of the plastic film should be 0.65m and its length is 80-100m.

• Fold the plastic film or sheets and make holes with 2 x 2-in distance using the punching stick or metal or common nail.

**Preparation of frame guide for seedbed establishment**

• Wood, bamboo sticks, or angle bar (or any similar materials) can be used to prepare the frame guide.

• Make a frame (170cm x 0.58cm x 2cm). The frame guide will be used as guide in making the seedbed.

• The frame guide should be as light weight as possible.

**Establishment of modified wet dapog**

1. Level 120-m² area.

2. Drain the seedbed area 2 days before seed sowing. Construct 3 to 5-cm raised bed (optional).

3. Place the plastic film into the seedbed area with 0.5 to 0.7-m distance between beds. Pegs can be used to hold the plastic films.
4. Place the frame guide on top of the plastic film. Collect clod-free mud between the seedbeds. Spread the 2-cm thick mud evenly on top of the plastic films. Apply 1kg of organic fertilizer/m² or 85kg of carbonized rice hull/ha (optional).

5. Level the seedbed using hand floats. The thickness of the seedbed should not exceed 2cm.

6. Remove the frame guide and repeat step until the entire mat nursery is established.

7. Spread the germinated seeds evenly using the required weight of seeds per area of the seedling frame (420-600g of seeds/frame size of 170cm x 58cm).

8. Cover seedbed with rice straw, cogon grass, plastic sheet, or jute sacks.

9. Remove the cover 5-6DAS when the height of seedling reaches 1-2cm if cogon or rice straw is used as cover. If jute sack or plastic is used as cover, remove the cover 2DAS.

10. Protect the seedling from pests such as rats, birds, and snails.

11. Follow the recommended management for seedbed.

12. Transplant seedlings at 14-18DAS or when the seedling height reaches 15-20cm.
Seedling tray method using natural mud in seedbed as replacement for garden soil

This should be done 12-18 days prior to the anticipated date of transplanting.

Materials

- 20-25kg of hybrid rice seeds per hectare
- Scraper
- 5 sacks of rice straw
- 250-350 seedling trays
- Seeder
- Table and seeder guide
- Weighing scale
Procedure for seedling tray method

1. Level the area (10m x 8.2m).

2. Drain the seedbed area 2 days before seed sowing.

3. Prepare the seedling tray. To plant 1ha using a mechanical transplanter, use 250-350 pieces of seedling trays (58cm x 28cm).

4. Collect clud-free mud from the seedbed area. Put mud in seedling tray. Spread 2-cm thick mud evenly on the seedling tray. Apply 1kg of organic for every 6 pieces of seedling tray (optional).

5. Spread the germinated seeds (70-100g of seeds/seedling tray) evenly using seeder/hands. When a white dot appears on the seeds, these are ready to be sown.

6. Stock file the seedling tray for 2 days.

7. Arrange the seedling tray on the seedbed area and cover with rice straw, cogon, or plastic sheet 4-6DAS.

8. At 5-6DAS or when the height of seedling reaches 1-2cm, remove the cover.

9. Protect the seedling from pests such as rats, birds, and snails.

10. Transplant seedlings at 14-18DAS or when the seedling height reaches 15-20cm.
Water and fertilizer management for modified wet dapog and seedling tray method using natural mud in the seedbed as replacement for garden soil

1. Water the seedbed at 5-6DAS. Water should be leveled on the surface of the mat-nursery or seedling tray.

2. For silty clay soil, increase the water level by up to 5cm to facilitate application of fertilizer (0.5kg of 14-14-14 per 10kg of seeds) at 8DAS.

3. Keep the seedbed saturated and drain the seedbed area 2 days before transplanting.

4. Transplant seedlings at 14-18DAS or when the seedling height reaches 15-20cm.

Preparation of the field before transplanting

1. Level the field 2 days before transplanting.

2. Drain the field and maintain at most 1-cm water depth.
Preparation of seedling before transplanting

1. Drain the seedbed 2 days before transplanting.

2. Transplant the seedling 12-18DAS.
   
   a. For modified wet *dapog*, cut the seedling mat into tray size (28cm x 58cm) using sharp knife.
   
   b. For seedling tray method, remove the seedling from the seedling tray.

3. Distribute the seedling along paddy dikes. To transplant 1000 m², use 25-30 pieces of seedling mats (28cm x 58cm).

4. Fit the seedling mat on the seedling rack. Transplant the seedlings using mechanical transplanter.

After transplanting

Manage rice crop following the recommended production practices.
Crop establishment costs of manual and mechanical rice transplanting

<table>
<thead>
<tr>
<th>Activities/ materials needed</th>
<th>Manual Transplanting</th>
<th>Mechanical Rice Transplanter using garden soil (conventional method)</th>
<th>Mechanical Rice Transplanter (modified method)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed requirement per hectare</td>
<td>18kg @ P3,816</td>
<td>25kg @ P5,320</td>
<td>25kg @ P5,320</td>
</tr>
<tr>
<td>Seedbed preparation</td>
<td>3MAD: P900</td>
<td>3MAD: P900</td>
<td>3MAD: P900</td>
</tr>
<tr>
<td>Fertilizer in seedbed</td>
<td>4kg @ P22/kg: P88</td>
<td>1kg @ P22/kg : P22</td>
<td>1kg @ P22/kg : P22</td>
</tr>
<tr>
<td>Garden soil</td>
<td>none</td>
<td>P1000</td>
<td>none</td>
</tr>
<tr>
<td>Organic fertilizer</td>
<td>8 bags @ P250/ bags; 2,000</td>
<td>5 bags @ P250/ bags; 1,250</td>
<td>none</td>
</tr>
<tr>
<td>Seedling pulling</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Bamboo wire</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>Seedling distribution</td>
<td>P7000 package</td>
<td>P6500 - P7000 Package (seedling distribution, transplanting, replanting)</td>
<td>P6500 - P7000 Package (seedling distribution, transplanting, replanting)</td>
</tr>
<tr>
<td>Transplanting</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Replanting</td>
<td>2MAD : P600</td>
<td>2MAD : P600</td>
<td>2MAD : P600</td>
</tr>
<tr>
<td>Total expenses</td>
<td>P14,404</td>
<td>P16,092</td>
<td>P13,842</td>
</tr>
</tbody>
</table>

Conventional vs modified method
*Nueva Ecija Experience

P16,092 - P13,842 = P2,250 (lower in cost)
4. Nutrient Management

Sufficient nutrient during vegetative, reproductive, and maturity stages will result in uniform growth and panicle development, and attainment of yield potential. Inadequate nutrients will result in less tiller, slow growth, and low grain weight while excessive nutrients will result in pest susceptibility and lodging.

- Use the Minus-One Element Technique (MOET) to know the right kind, amount, and timing of fertilizer application for the crop.
- Use Leaf Color Chart (LCC) to visually assess the nitrogen status of rice crops.

<table>
<thead>
<tr>
<th>Deficient Nutrient: Nitrogen, Phosphorus, and Potassium (NPK)</th>
<th>Wet Season</th>
<th>Dry Season</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal: 4 bags of 14-14-14/ha and 0.5 bag of 16-20-0/ha</td>
<td>Basal: 5 bags of 14-14-14/ha and 2 bags of 16-20-0/ha</td>
<td></td>
</tr>
<tr>
<td>PI: 0.5 bag of 0-0-60/ha</td>
<td>PI: 1 bag of 0-0-60/ha</td>
<td></td>
</tr>
<tr>
<td>Topdress: 1 bag of urea when LCC reading is less than 4 for transplanted rice</td>
<td>Topdress: 1.5 bags of urea when LCC reading is less than 4 for transplanted rice</td>
<td></td>
</tr>
</tbody>
</table>
5. Water Management

Water transports nutrients from the soil to the plant. Adequate water supply facilitates land preparation and ensures good crop establishment. It also promotes seedling vigor and normal crop growth and development, with minimal lodging. There is better nutrient uptake with right amount of water because it corrects some nutrient imbalances and it minimizes leaching.

- Follow alternate wetting and drying to save water.

6. Pest Management

Proper pest management results in good seed or grain quality. Correct pest identification and application of integrated crop management (i.e., resistant variety, date and method of crop establishment, fertilizer and water management, and pesticide use) also help manage pests.

- Conduct regular field monitoring to determine potential pests.
- Do not spray against defoliators during the first 30 days. Plants compensate early season defoliation. Don’t spray to increase population of beneficial organisms.
- To manage golden apple snails, keep the water level in the field at 2-3cm within 2 weeks after transplanting. Apply molluscide under heavy infestation.
• Practice proper timing, active and sustained community-wide control, and sanitation to effectively manage field rats.

7. Harvest Management

Timely reaping and threshing ensure good grain quality, high market value, and consumer acceptance. Harvesting too early will result in a larger percentage of immature grains. Harvesting too late will lead to increased grain shattering and excessive losses.

• Harvest when 1/5 or 20% of the grains at the base of the panicle are at hard dough stage. Most of the grains in the panicle will be golden yellow.

• Reap and thresh the palay not later than one day after reaping. Harvest the rice crop with combine harvester when 85-90% of the grains are mature.

REFERENCE:
SUBJECT MATTER SPECIALISTS
Engr. Marvin J. Manalang
Richard D. Romanillos
Arnold S. Juliano, PhD
Aurora M. Corales, PhD

MANAGING EDITOR
Hanah Hazel Mavi B. Manalo

DESIGN AND LAYOUT
Renz Romy C. De Joya

LAYOUT ASSISTANT
Reuel M. Maramara

EDITORIAL ADVISERS
Ronan G. Zagado, PhD
Sailila E. Abdula, PhD

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 work in our central and seven branch stations, coordinating with a network that comprises 59 agencies strategically located nationwide. We have the following certifications: ISO 9001:2008 (Quality Management), ISO 14001:2004 (Environmental Management), and OHSAS 18001:2007 (Occupational Health and Safety Assessment Series).

CONTACT US:

PHILRICE CENTRAL EXPERIMENT STATION
Malgaya, Science City of Muñoz, 3119 Nueva Ecija
Tel: (44) 456-0277 • Direct line/Telefax: (44) 456-0354

BRANCH STATIONS:

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

PHILRICE ISABELA, Malasin, San Mateo, 3318 Isabela;
Mobile: 0908-895-7796; 0915-765-2105;
Email: isabela.station@philrice.gov.ph

PHILRICE LOS BAÑOS, UPLB Campus, College, 4030 Laguna;
Tel: (49) 336-8620; 501-1917; Mobile: 0920-911-1420;
Email: losbanos.station@philrice.gov.ph

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

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

PHILRICE AGUSAN, Basibiasa, RTRomualdez, 8611 Agusan del Norte;
Telefax: (85) 334-0768; Tel: 334-0534; 334-0778;
Email: agusan.station@philrice.gov.ph

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

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

LIAISON OFFICE, 3rd Flr. ATI Bldg, Elliptical Road, Diliman, Quezon City;
Tel/Fax: (02) 920-5129

SATELLITE STATIONS:

MINDORO SATELLITE STATION, Alacaak, Sta. Cruz, 5105 Occidental Mindoro; Mobile:
0908-104-0855; 0948-655-7778

SAMAAR Satellite Station, UEP Campus, Catarman, 6400 Northern Samar; Mobile:
0948-754-5994; 0909-370-1332