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#92 RICE 2018 TECHNOLOGY BULLETIN

PHILIPPINE RICE RESEARCH INSTITUTE

Mechanized HYBRID RICE CULTIVATION

Rice Technology Bulletin Series

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FOREWORD

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

Variety	Average Yield (t/ha)	Maximum Yield (t/ha)	Height (cm)	Maturity (Days after sowing/ DAS)
Mestizo 1 (PSB Rc 72H)	5.4	9.9	97	123
Mestiso 19 (NSIC Rc 202H)	6.7	10.7	108	110
Mestiso 20 (NSIC Rc 204H)	6.4	11.7	112	111
Mestiso 73 (NSIC Rc 446H)	6.6	11.6	107	107

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.


Use of seedling tray

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.


Walk-behind transplanter

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 (80-100m^2)
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-m^2 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 clud-free mud between the seedbeds. Spread the 2-cm thick mud evenly on top of the plastic films. Apply 1kg of organic fertilizer/m^2 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 m^2, 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

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

Conventional vs modified method

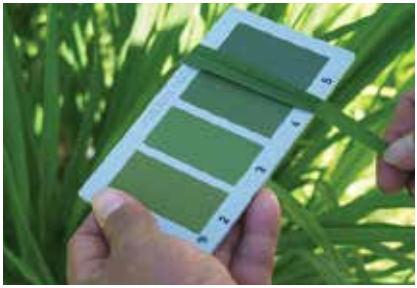
*Nueva Ecija Experience

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.

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

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 (ie., 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 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:

Rickman, J.F., Mussgnug, F., Khanda, C.M., Satpathy, S.D., Parida, N.,Singla, K., Kumar, V., Banik, N.C., Iftikar, W., Mishmar, A., Yadav, S., Malik, R.K., and McDonald, A.J. (2015). Operational Manual for Mechanical Transplanting of Rice. Retrieved from http://csisa.org/wp-content/uploads/sites/2/2014/06/Operational-Manual-for-Mechanical-*Transplanting-of-Rice.pdf*

NOTES:

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 Romyl C. De Joya

LAYOUT ASSISTANT
Reuel M. Maramara

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

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CONTACT US:

www.philrice.gov.ph
www.pinoyrice.com

rice.matters

rice_matters

0917-111-7423

PHILRICE CENTRAL EXPERIMENT STATION
Maligaya, 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) 536-8620; 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, Basilisa, RTRomualdez, 8611 Agusan del Norte;
Telefax: (85) 343-0768; Tel: 343-0534; 343-0778;
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 Flor. 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

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