ISSN 0117-9799

RICE TECHNOLOGY BULLETIN

#75
2014

PHILIPPINE RICE RESEARCH INSTITUTE

MANAGEMENT OF WHITE AND YELLOW STEM BORERS

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 (Filipino)
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
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 Stemborers
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

Foreword

One of the major crop production constraints in the Philippines is the damage caused by yellow stem borers (YSB) and white stem borers (WSB). Stem borer damage can decrease yield by up to 50%.

At PhilRice, our researchers have studied the occurrence of YSB and WSB. This was done to come up with management strategies that farmers can use to control these pests. This bulletin contains information on insect distribution, life stages, extent of damage, and management strategies.

This bulletin could increase the knowledge of extension workers and rice farmers on effective management of YSB and WSB.

Introduction

Stem borer is one of the major insect pests of rice that infests the rice plant at all stages of growth. The yellow stem borer (YSB), *Scirpophaga incertulas* (Walker) and white stem borer (WSB), *Scirpophaga innotata* (Walker) are the Philippine stem borer species that feed exclusively on rice.

Yield losses due to YSB and/or WSB may range from 25 to 50% or higher during outbreaks. Stem borers injure the rice stem causing deadheart during vegetative stage and whiteheads during reproductive stage. Deadheart is the drying of the central whorl while whiteheads refer to discolored panicles with empty or partially filled grains. Adult YSB and WSB differ in appearance, however, their larvae are difficult to differentiate by the naked eye.

Distribution and occurrence

YSB occurs in both the tropics and subtropics in South and Southeast Asia while WSB is restricted to the equatorial tropics of Southeast Asia and Oceania. YSB is more common in Luzon, YSB and WSB in Visayas, and WSB in Mindanao (Figure 1). YSB causes annual infestation in late-planted rice. High occurence of whitehead is expected when rice crops are planted later than the regular planting period.

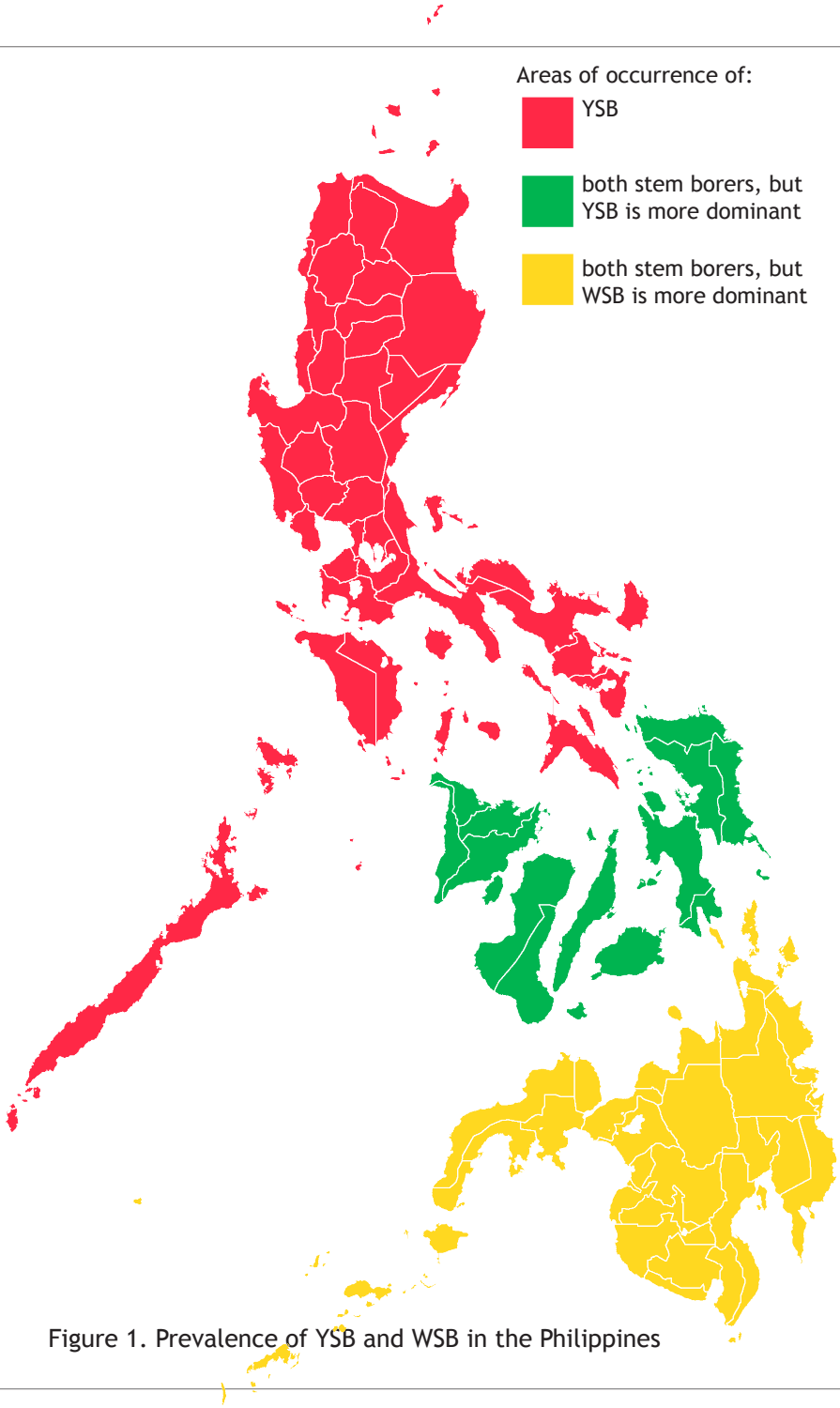
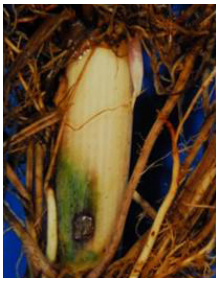


Figure 1. Prevalence of YSB and WSB in the Philippines

Life stages of YSB and WSB

<table>
<tr><th>YELLOW Stem borer</th><th>WHITE Stem borer</th></tr>
<tr><td colspan="2">Eggmass</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">• White, oval, and flat
• Covered with brownish hairs from the anal tufts of the female
• Length ranges from 2-8mm
• 7-9 days incubation period
• 70-100 eggs per mass</td></tr>
<tr><td colspan="2">Larva</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td>• Length of first instar is about 1.5mm with yellowish green body. A full-grown larva about 20mm long has brown head and prothoracic shield.</td><td>• A full grown larva is milky white and is 15-20mm.</td></tr>
<tr><td colspan="2">• Larval period ranges from 28 - 40 days with the larva undergoing five instars.</td></tr>
</table>

YELLOW Stem borer	WHITE Stem borer
Pupa	
	
• Fresh cocoon is pale brown and turns dark brown with age. The pupa is about 12mm long.	• Pupation is completed in 8-13 days.
• Pupa is soft-bodied, pale, and 12 - 15mm long.	
Adult	
	
• Female YSB moth has a pair of distinct black dots on its forewings. It has a wingspan of 24-36mm. Its abdomen is wide with yellow hairs.	• Female WSB moth does not have black dots on its forewings. It has a wing span of 26-30mm.
• Adult females live for 2-7 days while the males live for 2-5 days. • The development period from egg to adult ranges from 43-62 days.	

Damage

Larva of YSB or WSB bores into the rice stem and inner tissues resulting in deadheart or whitehead damage.

Deadheart

- Occurs at vegetative stage
- Central leaf whorl folds, turns brownish, dries up and dies (deadhearts)
- Damaged shoots can be easily pulled by hand
- There is stem borer damage when tillers have tiny holes and fecal matter
- When damage occurs at early tillering stage, plant compensates by producing additional tillers and yield loss is negligible

Whitehead

- Occurs at reproductive stage
- Damaged tillers produce panicles that are whitish and with empty grains (whiteheads)
- Whiteheads can be easily pulled out by hand
- There is stem borer damage when tillers have tiny holes or fecal matter
- Egg masses laid during the reproductive growth stage (panicle initiation) are critical because whiteheads may occur and yield loss could be significant

Management strategies

An integrated approach to management of YSB and WSB (combination of cultural practices, biological control, and chemical control) must be employed. This integrated approach could maintain pest populations at economically non-damaging levels.

1. Practice synchronous planting after a fallow period.

   The field has been planted seven days before and after the majority service area has been planted after a fallow period of at least 30 days.

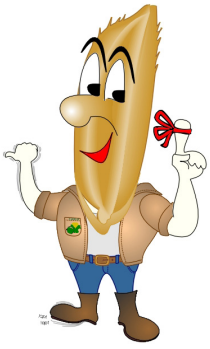
   Synchronous planting avoids the overlapping incidence of insect and disease populations. A fallow period of at least one month breaks the insect pest cycle and destroys insect habitat. This scheme is largely affected by the availability of water in the locality.

2. Plant at the right time.

- Know the peak of stem borer populations in your locality to determine the right planting time.
- Historical data says that light trap catches of adult YSB and WSB at PhilRice Nueva Ecija and Agusan usually peak from April to May, and from October to November. Hence, it is advisable to plant from December to January for the dry season, and June to July for the wet season so that the crop will be harvested before stem borer population reaches its peak.

Light trap

NOTE: For a 120-day variety, it is important that the critical reproductive stage (50-60 days after transplanting or 70-80 days after direct wet-seeding) does not coincide with the peak of adult stem borer population based on light trap catches.



3. Conserve natural enemies.

- Conserve biological control agents like parasitoids, predators, and microbial agents. Avoid indiscriminate use of pesticide as this disrupts the natural balance among insect pests and beneficial insects/ organisms.
- Parasitoids that attack the eggs of stem borers play an important role in controlling stem borer population. When conserved, parasitoids reduce pest incidence and help maintain the natural balance of the agroecosystem. Parasitoids that are abundant in the field include *Telenomus sp.* (*Scelionidae*), *Tetrastichus sp.* (*Eulophidae*), and *Trichogramma sp.* (*Trichogrammatidae*). Among these parasitoids, *Telenomus sp.* is the most abundant.

Conserve these natural enemies!

Natural enemies of stem borer during its life stages

Egg

Wasps (*Tetrastichus, Telenomus,Trichogramma*)

Wasp

Larva

Water bug (*Mesovilia*), Assasin bug (*Polytoxus*), Earwig (*Euborellia*), and Lady beetle (*Coccinelids*)

Pupa

Wasps (*Goniozus, Apanteles, Bracon, Rhaconatus, Stenobracon, Tropobracon, Amauromorpha, Eriborus, Isochnojoppa, Isotima, Temelucha, Pteromalus*) and Pathogen (*Beauveria*)

Earwig

Adult

Spiders (*Pardosa, Oxyopes*), Longhorned grasshopper (*Conocephalus*), Dragonfly, and Damselfly

Longhorned grasshopper

4. Use resistant varieties.

- Plant varieties with resistance to stem borers such as PSB Rc100 (Santiago), PSB Rc76H (Panay), PSB Rc50 (Bicol), PSB Rc44 (Gohang), NSIC Rc122 (Angelica), NSIC Rc106 (Sumilao), and NSIC Rc11 (Canlaon).
- Change or rotate varieties every 2 - 4 cropping seasons to delay insect pest adaptation and prevent insect pest buildup.

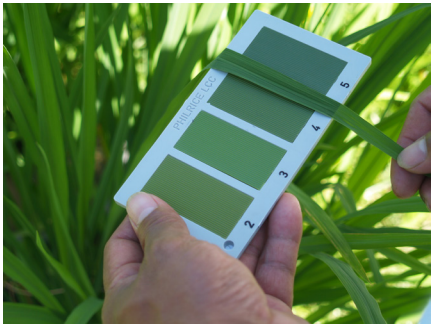
5. Use insecticide when needed.

- Do not apply insecticide within 40 days after planting. During this growth phase, rice plants can compensate for the damage by producing more tillers.
- When stem borer egg masses are observed in the field at panicle initiation stage, collect and place them in a covered bottle.
- Observe the parasitoids that emerge from the eggs. If the population of parasitoids emerging from the eggs is greater than the larvae, do not apply insecticide. At this stage, egg masses population is usually less than 1/ m^2 .
- If 1-2 egg masses are observed in every m^2 in the field, application of insecticide is recommended.
- When whiteheads appear, there is no need to apply insecticide.
- Use light traps to monitor the monthly occurence and population of stem borers.

6. Apply fertilizer properly.

- Know and manage the nitrogen (N) needs of your plants based on the leaf color chart (LCC) and assess other nutrients based on the Minus-One Element Technique (MOET) test.

LCC



Assess the “real time” crop need for N fertilizer with the use of LCC.

Use LCC every 7 days from 21 days after transplanting or 28 days after direct wet-seeding until early flowering.

Use the LCC to assess crop need for N fertilizer. Excessive N fertilizer can make the plant more succulent, prone to lodging, and more susceptible to stem borers.

MOET

MOET is the diagnostic kit for limiting nutrients such as phosphorus, potassium, zinc, and sulfur. Soil nutrient deficiencies are assessed based on plant nutrient deficiency symptom.

Conduct MOET test 30 days before transplanting or direct-wet seeding to assess soil nutrient deficiencies and apply the optimum fertilizer requirement.

7. Rotavate the soil immediately after harvest.

    - This practice exposes the larva and pupa to the sun, thereby, killing them. This also destroys the habitat of stem borers.

Figure 3. Summary of pest management strategies for YSB and WSB at various crop growth stages.

CROP ESTABLISHMENT	VEGETATIVE (Tillering)	REPRODUCTIVE (Early panicle initiation to flowering)	RIPENING	HARVEST AND POSTHARVEST
				
• Practice synchronous planting after a fallow period. This will deprive stem borers of continuous food supply, thus, preventing continued reproduction of the pest. • Plant at the right time so that the crop will be harvested before the stem borer population peaks. • Use resistant varieties • Change varieties every two to four cropping seasons.	• Conserve natural enemies as they play an important role in regulating stem borer population. • Do not apply insecticide within 40 days after planting. Plants compensate the damage during this growth stage by producing more tillers. • Apply fertilizer properly.	• Use insecticide only when needed. • Do not apply insecticide when the population of parasitoids is greater than the larvae (based on egg mass collected from the field and reared in covered bottles). At this stage, egg mass population is usually low (less than one egg mass a m^2). • Apply insecticide when 1-2 egg masses are observed in every square meter in the field.	• When whiteheads appear, there is no need to apply insecticide.	• Rotavate the soil immediately after harvest to kill the larvae and pupae.

REFERENCES

ANGOON, L. 1981. A revision of the old world species of Scirpophaga (Lepidoptera:Pyralidea). Bulletin of the British Museum of Natural History (Entomology) 42: 185-298.

DUTT, N., and D.K. Kundu. 1984. Stem borer incidence in paddy and its effect on yield and yield components. Indian J. Ent. 46(2): 135-147.

GOMEZ, K. and R.C. Bernardo. 1974. Estimation of stem borer damage in rice fields. J. Econ. Entomol. 67(4):509-513.

HEINRICHS, E.A. 1986. Field evaluation of commercial insecticides for controlling yellow stem borer (YSB) in the Philippines. Int. Rice Res. Newsl. 112(2): 27-28.

HEINRICHS, E.A. (ed). 1994. Biology and management of rice insects. Wiley Eastern, New Delhi, 779 p.

KHAN, Z.R., J.A. Litsinger, A.T. Barrion, F.F.P. Villanueva, and N.J. Fernandez. World bibliography of rice stem borers. 1974-1990.IRRI and ICIPE. 415 p.

KIRITANI, K. 1979. Pest management in rice. Annu. Rev. Entomol. 24:279-312.

LITSINGER, J.A., E.L. Alviola, C.G. Dela Cruz, B.L. Canapi, E.H. Batayan, and A.T. Barrion, 2004. Biology and pest status of the white stem borer, Scirpophaga innotata (Walker) (Lepidoptera:Pyralidae) in Southern Mindanao. Philippine Entomologist 18:1-15.

LITSINGER, J.A., J.P. Bandong, B.L. Canapi, C.G. Dela Cruz, P.C. Pantua, A. L. Alviola, and E.H.Batay-an. 2005. Evaluation of action thresholds for chronic rice insect pests in the Philippines. I. Less frequently occurring pests and overall assessment, International Journal of Pest Management, 51:45-61.

LITSINGER, J.L., A.L. Alviola, C.G. Dela Cruz, B.L. Canapi, E.H. Batay-an, and A.T. Barrion. 2006. Rice white stem borer, Scirpophaga innotata (Walker) in southern Mindanao, Philippines. I. Supplantation of yellow stem borer, S. incertulas (Walker) and pest status. International Journal of PestManagement, 52:11-21.

LITSINGER, J.A., A.L. Alviola, C.G. Dela Cruz, B.L. Canapi, E.H. Batay-an, and A.T. Barrion, 2006. Rice white stem borer, Scirpophaga innotata

(Walker) in Southern Mindanao,Philippines. II. Synchrony of planting and natural enemies. International Journal of Pest Management, 52:23-37.

PANDA, S.K., A.P. Samalo, N. Shi, and S.S. Mishra, 1986. Influence of variety, fertilizer dose and water management on stem borer incidence and yield of rice. Madras Agric. J.73(6):334-339.

PATHAK, M.D. 1968. Ecology of common insect pests of rice. Annu. Rev. Entomol. 13:257-294.

PATHAK, M.D. and Dyck V.A. 1973. Developing an integrated method of rice insect pest control. PANS. 19(4):534-544. Philippine Rice Research Institute. 1999. Rice Stem borers in the Philippines. Rice Techno. Bull. DA- PhilRice #20, 12p. PhilRice-FAO Handbook. 2007. PalayCheck system for irrigated lowland rice. PhilRice, Nueva Ecija.

PhilRice Agusan Annual Reports for 2001, 2002, 2003, 2004 (Unpublished). Basilisa, RTR, Agusan del Norte.

REISSIG, W.H., E.A. Heinrichs, J.A. Litsinger, K. Moody, L. Fiedler, T.W. Mew, and A.T. Barrion. 1986. Illustrated guide to integrated pest management in rice in tropical Asia. Philippines. International Rice Research Institute. 411 pp.

RILLON, G.S. and H.D. Justo. 1998. Pest incidence and yield of direct seeded and transplanted rice. In Philippine Rice R and D Highlights for 1997. PhilRice Maligaya, Muñoz, Nueva Ecija, Philippines.

RILLON, G.S. and H.D. Justo. 1997. Control of stem borer populations in late-planted rice through strategic application of insecticides. In Philippine Rice R and D Highlights for 1996. PhilRice Maligaya, Muñoz, Nueva Ecija Philippines.

SUBRAMANIAN, V., M. Mani, and V.D.G. Raja. 1977. Effect of graded levels of nitrogen on the incidence of rice stem borer, Tryporyza incertulas Walk. Science and Culture. 43(5). 222-223.

SOEJITNO, J. 1977. Relation between damage by rice stem borer Tryporyza incertulas and yield of rice variety Pelia I-1. Int. Rice Res. Newsl. 2(4).

NOTES

Subject Matter Specialists
Eliseo H. Batay-an*
Genaro S. Rillon***
Alejandra B. Estoy, PhD*
Nerissa D. Santiago*

Managing Editor/Layout Artist
Charisma Love B. Gado*
Alfred Franco T. Caballero**
Samantha M. Hautea***
and Jayson C. Berto***

Volume Editor
Jennifer Jara-Rabara*

Technical Reviewers
Rolando T. Cruz, PhD*
Hilario D. Justo Jr, PhD*
Fe A. de la Peña, PhD*

Editorial Assistants
Hazel V. Antonio*
Antoinette A. Kindipan*

Editorial Advisers
Leocadio S. Sebastian, PhD*
Diadem B. Gonzales*
Ruben A. Miranda, PhD**
Karen Eloisa T. Barroga, PhD**
Jaime A. Manalo IV***
Myriam G. Layaoen***

**First Edition, 2007. Philippine Rice Research Institute Maligaya, Science City of Muñoz, 3119 Nueva Ecija*

***Second edition, 2011. Philippine Rice Research Institute Maligaya, Science City of Muñoz, 3119 Nueva Ecija*

****Third edition, 2014. Philippine Rice Research Institute Maligaya, Science City of Muñoz, 3119 Nueva Ecija*

For more information, text the PhilRice Text Center (0920) 911-1398

visit: www.pinoyrkb.com

write,visit, or call:

The Crop Protection Division
Philippine Rice Research Institute
Maligaya, Science City of Munoz, Nueva Ecija 3119
Tel. No.; (044)456-0285; 0113; 0651 local 227

ISSN 0117-9799 #75
RICE 2014
TECHNOLOGY
BULLETIN
PHILIPPINE RICE RESEARCH INSTITUTE

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

We accomplish this mission through research and development work in our central and seven branch stations, coordinating with a network that comprises 58 agencies and 70 seed centers strategically located nationwide.

To help farmers achieve holistic development, we will pursue the following goals in 2010-2020: attaining and sustaining rice self-sufficiency; reducing poverty and malnutrition; and achieving competitiveness through agricultural science and technology.

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:

www.philrice.gov.ph
www.pinoyrkb.com

rice_matters
Rice-awareness

rice_matters

0920-911-1398

PHILRICE CENTRAL EXPERIMENT STATION
Science City of Muñoz, 3119 Nueva Ecija; Tel: (044) 456 -0277;
Direct line/Telefax: (044) 456-0112;
Email: prri.mail@philrice.gov.ph

BRANCH STATIONS:
PHILRICE BATAC MMSU Campus, Batac City, 2906 Ilocos Norte;
Tel: (077) 670-1867; Telefax (077) 792-4702, -2544;
Email: batac.station@philrice.gov ph

PHILRICE ISABELA San Mateo, 3318 Isabela;
Tel: (078) 664-2954; Telefax: (078) 664-2953;
Email: isabela.station@philrice.gov.ph

PHILRICE LOS BAÑOS UPLB Campus, College, 4031 Laguna;
Tel: (049) 501-1917; Telefax: (049) 536-8620;
Email: losbanos.station@philrice.gov.ph

PHILRICE BICOL Batang Ligao City, 4504 Albay;
Mobile: 0906-935-8560; 0918 946-7439
Email: bicol.station@philrice.gov.ph

PHILRICE NEGROS Cansilayan, Murcia, 6129 Negros
Occidental; Mobile: 0928-506-0515;
Email: negros.station@philrice. gov.ph

PHILRICE AGUSAN Basilisa, RTR omualdez, 8611 Agusan del Norte;
Tel: (085) 343-0778; Telefax: (085) 343-0768;
Email: agusan.station@philrice.gov.ph

PHILRICE MIDSAYAP Bual Norte, Midsayap, 9410 North Cotabato;
Tel: (064) 229-8178; Telefax: (064) 229-7242;
Email: midsayap.station@philrice.gov.ph

PHILRICE FIELD OFFICE CMU Campus, Maramag, 8714 Bukidnon,
Tel: (088) 222-5744

LIAISON OFFICE: 3rd Flor. ATI Bldg, Elliptical Road, Diliman, Quezon City,
Tel/Fax (02) 920-5129, Mobile: 0920-906-9052

PHILRICE
PHILIPPINE RICE RESEARCH INSTITUTE

CERTIFICATION INTERNATIONAL