

RICE TECHNOLOGY BULLETIN

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BAKANAË: THE “FOOLISH” DISEASE OF RICE



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Foreword

Bakanae is not a new plant disease. In fact, its occurrence in the Philippines was first noted in the early 1980s but did not cause much controversy since it was easily controlled.

In 2002, the disease was again observed because of the popular use of PSBRc82, a known high yielding variety that is susceptible to bakanae.

The 2006 survey report of PhilRice's Socio Economic Division shows that 46% of the farmer-respondents in Ilocos Norte, 39% in Agusan, and 54% Nueva Ecija use PSBRc82. Bakanae is mainly a seed-borne disease, thus, the increasing use of PSBRc82 without caution can lead to serious infestation.

In PhilRice, inquiries regarding this disease noticeably increased in 2003. Thus, a team of rice specialists was assigned to study bakanae in 2005.

We are publishing this technology bulletin based on their study and experiments to give you basic information on how the disease occurs, including its control measures. We hope this material can help farmers, extension workers, and students understand the disease and how to manage it.



LEOCADIO S. SEBASTIAN
Executive Director

Introduction

Bakanae is one of the oldest diseases of rice. It is a Japanese word, which means "foolish seedling". In the Philippines, it is commonly called *palay lalake* because infected plants



normally do not produce grains. On the other hand, it is called "white stalk" in China and "man rice" in Guyana.

Bakanae is mainly a seed-borne disease caused by the sexual stage of *Fusarium fujikuroi*, also known as *Gibberella fujikuroi*. It refers to the abnormal elongation or hypertrophic growth of the seedling. The bakanae fungus produces gibberellin, a growth hormone that is responsible for plant elongation. The disease renders several damages in specific localities and is common during wet season.

Bakanae is common in Southeast Asia although in some countries the percentage of infection is small. Yield losses were estimated at 20%-50% in Japan; 5%, India; 4%-15% Thailand; and 21%, Bangladesh.

In 1999, bakanae infested as much as 30% of rice fields in California. Other reports show that bakanae also infects maize, sorghum, and sugarcane.

Bakanae occurred in Japan in 1908, which is much earlier than its first occurrence in the Philippines in 1980s. Recently, the disease has again surfaced especially with the use of PSB Rc82 (Peñaranda) variety.

Reaction of popular varieties on the disease

PhilRice data of bakanae infection in the field trial plots of the National Cooperative Testing during the dry season of 2006 shows that PSBRc18 and PSBRc82 can reach up to 50%. Bakanae infection in other popular varieties, however, was less than 5%.

The data is reflected in the table below.

Variety	Infection (%)
PSBRc82	Up to 50.0
PSBRc18	Up to 50.0
IR64	1.0 - 10.0
Basmati Pak	3.3
PJ25	1.5 - 3.3
MS14	1.6
IR65	1.0
IR72	1.0
NSICRc110	1.0
NSICRc128	1.0

Source: EBGergon, ATAngeles, *et al.*, 2006

Another PhilRice study from 2005-2006 wet and dry seasons shows that PSBRc10, PSBRc34, PSBRc78, PSBRc80, NSICRc112, and NSICRc122 can also be infected by bakanae. However, the level of infection, from 0.01% to 5.66% was much lower than that of PSBRc82, the control variety, which had 17% to 35% infection.

In both seasons there was no bakanae incidence in two varieties - PSBRc54 and NSICRc130.

Signs and symptoms

- **Presence of white fluffy mycelial mat.** The presence of fungus on rice seeds can be observed as a white fluffy mycelial mat covering the seed, later appearing powdery owing to microconidial formation.



A seed covered with fungi

- **Abnormal elongation of the plant.** Infected plants have tall lanky tillers bearing pale green leaves. The diseased plants are noticeably taller than the general level of the crop. Earliest symptoms of an infected plant become visible in the field in about 30 days.



Bakanae-infected plants showing pale green leaves and abnormally taller plants.



Tiny roots on the nodes and fungal growth on the stems.

- Growth of tiny roots and fungus in the nodes of the plant



Rice plants with few tillers (right and center) because of bakanae infection compared with normal plant (left).

- Few tillers



Partially exerted panicles with unfilled grains.

- Empty panicles



■ Dead plant

Dead plant caused by bakanae infection.

Mechanism of damage

The bakanae fungus infects the seeds, roots, or crowns of the rice plant through their infective structures such as spores and mycelia. Spores are carried to other plants by air, water, or soil.

Airborne spores, which are either ascospores (sexually produced) or conidia (asexually produced) are discharged by infected plants into the air at night or during rain. The spores may also contaminate the seeds through the water used for soaking or during harvesting.

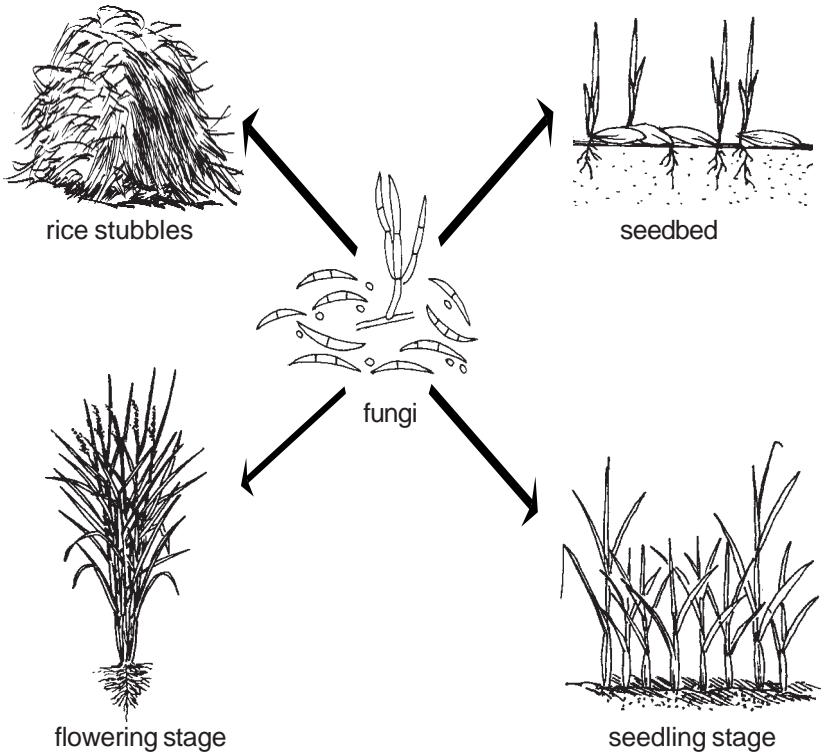
Likewise, the fungus in the seed may infect a newly germinated plant, grow inside, move to the stem, and eventually to the growing panicle. Thus, the plant produces infected seeds that can also contaminate the seeds of the surrounding healthy plants during flowering stage. The infected plant may also produce spores on the stem, near the base of the plant, which may contaminate the soil. The fungus, being soil-borne, can survive in the soil for about 4 months in the form of thick-walled hyphae or macroconidia.

Modes of infection

The bakanae fungus can infect the rice plant in any of its growth stages.

Once infected, seedlings die as early as 10 days after infection while those that survive in the seedbed may die after transplanting. Few plants may survive up to maturity stage but they bear empty panicles.

Infected plants usually produce few tillers; their leaves dry up starting from the lower part of the plant and eventually die after a few weeks.



The bakanae fungi can start infecting the rice plant any time from seed to postharvest stage.

Management options

Cultural Methods

- Use resistant varieties such as PSBRc54 and NSICRc130.
- When using inbred varieties, manually remove deformed and discolored seeds before planting. This will minimize the occurrence of bakanae and other seed-borne diseases.
- Use certified seeds. Since the pathogen is mainly seed-borne, clean and disease-free seeds should be used as planting material to minimize its occurrence. Buy seeds from accredited seed growers or reliable sources.



- Before replanting, till the land to expose the soil to sunlight and eliminate harmful organisms, particularly fungi. This will also minimize weeds.

- Rogue or immediately pull bakanae-infected plants to avoid contaminating other plants.



Roguing of bakanae-infected field.

- Practice field sanitation. Plow under rice stubbles, volunteer plants, and weeds after harvesting.



Plowing of field to prevent the spread of bakanae fungus.

Physical Method

- **Hot water treatment.** Soak the seeds in tap water for three hours. Then soak them again in hot water (50-57°C) for 15 min to kill the microorganisms in the seeds.



Hot water treatment of rice seeds.

Chemical methods

- Seed treatment with fungicide is recommended when using varieties that are susceptible to bakanae like PSBRc82. This could be done either through slurry or liquid form.
- For slurry treatment, slowly add small amount of water to the fungicide and stir the mixture until a paste is formed. Use 5 to 20 g fungicide for every kilo of seeds. Coat the seeds with the mixture and air dry for 24-48 hours before using.

- For liquid treatment, mix 1 ml fungicide with 1 L water for one-hour soaking or 1 ml fungicide with 2 L water for five-hour soaking. After treating the seeds, drain the fungicide solution, replace with water, and soak the seeds for 24 hours before incubation and seeding.



Rice seeds treated with fungicide.

Note: Benomyl or benomyl-thiram combination is still the most effective seed treatment for the disease. But if unavailable, captan and mancozeb can be used.

- In PhilRice, seed is treated in bulk by spraying. For such, uniformly spread the seeds on a canvass sheet or nylon net in less than 3 cm height. The sheet or nylon net should be on a flat surface, preferably cemented floor. Spray the seeds with a fungicide solution recommended for bakanae using the battery-operated ULV sprayer, which is commonly used in the application of GA₃. Consume the recommended amount of fungicide solution in at least 10 passes (the more number of passes, the better), mixing or stirring the seeds with a wooden stick after each pass.

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PhilRice

PhilRice is a government-owned and -controlled corporation attached to the Department of Agriculture created through Executive Order 1061 on 5 November 1985 to help develop high-yielding and cost-reducing technologies so farmers can produce enough rice for all Filipinos.

It accomplishes this mission through research, development, and extension (RD&E) through its central and branch stations coordinating with a network that includes 57 agencies and 101 seed centers strategically located nationwide.

PhilRice R&D structure for 2006-2010 includes three (3) programs and (16) major projects. Its interdisciplinary programs are irrigated lowland, (2) rainfed lowland, and (3) knowledge management and promotion. With these programs, PhilRice aims to develop and promote technologies that are ecosystem-based, location- and problem-specific, and profitable to the Filipino farmers.

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