

Panicle blight or bacterial grain rot or rice

Vincent Lanoiselet

Quarantine Plant Pathologist

Department of Agriculture and Food, Western Australia

Phone: 08 9368 3263

Email: vlanoiselet@csu.edu.au

Eric Cother

Private Consultant

Phone: 02 6361 4753

Email: rncother@bigpond.com

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Host range

Rice

Part of plant/commodity affected

Seed.

Biology

Identification/Symptoms

Seedlings can be infected where the pathogen causes conspicuous chlorosis in the basal parts of the leaves, and subsequent rotting. In flowering plants, infection causes spikelet sterility. The glumes of infected spikelets are discoloured, becoming yellow-brown at the base then turning dark brown and shrunken (Figure 1, Figure 2). Distinct brown bands form over the belly of the infected kernel. Infected spikelets are scattered in the panicle but up to 50% may be affected in severe cases. The disease usually occurs at the milk stage.

Figure 1. Discolouration of glumes caused by infection of *B. glumae* (photo : E. Cother)



Figure 2. Discolouration of glumes caused by infection of *B. glumae* (photo : E. Cother)



Disease cycle

Rice grains are most susceptible during flowering, with susceptibility falling about 6 days after flowering. The disease is favoured by high temperatures and humidity.

Dispersal

The pathogen is seed transmitted, mainly in the intercellular spaces of the parenchyma beneath the inner epidermis of the lemma.

Surveillance

General surveillance

Rice-growers/agronomists/extension personnel need to be educated about the threat bacterial grain rot represent to their industry and should also be encouraged to increase their vigilance for inspecting their crops for unusual symptoms or pests. Any unusual symptoms observed by growers/agronomists/extension personnel should be immediately reported to an experienced and trained plant pathologist for formal identification. Alternatively, the Exotic Plant Pest Hotline can be contacted on 1800 084 881.

Targeted surveillance

Strict quarantine vigilance on the bacterial grain rot pathogen and other exotic pathogens must be maintained to protect the Australian rice industry. Evidence from southern USA suggest that the pathogen could readily be introduced to Australia on any seed from south-east Asia or Japan. Vigilance to detect the disease in seed production plots may result in successfully containing it to a smaller area, with the possibility of eradication.

Barrier quarantine is in place in Australia both at the national and state level to prevent the introduction of exotic pests into Australia. The Australian Commonwealth Quarantine Act 1908 requires an Australian Quarantine Inspection Service (AQIS) permit to import any parts of *Oryza* plants or plant parts and prohibit the importation of unmilled rice. The NSW Plant Diseases Act 1924 prohibits the importation of rice plant parts, and machinery or packaging that has contacted rice plant parts into the rice quarantine area of NSW without the permission of the Chief of Division of Plant Industries of NSW Agriculture. Second hand agricultural machinery, including headers, are regularly imported from overseas and despite strict Australian quarantine regulation, it cannot be excluded that infected rice grains present in agricultural machinery/headers may have passed through quarantine inspection undetected. The 1996 rice blast outbreak in California (Greer et al. 1997) illustrates that the isolation of one rice-growing region from other rice-growing areas of the world does not guarantee continues freedom from exotic diseases threat. The quarantine vigilance should be maintained in order to protect the Australian rice industry from exotic diseases.

Passengers arriving from overseas, especially if they have visited a farm while overseas need to be monitored very closely by AQIS.

Exotic pest survey method

Collection of samples

RICE PLANTS – Bacterial grain rot is noticeable at crop maturity.

Diagnostics and laboratories

Samples presenting symptoms should be placed into paper bags and taken/sent to the Plant Pathologist as soon as possible. Plastic bags are not recommended, especially during the hot Australian summer as they tend to trigger favourable conditions for the growth of saprophytes. After collection, the samples should be placed into a closed container such as a cardboard box to protect the samples from physical damage and dusty conditions. Placing the container into a cooler box is then highly recommended especially if long distance driving is required to take the samples to the Plant Pathologists. If sending the samples by mail, express mail should be used and (they) should not be sent at the end of the week to prevent samples staying in hot conditions over the week end.

The following researcher should be consulted for diagnosis of suspected bacterial grain rot of rice:

Eric Cother

Private Consultant

Phone: 02 6361 4753 / rncother@bigpond.com

Management/control operations/R&D

Bacterial grain rot is a seedborne disease. The best way to control the disease is to use inoculum free seed. The pure seed scheme operated by the Australian rice industry reduces the spread potential of bacterial grain rot.

In the event of a bacterial grain rot outbreak

Defining the outbreak zone

The primary area to be inspected should cover all bays/fields sown from the same seed batch. Neighboring fields should be inspected at random. If bacterial grain rot symptoms are observed, all farms receiving seed from the same source should be surveyed.

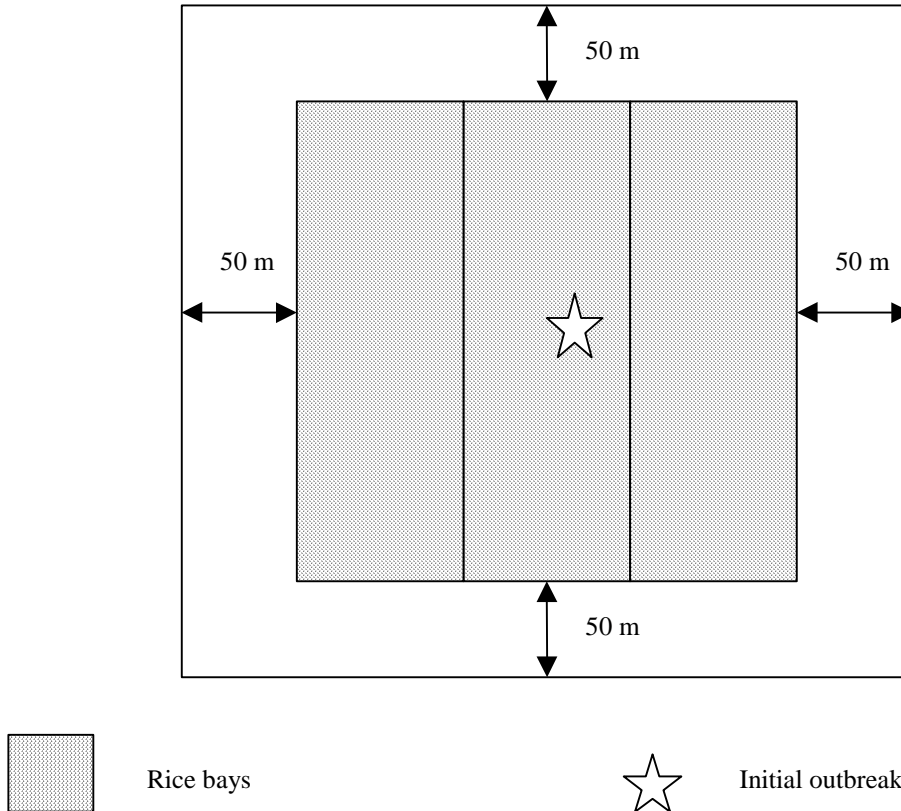
Case 1: Bacterial grain rot is found in one or a few rice fields

DEFINING THE QUARANTINE AREA

Once the infected area defined, a quarantine area needs to be set up:

- The infected rice bay and any other contiguous rice bays plus the banks of the rice bays and a dryland boundary area around the block 50 m wide (Figure 3).

Figure 3. Quarantine area around the initial rice blast outbreak



Once bacterial grain rot has been confirmed, drainage of the area should be blocked in order to let the water evaporate completely. Entry into the diseased crop should be strictly monitored and kept to a minimum. Personnel entering the crop must wear disposable overalls which can be destroyed after use.

QUARANTINE AND CONTAINMENT

Once the infected area has been delimited, a quarantine zone should be established to prevent the dissemination of the disease. The quarantine area should extend for 100 m around the infected area. Movement of people, vehicle and farm machinery must be restricted to the minimum required for the monitoring of the situation and the eradication attempt.

Rice grains and infected rice debris can be accidentally transported by the vehicles/equipment/machinery used within the quarantine area. Therefore, any vehicle/equipment must be cleaned of any plant and soil debris before leaving the quarantine area, ideally with a 2% hypochlorite solution using a high pressure cleaner. Boots, overall and gloves used by the survey and control team must be disinfected using a 2% hypochlorite solution.

DESTRUCTION/ERADICATION

The whole quarantine area must then be burnt. If the quarantine area is not dry enough for a good burn, it should be sprayed with a herbicide containing the active ingredient paraquat. Gramoxone® contains 250 g/L of paraquat and should be used at the rate of 4-8 L/ha¹. Roundup® (360 g/L of glyphosate) is not recommended in this case as the effect of this herbicide is too slow in such an emergency situation. The use of paraquat is strongly recommended as it has the advantage of being a plant desiccant. The whole quarantine area must then be burnt and no rice must be grown within the quarantine area for at least 2 years.

DOCUMENTATION TO ESTABLISH AREA FREEDOM

Rice should be grown at the end of the quarantine period (2+ years) and the crop should be monitored during the entire rice-growing season. No bacterial grain rot symptoms may indicate disease freedom.

Case 2: Bacterial grain rot is found widespread

This situation could arise if the initial disease outbreak was not detected for some time and seed multiplication sites are contaminated. At this stage the disease has to be contained within the affected area. The whole infected rice-growing area will be declared Quarantine area (i.e MIA or CIA or MVDI or the Lachlan Valley).

CONTAINMENT

Everything needs to be done to contain the disease within the contaminated area and prevent it to spread to the other rice-growing areas:

- rice grains originating from the infected area must be segregated and should not be delivered to a silo located outside the Quarantine area. The rice industry will have to put a segregation system into place.
- the SunRice pure rice seed production sites will have to be (re-)located in one of the disease free area. These certified seed should always be used by rice-growers.
- movement of people, vehicles and rice farming equipment can potentially spread bacterial grain rot and other pests and therefore must be managed. Harvesters and other farming equipment used to harvest rice within the Quarantine area should not leave the Quarantine area unless cleaned and fumigated. Farm vehicles should be clean of mud, soil and plant debris before a contaminated farm.
- clothing, tools and footwear used on farms located within the infected area should not leave the Quarantine area and should never be used on disease-free farms.
- within the Quarantine area, all rice stubbles should be burnt as a precaution.

¹ In NSW, Gramoxone is registered for 'right of way/firebreak' applications at the rate of 1.6 to 4 L/ha