THE CURRENT DISEASE SITUATION IN COMMERCIAL SUGARCANE AT RAMU, PAPUA NEW GUINEA

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Abstract

PAPUA NEW GUINEA (PNG) is a centre of origin for several Saccharum species, including S. officinarum, the original species used in commercial production. A number of endemic diseases affect commercial sugar production in PNG on the commercial estate of Ramu Sugar Limited at Gusap, Madang Province. These include downy mildew, Ramu stunt and the leaf diseases brown rust and yellow spot. Of these, downy mildew is of greatest significance. Ramu stunt has also had a very serious effect on crop production. Resistance screening trials are undertaken routinely for both downy mildew and Ramu stunt. In recent years, two previously exotic major diseases, leaf scald and ratoon stunting disease (RSD), have been identified on the estate. RSD is now a serious problem for Ramu Sugar and control programs are being established. Diseases will be of on-going importance for commercial sugar production in PNG.

Introduction

Papua New Guinea (PNG) is the centre of origin of several Saccharum species. Pests and diseases of sugarcane are common and on-going high disease pressure is a direct result of the widespread distribution of Saccharum species.

In the 1960 to 1980 period, commercial hybrid varieties were introduced into PNG with a view to establishing a PNG sugar industry. Ramu Sugar Limited operates the commercial estate located at Gusap in the Madang Province. With the monoculture of hybrid sugarcane over an extensive area, the estate has predictably had problems with outbreaks of endemic pests and diseases.

In the early 1990s, Ramu Sugar initiated a breeding program to develop local varieties that are resistant to diseases endemic in the area. This paper describes the major diseases at Ramu Sugar, the methods used to control these diseases, and future prospects for the PNG sugar industry.

Major diseases

Downy mildew

Downy mildew caused by Peronosclerospora sacchari is widely distributed in PNG (Hughes, 1952), though it is not readily found everywhere (more commonly on the northern side of the island of New Guinea, Magarey et al., 2002).

At Ramu Sugar, it is endemic in wild Saccharum species growing around the estate, and commercial crops are therefore under constant infection pressure. For this reason, varietal resistance is essential. The resistance of varieties obtained from different breeding programs around the world varies; the proportion of susceptible canes is generally around 20%.

Yield losses from the disease can be high with total crop loss in highly susceptible canes, particularly in ratoon crops. Research at Ramu Sugar in recent years suggests maximum losses may be up to 40–45% in varieties of intermediate resistance (unpublished data). Losses become significant when diseased stalk populations exceed 15%.
In the Ramu breeding program, clones are screened during the selection process and obviously diseased varieties are discarded. When clones are nearing commercial release, they are tested in a specific downy mildew resistance screening trial that includes a set of ‘standard’ varieties of known reaction.

**Ramu stunt**

Ramu stunt was unknown until the 1985–86 cropping seasons when poor yields, stool death and severe stunting became evident in commercial crops of Ragnar (Eastwood, 1990; Magarey *et al.*, 2002). Investigations revealed unusual leaf mottling and striping symptoms associated with the poor growth. The importance of the disease is illustrated by production in the 1986 season; estate production was initially estimated at 360 000 tonnes harvested product but final production was only 120 000 tonnes (Eastwood, 1990). Subsequent investigations have shown that the planthopper *Eumetopina flavipes* can transmit the disease (Kuniata *et al.*, 1994), that there is a range of varietal resistance to the disease (most varieties are resistant), that stool death in susceptible varieties is common (Suma and Jones, 2000), and that the disease can be found in related *Saccharum* species growing in different parts of PNG (Magarey *et al.*, 2002). Susceptible varieties are discarded from the breeding program, both during the early stages of the selection process and towards the end, when all clones are grown in a specific resistance screening trial. The percentage of canes with symptoms in these trials is around 25%. The causal agent of Ramu stunt has not been elucidated so far (Magarey *et al.*, 2005).

**Leaf scald**

Leaf scald, caused by *Xanthomonas albilineans*, was not recorded in Papua New Guinea until recently. The disease was first noted in commercial crops of the susceptible Cassius at Ramu Sugar in 1988. How the disease entered PNG is not known. The disease has not yet been seen outside the Ramu Valley (Magarey *et al.*, 2002) but there is obvious spread along the Ramu River in wild canes. The passage of commercial varieties from Ramu Sugar to other centres around PNG is a potential mechanism for the spread of leaf scald.

With no hot water treatment facilities at Ramu Sugar, disease control relies on the planting of resistant varieties. The disease can still be seen in a few crops at Ramu. With the production of PNG-bred canes (‘PN’ varieties) of unknown resistance, some commercial crops may be susceptible to the disease. It is important that all PN canes are screened for resistance in the next few years.

**Ratoon stunting disease (RSD)**

The PNG sugar industry was until recently the only significant industry world-wide remaining unaffected by RSD caused by *Leifsonia xylit* subsp. *xylit*. Surveys of chewing, and some wild canes in 2001 failed to find any sign of this pathogen (Magarey *et al.*, 2002). However, assays conducted in mid-2002 on samples from commercial crops highlighted the presence of the disease on the estate. With no control measures in place, the disease has no doubt spread and become the greatest priority for disease control on the estate. It is estimated that up to 80% of the estate crops are diseased, and a massive control program using disease-free planting material produced by hot-water treatment is underway. The effect on the *Saccharum* germplasm in PNG is uncertain; it is likely much of it will become diseased.

**Minor diseases on Ramu Estate**

**Fiji leaf gall**

Fiji leaf gall caused by *Fiji disease virus* is endemic in PNG (Magarey *et al.*, 2002) and can be found in *S. officinarum* and *S. edule* in village gardens or in *S. robustum* growing along roads and rivers. Vector populations on the Ramu estate have never been high and, accordingly, the disease has only been of minor concern to commercial production.

**Chlorotic streak**

In 2001, this disease of uncertain aetiology was found to be widely distributed around PNG and is no doubt endemic in the country. As waterlogging is rare at Ramu and rainfall is moderate (around 1950 mm), the disease is considered of minor importance only and no specific control measures are necessary.

**Leaf diseases**

A range of sugarcane leaf diseases occur in PNG including orange rust (*Puccinia kuehniit*), brown rust (*P. melanocephala*), yellow spot (*Mycovellosiella koepkei*), veneer blotch (*Deightonella papuana*), and ring spot (*Leptosphaeria sacchari*). These diseases are not as significant as downy mildew, Ramu stunt,
leaf scald and RSD, but they can cause losses from time to time. Although the occurrence of brown spot caused by *Cercospora longipes* has been reported in PNG (Saumtally and Sullivan, 2000), this is considered doubtful. Controls are not directly applied for any of these leaf pathogens.

Ramu orange leaf caused by an unidentified fungus (belonging to the order Exobasidiales) is a systemic fungal disease unique to PNG. It is present in ‘wild canes’ growing along rivers in PNG but is not commonly seen. While it can kill diseased shoots, it has never reached a high incidence and is considered of minor importance. Ramu streak (uncertain aetiology) causes leaf symptoms vaguely resembling those of chlorotic streak, although no necrosis is evident. The disease is also of minor importance.

**Conclusions**

Pests and diseases are of great concern to Ramu Sugar. The outbreak of Ramu stunt in Ragnar in the mid-1980s nearly caused economic disaster for Ramu Sugar. The outbreak of RSD in 2002 is causing a significant loss of revenue for the estate and these losses will continue for the next few years until the disease is brought under control.

Diseases such as downy mildew are endemic in local *Saccharum* species, and it will not be possible to eradicate these from Ramu Sugar. Consequently, there will always be a need to grow only varieties with sufficient resistance to the disease. However, the introduction of hot water treatment for RSD control, and the better utilisation of disease-free nursery material is likely to reduce downy mildew incidence and potentially allow the growth of more susceptible varieties. This will be an additional benefit from the RSD control program.

There is no doubt that the greatest need in the area of disease control at Ramu Sugar currently is the containment and reduction of the area affected by RSD. Of great significance is the possibility of spread away from the estate into other *Saccharum* species causing potential erosion of the germplasm that is a valuable resource for sugarcane breeding programs worldwide.

**REFERENCES**


LA SITUATION ACTUELLE DES MALADIES DANS LES PLANTATIONS INDUSTRIELLES À RAMU, EN PAPOUASIE-NOUVELLE-GUINÉE

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Résumé

La Papouasie-Nouvelle-Guinée (PNG) est un centre d'origine de plusieurs espèces de Saccharum, dont S. officinarum qui a, depuis toujours, été utilisé pour la production industrielle de la canne à sucre. Un certain nombre de maladies endémiques affectent la production sucrière sur l'établissement de Ramu Sugar Limited à Gusap, dans la Province de Madang (PNG), dont le mildiou, le Ramu stunt et les maladies foliaires qui sont la rouille brune et les taches jaunes. La maladie la plus importante à Ramu est le mildiou, mais le Ramu stunt a aussi eu un effet néfaste sérieux sur la production. Des essais d'évaluation des variétés pour le mildiou et le Ramu stunt sont effectués de manière routinière. Ces dernières années, deux maladies majeures, jusque-là exotiques - l'échaudure des feuilles et le rabougrissement des repousses (RSD) - ont été identifiées sur l'établissement sucrier de Ramu. Le RSD est maintenant un problème sérieux pour la sucrerie et des mesures de lutte sont mises en place. Les maladies seront toujours une préoccupation majeure pour la production industrielle de la canne à sucre en Papouasie-Nouvelle-Guinée.

SITUACIÓN ACTUAL DE ENFERMEDADES EN CAMPOS COMERCIALES DE CAÑA DE AZÚCAR EN RAMÚ, PAPUA NUEVA GUINEA

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PALABRAS CLAVES: Leifsonia Xyli subsp. Xyli, Peronosclerospora Sacchari, Raquitismo de Ramú, Xanthomonas Albilineans.

Resumen

Papua Nueva Guinea (PNG) es el centro de origen de diferentes especies de Saccharum, entre las que se incluyen S. officinarum, empleada en la producción comercial. Ciertos número de enfermedades endémicas afectan la producción de azúcar comercial en PNG, en el estado comercial de la empresa Azúcar Ramú Limitada en Gusap, en la provincia de Madang. Estas afecciones comprenden el mildio veloso, el raquitismo de Ramú y las enfermedades foliares de la roya café y la mancha amarilla. De éstas, el mildego veloso es de mayor importancia. El raquitismo de Ramú también ha tenido efectos significativos en la producción. De manera rutinaria se han estado haciendo evaluaciones de resistencia al mildego veloso y al raquitismo de Ramú en los últimos años, dos enfermedades importantes previamente consideradas exóticas, escaldadura de la hoja y raquitismo de la soca (RSD), se han identificado en el estado. Hoy en día el RSD se ha vuelto un problema muy serio para Azúcar Ramu Ltda, y por consiguiente se han establecido programas de control. En un futuro las enfermedades serán de gran importancia para la producción comercial de la caña en PNG.

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