



## Review on the possible control strategies of Sugar cane disease

### Pokkah boeng

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**Abstract:** Sugarcane is a highly industrious crop that suffers from a multitude of diseases induced by different species and causes such as environmental and physiological abnormalities and nutritional deficiencies. Owing to the prevalence of a variety of diseases viz., red rot, smut, wilt, grassy shoot, and pokkah boeng, significant yield losses in sugarcane occur. Pokkah boeng is going to be the largest of the diseases. Pokkah boeng is common and may occur in most varieties, but typically does not do much harm. In sugarcane, heavy losses in yields are caused due to the incidence of a number of disease viz., red rot, smut, wilt, grassy shoot and pokkah boeng. Among diseases, Pokkah boeng is going to be a major of them. The occurrence and intensity of pokkah boeng differ greatly from year to year depending on the varieties grown and the environmental conditions. Conventional approaches such as the use of aggressive host cultivars and industrial fungicides render the most infectious pathogens challenging to monitor. Among the main reasons undermining attempts to implement such protection, mechanisms are the absences of effective chemical controls, the incidence of fungicide tolerance in pathogens, and the degradation or situation of host susceptibility by pathogen species. In this review, we highlight the importance of breeding and the protection steps that can be introduced to minimize possible sugarcane yield losses induced by pokkah boeng.

**Keywords:** Pokkah Boeng; Biological Control Agents; Sett Treatment; fungicide; pathogen

### Introduction

Sugarcane disease control is achieved mainly through the use of tolerant varieties [1]. Frequent reviews of new varieties in the breeding system at specific selection levels, along with screening trials against some of the most significant pathogens, was intended to eradicate susceptible varieties[2]. Cane breeding has a dominant role for developing suitable crosses and screening and selection of resistant clones. But resistance must not be achieved at the cost of yield. Disease management in sugarcane is completely based on the integration of manipulated legislation, resistant cultivars and other management procedures [3].

The sugarcane Pokkah boeng is an economically important disease worldwide. Pokkah boeng is an infectious fungal disease triggered by *Fusarium sp.*, which can cause significant yield losses in susceptible sugarcane varieties[4]. *Fusarium* species are also known to produce a variety of mycotoxins making the study of these pathogens economically and socially significant[5]. The losses from these diseases can vary from place to place and depending on the variety of crops. The diseases could therefore not be ignored and neglected due to their effects on the sugarcane quality and quantity.

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All parts of the sugar cane plant can be infected with disease, and one or more diseases can occur in virtually any plant and in any field [6]. Resistant cultivars, due to the difficulties of widespread use of accessible cultural and chemical control measures for various diseases, and the drawbacks associated with the use of biocontrol methods, a significant focus on the production of resistant cultivars[7]. This system is able to discriminate pathological and stress adaptation for genetic mutation. There are available short-term spraying options but their economic viability may not be sustained. In addition, harvesting machines can transmit disease. Because of the more critical ailment problem, a modern effort to socialize and conduct integrated management for controlling the disease. The cultivation of genetically resistant cultivars is the most cost-effective technique to manipulate the disease and documented the presence of genetic variations towards fungal pathogens. Qualitative resistance provides a high level of protection, but is frequently prone to breakdown, regardless of the method of management [8]. Managing fungal pathogens are most effective when implementing manipulative measures an incorporated manner. Before working on disease resistance on pokkah boeng, information should be made available on area under susceptible varieties, degree of disease infestation in the area, expected potential losses to be occurred and the available stock of resistant strains with research station. Therefore, attention has to be focused on the more genes for resistance/ tolerance. In this review, we highlight the importance of breeding program against fungal pathogen of sugarcane.

### **Chemical control management**

The usage of resistant cultivars eliminates the use of toxic chemicals that may disturb the balance of nature and allow certain pests to become a concern. Integrated approaches are

being established continuously on the basis of integrated connections with the agro-ecosystems and are wide-ranging, from landscape conservation to unique high technology[9]. Spraying with specific fungicides such as Bavistin (1gm/lit. with water) or Blitox (0.2%) or Copper oxychloride or 0.3% Dithane M-45 (3gm/L of water) is successful in minimizing Pokkah Boeng disease [10]. Two to three sprays with an period of 15 days limit the dissemination of the pathogen and the loss of yield and consistency of the cane[11]. Daily examination of new varieties at various levels of selection throughout the breeding system is meant to remove susceptible varieties[12]. This requires a complete knowledge of all the relationships between pests, ecosystems and environmental management as well as an understanding of new technology.

### **Ratoon management**

Numerous causes, such as low winter levels, poor irrigation and aeration, egregious cultural traditions and heavy incidences of pathogens and pests, have led to the demise of the ratoon. [13,14]. Varietal differences also exist with respect to emergence of ratoon tillers from different nodes of the stubbles. The tillers may emerge from all nodes of the stubbles or from only the lower nodes or from any specific node number. Several results indicate that the ratoon crop will yield better if the main field stubble is cut with 2-3 nodes left [15]. Variations in soil, water, sun, and temperature significantly influence ratooning performance. Their interactions need to be analyzed properly to agronomically exploit the ratooning capacity. Planting a field for future sugarcane crops has been shown to increase soil fertility. Removing herbicidal ratons (glyphosate) rather than tillage decreases soil compaction and increases soil structure[16]. Many sugarcane growers held a medium level of knowledge regarding sugarcane ratoon management activities and

features such as age were negative and important correlation between the respondents level of knowledge. Management practices have been found to be detrimental to the substantial chemical and biological properties of the land, such as inter-row tearing harvest burning of crop residues, cultivating under damp conditions and the usage of strong infield transport [17]. Practices that conserve organic soil resources such as green manure, limited tillage, usage of organic fertilizer carriers such as filter cake, compost for chicken and livestock, and cane trashing for harvest. [18] have greatly increased in the industry as there is a need to sustain the all-important functions of the soil food web by maintaining soil humus. [19] Successive ratoons are distinguished by cane yield declines attributable to infectious diseases or physical damage to stools, and the amount of ratoons produced from a single crop often depends on genotypical and environmental factors. Varietal improvement and resistance to diseases is of prime importance in ratoon management. The varieties need to be of desired growth duration for specific growing conditions. Several problems in ratoon cropping need to be tackled immediately.

### **Sett treatment to deliver fungicides/ Bioagents**

The rapid sett treatment tool used to treat sugarcane planting material (setts/bud chips) with fungicides or antagonistic microbes in order to defend against fungal diseases. In which, owing to the decreased pressure produced in the treatment chamber, the soaking period is greatly shortened and the chemicals are more easily absorbed into the sugarcane setting/buds [15]. Such treatment culminated in the defense of young crops from primary sources of fungal inoculates allowing the risk of epidemic in the field to be decreased. Seed sets will provide enough nutrients to keep new seedlings developing before they establish their

own root system [17]. Setting from good, robust crop gives more germination than from the crop that is undernourished, frail and poorly developed. Best germination of top seed pieces and immature cane is stated to be due to higher nitrogen contents. The use of a fungicide, either as a seedcane treatment or applied to the soil in the furrow during planting, is recommended whenever germination conditions are likely to be less than optimal. The best way to prevent disease incidence is to plant healthy seed material and use resistant varieties and follow Integrated Disease Management practices [20]. Healthy seedcane must be planted into fields that are free of volunteer regrowth from old stubble. Care should be paid automatically to variety resistance, seed cane health effective eradication of old crops, and rouging. This ensures that the varieties eventually released to growers have a high measure of general resistance to fungal disease.

### **Endophytic biological control agents**

*Fusarium* is commonly found along with higher plants, and is prevalent in terrestrial ecosystems [21], colonizing a wide variety of plant species, for example. *F. Verticillioids* have infected more than 1000 species [22]. Most strains are pathogenic to various crops causing wilts, rots etc. Endophytic *Fusarium* strains have been isolated from maize, barley [23], wheat [24] and sugarcane [25]. *Monoliformin*, also developed by *Fusarium spp.*, can trigger disease by inhibiting the oxidative enzyme mitochondrial, pyruvate dehydrogenase, which affects the entry of carbon into the Krebs cycle during plant respiration. The necrosis of infected plant tissue may be due to the action of fumonisins, which are *Fusarium spp* produced phytotoxic compounds. Also within a host's native zone, endophyte assemblies can vary greatly, which can be due to factors such as management practices. Non-biotic conditions may also cause endophyte outbreaks [26] describes an endophyte as a

fungus that apparently causes symptomatic occupation of host plant tissues throughout or part of its life cycle. This can potentially include fungi ranging from latent pathogens to mutual symbionts.

Biological control agents that suppress plant pathogens usually either act directly through mechanisms such as competition, mycoparasitism and antibiosis or indirectly by triggering plant responses such as induced systemic resistance that reduce or alleviate plant disease[27]. Biological control of plant pathogens is an appealing alternative to current agriculture's robust dependence on chemical fungicides that cause pollutants to the environment and the development of resistant strains[28]. Species of *Pseudomonas* and *Bacillus* have long been recognised for their capacity to suppress plant diseases induced by fungal pathogens, and some have been evaluated for biocontrol efficiency in several glass-house and field trials[29,30]. These biocontrol bacteria have been documented to kill fungal pathogen cells after or just before invasion. They have potential as biological pest and disease control agents, since they contain a broad variety of compounds harmful to insects and pathogens. They demonstrate necrotrophy and using nutrients from declining or dead hosts. Bacteria display antagonistic symptoms of antibiosis, resistance or degradation, and is subdivided into predation and active parasitism, as opposed to fungal pathogens[31]. The usage of industrial agricultural fertilizers and pesticides disrupts the natural and biological balance in the environment and is deemed toxic to microorganisms and other life forms and is prevented. Biological and biochemical soil materials follow this criterion and are often sensitive to environmental stress, which is why they are ideal for estimating soil content. Hot-water treatments are used to disinfect the planting material to obtain such planting

material[32]. Quick application with hot water (50°C for 30 minutes) is used to control chlorotic and other insect pests. Minimizing agriculture may also foster stable microbial populations, and develop pathogens that trigger disease.

### Conclusion

Plant breeding is a fiercely competitive work that has seen tremendous development over the last century. The development of genomics allows emerging technology and programs to be applied to address major new agricultural problems. When these concepts and procedures are implemented, synergistically to increase the cane's efficiency and profitability, and lower inputs to produce higher yields and extra intercropping revenues. Long term, reliable, management of the disease in the field will largely depend on breeding for resistance to the *Fusarium* pathogens. A effective pathogenicity test is required so that existing cultivars and advanced breeding lines can be tested for their relative susceptibility levels to the established pathogens. Early and accurate identification is critical for disease prevention and for the application of disease management approaches as they are expected to be more successful. It is critical that alternate hosts are established in potential research efforts. The most suitable alternative is the use of genetic method to regulate the pokkah boeng. However, since the resistance in sugarcane a complex and quantitative trait involving the interactions among pathogen, trichothecenes, environments and genotypes, the development of resistant cultivars is very challenging. Advanced technologies and methods are continually being made accessible for sugarcane, such as a deeper knowledge of the genome, genetics, physiology, molecular biology, new markers of agronomic importance and advanced analytical techniques. Breeding programs will take advantage of these resources and integrate into their selection pipelines superior new cultivars that adapt to

the current and future needs of the industry and to the aspirations of the general population. Integrated and timely use of fertilizers and integrated pest management are also important areas where concentrated efforts are required on a sustainable basis.

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