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Major Diseases of Sugarcane and Their Integrated Disease Management under Tropical and Sub-Tropical Conditions

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Sugarcane *(Saccharum officinarum)* belongs to Poaceae family and is an important agro-industrial crop. The crop contributes approximately 80% of global sucrose worth of US$150 billion annually (*Ali et al.*, 2019). Sugarcane belongs to the genus *Sachharum* and is a long duration vegetative propagated plant and efficient quantum convertor of solar energy. Sugarcane is the main source of sugar and ethanol in the world. Sugar industry is the second largest agro-industry in India. The crop is cultivated in tropical and sub-tropical in 5 million ha area (Ram and Hemaprabha, 2020). Sugarcane is affected by a large number of abiotic and biotic stresses. Drought, soil salinity, floods and heat are the main abiotic factors that affect the quality and quantity of the crop badly. Among biotic stresses fungi, bacteria, nematodes and viruses are the main pathogens of the crop. In the country, more than 50 diseases were recorded in sugarcane crop.

Red Rot

Scientific name: *Glomerella tucumanensis*

Symptoms: On the leaves, small red oval spots occur on the midrib and upper surface of the leaf; these develop pale yellow to white centers, sometimes merging to cover the length of the leaf. The affected leaves change theircolor from green to orange and then to yellow. The yellow will be found in the third or fourth leaf. After that, the leaves start drying from bottom to top. In infected sugarcane,the external symptoms will appear after 16-21 days; after another ten days, the sugarcane fully becomes dried.

Management: There are three methods of prevention from the disease:

- **Cultural method:** The best way to control the red rot disease is to plant healthy set in a disease-free area. Growing resistant and moderately resistant varieties viz., Co 86032, Co 86249, CoSi 95071, CoG 93076, CoC 22, CoSi 6, and CoG 5 are recommended.
- **Physical method:** In a fungicide solution, dip the cut ends and the entire setts. If the disease is noticed in the field, the leaves and canes should be collected and destroyed by burning.
- **Chemical method:** Adopt sett treatment with cabendazim with before planting (Carbendazim 50 WP (0.5 gm in 1 liter of water) or Carbendazim 25 DS (1 gm 1 liter of water) along with 2.5 of Urea in 250 liter of water.

Pokka Boing

Scientific name: *Fusarium moniliforme var. Subglutinans*

Symptoms: The symptom is easy to recognize because it affects the top of the plant and the young leaves begin to chlorosis. The development of symptoms that may result in damage or death to the whole plant or portions of it. The initial sign is easy to recognise because it involves the top portion and the chlorosis region at the base of the young leaf. If the fungus is confined to the leaves, the plant will normally recover, else internal ladder-like lesions can occur in the stem.

Management: The controlling methods are given below:

- **Cultural control:** The only practical method of controlling this disease (if needed) is by using resistant varieties.
- **Chemical method:** Spraying different fungicides, such as Bavistin (1 g l-1 water) or Blitox (2 g l-1 water) or copper oxychloride or Dithane M-45 (3 g l-1 water), can effectively reduce pokkah boeng disease [15].

Smut

Scientific name: *Ustilago scitaminea*

Symptoms: The disease is the production of spore- bearing, black, whip-like structure from the growing point. Severely infected plants may be stunted with small, narrow leaves, and abundant tillers; they look weak and grass-like. More than one flush of whips can cause considerable damage to crops of susceptible varieties.

Management: The controlling methods are given below:

- **Cultural control:** Deep plough or irrigate fields following outbreaks to reduce the level of viable spores in the soil or in sugarcane debris. and use the of varieties with resistance is the main method used to manage sugarcane smut
- **Chemical method:** This is not an appropriate method to use for controlling this disease, apart from the use of fungicides after hot water treatment. Usually, cuttings are dipped in fungicide (flutriafol or propiconazole) after hot water treatment to protect the buds, which may become soft and more easily infected.

Leaf Spot

Scientific name: *Bipolaris sacchar*

Symptoms: Reddish-brown to yellow-brown streaks above the spots, extending upwards towards the leaf tips. sugarcane leaves infected by *B.sacchari* exhibit lesions that begin as small reddish spots on both leaf surfaces. The center of the spot becomes grey or tan. The spots may run together and form long streaks.

Management: The controlling methods are given below:

- **Organic control:** Unfortunately, no known alternative treatment against the *Bipolaris sacchari.*
- **Chemical control:** A foliar application of 0.2% copper oxychloride or 0.3% mancozeb with 2 to 3 sprayings for 10 to 15 days is recommended. Spraying is to done as per severity of the disease.
- **Cultural control:** The only practical method of controlling this disease (if needed) is by using resistant varieties.

Leaf Scald (Bacterial Disease)

Scientific name: *Xanthomonas albilineans*

Causal organism: The disease is caused by the bacterium Xanthomonas albilineans which infects the sugarcane plant's xylem (water transport) vessels. This bacterium is rod-shaped.

Symptoms: The symptoms of Leaf scald included bleaching, characteristic narrow, white pencil lines, and necrosis of the leaves. Shoot, young stalk death, and the development of symptomatic shoots from axillary buds of mature stalks was also observed (Hoy, 1994).

Management: The controlling methods are as follows:

- **Organic control:** Seed can be given a long hot water treatment to kill the pathogen. Pre-soak the cane seed or cuttings in flowing water, followed by a heat treatment at 50°C treatment for three hours to clean infected planting material.
- **Chemical control:** Cane seed can be treated with a solution containing carbendazim 5g in 10 lit of water for 15 minutes after hot water treatment to reduce infestation to a certain level.

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