

Integrated disease management in sugarcane and estimated cost of components

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Abstract

Sugarcane crop is constrained by many biotic and abiotic stresses in which diseases are one of them. In Bihar, about 20 diseases have been reported affecting its quality as well as quantity. It was noticed that unrestricted movement of unreleased seed materials from other zones and planting of the cane without testing posing a threat to cane cultivation in Bihar. Multiple ratooning is also an important factor in disease spread. To mitigate the losses caused by various diseases plant protection measures are of much importance and should adopt an integrated disease management strategy. Sett treatment before planting for 30 minutes and three sprays with Carbendazim @ 0.1% at 15 days interval was found effective against Pokkah boeing, sett rot and wilt diseases. Use of biological agent as soil application, sett treatment as well as foliar spray at early stage of the crop showed reduction in disease development.

Keywords: Sugarcane, Integrated Disease Management, Cost

Introduction

Sugarcane is the most important agro-industrial and emerging multi product crop in the country and Bihar state as well and contributes about 70 percent of world sugarcane production and provides raw materials for many other by-products (Gawade et al; 2012). In India, Sugarcane has occupied about 5.20 million ha of land with an annual production of 400.37 million tonnes and productivity of 76.99 tonnes/ha. In Bihar, it is cultivated in an area of 3.04 lakh ha with production of 182.85 lakh tonnes and its productivity was 60.15 tonnes/ha (GOB, 2019). In Bihar, its production and productivity are



low in respect to other states due to various factors. Among the various factors which lower down its production and productivity is the prevalence and abundance of diseases. It is a vegetatively propagated crop is exposed to complex diseases during the course of its germination, growth and maturity which reduces both quality as well as quantity. More than 100 diseases in sugarcane reported from various parts of the country and reduce 10-15% sugar (Viswanathan and Rao. 2011). More than 20 diseases of sugarcane caused by various categories of pathogens have been reported from Bihar. Red rot, wilt, smut, sett rot, pokkah boeng (top rot), leaf spot, mosaic, grassy shoot, red stripe, leaf scald, ratoon stunting is appearing in different cane growing regions of Bihar. Recently, yellow leaf disease is also noticed in few pockets of Bihar in traces to 2%, earlier, Pokkah boeng disease is known to be less importance but during recent past this is posing threat to the cane cultivation and most of the varieties was affected due to this disease in Bihar. However, red rot, wilt and smut are the major diseases of sugarcane prevalent in Bihar. Among these major diseases, red rot is the most important and devastating disease as it gets most congenial conditions for its occurrence and spread. So, Bihar is considered to the hot spot for this disease. Due to red rot several popular commercial varieties were eliminated from cultivation (Viswanathan, 2010). As per an estimate, loss due to diseases ranges from 10-20 per cent in terms of yield and juice quality. Losses due to red rot disease was also observed by (Minnatullah and Kamat, 2018).

Generally, it is noticed that due to unrestricted movement of seed materials of susceptible and unreleased from other zones or other states are being introduced in Bihar without proper testing or evaluation against diseases which posing a threat to cane cultivation in Bihar. Multiple ratooning is another factor which is responsible for spread of several diseases. To know the disease situation and varietal susceptibility a critical monitoring and survey of different cane growing areas are frequently needed. In sugarcane, preventive plant protection measures are of much more importance. It is fact that preventive measures can also eliminate some of the future diseases. Therefore, plant protections a continued necessity and not a short-term requirement for maintaining of disease level of sugarcane production. To mitigate the losses caused by diseases, an integrated disease management was introduced. An integrated disease management does not evolve single method of diseases management, rather it includes all the known methods of disease management. These diseases as observed in different cane growing areas of Bihar:

Symptoms of Sugarcane diseases



Sett rot disease of Sugarcane



Red rot disease of Sugarcane



Wilt disease of Sugarcane



Smut disease of Sugarcane



Pokkah boeing disease of Sugarcane



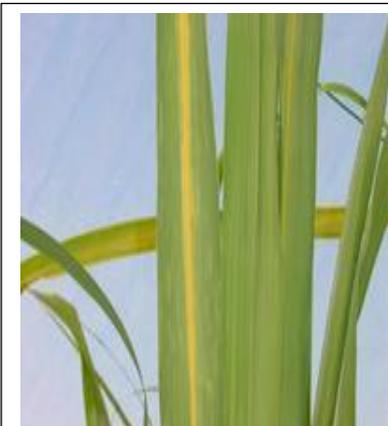
Leaf spot disease of Sugarcane



Leaf scald disease of Sugarcane



Mosaic disease of Sugarcane



Yellow Leaf disease of Sugarcane

Based on the present disease situation, an integrated disease management strategies have been drawn out.

Components of integrated disease management

Integrated disease management in sugarcane includes:

(a) Soil management

- (i) Preparatory cultivation
- (ii) Deep ploughing

(b) Seed management

- (i) Selection of varieties
- (ii) Selection of seed
- (iii) Seed treatment
 - (a) Chemotherapy
 - (b) Thermotherapy

(c) Crop management

- (i) Season of planting
- (ii) Crop rotation
- (iii) Companion cropping
- (iv) Improvement in drainage system
- (v) Survey and Roughing
- (vi) Spraying of crops through chemical and bioagent



Components of integrated disease management

Integrated disease management in sugarcane includes:

(a) Soil management

Preparatory cultivation: Since inoculum of red rot, smut, wilt, root rot, and sett rot remain viable in soil or plant debris, the crop residues such as stubbles, dry foliages as well as dead and dried canes should be destroyed to reduce the inoculums of these diseases from the field.

Deep ploughing: A good deep tillage of the soil during summer season helps in exposing the inoculums to sun. Due to high temperature during summer inoculums will die.

(b) Seed management

(i) Selection of varieties: Although, replacing susceptible varieties with resistant one is the most common way to control the diseases but breeding and selection of varieties with high resistance against a parasite is highly unmanageable as the pathogen changes their behaviour in nature.

(ii) Selection of seed: Since sugarcane is propagated vegetatively, the chances of the pathogen remaining viable in or on setts are great. It is therefore, advisable to use the seed material from a crop free from diseases. The best way to ensure freedom from the diseases is to grow small seed crop nurseries preferably raised from heat treated seed materials.

(iii) Seed treatment

Chemotherapy: Chemical treatment is used for protection of cut ends to avoid entry of soil borne pathogens (sett rot, red rot, smut and wilt) through cut ends. Bavistin at 0.1% as sett dip for 30 minutes is recommended before planting. This will not only protect the cut ends from soil borne pathogen but also enhance the germinability.

Thermotherapy: Setts are also treated with heat to inactivate or eliminate the pathogens. In thermotherapy, the differential effect of heat on the pathogen and the host is taken advantage of in freeing infected stalks of grassy shoot, ratoon stunting, mosaic, leaf scald, downy mildew and smut. In this process, pathogens present in or on setts are inactivated or eliminated at temperature which is not lethal to host tissue. Heat therapy was not only found effective against certain seed borne diseases but also against scale insects, mealy bugs and larvae of borers. Hot water treatment at 50-degree centigrade for 2 hrs and moist-hot-air treatment at 54 degrees centigrade for 4 hrs was found effective.

(C) Crop management

(i) Season of planting: Season and date of planting have a significant influence on disease development. Autumn planted cane crop showed resistance against disease because its susceptible phase passes at time (March-June) when climatic conditions are unfavorable for pathogen. Spring planted crop is vulnerable to attack as the crop passes through the susceptible phase in (July-October). This time climatic conditions are favorable for the pathogen development.

(ii) Crop rotation: Monoculture of sugarcane over large areas provides congenial conditions for the rapid buildup of inoculums. To break this, crop rotation with green manure crop should be followed.

(iii) Companion cropping: Sugarcane when grown with coriander, garlic, linseed and mustard as a companion crop, they substantially reduce wilt incidence. The incidence of red rot was also

reduced when sugarcane was grown after the harvest of garlic, coriander, linseed, mustard and onion.

(iv) Improvement in drainage system: Flooding and ill drained conditions help in the spread of inoculums of red rot, smut, wilt and sett rot diseases. To avoid this, upland should be selected as far as possible for planting failing which good drainage should be ensured for mitigating the diseases. Irrigation water should not flow from diseased field to disease free field.

(v) Survey and Rouging: Frequent and critical survey of cane field should be carried out carefully and diseased clumps should be removed from the field at an early stage to remove the foci of infection and thus preventing wide dissemination of inoculums.

(vi) Spraying of crop through chemical and bioagent: Although, several fungicides have been found effective against sett rot, top rot, root rot, leaf spots, downy mildew and rust diseases but to date no fungicide has been found satisfactory against seed borne diseases. Sett treatment before planting for 30 minutes and three sprays with Carbendazim @ 0.1% at 15 days interval was found effective against Pokkah boeing disease, wilt and sett rot diseases. After removing the whip smut two prophylactic sprays with Propiconazole @ 0.1% at 15-20 days intervals has been recommended. Use of biological agent viz. *Trichoderma viride* & *Trichoderma harzianum* as soil application, sett treatment and foliar spray at early stage also showed reduction in disease incidence.

Table-1. Estimated cost of cultivation used in Integrated disease management (IDM)

Particulars	Quantity	Rate	Value (Rs/ha)
Seed treatment (Sett treatment) with Carbendazim	1 gm/litre of water 500 gm / 1000 litre of water	Rs. 500/kg	Rs. 250.00 (3.03)
Need based biological agent sett treatment powder form	05 kg/ha	Rs. 250/kg	Rs. 1250.00 (15.15)
Need based spraying with carbendazim	1 kg/1000 litre of water/ha	Rs. 500/kg	Rs. 500.00 (6.06)
Need based spraying with Blitox 50	2 g/litre of water or 2 kg/1000 litre of water/ha	Rs. 400/kg	Rs. 800.00 (9.70)
Need based spraying with propiconazol	1 ml/litre water 1 litre/1000 litre of water/ha	Rs. 1100/litre	Rs. 1100.00 (13.33)
Need based spraying with plantomycin	50 gm/Acre or 125 gm/ha	Rs. 140 for 50 gm=350.00	Rs. 350.00 (4.24)

Roughing/monitoring and survey of diseases clumps	10 labour/ha	Rs. 400/mandays	Rs. 4000.00 (48.48)
		Total	8250.00 (100.00)

Figures in the parenthesis indicate percentage value.

It was observed from the table-1 that total cost of cultivation of integrated disease management (IDM) was estimated Rs. 8250 per hectare. Out of total variable cost rouging/monitoring and survey of disease clumps accounted for 48.48 percent followed by 15.15 percent, 13.33 percent, 9.70 percent, 6.06 percent and 4.24 percent on need base biological agent sett treatment powder form, need based spraying with propiconazol, spraying with Blitox-50 and spraying with Carbendazim and need based spraying with Plantomycin respectively. Among these particulars, roughing/monitoring and survey of disease clumps was the most expensive Rs. 4000 per hectare mainly due to high labour wage and programme like MGNREGA will also provide non-farm income guaranteeing opportunities to the rural people.

Conclusion

The disease management strategies mostly rely upon form of pathogen which is responsible for carrying a disease from one season to another and preservation of diseases by soil, debris, wind, rain, irrigation water, weeds and insect vectors. Hence, to mitigate the losses caused by diseases, an integrated disease management strategies becomes essential for the management of the crop. The bad effects of several chemicals have also been well recognized. Therefore, to break similar situations has compulsory to work out an integrated disease management approaches so that cane cultivation could not distressed.

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