



Deterioration in Sugarcane Due to Pokkah Boeng Disease

ATUL SINGH*, S.S. CHAUHAN, ANEG SINGH and S.B. SINGH

Sugarcane Research Institute, Shahjahanpur- 242 001, Uttar Pradesh, India

ABSTRACT

During the survey of sugarcane diseases in different seasons the Pokkah Boeng disease was observed on eleven varieties in monsoon and post monsoon seasons in central Uttar Pradesh. The incidence varied from 0.1 to 10.0 percent the minor elements reduction in major phosphorus and sulphur and minor elements zinc, iron, copper and manganese were recorded in diseased stalks and leaves in comparison to healthy ones. Maximum reduction in weight length, internodes, total juice, girth, pol per cent and total sugars was recorded in the varieties i.e. CoS 8436 and CoS 88230.

Key words: Sugarcane, pokkah boeng, macro and micro-nutrients, reduction

Sugarcane is an important cash crop of India. A number of minor diseases have been reported on this crop. Pokkah Boeng disease of sugarcane is one of them and was reported as minor disease in early 1930s. Its incidence was reported by Padwick (1940) on Co 317 variety, which ranged from 2.4 to 2.8 percent. During 1960-61 this disease become conspicuous, with the introduction of Co 658 variety in Tamil Nadu state (Amed and Padmanabhan, 1964). This disease was reported in varieties Co 1148, CoS 767 and CoJ 64 during the survey of Sarawasti Sugar Mills, Yamuna Nagar (Singh and Virk, 1997). Further the disease was reported in Maharashtra (Patil). In the present study the area of Rosa, Aira and Hargaon Sugar Factory Zones were surveyed and the disease incidence was recorded during the year 2000-2001 to 2001-2002. It has been noticed that the diseased plant become deficient of trace elements and few major elements simultaneously the pol percent in juice and sucrose percentage in juice also declined. Since this disease is spreading fast in wider areas, it appears essential to study the deterioration due to this disease in sugarcane. The quantitative and qualitative deterioration in sugarcane due to this disease have been thoroughly work out.

Survey was conducted during 2000-2001 to 2001-2002 in sugarcane fields at Rosa (Shahjahanpur), Aira (Lakhimpur) and Hargaon (Sitapur) factory zones of central Uttar Pradesh, India to adjudge the incidence of Pokkah Boeng disease. Three 10m x 10m blocks were selected randomly in the field, diseased and healthy clumps of canes were counted and percentage of diseased clumps were calculated.

Analysis of macro and micro nutrients

The plants were separated in to leaves and stalk, washed thoroughly under running tap water and finally in deionized water. The samples were dried, chopped into small pieces and dried in hot air oven initially at 102°C for two hours followed by drying at 60°C to a constant weight. The samples were ground in a steel mill to pass through of 20 mm sieve and nitrogen content in each sample was analyzed by modified micro Kjeldahl method. The ground leaf and stalk samples were digested in diacid mixture of HNO₃ and HClO₄ (4:1) phosphorus in the extract was estimated by Vanadomolybdophosphoric yellow method. The available sulphur in the same extract was determined turbidimetrically (Chesmin and Yien, 1951). The micro nutrient (Zn, Fe, Cu and Mn) were estimated by atomic absorption spectrometer (SCLNO-4).

Studies on quantitative parameter and juice analysis

In two cane varieties CoS 8436 and CoS 88230 ten cane weight with top and with out top (kg), height, number of internodes, total juice, girth of ten canes of each variety was studied. Pol percent in juice and total sugar in juice was also studied by method of Thau and Chen (1993). All the above noted parameters were studied in samples collected from at three different farmer's fields and the average of each parameter was calculated separately.

Three factory zones Rosa, Aira and Hargaon of Shahjahanpur, Lakhimpur and Sitapur districts respectively were surveyed to find out the Pokkah Boeng disease incidence in central Uttar Pradesh. Survey results revealed that the

*Author for Correspondence: Atul Singh
e-mail: upcsr@sancharnet.in

Table 1. Micro nutrient contents in healthy and Pokkah boeng disease affected plants in different sugarcane varieties.

Name of variety	Percentage of Nitrogen (N%)				Percentage of Phosphorus (P%)				Percentage of Sulphur (S%)									
	Stalk		Leaf		Stalk		Leaf		Stalk		Leaf							
	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent						
1 CoS 8432	1.98	1.55	0.43	2.50	1.82	0.68	0.12	0.11	0.01	0.15	0.10	0.05	0.15	0.15	0.00	0.18	0.16	0.02
2 CoS 8436	2.12	1.67	0.45	2.32	1.82	0.50	0.14	0.13	0.01	0.17	0.12	0.05	0.19	0.19	0.00	0.21	0.17	0.04
3 CoS 88230	2.30	1.84	0.46	2.52	1.90	0.62	0.20	0.19	0.01	0.27	0.22	0.05	0.22	0.19	0.03	0.25	0.19	0.06
4 CoS 95222	1.90	1.83	0.07	2.00	1.92	0.08	0.12	0.09	0.03	0.14	0.10	0.04	0.17	0.16	0.01	0.19	0.17	0.02
5 CoS 95255	1.90	1.62	0.28	2.10	1.76	0.34	0.14	0.14	0.00	0.18	0.07	0.11	0.15	0.15	0.00	0.20	0.16	0.04
6 CoS 96258	2.32	1.63	0.69	2.40	1.80	0.60	0.17	0.16	0.01	0.21	0.13	0.08	0.21	0.20	0.01	0.23	0.18	0.05
7 CoS 97264	2.00	1.76	0.24	2.19	1.90	0.29	0.14	0.10	0.04	0.15	0.11	0.04	0.16	0.15	0.01	0.19	0.18	0.01
8 CoP 84212	2.05	1.71	0.34	2.20	1.92	0.28	0.13	0.12	0.01	0.16	0.09	0.07	0.18	0.16	0.02	0.20	0.17	0.03
Mean	2.07	1.70	0.37	2.27	1.85	0.42	0.16	0.12	0.01	0.17	0.11	0.06	0.17	0.16	0.01	0.20	0.17	0.03

Table 2. Micro nutrient contents in healthy and Pokkah Boeng disease affected plants in different sugarcane varieties.

Name of variety	Percentage of Zinc (Zn%)				Percentage of Iron (Fe %)				Percentage of Copper (Cu%)				Percentage of Manganese (Mn%)											
	Stalk		Leaf		Stalk		Leaf		Stalk		Leaf		Stalk		Leaf									
	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent	Healthy %	Decreased in percent								
1 CoS 8432	15.2	14.2	1.0	22.0	19.2	2.8	121.5	105.3	16.2	190.5	145.0	45.5	6.0	6.0	1.8	28.0	25.0	3.0	29.0	21.0	8.0			
2 CoS 8436	23.0	19.0	4.0	23.5	21.7	1.8	123.5	120.0	3.5	205.5	190.2	15.3	9.0	7.6	1.4	11.0	8.0	3.0	27.0	26.1	0.9	33.0	25.5	7.5
3 CoS 88230	19.0	18.0	1.0	22.0	21.5	0.5	135.5	132.0	4.0	175.0	155.8	20.2	7.0	5.0	2.0	11.0	9.0	2.0	37.0	34.3	2.7	41.0	36.2	4.8
4 CoS 95222	14.1	13.1	1.0	20.1	17.1	3.0	110.0	98.5	11.5	219.5	171.5	48.0	5.8	5.0	0.8	6.7	5.7	1.0	22.0	21.0	1.0	27.0	25.4	1.6
5 CoS 95255	12.5	11.5	1.0	23.3	17.7	5.6	133.0	121.5	11.7	170.5	157.2	13.3	6.5	6.0	0.5	8.5	6.2	2.3	30.0	27.5	2.5	34.0	31.2	2.8
6 CoS 96258	15.7	12.7	3.0	19.2	18.2	1.0	132.5	131.0	1.5	175.3	143.5	31.8	7.3	6.3	1.0	9.1	7.0	2.1	33.0	33.0	0.0	38.0	33.0	5.0
7 CoS 97264	16.3	14.3	2.0	21.2	15.2	6.0	113.0	110.0	1.0	202.0	145.0	57.0	8.6	8.0	0.6	8.7	7.3	1.4	24.0	21.0	3.0	28.0	26.2	1.8
8 CoP 84212	20.0	18.2	1.8	21.6	20.0	1.6	127.0	112.0	16.0	195.0	178.0	17.0	8.5	7.9	0.6	9.0	7.0	2.0	25.0	25.0	0.0	32.7	28.0	4.7
Mean	16.97	15.12	1.85	21.4	18.82	2.79	124.18	116.13	8.05	191.66	160.31	130.95	7.33	6.47	0.86	8.97	7.02	1.95	28.25	26.61	1.64	32.83	28.31	4.52

Table 3. Effect of Pokkah Boeng disease (top rot) on yield parameters of two sugarcane varieties

Parameters	CoS 88230		CoS 8436	
	Healthy canes Average of three locations	Diseases canes Average of three locations	Healthy canes Average of three locations	Diseases canes Average of three locations
*Cane weight with top (kg)	17.00	15.00	11.00	10.00
*Cane weight without top (kg)	12.00	10.00	8.00	7.50
Length (cm)	215.4	201.50	134.70	131.40
Number of internodes/ stalk	17.40	16.30	15.80	13.5
Total juice (kg)	5.80	5.30	4.80	3.80
Girth (cm)	Top	2.30	2.23	2.00
	Middle	2.50	2.10	2.60
	Bottom	2.57	2.67	2.70
Pol percent in juice	16.05	15.81	16.25	15.85
Sugar content in juice (total sugar)	16.747	16.295	16.536	16.131

*Average of ten canes

incidence of this disease varied from 0.1 to 10.0 percent in varieties CoS 767, CoS 802, CoS 8432, CoS 8436, CoS 88230, CoS 91269, CoS 95255, CoS 96258, CoS 97264 and CoPant 84212 at Rosa sugar factory zone, Shahjahanpur and research form of Sugarcane Research Institute, Shahjahanpur. Mild cases of this disease were recorded at Hargaon factory zone, Sitapur in varieties CoS 8436, CoS 88230, CoS 96260 at few farmers field. Mild cases of this disease were also reported at Aira factory zone in varieties CoS 767, CoS 802, CoS 8436, CoS 88230 and CoS 91269. This survey for the disease was conducted during monsoon period. The sampling for the analysis purpose was done in the month of November and December from Rosa factory zone, Shahjahanpur. The incidence of this disease varied from 0.1 to 10.0 percent in the above factory zones.

The macro nutrients nitrogen, phosphorus and sulphur were analysed in stalk and leaf of eight sugarcane varieties (Table 1). The decrease in stalk nitrogen percent was minimum in CoS 95222 variety i.e. .01 per cent. Whereas, it is maximum in CoS 96258 i.e. 0.69 per cent. Mean decrease per cent in nitrogen among all the eight varieties tested was 0.25 per cent in leaf was maximum in CoS 95222 i.e. 0.08 per cent. Mean decrease in cane leaf nitrogen was 0.42 per cent (Table 1.).

Percent of phosphorus in stalk and leaves of healthy and disease canes were estimated. Decrease in phosphorus was not observed in CoS 95255 and maximum decrease was observed in stalk of CoS 97264. The mean decrease in diseased stalk in comparison to healthy once was 0.01 per cent. The maximum decrease in cane leaf was recorded in variety CoS 95255, i.e. 0.11 per cent and maximum decrease was in varieties CoS 95222 and CoS 97264 i.e. 0.04 per cent (Table 1).

There was no decrease in sulphur percentage in the stalk of the CoS 8432, CoS 8436 and CoS 95255 varieties. Maximum decrease in sulphur was recorded i.e. 0.60 per cent in variety

CoS 88230. Mean decrease of sulphur in stalk was recorded 0.01 per cent whereas it was 0.03 per cent in leaves.

Four micro nutrients zinc, iron, copper and manganese were estimated in healthy and diseased stalk and leaves of eight cane varieties. Minimum decrease was recorded in zinc percent in stalk and leaves of variety CoS 88230. Maximum decrease in zinc percentage was recorded in variety CoS 96258 i.e. 3.0 per cent in cane stalk. Maximum decrease in zinc percentage in leaf was 6.0 per cent in variety CoS 97264. Mean decrease in zinc was 1.85 percent in cane stalk and it was 2.79 in leaves of different cane varieties.

Minimum decrease in iron percentage was recorded in CoS 97264 i.e. 1.0 per cent and it was maximum in CoS 8432 i.e. 16.2 per cent in the stalk. Maximum decrease in leaf was recorded in variety CoS 95222 i.e. 48.0 per cent and minimum in CoS 95255 i.e. 13.3 per cent. Mean decrease in iron in stalk and leaf was 8.05 and 30.95 per cent, respectively (Table 2).

No decrease in copper percentage was recorded in variety CoS 8432 in stalk and it was 1.0 per cent in leaves of variety CoS 95222. Maximum decrease was 14.0 per cent in stalk of variety CoS 8436 and 3.0 per cent in leaves of the same variety (Table 2). Mean copper percentage was 0.86 in stalk and 1.95 per cent in leaves of the different cane varieties.

Difference in manganese percent in stalk was 0.0 per cent in varieties CoS 96258 and CoPant 84212. It was minimum among all the varieties. Manganese percentage was maximum in stalk of the varieties CoS 8432 and CoS 97264 i.e. 3.0 per cent. Minimum per cent of manganese was recorded in leaves of variety CoS 95222 and it was maximum in CoS 8432. Mean decrease of manganese in different cane varieties was 4.52 percent. Khangura and Sokhi (1994) reported in two varieties of *Brassica juncea* viz. RL-1359 and RLM-619 and one variety

of *Brassica campestris* var TL-15 that in *Brassica* infected with *Albugo candida* (Pers and Lev). The malformed inflorescences of these genotypes exhibited lower levels of N, P, Ca, Mg, S, Fe and Mn as compared to healthy ones. However, the concentrations of K, Zn and Cu were higher in malformed inflorescences as compared to healthy ones. In sugarcane due to Pokkah Boeng disease almost all the tested major and minor elements e.g. N, P, K, S, Zn, Fe, Cu and Mg decreases in stalk and leaves of diseased plant in comparison to healthy ones.

Quantitative and qualitative parameters and juice analysis were studied in two varieties namely CoS 88230 and CoS 8436. Results were based on average of ten cane and mean of three locations from where the healthy and diseased canes of each variety were collected. Weight of cane with top was measured in kilogram, it decreased in both the varieties in diseased canes in comparison to healthy ones. Weight without top also decreased in diseased cane. Length of the canes were measured in centimeter it also decreased canes in both the varieties. Number of internodes per stalk were also decreased. Total juice quantity and girth of the cane also decreased in both the varieties in comparison to healthy ones. Pol percent and total sugars in juice also showed declined trend in both of the varieties in comparison to healthy ones (Table 3). Singh and Virk (1997) reported reduction in the girth of stalk, number of internodes/ stalk and stalk weight as compared to healthy plants in variety CoJ 64. Higgs *et al.* (1977) reported that stalk weight and level of soluble solids of diseased plants were lesser than those of the healthy ones.

The pokkah boeng disease have been observed on number of varieties but in general its incidence have been

noted on the broad leaves varieties during monsoon. In the present study drastic reduction have been recorded in macro and micro nutrient levels in pokkah boeng diseased stalk and leaves. The reduction in weight length, internodes, juice, girth, pol per cent and total sugars in juice in infected canes of varieties CoS 8436 and CoS 88230 have been also reduced.

REFERENCES

- Amed, N.J. and Padmanabhan, D. (1964). *All India Conf. Sugarcane Res. And Rev. Workers*, 5: 660-676
- Chen, C.P.J. and Chou, C.C. (1993). *Cane Sugar Hand Book*, John Wiley & Sons- Inc.
- Higgs, A.H., Abd, Elvazik, A.A. and Rushdi, M.N. (1977). *Proc. Int. Soc. Sugarcane Technol.* 16: 473-487
- Khangura Raojit, K. and Sokhi, S.S. (1994). Nutrient level in healthy and malformed inflorescences in *Brassica* infected with *Albugo candida* (PERS Ex LEV) *Kuntze Plant Disease Research* 9(1): 41-46
- Martin, J.P., Andojo, H. and Wismer (1989). *Disease of sugarcane: Major diseases* eds O.C. Ric and Egan, B.T., Gillaspic, A.G. and Hughes, C.G., Elsevier, Amsterdam: 158-168
- Padwick, C.W. (1940). *Soc. Rept. Agril. Res. Inst. New Delhi* 198-39: 103-115
- Singh, N. and Virk, K.S. (1997). Occurrence of Pokkah Boeng disease on CoJ 64 in Yamunanagar area Eds. Dhawan, A.K., Chaudhary, M.K., Dendsey, J.P.S. and Dang, Y.P., C.C.S. Haryana Agric. University Publication: 163-165.

Revised : August 7, 2005; Accepted in Revised form: July 12, 2006