

Effect of Planting Time and Seedcane Sources on White Leaf Disease Incidence, Cane Yield and Sucrose Content

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ABSTRACT

An experiment was conducted to find out the effect of time of planting and seedcane sources on white leaf disease (WLD) incidence, yield of cane and sucrose content at Sreepur, Gazipur under Modhupur AEZ. The experiment was carried out in RCB factorial design with four replications in three successive crop seasons from 1998-89 to 1990-91. Three planting times in autumn, spring and summer and two seedcane sources viz. apparently healthy and diseased seedcane were taken into the experiment. Results revealed that autumn planting with apparently healthy seedcane is the best planting time to avoid WLD incidence and to get significantly higher cane and sugar yield than that of spring and summer plantings with any kind of seedcane source at Modhupur AEZ. Disease incidence in autumn planting with apparently healthy cane was found significantly lower than that of spring and summer plantings. Significantly higher WLD incidence was observed in both the seedcane sources in spring compared to autumn and summer plantings. Reduction of millable cane, yield of cane and sucrose content were higher in diseased seedcane compared to healthy seedcane sources in all the planting times.

Key words : Sugarcane, white leaf disease, seedcane sources, cane yield, sucrose content.

INTRODUCTION

White leaf disease (WLD) is caused by micoplasma like organism (MLO) was recognized in India in 1949 followed by Thailand and Taiwan in 1954 and 1958 respectively (Chen, 1980). The disease is most important and disastrous one in Bangladesh. Rahman *et al.* (1980) first reported the occurrence of the disease in Co 1158, Isd 2/54 and Isd 16 varieties under different mills zone in Bangladesh. In recent years most of the sugarcane varieties and promising clones are found to be susceptible to WLD. Yield loss due to the disease was found ranging from 0.5 to 70 percent in Bangladesh (SRTI Annual Report, 1985). The loss contributing factors are mainly shortening of cane, reduction in weight and reduction in sucrose content. Chuang Yang and Ling (1963) compared WLD infected cane with healthy cane and found yield loss of 37.2% due to shortening of cane, 51.01% in cane weight and 81.0% in sucrose content. Dhumal and Nimbalkar (1986) studied that MLO adversely affected germination and growth but stimulated tillering in Co 419 and Co 740. They further stated that MLO impaired sucrose metabolism which resulted in poor juice quality. Diseased cane stalks contained higher amount of reducing sugar while the content of non-reducing sugar, total sugar and commercial sugar decreased. This may be due to enhanced activity of invertase and lower activity of sucrose synthetase and sucrose-P synthetase. Liu *et al.* (1963) reported that losses in yield depends on the time of occurrence and the degree of incidence of the disease. Agnihotri (1990) reported that the occurrence of disease is safe in spring-planted sugarcane. He pointed out that the studies on the ecology of disease occurrence in the field shows that spring-planted sugarcane is practically safe from the

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disease in an area where the disease incidence is high if the seed setts were taken from cane planted in the preceding autumn-planting. He further reported that even in autumn-planting, the disease incidence could be minimized if the cutting are obtained from the spring-planted canes.

The Modhupur AEZ environment is one of the largest gur producing zone of the country. Only few primitive sugarcane variety were found to be cultivated which were highly susceptible to WLD. Sugarcane farmers usually practicing cultivation starting in late spring to summer or even in late summer with Misrimala variety. A recent survey indicated that about 20-70% plant crop and about 30-100% ratoon cane were found to be infected by WLD that causing serious damage to the country's gur industry. The most popular sugarcane variety Misrimala that covers more than 90 percent of the area is very good for gur production and highly susceptible to WLD. Entirely pure white and striped type symptoms are found in this area. At present there is BSRI bred sugarcane varieties to replace Misrimala for the Modhupur AEZ environment. Therefore, the experiment was undertaken to minimize the loss in sugarcane yield and gur production by altering the planting time and to asses the loss due to the disease from different planting time and seedcane sources.

MATERIALS AND METHODS

The experiment was conducted in Cotton Seed Multiplication farm of Cotton Development Board at Sreepur, Gazipur in three successive years during 1988-89 to 1989-91 planting seasons. The experiment was carried out in RCB factorial design with four replications for each treatment. Three planting times and two seedcane sources were selected. Autumn (November), Spring (February) and Summer (April) were the planting times and apparently healthy and WLD infected seed were the seedcane sources. Seedcane from preceding spring planted cane were taken for all planting times and types. Diseased seedcane from diseased infected clumps and disease free apparently healthy seedcane from disease free clumps were collected from the locally adopted Misrimala variety. Seedcane were cut into single bud pieces for planting into the polythene bags and 4-5 leaves aged seedlings were transplanted in the main field for each planting times. One hundred and twenty settings for each plot containing eight rows were transplanted in 48.6 square meter plot. Germination and disease incidence were recorded in the nursery bed. Life irrigation was done for autumn and spring transplanted cane for establishment of the seedlings. From growing period to harvest of the crop data on WLD incidence, number of millable cane, weight of cane and sucrose content were collected separately for individual treatment. Data on WLD incidence were taken in different times from germination to harvest. Millable cane stalk count and weight were taken from middle rows of each plot during harvest. Sucrose content was determined from 13-14 months aged cane stalks of four inner rows from individual plot. Cane yield was estimated from the recorded number of millable cane stalk multiplying by the mean cane stalk weight. Finally, the data were analyzed statistically using IRRISTAT computer programme.

RESULTS AND DISCUSSION

Planting time and seedcane sources had a significant effect on the incidence of WLD, yield of cane and sucrose content. Results presented in Table 1 indicates that autumn planting with apparently healthy or even with diseased seedcane is always better than that of summer and spring planted sugarcane.

Table 1. Effect of planting time and seedcane sources in the incidence of while leaf disease and cane yield.

Time of planting	WLD incidence (%)		LSD (0.05)	Cane yield (TCH)		LSD (0.05)	Sucrose content (%)		LSD (0.05)
	Apparently healthy	Diseased		Apparently healthy	Diseased		Apparently healthy	Diseased	
Autumn (November)	5.55	33.39	**	119.44	92.18	*	10.38	9.88	*
Spring (February)	19.50	57.16	**	84.42	45.23	**	10.88	10.04	**
Summer (April)	11.01	47.04	**	64.49	31.46	*	11.07	10.70	NS
Mean	11.95	46.01		89.45	56.29		10.77	10.21	

The WLD percentage were significantly higher in spring-planting either with apparently healthy or diseased seedcane from that of autumn and summer plantings. This might be the case of insect vector or environmental factor (s) or planting technique of sugarcane. Insect vector with the interaction of planting technique and physical environment might have influenced the pathogen to propagate rapidly in the established seedlings at the end of spring or at early summer for the spring transplanted sugarcane. Planting time and seedcane sources also influenced the cane yield and sucrose content. Apparently healthy sources in autumn planting produced the highest cane yield and sucrose content compared to spring and summer planting in both the seedcane sources. This might be due to less infection and appropriate time of plantation in the environment. This suggests that cane cultivation is safe in autumn or in the other hand WLD incidence could easily be escaped largely by planting sugarcane in autumn to get desirable cane and sugar yield in the Modhupur AEZ.

A significant effect on the incidence of WLD, number of millable cane, weight of cane and sucrose content were found with planting time and environment. Results presented in Table 2 indicates that WLD incidence (%) may occur higher or lower due to environmental variation in different planting times and consequently the influence of WLD incidence might influence the production of millable cane stalk, its weight and ultimately the cane and sugar yield. This suggests that the yield and yield contributing parameters of sugarcane are flexible to contribute poor or better performances due to WLD with the interaction of environmental factors. However, the ultimate goal of sugarcane yield was always found higher in autumn planting. This further, suggests that WLD incidence can be minimized in the Misimala variety by altering the planting time from summer to autumn specially in the tested environment.

Table 2. Interaction effect of planting time over years in the incidence of WLD, millable cane and cane yield.

Year	WLD (%)			Millable cane (10^3ha^{-1})			Yield (TCH)		
	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer
1	13.12b	50.29a	18.95b	98.84a	60.89a	66.32a	124.60a	76.33a	56.07a
2	27.95a	39.70b	47.11a	78.57b	67.56a	49.40b	65.34b	51.79b	35.76b
3	17.13b	25.67a	21.01b	84.04b	68.46a	58.05ab	127.50a	66.37ab	52.09ab
Mean	19.37	38.56	29.03	87.15	65.64	57.92	105.81	64.37	47.98

In a column means followed by a common letter are not significantly different at the 5% level by DNMRT.

The interaction effect of different seedcane sources with changes of environment in different years had a significant influence on the incidence of WLD, millable cane, cane yield and sucrose content. Results presented in Table 3 show as significant variation on the incidence of WLD in both the seedcane sources in different years. This suggests that in the changing environment, WLD incidence with any kind of seedcane sources may vary and the level of incidence may go significantly upward or downward depending the change of environment. Another cause might be the vector population that with the changing environment might change their feeding and breeding habit that ultimately influence the pathogen to infect severe or at lower limit. But the presence of any vector could not be identified in this experiment. However, with the change of environment in different years and seedcane source the production of millable cane, yield of cane and sucrose content were found simultaneously increased or decreased with the higher or lower level of WLD infection. This confirms the dangerous effect of the disease.

Table 3. Interaction effect of seedcane sources over years in the incidence of WLD, millable cane and sucrose content.

Years	WLD (%)		Millable cane (10^3ha^{-1})		Cane yield (TCH)		Surose content	
	Apparently healthy	WLD Infected	Apparently healthy	WLD Infected	Apparently healthy	WLD Infected	Apparently healthy	WLD Infected
1	24.06a	20.55c	75.89b	70.81a	93.94a	77.39a	9.34b	9.44a
2	10.88 b	65.56a	79.63ab	50.73b	69.06b	32.86c	10.78b	10.94a
3	0.63 c	41.92b	86.21a	54.15b	105.36a	58.62b	11.78b	11.49a
Mean	11.95	46.01	80.57	58.56	89.45	56.29	10.63	10.62

In a column, means followed by a common letter are not significantly different at the 5% level by DNMR.

Planting time, seedcane source and environment interaction had a significant effect on the incidence of WLD, number of millable cane, yield of cane and sucrose content of sugarcane. Results presented in Table 4 shows that at WLD incidence under each planting time with same source of seedcane in different seasons differ significantly for the interaction effect of time, source and environment. This suggests that with a slight variation of a single factor or factors the incidence of WLD could go higher or lower level. In case of millable cane production, cane yield and sucrose content the same trends were observed where with the interaction effect of time, source and environment influenced significantly on the yield and yield contributing parameters of sugarcane.

Table 4. Interaction effect of planting time from different seedcane sources over different years in the incidence of WLD, millable cane and sucrose content.

Plaing time	Years	WLD (%)		Millable cane (10^3ha^{-1})		Cane yield (TCH)		Sucrose content (%)	
		Apparently healthy	WLD (%) infected	Apparently healthy	WLD (%) infected	Apparently healthy	WLD % infected	Apparently healthy	WLD (%) infected
Autumn	1	12.29a	13.95c	99.02a	98.65a	128.80a	120.40a	9.36a	9.45a
	2	3.55ab	52.16a	92.54a	64.61b	87.70ab	42.88b	9.96b	10.69a
	3	0.21b	34.04b	94.95a	73.12b	141.74a	113.26a	11.27a	10.39
Spring	1	45.79a	54.79b	67.00b	54.78a	92.11a	60.54a	9.65b	9.10b
	2	12.10b	67.30a	77.36ab	57.76a	63.72b	39.86a	9.93b	10.99a
	3	0.62c	50.73b	82.35a	54.31a	97.45a	35.30a	12.02a	11.36a
Summer	1	14.99a	22.93c	61.64b	58.99a	60.91a	51.23a	9.01a	10.05b
	2	17.00a	77.23a	68.97ab	29.83b	55.85b	15.85b	10.17a	11.13a
	3	1.04b	40.98b	81.07a	35.02b	76.88a	27.30ab	12.05a	11.85a
Mean		11.95	46.01	80.43	59.68	89.45	56.29	10.38	10.56

In a column, under each planting time means followed by a common letter are not significant different by at the 5% level by DNMR.

It appears from Table 5 that autumn planting with apparently healthy seedcane is the best combination of sugarcane cultivation in the Modhupur AEZ with the test variety Misrimala. WLD incidence from diseased seedcane compared to apparently healthy seedcane sources were found significantly higher in all planting times. This indicates that sugarcane planting from apparently healthy cane sources is better than planting with diseased sources. Highest reduction in number of millable cane stalk (41.5%) in summer transplanted cane and cane yield (51.88%) in summer transplanted cane were found in diseased source compared to healthy one.

Table 5. A comparative study of reduction percent due to WLD infection on growth and yield parameters of sugarcane.

Time of Planting	WLD (%)			Millable cane (10^3ha^{-1})			Cane yield (TCH)		
	Apparently healthy	Diseased	Increased (%)	Apparently healthy	Diseased	Reduction (%)	Apparently healthy	Diseased	Reduction (%)
Autumn	5.55	33.39	83.38	95.50	78.79	17.5	119.44	92.18	22.80
Spring	19.50	57.61	66.15	75.57	56.62	25.08	84.42	45.23	46.42
Summer	11.01	47.04	76.59	70.55	41.28	41.50	64.49	31.46	51.88

The results were fully agreed with the findings of Rahman *et al.* (1982, 1985) and Chuang Yang and Ling (1963). With the increased WLD incidence a significantly higher reduction of number of millable cane, yield of cane and sucrose content were observed in the seedcane sources. This suggests that the higher is the WLD incidence the lower is the production of sugarcane and sugar yield. In other words, WLD incidence directly affects the yield and yield contributing parameters of sugarcane.

From the above discussions it may be concluded that autumn planting with apparently healthy seedcane sources is the best way for avoiding the disease in the WLD prone environment of Modhuour AEZ with the locally adapted sugarcane variety Misrimala. Further investigation is needed to find out the insect vector (s) that might cause the secondary infection. Restriction of planting of sugarcane in spring would be another way of escaping WLD incidence largely until the alternate causes of infection i.e. the insect vector (s) is identified. They variety Misrimala can be successfully cultivated if the planting materials are used from clean seed source by introducing clean seed programme in the AEZ of Modhupur.

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