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Effect of Sowing Dates on Incidence of Cotton Leaf Curl Virus on Different Cultivars of Cotton

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Abstract: Trials were conducted during 2003-04 on planting dates from May 1st to July 1st at 15 days intervals with three commercial varieties of cotton i.e. CIM-496, CIM-497 and CIM-506. Maximum CLCuV percentage was recorded in June 1st planting. It was found that CLCuV percentage rapidly increase in the first week of August in all the planting dates. It was also concluded that planting of cotton should be done in May 1st to June 1st to avoid the percentage losses of CLCuV. CLCuV effects were higher in variety CIM-497 in the June 15th planting whereas variety CIM-506 showed low attack, when compared with other varieties.

Key words: *Gossypium hirsutum*, CLCuV, sowing dates, CIM-496, CIM-497 and CIM-506

INTRODUCTION

Cotton is an important cash crop of Punjab province. Cotton leaf curl virus is a serious threat to successful cotton production in Pakistan. Cotton leaf curl virus (CLCuV) is transmitted through whitefly (*Bemisia tabaci* and *B. argentifolii*), the patent insect vector. The disease is characterized by an upward curling of leaves, thickening of veins and laminar outgrowths on underside of the leaf called enation^[1-3]. Cotton leaf curl disease was first recorded in 1912 by Farquaherson in Nigeria and was reported to be confined to Africa. In Sudan, the disease played havoc and cotton cultivation had to be abandoned for three years till the disease was controlled by resistant varieties. In Pakistan especially Punjab, the disease was recorded for the first time in Multan in 1967^[4]. At that time, the disease was of minor importance. In 1991-92, Pakistan achieved a record production of 12.8 million bales, which decline to 7.9 million bales in 1994-1995^[5]. Since then the yield losses has become a constant phenomenon every year due to CLCuV. A new strain of CLCuV was diagnosed in Burewala territory of Punjab, which is more virulent than previous strain of virus. All the cultivated varieties, which were resistant to previous CLCuV, now become susceptible to this new strain. CLCuV is now spreading widely in Punjab (Pakistan) and posing a major threat to cotton production^[6]. Losses due to CLCuV were found to be dependent on the time of infection and variety. The greatest damage and subsequent losses occur when cotton is infected at early growth stages. Late season infection result in only minimal damage^[7,8]. Present studies revealed that at which time on different cultivars, the CLCuV appears. So this study have tried to

investigate the time of appearance of CLCuV on sowing date as well as concrete with variety.

MATERIALS AND METHODS

The studies were conducted at Central Cotton Research Institute, Multan during 2003-2004. The experiment was planted in Split Block Design with three replications. The distance between rows was 75 cm and plants were spaced at 25-30 cm. Three most advance varieties of cotton i.e., CIM-496, CIM-497 and CIM-506 were selected for these studies. The crop was planted on beds and furrows. The planting of these varieties was started from May 1st to July 1st at 15 days intervals following uniform cultural practices. Sowing was done manually by dibbling method seed at 22.5 cm apart. Later on weeds were controlled by cultural practices. Plant protection measures were adopted to protect the crop from insects as when required. Cotton leaf curl virus percentage was recorded by the total number of healthy and disease plants in these varieties after 40 days, onwards on each five sowing dates.

RESULT AND DISCUSSION

Results showed that all the three advance varieties known to be resistant against CLCuV in previous years under trial, but in this trial, it showing highly susceptible to this disease. It was also indicating that plants infected with this virus on all sowing dates from starting, only the difference was that the symptoms appeared late, may be due to environment. Table 1 shows that cotton leaf curl virus rapidly increase in the first week of August in all the

Table 1: Incidence and fortnightly increase of CLCuV on sowing date trial

Observation dates	CIM-496		CIM-497*		CIM-506*	
	D.I.	F.N. Inc.	D.I.	F.N. Inc.	D.I.	F.N. Inc.
D₁						
10/6	0.00	-	0.00	-	0.00	-
26/6	0.13	0.13	0.89	0.89	0.12	0.12
10/7	1.18	1.05	1.88	0.99	0.34	0.22
26/7	2.81	1.63	6.41	4.53	1.53	1.19
10/8	8.66	5.85	13.33	6.92	4.33	2.80
26/8	11.01	2.35	20.30	6.97	4.33	0.00
10/9	13.02	2.01	21.07	0.77	4.55	0.22
26/9	-	-	-	-	-	-
D₂						
10/6	-	-	-	-	-	-
26/6	1.50	1.50	0.26	0.26	0.28	0.28
10/7	7.93	6.43	6.45	6.19	0.96	0.68
26/7	12.89	4.96	10.65	4.20	3.45	2.49
10/8	18.33	5.44	15.66	5.01	6.00	2.55
26/8	19.28	0.95	20.38	4.72	7.27	1.27
10/9	20.41	1.13	21.76	1.38	8.32	1.05
26/9	-	-	-	-	-	-
D₃						
10/6	-	-	-	-	-	-
26/6	-	-	-	-	-	-
10/7	2.54	2.54	2.13	2.13	2.70	2.70
26/7	5.56	3.02	10.13	8.00	6.81	4.11
10/8	13.00	7.44	17.00	6.87	15.00	8.19
26/8	14.36	1.36	21.25	4.25	16.63	1.63
10/9	16.46	2.10	22.25	1.00	17.12	0.49
26/9	16.46	0.00	25.27	3.02	19.36	2.24
D₄						
10/6	-	-	-	-	-	-
26/6	-	-	-	-	-	-
10/7	-	-	-	-	-	-
26/7	7.25	7.25	14.91	14.91	11.86	11.86
10/8	25.33	18.08	32.66	17.75	22.33	10.47
26/8	31.21	5.88	33.97	1.31	25.13	2.80
10/9	33.23	2.02	37.78	3.81	29.82	4.69
26/9	33.84	0.61	39.48	1.70	31.18	1.36
11/10	33.84	0.00	39.48	0.00	-	-
D₅						
10/6	-	-	-	-	-	-
26/6	-	-	-	-	-	-
10/7	-	-	-	-	-	-
26/7	-	-	-	-	-	-
10/8	6.46	6.46	5.54	5.54	5.59	5.59
26/8	13.15	6.69	12.86	7.32	14.21	8.70
10/9	18.19	5.76	19.63	6.77	20.05	5.76
26/9	23.17	4.26	38.08	18.45	27.90	7.85
11/10	23.58	0.41	44.04	5.96	-	-

D₁*=May 1st D₂=May 15th D₃=June 1st
D₄=June 15th D₅=July 1st D.I=Disease incidence
F.N Inc.=Fortnightly increase

planting dates. It was also obvious from the fortnightly increase percentage, how much increase in all the three varieties. The incidence of CLCuV was more in June 15th planting followed by May 15th planting. All the cultivars showed high incidence rate, but the cultivar CIM-497 showed more incidence of CLCuV.

Table 1 indicated that in all sowing dates CLCuV found in range of 0.12 to 44.04%. It was found that CLCuV rapidly increase in the first week of August in all the planting dates. It was noted that in June 15th planting, disease incidence increase from 7.25 to 25.33% in variety CIM-496. Similarly 14.91 to 32.66% increase in variety CIM-497 and 11.86 to 22.33% in variety CIM-506. It was seen that disease started appearing in the planting dates after 40 days of planting. It was increasing gradually till the end of July, but rapidly increases in the first week of August. It's clear from the Table 1 that the peak incidence of CLCuV was recorded during the month of August, but it also seen that rate of incidence of disease goes up to September in almost all the planting dates. In June 15th planting in all the three tested varieties, the incidence of CLCuV was higher than all other planting dates. It can be concluded that planting of cotton should be done in between May 15th and June 1st to avoid more losses by CLCuV because rate of incidence of CLCuV was low during these periods.

Effect by number of bolls: The percentage decrease over healthy were also calculated in different planting dates. Table 2 showed that maximum percentage decrease over control was recorded in the June 15th followed by July 1st planting. It was observed that cotton leaf curl virus affected maximum number of bolls in the 1st week of August. Therefore, its effects on the percentage losses, as far as in the May 1st planting the percentage decrease were less as compared to the June 15th planting. As the diseased number of bolls progress in all the planting dates, the percentage decreases over healthy also increased. In June 15th planting, the percentage decrease over healthy is range between 48.56 to 58.36% whereas in the May 1st planting the percentage decrease over healthy ranged in 22.13 to 30.30%.

As far as varieties are concerned all the three varieties showed percentage decrease over healthy. In the June 15th planting maximum percentage decrease over healthy was recorded in the variety CIM-506 (58.36%). In June 15th planting, the percentage decrease was almost double when compared with the May 1st planting. Therefore, it is better strategy that planting should be done in May 1st to May 15th to avoid the maximum damage caused by cotton leaf curl virus. It was also observed, as the whitefly is the carrier of this disease. Its

Table 2: Effect of boll formation on different sowing date against CLCuV

Varieties	Sowing dates	Healthy	Diseased	%age decrease over healthy
CIM-496	May 1st	16.86	12.96	23.13
	May 15th	16.86	11.50	31.79
	June 1st	20.93	15.46	26.13
	June 15th	20.46	8.83	56.84
	July 1st	9.60	4.10	57.29
CIM-497	May 1st	15.00	11.33	24.46
	May 15th	15.66	12.16	22.34
	June 1st	19.80	14.50	26.76
	June 15th	18.53	9.53	48.56
	July 1st	7.53	5.36	28.81
CIM-506	May 1st	19.80	13.80	30.30
	May 15th	21.26	11.53	45.76
	June 1st	25.80	14.46	43.95
	June 15th	20.80	8.66	58.36
	July 1st	10.60	4.73	55.37

behavior towards crop is to like tender crop. During the June 15th planting the infected whitefly ratio flare-up, so the percentage decrease over healthy was found higher disease.

Varietal effects

CIM-496: In this variety, maximum incidence of CLCuV was recorded in June 15th planting where it was 33.84% followed by July 1st planting at the peak of the period (Table 1). As indicated by fortnightly increase, it is also maximum in the June 15th planting 18.08% following by June 1st planting where it was 7.44%. It was observed that the trend of increase in all the planting dates in this variety CIM-496 was at the 1st week of August (August 10, 2003). After the 1st week of August, indicated that it was fallen down appreciably except last planting date July 1st where it was still increasing. It can be estimated in July 1st the crop was still not mature, the rate of decrease in incidence was slow, whereas in May 1st it was gone down 5.85 to 2.35%, in May 15th it decreased from 5.44 to 0.95%, in June 1st it was 7.44 to 1.36% and in June 15th 18.08 to 5.88%, whereas at July 1st it increases from 6.46 to 6.69% and then goes on decreasing.

CIM-497: In this variety the maximum incidence of CLCuV was recorded in July 1st planting that was 44.04% followed by the July 15th planting where it was 39.48% (Table 1).

Table 1 shows that fortnightly increase in this variety was maximum in June 15th planting i.e. 17.75%. Trend of increase of CLCuV incidence in all the planting dates in CIM-497 variety was also observed at the first week of August. The incidences of CLCuV remains stand on it or start decreasing after the 1st week of August in all the planting dates. In this variety, it was noticed that in June 15 planting, the fortnightly decrease in incidence was after 1st week of August; it was 17.75 to 1.31%. This was the maximum decrease in incidence when compared with the other planting dates. In May 1st planting the fortnightly incidence was ranged in 0.89 to 6.97% in May 15th planting it ranged from 0.26 to 5.01% and in June 1st planting, it was ranged in 1.00 to 6.87%. As in July 1st planting, the trend of fortnightly incidence was ranged in 5.54 to 18.45% that was the different from other planting dates. This may be due to the crop was tender and the inoculum's was more. It was also seen whitefly prefer to new emerging leaves, that is why the rate of incidence goes higher in the July 1st planting.

CIM-506: In variety CIM-506, it was recorded that the maximum incidence of CLCuV was in the June 15th

planting followed by the July 1st planting (Table 1). The disease incidence ranged in 0.34 to 31.37% in all the planting dates. It was observed that this variety showed low susceptibility when compared with other two varieties i.e., CIM-496 and CIM-497.

Table 1 showed that fortnightly increase was also maximum in June 15th planting like other two varieties 10.47% followed by June 1st planting where it was 8.19% in the first week of August. After the first week of August it was recorded the fortnightly incidence of CLCuV fallen down too much except the July 1st planting where the disease incidence show rising of fortnightly incidence. In the May 1st planting, the fortnightly incidence decrease after first week of August from 2.80 to 0.00%, in May 15th planting from 2.55 to 1.27%, in June 1st planting from 8.19 to 1.63% and in the June 15th planting, it was decreased down from 10.47 to 2.80%. It was also recorded that in July 1st planting fortnightly increase continued upto last week of August that was 5.59 to 8.70%, then trend was decreasing of CLCuV incidence. In all the planting date the fortnightly disease incidence ranged in 0.00 to 10.47%.

From these studies that there was no correlation between varieties and sowing dates with respect to cotton leaf curl virus. Cotton leaf curl virus is a complex disease and many factors are involve to minimize it. It should be suggested that all planting should be done after 1st May to June 1st to minimize the CLCuV. Similarly during the first week of August CLCuV was maximum on all varieties and all sowing dates which decreases slowly after 1st week of August.

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