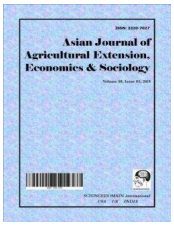

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Cotton Leaf Curl Virus Disease in District Jhang Punjab Pakistan

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Authors' contributions

This work was carried out in collaboration between all authors. Authors RA and BS designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors NAS and NK reviewed the design and all drafts of the manuscript. Authors EA and BNS managed the analyses of the study. All authors read and approved the final manuscript.

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ABSTRACT

Cotton is the most important cash crop of the country which significantly contributes to the Pakistan's economy. It is a significant source of foreign exchange earnings. Cotton leaf curl virus (CLCV) is one of the most lethal diseases of the cotton crop. The cheap quality and low standard cotton comes in the market due to the lack of farmer's knowledge about CLCV. The study is conducted to assess the knowledge level of farmer's regarding different aspects of cotton leaf curl virus in Tehsil Jhang, Punjab, Pakistan. The data is collected by using a pre-tested scheduled interview and interpreted by using the Statistical Package for Social Sciences (SPSS). All the respondents are aware of Cotton Leaf Curl Virus disease. About 45.8% of the respondent has very

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high level of knowledge about the damage caused by CLCV, 22.5% have high, 15.8% medium, 10% low and 5.8% have very low level of knowledge. The knowledge of farmer community about cotton leaf curl virus is poor due to which cotton leaf curl virus has become a big threat of cotton. Keeping this in view, the present study was designed. Incidence and severity of CLCV in the Punjab, Pakistan must be reduced. This is possible by a sound, viable and dynamic integrated disease management program.

Keywords: Cotton; CLCV; livelihoods; curl virus disease; economy.

1. INTRODUCTION

Agriculture is the main stay of Pakistan's economy. It contributes 21.8 % to the country's Gross Domestic Product (GDP) and provides employment opportunities to 44.8% of the country's labor force. It gives substantial share to Pakistan's exports [1]. It contributes to growth as a supplier of raw materials to industry as well as market for industrial products. In rural areas, nearly 66.9% population depends directly or indirectly on agriculture for their livelihoods. Agricultural sector consists of two sub-sectors i.e. crop and livestock sector. Major crops, accounting for 33.4% of value added in agriculture, while minor crops, accounting for 12.0% in agricultural value added, posted a growth of 3.6% against the negative growth of 10.9% last year 2011. The performance of livestock, accounting for 51.8% of agricultural value added has so far been satisfactory as it grew by 3.7% in 2010 [2]. The major crops include wheat, rice, sugarcane and cotton etc.

Cotton is the most important cash crop of the country which significantly contributes to the national economy by providing raw material to the local textile industry and providing export item such as cotton lint. It contributed 7.8% in agriculture while 1.5% of GDP during 2012-13 [3]. Pakistan occupies fourth position in production of raw cotton and ranks third in the world consumption. In 1947, production of cotton was only 1.23 million bales, whereas production of 14.6 million bales was achieved in 2004-05, followed by the second largest crop of 13,026 million bales in 2012-13. The national average yield of raw cotton in the country is; however, low to meet the level attained in other major cotton producing countries. The average yield of cotton in the country was 769 kg/ha during the year 2012-13 as against Australia (1982 kg/ha), Turkey (1289 kg/ha), Brazil (1124 kg/h), China (1119 kg/h) and Greece (1040 kg/h) [3]. There also exists a huge difference between the yield obtained by progressive and ordinary farmers, which is supposed to be one of the main reasons of over all low yield of cotton in the country [1].

The cotton varieties being used in Pakistan have played a major role in the epidemic. Some of the most widely grown varieties showed differing degrees of tolerance. More recent cotton variety selections have increased tolerance and some appear immune although the use of immune varieties incurs some yield penalty. A key issue during the early years of the epidemic was variety identification and seed quality, which was resolved by Restriction Fragment Length Polymorphism RFLP mapping and certification [4].

The low yield of cotton might be attributed to different factors including improper picking, poor insecticides spraying methods, improper time of irrigation, processing and ginning by improper and primitive methods etc., but diseases are the most important factor reducing yield and quality as well [4]. Cotton is susceptible to a large number of diseases such as fungi, bacteria, nematodes and viruses; carried by seed, soil and insects. There are heavy losses due to diseases every year. According to rough estimates, these losses range between 12 to 35%. Among the virus diseases affecting cotton, leaf curl, cotton leaf crumble, small leaf, and mosaic have been reported as more serious and distributed in different parts of the world. In Pakistan, cotton leaf curl virus has appeared as a serious and destructive disease affecting productivity and quality of the cotton crop [5]. The production of cotton crop has been suffering continuously for the last several years due to CLCV [6]. The cause of this disease was scientifically established in 1992 as a whitefly transmitted Gemini virus. CLCV is characterized by upward and downward curling of leaves, thickening of small or main veins, and appeared of cup shaped or leaf laminar outgrowth on the underside of the leaf. Knowledge of farmer community about cotton leaf curl virus is poor due to which cotton leaf curl virus has become a big threat of cotton. They are unaware of preventive measures to

tackle the cotton leaf curl virus. Keeping this in view, the present study was designed.

2. METHODOLOGY

This study was conducted to assess the knowledge level of farmers regarding cotton leaf curl virus (CLCV) in Tehsil Jhang, Punjab, Pakistan which was selected purposively because it is one of the leading Tehsil within Punjab in terms of cotton production. The Tehsil Jhang consists of 6 urban Union Councils (UCs) [7] and 49 Rural Union Councils (RHC) [8]. Out of 49 rural union councils, 4 union councils were selected randomly. From each selected union council, 3 villages were selected at random and from each selected village, 10 former respondents were selected randomly, thereby making a sample size of 120 respondents. A well-structured interview schedule was prepared and pre-tested before actually collecting data. The data were analyzed by using Statistical Method for Social Sciences (SPSS) [9].

3. RESULTS AND DISCUSSION

3.1 Prevalence Rate of CLCV

On the basis of a well-structured interview scheduled, the collected data is shown in Table 1.

Table 1. Distribution of the respondents according to their thinking about attack of CLCV on cotton crop

Response	Freq. no	Percentage
Yes	107	89.2
No	13	10.8
Total	120	100.0

The data presented in Table 1 showed from total sample (120 respondents) most of the respondents have positive thinking regarding the attack of CLCV on their cotton crop. According to the results most of respondent's crop affected due to CLCV. Only about 10 percent respondents have opposite response regarding the attack of CLCV.

The data presented regarding the attack percentage and respondent frequency accordingly. Table 2 shows that majority of the respondent's crop is 60 percent affected. Minimum attack level is 20 percent in only 14 respondents.

This Table 3 shows the results regarding the attack percentage of other different diseases on cotton crop. According to the results most of the respondent's cotton crop affected with other diseases below than 25 percent. Small amount of respondent's crop affected about 50 to 75 percent as shown in Table 3.

Table 2. Distribution of the respondents according to the attack of CLCV on their cotton crop

Attack (%)	Freq. no.	Percentage
20	14	11.6
40	12	10
60	68	56.7
80	26	21.7
100	-	0
Total	120	100.0

Table 3. Distribution of the respondents' perception concerning the percentage of their cotton crop under attack of other disease

Percentage of their cotton crop is under attack of other disease	Freq. no.	Percentage
Below 25%	70	58.3
25-50%	35	29.2
50-75%	15	1.5
Total	120	100.0

The data presented in Table 4 showed that knowledge level of respondents regarding different diseases the results in above table show that majority of the respondents well aware of root rot of cotton dieses. The respondents have also knowledge regarding other dieses like Angular leaf spot and Bad opening of ball but only about above 90 percent respondents in study area according to sample size.

3.2 Damage of Cotton Crop Due to CLCV

On the basis of a well-structured interview scheduled, the Distribution of the respondents according to their knowledge about damage of cotton crop due to CLCV is shown in Fig. 1.

The data presented in Fig. 1 showed that all the respondents were well aware about the damage caused by cotton leaf curl virus in cotton crop. As far as the damage caused by this disease is concern, all the respondents had knowledge about the disease is lethal for cotton crop.

The data given in Table 5 indicated that majority 68.3 percentage of the respondents reported that during the previous year, the attack of CLCV was more than 75% which is much higher than current year. Current year maximum damage due to CLCV is 25 to 50 percent. it is predicted

that in the current year this dieses is controlled due to different measure.

The data given in Table 6 indicated that an overwhelming majority of the respondents reported that plant growth is affected by CLCV by giving answer yes and only 5 percentage respondents reported that the growth is not affected by CLCV by giving answer no.

The data given in Table 7 indicated that a vast majority 90 percentage of the respondents reported that maturity of the plant is affected by CLCV and only 10 percentage of the respondents reported that maturity is not affected by CLCV.

The data of Table 8 revealed that most of the respondents were aware of different resistant verities of cotton from CLCV. Further more different respondents use different prevent measures like seed treatment and removal of affected plants to control CLCV dieses.

Table 4. Distribution of the respondents according to their knowledge about the names of cotton diseases

Disease Name	Yes		No	
	Freq. no.	% age	Freq. no.	% age
Root rot of cotton	108	90.0	12	10.0
Angular leaf spot of cotton	97	80.8	23	19.2
Bad opening of ball	91	75.8	29	24.2

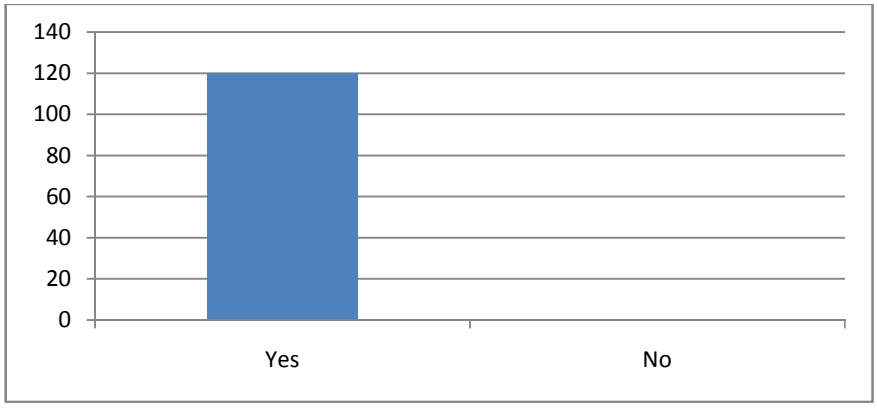

Fig. 1. Distribution of the respondents according to their knowledge about damage of cotton crop due to CLCV

Table 5. Distribution of the respondents according to damage by CLCV during the previous crop and their extent of knowledge

During the previous and current year crop what was the estimated damage to their cotton crop by CLCV	Previous year		Current year	
	Freq. no.	Percentage	Freq. no.	Percentage
Below 25%	12	10	25	20.8
25-50%	18	15	80	66.7
50-75%	8	6.7	15	12.5
More than 75%	82	68.3	-	-
Total	120	100	120	100

Table 6. Distribution of the respondents according to plant growth affected by CLCV

Plant growth affected by CLCV	Freq. no.	Percentage
Yes	114	95
No	6	5
Total	120	100

Table 7. Distribution of the respondents according to the maturity affected by CLCV

Maturity affected by CLCV	Freq. no.	Percentage
Yes	108	90
No	12	10
Total	120	100

Table 8. Distribution of the respondents according to the awareness about the preventive measures to control CLCV

Preventive measure	Yes		No	
	Freq. no.	%age	Freq. no.	%age
Seed treatment	75	62.5	45	37.5
Vector control	78	65	42	35.0
Removal of diseased plant	98	81.7	22	18.3
Resistance varieties	102	85	18	15.0

Table 9. Distribution of the respondents according to the extent of awareness about the preventive measures to control CLCV

Preventive measure	1		2		3		4		5	
	No.	%	No.	%	No.	%	No.	%	No.	%
Seed treatment	3	2.5	3	2.5	16	13.3	53	44.2	-	-
Vector control	-	-	4	3.3	23	19.2	46	38.3	5	4.2
Removal of diseased plant	4	3.3	9	7.5	27	22.5	55	45.8	1	0.8
Resistance varieties	2	1.7	5	4.2	31	25.8	60	50.0	4	3.3

Scale: 1= Very low, 2 = Low, 3 = Medium, 4 = High, 5 = Very High

Table 10. Distribution of the respondents according to the most destructive disease to cotton crop

Most Destructive Disease	Yes		No	
	Freq. no.	%age	Freq. no.	%age
Cotton leaf curl virus (CLCV)	81	67.5	39	32.5
Root rot of cotton	19	15.8	101	84.2
Angular leaf spot of cotton	8	6.7	112	93.3
Bad opening of ball	12	10.0	118	90.0

Half of the respondents (50%) had high level of knowledge about the use of resistant varieties as a preventive measure to control CLCV, while 25.8%, 4.2% and 1.7% had medium, low and very low level of knowledge about the use of resistant varieties as a preventive measure. 45.8% of the respondents have high level of knowledge, 22.5% had medium and 3.3% had very low level of knowledge about removal of diseased plants as a preventive measure. As far as the vector control as a preventive measure is concerned, 38.3% of the respondents had high, 19.2% had medium and 3.3% respondents had low level of knowledge as shown in Table 9.

The data of Table 10 show comparative results regarding the destruction level due to different diseases. According to the results of table CLCV cotton dieses is more destructive than other diseases, after that bad opening of ball is also affected more the crop yield in cotton crop.

67.5% of the respondents reported that cotton leaf curl virus is most destructive to cotton crop, 15.8%, 6.7% and 10% of the respondents rank the root rot of cotton, angular leaf spot of cotton and bad opening of ball respectively as most destructive to cotton crop.

4. CONCLUSION

On the basis of the results collected, it is concluded that farmers have good knowledge regarding prevalence rate of cotton leaf curl

virus. However the knowledge about preventive measures against this disease is not satisfactory. It is suggested that extension field staff should be activated to make farmers aware of the preventive measures regarding the control of cotton leaf curl virus. Incidence and severity of CLCV in the Jhang, Punjab must be reduced. This is possible through a sound, viable and dynamic integrated management program. It should include use of tolerant varieties, seed treatment, eradication of weeds and alternate hosts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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