

# Impediments Regarding Citrus Canker Disease And Its Control Measures In District Faisalabad, Punjab, Pakistan

Ayesha Anwar Sulehri, Awais Ijaz, Rana Muhammad Amir, Rao Sabir Sattar, Ansa Rebi, Muhammad Hammad Raza, Amreena Begum, Hafiz Ali Raza\*\*

**Abstract:** Citrus is one of the significant fruit crops worldwide and also grown in Pakistan provinces. Punjab produces above 95% of this fruit crop due to a conducive growing environment. The citrus production gap is linked with numerous factors; the main factor is insects and diseases of citrus fruits. In this respect, the main problem is fewer responsiveness of farmers about citrus canker disease. At the time of need, farmers are not capable to achieve the demands of the citrus fruit, so make a vast gap in citrus manufacture. Citrus canker is an excessive disorder, the pathogen, normally characterized through visible rough scratches on fruit, stems and leaves, twig dieback, falling off undeveloped fruits and trees and defoliation. The aim of the current study was to identify the farmer's awareness about the citrus canker disease and pest control measures. Therefore, the current study conducted in Tehsil Jaranwala, District Faisalabad. From the selected tehsil one union council was selected through purposive sampling technique and from eight villages of the union council (UC-15) citrus growers were selected which made a collective sample size of 120 respondents. A face-to-face interview was conducted for the collection of data. The results of the study presented that the majority of the respondents were growing Kinnow. Farmers suffering from many constraints as the majority of citrus growers faced citrus canker disease. Results indicated that research organizations, citrus development projects and newspaper were more effective source of information in order to control citrus canker disease. Respondents faced a lot of constraints regarding plant protection measures, these were non-availability of tube wells, expensive pesticides, spraying material due to high prices, lack of knowledge and less cooperation of extension workers. It is concluded from the current study that the growers need the training to increase the technical knowledge, finance for investment and pure chemicals for better protection. Growers were more dependent on conventional methods instead of bio-control. It is urged to the responsible sectors to create an awareness campaign should be launched regarding the effective control of the citrus canker disease and imparted the technical skills among growers to control it in an effective way.

**Keywords:** Citrus fruits, Citrus canker disease, Symptoms, Control measures, Bio-control.

## 1 INTRODUCTION

In Pakistan, agricultural area is very important for food crops. It is increasing quick population of the country, also contribution in 20.9% (GDP) gross domestic product [3]. The sector of agriculture has been terrible consequence to improve, distribute, income or food safety letdown. From the previous three several years development within the harvest has been decreasing for intense arrangement in new agricultural generation, seeds or strategies as harvest continued little with growing crop gaps since of water conformation are not being organized [3]. Citrus fruits in Pakistan, is grown about (170,000 ha) and about (30%) area below all fruit groves consists of citrus fruits. In Punjab Province, main citrus fruit variety is (Kinnow) and this fruit variety covers 80% of the overall growing area of citrus. they follow the tradition and set the rules Citrus (*Citrus L.* from Rutaceae) is the greatest significant world fruit yields it is used up generally as fresh juice due to its special flavor or nutritional value [2]. Most

widespread consumers within North America and Europe are sweet oranges, lemons (*Citrus limon*), grapefruits (*Citrus paradise*) and limes (*Citrus aurantiifolia*). Drinking of citrus juices and eating of citrus fruits are originating to be inversely related with numerous diseases [5]. Fruit like orange, sweet lime, grapefruit and lemon are eaten in newly as entire fruit or through juices especially in summer time days. Those end results are wealthy in vitamins, nutritional fibers, minerals which can be important for development and growth of dietary wholesome lifestyles. Those citrus culminations have anti-septic, anti-cancer, and anti-oxidant properties. They also give normal refreshment to the skin [12].

Citrus canker is very prominent phyto-bacterial disease. It is endemic all through Asia and numerous countries near the Indian Ocean [8]. It is the greatest disturbing disease that impend sale ability of citrus plants. Grapefruits, ruby purple with cankerous, ordinary and other commonplace peel illnesses inclusive of melanose, scab, insect damage, greasy spot and breeze scratch have been tested [9]. The disease instigated by *Xanthomonas axonopodis* pv. *citri* bacteria by uses different processes to settle its crowd [1]. Many definite proteins i.e. adhesins are significant to the development of this dangerous disease. The phyto-bacteria *Xanthomonas axonopodis* pv. *citri* formed biofilms that follow to each other. Citrus canker epidemics were generated with 108 colonies forming units/ml of phyto-bacteria (*Xac*) on citrus fruits. Largely, 2 environmental variable model containing minimum and maximum air temperature fit the data well explaining 93 percent variability in development of citrus canker disease [10]. Citrus leaf miner also plays a vital role for the spread of citrus canker among different varieties of citrus fruits (Atiq et al., 2013). In addition, this bacterium uses also a plant natriuretic protein to control the host. They discussed these bacterial strategies in citrus canker disease. Management of Asiatic citrus canker depends on an integrated approach consists of:

- Ayesha Anwar Sulehri, M.Phil. Scholar, Institute of Agri. Extension, Education and Rural Development (IAEE&RD), University of Agriculture Faisalabad (UAF), Pakistan, E-mail: Ayesha@gmial.com
- Awais Ijaz, BSc (Hons.), Department of Agriculture, PMAS Arid Agri. Uni, Rawalpindi. E-mail: awaisijaz2021@gmail.com.
- Dr. Rana Muhammad Amir is currently serving as Assistant Professor, IAEE&RD, UAF Pakistan, E-mail: Muhammad.amir@uaf.edu.pk
- Dr. Rao Sabir Sattar is currently serving as Assistant Professor, IAEE&RD, UAF Pakistan, E-mail: raosabirsattar@gmail.com
- Ansa Rebi, M.Phil. Scholar, Insti. of soil and Environmental Sciences, UAF, Punjab, Pakistan, E-mail: 2013-ag-3549@uaf.edu.pk
- Dr. Muhammad Hammad Raza, IAEE&RD, UAF Pakistan, E-mail: hammadext@gmail.com
- Amreena Begum, lecturer, Department of Sociology, Abdul Wali Khan University, Mardan
- Hafiz Ali Raza is currently Ph.D. Scholar, Institute of Agri. Extension, Education and Rural Development, Punjab, Pakistan. E-mail: Razaa0617@gmail.com\*\*

(1) production of disease-free nursery stock; (2) additional of susceptible citrus classes with unaffected material; (3) decrease of pathogen feast by starting windbreaks or fences around orchards; (4) insecticide applications for controlling Asian leaf miner and (5) preventative copper sprays [6]. Effectiveness of various copper sprays for the remedy of citrus canker disease produced by *Xanthomonas citri* in three to four years old commercial orchards of 'Pera' that is sweet orange in a citrus canker. Although, at a 28th day Cu sprays were suitable for the reduction of citrus canker that was present on harvested fruits and leaves to decrease the harvested loss (Behlau et al., 2010). Commercially suitable control of citrus canker especially on susceptible cultivars under favorable disorder improvement situations is normally tough. The better helpful control of the disease is through enhancing the use of unaffected cultivars with combined structures of well-matched cultural observes and phytosanitary procedures, together with quarantine and controlling records (Civerolo, 1981). Disease produced by bacterium *Xanthomonas citri* subsp. *citri* (Xac), this is cautiously significant ailment of citrus worldwide. In initial infection of *Xanthomonas citri*, development of biofilm plays a vital role on host leaves. They evaluated that minor particles inhibiting formation of bio-film decrease *Xanthomonas citri* contagion or increase the control of disease. Their study concluded that for the management of citrus canker biofilm inhibitors shared with Cu-based bactericides [7].

## 2 MATERIALS AND METHOD

The research population of the study considered of all farmers of citrus living in the rural union council No. 40. The researcher collected the sample (part of population) from the overall population of the citrus growers for her research which is also considered viable way of scientific endeavors all around the world (Chaudhry, 2017). Therefore, the research was conducted in one of the Tehsil of District Faisalabad. There is total six tehsils in Faisalabad (Chak Jhumra, Faisalabad City, Jaranwala, Faisalabad Sadar, Tandianwala Samundari). Out of these six tehsils Jaranwala was selected. There are 57 union councils of Tehsil Jaranwala. By using purposive sampling technique, a union council was selected from eight villages of the union UC-15 citrus farmers were selected which

made a collective size of sample of 120 respondents through survey software method with confidence level 95% and confidence interval of 5% available online on (surveysystem.com). With the help of interview schedule, quantitative data were collected for this study. Interviewing schedule was selected to collect the data tool. It was also designed to the perception of farmers regarding Citrus Canker disease in context to its control measures in Tehsil Jaranwala, District Faisalabad. Citrus farmers are those who grow citrus fruit at their farms. Analysis of data is another important step in any research so, it should be correctly analyzed for the better results. Data collected from face-to-face interviews. By using the statistical package, data collected examined for social sciences. Appropriate statistical measures for description (frequencies, percent's, cross types, means and standard deviation) were used.

## 3 RESULTS AND DISCUSSION

Table 1 indicates the perceived information sources of the farmers regarding citrus canker disease. Farmers were accessing information from different information sources about the recommended production practices for the control of citrus canker disease. Responses regarding use of information sources were recorded on five-point Likert scale, 1=Very Low Extent, 2=Low Extent, 3=Medium Extent, 4=High Extent, 5=Very High Extent. Table 1 indicated that research organizations, citrus development projects and newspaper were more effective source of information in order to control citrus canker disease. The remain information sources were medium in the study area. There is need to provide information for farmers through radio or (T.V) television broadcasting using local languages and participation of numerous pesticides agencies, development projects and many roles of mass media personnel, organizations or newspapers [17]. The gap of communication about destruction of citrus canker disease. Sometimes, farmers faced difficulties for various communication sources. So, growers questioned about their sources of information from where they got difficulties. lack of security and lack of discipline [11].

**Table 1: Perceived various communication sources regarding citrus canker disease among the respondents**

| Communication Sources             | Mean ± SD.   | W. S | R. O |
|-----------------------------------|--------------|------|------|
| Research organizations            | 3.21 ± 1.13  | 386  | 1    |
| Citrus Fruit Development Projects | 3.20 ± 1.4 5 | 384  | 2    |
| News paper                        | 3.07 ± 1.08  | 369  | 3    |
| Pesticides Agencies               | 2.99 ± 1.14  | 359  | 4    |
| Pamphlets                         | 2.96 ± 1.18  | 355  | 5    |
| Zarai Digest                      | 2.86 ± 1.06  | 344  | 6    |
| Television                        | 2.77 ± 1.00  | 333  | 7    |
| Radio                             | 2.6 ± 1.04   | 312  | 8    |

Table 2 The main constraints faced by farmers were less facilities of imported certified material of citrus fruits. Farmers were lack of awareness regarding chemical fertilizers. They also faced extension services; extension workers have been constantly failed to solve problems of farmers in order to provide information regarding the improved varieties [15].

Therefore, there is need to motivate the farmers to adopt new facilities of improved varieties, provide knowledge and awareness regarding chemical control and extension workers should build the self-confidence of growers and should visit the field minimum in a week [11].

**Table 2: Perceived constraints faced by the farmers regarding citrus canker disease**

| Communication Sources                               | Mean $\pm$ SD.  | W. S | R. O |
|---|-----------------|------|------|
| Accessibility of disease-free material              | 2.90 $\pm$ 1.24 | 349  | 1    |
| Awareness regarding chemical control                | 2.78 $\pm$ 0.99 | 334  | 2    |
| Facilities of improved certified material of citrus | 2.69 $\pm$ 1.17 | 323  | 3    |
| Contract with extension workers                     | 2.72 $\pm$ 0.87 | 327  | 4    |
| Facilities of improved varieties                    | 2.45 $\pm$ 1.01 | 295  | 5    |

Table 3 indicated that various factors were responsible for communication gap regarding citrus canker disease. In this context, technical knowledge, extension services, availability of spraying machinery, interest of citrus farming, market condition and cost of inputs were important barriers to control

the citrus canker disease in the study area. Citrus production can be improved by providing technical knowledge and extension services and proper input decisions [2].

**Table 3:** Factors faced by growers regarding control citrus canker disease in the study area

| Communication Sources              | Mean $\pm$ SD.  | W. S | R. O |
|------------------------------------|-----------------|------|------|
| Technical Knowledge                | 3.13 $\pm$ 2.82 | 347  | 1    |
| Extension Services                 | 2.82 $\pm$ 1.08 | 339  | 2    |
| Availability of Spraying Machinery | 2.5 $\pm$ 0.99  | 300  | 3    |
| Interest of Citrus Farming         | 2.65 $\pm$ 1.03 | 319  | 4    |
| Marketing Conditions               | 2.62 $\pm$ 1.11 | 315  | 5    |
| Costs of Inputs                    | 2.78 $\pm$ 2.11 | 314  | 6    |

Citrus Canker disease estimated on data collected from respondents. Size of land holding, age, education and information taken as an independent variable. Awareness, farming experience, adoption, marketing conditions, symptoms and technical knowledge were taken as dependent variables. To discover relationship between dependent and independent variables. To degree the result of all independent variables on dependent variable multiple regression models were used. Data examined through Statistical Package for Social Sciences (SPSS) to check the total significance, ANOVA (Analysis of Variance). Significance of coefficients was tested distinctly by using t-statistics. To take the result of coefficient

on the dependent variable, all additional variables were measured relentlessly. Significance of Coefficients was checked through t-statistics. T-Statistics deliver support in defining whether an independent variable should be combined in a model. In Table 4 shows the relationship between two variables education and technical knowledge. Education of respondents was positively affecting on technical knowledge of respondents. The results show that education of the respondents increased up to .009 value due to technical knowledge. So, it was found statistically significant because t value was 2.649.

**Table 4:** Relationship between two variables (education and technical knowledge) or significance of regression coefficients

| Variable                 | Coefficients | Standard Error | T- Test | Significant |
|--------------------------|--------------|----------------|---------|-------------|
| (Constant)               | 2.142        | .320           | 6.692   | .000        |
| Education of respondents | .222         | .084           | 2.649   | .009        |

Dependent Variable: Technical Knowledge

In Table 5 shows the relationship between two variables education and adoption of new technologies. Education of respondents was positively affecting on adoption of new

technologies. The results show that education of the respondents increased up to .508 value due to adoption of new technologies. Therefore, it was found statistically significant because t value was .663.

**Table 5:** Relationship between two variables (education and adoption of new technologies) or significance of regression coefficients

| Variable                 | Coefficients | Standard Error | T- Test | Significant |
|--------------------------|--------------|----------------|---------|-------------|
| (Constant)               | 1.908        | .066           | 28.931  | .000        |
| Education of respondents | .011         | .017           | .663    | .508        |

Dependent Variable: Adoption of new technologies

In Table 6 shows the relationship between two variables education and awareness regarding chemical control.

Education of respondents was positively affecting on awareness regarding chemical control. The results show that education of the respondents increased up to .253 value due

to awareness regarding chemical control. So, it was found statistically not significant because t value was -1.149.

**Table 6:** Relationship between variables education and awareness regarding chemical control

| Variable                 | Coefficients | Standard Error | T- Test | Significant |
|--------------------------|--------------|----------------|---------|-------------|
| (Constant)               | 3.129        | .301           | 10.412  | .000        |
| Education of respondents | -.090        | .079           | -1.149  | .253        |

Dependent Variable: Awareness regarding chemical control

In Table 7 shows the relationship between two variables size of landholding and marketing conditions. Size of land holding had positive impact on marketing conditions. The results show

that size of land holding increased up to .885 value due to marketing conditions. Therefore, it was found statistical not significant because t value was .145.

**Table 7:** Relationship between two variables (size of land holding and marketing conditions) or significance of regression coefficient

| Variable                     | Coefficients | Standard Error | T- Test | Significant |
|------------------------------|--------------|----------------|---------|-------------|
| (Constant)                   | 2.625        | .253           | 10.377  | .000        |
| Size of landholding in acres | .016         | .113           | .145    | .885        |

### 3 CONCLUSIONS

According to the data research organizations got higher score 386 and was ranked 1<sup>st</sup> and television and radio got low communication source. Moreover, accessibility of disease-free material, availability of Spraying machinery, awareness regarding chemical control, contact with extension workers were also very major constraints. The data indicated that the major factors were answerable for the communication gap regarding citrus canker disease among citrus farmers. However, the ranking showed that lack of technical knowledge was ranked 1st among the factors. Extension services was ranked 2<sup>nd</sup>. Therefore, cost of inputs was ranked last factor responsible for communication gap. This study urges special educational campaigns for the farmers to make them aware about the recommended measure and effective management of the citrus canker disease by the appropriate information sources.

### REFERENCES

- [1] N. Gottig, B. S. Garavaglia, C. G. Garofalo, T. Zimaro, G. G. Sgro, F. A. Ficarra, G. Dunger, "Mechanisms of infection used by *Xanthomonas axonopodis* pv. citri in citrus canker disease." Current Research, Technology and Education Topics in Applied Microbiology and Microbial Biotechnology 1, no. 1, vol.13, pp. 196-204, 2010.
- [2] S. Ashraf, Khan, G. A, Ali, S. Ahmed, and M. Iftikhar, "Perceived effectiveness of information sources regarding improved practices among citrus growers in Punjab, Pakistan." Pak. J. Agri. Sci., vol. 52, no. 3, pp. 861-866, 2015.
- [3] GOP. 2017. Pakistan Economic Survey (2016-17). Ministry of Food Agriculture and Livestock, Federal Bureau of Statistics, Government of Pakistan, Islamabad, Pakistan. Available: [http://www.finance.gov.pk/survey/chapters\\_17/pakistan\\_es\\_2016\\_17\\_pdf.pdf](http://www.finance.gov.pk/survey/chapters_17/pakistan_es_2016_17_pdf.pdf)
- [4] A. K. Das, "Citrus canker-A review. J. Applied Horti., vol. 5, no.1, pp. 52-60, 2003.
- [5] K. J. Joshipura, F. B. Hu, Manson, M. J. Stampfer, E. B. Rimm, F. E. Speizer, G. Colditz, A. Ascherio, B. Rosner, D. Spiegelman and W. C Willett, "The effect of fruit and vegetable intake on risk for coronary heart disease." Ann intern medi., vol.134, no.12, pp.1106-1114, 2001.
- [6] Graham, J. H., & Leite Jr, R. P. (2004). Lack of control of citrus canker by induced systemic resistance compounds. Plant Disease, 88(7), 745-750.
- [7] M. Y. Ashraf, A. Gul, M. Ashraf, F. Hussain and G. Ebert, "Improvement in yield and quality of Kinnow (*Citrus deliciosa* x *Citrus nobilis*) by potassium fertilization. J. Plant Nut., vol. 33, no.11, pp. 1625-1637, 2010.
- [8] O. Pruvost, B. Boher, C. Brocherieux, M. Nicole and F. Chiroleu, "Survival of *Xanthomonas axonopodis* pv. citri in leaf lesions under tropical environmental conditions and simulated splash dispersal of inoculum." Phyto., vol. 92, no. 4, pp. 336-346, 2002.
- [9] J. Qin, T. F. Burks, M. A. Ritenour and W. G. Bonn, "Detection of citrus canker using hyperspectral reflectance imaging with spectral information divergence." J. Food Eng., vol.93, no.2, pp.183-191, 2009.
- [10] M. M. Raza, M. A. Khan, M. Atiq, R. Binyamin and M. Javaid, "Prediction of citrus canker epidemics generated through different inoculation methods". Arch. Phytopathol. Plant Prot., vol. 47, no. 11, pp. pp. 1335-1348,2014.
- [11] B. A. Saleem, A. U. Malik, M. A. Pervez, A. S., Khan M. N. Khan, Spring application of growth regulators affects fruit quality of 'Blood Red'sweet orange. Pak. J. Bot, vol. 40, no. 3, pp. 1013-1023, 2008.
- [12] A. Sanofer, "Role of citrus fruits in health. Int. J. Pharm. Sci. Res., vol. 6 no. 2, pp. 121-123, 2014.
- [13] E. C. Nisbet, K. E. Cooper and M. Ellithorpe, "Ignorance or bias? Evaluating the ideological and informational drivers of communication gaps about climate change." Public Underst Sci., vol. 24, no. 3, pp. 285-301,2015.
- [14] J. Silalahi, "Anticancer and health protective properties of citrus fruit components." Asia Pac. J. Clin. Nutr., vol.11,

no. 1, pp. 79-84, 2002.

- [15] H. A. Raza, R. M. Amir, A. Saghir and M. Tahir, "Sugarcane production and protection constraints faced by the growers of Punjab, Pakistan with special focus on the role of agricultural extension worker in related mitigation." *Pak. J. Agri. Sci.*, vol. 57, no. 6, pp. 1681-1688, 2020.
- [16] J. Li and N. Wang, "Foliar application of biofilm formation-inhibiting compounds enhances control of citrus canker caused by *Xanthomonas citri* subsp." *Citri. Phyto.*, vol.104, no. 2, pp. 134-142, 2014.
- [17] J. Servaes, E. Polk, S. Shi, D. Reilly and T. Yakupitijage, "Towards a framework of sustainability indicators for 'communication for development and social change' projects. *Int. Commun. Gaz.*, vol. 74, no.2, pp. 99-123, 2012.