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FARMER'S PERSPECTIVE ON SUGARCANE DISEASES AND THEIR MANAGEMENT IN DISTRICT RAHIM YAR KHAN

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A B S T R A C T

This study aimed at exploring the awareness and adoption of recommendations regarding sugarcane diseases management in District Rahim Yar Khan of the Punjab, Pakistan. Total 343, randomly selected farmers participated in the study as respondents. Participants were interviewed face to face on a structured questionnaire. Collected data were analyzed on Statistical Package for Social Sciences (SPSS). Findings indicated a huge difference in awareness of the recommendations among farmers and the level of adoption. More than half (59.5%) of farmers had awareness about the recommendations but the adoption appeared from very low level to low level ($\bar{x}$= 1.56±0.95), indicating an extensive adoption gap. Traditional information sources like fellow farmers were the most preferred information sources for farmers and this could be one of the profound reasons behind poor adoption of recommendations. The fellow farmers would have shared their experiences with the fellow farmers but not the recommendation among farmers. This study urges awareness campaigns among farmers to make them aware about the sugarcane disease management. The Public sector extension should integrate the modern gadgets like mobile phone, helplines and internet to expedite the information delivery mechanism. Moreover, the synergistic work of research and extension is much needed.

Keywords: sugarcane diseases, adoption, rust, root rot, awareness, research,

INTRODUCTION

Sugarcane is one of important crops, widely cultivated in 121 countries across the world for many reasons including to produce sugar, which is also an export item for many of the sugarcane growing nations. Hess *et al*., (2016) estimated that almost 80% of the sugar comes from sugarcane crop and 20% from sugar beet. This sugar is worlds 2nd leading sweetener after honey (Ruxton *et al*., 2009).

Brazil is the by far largest sugarcane producer globally followed by the India, China, Thailand and Mexico (DAC and FW, 2017). For Pakistan, sugarcane is the second largest cash crop after wheat, contributing 2.9% to agriculture's value addition and 0.6% to overall gross domestic product (GDP) of country (GOP, 2020). In addition to sugar producing source, it has a significant role in providing different by-products such as refined sugar, molasses, brown sugar, jaggery and various other valuable products like biogas production, pulp, bio-fertilizer, ethanol and paper-making, very helpful in sustaining the industry and strengthening socio-economic conditions of the farmers and creating employment opportunities (Rehman, 2015; Raza *et al.,* 2018; Raza *et al.,* 2020). Malik (2018) identified that sugarcane added 50-60 billion rupees annually to the national economy.

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In Pakistan, sugarcane holds 5th position with respect to area under cultivation and 15th in terms of production worldwide (Abbas *et al.,*2020). Three zones, tropical Sindh, Sub-tropical Punjab, and temperate Peshawar valley in Pakistan are regarded conducive for the sugarcane cultivation (PSMA, 2018). The total cultivated area of sugarcane in Pakistan was 1040 thousand hectares with total production of 66.880 million tons. In Punjab province, it was cultivated on 0.777 million hectares and production of 49.6 million tons (Chatta *et al.,* 2018).

The importance of sugarcane is well documented but still the production is way lesser than its potential and resultantly the income of farmers is gradually declining. Ahmad *et al*., (2007) found that lack of education among farmers and high cost of production were the factors limiting the sugarcane production. High prices of inputs, low output, delayed payments and inadequate technical knowledge possessed by the growers were contributing towards low productivity of sugarcane. In another study, Raza *et al*., (2020), unveiledthat due to inadequate awareness of protection measures, the production of sugarcane declined. Whereas, biotic factors had adverse impacts on sugarcane production (Sengar, 2018).

With special reference to diseases and their impacts on sugarcane yield, number of studies such as Qureshi and Afghan (2005), Haider *et al*., (2011) and Elsharif and Abu-Naseer, (2019) have agreement that diseases had adverse impacts on sugarcane yield. Diseases curtailed the sugarcane production from 10 to 77% and loss in sugar recovery from 4 to 74%. Almost 55 type of sugarcane diseases caused by the bacteria, viruses, nematodes, fungi and phytoplasmas are reported. Pokkah boeng, sugarcane mosaic virus, red rot, smut, rust and white leaf are major diseases affecting the production adversely (Viswanathan and Rao, 2011).

Different agronomic practices such as using resistant varieties, adopting proper planting method, using of healthy seed and avoiding affected ratton crop are regarded as important to rheostat the sugarcane diseases. Sugarcane sets treatment by thiophanate methyl fungicides along with adopting biological control method were found effective in controlling the red rot sugarcane disease (Malathi *et al*., 2002). However, this adoption is strongly associated with the knowledge that farmers have to identify the diseases and adopt respective recommendations of disease management. The literature indicates the persistence of knowledge gap among farmers regarding disease management and perhaps due to this reason the sugarcane production decline is hardly controlled. Sahu *et al.* (2010) and Pervaiz *et al.* (2013) affirmed that farmers were not well aware about the cultural practices to resist sugarcane diseases. In order to bridge the knowledge gap among farmers, as suggested by Ogutua *et al*., (2014), information acquisition through various channels is indispensable. Therefore, this study explored the awareness and adoption among farmers regarding diseases management. This study also explored the preferred information sources of the farmers, that they used to access the information relevant to diseases and their concerned control.

Methodology: This study was conducted in district Rahim Yar Khan of the Punjab, province. The district was chosen as study area purposively, because a large number of farmers are practicing sugarcane cultivation in the district. All the sugarcane grower widespread across the district were considered as targeted population whereas the representative sample was chosen through the multistage random sampling technique. At the first stage, district Rahim Yar khan was selected purposively as a study area. The district consists of four tehsils namely Sadiq Abad (SDK), Khanpur (KP), Liaquat Pur (LP) and Rahim Yar Khan (RYK). At the second stage, all tehsils in District Rahim Yar Khan were selected in order to draw sample size. At third stage, the list of the registered growers was obtained from the office of Deputy Director of Agriculture (Extension), Rahim Yar Khan. The population of the study comprised of all registered sugarcane growers (3193) of district Rahim Yar Khan. In this regard, a random sample size of 343 was drawn by using an online website www.surveysystem.com by taking a confidence interval of 5% and a confidence level of 95 %.

In order to collect data, a validated and reliable questionnaire, well inline to the objectives of study was developed and later, administered through the face-to-face interview technique. The collected data were analyzed with the help of Statistical Package for Social Sciences (SPSS).

RESULTS AND DISCUSSION

Awareness level estimation: In this section, farmers were inquired in order to explore their awareness level about the different diseases of the sugarcane along with respective recommendations necessary to avoid diseases infestation. The responses were binary as1 was used in case farmers was aware and 2 for the otherwise. The description of the information generated is portrayed in Figure 1.

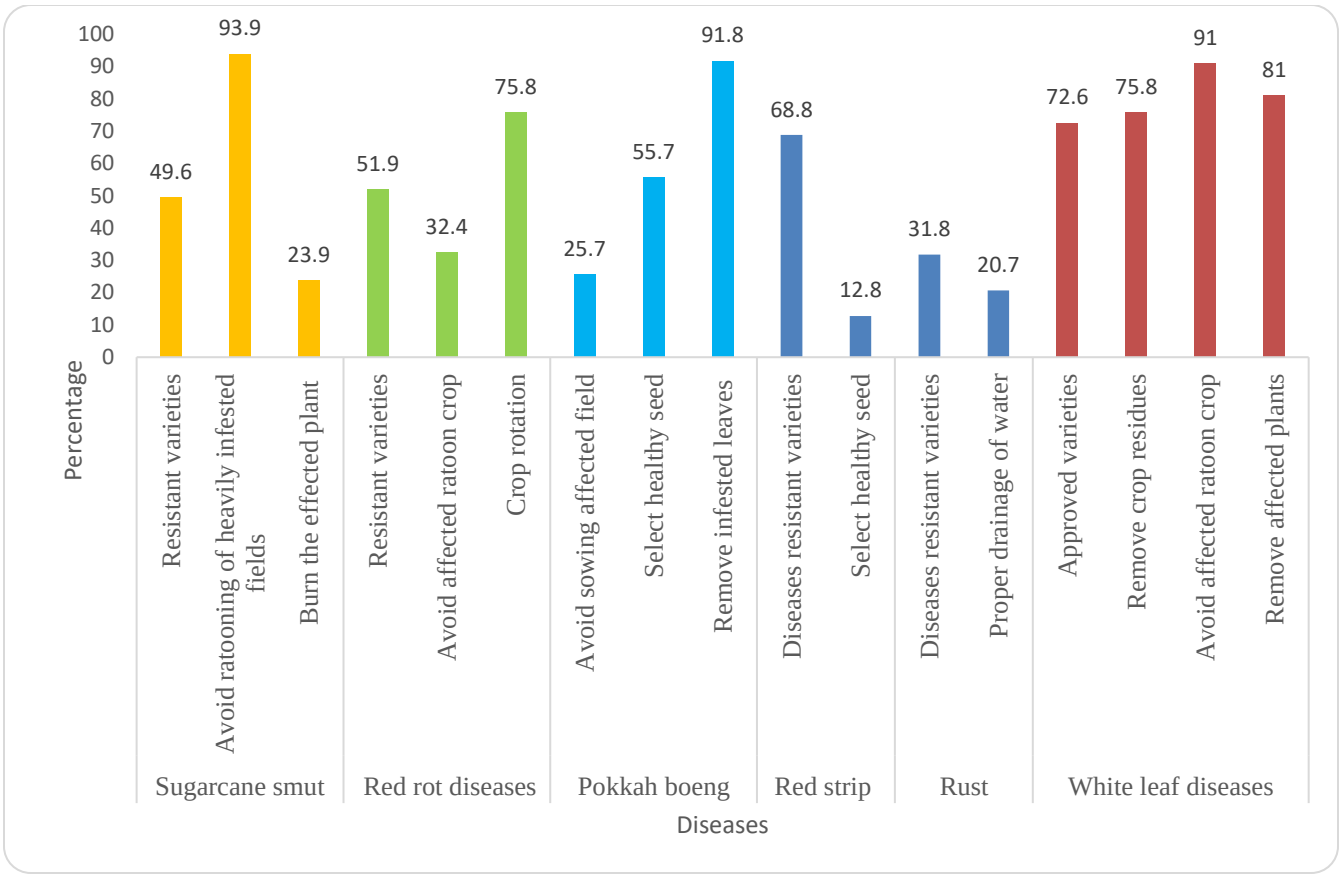

Figure 1. Awareness of farmers regarding sugarcane diseases.

Figure 1 shows that sugarcane smut, red rot disease, pokkah boeng, red strip, rust and white lead diseases were the common diseases known to different levels among respondents. In the context of sugarcane smut disease awareness, almost half (50%) of the respondents were known to cultivation of resistant varieties to prevent this disease. Avoiding ratooning of heavily infested sugarcane fields to prevent sugarcane smut was known to 93.9% of farmers. This indicates, avoiding ratoon crop was a common strategy that was familiar among the overwhelming majority of farmers.

About 24% of the respondents were aware about the burning of the infected plants to prevent from sugarcane smut disease. With regard to red rot disease, the awareness level of the respondents about sowing resistant varieties and avoiding affected ratoon crop stood as 51.9 and 32.4%, respectively. Majority (75.8%) of sugarcane growers had knowledge about crop rotation to prevent from this disease. The awareness level of the respondents about avoiding sowing of affected fields, selecting healthy seeds and removing infected leaves were known to 25.5, 55.7 and 91.8% of total respondents, respectively. This implies that among cultural practices, removing infected leaves was a widely known strategy. Regarding sugarcane rust disease awareness, overwhelming majority (92%) of the respondents were aware about the cultivation of resistant varieties to prevent from its prevalence. The proper drainage of water to avert sugarcane rust disease was known to one fifth of respondents (20%). This means that the great number of farmers were not familiar with this strategy and farmers might have faced a huge crop loss due to the infestation of sugarcane rust. Awareness of farmers about cultural practices such as using approved varieties (72.6%), removing crop residues (75.8%), avoiding affected ratoon crop (91%) and removing affected plants (81%) was good enough.

Adoption of recommendations: Data were collected from the farmers regarding different recommended management strategies for sugarcane diseases as adopted by the farmers on five-point Likert scale (1=V. Low Extent, 2=Low Extent, 3=Medium Extent, 4=High Extent, 5=V. High Extent). The adoption level was assessed by computing means and standard deviation, as given in Table 1.

Table 1. adoption level of farmers regarding recommended diseases management techniques

Recommendation Production Technology/ adoption		Mean± S. D
Sugarcane smut	Use of resistant varieties	2.34±0.873
	Avoid ratooning of heavily infested fields	4.27±0.160
	Burn the effected plant	1.38 ±0.46
Red rot diseases	Use of resistant varieties	2.72 ±0.99
	Avoid affected ratoon crop	2.75±0.62
	Crop rotation	1.43±0.92
Pokkah boeng	Avoid sowing affected field	1.00± 0.25
	Select healthy seed	1.29± 0.88
	Remove infested leaves	1.80± 0.55
Red strip	Diseases resistant varieties	1.83± 0.50
	Select healthy seed	1.81± 0.67
Rust	Diseases resistant varieties	1.80 ±0.55
	Proper drainage of water	2.48±0.29
White leaf diseases	Approved varieties	1.38 ± 0.46
	Remove crop residues	1.43±0.92
	Avoid affected ratoon crop	1.13± 0.43
	Remove affected plants	1.07± 0.82

Table 1 shows that for sugarcane smut disease management, cultivation of resistant varieties was foremost adopted ($\bar{x}$ = 2.34±0.873). The mean value fell between low to medium level on a likert scale. Whereas, the adoption of other cultural practices adopted by the respondents were avoiding of ratooning heavily infested field as preventive measures ($\bar{x}$ = 4.27±0.16) and burn the affected plant ($\bar{x}$ =1.38 ±0.46). The adoption of use of resistant varieties ($\bar{x}$ =2.72 ±0.99), avoiding affected ratoon crop ($\bar{x}$ =2.75±0.62) and crop rotation ($\bar{x}$ =1.43±0.92) to prevent sugarcane red rot diseases stood of less than medium level but closer to low level, indicating a wide adoption gap. , The respondents' adoption for avoid sowing affected field ($\bar{x}$ =1.00± 0.25), selecting healthy seed ($\bar{x}$ = 1.29± 0.88) to control rust was poor as the level of adoption on likert scale was of very low level. Adoption of diseases resistant varieties ($\bar{x}$ = 1.83± 0.50) was perceived poor as well to prevent Pokkah boeng disease. Diseases resistant varieties ($\bar{x}$ = 1.00± 0.25) and proper drainage of water ($\bar{x}$ = 2.48±0.29) were perceived poorly adopted as the recommended cultural practices for rust management in the study area. Out of the other cultural practices against sugarcane white leaf diseases, remove crop residues was on top with highest mean value ($\bar{x}$ = 2.48±0.92) followed by other practices approved varieties ($\bar{x}$ = 1.38 and SD=0.46), avoid affected ratoon crop ($\bar{x}$ = 1.13±0.43) and remove affected plants ($\bar{x}$ = 1.07±0.82).

Awareness and adoption-related to preventing measures: Farmers were inquired in order to explore their awareness and adoption level about the preventing measures against the overall disease prevention. The responses were binary in nature. 1 was used in case farmers were aware and 2 for them otherwise. The description of the information generated is portrayed in table 2.

Table 2. Awareness and adoption regarding preventing measures against the overall disease prevention.

Recommendations for prevention of sugarcane diseases		Frequency (%)	Adoption
Overall diseases management	Treat seed with Vitavax solution of (1:800) or Dithane M-45(1;400) or Benlate (1;600) solution before sowing	204 (59.5%)	1.56±0.95

The awareness of the growers about preventing measures against the overall disease prevention through seed treatment is presented in Table 2. About 60% of farmers had information regarding fungicides use, vitavax solution of (1:800) or Dithane M-45 (1:400) or Benlate (1:600) solution for seed treatment before sowing. Whereas, the adoption regarding the use of fungicides for seed treatment was low ($\bar{x}$ = 1.56±0.95). This demonstrates that, seed treatment was effective against the diseases and farmers had adequate awareness about the recommendations of seed treatment. However, the adoption was perceived lower showing adoption gap. Findings are supported with those of Sahu *et al*. (2010) as they found a wide

awareness gap among farmers and pertinent to this gap and inadequate knowledge the production of sugarcane decreased.

Information sources and their effectiveness: In this section, information sources of the farmers were explored. Farmers were accessing information from different information sources about the recommended production practices for the control of sugarcane diseases. 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. In order to calculate the effectiveness of each information sources, the total response of likert scale were summed up and divided by the 5. The obtained mean value was used as cut value to decide either information source was more effective or less effective. The calculation is appended below;

Likert scale= 1+2+3+4+5= 15

Mean= 15/5= 3

Cut value= 3.00

The cut value 3 refers that, if the mean value of any information sources exceeds 3, then it is more effective, in case the mean value is less than 3, the information source is less effective. The detailed description of the data is given in Table 3.

Table 3. Perceived information sources for the awareness and adoption of preventing measures against the overall disease prevention.

Information sources	Mean	Std. Deviation	Remarks
Fellow farmers	4.27	0.31	More effective
Pesticide's dealer	3.64	0.92	More effective
Sugar mills advisory services	3.40	0.10	More effective
Internet	3.28	0.24	More effective
TV channels	3.11	0.05	More effective
Mobile phone calls	2.89	0.01	Less effective
Printed Materials (magazines, newsletters)	2.59	0.08	Less effective
Public extension workers	2.35	0.71	Less effective
Agricultural help lines	2.28	0.87	Less effective
Radio	1.83	0.20	Less effective

Table 3 indicates that, fellow farmers, pesticides dealers, sugar mills advisory service providers, internet and TV were more effective sources of information in order to access information regarding sugarcane production technology. Findings are similar to those of Jafri *et al*. (2014) as they found hefty inclination of farmers towards TV to access required information. Findings are further in agreement with those of Ashraf *et al*. (2015) as they found that fellow farmer was the most effective information source for the farmers.

Mobile phone calls, printed material, public sector extension field staff, agricultural helplines and radio were found as fewer effective sources of information. The findings of the current study are similar to those of Mirani and Memon (2011) as they found that majority of sugarcane farmers did not get information related to production and protection practices from agriculture extension workers (AEW). Findings are endorsed with those of Ahmad *et al*., (2007) as they found that agricultural extension was not effective source of information for the farmers. Likewise, Sharma and Singh, (2019) reported that the majority of farmers were not capable of the adoption of the latest production technologies due to a lack of information sources. Similarly, Baloch and Thapa, (2018) identified that the source of information was proven very effective for the farmers to educate them about the adoption of the latest practices of sugarcane. The current findings augment that, farmers were more relying on traditional information sources whereas inclination towards modern gadgets like mobile phone was poor.

Estimation of Adoption Gap: This section meant for the estimation of adoption gap of recommended disease management strategies developed by the agriculture department, Government of Punjab, Pakistan and the knowledge possessed by the respondents in the study area. In this regard, 5- point Likert scale (1=V. Low Extent, 2=Low Extent,

3=Medium Extent, 4=High Extent, 5=V. High Extent was used as standard. The adoption gap of recommended sugarcane diseases management strategies was calculated by subtracting obtained mean values from the total mean of five, as presented in Table 4.

Table 4. Estimated adoption gap.

Recommendation Production Technology/ adoption gap		Adoption gap	Level of extent
Sugarcane smut	Use of resistant varieties	2.66	Close to medium level
	Avoid ratooning of heavily infested fields	1.73	Low level
	Burn the effected plant	3.62	High level
Red rot diseases	Use of resistant varieties	2.28	Medium level
	Avoid affected ratoon crop	2.25	Low level
	Crop rotation	3.57	High level
Pokkah boeng	Avoid sowing affected field	4	Very high level
	Select healthy seed	3.71	High level
	Remove infested leaves	3.2	Medium level
Red strip	Diseases resistant varieties	3.17	Medium level
	Select healthy seed	3.19	Medium level
Rust	Diseases resistant varieties	3.2	Medium level
	Proper drainage of water	2.52	Medium level
White leaf diseases	Approved varieties	3.62	High level
	Remove crop residues	3.57	High level
	Avoid affected ratoon crop	3.87	High level
	Remove affected plants	3.93	High level

Table 4 shows that regarding sugarcane smut diseases management, the adoption gap among use of disease-resistant varieties (medium level) avoids ratooning of heavily infested fields (low level) and burn the affected plant appeared of (medium level). Whereas, for controlling red rot diseases, the adoption gap among the recommended practices such as use of resistant varieties (medium level) and crop rotation (high level) was promising. Regarding the use of selecting healthy seeds the adoption gap found was high level for prevention of Pokkah boeng. In context to red strips and rust, the adoption gap was found medium for using selecting healthy seeds among cultural practices. Whereases, the adoption gap was found at a high level of all cultural practices among the respondents for preventing white leaf diseases. This is deducted that, there was a huge adoption gap among farmers regarding recommended production practices admissible to control the diseases.

CONCLUSION

This study concludes that, awareness among sugarcane growers regarding sugarcane diseases and the recommendations for the control of diseases was far better than the adoption level. Adoption of the recommendations was poor showing an extensive adoption gap regarding diseases management. This difference in awareness and adoption among farmers propels that perhaps the awareness among farmers is inadequate or information received is not in accordance to the needs of the farmers. The over reliance of farmers on fellow farmers and other traditional sources accentuates that information received by the farmer was beyond their needs. This study urges special educational campaigns for the farmers to make them aware about the diseases of sugarcane and effective management of the diseases by the advisory service providers. Public sector extension field staff appeared among the less effective information sources; thus, the public sector extension needs to revamp their working and expedite the information dissemination mechanism by the integration of modern gadgets like mobile phone, internet and helplines. The synergistic working between the research and extension is much needed in order to foster the sugarcane diseases management on farm level.

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Rana M. Amir	:	Supervised the study
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Rashida Perveen	:	Technical Review
Imran Khalid	:	Help in paper setting
Amjad Saeed	:	Help in data collection
Sundaisa Abru	:	Methodology setting
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Saleem Ashraf	:	Review and proof reading