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Constraints in Adoption of Biological Control in Sugarcane Crop

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Abstract
Sugarcane is one of thehigh value and important cash crops in Pakistan. This crop has high significance for sugar and sugar related production. Sugarcane accounts for 3.4 percent in agriculture value addition and 0.7 percent in gross domestic production. Biological control is animportant component of integrated pest management and helps to counteract insecticide resistant pests, withdrawal of chemicals and minimize the usage of pesticides. The purpose of this study was to examine factors effecting adoption of biological control by farmers of sugarcane in district Sanghar. Face to face interviews of 60 respondents was conducted to collect the data for the study. Random sampling method was used to collect data from farmers of study area. Results this study showed that there was a significant difference between the two groups of adopters and non-adopters of biological control. The results showed that the many social and institutional constraints effect the adoption of biological control. Important identified factors that affect the adoption of biological control in the study area are level of education and awareness, lack of adequate extension services, perceptions of time consuming practice, risk and uncertainty.
Keywords: Sugarcane farmer, constraints adoption, biological control, Sindh

Introduction

Sugarcane is an important and high value cash crop, occupies an important position in cane producing countries in the world(Khushk*et al* ., 2010). It is significantly important for sugar and sugar related production. The sugar industry play vital role in the national economy for Pakistan. Sugarcane accounts for 4.5 percent in agriculture value addition and 0.9 percent in GDP (GoP, 2008).

Major Sugarcane Pests

The average yield of sugarcane in Pakistan particularly in Sindh is low. Among many reasons behind this low production such as poor management practices, weeds, water shortage etc. insect pests also play a negative role in decreasing the yield. According to rough estimates insect pests cause almost 20 to 40 percent reductions in yield of the crop resulting in huge losses to growers. Amongst sugar cane pests, borers cause more damage to the crop. Moths of sugar cane stem borers lay their eggs underside the leaves. Within 36 to 48 hours larvae come out of the eggs and start feeding on tender parts of the plant. After some time, the larvae find their way into the stem. They keep feeding inside the cane and render it unfit for consumption and milling. Weight of cane and sucrose percentage is drastically reduced. In case of root borer attack, the central whorl of leaves dry up and form dead hearts. (Dawn, 2007)

Biological Control Agents

Biological Control agents are environmentally safe, non-toxic and non-polluting. Biological control agents are pest-specific and greatly prefer to feed on the target organism, leaving non-pest organisms undisturbed. Once a biological control program is underway, the field aspects of the program are inexpensive compared to other control methods and require little human efforts Biological control agents can sustain themselves and spread on their own. Beneficial animals and plants as well as people in an area where biological control is being used and large unaffected by this method of control. (Abid 2012)

This process continues and the population of trichogramma keeps increasing and the population of borers keeps decreasing, and thus the cane crop remains protected from borers' attack. Sometimes due to unfavorable weather conditions or spray of pesticides population of trichogramma is drastically reduced and the chance of borer's attack is increased. In such conditions to maintain an adequate population of trichogramma in the field, scientists have evolved a technique (Khushk*et al* ., 2007).

The females of *Trichogramma* trace the eggs of the cane borers and lay their eggs between them. From these eggs tiny larvae of the parasite emerge which eat up the embryo of borer eggs. Within seven days the parasite completes its life-cycle and adults of trichogramma emerge from cane borer's eggs (Mansoor 2012)

Another harmful pest of cane is the leaf hopper (*pyrilla*), which causes serious damage to the crop. Its attack is reported to have been increasing for the last couple of years in Sindh. *Perilla* is an insect pest which sucks the juice from the leaves as a result they dry up. In addition, it also emits a sweet substance (honeydew) which serves as a medium for a fungus namely sooty mould, which turns the leaves black and photosynthetic activity of plants is badly affected. Plants get weakened and sucrose percentage also drops. Both the adults and nymphs suck the sap from the leaves. The leaf hopper is very agile and jumps around in large numbers, making a

faint noise when a person walks through a heavily infested field. This pest breeds throughout the year and migrates from one crop to another in search of fresh food (Khushk*et al* ., 2007).

Biological Control:

Biological control is very successful in cane crop and is gaining popularity among growers. Natural enemies of sugarcane pests like *trichogrammachilonis*and *chrysoperlacarnea*are periodically released in the field. In 1930, after a lot of research, entomologists succeeded in finding an alternative method of pest control -- the biological control. This method involves predators and parasites to control harmful insect pests. This is a safe method of pest control. In Sindh, this method has been tried in sugar cane crop growing areas of Mehran Sugar Mills, TandoAllahyar, Al-Noor Sugar Mills, Moro, Matiyari Sugar Mills, Matiyari, Habib Sugar Mills, Nawabshah, and Fauji Sugar Mills, Khoski (Khushk& Mal 2007).

Precautionary measures: For achieving better control these cards should be tagged preferably on the underside of leaves and tagged early in the morning or evening, so that it may not face heat or sun as soon as they emerge. Trichogramma cards should be regularly tagged each month from March to September. Chrysopa cards should be tagged every month from July to November.

Advantages of biological control: By this method sugarcane pest like root borer, stem borer and top borer can be successfully controlled without the application of pesticides. This method is not harmful to other beneficial insects and is safe for the environment and easy to apply (Dawn,2007).

Expenditures involved: This method is very economical as compared to chemical control method. It costs Rs.300 to Rs.400 per acre annually whereas a cost of Rs.1, 500 to Rs.2, 000 per acre is incurred on chemical control method.

The main purposes of this study were to seek out the level of adoption, awareness and also the most important constraints in adoption of biological control practices on sugarcane in District Sanghar .The following section discusses the research design, population and sample size, analysis of data and interpretation of results.

DATA

The population of this study consisted of sugar cane growing farmers of district Sanghar. The growers of sugarcane from 3 taluka, two villages from each taluka were randomly selected. Sample size consist 60 farmers, 30 farmers (Adopter) who used the biological control agents and 30 (Non adopter) who did not use biological control in their field. Interviews were conducted according to study needs.

MATERIALS AND METHOD

The study was conducted in district Sanghar Sindh. A cluster random sampling technique was used from the entire set of population. The study was conducted using descriptive method. A well designed questionnaire was used to analyze the current status, level of adoption, awareness and also the most important constraints in adoption of biological control practices in sugarcane in district Sanghar. A 4 point liker scale was used for analyzing the proper answer of the respondents. The sample size of the respondents was determined by using suggested formula. The respondent size of 60 sugarcane growers was randomly selected.

Each research study entail different liens of work depending upon its objectives and working plan .thus a meaningful research work involves an appropriate planning before proceeding. The study was conducted by survey method, for this purpose a comprehensive questionnaire covering all aspects related to the current status and constraints in adoption of biological control of sugarcane growers and factors affecting in adoption of biological control in sugarcane. The study was developed on a random sample of 60 respondents from 6 different villages and each village has 10 respondents.

Percentages

Percentages were calculated in simple and cross tables for the purpose of comparisons; $F / N \times 100$. Where F represents the class frequency and N stands for total respondents.

Arithmetic mean

Arithmetic mean or average can also be used for tabulated presentation of data. It is true representation of the whole data; A.M or Average = $\Sigma Xn / n$.

Standard deviation

Deviation of a data from its mean is called the standard deviation. If a deviation of its mean is squared then the resulting deviation is called standard deviation; $S.D = \sqrt{[(\Sigma X - X^*) / n]}$.

RESULTS AND DISCUSSION

The objectives of this study were to identify the sources of information their effectiveness, level of awareness, adoption and the problem faced by the sugarcane growers in adoption of biological control and also opinion about the chemical and biological control from the farmers in District Sanghar.The data were collected from the list of farmers available from sixty randomly selected sugarcane growers using a pre-tested structured interview schedule. The data were collected during January 2013

Many factors have been found to affect farmers' adoption of new technologies. Thesocioeconomic characteristics of sugarcane grower such as age, educational level, land size, farming experience, area under sugarcane grown, and yield play an important role in determining grower's adoption of the biological control**.**

Sources of Information Used by Farmers Regarding Trichogrammachilonis

Table-1 indicates that the adopter farmers "always" received information regarding the Trichogrammachilonisfrom the sugar mill extension services (Mean=4.46), "Most of the time" received information regarding Biological Control from progressive farmers (Mean=1.26) and "sometimes" received information from extension worker (Mean=1.20). While non-adopter farmers category received information "Most of the time" from progressive farmers (Mean=1.66) and "Sometimes" from the sugar mill extension services (Mean=1.53).

Table-1 Sources of information used by farmers regarding Trichogrammachilonis.

Sources	Adopter farmers		Non-Adopter farmers	
	Mean	Standard deviation	Mean	Standard deviation
Radio/television	1.06	.25	1.20	.77
Sugar mill extension Services	4.46	.83	1.53	.91
Research institute/station	1.06	.25	1.00	.00
Extension worker	1.20	.56	1.06	.25
Progressive farmer	1.26	.45	1.66	.72
NGO	1.00	.00	1.00	.00

scale 1 = Not at All, 2 = Some Times, 3 = Most of the Time, 4 = Almost Always, 5= Always

Sources of information regarding Chrysoperlacarneaused by the farmers

Table reveals the adopter farmers got the information regarding Chrysoperlacarnea "always" from sugar mill extension services (Mean=4.33) and "sometimes" from the radio/television (Mean=1.26). Whereas non-adopter farmers category "sometimes" got information regarding Chrysoperlacarnea from extension worker (Mean=1. 66) and from progressive farmers (Mean=1. 33)

Table-2 Sources of information regarding Chrysoperlacarneaused by the farmers

Sources	Adopter farmers		Non-Adopter farmers	
	Mean	Standard deviation	Mean	Standard deviation
Radio/television	1.26	1.03	1.20	.77
Sugar mill extension services	4.33	.89	1.66	1.11
Research institute/station	1.00	.00	1.00	.00
Extension worker	1.20	.56	1.06	.25
Progressive farmer	1.13	.35	1.33	.48
NGO	1.00	.00	1.00	.00

Note: scale 1 = Not at All, 2 = Some Times,3 = Most of the Time,4 = Almost Always 5 = Always.

Effectiveness of Sources of Information

The farmers were asked to rank the source of information according to their effectiveness in transferring the biological control. The answers presented in table.

Table- 3 depicts that farmers perceived "sugar mill extension services" are effective at "greater extent" source of information regarding biological control and ranked 1st position, progressive farmers were ranked 2nd, extension worker ranked 3rd and Radio/Television and NGO's were "not at all" effective and ranked 4th and 5th respectively. In the same way non-adopter farmers realized that "sugar mill extension services "is effective source of information regarding biological control to "effective extent' ranked 1st progressive farmer and extension worker is considered effective to "Some extent" ranked at 2nd and 3rd position. Radio/television and NGO's to "not at all" effective and were ranked 4th and 5th respectively.

Table-3 Effectiveness of Sources of Information as perceived by farmers

Sources	Adopter farmers			Non-Adopter farmers		
	Mean	Standard deviation	Rank	Mean	Standard deviation	Rank
Radio/television	1.06	.25	5th	1.20	.56	4th
Sugar mill extension	3.33	.72	1st	1.60	1.12	1st
Extension worker	1.40	.73	3rd	1.26	.45	2nd
Progressive farmer	1.60	.82	2nd	1.26	.59	3rd
NGO	1.06	.25	4th	1.00	.00	5th

Scale = Not at All, 2 = Some Extent, 3 = Effective Extent, 4 = Greater Extent Effective

Level of Awareness of Biological Control practices

Table -4 specifies that adopter farmers category had "extremely high level" of awareness about staple the card beneath the leaves in cane (Mean=3. 20), “High Level” of awareness about the use of card early in the morning (Mean=3.00), “Moderate Level” awareness of the use of 5 cards per acre (Mean=2.80), awareness “To Some Level” use of biological card in a specific period and use in February (Mean=2.33). “not at all” aware about card can be saved 50 days at 5c to 7c Mean= (1.86). Whereas non-adopter farmers had "moderate level" of awareness about staple the card beneath the leaves (Mean=1.86), use of biological control in a specific period had "some level" of awareness (Mean=1.73), "some level" of awareness own by the farmers about use at early morning, and sugarcane growers of non adopter group are not aware that the card can be saved about 50 days at 5c to 7c Mean= (1.33)

Table-5- Level of Awareness of Biological Control practices

Biological control practices	Adopter farmers		Non-Adopter farmers	
	Mean	Standard deviation	Mean	Standard deviation
Awareness about use of biological control in February	2.33	.61	1.40	.63
Awareness about use of 5 Card per acre	2.80	.86	1.73	.70
Awareness about Staple the card beneath the leaves	3.20	.67	1.86	.91
Awareness about February to September every month use the card	2.33	.61	1.13	.51
Awareness about use of card at early morning	3.00	1.00	1.33	.72
Awareness about You can save the card 50days at 5 to 7c	1.86	.91	1.13	.51
Awareness of no environmental pollution	2.20	.77	1.06	.25

Scale 1=Not at All, 2=To Some Level, 3=Moderate Level 4=High Level, 5=Extremely High Level

Level of Adoption of Biological Control

Table-5 illustrate the level of adoption of sugarcane growers, the adopter farmers group had adopted biological control at "high level" staple the card beneath the leaves Mean= (3.40) and used 5 card per acre Mean= (2.86), and they had adopted "Moderate level" in February Mean= (2.46), also they adopted biological control in specified period at "Moderate level". While non-adopter farmers group had "not at all" adopted biological control practices.

Table-13 Level of Adoption of Biological Control

Biological control practices	Adopter farmers		Non-Adopter farmers	
	Mean	Standard deviation	Mean	Standard deviation
Used biological control in February	2.46	.63	1.00	.00
Used 5 Cards per acre	2.86	.74	1.00	.00
Used and Stapled the cards beneath the leaves	3.40	.73	1.00	.00
Used the cards February to September every month	2.20	.86	1.00	.00
No environmental pollution	2.20	1.08	1.00	.000

Scale 1=Not At All, 2=To Some Level, 3=Moderate Levels, 4=High-level, 5=Extremely High Level

Constraints in Adoption of Biological Control

Table-6 signify that the adopter farmers of biological control had faced non-availability Mean= (2.93) lack of proper extension Mean= (2.80), non-awareness Mean= (2.60), lesser impact than chemical control, storage and less shelf problems "to great extent" Mean= (1.73) and time consuming practice Mean= (1.53) during the adoption of biological control. Whereas non-adopter farmers had faced non-awareness, lack of extension, non-availability problem and "some extent" faced risks and uncertainty, non-effectiveness, storage and shelf problems "To A Greater Extent", along with Risk and uncertainty, difficult in use, and time consuming problems in adoption of biological control.

Table-6 Constraints in Adoption of Biological Control

Constraints in adoption of biological control	Adopter farmers		Non-Adopter farmers	
	Mean	Standard deviation	Mean	Standard deviation
Non-awareness problem	2.60	.50	2.93	.25
Lack of adequate extension problem	2.80	.41	2.93	.25
Lesser impact than chemical control problem	1.73	.59	2.06	.25
Expensive problem	1.13	.51	1.13	.35
Non-availability problem	2.93	.25	2.93	.25
Non-Effectiveness problem	1.60	.50	1.86	.35
Difficult in use problem	1.20	.41	1.66	.48
Time consuming practice problem	1.53	.51	1.66	.48
Risk and uncertainty problem	1.40	.50	1.93	.45
Storage and less shelf problem	1.73	.70	2.53	.74

Scale 1 = Not At All, 2 = To Some Extent, 3 = To A Greater Extent

CONCLUSION AND RECOMMENDATIONS

The research reveals that the majority (33.3%) of adopter farmer's category belongs to the age category 31-40years, (20%) of adopter farmers belong to 41-50years category. While 40.0% of non-adopter farmers belong to the 31-40 years, and 13.3% of the farmers belong to 41-50 years category. 46.7% of adopter farmers were intermediate level of education. Whereas, from non-adopter farmers 46.7% were secondary level of education.The study further discovered that the adopter farmers received information regarding biological control the from the sugar mill extension services and perceived it effective source of information. While non-adopter farmer's category received information Most of the time from progressive farmers. Research also specifies that adopter farmer's had Moderate level of awareness about the use of biological control in sugarcane crop. Whereas non-adopter farmers had low level of awareness about the technology.

The study further revealed that Adopter farmers group had adopted Moderate level biological control. While non-adopter farmers group had not at all adopted biological control practices. The study specifies that the non-availability, lack of proper extension, non-awareness, lesser impact than chemical control is the key obstacles to the adoption of biological control. Biological control technique as time consuming practice, storage and less shelf problems also perceived as major constraints to adoption of biological control. This investigation also explore that non-adopter farmers had faced non-awareness, lack of extension, non-availability problem to greater extent. Risks and uncertainty, non-effectiveness of biological control, storage and shelf problems as main obstacles in adoption of biological control in sugarcane. Therefore it is very important to reorient the biological control programe.

RECOMMENDATIONS

On the basis of research findings it is suggested that;

- Majority of farmers are not fully aware about the biological control of insect pest of sugarcane crop, therefore it is recommended that a comprehensive awareness campaign should be used to aware, motivate the farmers to adopt this eco friendly and cost efficient technology.
- It was found that farmers did not receive information from radio and television. Therefore, it is recommended that the concerned authorities should telecast training program on radio and television especially on local channels.
- Farmers know about the biological control but they do not adopt, therefore, it is recommended that the government should invest in extension services to increase its effectiveness. Extension worker should also ensure timely availability along with complete guidance to use it.
- It is pointed out that learning from social networks (peers) and extension workers for boosting

technological adoption. Therefore arrangements of group discussion should be conducted between adopter and non-adopter group on biological control technology to interchange the experiences with each other.

- The evidence suggests that social learning is a powerful force for the adoption of new technologies and is far more persistent than learning from extension services over this period. Therefore, It is recommended that the extension worker should invite the non-adopter farmers at model farm to demonstrate the usefulness of biological control.

REFERENCES

Khushk, A.M.,andA.Memon 2010. Snags in Sugarcane Production in Pakistan. Technology Transfer Institute,Tandojam

Khushk, A.M., and Bhugro M 2007 **Controlling sugar cane pests** News Channel (online) Sindh agriculture department, Sindh www.sindhagri.gov.pk/sugar-about.html

GoP, 2000. Agricultural Census of Pakistan 2000. Agricultural Census Organization, Lahore, Pakistan.

Government of Pakistan. 2008. Pakistan Economic Survey 2007-08.FinanceDivision,EconomiAdvisor'swing,Islamabad, Pakistan

Government of Pakistan. 2006. Pakistan Economic Survey 2005-06 .Finance Division,Economic Advisor's wing, Islamabad, Pakistan Controlling Sugarcane Pest 2007 Dawn News Paper.

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