

## **WEEDS AND WEED CONTROL METHODS IN SUGARCANE: A CASE STUDY OF KHYBER PAKHTUNKHWA PAKISTAN**

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### **ABSTRACT**

*The present research was initiated to find out the farmers' perception of weeds and their control in sugarcane. Two districts i.e Mardan and Charsadda were selected as a sample of the study. Data were collected from 336 sugarcane growers through pre-tested interview schedule. It was observed that overwhelming majority of 96 % of the sample respondents reported Scandix spp. was considered as a weed problem followed by Sorghum halepense as reported by 89% and 85% of the sample respondents considering the Cirsium arvense as the biggest weed problem locally known as "Ghanaki". Both mechanical and manual weed control methods were reported by all the respondents. Pests such as whitefly, mites, bugs etc. were reported on their sugarcane crop by 88% followed by rates and bore responded by 85% and 62% respectively. Use of pesticides was reported by 70 % respondents. It is recommended that farmers must be aware of the proper weed management through adequate trainings and demonstration of mechanical eco-friendly pesticides application. Moreover, Agricultural Educational institution may be involved to educate farmers in weeds and their control measures.*

**Key words:** Farmers, Khyber Pakhtunkhwa Pakistan, sugarcane, weed control methods, weeds.

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### **INTRODUCTION**

It is theorized that sugarcane was first domesticated as a crop in New Guinea around 6000 BC. New Guinean farmers and other early cultivators of sugarcane chewed the plant for its sweet juice. In the beginning farmers in Southeast Asia and elsewhere boiled the cane juice down to a viscous mass to facilitate transportation but the first known production of crystalline sugar began in Northern India. Around the 8<sup>th</sup> century AD, Arab traders introduced sugar from South Asia and

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the other parts of the Abbasid Caliphate in Egypt, North Africa and Andalusia. By the 10<sup>th</sup> century, there was no village in Mesopotamia that did not grow sugarcane. It was among the crops brought to the Americas by the Andalusians from their fields in the Canary Island and the Portuguese from their fields in the Madeira Island (Kew, 2014).

Sugarcane is one of the major cash crops of Pakistan. Sugarcane production generates income for farming community and source of employment for the youth of Pakistan. It provides necessary raw materials to industries like sugar mills, chipboard and paper. Its added value to agriculture and Gross Domestic Product (GDP) is about 4% and 1%, respectively (GOP, 2011). Therefore, the present study would be an asset particularly for the policy makers. Thus, if attention is not paid to this situation not only sugar crises will emerge but also big problem of un-employment will be created for the local youth. Moreover, a serious political problem is expected to take place and people will stand in long queues to get one or two kg of sugar for one month (GOP, 2012-13).

Heavy weed infestation is another cause of low yield both in plant and ratoon crops. Weed competition between early growths up to tillering is detrimental to obtain optimum crop stand, growth and yield. Cane yield losses up to 24-50 % were observed under check conditions. Chemical and mechanical weed control measures were found equally effective. However, pre-emergence Gesapex x Combi application was more efficient and economical than manual or bullock hoeing operations. It was further observed that chemical control along with one inter-row cultivation during tillering provided higher cane yield and cost benefit ratio 1:10 (Karim, 1990).

The present study was, thus, designed to find out the perception of farmers regarding weeds control and also to estimate the losses caused by weed infestation.

## **MATERIALS AND METHODS**

District Charsadda and Mardan are the major sugarcane growing areas of Khyber Pakhtunkhwa province being the target area of the study and these districts were selected through multistage sampling method. A list of sugarcane growers from each selected village was prepared with the help of Agricultural Extension Department. Due to limited time and financial constraints the researchers took randomly 15 % of the sample from the selected villages, the same techniques were also used by Parviaz *et al.* (2013) in their research study. Thus, total number of respondents for this study were 336.

The interview schedule was designed in such a way to collect complete and concrete information needed for this study and was pre-

tested. The data were analyzed using Statistical Package for Social Science (SPSS). Results were presented in frequency distribution tables and percentages. Chi-square test was used to check the association between two attributes, while t-test was used to check the difference between two variables.

## **RESULTS AND DISCUSSION**

### **Self Perception of farmers about different types of weeds in sugarcane**

Weeds are common and main problem of the farmers across the country. There are many types of weeds such as grasses, broadleaf and sedges. However, respondents were asked questions regarding types of weeds and their answers were converted into botanical manner. The data in Table-1 showed that 67 % of the sample respondents reported the *Convolvulus arvensis*, while 89 % reported *Sorghum halepense*, a severe problem. These were followed by 70 % of the sample respondents who reported that *Sisymbrium irrio* was the big issue for them. The severity of this weed was stated almost equally in both districts under study. The 74 % of the sample respondents faced the problem of *Parthenium* sp. in local language "Speen Guli" meaning white flower. The 84 % of the sample respondents reported the *Cirsium arvense* as the biggest weed problem. This weed is locally known as "Genaki" competing with plants for nutrients from the land since its root goes much deeper compared to sugarcane. Consequently, sugarcane yield is badly affected. The last weed reported by overwhelming majority of 96 % by the respondents sample was *Scandix* spp. The weed inflicted 20-30% decrease in various crops on the average. On the national level, total monetary decreases due to weeds well surpassed over 120 billion, whereas, only wheat reported for more than Pak Rs 30 billion (4<sup>th</sup> Intl. Weed Sci. Conf., 2012). Furthermore, weed control is the most neglected aspect in cane culture. Only weeds may reduce 20-50 % cane yield (Karim, 1990).

**Table-1.** Distribution of respondents stating different types of weeds in sugarcane

Distt.	Village	Types of weeds												Total
		<i>Conv. arvensis</i>		<i>Sorg. halepensis</i>		<i>Sisymb. irio</i>		<i>Parth. spp.</i>		<i>Cirsium arvense</i>		<i>Scandix spp.</i>		
		Y	N	Y	N	Y	N	Y	N	Y	N	Y	N	
Mardan	Gulmehra	36	-	34	2	24	12	35	1	27	9	35	1	36
	Miaganoo Killi	35	-	35	-	28	7	35	-	26	9	28	7	35
	Akberabad	34	-	23	11	20	14	24	10	23	11	29	5	34
	Qutabgarh	26	7	23	10	16	17	21	12	26	7	29	4	33
	Feroz Shah	36	9	32	13	19	26	34	11	40	5	42	3	45
Charsadda	Dobandi	30	-	30	-	30	-	30	-	30	-	30	-	30
	Payan	26	1	27	-	23	4	23	4	25	2	27	-	27
	Tangi Abazai	0	29	29	-	16	13	6	23	28	1	29	-	29
	Hisara Nehri	0	43	43	-	43	-	21	22	43	-	43	-	43
	Qumbati	1	23	24	-	17	7	20	4	16	8	24	-	24
Total	224 (67)	112 (23)	300 (89)	36 (11)	236 (70)	100 (30)	249 (74)	87 (26)	284 (85)	52 (15)	316 (94)	20(6)	336 (100)	

Source: Field Data, 2012-13

### Perception of farmers about weeds control methods in sugarcane

Aiming to get successful crop production. the man has been active for ages in destroying unwanted plants from the main crop. Various methods have been applied starting from hand pulling of weeds to the use of hand hoeing tools, livestock-bullocks, horses and modern farm machinery for mechanical weed control. The latest technique in this category is the use of chemicals called herbicides for weed control. The modern day technology is the integrated methods of weed control including the use of cultural, mechanical and chemical means. As for a long growing season, in crop like sugarcane, single method of hoeing or chemical weed control is not sufficient to attain the goal of complete weed control (Karim, 2005). Land preparation is a main feature in controlling weeds. For suitable weed control, Gesapex Combi 80 WP may be applied @ 3.5 kg ha<sup>-1</sup> in medium textured soil and @ 4.5 kg ha<sup>-1</sup> in heavy soils in 100 to 120 liters of water. The weedicide should be used in accordance with the advice of the technical experts (Zubair, 2014). The data showing methods of weed control by the respondents is available in Table-2.

**Table-2.** Distribution of respondents stating different methods of weeds control

Districts	Villages	Methods of weed control						Total
		Mechanical	Chemical		Biological	Cultural		
		Yes	Yes	No	No	Yes	No	
Mardan	Gulmera	36	22	14	36	35	1	36
	Miagano Killi	35	14	21	35	34	1	35
	Akber Abad	34	9	25	34	34	-	34
	Qutabgarh	33	21	12	33	33	-	33
	Feroz Shah	45	33	12	45	45	-	45
Charsadda	Dobandi	30	9	21	30	30	-	30
	Payan	27	-	27	27	27	-	27
	Tangi Abazai	29	-	29	29	29	-	29
	Hisara Nehri	43	1	42	43	43	-	43
	Qumbati	24	-	24	24	24	-	24
Total		336 (100)	109 (32)	227 (67)	336 (100)	334 (99)	2 (1)	336 (100)

Source: Field data, 2012-13

During the research study respondents were asked how they controlled weeds. Many and varied weeds control methods were stated such as mechanical, chemical and cultural. Mechanical method of weed control was reported by all the respondents. However, 32% respondents of total reported the use of chemical method. There were 68% who did not use chemical methods for weed control. Cultural method weed control was reported by 99% respondents. While biological weeds control method was not reported by any one sample respondents. All the control methods such as cultural, mechanical, biological and chemical individually and in combination significantly reduced infestation of shoot gurdaspur and root borers as compared to untreated plots during the growing period of plant and ratoon crops. When mechanical, cultural, biological and chemical control were applied in combination they proved significantly best control of borers and increased cane yield (Gul *et al.*, 2008).

### Specification of cultural method

Hand hoeing is the conventional method of weed control employed soon after planting as well as hoeing cane crop in inter-row spaces during growth period. In the past blind hoeing was a usual practice before seed set germination. Hand tools "Khurpa" and "Baguri" are used for this purpose. In dry method of planting, hoeing is done after planting and is completed within 12 -15 days of plantation. Hand hoeing is practiced in small size landholdings where

labour is less expensive and easily available. Hoeing has been considered an essential cultural operation for control of weeds. However, many times field conditions do not permit timely hoeing and some noxious weeds get established. Furthermore, the hoeing of weeds within cane shoots is very cumbersome, thus nuts and grasses are difficult to control. The modern philosophy of mechanization is the least tillage operation to zero tillage within cane rows (Karim, 2005). The data showing cultural methods for weed control is presented in Table-3.

**Table-3.** Distribution of respondents stating cultural methods for weed control

Districts	Villages	Types of method of cultural control							Total
		Cultivate resistance varieties		Remove manually from crops	Crop rotation		Physical control		
		Yes	No		Yes	No	Yes	No	
Mardan	Gulmera	1	35	36	1	35	35	1	36
	Miagano Killi	-	35	35	1	34	35	-	35
	Akber Abad	-	34	34	-	34	34	-	34
	Qutabgarh	-	33	33	-	33	33	-	33
	Feroz Shah	-	45	45	18	27	45	-	45
Charsadda	Dobandi	-	30	30	-	30	30	-	30
	Payan	-	27	27	-	27	27	-	27
	Tangi Abazai	-	29	29	-	29	29	-	29
	Hisara Nehri	-	43	43	-	43	43	-	43
	Qumbati	-	24	24	-	24	24	-	24
Total		1 (0.3)	335 (99.7)	336 (100)	20 (6)	316 (94)	335 (99.7)	1 (0.3)	336 (100)

Source: Field data, 2012-13

During the research study question was asked in local language about the method of cultural control. Only 1 respondent reported that he had used resistant variety for weed control. As against 99.7 % respondents of the total ones reported they had not cultivated any resistance variety for weed control. All the respondents reported that they usually remove weeds from the crops manually. Moreover, this cultural method is informal. There were only 6 % respondents who used crop rotation methods for controlling weeds. Strangely all these 6 % respondents were present in district Mardan. As against 94 % respondents who did not use crop rotation method for weed control. Physical control was used by 97.7 % respondents.

### **Infestation in sugarcane crop**

Considerable losses in yield and quality are reported from insect infestation. Insects like borers, pyrilla, mites, bugs and termites attack cane fields. Sometimes these hazards create panic in certain regions and sometime their attack is localized. Rodents and wild bore also cause considerable yield losses. Mosaic is a common disease in all the fields. Red rot and smut also infect susceptible varieties sometime causing severe losses (Karim, 1990).

Among the factors contributing low yield in our country is the considerable insect pests attack. Different insect pests like termites, borers, pyrilla, whitefly, bugs and mites etc attack this crop and cause serious losses in terms of less yield and quality. Sugarcane borers create tunnels in stubbles and internodes resulting in blocking food supply to aerial parts of stem and leaves. Moreover, these tunnels cover way for diseases. Without some useful measures the crop cannot be protected from the attack of insect pests particularly borer (Gul *et al.*, 2008). The data in this regard of pest is revealed in Table-4. During the research study, respondents were asked questions about the attack of pest. The 47 % respondents reported that Termites damaged the sugarcane crop. On the other hand 53 % respondents stated that Termites were not the problem for their crop. It is generally believed that rats are troublesome not only in houses but also in the field. The data described in Table 4 showed that vast majority (85 %) respondents among the total reported that rats were major problem for sugarcane. However, 15 % respondents reported that rats were not the main problem. Pyrilla and borer were another problems stated by 62 % respondents. While 38 % respondents reported that pyrilla and borer were not problems. Only 12 % respondents narrated mix problem while 88 % respondents of the total respondents reported that there were some other pests like whitefly, mites, bugs etc. attacking their sugarcane crop.

In Pakistan there are not enough exact estimates of sugarcane yield losses due to insect attack but it has been reported that borer like stem borer, Gurdaspur borer and Pyrilla cause a reduction in sugarcane yield from 15-20, 10-20 and 30-35% respectively (Zubair, 2014).

**Table-4.** Number of respondents stating about the different pests of sugarcane

Districts	Villages	Pests of sugarcane										Total
		Termites		Rates		Payrilla		Borer		Other		
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Mardan	Gulmera	31	5	36	-	32	4	20	16	-	36	36
	Miagano Killi	29	6	35	-	20	15	26	9	-	35	35
	Akber Abad	28	6	34	-	16	18	16	18	-	34	34
	Qutabgarh	20	13	33	-	16	17	8	25	-	33	33
	Feroz Shah	22	23	45	-	26	19	0	45	1	44	45
Charsadda	Dobandi	28	2	30	-	28	2	19	11	12	18	30
	Payan	-	27	27	-	20	7	24	3	0	27	27
	Tangi Abazai	-	29	1	28	18	11	28	1	19	10	29
	Hisara Nehri	-	43	43	-	18	25	43	-	-	43	43
	Qumbati	-	24	-	24	14	10	24	-	6	18	24
Total		158 (47)	178 (53)	284 (85)	52 (15)	208 (62)	128 (38)	208 (62)	128 (38)	38 (12)	297 (88)	336 (100)

Source: Field data, 2012-13

### Pesticides application

Plant protection is defined in terms of equipment and chemicals control methods use. Pest identification and advisory services are also remains in sugarcane mill zone. Sugarcane has not received optimum plant protection measures compared to cotton crop (Karim, 1990). The use of herbicide is positively depending on environment viz. temperature, moisture and rainfall etc. Some of the systematic or translocated herbicides are selective for one kind of plant, while others are non-selective. They could be selective for broad leaf crops but non selective for grasses and vice versa. Some have very short life span while others are more persistent having long residual result (Karim, 2005). The data show use of pesticides by respondents in Table 5. During the research study farmers were asked whether they used insecticides or weedicides. The data given in Table-5 showed that 70 % respondents reported the use of pesticides. However, the 30 % respondents reported that they did not use pesticides for their crops. This could be due to high prices, non availability and adulteration etc. while weedicides were used by 33 % respondents. Thus, majority of the respondents (70%) did not use weedicides. Insecticides were used to kill the insects by 34% respondents and 66 % respondents did not use them. In the study area 32 % respondents used termeticides and 68 % respondents did not use them. The data concluded that awareness lack about pesticides and financial conditions are the main hurdle in pesticides use.

**Table-5.** Number of respondents stating use of pesticides

Districts	Villages	Use of pesticides								Total
		Pesticides		Weedicides		Insecticides		Termeticides		
		Yes	No	Yes	No	Yes	No	Yes	No	
Mardan	Gulmera	35	1	22	14	-	36	30	6	36
	Miagano Killi	22	13	14	21	-	35	20	15	35
	Akber Abad	26	8	11	23	-	34	24	10	34
	Qutabgarh	33	0	21	12	13	20	17	16	33
	Feroz Shah	43	2	32	13	23	22	16	29	45
Charsadda	Dobandi	17	13	10	20	17	13	-	30	30
	Payan	12	15	-	27	11	16	-	27	27
	Tangi Abazai	14	15	-	29	14	15	-	29	29
	Hisara Nehri	21	22	-	43	21	22	-	43	43
	Qumbati	14	10	-	24	14	10	-	24	24
Total		237 (70 %)	99 (30 %)	110 (33)	226 (67)	113 (34)	223 (66)	107 (32)	229 (68)	336 (100)

Source: Field data, 2012-13

### Types of weedicides

Different techniques are being used to control weeds in agricultural production. The use of Ametryn with one hoeing at sixty days after planting (DAP) recorded lesser weed flora and higher average sugarcane production of 150 tons/hectare followed by three manual hoeing at 30, 60 and 90 DAP observed 146 tons/hectare sugarcane production (Mishra *et al.*, 2003). Atrazine in combination with 2, 4-D at 60 DAP or manual hoeing 45 DAP reduced the weed biomass significantly and was alike in effectiveness with 3 hoeing. The highest sugarcane production of 73 tons/hectare was recorded with manual hoeing (Chauhan and Srivastava, 2002). Weed control through wheat straw mulch gave the main germination 75 % and sugarcane yield of 62 tons/hectares. Trash mulch was the most capable in decreasing weed population and dry matter. Weed dry matter increased nitrogen rates up to 150 kg ha<sup>-1</sup> at 80 days after cultivating and up to 187.5 kg ha<sup>-1</sup> at 120 days after cultivating. In general, rising nitrogen rates resulted in higher weed control efficiency and lesser weed index values (Deho *et al.*, 2002). The conventional weed control practices pointed out that the net profit was main with conventional practice being higher Rs. 30310, followed by Metribuzine + Trash mulching Rs. 28272 and Atrazine plus Trash mulching Rs. 27122 (Singh *et al.*, 2001). Weed control practices are required to be adopted for both economic and environmental reasons (Bilalis *et al.*, 2003). The data regarding use of various types of weedicides is presented in Table No. 4.52. The data in Table No.6 showed that 32 % of the respondents used Ametryn whereas, vast majority (68 %) of

the respondents did not use it. Another 31 % of the respondent used Atrazin. On the other hand vast majority (69 %) of the total respondents did not use it. The 16 % of the total respondents used Azafax Port and vast majority (84 %) of the respondents did use it. Parvan was used by only 4 % of the respondents. The majority (96 %) of the respondents did not use it. Other types of weedicides were used by only 7 % of the respondents. The reasons are simple that majority of farmers are small land holders of poor financial condition and weedicide is not of good quality. Therefore, these samples of the respondents did not use weedicides.

**Table-6.** Number of respondents stating use of different weedicides

Distt.	Villages	Types of weedicides										Total
		Ametryn		Atrazin		Azafax port		Parvan		Others		
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
Mardan	Gulmera	20	16	19	17	8	28	3	33	4	32	36
	Miagano Killi	13	22	11	24	12	23	0	35	0	35	35
	Akber Abad	11	23	11	23	9	25	3	31	1	33	34
	Qutab garh	20	13	20	13	13	20	0	33	3	30	33
	Feroz Shah	33	12	32	13	13	32	6	39	17	28	45
Charsadda	Dobandi	10	20	10	20	-	30	-	30	-	30	30
	Payan	-	27	-	27	-	27	-	27	-	27	27
	Tangi Abazai	-	29	-	29	-	29	-	29	-	29	29
	Hisara Nehri	-	43	-	43	-	43	-	43	-	43	43
	Qumbati	-	24	-	24	-	24	-	24	-	24	24
Total		107 (32)	229 (68)	103 (31)	233 (69)	55 (16)	281 (84)	12 (4)	324 (96)	25 (7)	311 (93)	336 (100)

Source: Field data, 2012-13

## CONCLUSION

Keeping in view the importance of sugarcane as a major cash crop and the low yield due to weeds, overwhelming majority i.e. 96 % of the sample respondents *Scandix* spp. was considered as a weed problem followed by *Sorghum halepense* as reported by 89% and 85% of the sample respondents stating the *Cirsium arvense* as the biggest weed problem. Mechanical along with chemical method of weed control were reported by all the respondents as well as removing the weeds manually. Seventy percent of the respondents reported the use of pesticides. The sugarcane growers (85%) along with 62% were using Regind, Malathion and Furadan as insecticides. It is recommended that farmers must be made aware of the proper weed management through adequate trainings and demonstration of mechanical eco-friendly pesticide applications. Moreover, Agricultural Educational institutions may be involved to educate farmers in weeds and its

control measures to raise the socio economic conditions of the rural masses.

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