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Impact of Sugar Mills Advisory Services on Sugarcane Production

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Abstract

The research study was carried out in the year 2019 to evaluate the sugar mills extension services on promoting modern sugarcane production technology and its impact on sugarcane production in district Muzaffargarh. A sample of 120 sugarcane growers was selected and interviewed personally from eight Union Councils (UC) of the study area. The results revealed that demographic traits were significantly linked with sugarcane production. All the respondents in the area acknowledged getting information regarding modern sugarcane cultivation practices and the latest research findings from sugar mills staff on enhancing sugarcane productivity. The most notable finding was the awareness and adoption of approved & recommended sugarcane varieties, filter cake, facility of soil/water testing and biological control laboratories services of sugar mills. Moreover, a 23.3% increase in sugarcane yield per acre was seen due to the facilitation of sugar mills extension services in the study area.

Keywords: Extension Service, Varieties, Value addition, Soil Water testing

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Introduction

Sugarcane crop is grown in about 107 countries of the world (FAO, 2019). Sugarcane crop is largely planted on earth over sub-tropics surfaces between latitude 30° at North and 35° at South (Nazir, 2000). Marginal quantities of sugarcane (*Saccharum officinarum*) are consumed, either directly as food or in the form of juices in the world. According to the statistical data of FAO-2019, Pakistan is in the fifth position (66.9 million tons) in sugarcane production after Brazil (746.8 million tons), India (376.9 million tons), China (108.7 million tons) and Thailand (104.3 million tons). The sugarcane area harvested was 1.04 million hectares, while the yield per hectare of Pakistan ranked at 15th position in the world which is around the average of 63.9 tons per hectare (PSMA, 2020). The yield per hectare in Pakistan is low compared to the neighboring country (India) attaining an average yield of 80.3 tons per hectare (FAO, 2019). The importance of this sub-sector to Pakistan's economy cannot be over-emphasized enough. In 2020, about 6.01 million metric tons of white refined sugar was produced by 90 sugar mills in Pakistan (PSMA, 2020). The value addition in agriculture and GDP of sugarcane crop in Pakistan is about 3.4% and 0.7% respectively (Govt. of Pakistan, 2020-21). The sugar industry has encouraged the sugarcane growers on large scale in the country for sugar production. Successively, employment has been generated for the community in terms of un-skilled, semi-skilled and skilled people of that locality. In addition to, self-employment opportunity services are provided for the cane growers.

The district Muzaffargarh has an important position in growing sugarcane in Punjab, which is about 50.6 million hectares of the total cultivable area of 468 million hectares and yields were 77.9 tons per hectares (Govt. of Punjab CRS, 2020-21). District Muzaffargarh has four tehsils i.e. Kot Addu, Ali Pur, Jatoi & Muzaffargarh. This district has four sugar mills of which two are installed in tehsil Kot Addu (Fatima Sugar Mills & Sheikho Sugar Mills), one in tehsil Muzaffargarh (Tandliawala Sugar Mills) and one in tehsil Jatoi (Haseeb Waqas Sugar Mills).

The extension workers of agricultural sector have an imperative role as they can promote the acceptance of new technologies in agriculture and create significant relationship between research organizations and grower's communities. Besides the Punjab agriculture extension department, the extension field staff of sugar mills is also actively involved in transferring modern production technology of sugarcane to the farmer's in their communities. The results in the study of Bashir *et al.* (2012) also shows encouraging contribution of sugar mills development activities in Punjab for increasing sugarcane profitability as the percent cultivated area under high yielding varieties of excellent sugar recovery percentage is increasing gradually. The study of Farooq *et al.* (2020) also revealed that Fatima Sugar Mills was ahead in providing the technical advisory services to the sugarcane growers due to the better availability of funds as compared to the public extension department.

The selection of approved variety is the basic factor for good sugarcane production and also the dire need of the time. Fatima Sugar Research and Development Center, Fatima Sugar Mills Limited, Kot Addu, district Muzaffargarh is specially working on the evaluation of area specific sugarcane varieties with the collaboration of PARC, Islamabad. Most of sugar mills are providing soil and water testing facility to their growers that can

be helpful increasing the productivity and profit return the extension workers of sugar mills can play significant role to create awareness about the balance use of fertilizers and in the selection of approved high yielding varieties for the sugarcane crop.

The present study was conducted with following objectives.

- 1- To determine the role of demographic traits of the respondents on sugarcane production.
- 2- To find out the awareness and opinion of respondents about the sources of information regarding sugarcane cultivation in the area.
- 3- To investigate the role of sugar mills extension services to promote modern sugarcane production technology.
- 4- To find out the impact of sugar mills extension services by comparing existing sugarcane crop yield with the previous yield by using conventional practices.

Methodology

Sampling

District Muzaffargarh was purposefully selected for the study. Primary data was collected and systematized accordingly. Primary data was gathered personally from 120 respondents.

Convenience sampling method in different stages was applied in the study to observe data from required number of respondents. In this method, a sub-sample was taken from a large sample unit; the same method was adopted by Cochran (1977) and Khan (2015). The procedure adopted in the study consists of different selections i.e. tehsil, union councils (UC), moza and after it, respondents were identified. All sugarcane farmers in Muzaffargarh district were the population of the study. Keeping in mind the time and resources available, Tehsil Kot Addu was selected from total four tehsils of the district based on large sugarcane cultivation area (56.16%) and two sugar factories. In tehsil Kot Addu, sugarcane is cultivated on 29.8 million hectares, (GOP, 2019). The area of this tehsil is 355.5 million hectare acres from which 171.9 million hectares are being used for cultivation. The study is focused on two sugar mills extension services of tehsil Kot Addu i.e. Fatima Sugar Mills and Sheikho Sugar Mills. They were considered the main purchaser of sugarcane crop from tehsil Kot Addu. Therefore, Tehsil Kot Addu was selected to find the impact of the services of sugar mills on sugarcane production. The lists of contact/registered growers were obtained from both mills of Kot Addu.

Tehsil Kot Addu has 16 rural areas Union Councils. Viewing the time and resources available, half of the rural area union councils (08) were selected based on the large number of growers. The sample size from the population was selected from all selected 08 union councils. From each UC, 15 respondents/farmers were selected by using a simple random sampling technique based on a large sugarcane cultivation area from registered grower's record of sugar mills making a total of 120 respondents.

Collection of Data

The data was collected personally by interviewing the 120 respondents. To acquire information from all respondents, a questionnaire was prepared. Questions were tested on fifteen sugarcane growers/respondents to make essential amendments to verify its validity and reliability for correct data collection and then made a final shape. Local languages were used to collect data from growers and then convert it to English.

Results and Discussions*Data Analysis*

The SPSS software has been used for drawing conclusions and formulating recommendations. Descriptive statistics values such as percentage, frequencies, mean, standard deviations and ranking were used for the interpretation of whole data values. A weighted score was calculated for finding the relative ranking of various factors. Then factors were ranked by considering their means. After that, rank order was calculated. In the end, the t-Test for Independent Means was applied to conclude significant variance between the existing and previous sugarcane yield of growers.

1. Association of demographic traits with sugarcane production

The age, education, size of land holding, type of tenure, the area under sugarcane cultivation, sowing time and farming experience were the basic demographic traits of sugarcane growers on which the adoption rate of modern production technology can be assessed and its impact on yield be measured.

Age

Age of respondents plays a pivotal role in determining their attitude to adopt an innovation. It determines the response to different activities performed in his life. From the results, it was noticed that matured-aged (41-50 years) respondents are more (40.8%) in the study area followed by middle-aged (31-40 years) respondents (31.7%). Age is the most significant features on which decision on adaptations directly depend which ultimately lead towards crop production. The data also depicted that the younger aged group had healthy crop and more average sugarcane yield followed by middle-aged, matured and old-aged group. Khan (2015) presented the same results that Youngers are more initiatives to take actions.

Education

Education is the process gaining knowledge and skills. Education is one of the most essential elements for the economics and social improvement of any nation. Education enables the growers to adopt more favorable and positive attitude toward crop production and protection measures (Khan, 2015). To evaluate the education level of the respondents, they were asked one basic question ‘‘literate or no formal education’’? Of the total respondents, 70% were no formal education and literate respondents were characterized further on their level of education. Results are matched with Pervaiz *et al.* (2013) that 70% of respondents were no formal education. The data showed that 26.7% of the respondents were in primary education followed by the graduation and above level (7.5%), matric level (6.7%), up to the middle level (2.5%) and up to the intermediate level (1.6%). The significant high sugarcane yield among educated growers exhibited that literacy status has direct relationship with the production of sugarcane. From the results, it was also noted that sugarcane yield was increasing as the literacy status or rate is increasing. Literate growers were much aware of recent sugarcane cultivation practices, techniques and extension methods.

Size of Land Holding

The size of any farm plays significant role in the acceptance, distribution and dissemination of modern cultivation technology among the growers. All the 120 respondents were gathered into four group categories like small size (up to 5 acres) 51.7 %, medium-sized (6-15 acres) 28.5 %, upper-medium (16-25 acres) 14.2 % and large size area (26 acres and above) 5.8 %, same criteria were used by Arshad (2012) in his study to find the relation of land size with adoption. Upper-medium category of land size has more yield (26.4 t/acre) followed by small, medium, and large size respectively.

Tenancy Status

The data describes that most of the respondents (61.7%) were the owner of the land followed by owner-cum-tenant holders (30.8%). However, tenant or on lease land holder respondents were only 7.5%. The results are the same as those obtained by Kashif (2006) who found that 68, 26.4 and 5.6% respondents are owner, owner-cum-tenant and tenant status respectively. It was also noticed from the results that the owner of the land had more yield (26.4 tons/acre) than the tenants farmers. It was very clear that the own land holders were getting higher production of sugarcane than others i.e. tenant due to their keen interest and application of modern techniques by utilizing the resources very efficiently to get higher income.

Planting Season

Sugarcane is usually planted in the spring season with an active growth period of 10-11 months. During the field survey, it was investigated the growers/respondents about their planting season of sugarcane crop i.e. spring or autumn plantation. A majority (95.8%) of respondents observed that their sowing time was during the spring season. Only 4.2% of respondents revealed that they sow during the autumn season. Results showed a significant difference in sugarcane production during autumn plantation (31.4 tons/acre) rather than in the spring season (24.7 tons/acre). Zubair (2014) reported a 25-35% high sugarcane yield in September sown crop.

5. Source of information for sugarcane cultivation

Agricultural information plays significant role in achieving good production of any crop. To find out the source of information about sugarcane cultivation in the study area, all the 120 respondents answered "YES" to being. It means all of them were informed about modern sugarcane cultivation practices to enhance productivity from any sources available, and then they were further asked about the source of the information. The data of these factors are presented in below table 1.

Table 1. Respondents distribution of source of information regarding modern sugarcane cultivation practices

Source	Yes		No		Total	
	f	%	f	%	f	%
EFS, Agriculture Department	17	14.17	103	85.83	120	100
Representative of Pesticide/Fertilizer company	82	68.33	38	31.67	120	100
Sugar Mills Extension staff	120	100	00	00	120	100
Neighbors & Relatives Farmers	105	87.5	15	12.5	120	100
Friends	101	84.17	19	15.83	120	100
Radio & Television	26	21.67	94	78.33	120	100
Local Leaders	32	26.67	88	73.33	120	100
Print Media	24	20	96	80	120	100

*where EFS: Extension Field School

Table 2. Mean comparison of respondents regarding helpful level of information source

Source	Mean	SD	Weighted score	Rank
EFS, Agriculture Department	1.82	0.62	31	8
Representative of Pesticide/Fertilizer company	2.39	0.73	196	2
Sugar Mills Extension staff	2.28	0.80	269	1
Neighbors & Relatives Farmers	1.76	0.64	185	4
Friends	1.87	0.68	189	3
Radio & Television	1.96	0.59	51	6
Local Leaders	2.44	0.74	78	5
Print Media	1.79	0.76	43	7

5. Role of sugar mills extension services to promote modern sugarcane production technology

Awareness of recent seed bed preparation practices

Table 3. Mean comparison of respondents about awareness to proper seed bed preparation practices

Awareness of seed bed preparation practices	Mean	SD	Weighted score	Rank
Does mills staff help you in seed bed preparation?	1.74	0.87	176	3
Have you ever received onsite training on recommended seed bed preparation techniques from mills staff?	1.66	0.81	121	4
Do you get awareness about the benefits of laser land leveling from mills staff?	2.24	0.79	244	2
Does any mill staff aware you of the use of proper agricultural machinery?	2.47	0.66	291	1

Because of long duration crops consist of 2-3 years, seed bed preparation is a key factor in getting good sugarcane production, which most growers ignore. If any grower is well aware of the proper preparation of land for sugarcane crop with appropriate agricultural machinery, then he gets a maximum yield of the crop. The role of sugar mills extension services regarding the awareness of proper seed bed preparation practices was ranked based on the weighted score in table 3.

Awareness of approved variety selection and sowing of crop

The role of sugar mills extension services regarding the awareness of the variety selection and sowing of crop were ranked based on weighted score in table 4.

Table 4. Mean comparison of respondents of awareness to approved variety selection and sowing of crop

Awareness to variety selection and sowing of crop	Mean	SD	Weighted score	Rank
Does mills staff guide you in the selection & provision of approved variety?	1.79	0.66	201	1
Does mill staff guide you about the sowing time of sugarcane?	1.89	0.81	191	2
Does mill staff guide you about recommended seed rate per acre?	1.64	0.55	184	3
Does mill staff guide you about fungicide/Hot Water treatment for seed treatment?	1.23	0.42	122	5
Does mill staff guide you about proper row spacing?	1.33	0.64	157	4

Awareness of weeds management

Weeds reduce the quality and quantity of the crop and affect a lot on crop growth and productivity. Weeds infestations can cause a [12-72%](#) reduction in the yield of the sugarcane crop. Weeds also consume the fertilizers and water from the quantity applied for the sugarcane crop. So, the weeds management is very important to get maximum production of sugarcane crop. The role of sugar mills extension services regarding the awareness of weeds management was ranked based on the weighted score in table 5.

Table 5. Mean comparison of respondents of awareness of sugarcane weeds management

Awareness of weeds management	Mean	SD	Weighted score	Rank
Does sugar mills staff guide you about weeds identification?	2.29	0.70	224	2
Does sugar mills staff guide you in weeds management?	2.34	0.70	248	1

Awareness of fertilizers and irrigation

Table 6 revealed that guidelines of sugar mills staff regarding about use and benefits of farm yard manure (FYM) & filter cake for sugarcane crop was ranked 1st followed by the awareness of growers about soil/water testing facility for fertilizers recommendation, guidelines of sugar mills staff to respondents regarding the use of recommended and balanced fertilizers doses, and the guidelines provided to growers about exact water requirement for the crop.

Table 6. Mean comparison of respondents regarding awareness of fertilizers and irrigation

Awareness of fertilizers and irrigation	Mean	SD	Weighted score	Rank
Does any mill staff aware you about the facility of soil/water testing?	1.90	0.51	210	2
Does mills staff guide you about the use of recommended and balanced fertilizers doses?	1.59	0.52	188	3
Does the mills staff guide you on the exact water requirement for crop?	1.14	0.34	50	4
Does these mills staff guide you on the use and benefits of FYM & Filter cake?	2.46	0.61	236	1

Awareness to Insect/Pest control measures

The role of sugar mills extension services regarding the awareness about insect/pest measures were ranked based on weighted score in table 7.

Table 7. Mean comparison of respondents about awareness to insect/pest control measures

Awareness regarding	Mean	SD	Weighted score	Rank
insect/pest control measures				
Does mills staff guide you about sugarcane insect/pest infestation and its identification?	1.45	0.60	155	2
Does mills staff aware you about the economic threshold level of insect/pest?	1.29	0.45	134	3
Does mills staff guide you about biological control of insects/pest?	1.69	0.77	176	1

Awareness of disease management

Table-8 reveals that mills staff guidance to the growers for the control of sugarcane diseases was at ranked 1st followed by awareness given by mills staff about economic threshold level of diseases attack.

Table 8. Mean comparison of respondents about awareness of diseases control measures

Awareness of diseases control measures	Mean	SD	Weighted score	Rank
Does the mills staff aware you about the economic threshold level of diseases attack?	1.29	0.46	119	2
Does mills staff guide you in diseases control measures?	1.52	0.57	170	1

Awareness to harvest, post-harvest and marketing of crop

Table-9 reveals that mill staff guidelines about the procedure to supply of sugarcane to sugar mills was ranked 1st followed by help for getting payment and guidance about harvesting time.

Table 9. Mean comparison of respondents about awareness of about harvest, post-harvest and market strategies

Awareness of harvest, post-harvest and market strategies	Mean	SD	Weighted score	Rank
Does mills staff guide you about proper harvesting time?	1.53	0.50	162	3
Does mill staff guide you about the procedure of cane supply to mills?	2.57	0.64	308	1
Does mill staff help you in getting payment of sugarcane from mills?	1.87	0.61	215	2

5- Comparison of Existing Sugarcane Crop Yield with the Previous Yield by using Conventional Practices

To investigate whether the extension services of sugar mills helps to improve the per acre yield of sugarcane in district Muzaffargarh or not, yield data (tons/acre) were collected during interviews of each respondent. Each respondent was asked about their present sugarcane yield per acre and the previous five years yield per acre using conventional practices. The detailed data are presented in table 10.

Table 10: Per Acre Yield Comparisons of Respondents

Union Council	Sugarcane Yield (tons/acre)		Difference (tons/acre)	t-value	Significance
	Existing	Previous			
1	25.1	19.5	5.6	5.72	0.000
2	28.2	18.6	9.6	7.01	0.000
3	25.3	19.2	6.1	6.13	0.000
4	23.9	20.3	3.6	3.44	0.000
5	24.9	19.1	5.8	5.47	0.000
6	24.7	18.7	6.0	5.02	0.000
7	22	17.9	4.1	4.45	0.000
8	25.2	19.3	5.9	5.20	0.000

Total	24.9	19.1	5.8	5.30	0.000
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Table 10 shows the comparison of per acre yield of sugarcane crop of all respondents in 08 union councils of tehsil Kot Addu of district Muzaffargarh. Where the analysis was conducted using a standard Paired T-test by SPSS Software package. Comparison of the existing sugarcane production of respondents who gained the extension services of sugar mills to their previous yield by using conventional practices was made at $p = 0.05\%$ level of significance. About a 23.3% increase in sugarcane yield was observed in the study area. Statistically significant-values show that at the rate of 10% sample size the result is highly significant which indicates that due to activities of extension services of sugar mills, positive change was observed in sugarcane production of the area. The results are closely the same with the conclusion of Bashir *et al.* (2010) in a similar study that the wheat crop production of growers was increased by 13 % due to the micro-credit facility. These outcomes are also similar to another research study by Kamal *et al.* (2013) that confirmed productivity of the tomato crop was improved by 10.39% expressively due to the extension activities of extension agent in the area. Bashir *et al.* (2012) also concluded that sugar mills development activities had a positive effect in the study area as the percent area under high yielding varieties with excellent sugar recovery% is increasing day by day.

Conclusion

It was found from the study that demographic traits of growers such as age, literacy status, land size holding, tenancy status and planting season were much linked with sugarcane production. Middle-aged group (31-40 years), literate, owner of the land, medium size cultivation land and experienced farmers were getting significantly better yield than others checked treatments. It was observed that autumn planted crop had more production than spring but only 4.2% of respondents in the study area were planting during the autumn season. All the farmers (100%) were getting information regarding modern sugarcane cultivation practices from sugar mills staff than other sources like EFS, print media, TV, Radio, friends, etc. Most of the respondents agreed with the positive role of sugar mills extension services in promoting recent research outcomes of production technologies like seed bed preparation, approved variety selection, fertilization, irrigation and control measures for weeds/insects/pest and diseases.

All the respondents appraised the services of sugar mills and confirmed a positive change in their sugarcane crop yield per acre.

It was seen that provision of approved and recommended varieties, soil and water testing facility, services of biological control laboratories along with the provision of filter cake including inputs such as fertilizers etc. were seen as the most effective services of sugar mills. A significant higher difference (23.3%) in terms of yield per acre of sugarcane was observed due to the provision of sugar mills services.

Recommendations

High-yielding advance sugarcane varieties should be provided by sugar factories to growers of their area with the collaboration of research institutes to establish seed bank.

The facility of biological control & soil and water testing laboratories has much importance and should be easily accessible to all sugarcane growers.

Extension staffs of sugar factories are front line workers for the development of sugarcane crop should possess technical knowledge as well as communication skills including practical knowledge of recent farming practices and well trained regularly by research institutes and agricultural Universities.

The facility for the provision of filter cake must be availed to all the growers of their area to enhance the fertility status of the soils.

References

- Ali, T., Zia, M.A., Yousaf, R.M., Hanif, S., Chaudhry, K. M., & Khan, S.A. (1992). Comparative effectiveness of various sources of information for cane growers in Crescent Sugar Mills Area, Faisalabad. *Pakistan Journal of Agricultural Sciences*, 29(1), 22–24.
- Arshad, M. H. (2012). Problems and opportunities of sugarcane growers in Tehsil Gojra, District Toba Tek Singh. M.Sc. (Hons) Agri. Ext. Thesis, Allama Iqbal Open University, Islamabad.
- Asghar, M. (2000). Perceptions of sugarcane growers regarding the working efficiency of extension personals of Kamalia Sugar Mills, Kamalia. M.Sc. (Hons) Agri. Ext. Thesis, Univ. of Agri. Faisalabad.
- Bashir, M. K., Mehmood, Y., & Hassan, S. (2010). Impact of agricultural credit on productivity of wheat crop: Evidence from Lahore, Punjab, Pakistan. *Pakistan Journal of Agricultural Science*, 47(4), 405-409.
- Bashir, A., Abbas, M., Munir, M. A., & Afzal, A. (2012). Impact of sugarcane mills development activities on cane production in Punjab. *Pakistan Journal of Agricultural Research*, 25(1), 21–27.
- Cochran. W. G. (1977). Sampling Techniques, 3rd Edition. John Wiley and Sons, New York. Pp 37–40.
- FAO, (2019). Statistical year Book, online available at www.fao.org
- Farooq, M. Z., Siddiqui, B. N., Masud, K., Khan, M. R. A., Ali, M., Rayit, A., & Naeem, G. (2020). Comparison between public and private extension services for sugarcane production in Muzaffargarh District, Punjab, Pakistan. *Journal of Agricultural Extension and Rural Development*, 12(1), 1–5.
- Government of Pakistan. (2020). Agricultural Statistics of Pakistan, Ministry of Food, Agriculture and Livestock, Government of Pakistan, Islamabad
- Government of Pakistan.(2021). Economic Survey of Pakistan, 2020-2021. Economic advisor's wing, Finance Division, Islamabad
- Government of Pakistan. (2020). Economic Survey of Pakistan, 2019-2020. Economic advisor's wing, Finance Division, Islamabad
- Government of Punjab. (2021). Second estimate of sugarcane crop. Crop reporting services Punjab.
- Government of Punjab. (2020). Second estimate of sugarcane crop. Crop reporting services Punjab.
- Habib, M., Zafarullah, M., Iqbal, M., Nawab, K., & Ali, S. (2007). Effect of farmer field schools on sugarcane productivity in Malakand Agency. *Sarhad Journal of Agriculture*, 23(4), 1133–1137.

- Kamal, T. (2013). Role of agricultural extension agents in enhancing tomato production in district Peshawar, Khyber Pakhtunkhwa-Pakistan (Doctoral dissertation, M.Sc Thesis.Department of Agricultural Extension Education and Communication, the Univ. of Agri., Peshawar).
- Kashif, Z.A. (2006). A Study into the Adoption of Wheat Management Practices among wheat growers of Tehsil Faisalabad. M.Sc. (Hons) Agri. Thesis, Univ. of Agri. Faisalabad.
- Khan, F. (2015). Role of extension services on production of sugarcane in district mardan and charsadda: Khyberpakhtunkhwa-Pakistan (doctoral dissertation, the University of Agriculture,Peshawar-Pakistan).
- Khan, F., & Khan, Z. M. (2015).Role of education in enhancing sugarcane yield in Mardan and Charsadda districts of Khyber Pakhtunkhwa, Pakistan. *Sarhad Journal of Agriculture*, 31(2), 123–130.
- Nazir, M.S. (2000). Crop Production, National Book Foundation, Islamabad. pp: 421–422.
- Pervaiz, U., Khan, F., Jan, D., & Zafarullah, M. (2013). An Analysis of Sugarcane Production With Reference to Extension Services in Union Council Malakandher-Peshawar. *Sarhad Journal of Agriculture*, 29(1), 37–42.
- PSMA, (2020). Sugarcane statistics, Pakistan sugar mill association.
<http://www.psmacentre.com>
- Zubair, M. 2014. Pakistan Agricultural Research Council (PARC). Sugar Crops Research Program National Agricultural Research Center (NARC)-Islamabad. Available at web cit: [www. Parc.gov.pk/1subdivisions/narccsi/csi/sugar-html](http://www.Parc.gov.pk/1subdivisions/narccsi/csi/sugar-html). 08-06-2013.

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