

Engagement with extension services by small-acreage sugarcane farmers in selected districts of Pakistan

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Abstract. Extension services perform a pivotal role in encouraging farmers to adopt better farm practices and boost agricultural yields. A multi-stage sampling technique was applied to select 336 sugarcane growers who were interviewed in face-to-face meetings. Results of study show that most growers (299) farmed small parcels of land up to 2.0 ha. Of these small growers, less than half (139) had any knowledge of the public agricultural extension services available to them. Moreover, only 44 growers reported that they knew an extension agent and 23 confirmed that they had sought information by a range of extension methods. These 23 growers achieved an average yield of 108 t ha⁻¹ while the remaining 313 farmers achieved average yields around 60 t ha⁻¹. This study suggests the government of Pakistan should review the performance of public agricultural extension departments and extension agents and consider strengthening the present extension services.

Keywords: extension methods, demonstration, public extension workers, sugarcane growers, public agricultural extension

Introduction

Sugarcane is one of the major cash crops grown in Pakistan and generates income for farming communities and provides a source of employment for the youth of Pakistan. It is primarily a tropical crop that usually requires 8-14 months' growth to reach maturity. High temperatures, such as apply in Pakistan, may permit rapid growth for eight months or more in a year provided there is adequate soil moisture (Zubair 2014). Sugarcane growers provide the necessary raw materials to sugar mills and industries like chipboard factories and paper manufacturers.

The area planted to sugarcane in Pakistan in 2015-16 was 1.132 million hectares, slightly lower than the cultivated area of 1.141 million hectares in 2014-15. Production in 2015-16 was 65.5 million tonnes of cane with an average yield of 57.8 t ha⁻¹. The sugar industry's contribution to the agricultural economy in Pakistan and to Gross Domestic Product (GDP) is about 3.2% and 0.6%, respectively (Govt of Pakistan 2017).

Agricultural extension services can be an efficient way to disseminate information which encourages farmers to adopt successful, cost-effective, and environmentally sustainable farming methods. It can strengthen the capacity of farmers and improve their livelihoods.

Agricultural extension services in Pakistan have been organized as part of the Ministry of Agriculture. Most of the public extension staff use methods based on the traditional linear model. The mostly multi-sectoral extension programs have been focused on rural and community development, while the public agricultural extension field staff (EFS) have identified difficulties they face in transferring technology. The majority of EFS lack transport to cope with the large areas of their jurisdictions (Naqvi, Hamid & Aminullah 1988; Slade, Feder & Chhikara 1988; Khan 1997). Due to the large areas to be serviced, EFS do not pay regular visits to farmers' fields and thus are unable to disseminate information about new farming technology (Memon 2007; Mirani & Memon 2011).

The agricultural extension system in Pakistan is under heavy pressure and criticism, being described as outdated and out of touch. The main obstacles faced by extension field staff in the country are insufficient funds, lack of proper transport services to approach farmers, large areas allocated to frontline extension workers, the Agriculture Officers (AOs), and lack of cooperation among allied departments. In these circumstances, agricultural extension policies need to be changed to revitalize the agricultural extension system. There needs to be better integration of public and private agricultural extension services to address the real issues facing the farming community (Yaseen et al. 2015). Despite the commitment of the government to provide public extension services to the farmers' doorsteps, the farmers complain that no extension field workers visit their farms. An earlier study concluded that the weakness of the extension system was due to the lack of devotion, motivation, and sense of responsibility among extension agents and a weak monitoring system (Jan, Khan & Jalaluddin 2008). The normal task of transferring and disseminating information about good farming practices and appropriate agricultural technologies to farmers needs to be supported by an effective extension system and public extension services

need to engage in a more proactive and participatory approach based on strong extension-farmers linkages in Khyber Pakhtunkhwa (Jan, Khan & Jalaluddin 2008).

The aim of this paper is to report our understanding of the extent to which existing extension services are reaching the farmer audience. To suggest suitable extension methods to generate a stronger, closer, more constructive working relationship between small farmers in the cane industry and the extension service in Khyber Pakhtunkhwa province, we sought information from a sample of farmers on the frequency with which they contacted the extension service, whether there were differences according to farm size and other information that would assist in developing a more effective service.

Research methodology

Sugarcane is one of the main cash crops of Pakistan. It is cultivated in 17 districts out of a total of 26 in Khyber Pakhtunkhwa Province because of the availability of irrigation water and suitable environmental conditions to encourage cultivation of this crop.

Selection of farmers to interview

Mardan and Charsadda districts recorded the third and fourth largest areas of sugarcane planted in the Khyber Pakhtunkhwa Province in Pakistan in recent years, although the production and yield is less than in some other districts. These two districts were purposefully selected for this research to understand the reasons for this poor performance.

A multi-stage sampling technique was used to select the required sample of sugarcane growers to interview. In the first stage, two *tehsils* (the next administrative sub-division below district), namely Takhat bhai from Mardan and Tangi from Charsadda district were selected at random and from each selected *tehsil*, five union councils (next lower sub-division below *tehsil*) were likewise randomly selected. The names of the union councils selected are presented in Table 1. From each selected union council, one village was randomly selected, and 15% of cane growers in each selected village were randomly chosen for interview.

Table 1. Implementation of multi-stage sampling technique

Districts	Tehsils	Union Councils	Villages	Sugarcane growers*
Mardan	Takhat bhai	Saro Shah	Ferozshah	302 (45)
		Madey Baba	Qutabgargh	224 (34)
		PirSaddi	Akbarabad	217 (33)
		Mia Issa	MianganoKilli	232 (35)
		Lundkhawar	Gulmera	237 (36)
Charsadda	Tangi	KozBehramDehri	Dobandi	200 (30)
		Gandhera	Payan	180 (27)
		Abazi	Tangi Abazi	195 (29)
		HisraNehri	Gumbati	160 (24)
		Sherpao	HisaraNehri	289 (43)
Total	2	10	10	2236 (336)

*Total number of growers in each village with number selected for interview in brackets.

Primary data collection

An appropriately designed and pre-tested interview schedule was used in the field by the principal author to collect primary information on cane yield from sugarcane growers for January and March of years 2012 and 2013. The main items in the questionnaire were age, educational status, size of land holding, land tenure status, length of sugarcane farming experience, varieties grown, yield per hectare, cultivation techniques and contact with the public agricultural extension department. Later questions asked whether they knew the field assistant, the distance from the farmer's sugarcane field to the office of the public agricultural extension department, services provided by the public agricultural extension department, as well as other methods of obtaining information.

Face-to-face interviews were conducted with 336 sugarcane growers in a suitable location like the farmer's field or *Hujra* (community centre). The farmers were asked these questions in their local language (Pashto), so that they understood each question properly and responded accordingly, while their replies were recorded in English.

Secondary data

Secondary data, mainly production statistics, were collected from authentic published and unpublished sources. Cane yields for individual growers were the mean of two years results, 2012

and 2013, and were estimated by sampling a small area of cane. The size of this small area was confirmed by a provincial government employee (*Patwari Halqa*) appointed to the union council base to keep land records. He has extensive knowledge about the land cultivated by the farming community.

Data analysis

Computer programs Excel and SPSS were used to analyse the primary data, mainly to derive descriptive statistics and do Chi-squared analysis. The Chi-squared test was used to assess whether samples are independent, that is whether both could conceivably come from a normally distributed population with mean " μ_i " and variance " σ_i^2 ". Results of the Chi-squared tests were regarded as significant if the probability exceeded 0.05.

Results

Of the 336 sugarcane growers interviewed, the majority (299) were small landholders with up to two hectares of sugarcane cultivated. There were only three sugarcane growers who cultivated are more than 9 hectares of sugarcane in the study area. Farm size was heavily skewed to the small end of the range (Table 2). The research of Haq et al. (2016) identified the average total cultivated area of farms in Punjab Province as 5.55 ha with 2.63 ha used for sugarcane cultivation, quite similar results from the current study.

Table 2. Distribution of sugarcane growers by cultivated area

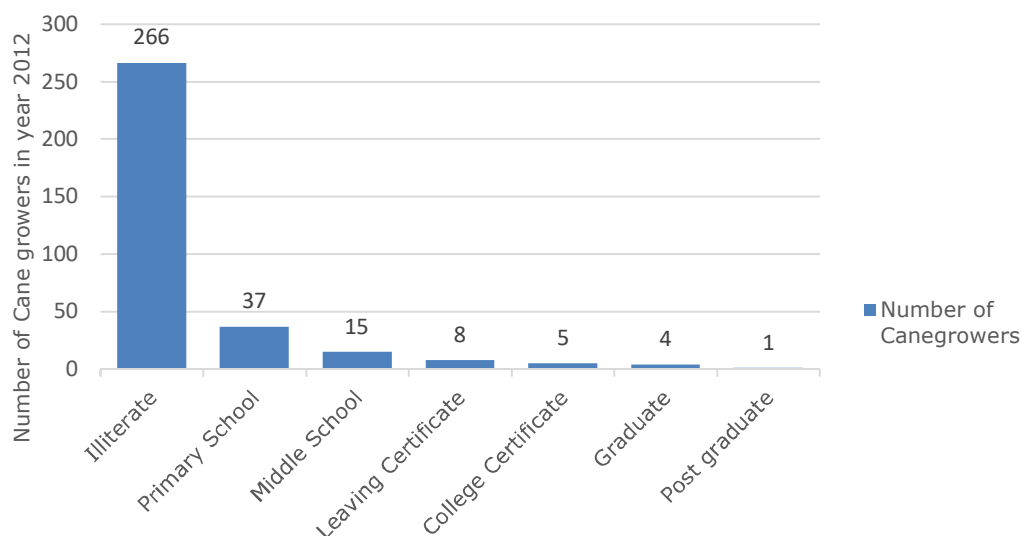
District	Village	Cultivated area of sugarcane crop (hectares)				
		Up to 2.0	2.1-4.0	2.1	6.1-8.0	8.1 & above
Mardan	Gulmera	33	1	1	1	--
	MiaganoKilli	33	2	--	--	--
	Akhbar Abad	32	1	--	--	--
	Qutabgarh	29	2	--	2	1
	Feroz Shah	35	2	3	3	2
Charsadda	Dobandi	23	7	--	--	--
	Payan	25	2	--	--	--
	Tangi Abazi	24	3	2	--	--
	HisaraNehri	42	1	--	--	--
	Qumbati	23	1	--	--	--
Total		299	22	6	6	3

Source: Field Survey, 2012 and 2013

Distribution of the sample of sugarcane growers by educational status is shown in (Figure 1). Results indicate that 266 sugarcane growers out of the total surveyed (79%) were illiterate, while of the remainder, 37 had completed primary school, 15 went to middle school, while a similar proportion had as school leaving certificate (Figure 1).

The distribution of sugarcane growers with knowledge about the public agricultural extension department is shown in Table 4. Of the 336 sugarcane growers, 197 reported that they had no knowledge about the staff or activities of the public agricultural extension department and only 139 growers reported some knowledge of the public agricultural extension department. The situation was worst in the case of small growers with a much higher proportion of small growers (189 with farms less than 2.0 hectares) reporting that they had no knowledge about the public agricultural extension department. Meanwhile, all eight of the larger growers with farms greater than 6.1 ha (only 2.4% of the sample) reported that they knew about the public agricultural extension department (Table 4).

Distribution of sugarcane growers by visits to the public agricultural extension department is also presented in Table 4. Of the 299 small growers (with up to 2.0 hectares of sugarcane), only 21 paid a visit to the public agricultural extension department. Presumably, they do not visit the public agricultural extension department because it is so far from the farmers' village, while the farming community generally does not have personal transport and public transport is not available. Moreover, the difference in social standing between public agricultural extension agents and the farmers might discourage visits. Another possibility is that the farmers have a minor role in adoption decisions, which are often made by the land owner. The significant number of tenant farmers supports this view.

Figure 1. Distribution of sugarcane growers by educational status

Source: Field Survey, 2012 and 2013

Note: Farmers were interviewed between January and March 2012.

Table 4. Distribution of respondents by visits to public agricultural extension department

Cultivated area (ha)	Knowledge about public agricultural extension department				Total
	No knowledge	Some Knowledge	No visit to agricultural department	Visited Agricultural department	
Up to 2.0	189	110	278	21	299
2.1 - 4.0	7	15	17	5	22
4.1 - 6.0	1	6	3	4	7
6.1 - 8.0	--	6	1	5	6
8.1 and larger	--	2	--	2	2
Total	197	139	299	37	336

Source: Field Survey, 2012 and 2013

The 37 sugarcane growers mentioned in Table 4 who visited the public agricultural extension department, all came from the same district (Mardan). All visited the department once per year with only one grower reporting that he visited it more frequently.

The Agricultural extension Department is a place where farmers can visit to get recommended information. Table 5 shows that 105 of the survey respondents stated that their farms were 1-3 kilometres from the public agricultural extension department while 221 respondents reported that their farm was 4-6 kilometres away and only 10 respondents were between 6-10 kilometres from the public agricultural extension department. Due to lack of personal transport and poor availability of public transport, it is difficult for small land holders to visit the extension department.

Infrastructure plays an important role in transportation and visiting the public agricultural extension department. Roads are not really the problem as 217 farmers recorded good road conditions between their farm and the extension centre (Table 6).

Table 5. Distribution of growers by distance (km) of farms from public agricultural extension department.

District	Village	Distance to public agricultural extension office			Total
		1-3	4-6	7-10	
Mardan	Gulmera	13	20	3	36
	MiaganoKilli	9	23	3	35
	Akber Abad	9	23	1	33
	Qutabgarh	13	21	--	34
	Feroz Shah	23	22	--	45
Charsadda	Dobandi	17	13	--	30
	Payan	--	24	3	27
	Tangi Abazai	17	12	--	29
	HisaraNehri	3	40	--	43
	Qumbati	1	23	--	24
Total		105	221	10	336

Source: Field Survey, 2012 and 2013

Table 6. Distribution of growers by road condition to public extension office

District	Village	Road condition to public agricultural extension office		Total
		Good	Poor	
Mardan	Gulmera	20	16	36
	MiaganoKilli	24	11	35
	Akber Abad	24	9	33
	Qutabgarh	24	10	34
	Feroz Shah	28	17	45
Charsadda	Dobandi	17	13	30
	Payan	11	16	27
	Tangi Abazai	29	--	29
	HisaraNehri	29	14	43
	Qumbati	11	13	24
Total		217	119	336

Source: Field Survey, 2012 and 2013

Another way to assess growers' knowledge about the availability of extension services was to ask them whether they knew the field assistants from the local public agricultural extension department. Out of 299 small sugarcane growers (with up to 2.0 hectares of sugarcane), only 26 seemed to know the field assistant from the public agricultural extension department (Table 7). Of the eight larger sugarcane growers (above 6.1 ha) who were interviewed, all knew the field assistant. These larger sugarcane growers were all owner-cultivators, where the land owner has the main role in decision making. The public agricultural extension agent stands to visit the larger cultivators because they may be connecting with many tenant growers. The extra resources of larger growers also tend to divert attention of the public agricultural extension agents toward them. Due to large jurisdictional areas and limited resources, it is not possible for public agricultural extension agents to visit small farmers individually.

Table 7. Distribution of respondents by knowledge about field assistants from public agricultural extension department

Cultivated area (hectares)	Knowledge about extension field assistant		Total
	No knowledge	Yes know field assistant	
Up to 2.0	273	26	299
2.1- 4.0	16	6	22
4.1 --6.0	3	4	7
6.1 -8.0	--	6	6
8.1 and larger	--	2	2
Total	292	44	336

Source: Field Survey, 2012 and 2013

Although the extent of contact was very low, with only 23 growers who were interviewed saying they acquired information by any extension method, there was a variety of extension methods chosen to acquire information (Table 8). Among these growers, 10 got information by office calls

while a small number of growers nominated farm home/field visits, results demonstrations and method demonstrations respectively as the way they acquired information. This is similar the research of Ullah et al. (2015) who reported farmers' visits to the public agricultural extension department and field assistants' visits to the farmers' fields. From their study, it was reported that demonstration of results in the field was an effective method of extending information when applied to fertilizer application and seed bed preparation.

Information collected during the survey describes how important the exchange of information by personal contact is. Majority of farms in each size category obtained information from farming colleagues, neighbours and friends or relatives. It is important to mention here that a few sugarcane growers were certainly knowledgeable and progressive; however, the progressive growers do not necessarily co-operate and transfer information to other farmers. The growers appeared to be serious about their farming, but probably have less knowledge about recommended practices and suitable sources of information than is desirable. More seriously, even if the growers have knowledge about the appropriate sources of information, they have limited resources to benefit from applying it.

Table 8. Extension methods involved in disseminating information for farmers with knowledge about field assistants

Cultivated area (ha)	Extension methods						Total
	Farm home/field visit	Office calls	Method demonstration	Result demonstration	Farm home /field visit &office call	Office call &result demonstration	
Up to 2.0	--	6	1	2	--	1	10
2.1 - 4.0	--	1	--	1	--	--	2
4.1- 6.0	2	--	--	--	2	--	4
6.1 - 8.0	3	2	--	--	1	--	6
>8.0	--	1	--	--	--	--	1
Total	5	10	1	3	3	1	23

Source: Field Survey, 2012 and 2013

While the number of responses is small, Table 9 seems to indicate that growers contacting the extension service achieve higher yields of cane. The average cane yield of the 23 growers who actively contacted the extension service was 108 t ha⁻¹ with a tendency for the farms using the more interactive extension methods to achieve higher yields. That may reveal more about the attitude and nature of the growers than the effectiveness of extension methods and it could be coincidental that growers who made active contact, through field and office visits, achieved higher yields than those who attended demonstrations of methods and results. Furthermore, the research by Mirani & Memon (2011) reported that farm/home visits were an effective method for disseminating suitable and recommended information among the farmers' community.

At the other end of the spectrum, results from this investigation suggest that growers who shared information about sugarcane production with co-farmers/neighbours, friends/relatives, and used other traditional methods to obtain information, had much lower cane yields, averaging 63 t ha⁻¹ (Table 10), than the farmers who were in contact with the extension service. There could be other reasons for this difference in yield related to farm size, soil type, fertiliser application or cane variety for which we either have no data, or the small number of observations affects its reliability. There is scope here for more detailed investigations, but a possible conclusion from this study is that both public and private extension agents should improve and increase the number of visits they make to farmers' fields.

Table 9. Average yield of sugarcane grouped by extension method

Extension methods	Average yield (t ha ⁻¹)	No. of respondents
Farm home, field visit & office call	123	3
Farm home, field visit	116	5
Office calls	112	10
Office call & result demonstration	103	1
Method demonstration	91	1
Result demonstration	78	3
Average (all methods)	108	23

Source: Field Survey, 2012 and 2013

Table 10. Average yield of sugarcane with informal methods of information dissemination

Methods of information gathering	Average yield (t ha ⁻¹)	No. of respondents
Co-farmers, neighbour	48	4
Friends, relatives	55	1
Co-farmers, neighbour& friends, relatives	64	306
Cooperation with formal source of information, co-operating farmers, neighbours	87	1
Traditional methods	51	1
Average	63	313

Source: Field Survey, 2012 and 2013

The growers were asked at the interview whether the public agricultural extension department had initiated any programs related to weed or pest control, use of machinery and cultivation practices, farm management, market facilitation, information on High Yielding Varieties, application of fertilizers, or any other practices that might improve the performance of growers in the study area. The response from all growers was negative.

The 139 sugarcane growers who knew about the public agricultural extension department and 44 growers with knowledge of the public agricultural extension assistant reported their perceived reasons for poor performance (Table 4 & 7). Of these 183 sugarcane growers, 31 reported poor staff members, 2 transport problem, 68 no monitoring of staff performance, and 82 thought staff had little interest in government duty.

Discussion

The majority farmers in Pakistan and in the study are small-scale land holders. In areas where the environment is suitable and there is adequate irrigation water, most of their land is often used for sugarcane production.

In the case reported here, small farmers cultivating up to 2.0 ha of sugarcane were mainly tenant farmers or leased land. In the farming system in Khyber Pakhtunkhwa province of Pakistan, the landlords contribute their land, often a part of the operating capital, and make some management decisions, while the tenant farmers contribute their labour along with capital and management skills. According to the legal commitment between tenant farmers and landlords, the tenant farmers pay a fixed proportion of between half and three-quarters of production to the land owner. The decisions about adoption of farming practices always remains with the land owners, which possibly accounts for the lack of contact by many farmers with extension agents.

Only about one third of small farmers knew about the public agricultural extension department and only the larger farmers (6% of the sample) visited the public agricultural extension office, about once per year. For most of the growers (64%), the office of the public agricultural extension department was 4-6 kilometres away from their farms; while a similar number reported that road conditions were good. Neither public nor private transport was available to visit the extension office. Therefore, lack of access appears to be a major reason for these small growers not contacting the extension service.

Almost all growers responded negatively when asked whether the public agricultural extension department had initiated any specific programs for cane growers. The lack of contact with the public agricultural extension department and public agricultural extension workers has left small farmers with little option but to rely on contact with co-farmers, neighbours and friends or relatives for needed information. These small farmers achieved quite low average yields of cane (63.4 t ha⁻¹) but there is insufficient evidence that lack of extension contact was the reason.

The research by Pervaiz et al. (2013) concluded that public agricultural extension workers in Pakistan failed badly in disseminating relevant information among the farming community. Other earlier research by Abbas et al. (2003) suggested that public agricultural extension agents communicated almost exclusively with the larger landholders regarding the latest appropriate technologies in sugarcane production in Pakistan, and those growers usually adopted the recommended technologies. In this study, there were few large growers surveyed. While they had more active contact with the extension department, and reported higher yields of cane (106 t ha⁻¹), there is insufficient evidence to propose a relationship between yield and extension contact. It could have been due to better soils on the larger farms, higher yielding varieties, better management of water and fertiliser, or other factors that could be investigated further.

The poor performance of the public agricultural extension service is possibly caused by budgetary crises, insufficient funds, bureaucratic nature of the service, poorly motivated staff and a top-down approach that ignores the women and poor farmers in the decision-making process. In a global context, development paradigms and reforms like decentralization, privatization, and demand-driven approaches are being promoted and seem to be prevailing. This scenario will ultimately accelerate the responsibility on extension agents to service all sections of the community (Mengal, Mirani & Magsi 2014).

In other research related to this study, nearly 80% of growers were illiterate which has major implications for the delivery of extension information (Khan, unpublished PhD research, University of Peshawar, 2015). The illiterate growers achieved an average yield of 64 t ha⁻¹ in the years 2012 and 2013 while there was an increasing trend in cane yield over the same period for those growers who were primary and middle school educated, certificate holders, or graduates with each of those groups achieving average sugarcane yields of 61, 88, 95 and 111 t ha⁻¹ respectively (Khan and Khan 2015). Again, there could easily be other factors causing this result and further study into the relationship is needed.

Conclusions and suggestion to policy makers

Most small farmers in the research area were tenants and therefore have less influence over decisions regarding farm practices than larger growers who have tenure over most of their land. This may partly explain why small farmers showed a lack of interest in the public agricultural extension department and extension workers. Moreover, the public agricultural extension department is some distance from many small growers' farms and they did not visit it as frequently as the larger farmers, possibly because these small farmers do not have a vehicle and public transport is not available. In addition, the public agricultural extension workers appear to be visiting the large land holders almost exclusively. The larger farmers have resources and decision-making power to implement recommended changes which may encourage that contact.

While the public agricultural extension workers were disseminating recommended information to large farmers by individual contact methods like farm or home visits and office calls, the contact with small farmers was mostly by group contact through method and result demonstrations. Because of the large areas that public agricultural extension workers have service with limited resources and staff numbers, it is not possible for public agricultural extension staff to visit every farmer. Furthermore, a related study of the same sample of farmers revealed that majority of them were illiterate and therefore it may be more difficult for them to understand technical messages or get information about the public agricultural extension department or its services by printed or electronic media unless it is in a special format.

The result of this investigation, where contact by public extension staff with small farmers was infrequent or non-existent, it is suggested that the public agricultural extension department should concentrate on servicing small and tenant farmers within the community as well as the larger land owners, although these groups might be serviced by entirely different methods. In order to do this, they should consider increasing staff numbers, monitoring activities of public agricultural extension workers and other staff members, and providing incentives to public agricultural extension staff to take more interest in their duties. Moreover, the public agricultural extension staff should be located near the farming areas and advertise their presence so that the farming community gets to know about them.

To overcome transport and other problems, the government should empower public agricultural extension workers by providing resources like vehicles, give them access to high yielding cane varieties that they can distribute among small farmers, and train them in appropriate technologies to enable them to undertake the challenging task that confronts them. The public agricultural extension workers should be able to provide innovative information to small farmers on high yielding varieties, irrigation practices, appropriate application of inputs, including knowledge and application techniques for recommended pesticides and weedicides which may require the implementation of specific programs that have not been conducted in past years. At a later stage, they may be able to initiate broader education programs for cane growers through electronic media in the local language with emphasis on small farmers and illiterate growers in the community.

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References

- Abbas M, Mohammad S, Nabi I & Sheikh AD 2003, 'Farmer-extension interaction and the dissemination of recommended sugarcane production technologies in the central Punjab (Pakistan)', *International Journal of Agriculture & Biology*, vol. 5, pp. 134-137.
- Abbas M, Muhammad S, Nabi I & Kashif M 2003, 'Farmers' information sources, their awareness and adoption of recommended sugarcane production technologies in the central Punjab', *Pakistan Journal of Agricultural Sciences*, vol. 40, no. 3-4, pp. 202-206.
- Govt of Pakistan 2018, *Highlights of economy of Pakistan*. Available from: <<http://www.app.com.pk/>> [12 November 2018].
- Haq US, Ceyhan V, Boz I & Shahbaz P 2016, 'Effect of different crop management system on technical efficiency in sugarcane production in Faisalabad, Punjab Region of Pakistan', *Journal of Biology, Agriculture, and Healthcare*, vol. 6, no. 12, pp. 106-114.
- Jan I, Khan H & Jalaluddin M 2008, 'Analysis of agricultural extension system: a discrepancy between providers and recipients of the extension services empirical evidence from north-west Pakistan', *Sarhad Journal of Agriculture*, vol. 24, no. 2, pp. 349-354.
- Khan F & Khan ZM 2015, 'Role of education in enhancing sugarcane yield in Mardan and Charsadda districts of Khyber Pakhtunkhwa, Pakistan', *Sarhad Journal of Agriculture*, vol. 31, no. 2, pp. 123-130.
- Khan F & Wegener M 2016, 'Factors associated with excess use of nitrogen in sugarcane crops in selected districts of Khyber Pakhtunkhwa Province, Pakistan', in Proceedings, 38th annual conference, *Proceedings Australian Society of Sugar Cane Technology*, vol. 38, pp. 101-111.
- Khan SA 1997, 'Introduction to extension education', in *Extension methods*, 2nd edn, ed. E Bashir, National Book Foundation, Islamabad, pp. 3-34.
- Khurshid L, Khan ZM, Pervaiz U, Khan A & Nawaz A 2017, 'Role of agricultural extension agents in transfer of onion production technology in district Swat', *International Journal of Agricultural and Environmental Research*, vol. 3, no. 1, pp. 158-164.
- Kumara RMI, Wekumbura WGC & Sivashankar P 2015, 'Level of awareness and constraints to adopt new technologies determining the retention of farmers in sugarcane cultivation', in *Proceedings of the Peradeniya University International Research Sessions*, Sri Lanka, Vol.19, 5th & 6th November 2015.
- Mari JM, Shahzadi AK & Chachar QL 2011, 'Perception of the problems in farming community at Hyderabad Pakistan', *Journal of Agricultural Technology*, vol. 7, no. 1, pp. 9-17.
- Memon FH 2007, Farmers perception regarding the role of print media for transfer of technology of cotton crop in District Hyderabad Sindh, M. Sc. Agric. Ext., Sindh Agriculture University, Tandojam Sindh, Pakistan.
- Mengal AA, Mirani Z & Magsi H 2014, 'Historical overview of agricultural extension services in Pakistan', *The Macrotheme Review*, vol. 3, no. 8, pp. 23-36.
- Mirani Z & Memon A 2011, 'Farmers' assessment of the farm advisory services of public and private agricultural extension in Hyderabad district, Sindh', *Pakistan Journal of Agricultural Research*, vol. 24, no. 1-4, pp. 56-64.
- Naqvi HM, Hamid A & Aminullah 1988, Evaluation of training and visiting system of agricultural extension in Mardan SCARP Area: Peshawar; Pakistan Academy for Rural Development.
- Pervaiz U, Khan F, Jan D, Huma Z & Khan ZM 2013, 'Analysis of sugarcane production with reference to extension services in union council Malakander-Peshawar', *Sarhad Journal of Agriculture*, vol. 29, no. 1, pp. 145-150.
- Slade R, Feder G & Chhikara R 1988, 'Reforming agriculture extension; the training and visiting system in India', *Quarterly Journal of International Agriculture*, vol. 27, pp. 3-4.
- Ullah R, Ullah K, Khan ZM & Inam U 2015, 'Influence of agriculture extension services and farmer's socio-economic characteristics on adoption of Date palm (*Phoenix dactylifera* L.) in district Dera Ismail Khan, Pakistan', *Journal of Resources Development and Management*, vol. 11, pp. 98-106.
- Ullah R, Safi QS, Shah J & Khan KH 2011, 'Comparative analysis of sugarcane on farm and research station in district Mardan', *International Journal of Latest Trends in Agriculture & Food Sciences*, vol. 1, no.1, pp. 6-8.
- Yaseen M, Shiwei X, Wen Y & Hassan S 2015, 'Policy challenges to agricultural extension system in Pakistan: a review', *International Journal of Applied Agricultural Science*, vol. 7, no. 2, pp. 111-115.
- Zubair M 2014, 'Sugar crops research program national agricultural research centre (NARC)-Islamabad', Available from: <<http://www.parc.gov.pk/>> [3 March 2016].