EFFECTIVENESS OF OUTREACH ORGANIZATIONS IN BUILDING CAPACITY OF SMALLHOLDER RICE GROWERS REGARDING WEED MANAGEMENT

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ABSTRACT
Rice (Oryza sativa L.) is feeding more than half of the world's population. It is cultivated in almost 114 countries for food, income and employment generation. Ninety percent share of rice production is contributed by the Asian countries. Like other Asian states, it is also the staple food in Pakistan. Ironically, rice production is continuously dwindling due to less effective performance of public and private agricultural extension organizations in capacity building of smallholder farmers regarding weed, insect, and disease management. Therefore, the present study "building capacity of smallholder growers regarding weed management of rice crop: an acid-test for public and private extension services in the Punjab" was designed to improve effectiveness of extension work in the provinces. Gujranwala was selected as the study area because it was the largest rice producing district in the Punjab province. A sample of 342 drawn by using Table developed by Fitz-Gibbon and Morris from the list of 2,365 rice growers registered by public and private sectors in Gujranwala, were interviewed. Data were collected through a well prepared, reliable and validated interview schedule along with observations and focus group discussions. The data were analyzed with Statistical Package for Social Sciences (SPSS). It was found that smallholder farmers were mostly relied on chemical management of weeds almost not using biological management. The authors conclude by suggesting that both sectors should focus on biological management of weeds in-order to promote environment friendly agriculture.

Keywords: Agricultural extension in Pakistan, capacity building of smallholder farmers; public and private extension services; weed management in rice.

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INTRODUCTION

Rice (Oryza sativa L.) is the largest staple food as well as the most cultivated cereal after wheat in the world. Two-thirds of global impoverished population lives in Asia and intakes 80 percent of the daily calories from rice. It provides 21 and 15 percent of global human per capita energy and protein, respectively. In addition to dietary energy (1527 KJ/100g) and protein (7.9 g/100g), it is a rich source of minerals (K, Ca, P, Fe, Zn), amino acids and vitamins (thiamine, riboflavin, niacin) which protect the human being against neural sickness and ensures healthy growth during pregnancy and childhood. It is very useful against anemic diseases due to its iron contents (1.5mg/100g) (USDA, 2014; Zeigler, 2006). It adds 3.1 percent value in agricultural commodities and contributes 0.9 percent in economy of Pakistan. Rice industry absorbs 9 percent of the national labor force. It also shares on an average Rs. 2 billion national foreign exchange exchequers annually along-with bilateral trade with other countries (Govt. of Pak., 2015). According to Trade Development Authority of Pakistan (2014) rice trade is one of the main reasons behind the close ties of Saudi Arabia, United Arab Emirates, Iran and Sri Lanka with Pakistan.

Pakistan is the 11th largest rice producer in the World. Almost 6 million tons of rice is produced annually. It adds 2 million tons in national food requirements. There was 2.3 million hectare (1.05 Basmati, 0.58 IRRI, 0.66 others) area under rice cultivation and 5.5 million tons production (1.86 Basmati, 1.82 IRRI, 1.85 others) with 1.7 tons per hectare during 2013 which is 10 percent less than previous year (Pak. Bureau of Statistics, 2014). The Punjab is the leading province in rice cultivation with 0.99 million hectare under rice crop and 3.4 million tons production annually. It is more than 70 percent of total national rice cultivation and production. The contribution of the Punjab in production of fine rice is also very significant. Gujranwala is the predominant district out of 36 districts of the province regarding rice cultivation and production. The crop is cultivated on an area of about 0.25 million hectares with a production of 0.55 million tons (Crop Reporting Service, 2014).

Various agricultural research institutions are working to improve the rice quality its and quantity through improved germplasm and cultivation techniques. Main emphasis of Pakistan Agricultural Research Council (PARC), Islamabad and Nuclear Institute of Agriculture and Biology (NIAB), Faisalabad is on genetic modification as well as reduction of phytic acid by mutation and hybridization for high quality rice germplasm. They are also endeavoring on disease (Bacterial Leaf Blight), cold and salt tolerance of rice (Nat. Inst. Agri. Biotechnology, 2015; Pak. Agric. Res. Council, 2008). Rice Research Institute, Kala Shah Kaku has been struggling to reduce the plant height, water requirement and time of maturity since 1970. It is also tending to introduce high iron, zinc and pro-vitamin A content varieties. To develop genetic pool to produce pure pre-basic and basic seed of different approved rice varieties is also on the account of the institute. The achievements of the institute are very outstanding.

It has developed 22 basmati varieties along with the first aromatic basmati variety (Bas, 370) in the world. It has also ascended the potential yield of fine varieties from 30 maunds/ acre (3 tons ha^{-1}) (Bas, 370, Bas, Pak) to 75 maunds/ acre (7.5 tons ha^{-1}) (Bas, 515), while of coarse varieties from 100 maunds/acre (10 tons ha^{-1}) to 105 maunds/ acre (10.5 tons ha^{-1}) (Akhter, 2014). The efforts of this institute not only shortened the crop duration (Bas, 385; Super Bas, and Bas, 2000 which ripe within 103 days instead of 130 days in case of fine while 100 days instead of 111 days in case of coarse varieties) but also plant height from 170cm (Bas, 370) to 120cm (Bas, 515) of fine varieties and

115cm to 105cm of coarse varieties. This landmark is very helpful in reducing the chances of lodging, conserving 3 inches water without affecting the yield as well as in increasing the grain length from 6.50 mm (Bas, 198) to 7.68 mm (Bas, 2000) in fine varieties while 7.07 mm (KSK 133) in coarse varieties. Benchmarking of rice parboiling technology, production of rice bran oil, direct rice seeding, mechanized transplanting and establishment of Rice Research Station Bahawalnager are the future development projects of the organization (Badir and Akhtar, 2014).

A technically sound farmer can only harvest the aforementioned fruits. In agrarian aspect, the technicality or capacity of a farmer can be judged on the basis of acquired knowledge, application of technology, labour and physical assets management as well as the ability to improve out-put of the farmer (World Bank, 2011: Kamruzzaman and Hiroyuki, 2008). The agricultural extension organizations improve the farmers' capacity through: transferring the innovations, educating the farmers, making them technically skillful, encouraging them for application of technologies and assess their competencies (FAO, 2013). All in one is that the ultimate objective of agricultural extension services is to make a farmer technically mature (Kamruzzaman and Hiroyuki, 2007).

In Pakistan, since 1988 private sector has also been rendering extension services along with public sector. Both sectors are hands-in-hands to improve the awareness of recommended rice production technologies among farmers. Therefore, it is need of the hour to check the effectiveness of public and private sectors in improving awareness of recommended weed, disease, and insect-pest management practices of rice growers.

PURPOSE AND OBJECTIVES

This study was designed to assess effectiveness of outreach organizations in building capacity of the rice growers. Capacity building, in this study, is defined as the ability to gain knowledge and skills of recommended technologies that improve farmers' performance. The specific research objectives are:

1. To identify the awareness against weeds;
2. To determine the awareness of recommended weed management practices.

MATERIALS AND METHODS

A survey research methodology was applied to conduct the study. The study was conducted in Gujranwala, Pakistan; the largest rice producing district in the country. The population or sampling frame was made up of rice growers registered with the Department of Agriculture (Extension Unit) and the largest private extension unit, a pesticide company. The largest private unit in the district was Syngenta Agrochemicals. A sample size of 342 farmers was drawn out of 2,365 rice growers from the four tehsils of the district: Gujranwala i.e. Wazirabad, Kamoky and Noshehra Virkan by using Table developed by Fitz-Gibbon & Morris, 1987 (Fitz-Gibbon & Morris, 1987). The respondents from each tehsil were selected on the basis of number of farmers in the tehsil. There was: 103 respondents selected from tehsil Gujranwala; 97 respondents from tehsil Kamoky; 83 respondents from tehsil Wazirabad; and 59 respondents from tehsil Noshehra Virkan. An interview schedule was prepared in English but ad-libbed in vernacular (Punjabi) to facilitate the respondents (Fraenkel and Wallen, 2006). Its validity and reliability was checked through pre-testing. Data collection was carried out by the lead author through face-to-face interviews. There were 289 respondents interviewed on their farms locally known as Deras while rest of them was at their homes or shops. Data analysis was done using the SPSS 24 (Statistical Package for Social Sciences).

The small sample size of 342 smallholder farmers is not enough to generalize the results to the whole country or even to the province. Though, it does help answer the research

hypothesis 'Private extension services are more effective than public extension services?'

RESULTS AND DISCUSSION

Crop protection is shielding of crop from diseases, insect/pests and competitive weed plants. Out of this, crop protection against weeds is different in nature because weeds are also plants like crops. The agronomists describe various ways to guard crop from weeds. Cultural control is the simplest way to protect crop (Hussain et al., 2012). It is performed either by hoeing, thinning, earthing up and crop rotation etc. Biological control is a method in which crop is protected through pheromones traps, using beneficial insects, inter-cropping of less important & weeds preventing crops etc. According to Yasin (2009), the most popular method is chemical control, it means application of chemicals to shield the crop against harmful and competitive weed plants such as herbicides, weedicides, etc. Application of chemicals should be according recommended dose especially for food crops because excessive doses of chemicals badly effect on food contents i.e. taste. The last but not the least, farmers also use local methods to protect the crop from weeds which called mechanical control method such as protection of crop through hand picking of diseased plants and weeding of crop through bullock (Kamran, 2004).

Built capacity refers to awareness of farmers about recommended technologies (recommendations given by the Agriculture Department) on rice. This study measured awareness about weed management. The awareness of the rice growers regarding each recommended practice was indicated by "Yes" and "No". Mean awareness of each category was also computed to assess overall knowledge about production aspects. Qualitative observations are also presented after quantitative description of each production aspect.

WEED MANAGEMENT

The responses of growers regarding awareness of weeds and recommended weed management practices are summarized in Table-1.

Table-1. Distribution of the respondents according to their awareness of weeds.

Weeds			Awareness				Mean Awarenes s	
			Yes		No			
Scientific Name	Common Name	Vernacula r Name	F	%	F	%	F	%
Cyperus rotundus	Purple nutsedge	Deela	342	100.0	-	-	267	78.2
Echinochloa colona	Jungle rice	Sawanki	342	100.0	-	-		
Paspalum distichum	Knot grass	Narro	332	97.1	10	2.9		
Echinochloa crus-galli	Barnyard grass	Didan	328	95.9	14	4.1		
Cyperus difformis	Flatsedge	Ghowain	144	42.1	198	57.9		
Cyperus iria	Smooth tufted sedge	Bhoian	116	33.9	226	66.1		

The data presented in Table-1 show that all the respondents were aware of Cyperus rotundus (vern. Deela) and Echinochloa colona (vern. Sawanki). An overwhelming majority (97.1 and 95.9%) of farmers were aware of Paspalum distichum (vern. Narru) and Echinochloa crus-galli (vern. Didan), respectively. Two-thirds (66.1%) of the respondents were unaware of Cyperus iria (vern. Bhoian) and 57.9% were of Cyperus difformis (vern. Ghowain). Pre-emergence weed management was known to large majority (83.2%) of the respondents of which 84.8 and 81.6% were aware of broad leaf weeds management and narrow leaf weeds management, respectively. Majority (62.4%) of the respondents were aware of post-emergence weed management practices. It was observed that generally, farmers were aware of weeds but ironically, were not practicing recommended weed management practices because of: unavailability of weedicides; high market rates and contamination in weedicides.

The farmers also use local methods to protect the crop from weeds which are mechanical control method such as puddling, protection of crop through using rope, use of light trap to attract light loving insects, hand picking of diseased plants and weeding of crop through bullocks in puddling but the most common method is the use of weedicides (Kamran, 2004). Pre-emergence weed management was known to large majority (83.2%) of the respondents of which 84.8 and 81.6% were aware of broad leaf weeds management and narrow leaf weeds management, respectively (Table-2). Majority (62.4%) of the respondents were aware of post-emergence weed management practices. About two-thirds (67.2%) and 71.1% of the respondents were unaware of pre-sowing management and cultural management of weeds, respectively. Generally, farmers are aware of chemical control methods but don't know pre-sowing and cultural methods to control weeds. They argued that being small landholders, farming is only source of their livelihoods. We can't afford rotation of our cropping patterns because no other crop in our locality is more profitable than wheat and rice. We (farmers) don't know weed resistant varieties If such verities are available to us, we may cultivate these. Though, these results are in line with Rehman (2003) described that few farmers' burn the stubbles of crop after harvesting in field rather than cultivation to get rid of weeds before sowing of next crop to save the crop from weeds. This practice badly affects the beneficial soil microbes as well as degrades environment.

It was observed that generally the farmers were aware of weeds but ironically were not practicing recommended weed management because of non-site specific recommendations, unavailability of weedicides, high market rates & contamination in weedicides.

Table- 2. Distribution of the respondents according to their awareness of weed management technologies.

Recommended weed management technologies		Awareness				Mean	
		Yes		No		F	%
		f	%	f	%		
Pre-sowing management	Culmination of rice stubbles before 28th February	16	04.7	326	95.3	112	32.8
	Nursery raising after 20th May	95	27.8	247	72.2		
	Proper cleansing of field bunds and water channels	226	66.1	116	33.9		
Cultural management	Removal of crop residue	204	59.6	138	40.4	98	28.9
	Timely planting	138	40.4	204	59.6		
	Improved drainage	124	36.3	218	63.7		
	Crop rotation	28	08.2	314	91.8		
Chemical control	Pre-emergence weed Management						
	For Broad leaf weeds Machete, Topstar, Topclore, Rifit @800ml/acre	290	84.8	52	15.2	284	83.2
	For Narrow leaf weeds Sweadal, Petral, Razor, Sunstar @400ml/acre	279	81.6	63	18.4		
	Post-emergence weed Management						
	For Broad leaf weeds Clover@80g+80ml/acre	225	65.8	117	34.2	213	62.4
	For Narrow leaf weeds Winstar, Bingo@100g/acre	202	59.1	140	40.9		

CONCLUSIONS AND RECOMMENDATIONS

Rice growers direly needed capacity building regarding weed management. In the light of above results, it is concluded that rice growers were very well aware of chemical management of weeds while very little aware about their pre-sowing and cultural management. Therefore, it is recommended that public as well as private sector should convince farmers about good nutritional value of crop without application of chemicals inorder to discourage the extensive use of chemicals. Public & private sectors should site-specified their recommended weed management practices in order to improve the adoption of these practices. Both sectors should work together to improve the adoption of biological management of weeds to promote climate-friendly agriculture.

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