

Analyzing the Impact of Biogas Technology Adoption on Farming System: a Case of District Dera Ismail Khan

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ABSTRACT

The main purpose of this paper is to present results of a research based on analyzing the impact of bio gas technology on farming system in one randomly selected district in Khyber Pakhthunkhwa by applying farming system research methodology. Data were collected partly by using PRA tools and partly through individual interviews by using a questionnaire from all 103 rural biogas households who were successfully using bio digesters in those villages. Results revealed that BGT has brought significant improvements in labor availability, water's absorption capacity of soil, germination capacity of crops, animal fodder supply, crop production and land fertility. However, the wood cutting phenomena has not been reduced with the use of bio gas because it is now used for selling purposes instead of fuel use. Apart from biogas generation from animal's dung, there are further possibilities for providing energy by using agricultural biomass, which may turn a farm enterprise into a net energy producer and which could eventually make possible to use underground water for irrigating rainfed and fallow lands. Therefore, large scale commercial bio gas installations are needed to be promoted by government. Organic farming should be another priority by government to make it possible to be widely provided to farming community. All these efforts can make farming system very efficient and sustainable in the long run.

Keywords: Bio gas Technology, Farming System, Organic Farming, Farming System Research Methodology, Dera Ismail Khan.

INTRODUCTION

At the time of independence Pakistan was primarily agriculture based country. But with the passage of time, industrialization took hold and the economy became more diversified. Though the share of agriculture sector has decreased significantly since its birth, however, still industrial development could not reduce the significance of agriculture sector in Pakistan. According to economic survey of 2010-2011, the development of rural areas is necessary for Pakistan's economy because almost 62% of country's population lives in rural areas. Agriculture has been like a back bone for the development of the rural areas. It acts as both the means of subsistence for the villagers and the biggest source of employment for them which further provides income to the rural people resulting in their expenditure on education and health [1]. The World Development Report (2008), recommends that the growth originating in agriculture is four times more effective in reducing poverty than the growth coming from non-agriculture sectors. Thus agriculture helps in reducing the income inequality between rural and urban sectors in Pakistan [2].

Pakistan's national agricultural policy is striving towards achieving self sufficiency in food production and increasing farm income equal for all. Unlike the first objective, we are far behind to achieve the second objective. Research is growing to bring more innovations which significantly improve the output per unit area but owners of small farms are not getting benefit from these innovations due to socio economic reasons and still living in poverty. There is lack of optimum

coordination among research, extension and other support services followed by the sub-optimal development of the farms. Less attention has been paid by planners, policy makers and researchers on other determinants of farm-household income like fuel wood etc. and off-farm activities. Extension service to farmers is yet to go beyond exclusive crop oriented approach [3]. Kossmann et al. (2010) have discussed the contribution of biogas technology towards the conservation of resources and development of rural communities [4]. Langeni et al. (2009) suggest that each household utilizing biogas can save up to USD 724 a year by replacing wood with biogas, apart from other positive impacts on the environment [5]. Abdulkareem (2005) found that refined biogas from animal dung could be used as an alternative to petroleum-based products and that dry slurry can be used for plant nutrition [6]. Bio gas provides an alternative to unsustainable deforestation as deforestation is the use of wood fuel for cooking and lighting. Introduction of household anaerobic digesters and the use of biogas for cooking reduce wood fuel use and therefore reduce deforestation [7]; [8]; [9]. Ilyas (2006) in his paper found the reasons for the popularity and growing demand of biogas in the country. He concluded that the increased crop production because of bio slurry usage as an organic nutrient rich fertilizer and reduction of the workload for women and girls due to wood collection, dung cake making and cooking have been the main motivating factors [10].

Rural areas in Pakistan are characterized with poor farming systems and rural poverty so it is considered necessary to find out whether bio gas initiatives can improve their farming system which will further strengthen their economic condition. Further, bio gas technology is new in Pakistan as compared to China, India, Bangladesh and Nepal. So, that is why in Pakistan, research studies on impacts of bio gas on farming system are limited especially in the Khyber Pakhtunkhwa Province of Pakistan. Therefore, the current study is expected to fill these gaps and will help to give a clear picture of modified farming system with bio gas use.

Based on farming system research with reference to innovations like biogas, there is evidence of many studies in different parts of world. However, in context of Pakistan, and specifically in Khyber Pakhtunkhwa, such studies have not been conducted. Pakistan is a country where farming system is concerned with many problems and inefficiencies with reference to innovations. In this context, this research is hoped to fill these gaps by focusing on that to what extent farming system changes with adoption of biogas technology.

METHODOLOGY

This study was carried out in rural areas of KPK well known to be typical farming area with low energy consumption. Multistage sampling technique was used for selection of district, tehsil and union council. One district, D I Khan was selected through simple random sampling technique. one tehsil was selected from the said district through random sampling technique. From each tehsil, one union council was selected and finally, five villages out of seven villages were selected randomly for the study. In this study, all 103 successfully operating biogas users were intended to be considered for data collection. The head of the household was the respondent. The list of successful biogas users were obtained from the NGO named as FIDA (Foreign Integrated Development Action).

A questionnaire was designed by studying the related literature before getting primary data through face to face interview from 103 households during February to April 2015. In addition, PRA tools were used including daily activity chart, seasonal calendar, community resource mapping and transect walk in order to study farming system comprehensively. The participants for PRA were most commonly literate farmers for getting qualitative data to be drawn on charts. An attempt was made to develop a complete picture of the major activities and processes involved in farming system. The data collection was ended when no more new relevant information on activities and processes became apparent. Finally, the collected data were summarized, organized, refined and presented.

Farming system research methodology was used for achieving the aim of the current study. Farming systems is an approach to research, a way of perceiving the world. It does not define itself based on a unified conceptual framework, nor on a fixed set of methods, which can be applied recipe like. Being a farming systems researcher thus requires a solid grasp of assumptions underlying various theories and methods, as well as their respective strengths and limitations. And above all, researchers need a substantial amount of reflexivity [11].

RESULTS AND DISCUSSIONS

Perception of Respondents Regarding Changes Brought In Structure of their Farming System after BGT Adoption

Interview results of households' data revealed that positive changes were brought in structure of farming system with bio digester use. A considerable number of the farmers tend to increase share of livestock farming than crop farming. The reason behind this was their increased importance to bio gas technology which they considered could be started at commercial level and getting more income this way than crop farming. While some farmers also showed interest in organic farming but it is not practiced yet even in the rest of the country.

Farmer's Application of Bio Slurry to their Crops

It is evident from figure 2 that almost all bio gas users apply bio slurry to their crops.

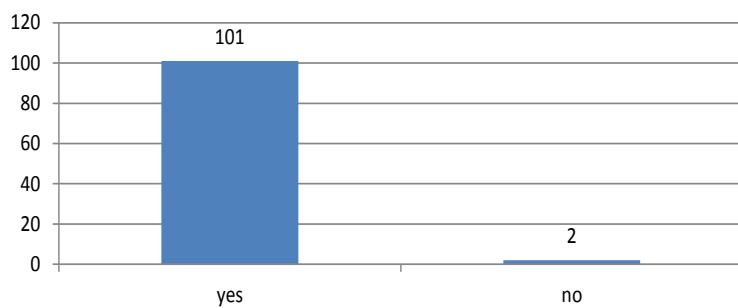


Figure2. Application of bio slurry for crop production

Impacts of Use of Bio Slurry on Land Fertility

Majority of the respondents during interview expressed their view that fertility of soil has been improved with application of bio slurry. Further, it has improved, on one hand, water absorption capacity of soil thereby minimizing the effect of scarce irrigation water and; on the other hand, germination capacity of vegetables and crops.

Impacts of Use of Bio Slurry on Crop Yield (Per Year)

The households thought that agricultural yield (per year) have been positively affected with the use of bio slurry implying that crop production has increased (figure 3).

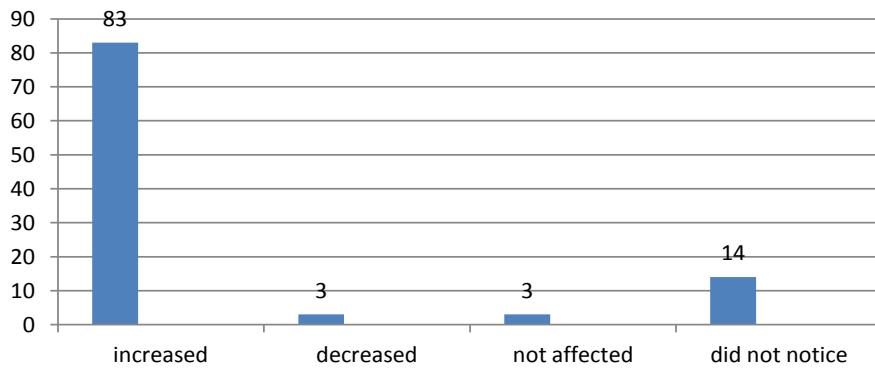


Figure3. Effect of bio slurry application on agricultural yield (per year)

Effect of Bio Gas Use on the Wood Cutting Phenomena

The wood cutting phenomena has been noted as not affected with the use of bio gas technology. The reason was that before bio gas technology adoption, the farmers had cut trees partly for fuel use and partly for selling while after BGT adoption they cut all trees for selling purposes. This way the cutting phenomenon is noted as unaffected.

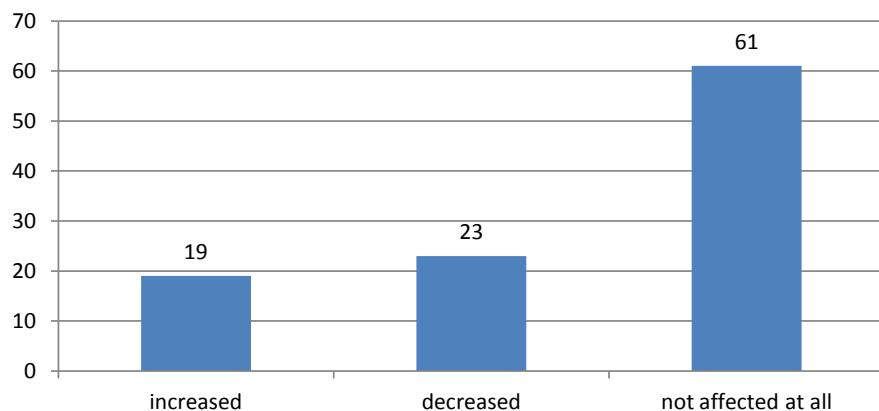


Figure5. Effect of bio gas use on the wood cutting phenomena

Change of the Labor Daily Activity Allocation

Daily activity chart by gender was drawn by a group of users and non users of bio gas. All of them were men and they also drew daily activities chart for women because the local culture did not allow women for drawing charts. Therefore, the men were expected to draw charts for women as well. The focus was made on the difference between women's and men's daily activities before and after bio gas adoption. After drawing the charts a discussion session was done with them in order to point out the main things that were not mentioned. It was concluded from chart that bio gas users (men) saved on one hour time on daily basis as compared to their bio gas non user counterparts and women who had bio digesters in home saved two hours time on daily basis as compared to their bio gas non user counterparts. In addition, the labor availability at household level has increased.

CONCLUSIONS

The main purpose of this study was to assess the impact of bio gas technology on farming system by applying farming system research methodology. Results from daily activity charts and from taking interviews by pre designed questionnaire revealed that farming system is changed substantially with use of bio digester. These include increased number of labor availability, increased crop yield, increased animal fodder and improved farm land fertility. Application of bio slurry has improved, on one hand, water absorption capacity of soil thereby minimizing the effect of scarce irrigation water and; on the other hand, germination capacity of vegetables and crops. However, the wood cutting phenomena has not been affected with the use of bio gas because it is now used for selling purposes instead of fuel use. A small number of the farmers tend to increase share of livestock farming than crop farming. The reason behind this was their increased importance to bio gas technology which they considered could be started at commercial level with a hope to earn more income this way compared to crop farming. While some farmers also showed interest in organic farming but it is not practiced yet even in the rest of the country. In fact, there is lack of relevant local expertise and practice of such farming.

Apart from biogas generation from animal's dung, there are further possibilities for providing energy by using agricultural biomass, which may turn a farm enterprise into a net energy producer and which could eventually make possible to use underground water for irrigating rainfed and fallow lands. Therefore, large scale commercial bio gas installations are needed to be promoted by government. Organic farming should be another priority by government to make it possible to be widely provided to farming community. All these efforts may make farming system very efficient and sustainable in the long run.

ACKNOWLEDGMENTS

The authors are grateful to the anonymous reviewers for valuable comments on this paper. The authors are also obliged to China Scholarship Council (CSC), China, for providing stipend that helped to produce this article. The principal author especially is grateful to Professor Liu Yonggong regarding his continuous help and support in the completion of this research endeavor.

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