Asian Journal of Agricultural Extension, Economics & Sociology
13(3): XX-XX, 2016; Article no.AJAEES.29026
ISSN: 2320-7027

SCIENCEDOMAIN *international*
www.sciencedomain.org

Assessment of Agricultural Biotechnology Competence and Training Needs of Agriculture Extension Officers in Khyber Pakhtunkhwa, Pakistan

Muhammad Zafarullah Khan[1*], Asif Nawaz[1], Rehmat Ullah[1] and Mubashir Habib[1]

[1]Department of Agricultural Extension Education and Communication, The University of Agriculture, Peshawar, Pakistan.

Authors' contributions

This work was carried out in collaboration between all authors. Author MZK designed the study, wrote the protocol and supervised the work. Authors AN and RU carried out statistical analysis. Author MH managed the analyses of the study. Author MZK wrote the first draft of the manuscript. Authors AN, RU and MH managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJAEES/2016/29026
Editor(s):
(1)
(2)
Reviewers:
(1)
(2)
Complete Peer review History:

Original Research Article

Received 18th August 2016
Accepted 19th September 2016
Published 2nd November 2016

ABSTRACT

Agricultural biotechnology has exhibited that it can assume a role in raising and to overcome the requirement of food, feed and fiber need. However, for agricultural biotechnology to be compelling and beneficial to the end-user, agricultural extension services must be successful in achieving high rates of adoption. One of the main responsibilities of Agriculture Extension Officers (AEOs) is to identify and meet the training needs of farmers for emerging techniques in agriculture such as biotechnology. Due to this utmost importance technical competencies of AEOs were evaluated to examine existing self-perceived and required levels in biotechnology in the Khyber Pakhtunkhwa

**Corresponding author: E-mail: drzafar@aup.edu.pk;*

Province of Pakistan. Respondents were asked about their acquired technical expertise in the field as well as the level required for effective performance. The acquired and required levels of competencies were determined on five point likert scale (1 = 'very low' and 5 = 'very high'). The study revealed significant differences in the technical competencies of AEOs based on their participation in training program and professional qualifications. Professional qualifications and regular trainings were found to be highly related to the technical efficiency in agricultural biotechnology. The differences were considered as training needs of the AEOs to improve their competencies for better service delivery in agricultural biotechnology.

Keywords: Agricultural biotechnology; training needs; agriculture extension officers.

1. INTRODUCTION

Agricultural production in Pakistan continues to be low and it is generally believed that dearth of information tailored to local needs and lack of technical knowledge at the farm level are the principal factors for this low and stagnant production [1]. This situation indicates that agricultural production in Pakistan depends upon a number of factors including feudalism/ absenteeism, lack of continuity in agricultural policies, politicized environment in agricultural support institutions, isolation of agricultural education, research and extension wings, unfavorable prices, buyer's and middleman "Mafia:, absence of necessary infrastructure for farm exports, deficient management and marketing skills, a large number of small operators, unproductive tenancy systems, only few full time farmers, etc. [2]. Developing an efficient sustainable agriculture in the current context of major global threats (climate change, soil degradation and erosion, water scarcity, biodiversity diminution) coupled with a continual population growth represents an imperative for conceiving a coherent strategy aimed to ensure the food, feed, fiber and fuel security. Two main conditions have to be taken into consideration for the successful development of such a challenging and far-reaching strategy: the use of all valuable knowledge and practical results accumulated so far, especially by the integration of conventional and biotechnological achievements and the common use of the highest competence gained not only at the national levels, but at the regional, continental and global ones [3].

Biotechnology is the application of scientific techniques to modify and improve plants, animals, and microorganisms to enhance their value. Agricultural biotechnology is the area of biotechnology involving applications to agriculture. Agricultural biotechnology has been practiced for a long time, as people have sought to improve agriculturally important organisms by selection and breeding. An example of traditional agricultural biotechnology is the development of disease-resistant wheat varieties by cross-breeding different wheat types until the desired disease resistance was present in a resulting new variety [4]. Herbicide tolerance and *Bt* genes both make a direct difference in farming, but newer types of transgenic crops are foreseen with human health or environmental applications. Companies are developing transgenic varieties without the anti-nutritive or allergenic factors that some foods, such as peanuts, soy, and wheat, naturally contain as well as other kinds of plants designed to improve health.

Biotechnology has helped to increase crop productivity by introducing such qualities as disease resistance and increased drought tolerance to the crops. Now, researchers can select genes for disease resistance from other species and transfer them to important crops. Farmers use crop-protection technologies because they provide cost-effective solutions to pest problems which, if left uncontrolled, would severely lower yields. Crops such as corn, cotton, and potato have been successfully transformed through genetic engineering to make a protein that kills certain insects when they feed on the plants [5]. Biotechnology has the potential to increase agricultural productivity and at the same time reducing environmental impact. Studies have indicated that genetically engineered crops have significant impact on plant and animal life. Today, global trends reveal an optimistic picture in the growth of biotech crops. In 2004, the global area of biotech crops grew by 20 percent [6]. Several researches revealed that extension agents are the most authentic and preliminary sources of information for various targeted groups regarding innovations. Effective extension specialists should be clear about the extension education process and must possess sufficient knowledge about the human development, learning and social interaction processes [7,8].

Agricultural extension is one of the means available to help alleviate poverty and improve food security. Agricultural extension means a continued service that extends the farmers basic education mainly to rural population employed within the agricultural sector. It involves systematic and organized communication with farming communities and among farmers' in order to give them a helping hand. Its objectives are particularly oriented to a better insight into farming practices, clear formulation of farmer's wishes and identification of their problems and looking for solutions [9]. Agricultural Extension Department is responsible for transfer of agricultural technology and providing technical guidance to farmers to improve agricultural practices to increase agricultural productivity. Their activities are well received not only in Pakistan, but all over the world. Nevertheless, despite such frequent visits of the extension agents to the field; their competency level is quite low for lack of trainings [10,11]. Self sufficiency in major field crops has not been achieved in Pakistan which is mainly attributed to inefficiency and low competency of extension agents.

Acknowledging this situation in Khyber Pakhtunkhwa province of Pakistan, this study of the agricultural biotechnology importance for AEOs was conducted to examine the existing levels of competency and the required level of competency for effective job performance. The study also explored demographic and social characteristics causing variation in the type of technical competencies of AEOs.

2. MATERIALS AND METHODS

This study was conducted in Khyber Pakhtunkhwa province of Pakistan and all Agricultural Extension Agents of agriculture extension department constituted the universe of the study. Due to time and financial constraints however, the sample was restricted only to Agricultural Extension Officers (AEOs). The study was based on both primary and secondary data. Primary data were collected through carefully prepared and pre-tested questionnaire. Secondary data were obtained through published sources. Questionnaires were mailed to Agriculture Extension Officers (AEOs) and their meetings were arranged at district level through management of the Agriculture Extension Directorate to explain the questionnaire The AEOs assessed their competencies by themselves at two levels; currently existing and the expected levels of skill as perceived by them on 1-5 Likert scale, where 1 indicated very low level while 5 represented very high level of competency.

Selected competencies were identified based on job description of AEOs. In this study, the purpose of scaling the index value ranged between 0 and 1. There are five parameters where scale step can be constructed into five categories (parameters). Scaling for possessed and required competencies was assigned values ranging from 0.00 to 1.00 into five scales. The scales were assigned values 0.00 - 0.20 (very low), 0.21 – 0.40 (low), 0.41 – 0.60 (moderate), 0.61 – 0.80 (high) and 0.81 – 1.00 (very high). Information on demographic and social characteristics and technical competencies perceived by AEOs were also collected by the survey questionnaire. The weighted average index of technical competencies both on existing and expected level perceived by AEOs was based on the five scale assigned values.

T-test was used to analyze the differences between the technical competencies of each aspect having comparison between the existing and the expected levels perceived by the AEOs. Furthermore, Pearson's correlation coefficient was also performed to ascertain the correlation among demographic characteristics with technical competencies of biotechnology.

3. RESULTS

3.1 Age

Table 1 shows the descriptive statistics of age of the respondents. The table illustrates that the age of the AEOs ranged from 25 to 62 years with mean age as 44.21 years. The very less number of AEOs was 12.6% which occurred in the age group of 25-35 years. In contrast, the larger number of AEOs as 42.34% belonged to the age group of 46-55 years. This depicts that most of the AEOs were of older age that have attained qualification enough before. They had more work experience but more probably their education was obsolete. In order to cope with the modern requirements of the farmers, they had to be trained with the latest techniques in biotechnology. To make these extension officers acquainted with the modern technique has been a need of the day.

3.2 Professional Experience

Table 2 highlights the field experience of AEOs. The findings which are synonymous to that of

Table 1 reveal that 63.10% AEOs had job experience of more than 16 years. More number of service years can be negatively significant if the education they attained is taken as outdated. In such circumstances, the likelihood of more trainings is higher for AEOs so that to equip them with latest techniques.

Table 1. Distribution of agricultural extension officers by age

Age (years)	Frequency	Percent
25 – 35	14	12.61
36 – 45	19	17.12
46 – 55	47	42.34
56 above	31	27.93
Total	111	100.00
Average	44.21	
Minimum: 25 Maximum: 60		

Table 2. Distribution of agricultural extension officers by professional experience

Experience (in years)	Frequency	Percent
1 – 5	22	19.80
6 – 10	3	2.70
11 – 15	16	14.40
16 – 20	32	29.00
21 – 25	30	26.90
26 and above	8	7.20
Total	111	100.00
Average	16.81	

3.3 Existing and Expected Levels of Technical Competency

The findings in Table 3 are based on responses of the AEOs to the question related to their existing technical competencies and required levels for effective job performance. The gap between the acquired level of competency of the AEOs and their required levels was considered as training need of the AEOs. Results in Table 3, Fig. 1 depicts that out of the five parameters used to assess the technical competencies of AEOs, "Importance of biotechnology" has been ranked as good in terms of the AEOs possessed competencies. The lowest competencies index was observed in the category (parameter) "Knowledge of medicinal plants" possessed by the AEOs. This is the category which has the highest gap among all the categories measured to calculate technical competencies delivering agricultural extension services to the farmers.

The findings of the study related to self-perceived technical competencies of AEOs of Khyber Pakhtunkhwa, Pakistan revealed that the level of the possessed competencies is lower than the required competencies of these officers. The difference of the indices between required and possessed competencies has been termed as "Training Gap" of the AEOs. The performance of the AEOs in terms of "Importance of biotechnology" was close to as required competency indicating the smallest gap among all the categories discussed. The average index of all the categories for both "possessed" and "required" were 0.49 (Moderate) and 0.85 (high) respectively where 0 represent the lowest value and 1 represent the highest value. The overall training gap is observed as 0.36 which implies that the existing competency is lagging behind by 36 percent of the competency required to fulfill the farmers' need according to the self-evaluation of the AEOs.

According to [12], AEOs in NWFP (North West Frontier Province) (now called as Khyber Pakhtunkhwa) needs trainings to make them efficient, effective and competitive to meet the emerging challenges. To perform the multidisciplinary roles by the extension agents, they must be trained in areas beyond technical agriculture to build skills in motivating the farming community as farming community is always helped by agricultural extension [13]. Moreover, [14] also highlighted the need and importance of biotechnology in agriculture and reported that the three groups of respondents (researchers, extension professionals and farmers) hold the same opinion regarding importance of extension services in generation and dissemination of agricultural biotechnology. This could be as result of the awareness and the perceived benefit of agricultural biotechnology in the increasing needs (food, feed and fiber) of people, which they perceived extension has a great role to play in informing, educating and advising.

This implies that agricultural biotechnology research and development represents one of such novel approaches with the capability of changing the face of agriculture so as to meet the increasing and varying needs (food, feed and fiber) of people in the new millennium which is the role of agricultural biotechnology that has been acknowledged since its commercial introduction in 1996 [15]. From the instant results it can be concluded that for agricultural biotechnology to raise the level of food, feed and fiber production in the country, agricultural extension services must be effective in achieving

high rates of adoption of these biotechnology products.

3.4 Analysis of Professional Competencies in Agricultural Biotechnology of AEOs by Demographic and Social Characteristics

Analysis of correlation coefficient of factors associated with technical competencies of Agricultural Biotechnology in Table 4 shows that several factors have positive relationship with it. These include age, job experience, professional qualifications and family background. Whilst specializations, domicile, previous experience in farming and attendance of irregular training program have their negative relationship with technical competencies of Agricultural Biotechnology. Among those associated factors from Table 4, only one factor has statistical significance at 95% confident level consisting of professional qualifications (0.215). This implies that those AEOs who had greater qualification has high competencies because of direct relation with technical competencies of AEOs.

Table 3. Self-assessment of AEOs in technical competencies in agricultural biotechnology on their existing and expected levels

Parameters	Existing level	Over all performance	Expected level	Over all performance	T-test (P-value)
Importance of biotechnology	0.56	Moderate	0.87	Very High	0.000**
Understanding of tissue culture	0.49	Moderate	0.86	Very High	0.000**
Importance of biodiversity	0.49	Moderate	0.86	Very High	0.000**
Understanding of genetic engineering	0.47	Moderate	0.85	Very High	0.000**
Knowledge of medicinal plants	0.44	Moderate	0.83	Very High	0.000**
Average	0.49		0.85		

*Remarks:** T-test is significant at the 0.01 level*

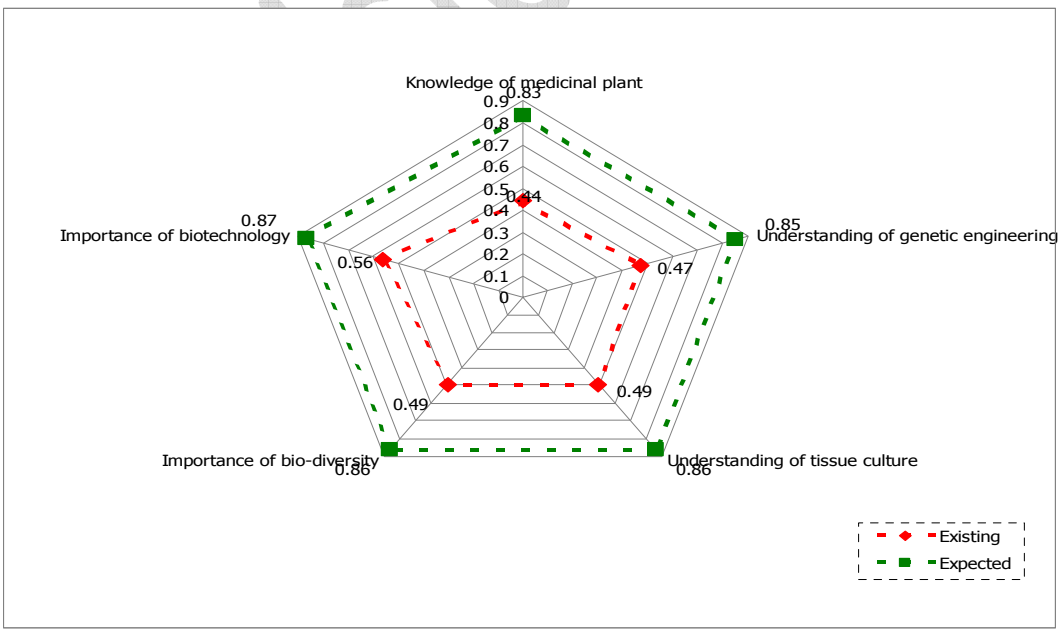

Fig. 1. Comparison between existing and expected level of technical competency of AEOs in agricultural biotechnology

Table 4. Factors associated with technical competencies of agricultural biotechnology

Factors (independent)	Correlation co- efficient value	Significant level
Age	0.008	0.935
Job experience	0.063	0.510
Professional qualifications	0.215*	0.023
Specializations	-0.123	0.199
Family background	-0.015	0.873
Domicile	-0.073	0.444
Previous experience in farming	0.073	0.447
Attendance of irregular training program	-0.139	0.147

It can be concluded that those AEOs who has high qualification perceived better understanding and know the importance of biotechnology in agriculture. Public education is a major task of extension worldwide, and is one potential strategy to inform diverse audiences about agricultural biotechnology as observed by [16]. If so, extension must take a proactive leadership role and formulate innovative strategies to address the issue of transferring the research findings on agricultural biotechnology and educating the end users to adopt innovations on biotechnology. Also, agricultural extension has a great role in improving the linkages between public and private sectors involvement in agricultural biotechnology. Public private partnership is more an effective mechanism for converting the potential of biotechnology in producing products that improve productivity and economic conditions of agriculture sectors [17].

4. CONCLUSIONS AND RECCOMMENDA-TIONS

Based on the study, some differences were found between the existing and expected level of technical competencies in agricultural biotechnology of AEOs in Khyber Pakhtunkhwa province of Pakistan. Their expectations to improve their skills on the biotechnology were high in many aspects. Professional qualification has increased the level of competencies of AEOs where as on the other hand the demographic factors like age, job experience, farming experience training, specialization and the place of origin exhibited no effect on technical competency. The differences between the expected and existing levels in technical competencies in agricultural biotechnology show that the AEOs need in-service training in all competencies of biotechnology. The lowest competency level was observed in the category of knowledge of medicinal plants" possessed by the AEOs and hence indicates the highest gap in competency levels. It is recommended that opportunities should be provided to AEOs to improve their professional qualification and in-service trainings should be offered so that they can update their knowledge of agricultural biotechnology.

DISCLAIMER

This manuscript was presented in the conference Conference name: "47th Croatian and 7th International Symposium on Agriculture".
Conference link:
"http://sa.agr.hr/pdf/2012/sa2012_a0206.pdf"

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Gop. Pakistan Economic Survey 2015-16. Minister of Finance Government of Pakistan, Islamabad, Pakistan; 2016.
2. Ullah R, Khan MZ, Ullah K. Constraints and gap analysis of model farm services center approach. Sarhad Journal of Agriculture. 2016;32(1):29-39.
3. Hera C, Popescu A. Biotechnology and its role for a sustainable agriculture. Romanian Journal of Economic Forecasting. 2011;2:55-63.
4. Wieczorek A. Use of Biotechnology in Agriculture — Benefits and Risks. Cooperative Extension Services, College of Tropical Agriculture and Human Resources, University of Hawai, Manoa. 2003;1-6.
5. Job D. Plant biotechnology in agriculture. Biochimie. 2002;84:1105-1110.
6. James C. Global Status of Commercialized Biotech/GM Crops: ISAAA Briefs No. 34, ISAAA, Ithaca, NY; 2005.

7. Pervaiz U. An Investigation into the Causes of Slow Diffusion of Tube Well Irrigation Technology in NWFP, Pakistan. Unpublished PhD Dissertation. The University of Agriculture, Peshawar; 2009.
8. Kamal T. Role of Agricultural Extension Agents in Enhancing Tomato Production in District Peshawar, Khyber Pakhtunkhwa-Pakistan. M.Sc Thesis. Department of Agricultural Extension Education and Communication, The Univ. of Agri., Peshawar; 2013.
9. Haverland B, Kapila FP. Technological aspects of extension service in developing countries. Instt. of Tropical & Subtropical Agric. Czech Univ. of Agric. Prague. 2000; 33:3-9.
10. Khan AM. Restructuring of the agricultural department in NWFP. Report. Committee for Restructuring of the Agric. Deptt. in NWFP to the Chief Minister NWFP, Peshawar. 1998;8-14.
11. Haque UI. Uplift of landless poor through agricultural reforms: WB. Dawn Econ. & Business Rev. 29 April- 5 May. 2002;1-6.
12. Khan MZ, Nawab I, Khattak, Mahfooz S. An investigation into professional and technical competencies of AEOs in NWFP. Sarhad. J. of Agric. 2008;24(1):145-149.
13. World Bank Report. World Development Report. 2008;173.
14. Akinnagbe OM, Ukaegbu EO, Saddiq OAB. Role of agricultural extension services in generation and dissemination of agricultural biotechnology in Abia State, Nigeria. African Journal of Biotechnology. 2013;12(6):554-562.
15. Penn JB. Agricultural biotechnology and the development world. U.S. Society and Values. An Electronic Journal of the United States Department of State. 2003;8:3.
Available:http://www.usinfo.state.gov/journals/ites/0903/ijee/Chassy.htm
16. Davis K, Irani T, Payson P. Going toward in education on agricultural biotechnology: Extension's role internationally. J. Int. Agric. Ext. Educ. 2004;11(1):25-34.
17. Seyed JH, Somaieh BN, Maryam ON. Factors influencing the participation of private sector in developing agricultural biotechnology of Iran. Ann. Biol. Res. 2011;2(4):136-142.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/16748