ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

AN INVESTIGATION OF AGRONOMIC CAPABILITIES OF AGRICULTURE OFFICERS: A CASE STUDY FROM KHYBER PAKHTUNKHWA

Shah Saud[1] and Muhammad Zafar Ullah Khan[1],

1. Department of Agricultural Extension Education and Communication, The University of Agriculture Peshawar, Pakistan19120; (shah.saud1991@aup.edu.pk)
2. Department of Agricultural Extension Education and Communication, The University of Agriculture Peshawar, Pakistan19120 (drzafar@aup.edu.pk)

Corresponding Author: shah.saud1991@aup.edu.pk

ABSTRACT

Keeping in view the role of extension services in uplifting the socio-economic condition of the farming community is very important and crucial. The study was steered to assess the professional capabilities of Agriculture Officers (AOs) working in the Agriculture Extension Department Khyber Pakhtunkhwa to prioritize the training needs capabilities of the respondents in the study area. All the AOs (79) were interviewed from all districts of Khyber Pakhtunkhwa. The respondents were interviewed through a validated and pre-tested interview schedule and the outcomes presented in the form of graphs, tables and percentages. To get the desired objectives Linear Regression Model, Standard Deviation (SD), Mean, and Paired Sample t-test were used. Outcomes disclosed that maximum (49.4%) respondents were recorded in the age category of 31-40 years. Educational level of AOs showed that mainstream (79.7%) of the respondents had master qualifications. The results regarding In-Service and Pre -Service Training availed by the AOs showed that majority (81.0%) claimed that they didn't avail any In-Service training. The possessed mean in agronomic capabilities of AOs was recorded 3.23 against the mean required of 4.56. Based on the mean difference, AOs ranked, Coordination with seed companies, use of fermenter and know-how of advance knowledge of various macro & micro nutrients required for crop production at higher ranks of training needs highlighting a mean difference of -2.02, -1.75 and -1.70 respectively. Similarly, determination of appropriate techniques to reduce cost of production and familiarity with high efficiency irrigation system were ranked at 4rth and 5th order of training needs with a mean difference of -1.69 and -1.62 respectively. The statistical data measured from the regression analysis revealed that age had a positive and statistically significant effect on agronomic capabilities of the AOs. It means that with the increase in age, the ability in agronomic capabilities would increase. So, it is recommended that more in-service training courses need to be conducted that will add skilled manpower to the system. AOs need to be equipped and trained with required technology tools so they can perform their duty efficiently. Moreover, they should spend specified day in the field instead of offices and farmer should know these days for their easy access to solve the farmer problems effectively and efficiently.

Key Words: Agriculture Officers, Agronomic, Capabilities, Training Needs

I. INTRODUCTION

1.1 Agriculture in Developing Countries

Agriculture sector play key role in national growth as it contributes in a variety of ways, providing raw materials to industries, ensuring food security, and foreign exchange earnings not only through cash crops but provide services to a larger section of the inhabitants (Rehman *et al*., 2012). Climate change and food insecurity are the two pressing issues of the present era that can be addressed by expanding the agricultural sector (OECD and FAO, 2009). Agriculture has the potential to provide a significant contribution in terms of employment Gross Domestic Product (GDP), and poverty reduction in rural regions in many parts of the world (Ntale and Litondo, 2013). Because of the substantial percentage of poverty-affected farmers, agriculture is a key necessity for rural and remote communities (Muhammad *et al*., 2023).

Pakistan, like other emerging states, is primarily an agricultural country with massive potential for crop yield, animal, and other agricultural production due to its abundant natural resources. An exceptional climatic condition of Pakistan i.e. deep loams, satisfactory landscape, and water resources, has the potential to attain agricultural sustainability if

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
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appropriately managed (Khan, 2006 and Rehman *et al*., 2011). Agriculture, which consists livestock and crops, is the most important component of Pakistan's economy, accounts for 22.9% to the country's GDP and employees 37.4% of the country's overall labor force, as well as supplying raw materials to a variety of value-added industries. Agriculture's significance as a key source of export profits and a large supply of raw materials to local industry remains critical (GoP, 2025).

Table 1.1 depicted the rabi crops showed higher yield leading to an overall growth of 1.55 percent which rewarded the damages of the kharif crops as result of flood 2022. Similarly, wheat production growth (5.4 percent), maize production (6.9 percent) and sugarcane (2.8 percent) recompense cotton declining growth (41.0 percent) and rice (21.5 percent). Major crops were observed 3.20 percent in overall decline, while the other crops grew by 0.23 due to increased oil seeds production by 53.15 percent. Cotton Ginning share were declined by 23.01 mainly due to low production of cotton crop. Still, this differential gap was managed by the higher yields of other produces. In agriculture, the share of livestock 62.68 percent grew by 3.78 percent as compared to 2.25 percent during last year. The share of forestry was observed 2.23 percent in agriculture that grew at 3.93 percent contrary to 4.07 percent as result of increased timber production. Fishery share 1.39 percent grew at 1.44 percent associated to 0.35 percent of the last year (GoP, 2023).

Table 1.1 Agriculture Growth Percentages in Pakistan

Sector	2017-2018	2018-2019	2019-2020	2020-2021	2021-2022	2022-2023
Agriculture	**3.88**	**0.94**	**3.91**	**3.52**	**4.27**	**1.55**
Crops	4.61	-4.38	6.32	5.83	8.19	-2.49
Major crops	4.27	-8.59	5.24	5.82	5.41	-3.20
Other Crops	4.65	3.62	9.21	7.93	11.93	0.23
Cotton Ginning	8.27	-11.23	-4.06	-13.08	9.22	-23.01
Livestock	3.59	3.65	2.80	2.38	2.25	3.78
Forestry	2.24	7.22	3.36	3.35	4.07	3.93
Fishing	1.57	0.78	0.63	0.73	0.35	1.44

Source: GoP, 2023

Around 60% of Pakistan's rural population is directly dependent on agriculture for their livelihood, since agriculture provides a large part of raw materials for industry and other value-added products. Despite this substantial involvement, agricultural output is among the lowest in the world, and also falls short of the yields achieved by reformist farmers both locally and in other emerging countries (Khatam *et al*., 2013). Farmers' failure regarding adoption of new agricultural technologies, improper & old practices of farming, the non-existence of relevant information and a lack of technical knowledge, all contribute to low yields in Pakistan (Farooq *et al*., 2007). All of these factors can be improved dramatically if modern agricultural technologies are conveyed to farmers through an efficient extension procedure (Abbas *et al*., 2008).

1.2 Role of Agriculture in Pakistan's Economy

The economy of Pakistan is heavily based on agriculture as it contributes 18.9% to GDP and engages 42.3 percent of the workforce in employment. The government of Pakistan is focusing on small and marginalized farmers in order to promote the innovative technology. The agriculture sector's progress is contingent on the exchange of reliable and latest information as it provides base for expanding agricultural production, improving marketing

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
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and distribution tactics. This circumstance demands appropriate farmers' teaching for new and advanced technology, which can only be attained by educating the farming community through non-formal education provided by responsible extension agencies (Khan *et al*., 2008, Rehman *et al*., 2011). The use of enhanced and innovative agricultural technology has the potential to boost productivity in smallholder agriculture by raising the household income of the farming community (Asfaw *et al*., 2012). However, in today's era, extension services emphasize on climate smart agriculture, climate change preparedness, assisting farmers regarding marketing issues and also helps in addressing the general issues of the rural areas like health, food security, malnutrition, education of family, youth empowerment and resource conservation etc. This situation demands that Agriculture Officers should be capable enough to perform their duties efficiently who are considered as significant pillars of the agricultural economy (Sallam and Akram, 2005).

1.7 Significance and Justification of the Study

This study will provide a set of recommendations to the Provincial Agriculture Extension Department of Khyber Pakhtunkhwa and other organizations that will enhance the capabilities of Agriculture Officers. Farmers will be ultimately benefitted when skilled Agriculture Officers contribute their role regarding solution of the problem. distribution of agriculture inputs at district level. Capabilities are the possession of knowledge, expertise and approaches possessed by Agriculture Officers for educating the farming communities for adoption of innovation in the field of agriculture. Due to increasing economic instability, diversified food demand of each home, present climate change and fast fragmentation of land need adjustments for all option of development and content is the cry of the day (Dimelu and Saingbe, 2006).

1.9 Objectives of the Study

Following objectives were set to:

1. Identify the preferences of training needs AOs regarding time and desired methods of in-service training for improvement of their capabilities.
2. Identify the constraints which impede the capabilities of AOs in the study area.
3. Formulate suggestions and recommendations for future improvements and guidelines for policy makers.

III. MATERIALS AND METHODS

This chapter contains important information regarding research techniques applied to investigate the problem under investigation. This chapter include universe of the study, design of the study, data collection techniques, and appropriate statistical approach.

3.1 Universe of the Study

Khyber Pakhtunkhwa Province was the universe of the study and all the AOs of Provincial Agriculture Extension Department were the population of the study. The Khyber Pakhtunkhwa province is positioned to the north west of the country between 31 to 37° North Latitude and 70 to 74° East Longitude with a 10.17-million-hectare geographic area constitutes for 12.8% of Pakistan's total geographic area (Khan, 2017).

3.2 Selection of Respondents

As the current research is census study so all the Agriculture Officers (79) working in the Provincial Agriculture Extension Department Khyber Pakhtunkhwa were interviewed as sample of the study.

3.4 Research Instrument (Interview Schedule)

Focusing on the objectives of the research a well-organized interview schedule was set to collect primary data from all the AOs.

ISSN E: 3006-1466
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CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
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3.5 Validity

Validity confirms that the instrument is accurate as determined by professionals by checking it keeping in view the objective for which it is developed. As precise data collection is the actual results of the research tool with both face and content validity (Wimmer and Dominick, 2003). For this purpose, the interview schedule was referred to the experts of Provincial Agriculture Extension department to check the validity of the instrument and their opinion/suggestions were incorporated.

3.6 Pre-testing of Research Instrument

Considering the significance of pre-testing, the interview schedule was pre-tested on 20 Subject Matter Specialists and Agriculture Officers working in Agriculture Extension Department Khyber Pakhtunkhwa, Pakistan. Moreover, they were interviewed and their responses were the part of data although their pre-testing helped us to modify our interview schedules as per their suggestions.

3.7 Data Collection

The respondents' data were obtained by interacting with them in their offices using personal interview approach. The interview schedule was designed in English, but in the event of contradiction or confusion, the aim and questions were clarified for a fair response accumulation.

3.9 Data Analysis/Analytical frame work

The collected data were analyzed through Statistical Package for Social Sciences (SPSS) version 20. The results obtained were presented in the form of graphs and percentages. Moreover, the following test and Binary Regression Model, Paired Sample t-Test, Mean, and Standard Deviation were used to analyze the data for desired outcomes.

III. RESULTS AND DISCUSSIONS

3.1 Age of the Agriculture Officers

Age is one of the key factors as it affects how new technologies are adopted. Additionally, age has a significant impact on how innovation is disseminated, adopted and diffused (Saud and Khan, 2025). Being an important demographic characteristic, its contribution is much more significant in maturity, however, it cannot be said with assurance that its effect will always be considerable. Therefore, the collection of data is essential in relation to age of the respondents. Data collected from 79 respondents were categorized in three categories as shown in Table 3.1.

Table 3.1 Respondents Distribution Regarding their Age

Agro-Ecological Zones	Respondent's Age (in years)				Total
	22-30	31-40	41-50	50-60	
Central Valley Plain	1 (1.3)	14 (17.7)	5 (6.3)	4 (5.1)	24 (30.4)
Southern Piedmont Plain	3 (3.8)	9 (11.4)	3 (3.8)	4 (5.1)	19 (24.1)
Eastern Mountainous Zone	4 (5.1)	7 (8.1)	5 (6.3)	2 (2.5)	18 (22.8)
Northern Mountainous Zone	2 (2.5)	9 (11.4)	6 (7.6)	1 (1.3)	18 (22.8)
Total	10 (12.7)	39 (49.4)	19 (24.1)	11 (13.9)	79 (100)

Field Survey, 2020-2021
Note: Values in Parenthesis are Percentages

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ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
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CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

The above Table 3.1 highlight that maximum (49.4%) of the AOs were recorded in 31-40 years and minimum (12.7%) were recorded in the age category of 22-30 years of age. Similarly, (24.1%) respondents were in 41-50 years of age while 11.9% were recorded in the category of 50-60 years. Furthermore, in Central Valley Plain the total respondent's percentage recorded was 30.4%, in Southern Piedmont Plain 24.1%, in Eastern and Northern Mountainous Zone the percentage was recorded 22.8% respectively. The results showed that 49.4% of the respondents were found young and energetic if due attention is given in organizing proper training would be easily strewn among the farming community for the development of modern agriculture. Additionally, our results somewhat support those of Demenongu *et al.* (2015), who discovered that 37.6% of the extension workers were in the 31–40 age range. Ladele et al. (2015) reported similar results, stating that roughly 26% and 28% of the respondents, respectively, were over 50 and between the ages of 31 and 40.

3.2 Educational Level of the Agriculture Officers

Education is a system, method or technique through which desirable changes in the behavior of people can be brought about through the adoption of latest technology to improve the farming means and practices. Unfortunately, mostly our farmers are illiterate showing slight interest in new and improved technology. According to Patel (2000), extension agents with higher educational level become more creative and logical thinkers, which eventually leads to the development of their entrepreneurial capabilities.

Table 3.2 Respondents Distribution Regarding their Educational Level

Agro Ecological Zone	Educational Level of the Respondents			Total
	B.SC (Hons)	M.SC (Hons)	PhD	
Central Valley Plain	2 (2.5)	20 (25.3)	2 (2.5)	24 (30.4)
Southern Piedmont Plain	4 (5.1)	12 (15.2)	3 (3.8)	19 (24.1)
Eastern Mountainous Zone	2 (2.5)	15 (19.0)	1 (1.3)	18 (22.8)
Northern Mountainous Zone	1 (1.3)	16 (20.3)	1 (1.3)	18 (22.8)
Total	9 (11.4)	63 (79.7)	7 (8.9)	79 (100.0)

Field Survey, 2020-2021

Note: Values in parentheses indicate percentages

The above Table 3.2 showed that the majority (79.7%) of the respondents had a master qualification and 11.4% were recorded who had bachelor qualification. Similarly, only 8.9% of the respondents were Doctors of Philosophy (PhDs) in their respective field. Furthermore, maximum (25.3%) were in Central Valley Plain following 20.3% in Northern Mountainous Zone who had master qualification. The percentage of master qualification in Eastern Mountainous Zone was found 19.0% while only 15.2% in Southern Piedmont Plain were recorded. It was observed that due to easily access to get university education the educational level of central valley plain is high than the rest. AL-Subaiee*et al.* (2005) that the extension agent who had higher educational level were much satisfied as compared to those whose education level was low.

3.3 In-Service training availed by Agriculture Officers

Agriculture development is mainly concerned with agriculture extension as it provides the latest and timely information to the farming community regarding modern agriculture

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
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practices to improve production and to uplift the standard of living (Msuya *et al*., 2017). In-service training will help agriculture extension agents to become more competent in day-to-day and varied situations evolving in the farming community. In this connection, AOs were asked regarding the trainings and the results highlighted in the following Table 3.3.

Table 4.2.6 Distribution of respondents regarding In-Service training availed by them

Agro Ecological Zone	In-Service Training		Total
	Yes	No	
Central Valley Plain	5 (6.3)	19 (24.1)	24 (30.4)
Southern Piedmont Plain	6 (7.6)	13 (16.5)	19 (24.1)
Eastern Mountainous Zone	2 (2.5)	16 (20.3)	18 (22.8)
Northern Mountainous Zone	2 (2.5)	16 (20.3)	18 (22.8)
Total	15 (19.0)	64 (81.0)	79 (100.0)

Field Survey, 2020-2021

Note: Values in Parenthesis are Percentages

The above Table 4.2.6 depicts the results regarding in-service training availed in which the majority (81.0%) of the AOs claimed that they didn't avail any in-service training while (19.0%) of the respondents were prerogative with getting in-service training from the respective departments. In the central valley plain 24.1% of the respondents claimed that they didn't gain in-service training while 6.3% of the respondents were agreed with the provision of training during the service. Similarly, in southern piedmont plain 16.5% of the respondents claimed that they didn't avail in-service training while 7.6% of the respondents were agreed with the provision of training during the service. It is apparent from the above findings that mainstream of agriculture officers didn't avail proper in-service training related to their field of service from any government and non-government organizations. The results are somehow similar to that of Farooq *et al*., (2010) who concluded that agriculture extension agents need training for the improvement and management of farm practices to overcome the emerging problems.

3.4 Required and Possessed Level of Agronomic Capabilities of Agriculture Officers

Agronomic practices are the basic practices which have direct impact on the crop production. Hence, the entire agricultural professional needs to be well aware about the modern production technology. Appropriate agricultural and extension education are the key factor for boosting agricultural potential in rural areas and to meet the national food requirements. The data regarding the required and possessed level of Agriculture Officers in agronomic capabilities are presented in Table 3.4.

Table 3.4 Rank, Mean and SD of Technical Capabilities (Agronomic) of Agriculture Officers

S. No.	Capability Statement	Possessed Level			Required Level		
		Mean	SD	Rank	Mean	SD	Rank
1	Know-how of organic farming	3.56	0.65	1	4.88	0.31	1
2	Understand ways to improve fertilizer use efficiency	3.56	0.71	1	4.55	0.54	12
3	Knowledge about making compost	3.55	0.65	2	4.45	0.57	18
4	Awareness regarding cultivars &	3.49	1.01	3	4.65	0.52	6

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	hybrid seeds						
5	Understand nutrient contents of various fertilizers	3.45	0.67	4	4.58	0.56	10
6	Know-how of seed treatment with fungicide	3.41	0.82	5	4.53	0.63	14
7	Select various profitable crops	3.37	0.66	6	4.62	0.62	8
8	Awareness regarding tonics (nutrients) used to fulfill nutrient deficiency in various crops	3.37	0.81	6	4.54	0.50	13
9	Knowledge of selecting best seed for optimum crop production	3.37	0.68	6	4.58	0.54	10
10	Knowledge regarding seed production	3.35	0.89	7	4.53	0.55	14
11	Familiarity about the factors responsible for post-harvest losses	3.31	0.74	8	4.64	0.53	7
12	Diagnose causes of low yield of different crops	3.31	0.85	8	4.81	0.45	2
13	Identify ways to enhance water holding capacity of the soil	3.31	0.68	8	4.54	0.55	13
14	Understanding of hybrid & open pollinated seed, Advantages & Disadvantages	3.31	0.99	8	4.44	0.85	19
15	Practice of fumigation in seed store	3.25	0.80	9	4.46	0.61	17
16	Awareness about the factors affecting water requirements of various crops.	3.24	0.95	10	4.50	0.63	15
17	Understand crop management practices and its effect on irrigation requirements	3.24	0.86	10	4.34	0.52	21
18	Understanding of soil, water, crop environment relationship	3.22	1.09	11	4.60	0.49	9
19	Understand moisture content required for seed germination	3.20	0.77	12	4.54	0.55	13
20	Identify ways to improve water use efficiency	3.17	0.78	13	4.45	0.57	18
21	Familiarity with scientific storage of seed	3.15	0.86	14	4.56	0.54	11
22	Understand adverse effect of water pH on crops	3.12	1.00	15	4.39	0.66	20
23	Familiarity with high efficiency irrigation system	3.10	0.84	16	4.72	0.45	4
24	Determine appropriate methods to minimize cost of production	3.03	0.91	17	4.73	0.49	3
25	Know-how of advance knowledge of various macro & micro nutrients required for crop production	2.98	0.92	18	4.69	0.53	5
26	Understand Agro-climatic requirements of different crops	2.93	0.64	19	4.48	0.50	16

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ISSN P: 3006-1458
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27	Use of fermenter	2.69	1.10	20	4.45	0.55	18
28	Coordination with seed companies	2.50	1.02	21	4.53	0.55	14
Overall Mean		**3.23**			**4.56**		

Source: Field Survey, 2020-2021

Results in Table 3.4 highlighted that Agriculture Officers (AOs) possessed know-how of organic farming & understand ways to improve fertilizer use efficiency with a mean value of 3.56 followed by knowledge about making compost with a possessed mean of 3.55 against the mean required 4.88 and 4.45 respectively on the topmost rank order. It was due to the fact that AOs regularly interact with the rural communities in the field and were aware of fertilizers application methods, that's why these aptitudes were possessed by the respondents at topmost. The third-ranked capability at possessed level was awareness regarding cultivars & hybrid seeds with a mean possessed 3.49 against the mean required 4.65.

Capabilities of AOs in understanding nutrient contents of various fertilizers and know-how of seed treatment with fungicide were ranked at 4th and 5th order possessed a mean of 3.45 and 3.41 in contradiction to the mean required 4.58 and 4.53 respectively. It was found during the casual discussion, that the respondents were aware regarding composition of fertilizers and seed treatment as they were consistent in its application for the attainment of goals and objectives. The sixth-ranked capability at the possessed level was found in knowledge of selecting the best seed for optimum crop production & awareness regarding tonics (nutrients) used to fulfill nutrient deficiency in various crops with a mean of 3.37 against the mean required was 4.58 and 4.54 respectively on the same rank. At possessed level knowledge regarding seed production, understanding of hybrid & open; familiarity about the factors responsible for post-harvest losses & diagnose causes of low yield of different crops, practice of fumigation in seed store, awareness about the factors affecting water requirements of various crops & understanding of crop management practices, its effect on irrigation, understanding of soil, water, crop environment relationship were ranked 7th, 8th, 9th, 10th, and 11th with a mean possessed 3.35, 3.31, 3.25, 3.24 and 3.22 against the mean required 4.53, 3.81, 4.46, 4.50 and 4.60 respectively. The AOs were of view that due to rare use of these proficiencies in their services they are somewhat reasonably competent in the aforementioned abilities.

Similarly, the capabilities at the possessed level ranked 12th, 13th as understand moisture content required for seed germination and identify ways to improve water use efficiency were found with a mean of 3.20 and 3.17 against the required mean 4.54 and 4.45 respectively. The results further revealed that understanding scientific storage of seed, understanding the adverse effect of water PH on crops, and familiarity with high-efficiency irrigation system were at 14th, 15th, and 16th rank order with a mean possessed 3.15, 3.12, and 3.10 against the mean required 4.56, 4.39 and 4.72 respectively. Furthermore, the capabilities at the possessed level ranked 17th, 18th as determine appropriate methods to minimize the cost of production and know-how of advanced knowledge of various macro & micronutrients required for crop production were found with a mean of 3.03 and 2.98 against the required mean 4.73 and 4.69 respectively. Lastly, the results further revealed the lowest capabilities of AOs to understand agro-climatic requirements of different crops, use of fermenter and coordination with seed companies were ranked at, 19th, 20th and 21th order with mean (possessed) of 2.93, 2.69, and 2.50 against the required mean of 4.48, 4.45 and 4.53.

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ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
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3.5 Training Needs in Technical (Agronomic) Capabilities

Based on the data presented in Table 3.5, the most important training need reported was coordination with seed firms, with a mean difference of -2.02 indicating a ($P \leq 0.05$) significant difference between the required and possessed level. The use of fermenters ranked second in terms of training needs representing a mean difference of -1.75 followed by advanced knowledge of the various macro- and micronutrients needed for crop production, with a mean difference of -1.70. These training needs are on higher ranks because of poor coordination among seed companies, lack of technical skills regarding fertilizer application and to know requirements of plant/crops for better production.

Training needs in capabilities of familiarity with high-efficiency irrigation system, understand agro-climatic requirements of different crops and diagnose causes low yield of were at 5th, 6th and 7th ranked order with a mean difference of -1.62, -1.54 and -1.49 respectively. Familiarity with scientific storage of seed was ranked 8th of training need with a mean difference of -1.41 followed by understanding of soil, water difference of -1.41. Crop environment relationship stood at 9th rank, understanding moisture content for seed germination at 10th rank, identifying means to improve water use efficiency at 11th rank and awareness about factors affecting water requirements of various crops at 12th rank with a mean difference of -1.37, -1.34, -1.27, and -1.26 respectively.

Similarly, practice of fumigation in seed store (mean difference=-1.21), knowledge regarding seed production (mean difference=-1.17), awareness regarding cultivars & hybrid seeds and awareness regarding tonics (nutrients) used to fulfill nutrient deficiency in various crops (mean difference=--1.16, understanding nutrient contents of various fertilizers (mean difference=-1.12) and know-how of seed treatment with fungicide were ranked at 13th, 14th, 15th, 16th, and 17th order in training need. Lastly, understand ways to improve fertilizer use efficiency (mean difference=-0.98, t-value=-10.58), knowledge about making compost (mean difference=-0.89, t-value=-10.73) were ranked at 18th and 19th in training need of Agriculture Officers. These results can also be seen with a cursory look at the radar graph in Figure 3.1.

Table 3.5 Training Needs based on Mean Difference Regarding Technical (Agronomic) Capabilities of Agriculture Officers

S.No.	Capabilities statements	Level Possessed	Level Required	Mean Difference	Rank	t-value
1	Coordination with seed companies	2.50	4.53	-2.02	1	-19.28**
2	Use of fermenter	2.69	4.45	-1.75	2	-14.68**
3	Know-how of advance knowledge of various macro & micro nutrients required for crop production	2.98	4.69	-1.70	3	-18.20**
4	Determination of appropriate techniques to reduce cost of production	3.03	4.73	-1.69	4	-16.30**
5	Familiarity with high efficiency irrigation system	3.10	4.72	-1.62	5	-16.07**
6	Understanding Agro-climatic conditions for various crops	2.93	4.48	-1.54	6	-19.77**
7	Diagnose causes of low yield of different crops	3.31	4.81	-1.49	7	-13.29**
8	Familiarity with scientific storage of seed	3.15	4.56	-1.41	8	-12.66**
9	Understanding of soil, water, crop	3.22	4.60	-1.37	9	-10.39**

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	environment relationship					
10	To recognize moisture content needed for germination of seeds	3.20	4.54	-1.34	10	-12.61**
11	Identify ways to improve water use efficiency	3.17	4.45	-1.27	11	-15.50**
12	Awareness about the factors affecting water requirements of various crops.	3.24	4.50	-1.26	12	-11.92**
13	Recognizing hostile effect of water pH on crops	3.12	4.39	-1.26	12	-11.75**
14	Practice of fumigation in seed store	3.25	4.46	-1.21	13	-12.17**
15	Knowledge regarding seed production	3.35	4.53	-1.17	14	-11.08**
16	Awareness regarding cultivars & hybrid seeds	3.49	4.65	-1.16	15	-9.92**
17	Awareness regarding tonics (nutrients) used to fulfill nutrient deficiency in various crops	3.37	4.54	-1.16	15	-11.35**
18	Understand nutrient contents of various fertilizers	3.45	4.58	-1.12	16	-12.17**
19	Know-how of seed treatment with fungicide	3.41	4.53	-1.11	17	-10.93**
20	Know how to improve fertilizer use efficacy	3.56	4.55	-0.98	18	-10.58**
21	Knowledge about making compost	3.55	4.45	-0.89	19	-10.73**

** represents significance at 5% level of probability
Source: Field Survey, 2020-2021

ISSN E: 3006-1466
ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
Vol.03 No.03 (2025)

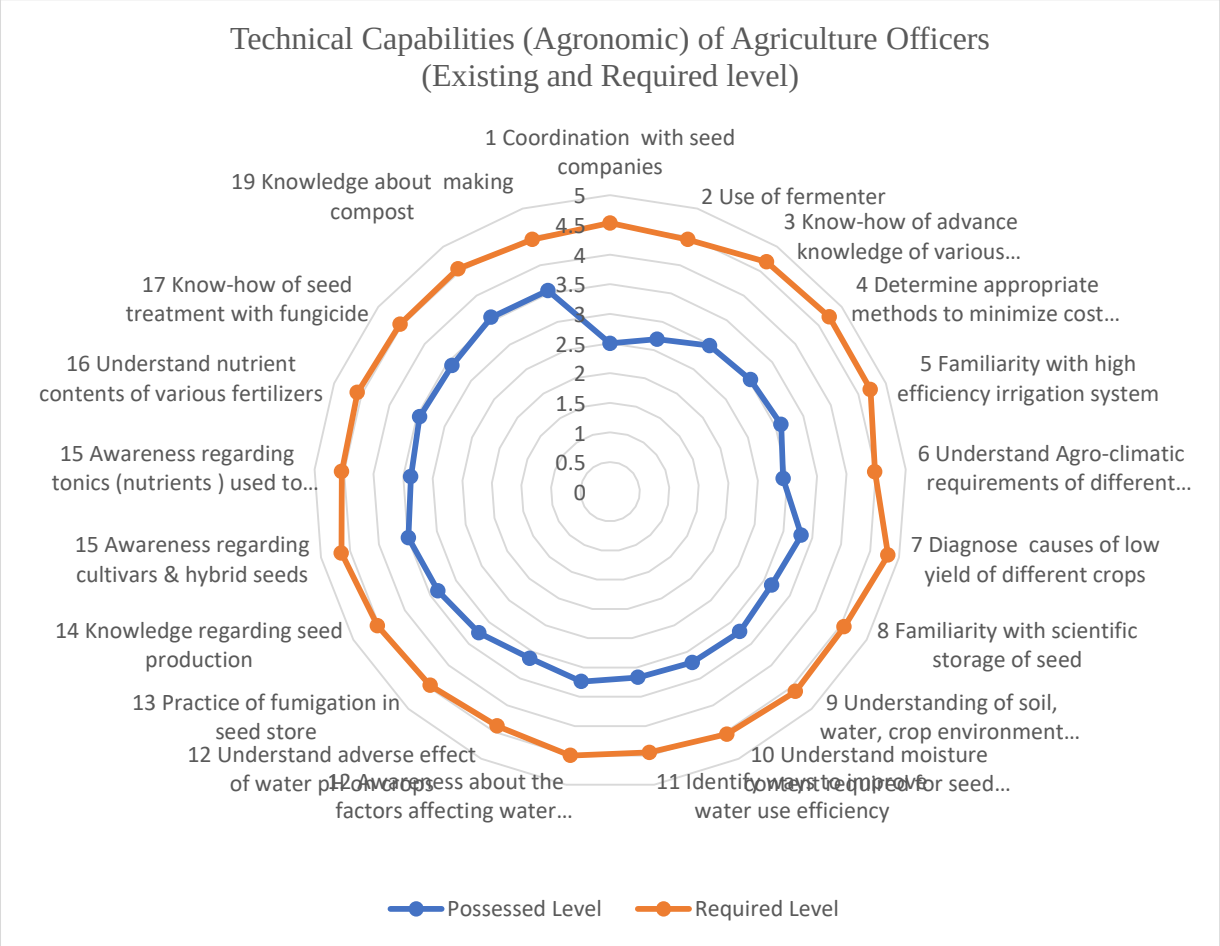

Fig. 3. Radar Graph regarding Technical Capabilities (Agronomic) of Agriculture Officers

5.2 Conclusions

Agronomic capabilities among agriculture officers in Khyber Pakhtunkhwa discloses significant understandings into the strengths and weakness within the extension services sector. The findings highlight that while many officers demonstrate a sound understanding of core agronomic principles, including know-how of organic farming, understand ways to improve fertilizer use efficiency and knowledge about making compost there remain critical extents demanding further development particularly in modern techniques such as diagnose causes of low yield of different crops, determine appropriate methods to minimize cost of production, familiarity with high efficiency irrigation system, know-how of advance knowledge of various micro & macro nutrients required for crop production.

Furthermore, the study highlights the necessity of ongoing professional development, hands-on training courses, and institutional assistance to improve officers' effectiveness and flexibility in the face of changing agricultural problems. To achieve sustainable agricultural growth, increase farmer productivity, and guarantee food security, these capacities must be strengthened. In order to close the gaps and develop a staff that is more capable and responsive, it is recommended that the Agriculture Extension Department take a strategic approach centered on resource allocation, performance monitoring, and targeted capacity-building.

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ISSN P: 3006-1458
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
CJSSR
CONTEMPORARY JOURNAL OF SOCIAL SCIENCE REVIEW
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