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Evaluating and promoting modern farming practices knowledge through Farmers' Field Schools (FFS) in Thar

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Abstract

This study was carried out during July to October, 2021 in four villages (Bhadi, Bhenio Bheel, Bhinyot, and Bhujbar) of the southern area Thar of district Umerkot, where Farmer Field Schools have been established and modified to suit the farmer's conditions. A total of 80 participants (74% female and 26% male) of the four FFSs were asked questions mentioned in the questionnaire before starting and after the end of all sessions. A total of 12 sessions were conducted in four months of the whole cycle of different indigenous crops (pearl millet, guar, sesame, and mung bean) cultivated in each school by two cropping methods (conventional and modern). At the maturity of crop plant height, the number of leaves per plant, seed, and straw yield was recorded. Farmers actively participated during all sessions as learning processes based on experimentation and learning by doing. During the FFS sessions, farmers achieved good knowledge. Out of the total participants, about 49, 31, 36, 61, 63, and 68% gave more than 75% feedback related to land preparation, variety selection, sowing methods, cultivation and cultural practices, agricultural inputs, and harvesting practices, respectively. Results related to growth parameters like plant height (cm) and number of leaves per plant, the higher plant growth were recorded in the FFS plots with the modern farming method used. However, seed and straw yield (kg ha-1) was also higher in the FFS plot as compared to the conventional method of farming. A plant grown in FFS plots with modern farming method received 26, 29, 24 and 35% more yield in seed and 21, 45, 8 and 17% more in straw yield of pearl millet, guar, sesame, and mung bean, respectively as compared to the conventional method of farming. In Thar region with a low rural literacy rate especially females, this approach of FFS learning is a better tool for obtaining good yields from crops and ensuring food security.

Keywords: Farmers Field School, Knowledge, Modern practices, Thar

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1. INTRODUCTION

Globally, smallholder farmers of backward areas like Thar are facing the problem of getting modern agriculture knowledge. Therefore, it is an important challenge to develop a sustainable approach for extending the agriculture knowledge among them[1]. For facing these types of problems, various techniques have been utilized for enhancing per acre crop yield in Pakistan[2]. Farmer Field School (FFS) is a participatory approach learning method by involving the people whom they can exchange knowledge with each other[3]. In 1995, the first FFS training took place in Ghana, Africa with contestants from Ivory Coast and Burkina Faso. However, the master trainer bought from the Philippines for facilitating the participants[4].

Recently, this approach of FFS used in different countries of the world by creating the environment of "learning by doing" strategies. Different development organizations like FAO have been trying to promote FFS in more than 90 countries for addressing challenges in technical areas at a wide range level[5]. As this program extended in other countries of the world, many people learn at the levels and many master trainers or facilitators are easily available at the regional level. FFS is designed on the basic principles that make it a better hands-on extension approach. The basic principle of FFS is the emphasis on growing a healthy crop, with minimum interruption of the agro-ecosystem[6].

This approach of FFS is time bound activity (one season or one crop cycle) used for getting direct observation in the field by encouraging easiness for taking the decisions. Observation can be attempted through FFS during the standing crops i.e., soil, irrigation water, agricultural inputs and different mechanical practices doing from cultivation to harvesting. Farmer Field Schools are not only the experimental based, but it present space for practical learning of farmers' groups[7]. To improve the existing knowledge of the farming community for sustainable agricultural production, FFS gives an initial knowledge platform to the farmer's group through a technical sound person (facilitator), participatory approach, and agro-ecosystem where participants can share their ideas, experiences, skills, and knowledge[8]. Likewise, elaborated different essential elements or core principles of FFS are group of farmers (20 to 30), field, facilitator, curriculum, comparative experiments, agro-ecosystem analysis, group dynamics, special topics, program leader, and financing[9,10].

In Pakistan, the sandy arid area of Thar is situated on southern east side. The agriculture of this area is totally dependent on rainfall and farmers are not using modern systems or technologies due to the lack of awareness. Farmers' field school is an efficient method or approach toward an extension for promoting rural farming community[11,12]. Pearl millet and cluster beans are major indigenous crops of Thar.

The cropping trend in this area is mostly a mixed cropping system i.e. various crops' seeds are sown in one go by mixing the seeds together. While, the duration of crops varies as a mixture of long and short duration crops, it makes the possibility of disturbance in water distribution, proper plant to plant distance, and harvesting practices. In addition to the strategies development of individual crop cultivation, the proper irrigation and leveling of the soil is also important in the area of Thar. In Pakistan, this approach of FFS is not still common in some backward areas like Thar under that type of learning practices. The different strategies for the development of modern practices in agriculture and knowledge about the new technology are very important to extend to the local farmers through the wise methods and approaches of FFS. Therefore, the goal of this study was to evaluate the knowledge of modern farming practices of the farming community of Thar through FFS approaches and the compare modern agriculture practices and old methods of farming in Thar.

2. MATERIALS AND METHODS

2.1 Data Sources

This study aims to evaluate the farming community's awareness regarding to modern agricultural practices in Thar through the Farmers' Field School approach. A total of four Farmers' Field Schools (FFS) and one in each village (Bhadi, Bhenio Bheel, Bhinyot and Bhujbar) were established in Thar area of taluka & district Umerkot. Twenty interested smallholder farmers including both genders (male and female) were selected

for each FFS and the total participants were 80 in four FFS. This study consisted of two parts, one on the personal information of all farmers in addition to related knowledge about crops before and after the FFS sessions and another on the growth and production of four indigenous crops (Pearl millet, guar, sesame, and mung bean) with response to conventional and modern methods of cultivation.

2.2 Personal information of farmers

Before starting the school, a questionnaire was developed to get the information from each farmer at the time of the first and last session. Personal information i.e. name, sex, age, marital status, and education were asked from each farmer on the generated questionnaire during the registration of farmers and the first session of FFS.

2.2.1 Motivation or interest in learning (Yes/ No)

The motivation or interest in learning of farmers was noted during the sessions. The facilitator asked all the participants whether they were motivated or interested in the sessions or not.

2.2.2 Farmers' knowledge level (before and after FFS sessions)

After getting the personal information, some basic questions were also asked for the farmers to analyze their knowledge level about the crops and their cultivation practices before and after the FFS sessions. All questions were related to the following major fields like land preparation, variety selection, sowing method, cultivation practice, cultural practice, agricultural inputs, and harvesting. Randomly, five questions were asked related to each field of cultivation practices from all farmers. For measurement of the accurate level of farmers' knowledge by giving 0 to 4 score for a specific field and the detail of the score is presented in (Table 1). After getting the score data in the prescribed format, the data was put into a table and made graphs for show the increasing or decreasing levels of farmers' knowledge, and finally interpreted all the data.

Table 1. Score assigned for knowledge of farmers and its description.

Score	Knowledge
0	Unaware/ not replied
1	Just listen, listen but not given specific answer
2	50% knowledge, 50% answered the questions
3	75% knowledge, 75% answered the questions
4	100% knowledge, answered all the questions

2.2.3 Marketing information

There are different options for practiced market and where they sold out crop produce. All FFS's farmers were asked where they sold their seed and straw produced from all crops either at the village, taluka, district HQ, another district, or other province level.

2.3 Field plot and data

A host farmer was selected in each school and all participants were involved in the selection of land (sandy loam in texture) and cultivation practice of crop for 12 sessions (three sessions per month). Two factorials randomized completely block design (RCBD) were used for this study. A total of eight treatments with four indigenous crops (pearl millet, guar, sesame, and mung bean) were cultivated with two methods (conventional and modern) methods. Each plot was replicated in four FFSs. The old methods were practiced in conventional type cultivation while mulching, proper weeding, and applying 1 wheel-barrow of FYM in a plot of a square meter for each crop included in the modern method. At the maturity of crops, parameters related to growth (plant height and number of leaves) and yield (seed and straw yield) were recorded.

2.4 Statistical analysis

The personal information and the knowledge obtained during the FFS sessions by participants were calculated through MS Excel, made graphs, and interpreted. In addition to that collected plant data with two factors (methods and crops) in response to growth and yield of crops were statistically analyzed (sum of square, degree of freedom, mean square, factor and significance between methods, crops, and method*crops) with a univariant general linear model (given tables in Appendix 2) through the Statistical Package Software for the Social Science (SPSS)[13].

3. RESULTS AND DISCUSSIONS

Personal information of the individual FFS farmers present in (Table 2) that all participants were in the age between 24 and 60 and the average age was 40.6 ± 10.1. All 80 FFS participants (59 female and 21 male) were married and motivated, during the sessions. However, only four farmers (2 female and 2 male) had the primary level of education and other all farmers were illiterate. However, the minimum level of education was illiterate mentioned zero and a higher level of education was up to 5th class (5), while the average education was 0.24±1. However, all FFS farmers had some area of land from the range of 2 to 12 acres (small farmers) with an average of 7.02±2.79 acres. While 19, 24, 18, and 19 farmers cultivated millet (2-10 acres), guar (2-10.5 acres), sesame (2.5-12 acres), and mung bean (2-10 acres), with an average of 4.79±2.39, 6.48±3.25, 6±3.16 and 5.5±2.4, respectively. All participants during all the sessions were very much interested and motivated to take the sessions. They enjoyed the sessions and commented that through these types of sessions of FFS were helpful and understandable for illiterate and less educated persons.

Table 2. Personal information, total land holding with cultivated individual crops and motivation of FFS farmers.

Particulars	Min	Max	Average	SD
Age	24	60	40.6	10.1
Education level	0	5	0.24	1
Total land holding of FFS participants	2	12	7.02	2.79
Cultivated under millet crop in acre (n=19)	2	10	4.79	2.39
Cultivated under guar crop in acre (n=24)	2	10.5	6.48	3.25
Cultivated under sesame crop in acre (n=18)	2.5	12	6	3.16
Cultivated under mung bean crop in acre (n=19)	2	10	5.5	2.4

Note: All FFS participants n=80 (59 female and 21 male) was motivated for taking sessions and married.

Genderwise participants during the FFS session are given in (Fig. 1). Out of total 80 FFS farmers, 74% females and only 26% males were interested to participate in the FFS. These participated FFS farmers divided into the different age classes on each 21-30, 31-40, 41-50, and 50-60 years, where there was a higher ratio of female participants 84, 75, 81, and 53%, respectively.

Land preparation is one of the basic cultivation practices and its knowledge gained by the FFS participants is given in (Fig. 2). In this learning only four farmers were unaware, 37 had just listened, 34 had little knowledge and 5 had 50% knowledge about the land preparation before FFS sessions. After the FFS sessions, no one said that they were unaware, only one in a class just listened and 19 farmers had still little knowledge about the practice. However, about 4, 36, and 15 farmers promoted their knowledge as they were unaware, just listening and had little knowledge about the land preparation, respectively. While, 20, 21 and 14 gained their knowledge and came in the class of 50, 75, and 100% knowledge about practice, respectively.

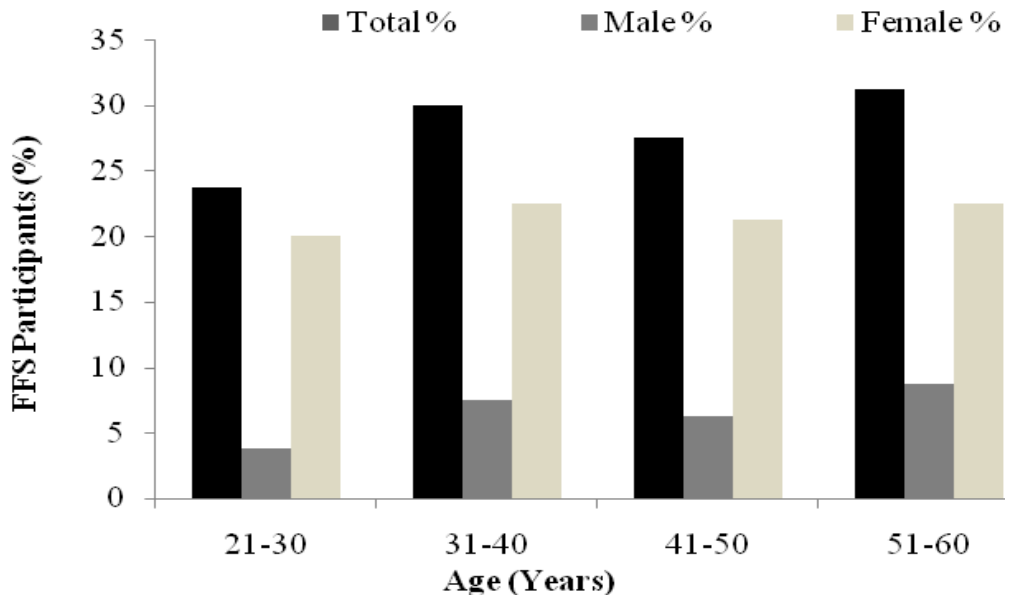

Fig. 1. Gender wise participants during FFS sessions falls in the various age classes

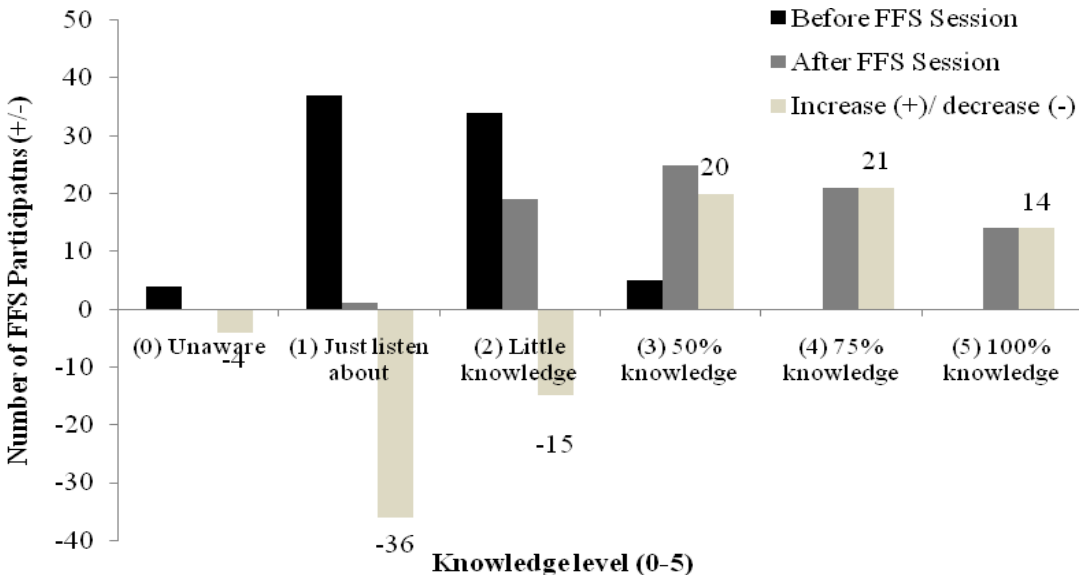

Fig. 2. Evaluating and Promoting knowledge of FFS participants about land preparation before and after FFS sessions

The selection of a variety of different crops is also a very important tool for getting more yield from crops and its result in gained knowledge present in (Fig. 3). Before FFS sessions about 6, 32 31 and 1 were in 0, 1, 2, and 3 classes, respectively. Whereas, no one were in class 4 and 5 before FFS sessions. As FFS sessions were completed the results showed that about 31, 32, 25, and 12 farmers gained their knowledge and met the criteria of class 2, 3, 4, and 5, respectively.

Crop sowing is the initial practice of crop management after which other management practices are followed. The result related to the increase and decrease in the knowledge of about sowing method (Fig.

4). Out of 80 farmers of FFSs, only 3 were not aware about the method of sowing. However, the majority of 33 and 30 farmers only just listened about it and had little knowledge, respectively.The rest of six farmers had 50% knowledge about crop sowing methods before FFS sessions. As farmers participated in all sessions of FFS regularly and the majority of farmers, 22, 29, and 15 had 50%, 75% and 100% knowledge related to the sowing method, respectively. Only the rest of the 8 farmers fall into the class with little knowledge about crop sowing.

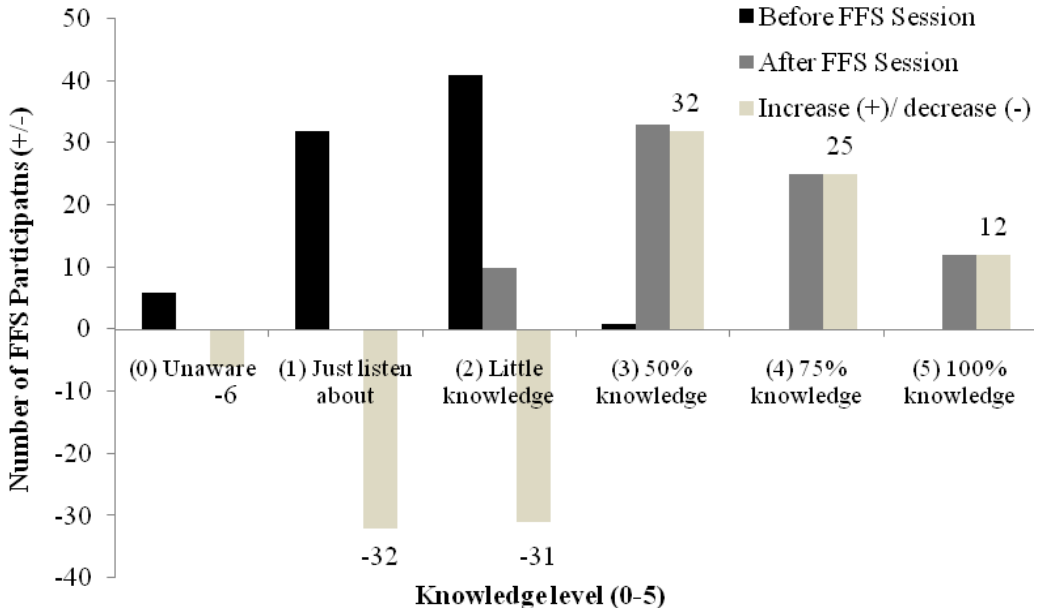

Fig. 3. Evaluating and Promoting knowledge of FFS participants about variety selection of different crops before and after FFS sessions

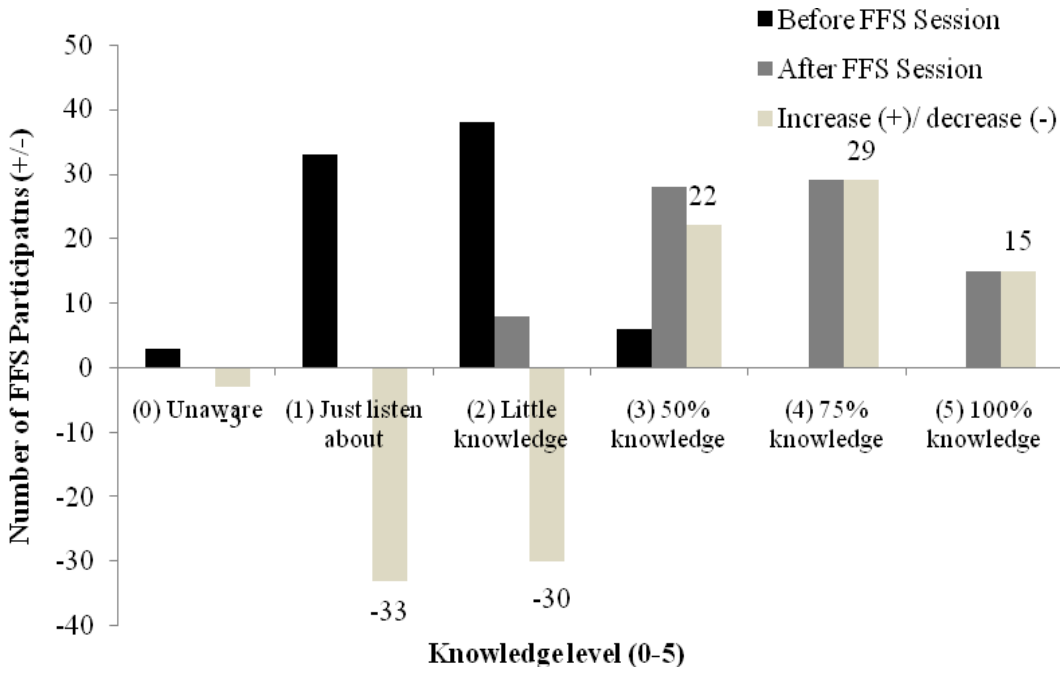

Fig. 4. Evaluating and Promoting in knowledge of FFS participants about crop sowing method before and after FFS sessions

Cultivation and cultural practices include land ploughing, land leveling and weeding. Participated farmers had related knowledge and promoting their knowledge during the FFS session is shown in (Fig. 5). Out of total 1, 35, 39, and 4 farmers had unaware, just listened, little knowledge, and 50% knowledge about cultivation and cultural practices. As they took all the FFS sessions and increased their knowledge related to this practice, no one told to them that they were unawared about this practice and just listened to it, 1 only had little knowledge, 26 had 50% knowledge, 34 had 75% knowledge and 15% had complete knowledge about this practice. However, before the FFS session all farmers had below 50% knowledge about it and about 61% of farmers improved their knowledge and got 75% complete knowledge.

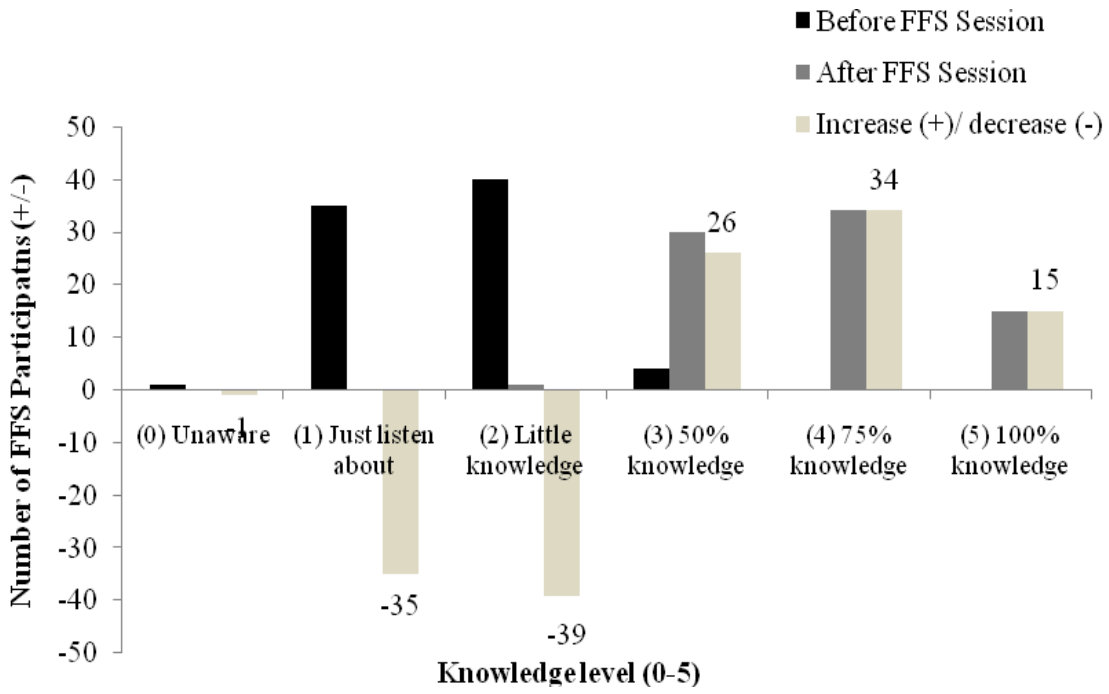

Fig. 5. Evaluating and Promoting in knowledge of FFS participants about crop cultivation and cultural practices before and after FFS sessions

Agricultural inputs like seeds, fertilizers, and pesticides are used to grow and protect crops. In barani agriculture, only seeds are used in regards to input and no any other inputs like fertilizer and pesticide used for crops. The knowledge of FFS participants about agricultural inputs before and after the FFS session is given in (Fig. 6). Before the FFS sessions most of the farmers were unaware (3), just listened (36), little knowledge (38), and only 2 had 50% knowledge. After the FFS session facilitator gave them knowledge about it and 27 farmers got 50% knowledge, 34 got 75% knowledge and about 16 got 100% knowledge. However, only one reached up to the little knowledge.

Crop harvesting and threshing are very important practices after the maturity of the crop and the knowledge increase or decrease of FFS participants about harvesting during FFS sessions is shown in (Fig. 7). About 3, 33, 41 and 3 farmers were unaware, just listened, little knowledge and 50% knowledge about practice, respectively before FFS sessions. After completion of the FFS session during the feedback session, all farmers had more than 50% knowledge and no one was below that. Out of a total 23, 33, and 21 had 50%, 75% and 100% knowledge, respectively after FFS sessions.

The effect of conventional and modern methods on plant height is present in (Fig. 8). The results indicated the effect of methods and different crops were highly significant ($p< 0.05$), but the interaction of methods x different crops was non-significant for plant height. Plants grown in the FFS plot with the modern method were significantly ($p< 0.05$) taller than of conventional method plots of all crops except sesame. The maximum height was noted of pearl millet (194 cm), followed by sesame (129 cm), guar (103 cm), and

mung bean (48 cm) cultivated in the FFS plots with modern methods. The shorter plants were found of pearl millet (158 cm), sesame (123 cm), guar (89 cm), and mung bean (41 cm) in the conventional method.

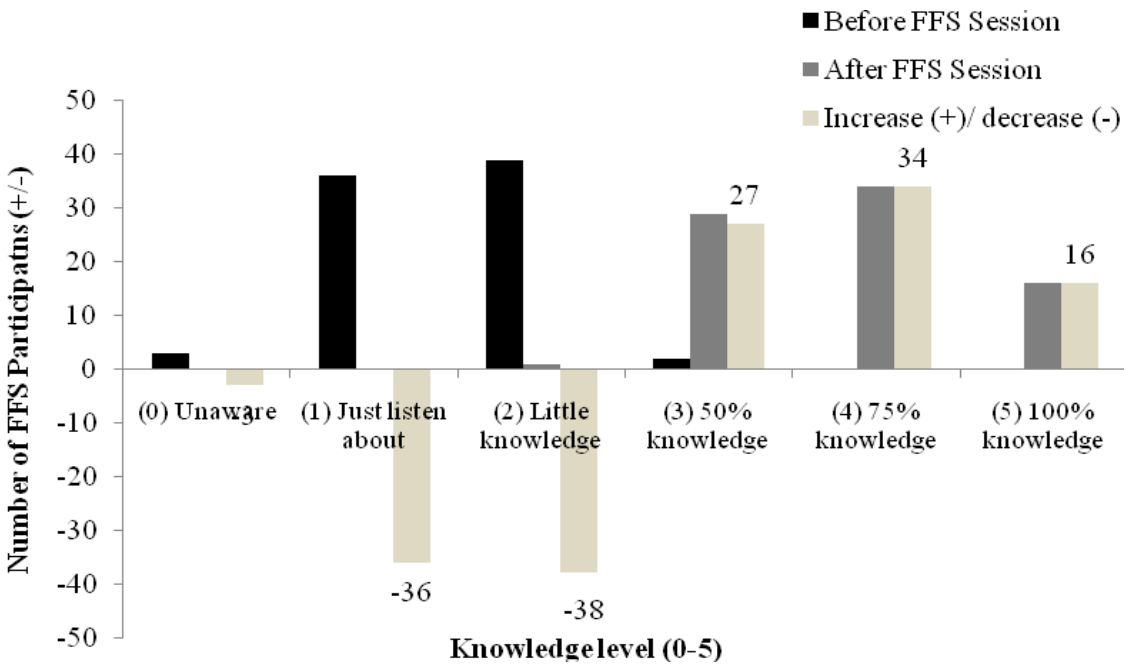

Fig. 6. Evaluating and Promoting in knowledge of FFS participants about agricultural inputs for crops before and after FFS sessions.

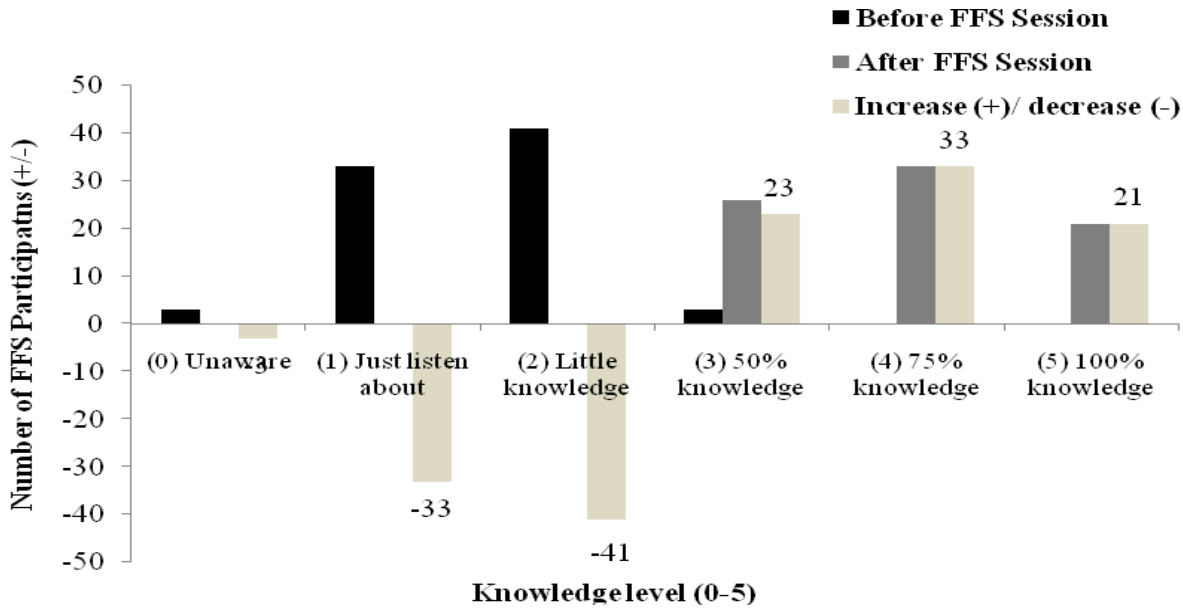

Fig. 7. Evaluating and Promoting knowledge of FFS participants about crops harvesting and threshing after FFS sessions

The effect of conventional and modern methods on number of leaves is shown in (Fig. 9). Obtained data showed that the method and interaction between method and different crops were non-significant but only data of crops were highly significant ($p< 0.05$) for this trait. Number of leaves per plant was

significantly (p< 0.05) more for all crops in the FFS plots with the modern method except guar which gave a non-significant number. The plants grown in FFS plot with the modern method of all crops indicated a higher number of leaves of guar (280) crops followed by mung bean (98), pearl millet (54), and sesame (31). However, all crops grown through the conventional method showed a lower number of leaves of pearl millet (42), guar (276), sesame (25), and mung bean (84) as compared to FFS plots with the modern method.

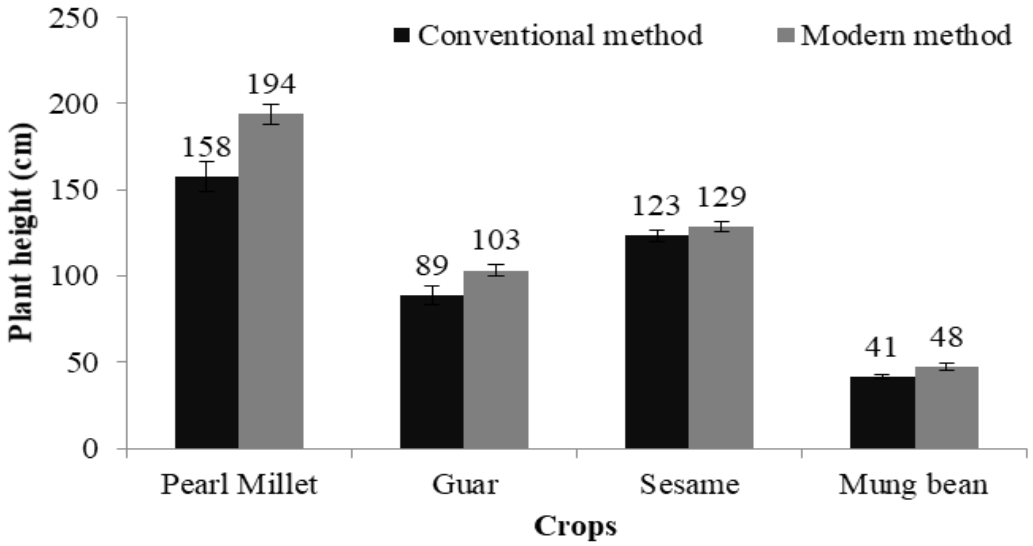

Fig. 8. Effect of conventional method and FFS plot with modern methods on plant height of different crops

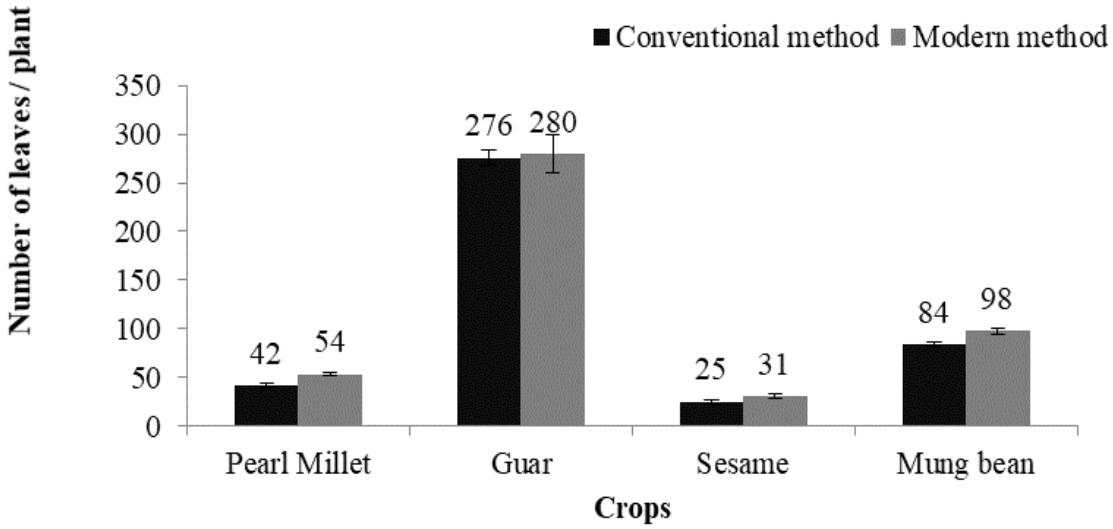

Fig. 9. Effect of conventional method and FFS plot with modern methods on number of leave per plant of different crops.

The result given in (Fig. 10) indicated a highly significant (p< 0.05) effect of methods, different crops, and their interaction for seed yield. The result revealed that the seed yield (kg/ha-1) of all four crops significantly (p< 0.05) increased in the FFS plots with the modern method as of the conventional method. The yield obtained from mung bean is higher (2041 kg/ha-1) from plants grown in FFS plots with the modern method followed by sesame (1365 kg/ha-1), guar (1048 kg/ha-1), and pearl millet (579 kg/ha-1).

While through the conventional method, the obtained yield was lower for mung bean (1514 kg/ha-1), sesame (1106 kg/ha-1), guar (814 kg/ha^{-1}), and pearl millet (460 kg/ha^{-1}).

The effect of methods (conventional and modern) of cropping on the straw yield of different crops is given in (Fig. 11). The results revealed that the effect of methods and different crops were highly significant (p< 0.05), but the interaction of methods x different crops was non-significant for this attribute. Straw yield (kg/ha^{-1}) was shown significantly (p< 0.05) higher of all crops in the FFS plots with a modern method of cropping. The higher yield of straw was from mung bean (2564 kg/ha^{-1}) in the FFS plots, followed by sesame (1615 kg/ha^{-1}), pearl millet (1583 kg/ha^{-1}), and guar (1428 kg/ha^{-1}). While, lower straw yield gained from guar (985 kg/ha^{-1}), pearl millet (1307 kg/ha^{-1}), sesame (1496 kg/ha^{-1}), and mung bean (2194 kg/ha^{-1}) in the plot with a conventional method.

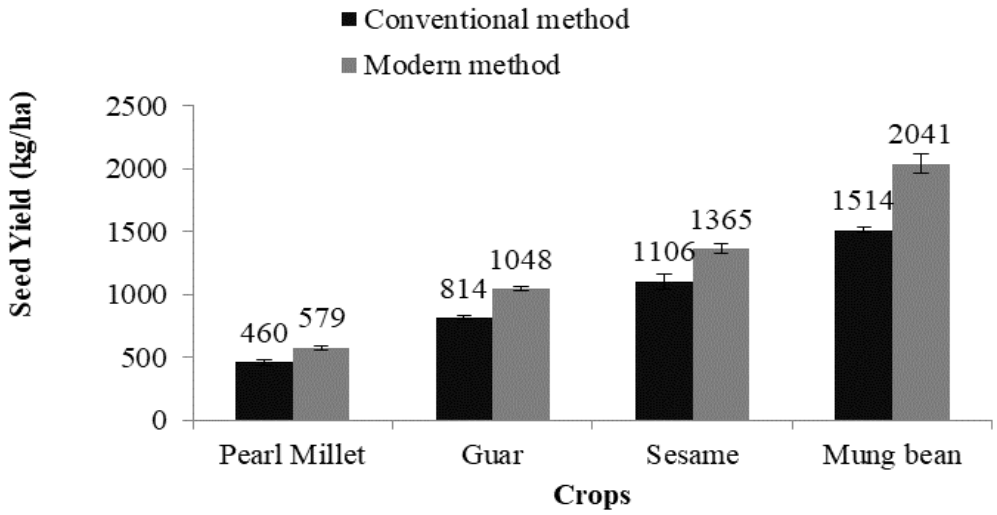

Fig. 10. Effect of conventional method and FFS plot with modern methods on seed yield of different crops

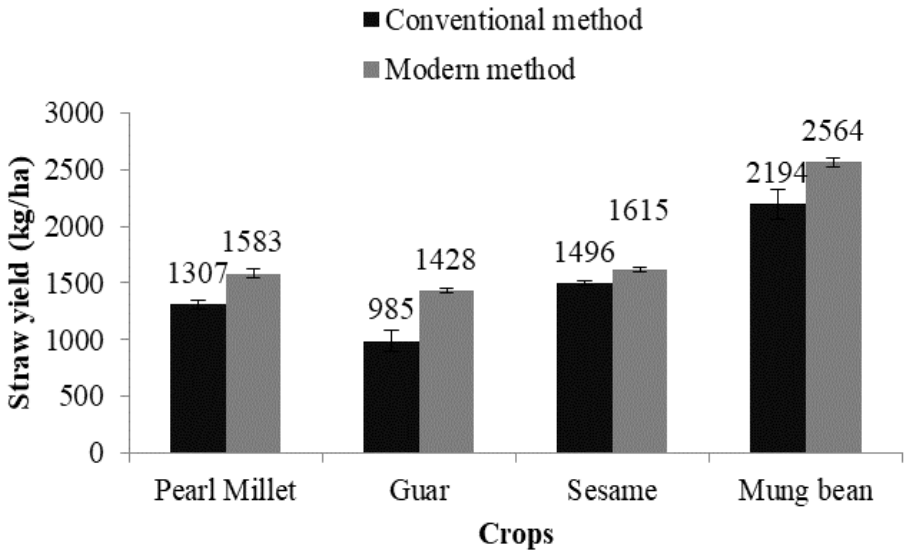

Fig. 11. Effect of conventional method and FFS plot with modern methods on straw yield of different crops

During all sessions,74% female and 26% male smallholder farmers (2-to-12-acre land-holders) participated in the FFS session and the age was in the range of 24 to 60 years. The majority of female farmers got sessions due to male farmers working as laborers in the urban areas and housewives are present in villages. Similarly,[14] suggested it should be seen that women need to be promoted in agricultural activities to meet the food requirement because the population is increasing day by day. However,[15] reported that women have a share in commercial vegetable production and the potential can be harnessed by increasing women's activities related to it. Most of the FFS participants were married very much motivated and gave too much interest in attending the sessions. Out of 80 farmers only 4 had a primary level of education and the rest were illiterate. Before starting the sessions, they were seeking to get these types of field school training related to agriculture. In the condition of high illiteracy of participants as they cannot read and write so for taught through pictorial way of teaching and learning by doing method as through the FFS are successful[16,17].

The knowledge related to agricultural activities is very much important to get a high yield of return from crops.Out of 80 FFS participants about 49, 31, 36, 61, 63, and 68% got more the 75% knowledge about land preparation, variety selection, sowing methods, cultivation practices, agricultural inputs, and harvesting, respectively. Before the FFS session, they had very little knowledge about these practices because farmers of the study area mostly practiced in growing barani crops. These Barani crops like pearl millet, guar, sesame, mung bean, and melons are mostly grown in this area during the monsoon season because there is no canal system of irrigation[18]. In the barani area of Thar, most crops are grown on rain water and zero tillage is used for crop cultivation. While; they did not level the soil before crop cultivation. For preparation of land, they only clean the bushes and vegetation from the land and wait for the rainfall. As rainfall came they cultivated their land by camel and donkey. Nowdays, some farmers are mostly sowing their crops through drills by tractors as well.

Most of the farmers of this area had little knowledge about the selection of variety and good seeds. As they only use the available grain of the specific crop mostly used as seeds. In the kharif season, all land was barren and no one cultivated their land by using alter sources of underground water. They had only knowledge that there is only one season for crop cultivation which is monsoon when rainfall occurs. Little of FFS participants had knowledge about the management of the farms and cultural practices. After the FFS sessions, they got the knowledge as they did all the practices and about 65% of farmers gave feedback as they got 75% knowledge. Related to agricultural inputs, they only used grain as seed but no one used fertilizer, farmyard manure, and pesticides. Without using inorganic fertilizers and pesticides, they are producing organic food and vegetables but they are unaware of the term organic food and its value. After the session, about 64% of the farmers got more than 75% knowledge about the agricultural inputs and their advantages and disadvantages. Knowledge about proper pre- and post-harvesting losses is very much important. As these practices when not done properly; causing losses in yield and quality of seed[19,20].

The agricultural practices in Thar region, mostly farmers doing zero tillage, not maintaining proper space between plants and rows, not using even any organic manure as input, and low knowledge about pre- and post-harvesting losses. FFSs were revealed to have an encouraging impact on per acre yield and revenue of women, illiterate people, and smallholder farmers[21,22]. However,[23] that observed the FFS participants had a higher yield than the non-participants. Due to the lack of modern practices and knowledge of farmers, they were getting lower average yields from different crops through conventional methods. A comparison between the conventional and modern method plots through FFS session showed significant ($P < 0.05$) differences among them in terms of plant height, number of leaves per plant, seed yield, and straw yield. Through the FFS learning, most of the farmers adopt knowledge and are interested in applying it their fields. This study was dependent on the adaptation of new technologies in their actual fields that can enhance the per-acre yield of crops. Spreading adaptation has not given ease and specific way but makes possible for innovation as well[4].

4. CONCLUSIONS AND RECOMMENDATIONS

This study concluded that the Farmers got a lot of knowledge and as per feedback more than 75% knowledge in the related farming practices like land preparation, variety selection, sowing methods,

cultivation, and cultural practices, agricultural inputs, and harvesting practices. However, the highest plant height (cm), number of leaves per plant, and Seed, and straw yield (kg ha-1) were recorded in the FFS plots with modern farming methods compare to conventional methods of farming. It is also recommended that the farming community opt for the benefit of converting the FFS group into the business farming group and generating more revenue and profit as they sell their agriculture commodities in bulk. Farming communities are suggested to make these types of other groups and involve learning through FFS approaches.

NOVELTY STATEMENT

The present work will be helpful in promoting knowledge and communication skills related to framing practices through Farmer Field School (FFS) methods.

AUTHOR'S CONTRIBUTION

F. Abbasi conducted all research work during his post-graduation, V. Suther regarded the main research idea and management of the article, D.M. Soomro and A.M. Ahmed prepared this manuscript, J.D. Suther helped in the collection of data, S. Abbasi and Samreen Abbasi helped in experimental layout and designing, S.A. Abbasi and S.A. Abbasi helped in the analysis of data.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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