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*Full Length Research Paper*

# Effectiveness of training offered by Ethiopian Institute of Agricultural Research to farmers: The case of Holetta, Melkassa and Debre Zeit Agricultural Research Centres

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**The research and extension divisions of Ethiopian Institute of Agricultural Research are responsible for transfer of technologies. There is a need to improve agricultural extension activities through training. Therefore, the objective of this study was to analyze the effectiveness of farmers' training in improving their knowledge and attitudes and to identify the factors influencing effectiveness of training in terms of improving knowledge and attitude of the participants. Equal numbers of respondents from each of the three research centers were selected for the study. Structured interview schedule and informal interview with key informants were used for collecting the essential quantitative and qualitative data, respectively. The quantitative data were analyzed using descriptive and nonparametric tests; Correlation and Regression analysis. The output of the study indicate that training offered by the three research centers significantly improved knowledge of potato, onion and durum wheat extension packages, attitude of farmers and level of practice of farmers compared to those of untrained sample farmers. The most important factors that significantly influenced knowledge of potato, onion and durum wheat extension packages were level of aspiration, education of farmers, information seeking behavior and extension contact. Similarly, the major factors that significantly influenced attitude of trained farmers include level of aspiration and education of farmers.**

**Key words:** Onion, durum wheat, potato, extension package, farmers, training, effectiveness.

## INTRODUCTION

Literature shows that the climatic and soil conditions in Ethiopia allow growing a wide range of field crops and livestock production (Abate, 2007). With a variety of altitudes and microclimates, and the long growing season and accessible irrigation sources in Ethiopia, anything can grow well (Yohannes, 1991). Although the country is suitable for a variety of crops and livestock production, approximately 50% of its population lives below the poverty line. In general, despite the rich resource base and suitable natural conditions for agricultural development, the country still suffers from reduced crop production and food insecurity. Among several institutions in the country, Ethiopian Institute of Agricultural Research (EIAR) is engaged in agricultural research and extension activities covering all activities associated with crops and livestock production (Abate, 2007). Several agricultural technologies and high yielding varieties were released from the research centers operating under the umbrella of EIAR such as Holetta, Debra

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**Abbreviation: EIAR,** Ethiopian institute of agricultural research; **HARC,** Holetta agricultural research center; **DZARC**, Debre Ziet agricultural research center; **MARC;** Melkassa agricultural research center.

Zeit and Melkassa Agricultural Research Centers. In addition to other research activities, EIAR's role would also include finding innovative and effective means of technology dissemination, in collaboration with its partners in extension, higher learning institutions, advanced research institutes, International Agricultural Research Centers, Non-Governmental Organizations, and Community-Based Organizations (Abate, 2007).

The focus of Research – Extension - Farmer Linkage, so far, has been technology transfer. Each improved technology has been demonstrated in one or two peasant associations, mostly in the vicinities of research centers, on a limited number of farmers' fields. In recent years, the department has shifted its focus to scaling up and scaling out proven agricultural technologies. While the core functions of EIAR are technology supply, popularization, national coordination and capacity building and policy development, the research and extension units of EIAR are responsible for transfer of technologies that are being developed in the respective research centers to farmers and other functionalities through training. Timely and targeted information and knowledge resources and services are also crucial to the successful accomplishment of the EIAR Systems missions and services to stakeholders nationwide (Abate, 2007). The public requires information on a very broad set of agriculture technologies released by EIAR. The research and extension department is charged with the responsibility to support these needs through effective farmers' training. Thus quite significant amount of time and money has been spent on agricultural technologies dissemination/transfer through farmers' and development agents' training programs which have been organized by each Research Center of EIAR. To have a clear assessment of these efforts, the evaluation of training is also an important part in the training process cycle. In evaluating an extension training program, one needs to consider that most training activities exist in a larger context of projects, programs, and plans. Raab et al. (1987) defined training evaluation as a systematic process of collecting information for and about a training activity which can then be used for guiding decision-making and for assessing the relevance and effectiveness of various training components. Therefore, the objective of the study are to study the effectiveness of farmers' training in improving their knowledge and attitudes on the selected packages, and to identify the factors influencing effectiveness of training in terms of improving knowledge and attitude of the participants.

## RESEARCH METHODOLOGY

### Selection of the study area and training program

A purposive sampling design was followed for the selection of the study research centers namely Holetta Agricultural Research Center (HARC), Debre Ziet Agricultural Research Center (DZARC) and Melkassa Agricultural Research Center (MARC). This judgmental sampling technique was followed by the investigator due to the reason that these three agricultural research centers were the most important ones currently involved on technology generation and dissemination under EIAR system. Around each research center, the study was undertaken in one *Wereda* which was selected purposively from where the Research Centers had been executing training for the past three years to farmers. This judgmental sampling method was chosen based on the preliminary study undertaken by the investigator. Welmera *Wereda*, Ada'a *Wereda* and Adama *Wereda* were selected for this study from the *Weredas* where HARC, DZARC and MARC had been offering training for the last three years, respectively. This *Weredas* were purposively selected based on some selection criteria. One of the criteria used during the selection procedure was the fact that the research centers had been offering trainings on agricultural technology (dissemination and extension) and these *Weredas* had more number of participants than other *Weredas*. The *Weredas* which were sufficiently close to the Agricultural centers to enable a series of visits to selected farmers by the researchers over a limited period of time was another criterion. HARC offered training for farmers from different *Weredas* on agricultural technologies related to barley, wheat, tef, faba bean, field pea, chickpea, linseed and potato during the last three years. The number of farmers who accessed improved agricultural technologies associated with different crops was found to be higher in *Welmera Wereda* when compared with the other *Weredas*. Therefore, training of potato package being the important one was chosen in the case of HARC to measure training effectiveness in this study. The reason for this was also attributed to the fact that HARC was coordinating national potato research and extension programs and actively involved on dissemination of potato packages nation wide.

Similarly, DZARC had been offering training on improved agricultural technology packages on several crop and livestock related areas of development. The major technology dissemination areas were associated with durum wheat, chickpea, lentils, tef, and poultry and beef production. When one compares training activities and number of farmers in the area of crops and livestock packages dissemination it seems a lot of work had been done by the centre on durum wheat and chickpea improved packages by DZARC over the last five years. Further, durum wheat agricultural technology adoptions as well as disseminations were being coordinated nationally by DZARC. Thus, training of durum wheat package was purposively chosen to assess training effectiveness study in the case of DZARC. Among the *Weredas*, Ada'a *Wereda* was found to be highly associated with the dissemination of durum wheat package. On the other hand,

MARC was located in the Ethiopia rift valley and found in warmer weather agro-climatic conditions and thus, improved crop technology packages were mainly associated with fruit and vegetables, haricot bean, sorghum, millet, flower, tef and silkworm production improved agricultural technology packages. Currently, MARC was highly engaged on adoption of onion production technology and involved on training the technology for farmers and SMEs. Also, MARC was nationally coordinating onion research and adoption. Therefore, the onion training program was purposively selected for this center in order to study the effectiveness of the trainings that were being offered to the farmers by the centre. Adama *Wereda* was selected for the study due to the reason that the highest frequency of farmers had training from MARC on onion package.

**Study area, site description and population**

HARC is located at a distance of 45 km from the capital city of the country, Addis Abeba. The centre is located at 8°30' E latitude and 9°00' N longitude with 2400 m altitude. The mean annual rainfall was 1078 mm and mean maximum and minimum temperatures were 22.1 and 6.2°C, respectively. Major soil type of the area was nitosols and vertisols. The Welmera *Wereda* consists of 61 and 39% dega and weynadega, respectively. Research commodities include barley (nationally coordinated), bread wheat, tef, highland oil crops (nationally coordinated), highland pulses (nationally coordinated), potato (nationally coordinated), fruits, soil and water management, dairy (nationally coordinated)http://www.eiar.gov.et/centers.htm. The study related to DZARC was contacted at Ada'a *Wereda* (around Debre Zeit town). Ada'a *Wereda* contains 3, 3 and 94% dega, winadega and kola (hot climate), respectively. The *Wereda* had 79781, 590, 1159.17, 477 and 250 ha of arable, grazing, forest, hills lands and water body, respectively. The total area of the *Wereda* is 92751.33 hectare. The area is found 47 km from Addis Ababa with an average geographic coordinate of 8°44' N latitude and 039°01.5'E longitude and an average altitude of 1900 m above sea level with an average annual rain fall of 851 mm. The average maximum and minimum temperatures were 24.3°C and 8.9°C, respectively. The study area consists of almost entirely of Alfisol/Mollisol and Vertisols with high clay content. The study area had a Tepid to cool moist mid to high altitude climate. Research commodities were: tef (nationally coordinated), durum wheat, lentil (nationally coordinated), fruits and vegetable, poultry, (nationally coordinated) dairy, beef, forestry, chickpea (nationally coordinated).

The MARC is found near Awash Melkassa (8°24'N latitude and 39°12'E longitude) that is 17 km southeast of Nazareth town and 117 km away from Addis Ababa. The area is situated at an altitude of 1550 m als. The average annual rainfall was 763 mm. the average monthly maximum and minimum temperatures were 28.6°C and 13.8°C, respectively. The agro climatic conditions of the centre are classified as dry land and semiarid. The soil of MARC farm had a dominantly loam and clay loam texture. The responsibility of the research centre in terms of research commodities was vegetables (nationally coordinated), fruits (nationally coordinated), sorghum (nationally coordinated), beans (nationally coordinated), maize, tef and farm implements (nationally coordinated). The study related to MARC was conducted at Adama *Wereda*. Adama *Wereda* was located in the central Rift valley of Ethiopia, Oromia Region East Shoa Zone, which was at the distance of 99 km eastern of Addis Ababa. The *Wereda* consists of 31, 45 and 24% low land, mid-high land and high land, respectively. The elevation of the *Wereda* ranges from 1400 m.a.s,l at low land areas to 2700 m.a.s.l at the peak of high land. The temperatures of the *Wereda* vary from 17°C to 34°C with the rain fall ranging from 600 mm to 1200 mm.

The total population of the study areas from HARC, DZARC and MARC was 87942, 301029 and 106244, respectively. The total population of male in the study areas associated with HARC, DZARC and MARC was 43672, 156125 and 51814, respectively. While the total population of female in the study areas associated with HARC, DZARC and MARC was 44270, 144904 and 54430, respectively.

**Sampling, types and methods of data collection**

***Sampling***

A multistage sampling procedure was used for the purpose of this study. From the 14 zones found in Oromya region, East Shewa and West Shewa were chosen purposively. The research centers under EIAR namely HARC, DZARC and MARC belonging to these zones were also chosen purposively. As described earlier, one *Wereda* was purposively selected from areas where each one of the three research centers is offering training to the farmers. Equal numbers of trained and untrained respondents were used for this study. Therefore, from each one of the three *Weredas* (Welmera, Ada'a and Adama) 40 trained and 40 untrained farmers were chosen for comparison purpose. The untrained farmers were selected from quite a significant distance away from where the trainings had been offered in order to avoid the cases of knowledge transfer from trained farmers to the untrained ones.

Welmera *Wereda* was in the mandate area of HARC and the farmers trained by centers were included in the sample from this area. Ada'a *Wereda* was under the area of DZARC and hence the farmers included from this Wereda were those who were trained by DZARC. MARC was located in Adama *Wereda*, and the farmers trained by the center were selected from this *Wereda*. The sample included 40 trained and 40 untrained farmers that were selected randomly from the three *Weredas* of the list of farmers under each center. Untrained farmers were selected randomly, from the sampling frame creating using the list of farmers growing the selected crop, with the help of development agents and PA leaders. Since the topics selected for the study for the centers were 'potato package' (for HARC), 'durum wheat package' (for DZARC) and 'onion package' (for MARC), the farmers who had participated in the respective trainings were only included in the preliminary lists that were prepared as well as in the sample. Under each research center one *Wereda* was selected and under each *Wereda* two PA were selected (one for trained and the other for untrained sample farmers) purposively. The PAs which consisted of the highest numbers of trained farmers in the *Wereda* were selected for the purpose of this study.

***Types of data***

This training effectiveness study was intended to be carried out in two stages through qualitative and quantitative data collection methodologies. Qualitative and quantitative data were collected from the respondents. Primary and secondary data were gathered and analyzed for the purpose of the study. The sources of primary data were the trained and un-trained farmers in the three *Weredas* where HARC, AZARC and MARC had been operating. In addition, supplementary qualitative information was collected from some of the extension functionaries who attended trainings in these centers, trainers and training organizations, as well as from farmers.

***Methods of data collection***

Quantitative data were generated from the farmer respondents using a pre-tested structured interview schedule. From the three *Weredas*, total sample of 240 farmers (40 trained and 40 untrained from each *Wereda*) were chosen to undertake survey for quantitative data, collection. For the collection of quantitative data a structured interview schedule was prepared. Fifteen development agents, five for each of the three Research Centers, employed for data collection, were trained on the methodology of data collection for two days. Pre-testing of the structured interview schedule was performed before data collection as a preliminary study in order to check its validity and consistency, and to make refinements. The result showed that the selected parameters were appropriate for the study (data not shown). Qualitative data, in line with the objectives of the study, were gathered from both categories of respondents through focus group discussions, informal interviews and key informant ratings. Professionals in the research and extension department of EIAR, subject mater specialists who were involved on training in their area of specialization in EIAR centers, development agents from the study locations as well as from the office of *Weredas'* capacity building and rural development and trained farmers were considered for individual or focus group discussions during qualitative data collection.

**Methods of data analysis**

All the data were processed and analyzed using appropriate statistical tools to fulfill the objectives of the study. The quantitative data was analyzed using descriptive statistics like frequency, mean, percentages, ranking, while chi-square t-test, Cramer's V, correlation and multiple linear regression analysis, were used to test the magnitude of the relationship and influence among dependent and independent variables. The qualitative data were coded, described and interpreted to supplement the quantitative data. Multiple linear regression (MLR) analysis was the statistical technique used to analyze the influence among variables (that is single dependant variables and single independent variables) with the objective of using the independent variables whose values were known to predict the single dependent variable (Hair et al., 1998). According to Bowen and Starr (1982) the regression equation takes the form:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + \ldots + b_px_p$$

Where

y = dependent variable
x = independent variables
a = y intercept
b = the slope of the line

**Estimating procedure**

Following the completion of the data collection, the responses were coded and entered into SPSS version 12.0 for analyses. Before estimating the models, it was necessary to check if multicollinearity exists among the explanatory variables, if multicollinearity turns out to be significant, the simultaneous presence of the two variables will reinforce the individual effects of those variables. According to Gujarati (1995) there are various indicators of multicollinearity and no single diagnostic will give us a complete handle over the collinearity problem. For this particular study, variance inflation factor (VIF) was used for continuous variables. The larger the value of VIF, the more it is troublesome. As a rule of thumb, if the VIF of a variable exceeds 10 (this will happen if $R_i^2$ exceeds 0.95), that variable is said to be highly collinear (Gujarati, 1995). Following Gujarati (1995), the VIF is given as:

$$VIF(X_j) = \frac{1}{1 - R_j^2}$$

Where, $R_i^2$ is the coefficient of determination when the variable $X_j$ is regressed on the other explanatory variables.

A condition index greater than 15 indicates a possible problem and an index greater than 30 suggests a serious problem with multicollinearity. Similarly, there may be also interaction between qualitative variables, which can lead to the problem of multicollinearity. To detect this problem, coefficients of contingency were compounded. The contingency coefficient was compounded as follows:

$$C = \sqrt{\frac{\chi^2}{n + \chi^2}}$$

Where, C is coefficient of contingency, $\chi^2$ is chi-square test and n = total sample size.

**Definition of variables and hypotheses**

The important variables investigated in the research were, dependent and independent variables. Dependent variable was a variable that was affected or explained by another variable. An independent variable was a variable that causes changes in another (Sarantakose, 1998).

***Dependent variables***

The general objective of this study was to assess training effectiveness. Any farmers' training was intended to bring about desirable changes in the behavioral dimensions of the participants such as knowledge and attitude leading to better on-the-job performance. For the purpose of this study, two major behavioral dimensions were considered such as knowledge and attitude to reflect the training effectiveness. These were treated as dependant variables in this study.

**Attitude measurement**

Attitude was defined as "the degree of positive or negative effect associated with psychological objects like symbol, phrase, slogan, person, institution, ideal or ideas towards which people can differ in varying degrees" (Thurstone, 1946). The focus of this parameter was on the attitude of farmers towards the technology offered by the EIAR centers. "Attitude was defined in this study as the degree of positive or negative feeling of farmer's towards technology that were offered to them by the three Agricultural Research Centers of EIAR. Farmers' attitude towards the technology packages was measured using a summated rating (Likert type) scale. The scale was prepared with larger number of items initially and subjecting them to editing and screening in the light of pre-testing so as to include only the relevant items reflecting both positive and negative effect on a five point continuum. The items covered on all aspects

related to the application of the given technology. Before administration, the scale was tested for its content validity and sufficient levels of reliability based on the pre-test results.

The attitude of a respondent was measured by adding the total scores obtained for ten item in the scale, by attributing 4 score for 'strongly agree' 3 score for 'agree', 2 score for 'undecided', 1 score for 'disagree' and 0 score for 'strongly disagree' responses in the case of positive items. In the case of negative statements the scoring pattern was reversed. The total scores were calculated by adding individual scores that each respondent obtained for all statements. The total scores of attitude varied from 0 to 40. For the descriptive analysis three categories such as low, medium and high were employed. Since the score range was 0 - 40, the respondents were categorized in to three such as Low (0 -13), Medium (14 - 26), and High (27 - 40) for analysis with the help of descriptive statistics and total score was used for correlation and regression analyses.

**Knowledge measurement**

Knowledge of trained and untrained farmers was measured using a "Teacher-Made Test". The test items included 14 questions related to onion, potato and durum wheat technology package under MARC, HARC and DZARC respectively. Though 11 question some 14 answers were expected. The scoring pattern was 1 score for correct answer and 0 score for wrong reply. The respondents were asked the question and the answers were recorded. Later these answers were evaluated and their total knowledge scores were calculated. Since the score range was 0-14 the respondents were categorized into three such as Low (0 - 4), Medium (5 - 9), and High (10 - 14) for further analytical purposes using descriptive statistics and total score was used for correlation and regression analyses.

**Practice measurement**

In addition, the practice of trained and untrained farmers under MARC, HARC and DZARC was tested. Practice was not a dependent variable for final analysis, but was incorporated to generate some useful information. Practice was operationalized as the application of the knowledge in the real life situation. The practice of farmers was measured based on the recommended package. To test the practice of trained and untrained farmers, seven questions related to onion, potato and durum wheat technology package were used. These seven questions had seven answers. The scoring pattern was 1 score for correct answer and 0 score for wrong reply. The respondents were asked the question and the answers were recorded. Later these answers were evaluated and their total practice scores were calculated. Since the score range was 0 - 7 the respondents were categorized in to three such as Low (0 - 2), Medium (3 - 5), and High (6 - 7) for further analytical purposes. This testing of practice was based on farmers' perception on their own practice, and hence it was not used as a valid measurement for further analysis. Practice/skill has to be observed for performance, but it was not possible to do it in the off season for crop cultivation.

***Independent variables***

The major criteria for the selection of independent variables were evidences from past research, from published literature as well as from discussion with expert. For Relevancy Rating, 21 different independent variables were listed. Relevancy coefficients of the independent variables were selected based on relevancy rating done by panel of expertise. For this procedure the list of identified 21 independent variables were subjected to rating for their relevancy to the study in four point continuum and based on the relevancy coefficient 16 variables were selected. Those with relevancy coefficients below 50% were excluded from the list. The relevancy coefficients were worked out using the formula:

$$RC = \frac{OS}{PS} x100\%$$

Where

RC = Relevancy coefficient
OS = Obtained score
PS = Potential score

The independent variables selected includes age of farmers, education, farm Size, social participation, access to irrigation, family labour force, level of aspiration, cosmopoliteness, information seeking behavior, extension contact, wealth status, farmers' experience, access to input market, access to credit. Age of farmers was operationally defined as the chronological age of the farmer at the time of data collection and measured as a discrete variable and this was expected to have a negative relationship with dependant variables. Education refers to the level of formal education of farmers. The sample measured in terms of category of schooling such as illiterate (0), read and write (1), 1 - 4 grade (2), 5 - 8 grade (3), 9 -10 grade (4) and preparatory and college (5). The variable was expected to have an influence on the dependant variables positively and measured as a discrete variable. Land holding size refers to area of the cultivated land owned by farmers or the house hold listed as house hold member or leased out area was also included in the measurement. This variable was expected to have a positive relationship with the dependant variables. Social participation was operationalized as extent of affiliation of the respondent with formal or informal association in terms of membership as well as degree of involvement in the activities. It was measured in terms of membership or official status in any formal or informal organizations, along with the frequency of participation and type of organization in which farmer is a member using the scale developed by (Deribe, 2007) with slight modifications. It was a continuous variable and expected to have positive relationship with dependent variables (Deribe, 2007).

Access to irrigation refers to the availability of irrigation source in hectare near to the cultivated land of the respondent and was treated by continuous variable; this was expected to have positive relationship with dependent variables. Family labour force was expected that when the number of the family members between the ages 15 up to 64 are more, the available family labour was high and facilitate technology adoption process, hence this variable would also influence the achievement from trainings. This was continuous variable and expected to have positive relationship with the dependent variable. Level of aspiration is operationalized as strong desire or an ambition to achieve something better in life. This variable was measured using the scale suggested by Pareek and Rao (1992) with suitable modifications. Level of aspiration was expected to have positive relationship with the achievement from training in terms of dependent variables. Cosmopoliteness is the degree of or intention of the respondents towards outside the social system to which they belong. This was measured in terms of its relevance to agricultural activities related to potato, durum wheat and onion production during visit to outside the village and the purpose of such visit. Cosmopoliteness was expected to have positive relationship with the dependent variables since it broadens the vision of the individuals (Deribe, 2007). Information seeking behavior was operationally defined as the degree to which the respondent is seeking to get information from various sources on the roles he or she performs. This was measured in terms of how much information sought, how frequently and from where the information was sought. This was continuous variable and was assumed to have positive relationship with dependent variables.

**Table 1.** Knowledge of trained and untrained farmers under three research centers.

| S/No. | Research center | Trained | | Untrained | | t-value |
|---|---|---|---|---|---|---|
| | | N | Mean | N | Mean | |
| 1. | Debre Zeit | 40 | 10.57 | 40 | 6.08 | 8.83*** |
| 2. | Melkassa | 40 | 9.56 | 40 | 7.75 | 3.62*** |
| 3. | Holetta | 40 | 10.55 | 40 | 7.02 | 5.67*** |

***Significant at P ≤ 0.01 levels of significance.
Source: Own survey data (2007/2008).

Extension contact represents the respondent's frequency of contact with the development agents and frequency of participation in extension activities such as, field days and on farm demonstrations. Extension contact might encourage the participants of the training to make better gains from the trainings in terms of knowledge and attitude change and hence assumed to have positive relationship with the dependent variables. Wealth status refers to the economic position of the farmers and was determined by various economic variables such as livestock population, type of housing and other business activities (Trivedi, 1963). The values of each material possession were estimated according to the current price in the markets available in the study areas. This was continuous variable. Farmers' experience refers to the number of years of experience the respondent has in cultivating the crop under consideration. More experience in the crops might help the respondent to make better gains from participating in the farming and hence expected to have a positive relationship with the dependent variables. Senkondo et al., (2004) identified positive and significant relationship between years of farming experience and dependent variable. Access to input market refers to the local availability of agencies to supply the required inputs for the technology package on time (whenever necessary) and this might influence the respondent to make better gains from the training attended and hence expected to have positive relationship with the dependent variables. This variable was used as a dummy variable. Availability of credit is one of the critical factors that facilitate technology utilization by the small holder farmers. Hence access to credit facilities might motivate the training participants to make better gains from the programs and expected to have positive relationship with the dependent variables. This was used as a dummy variable.

## RESULTS AND DISCUSSION

### Effectiveness of training

#### *Knowledge*

The t-test clearly showed that there was highly significant (P ≤ 0.01) difference between mean score of knowledge of trained and untrained farmers who obtained training in potato, onion and durum wheat extension packages at HARC, MARC and DZARC, respectively (Table 1). Knowledge test indicated that the trained farmers had better level of knowledge when compared to the level of knowledge that untrained farmers had on the durum wheat, potato and onion extension packages that were provided by DZARC, HARC and MARC, respectively. The result is in agreement with the findings of Kafyalew (2006) that training kept the farmers more informed and updated. In fact, this indicates that the untrained farmers also know something about these extension packages introduced into the area by the research centers. They can learn from the existing environment such as, informal discussion with the trained farmers, by observing trained farmer's farm activity and from their life experience. However, from the result obtained, it could be seen that training kept the trained farmers more informed and updated on extension packages disseminated by Agricultural Research Centers. In terms of improving the knowledge of farmers the training organized by the DZARC, HARC and MARC was effective. Moreover, the experts seemed to be able to transfer the required levels of knowledge for a specific technological package, which is the key factor to implement extension packages.

#### *Attitude*

The attitude of trained farmers from DZARC, MARC and HARC were significantly (P < 0.001) improved due to trainings offered on durum wheat, onion and potato extension packages (Table 2). Trained farmers had favorable attitude towards extension packages compared to the untrained farmers. Under DZARC, the higher percentage of untrained respondents in the medium category indicates that the changes in attitude may not only be due to training but also due to information flow in the area. In MARC, although the larger number respondents were found to be categorized in high category for both trained and untrained farmers, the frequency of trained respondents was significantly higher than that of untrained ones in the same category. This could demonstrate that training that was offered by MARC significantly improved the attitude of farmers towards improved onion extension package. This was inline with the findings of Kefyalew (2006) who stated that undergoing training by formal institutions and exposing oneself to the scientific information, it helps the individual to think rationally and seek new scientific information in all aspects of his/her life. Probably, the group situation in training and the group dynamics thereupon might have also influenced the participants to have an attitude

**Table 2.** Attitude of trained and untrained farmers under three Agricultural Research Centers.

| S/No. | Research center | Trained | | Untrained | | t-value |
|---|---|---|---|---|---|---|
| | | N | Mean | N | Mean | |
| 1. | Debre Zeit | 40 | 27.60 | 40 | 22.92 | 3.62*** |
| 2. | Melkassa | 40 | 28.87 | 40 | 22.85 | 3.72*** |
| 3. | Holetta | 40 | 28.55 | 40 | 20.85 | 4.79*** |

***Significant at P ≤ 0.01 levels of significance.
Source: own survey data (2007/2008).

**Table 3.** Practice of trained and untrained farmers under three Agricultural Research Centers.

| S/No. | Research center | Trained | | Untrained | | t-value |
|---|---|---|---|---|---|---|
| | | N | Mean | N | Mean | |
| 1 | Debre Zeit | 40 | 5.90 | 40 | 3.12 | 10.40*** |
| 2 | Melkassa | 40 | 6.02 | 40 | 3.95 | 6.71*** |
| 3 | Holetta | 40 | 6.67 | 40 | 4.35 | 8.80*** |

***Significant at P < 0.01 levels of significance.

**Table 4.** Knowledge, attitude and practice of trained and untrained farmers under three Agricultural Research centers (N = 240).

| Variables | Farmers | t-test | | | | | |
|---|---|---|---|---|---|---|---|
| | | N | Mean | SD | SEM | Df | t |
| Knowledge | Trained | 120 | 10.229 | 2.797 | 0.255 | 119 | 9.967*** |
| | Untrained | 120 | 6.954 | 2.361 | 0.216 | | |
| Attitude | Trained | 120 | 28.342 | 7.261 | 0.663 | 119 | 7.020*** |
| | Untrained | 120 | 22.208 | 6.841 | 0.625 | | |
| Practice | Trained | 120 | 6.200 | 1.274 | 0.116 | 119 | 14.689*** |
| | Untrained | 120 | 3.808 | 1.451 | 0.133 | | |

***, Significant at P < 0.01 levels of significance.
Source: Own survey data (2007/2008).

change in the favorable direction.

### *Practice*

The results presented in Table 3 clearly showed that the mean scores of practice of trained farmers on durum wheat, onion and potato extension packages were significantly (P < 0.01) higher under all the three agricultural research centers. The results presented showed that the training improved the levels of application of the scientific principles in durum wheat, onion and potato production due to trainings that were being offered by DZARC, MARC and HARC.

### *Knowledge, attitude and practice test using pooled data*

The t-test result clearly showed that the mean score of the knowledge of trained farmers on extension package was significantly higher (P < 0.01) than the mean score knowledge of untrained farmers (Table 4). This confirmed that the training offered by EIAR was effective in terms of improving knowledge of farmers. The comparison between attitude of trained and untrained respondents using paired difference test indicated that the attitude of trained farmers significantly (P < 0.01) improved by the training offered by the centers. Similarly, the mean score

**Table 5.** Profile of trained farmers in terms of selected independent variables.

| S/No. | Independent variables | DZARC (N = 40) | | MARC (N = 40) | | HARC (N = 40) | |
|---|---|---|---|---|---|---|---|
| | | Mean | SD | Mean | SD | Mean | SD |
| 1. | Age of farmer | 45.07 | 13.17 | 37.53 | 9.41 | 40.73 | 13.30 |
| 2. | Education of farmer | 3.02 | 1.31 | 2.45 | 1.69 | 2.55 | 1.45 |
| 3. | Family size | 6.52 | 2.44 | 6.05 | 2.21 | 6.50 | 2.53 |
| 4. | Social participation | 8.22 | 3.53 | 11.30 | 7.02 | 1.98 | 1.143 |
| 5. | Wealth of farmer | 15122.12 | 13223.82 | 20364.33 | 16672.36 | 20954.50 | 11189.85 |
| 6. | Farm size (ha) | 2.44 | 1.43 | 1.34 | 0.89 | 2.70 | 1.57 |
| 7. | Access to irrigation | - | - | 0.70 | 0.96 | - | - |
| 8. | Family labour force | 3.97 | 2.11 | 3.28 | 1.65 | 2.97 | 1.44 |
| 9. | Level of aspiration | 4.72 | 1.11 | 5.30 | 1.16 | 4.17 | 1.71 |
| 10. | Cosmo politeness | 4.70 | 1.45 | 3.90 | 1.93 | 4.02 | 1.27 |
| 11. | Information seeking behavior | 10.67 | 4.71 | 10.38 | 3.29 | 11.05 | 5.44 |
| 12. | Extension contact | 3.50 | 1.19 | 0.85 | 0.36 | 1.92 | 1.79 |
| 13. | Participation in extension activities | 6.45 | 4.72 | 4.15 | 3.09 | 1.50 | 1.20 |
| 14. | Farmers experience | 13.27 | 8.48 | 6.33 | 2.56 | 7.30 | 4.66 |
| 15. | Access to input market | 0.78 | 0.42 | 0.78 | 0.42 | 0.95 | 0.22 |
| 16. | Access to credit | 0.85 | 0.36 | 0.55 | 0.50 | 0.52 | 0.51 |

of practice of trained farmers on extension packages was found to be highly improved when compared to untrained farmers practice of the same extension package. The paired comparison between the mean score of practice of trained and untrained sampled farmers showed that trained farmers are able to perform better than untrained ones.

## Factors influencing effectiveness of training in terms of knowledge and attitude

### *Descriptive analysis of independent variables*

The mean scores for the independent variables that are classified as personal demographic, economic, situational and socio-economic factors for DZARC, MARC and HARC are presented in Table 5.

### *Relationship between dependent and independent variables*

The three categorized independent variables access to input market, education level and access to credit had positive association with knowledge of trained farmers under DZARC and HARC, although not statistically significant at $P < 0.10$ levels of significance (Table 6). However, the output of chi-square test revealed that among the three categorized independent variables access to input market and access to credit had positive and significant association with knowledge of trained farmers under MARC. The reason for this could be that if the farmers have access to credit and input market their interest to acquire more knowledge to implement the extension package increases.

The pooled data from the three agricultural research centers are also used for analysis in order to look at the relationship between the independent variables and the dependent variables (knowledge and attitude). The two variables such as educational levels and access to input market showed positive and significant association with knowledge at 5% level of significance. Similarly, education was positively and significantly associated with attitude of trained farmers towards extension packages at 5% level of significance. Out of twelve continuous or discrete independent variables, five variables namely participation in extension activity, social participation, information seeking behavior, level of aspiration and wealth status were found to be positively and significantly related with knowledge of durum wheat extension package at DZARC (Table 7). This implies that when these independent variables increase the knowledge of durum wheat extension package increases. However, all the twelve variables were non significant with the attitude of farmers towards durum wheat technology package.

Regarding the relationship between dependent and independent variables at HARC, out of twelve continuous independent variables only seven variables such as participation in extension activity, social participation, level of aspiration, cosmopoliteness, Information seeking behavior, extension contact and farmer experience were found to be positively and significantly related with knowledge of the potato packages. The correlation analysis between attitude of trained farmers toward potato package and the independent variables shows that, five independent variables such as participation in extension activity, level of aspiration, cosmopoliteness, information seeking behavior and extension contact were positively and significantly related with attitude of potato package.

The result presented in Table 7 displays that out of twelve independent variables three variables such as social participation, farm size and information seeking behavior were found to be positively and significantly

**Table 6.** Relationship between dependant variables and categorized independent variables of the trained farmers.

| Discrete independent variables | DZARC (N = 40) | | | | HARC (N = 40) | | | | MARC (N = 40) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $\chi^2$ | Df | P | Cramer's V | $\chi^2$ | Df | P | Cramer's V | $\chi^2$ | df | p | Cramer's V |
| **Knowledge** | | | | | | | | | | | | |
| Education level | 4.835 | 7 | 0.68 | 0.348 | 43.167 | 32 | 0.09 | 0.519 | 59.029 | 50 | 0.179 | 0.543 |
| Access to credit | 37.022 | 28 | 0.118 | 0.481 | 6.151 | 8 | 0.63 | 0.392 | 16.679** | 10 | 0.05 | 0.646 |
| Access to input market | 7.227 | 7 | 0.406 | 0.425 | 12.879 | 8 | 0.116 | 0.567 | 16.873*** | 10 | 0.018 | 0.649 |
| **Attitude** | | | | | | | | | | | | |
| Education level | 56.709 | 52 | 0.304 | 0.595 | 72.96 | 60 | 0.122 | 0.675 | 67.677 | 65 | 0.386 | 0.582 |
| Access to credit | 1.905 | 13 | 1.000 | 0.218 | 7.544 | 15 | 0.941 | 0.434 | 20.088 | 13 | 0.093 | 0.709 |
| Access to input market | 7.88 | 13 | 0.851 | 0.444 | 11.429 | 15 | 0.722 | 0.535 | 14.523 | 13 | 0.338 | 0.603 |
| **Pooled data** | | | | | | | | | | | | |
| | **Knowledge** | | | | **Attitude** | | | | | | | |
| Education level | 106.91*** | 60 | 0.000 | 0.422 | 151.95*** | 120 | 0.026 | 0.503 | - | - | - | - |
| Access to credit | 20.106 | 12 | 0.065 | 0.409 | 16.958 | 24 | 0.85 | 0.376 | - | - | - | - |
| Access to input market | 23.956*** | 12 | 0.012 | 0.447 | 25.236 | 24 | 0.393 | 0.459 | - | - | - | - |

*, **, ***Significant at P < 0.05 or 0.01.

related with knowledge of onion extension packages at MARC. On the other hand, out of twelve variables, two variables such as social participation and level of aspiration were found to be positively and significantly related with the attitude of farmers toward onion package. The output of Pearson correlation analysis of pooled data indicated that, out of twelve independent variables four of them such as level of aspiration, cosmopoliteness, information seeking behavior and extension contact were found to be positively and significantly related with the attitude of farmers towards the extension packages at different levels of significance (Table 8). The probable reason for this relation could be that when farmers experience, participation, internal desire and exposure increases the knowledge of extension package increases. Similarly, the results of Pearson correlation analysis provided in Table 6 showed that, out of twelve variables, six independent variables such as participation in extension activity, level of aspiration, cosmopoliteness, information seeking behaviour, extension contact and farmers experience were found to be positively and significantly associated with the knowledge of farmers towards the extension packages at different levels of significance.

As indicated in Table 8, level of aspiration, information seeking behavior and extension contact and cosmopoliteness were positively and significantly related with knowledge and attitude of trained farmers towards the extension packages at 0.01 levels of significance. The positive and strong relationship between respondents' knowledge and attitude towards extension packages and level of aspiration implies that, the higher the level of aspiration the more acquire knowledge of the extension packages. This could be attributed to the fact that the desire of the respondent to acquire new ideas or to listen attentively to others increases they would attain the desired level of knowledge with positive attitude. The positive and significant relationship of knowledge and attitude of trained farmers with information seeking behavior also implies that, when their search for information increases,

knowledge with favourable attitude, which is in agreement with the findings of Asres (2005). As can be seen in Table 8 pooled data result, there was significant and positive relationship for

**Table 7.** Relationship between knowledge and attitude of trained farmers and continuous or discrete independent variables.

| S/No. | Continuous independent variable | DZARC(N= 40) | | | | HARC(N= 40) | | | | MARC(N= 40) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Knowledge | | Attitude | | Knowledge | | Attitude | | Knowledge | | attitude | |
| | | r | P | R | P | r | P | R | P | r | P | r | P |
| 1. | Age of farmer | 0.091 | 0.576 | -0.003 | 0.985 | -0.061 | 0.708 | -0.081 | 0.618 | -0.055 | 0.735 | 0.260 | 0.106 |
| 2 | Family size | -0.051 | 0.755 | 0.050 | 0.761 | -0.008 | 0.961 | -0.056 | 0.732 | 0.135 | 0.406 | 0.172 | 0.288 |
| 3 | Family labour force | 0.095 | 0.562 | -0.090 | 0.581 | -0.195 | 0.229 | -0.184 | 0.255 | 0.016 | 0.924 | 0.093 | 0.569 |
| 4 | Farmers experience | 0.289 | 0.070 | -0.137 | 0.398 | .352* | 0.026 | 0.301 | 0.059 | -0.222 | 0.169 | 0.078 | 0.631 |
| 5 | Participation in ext. activities | 0.453*** | 0.003 | -0.083 | 0.612 | 0.661*** | 0.000 | 0.551*** | 0.000 | -0.035 | 0.828 | -0.024 | 0.885 |
| 6 | Extension contact | 0.258 | 0.108 | -0.031 | 0.851 | 0.619*** | 0.000 | 0.515*** | 0.001 | -0.050 | 0.760 | -0.019 | 0.906 |
| 7 | Information seeking behavior | 0.619*** | 0.000 | -0.171 | 0.292 | 0.693*** | 0.000 | 0.652*** | 0.000 | 0.636*** | 0.000 | 0.236 | 0.142 |
| 8 | Level of aspiration | 0.462*** | 0.003 | -0.027 | 0.871 | 0.781*** | 0.000 | 0.654*** | 0.000 | 0.275 | 0.086 | 0.442*** | 0.004 |
| 9 | Social participation | 0.412*** | 0.008 | -0.110 | 0.500 | 0.376** | 0.017 | 0.290 | 0.070 | 0.483*** | 0.002 | 0.350** | 0.027 |
| 10 | Cosmopoliteness | 0.207 | 0.200 | 0.016 | 0.920 | 0.737*** | 0.000 | 0.595*** | 0.000 | 0.050 | 0.758 | 0.003 | 0.985 |
| 11 | Wealth of farmer | -0.381** | 0.015 | -0.173 | 0.286 | -0.018 | 0.910 | -0.028 | 0.863 | -0.205 | 0.205 | 0.188 | 0.246 |
| 12 | Farm size | -0.023 | 0.889 | -0.058 | 0.723 | 0.174 | 0.283 | 0.162 | 0.318 | -0.478*** | 0.002 | -0.220 | 0.174 |

**, ***significant at P < 0.05 or 0.01, respectively.

knowledge and attitude of trained farmers with extension contact. This indicates that the measured extension contact facilitates higher knowledge and favourable attitude of trained farmers. Similarly, there were positive and significant relationship for knowledge of trained farmers with cosmopoliteness and experience. The probable reason could be that the familiarity gained by experience and extent of farmers exposure to technologies could help higher knowledge of extension packages.

## Influence of independent variables on knowledge and attitude of trained farmers

### Multiple linear regression analysis

The values of VIF and CI for continuous variables were found to be less than 10 and less than 30, respectively (Table 9). To avoid serious problem of multicollinearity, it is quite essential to omit the variables with VIF value greater than or equal to 10 and CI value greater than or equal 30 from the MLR analysis. Based on VIF and CI result, the data had no serious problem of multicollinearity. The results presented in Table 7 and 8 show that, for HARC seven independent variables for knowledge of extension packages and five independent variables for attitude of farmers were retained and entered into MLR analysis. For MARC, five (three continuous and two categorized) variables for knowledge of extension package and two continuous independent variables for attitude of the trained farmers were retained and entered into MLR analysis. Concerning HARC seven continuous independent variables for knowledge of potato extension package and six continuous independent variables for attitude of the trained farmers towards potato extension package were retained and entered into MLR analysis.

### *Influence of the independent variables on the knowledge of trained farmers*

Table 10 shows that, in pooled data out of nine factors considered in the model, only four variables were found to be significantly influencing the knowledge of trained farmers on extension package at 0.05 and 0.01 levels of significance. These variables include level of aspiration,

education of farmers, information seeking behaviour and extension contact of farmers.

**Level of aspiration:** According to the result, the

**Table 8.** Pooled analysis on relationship between dependent variables and continuous or discrete independent variables (N=120).

| No. | Independent variables | Attitude | | Knowledge | |
|---|---|---|---|---|---|
| | | R | P | r | P |
| 1. | Age of farmer | 0.002 | 0.983 | 0.016 | 0.862 |
| 2. | Family labour force | -0.077 | 0.403 | -0.031 | 0.734 |
| 3. | Farmers experience | 0.021 | 0.819 | 0.221** | 0.015 |
| 4. | Family size | 0.029 | 0.754 | 0.034 | 0.711 |
| 5. | Participation in extension activities | 0.020 | 0.832 | 0.202** | 0.027 |
| 6. | Level of aspiration | 0.441*** | 0.000 | 0.510*** | 0.000 |
| 7. | Information seeking behavior | 0.332*** | 0.000 | 0.643*** | 0.000 |
| 8. | Extension contact | 0.178** | 0.051 | 0.425*** | 0.000 |
| 9. | Social participation | 0.138 | 0.134 | 0.157 | 0.087 |
| 10. | Cosmopoliteness | 0.188** | 0.040 | 0.341*** | 0.000 |
| 11. | Wealth of farmer | 0.026 | 0.774 | -0.165 | 0.071 |
| 12. | Farm size | -0.001 | 0.993 | 0.067 | 0.467 |

**, ***significant at P < 0.05 and 0.01 levels, respectively.
Source of data: Own survey data (2007/2008).

**Table 9.** Variance inflation factor (VIF) and condition index (CI) for continuous and discrete variables.

| S/No. | Variable | HARC | | | | DZARC | | MARC | | | | Pooled data | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Knowledge | | Attitude | | Knowledge | | Knowledge | | Attitude | | Knowledge | | Attitude | |
| | | VIF | CI | VIF | CI | VIF | CI | VIF | CI | VIF | CI | VIF | CI | VIF | CI |
| 1 | Participation in ext. activities | 1.730 | 1.000 | 1.650 | 1.000 | 1.082 | 1.000 | - | - | - | - | 1.196 | 1.000 | - | - |
| 2 | Social participation | 1.439 | 4.167 | - | - | 1.263 | 3.270 | 1.357 | 1.000 | 1.001 | 1.000 | - | - | - | - |
| 3 | Level of aspiration | 4.274 | 5.235 | 3. 367 | 3.849 | 1.259 | 6.753 | - | - | 1.001 | 9.368 | 1.302 | 3.760 | 1.000 | 1.000 |
| 4 | Cosmopoliteness | 2.132 | 6.173 | 2.008 | 6.795 | - | - | - | - | - | - | 1.189 | 5.233 | 3.565 | 3.565 |
| 5 | Information seeking behavior | 2.146 | 7.988 | 2.132 | 9.556 | 1.282 | 6.95 | 1.319 | 2.374 | - | - | 1.346 | 7.068 | 5.825 | 5.825 |
| 6 | Extension contact | 1.786 | 11.139 | 1.709 | 13.039 | - | - | - | - | - | - | 1.462 | 8.575 | 7.709 | 7.709 |
| 7 | Farming experience | 1.203 | 16.838 | - | - | - | - | - | - | - | - | 1.383 | 11.894 | - | - |
| 8 | Wealth status | - | - | - | - | 1.089 | 13.805 | - | - | - | - | - | - | - | - |
| 9 | Farm Size | - | - | - | - | - | - | 1.385 | 4.420 | - | - | - | - | - | - |

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | Access to irrigation | - | - | - | - | - | - | 1.477 | 9.145 | - | - | - | - | - | - | | |

**Table 10.** Coefficients of regression function for the influence of independent variables on knowledge of technology packages.

| No. | Independent variables | Coefficient (N = 120) | | |
|---|---|---|---|---|
| | | B | t | Sig. |
| | (Constant) | 2.451 | 2.839*** | 0.005 |
| 1. | Level of aspiration | 0.414 | 3.118*** | 0.002 |
| 2. | Education of farmers | 0.496 | 4.145*** | 0.000 |
| 3. | Information seeking behaviour | 0.252 | 5.919*** | 0.000 |
| 4. | Extension contact | 0.297 | 2.458** | 0.015 |

**, ***Significant at 0.05 or 0.01 levels of significance.
Source: own survey data (2007/2008).

relation between level of aspiration of trained farmers and knowledge of agricultural packages was found to be positive and significant at 0.001 levels of significance.

One unit increment in level of aspiration would bring about 0.414 units increment in the trained farmers knowledge of extension packages. The result presented in this study also showed that, the level of aspiration of trained farmers is very important to update or improve the knowledge and practice of farmers on farm technologies, practices or activities associated with extension packages introduced by the HARC, MARC and DZARC. Thus, level of aspiration is one of a driving force to the improvement of the knowledge of farmers in farming and obviously, could lead to achieve better in farming life. In general, the analyses of combined data from the three centers specify that level of aspiration improves the knowledge and increase practical achievement from training. Farmers who have strong desire or ambition to achieve better in farming acquire more of theories and practices associated to technological packages which correspond with the findings of Deribe (2007).

**Education of farmers:** education can improve level of understanding and logical thinking of farmers and could lead to improved peoples' access to technology proven agricultural packaging. The combined data from the three agricultural centers when analyzed for the relation of knowledge with the independent variables showed that education highly ($P < 0.01$) influenced the knowledge of respondents on the extension packages. Also, the relationship between knowledge of extension package of the respondents who obtained training at HARC, MARC and DZARC with the independent variables was found to be positive. When education level of trained farmers increases by one percent, knowledge of extension packages increases by 0.496. The result showed that education of farmers' plays a vital role in the process of training on new and improved agricultural technologies dissemination and hence on contribution of agriculture in economic development. Besides being instrumental in farm development, it is also helps farmers' lead better lives. The finding of this study agrees with the findings by Deribe (2007) who reported that education has significant and positive influence on adoption of dairy package and its practices.

**Information seeking behavior:** The multiple linear regression analysis of combined survey data revealed that the coefficient of information seeking behavior of respondent (0.252) was positively and significantly ($P < 0.01$) associated with knowledge of potato, onion or durum wheat extension packages. This signifies that keeping the value of all other variable constant, a unit increase in an information seeking behavior would be accompanied by increases in the knowledge of package by 0.252 units. The reason for this could be that better information seeking behavior leads farmer to acquire all possible information concerning a given agro technologies packages. Information can therefore have different economic value; and benefit farmers to improve their knowledge of extension packages (Carberry, 2001).The analysis of combined data from the three centers, then, clearly confirmed that information seeking behavior of the farmers could be one of the very important external factors to be considered during the selection of trainees for training on package adoption processes. This is because information and learning related factors are likely to become increasingly important in dissemination and adoption process (Liewellyn, 2007).

**Extension contact:** correlation analysis shows that extension contact was positively and significantly ($P \leq 0.05$) correlated with knowledge of agricultural package's introduced by HARC, DZARC and MARC. A unit increment in extension contact of trained farmers leads to 0.297 unit increment in knowledge of respondent on the packages that were disseminated from the three agricultural research centers. The result revealed that as response and frequency of contact with development agents and their frequency of participation in different extension activities other than only theoretical training, the knowledge of packages significantly improve. This could confirm that the extension contact encourages participants of the training to make better gains from the training in terms of the trained farmers' knowledge of agricultural technologies. Similarly, Deribe (2007) has shown that

**Table 11.** Coefficients of regression function influence of independent variable on attitude of trained farmers at the three research center.

| No. | Independent variables | Coefficient | | |
|---|---|---|---|---|
| | | B | t | Sig |
| **Pooled data from the three centers (N = 120)** | | | | |
| | (Constant) | 14.994 | 6.281*** | 0.000 |
| 1. | Level of aspiration | 1.708 | 3.647*** | 0.000 |
| 2. | Education of farmers | 0.910 | 2.161** | 0.033 |

**, ***Significant at 0.05 or 0.01 levels of significance.
Source: own survey data (2007/2008).

frequency and timely contact with extension workers increased farmer's knowledge on dairy technologies, which is in agreement with the present findings in this study.

## Influence of the independent variables on the attitude of trained farmers

None of the independent variables used for multiple linear regression analysis was found to be significant at least at 10% levels of significance. Thus, the out put of the analysis for attitude under DZARC is omitted from Table 11. Only two independent variables such as level of aspiration and education of farmers were found to be significant at 0.01 and 0.05 levels of significance, respectively. The multiple coefficient of determination ($R^2$ = 0.618) was also found to be low implying that only 61.80% of the attitude variation was attributable to, or explained by, one or more of the independent variables used in the multiple linear regression test. However, the regression model was found to be significant at 0.01 level of significance. In general, there was a tendency of influence of independent variables on attitude of trained sample farmers when the pooled data from the three research centers are subjected to multiple linear regression.

**Level of aspiration:** Level of aspiration was one of the only two independent variables that positively and significantly affected attitude of respondents who participated in trainings offered on onion, potato and durum wheat package at 0.001 levels of significance. The result showed that when level of aspiration of the respondents increase by one unit the attitude of respondents increase by 1.708. As was discussion in the pervious section, the level of aspiration is related to desire or an ambition to achieve something better in the life. The result of this study also significantly shows that the level of aspiration had positive influence with attitude which is in agreement with the basic assumption as described by Pareek and Rao (1992) and Deribe (2007).

**Education of farmers:** education can improve level of understanding and logical thinking of farmers and could lead to improved peoples access to technology proven agricultural packaging. The combined data from the three agricultural centers when analyzed for the relation of attitude with the independent variables showed that education highly ($P < 0.01$) influenced the attitude of respondents on the extension packages. Also, the relationship between attitude of extension package of the respondents who obtained training at HARC, MARC and DZARC with the independent external variables was found to be positive. When education level of trained farmers increases by one percent, attitude of extension packages increases by 0.910. The result showed that education of farmers' plays a vital role in the process of training on new and improved agricultural technologies dissemination and hence on contribution of agriculture in economic development. Besides being instrumental in farm development, it is also an end in itself because it helps farmers' lead better lives. In general, pooled result shows that education when combined with high level of aspiration is very important for changes in the attitude of farmers and could lead to fastened development in farm life.

## Conclusion

The trainings offered by the EIAR were effective in terms of knowledge of technologies and attitude of trained farmers towards the extension packages. The attitude of trained farmers was found to be significantly higher for farmers who obtained training from Melkassa, Holeta and Debre Zeit Agricultural Research Centers and were classified as medium category, but significantly higher percentage of farmers' knowledge and practice which were classified in the highest category. The untrained farmers knowledge, attitude and practice were found to be lower than the level of knowledge, attitude and practice that the trained farmers had acquired. It was observed that the significant numbers of untrained farmers' knowledge, attitude and practice level on extension packages were categorized in the medium range for all the three research centers. The survey data obtained from the three study area were combined together to look at the factors influencing the knowledge and attitude of the trained farmers who obtained trainings

from the three research centers under EIAR. The result showed that education of farmers, wealth status, level of aspiration, information seeking behavior; extension contact and family size were the most importance independent variables which had significant influence on the knowledge of trained farmers. Whereas education and level of aspiration of trained farmers were the only two independent variables which had significant effect on the attitude of farmers for packages.

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