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Adoption of Newly Released Groundnut Varieties (*Arachis hypogea* L.) Production Technologies in Kondala District, Western Ethiopia

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Abstract: Legume crops play great role in improving households' food security and generating income for smallholder farmers. This study was tried to investigate the variation among farmers on the adoption and intensity of groundnut production technology in the Kondala district. Two stages sampling procedure were followed to select the sample households for the study. Four rural kebeles were selected from ten groundnut producing kebeles by using simple random sampling. Primary data collected from 185 sample selected households. Both key informant interview and focus group discussions were used to generate qualitative data. In addition, secondary data were collected from relevant sources. The data have been analyzed by descriptive statistics. Qualitative data narration was used to triangulate survey responses. The result of the descriptive statistics showed that the majority of farmers 57.3% were adopters and the remaining 42.7% were non adopters. This study also identifies groundnut production technologies such as recommended seeding rate, recommended fertilizer applications, land allocation and spacing among adopters and non-adopters and there was statistical significance difference in technology usage between adopters and non-adopters. Results of the descriptive statistics indicated that household ages, education level, farm experience, membership in cooperatives, access to agricultural inputs, participation in non-farm activities and frequency of extension contact were positively and significantly influenced the adoption of groundnut technologies. Whereas, distance from market center showed, negative relationship with the adoption of groundnut production technology. The overall finding of the study underlined high importance of institutional support in the areas of extension; membership in cooperatives and market to enhance adoption of improved groundnut production package. Therefore, policy and development interventions should give emphasis to improvement of such institutional support so as to achieve wider adoption which increased the productivity and income of smallholder farmers.

Keywords: Adoption, Ethiopia, Groundnut, Kondala, Technology

1. Introduction

Groundnut (*Arachis hypogea* L.) the Leguminosae family, is one of the world's key oil seed. It belongs to the family *Fabaceae,* subfamily *Papilionoidea* tribe [11]. The crop is known by numerous indigenous names, including peanut, earthnut, monkey-nut and goobers [6]. The origination of the crop was South America, but is widely distributed throughout the tropic and warm temperate countries such as Asia, Africa, Oceania, North and South America and Europe. Areas ranging from latitude 40° N to 40° S are very favored for production [1]. Groundnut grows best in a well-drained sandy loam or in sandy clay loam soils. Deep, well drained soils with a pH of 6.5-7.0 and high fertility are ideal. Optimum germination temperatures are thus between 20-30°C with a minimum of 18°C. It is an important crop in many countries, especially in Ethiopia, where it is a good source of protein (25%-34%), cooking oil (48%-50%) and vitamins and source of income. In addition to its economic importance it is used for improving soil fertility through providing nitrogen to soil [16]. Like any other crops, productivity growth in groundnut is not possible without yield increasing technologies such as high yielding improved varieties and inorganic fertilizers [15]. Alternative means to increase agricultural production have been widely

considered either by intensification or extnesification, or often through a combination thereof [8].

Increasing productivity in agriculture depends on adopting production enhancing technologies and the innovativeness of actors in the sector, particularly farmers. Because of farmers capacity and actors along the agricultural value chain innovates production activity depends on the availability of production technologies [5]. Even though groundnut is usually grown by a smallholder as crop in Ethiopia under rain-fed and irrigation conditions its productivity in Ethiopia as well as in the study area lower by two to three folds of the yield from researchers managed trials. This study was tried to investigate determinants and production gap that hamper groundnut in order to forward policy intervention in Kondala district by the stockholders.

2. Conceptual Frame Work of the Study

A conceptual framework represents the researcher's combination of literature on how to explain a phenomenon and conceptualize the current study. It maps out the actions required in the course of the study given his previous knowledge of other researchers' point of view and the research problem [14]. The conceptual framework of this study was based on the assumption that influences adoption of groundnut production technology namely personal, institutional and socio-economic variables identified based on the empirical studies of technology adoption discussed in the previous sections. The framework emphasized on the relationship of the explanatory variables with the status of adoption that is dependent variable. According to [9], practical experiences and observations of the reality has shown that, one factor may enhance adoption of one technology in one specific area for certain period of time while it may create barrier in other locations. Hence, the conceptual framework presented in figure below explains that affect the adoption of groundnut production technologies in the study area.

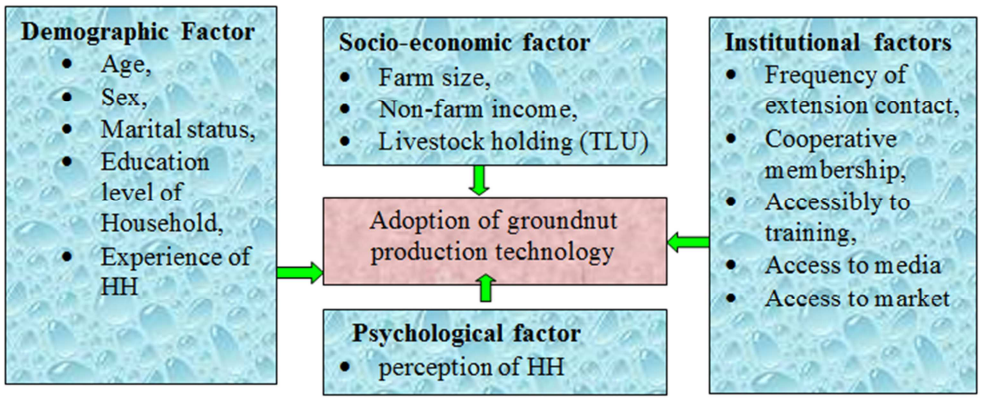

Figure 1. *Conceptual frame work.*

3. Methodology

This research was carried out in Kondala district which is one of the 22 districts of west Wollega zone of Oromia National Regional State, bordered by Begi district in west, Kelem Wollega zone in south and south east, Benishangul Gumuz region in north and Babo-Gambel and Mana-Sibu in eastern direction. Currently, the district has 36 administrative kebeles of which 32 are rural kebeles and the remaining 4 are small towns. Gaba Dafino town is the administrative center of the district located in eastern part of west Wollega zone and 211 Km away from zonal town (Gimbi) and 652 km far to the west of Addis Ababa.

3.1. Sampling Methods and Sampling Procedures

The study was under taken in the Kondala district, in selected areas of groundnut producing kebeles. A two stage sampling techniques were applied. First, four rural kebeles were selected from ten groundnut producer kebeles using simple random sampling. In the second stage, 185 farm household heads were selected using probability proportional to size of each of the four selected rural kebeles. Lastly each farm household was obtained using systematic sampling technique. The total sample size was determined following [18] formula as fallows.

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Where, n = sample size, N= total number of households in the sample (1953) and e= margin of error which is 0.07 in this study, 93% confidence level. Thus, n=1953/ (1+1953 X $(0.07)^2$, n=185, which is the determined sample size of the study area. The sample size thus obtained was assigned to each kebele based on probability proportional to size of the households (PPS).

3.2. Methods of Data Collection

The study was conducted in western Ethiopia particularly Kondala district and data were collected from April first to March 15, 2020. A survey was conducted in four kebeles namely Ifadin, Burka Nagenya, Gudina Misoma and Mada Jalala to collect primary information on groundnut production technologies.

3.3. Methods of Data Analysis

Descriptive analysis was employed to analyze the collected data. Both SPSS version 20 and STATA version 13 software were used for data analysis. The result of the analysis was interpreted and discussed using descriptive and inferential statistics. Descriptive statistics includes mean, standard deviation (SD), frequency, ratio, and percentage which were used to examine the socio economic and farming characteristics of households and categorization of the famers' classification. Inferential statistics such as chi-square test (for categorical variables) and T-test (continuous variables) were also used to compare and contrast different categories of adoption decision of the sample units to draw some important conclusions.

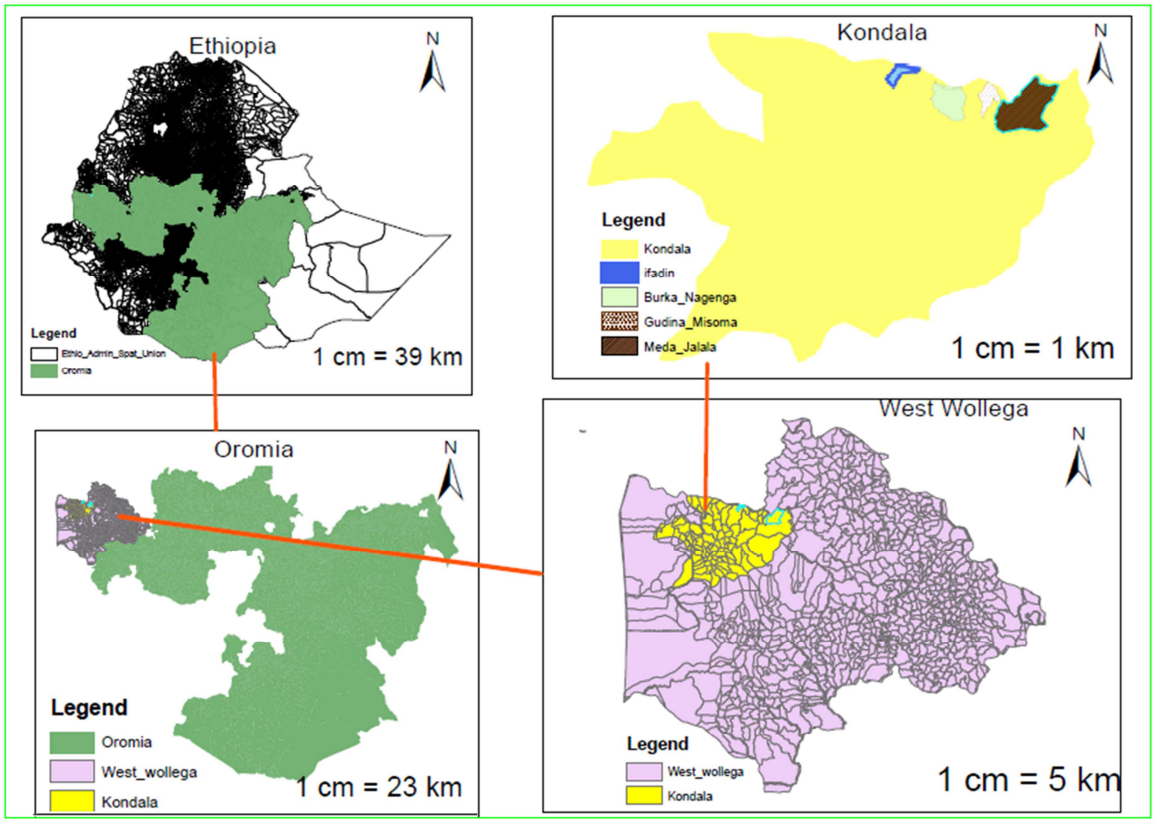

Figure 2. *Map of the study area.*

4. Result and Discussions

4.1. General Characteristics of the Respondents

Sample respondent of the study area consists of both male and female individuals. The male respondents were found to be 91.35% of the total sample household whereas the remaining 8.65% were females. Male household headed were more than females household headed. Regarding their house, from the total respondents 84 (45.41%) constructed their houses with corrugated iron sheet and 101 (54.6%) were grass roofed houses. Concerning their religious, all respondents were Muslim faith followers.

4.2. Socioeconomic Characteristics of Small Holder Groundnut Producers

4.2.1. Descriptive & Inferential Statistics of Continuous Variables

Age of the households: Age is one of the demographic factors that is useful to describe households and provide evidence about the age structure of the sample and the population. It plays an important role in household decision to adopt groundnut production technologies. The ages of respondents range from 23 to 60 years with mean 38.3 years for the adopters while the minimum and the maximum age was 24 to 70 years and standard deviation of 41.4 years for the non-adopters respectively. When the age increased from 23-39 the adopter number less compared to non-adopters, while in between 40-55 aged, the number of the adopters greater than the non-adopters. This showed that age was directly related with probability of adoption groundnut production. Hence the result of t- test showed that there was mean difference between adopters and non-adopters in terms of their age on adoption of groundnut production technology.

Education level of the respondents: According to [13], the complexity of a technology is one of barrier for people to adopt the technology and it is believed that this hurdle can be overcome by more education. Educated farmers are better able to process information and search for appropriate technologies to alleviate their production constraints. Therefore, the more education to a society

means the more intervention in different economic and social activities by that society. In this study level of education was one of the continuous variables that assumed to increase farmers' ability to obtain, process, and use information relevant to the adoption of improved groundnut production technology. Hence, it was hypothesized that level of education has a positive relationship between the household head and groundnut production technology adoption. With regard to their education status, the average years of formal schooling for the sampled farmers was 5.05 years for the adopters and 1.17 years for the non-adopters (Table 1). The result shows that there was a mean difference between the adopters and the non- adopters in term of their education. The reason is that education could likely allow farmers to make efficient decision, easy to see and grasp knowledge on new information. This result was consistent with the findings of [8].

Livestock ownership: In rural context, livestock holding is an important indicator of household's wealth position. Livestock's are prosperity indicator of Ethiopian farmers and an important source of income and draft power, food and means of transport. They played an important role in supporting the production and productivity of farmers. In this study livestock holding was assumed positively and significantly related for decision to adopt groundnut production implying that farmers with more livestock holding are more likely to devote the portion of their land for groundnut production than those households with less livestock holding. The result of t-test showed that there was no mean difference between adopters and non-adopters in terms of their livestock holding.

Experience in farming groundnut technology: Another important measure of adoption and use of groundnut production technology is experience in groundnut farming. Farmers with higher experience in adoption of new technology appear to have often full information and better knowledge to evaluate the advantage of the technology. It could also imply that knowledge gained over time from working decisive production environment may thereby influence their adoption decision. This result illustrated that the mean experiences of groundnut farming was 5.69 years for the adopters and 1.41 years for the non-adopters. The minimum and maximum experiences of adopter were between 3 and 9 years while the minimum and the maximum experience of the non-adopters were between 0 to 3 years. The coefficient of groundnut farming experience was found to be positive and significant at 1% significant level (Table 1). This showed that there was mean deference between adopter and non-adopter in terms of their experience on adoption of groundnut production technology. This was because the more experienced farmers may have better skill to access new information about the technology.

Farm size: Farm size is one of the determinant resource that affect technology to adopt or rejecting. Many studies have reported a positive relation between farm size and adoption of agricultural technology [4]. The result of this study showed that farm size and groundnut production technology adoption were positively correlated. The descriptive result of the sampled respondents indicated that average land holds of the sampled households were 1.95 hectare for the adopters 0.43 hectors for the non-adopters. The results of t-test showed that farm size was significant at 5% significant level. The result of t-test showed that there was mean difference between adopters and non-adopters in terms of their farm size (Table 1). This was due to the fact that farmers with large farm size are likely to adopt a new technology as they can afford to devote part of their land to try new technology unlike those with less farm size.

Off-farm Income (ETB): Participation on off-farm can affect the decision to adopt new technologies. This is particularly true if the adoption of the new technology would require a minimum investment in purchased inputs. The study also identified another income generating activity which called non-farm employment which determines the wealth status of respondents. These additional incomes will support individual farmer to adopt technologies. The off-farm activity in the study area includes petty trade, chat trade, trade of oxen, hand craft and donkey cart. The descriptive statistics result showed that mean annual off-farm income of adopters 10,229.7ETB and 3104.4 ETB for the non-adopters and was found to be significant at 1% significant level. The t-test result showed that there was a mean difference between adopters and non-adopters in terms of off-farm income participation (Table 1).

Table 1. *Descriptive statistics of continuous variables.*

Variables	Adopters (106)		Non-adopters (79)		Overall Mean	T-test
	Mean	SD	Mean	SD		
Age (year)	38.26	7.39	41.35	12.01	41.13	-3.93***
Education (schooling year)	5.05	1.59	1.04	1.17	3.47	-5.27***
Farm size (ha)	1.95	0.61	1.17	0.413	1.73	-3.15**
Livestock ownership (TLU)	9.32	4.87	9.150	3.46	9.68	11.87^{NS}
Distance to the nearest market (km)	3.45	1.97	10.49	3.88	3.76	-7.097***
Farm experience (year)	5.69	1.41	1.21	1.1	1.06	-3.41***
Off farm income (ETB)	10229	7568	3104.4	5633	5426	15.8***

Source: Model output (2020): ***, **,* significant at 1, 5& 10%, (NS), Non- significant).

Distance to the nearest market: Accessibility of market is an important variable in adoption decision of groundnut production technology. This is because a relatively closer distance of farmer's home to the market enables and facilitates marketing of inputs and outputs. It is also important for the producers to get attractive market price

through reduction of transportation cost. The increase in market distance make farmers to get out-dates market information and becoming out of adopting new agricultural technologies. The mean and standard deviation from market center of households were 3.45 km and of 1.97 km for the adopters and 10.49 km and 3.88 km for the non-adopters respectively. This shows that the adopters were closer to the nearest market place compared to the non-adopters counterpart. A farmer who is closer to the market place is likely being more informed about technologies compared to the one who is furthest from the market place.

4.2.2. Descriptive Results of Dummy/Categorical/Variables

Sex: It was one of determinant factor in affecting adoption of any technology. Sample respondent of the study area consists of both male and female individuals. The male respondents were found to be 91.35% of the total sample household whereas the remaining 8.65% was female. Male household headed were more than female household headed. The result of descriptive statistics showed that from 16 female households 9 (56.3%) were adopters and 7 (43.7) were non adopters and from 169 male households 97 (57.4%) were the adopters and the remaining 72 (42.6%) were the non-adopters. The result descriptive statistics illustrated that there was no observable percentage difference between adopters and non- adopters in terms of their sex.

Marital status of the respondents: The data of the respondent showed that about 93.5% of the respondents were married and living with their spouses and 3.78% and 2.7% of household heads were found to be divorced and widowed respectively and no single/not /married respondents. This indicates that the society in the study areas is stable. A stable society in general and stable households in particular can concentrate more on production than unstable society or family. From the total respondents the adopter were encompasses (55.67%) married, (1.62%) divorced and 0% widowed. The non-adopters includes married (37.8%), divorced (2.2%) and widowed (2.7%). The result of descriptive statistics showed that there was no observable percentage difference among the adopter and the non-adopter household heads in terms of their marital status.

Member to cooperatives: Membership in farmers based associations serve as a platform for accessing and dissemination of information and technology [10]. It can help farmers pulling resources together for their individual benefits which give them the opportunity to adopt more technologies than others who are not members and get more information about new technologies. In this study, access to cooperative member was helped farmers get better information and the variable was hypothesized to have a positive relationship with adoption of groundnut production technology [7]. The result of this study showed that out of the total sampled households interviewed, 58.9% of farm households were members of cooperative organizations while 41.1% were not members of cooperative organization. The result of the χ^2 test indicated it was significant at 1% level of significant. There was statistical percentage difference between adopters and non-adopters in terms membership in farmers' cooperatives. Focus group discussion showed that increase in possibility of meeting with other farmers as one becomes a member of different farmer groups and be informed about the new technology.

Frequency of extension contact: The use of agricultural innovations by farmers can be understood from the perspective of diffusion of innovations whereby innovations generated by agricultural research are passed to farmers through extension agents. Frequency of extension contact is the way to spread new agricultural technologies within the field of communication between extension agents and the farmers at the grassroots level. The result of χ^2 test showed that, it was significant at 1% level of significance. Based on this, the result of descriptive statistics showed that there is the percentage difference between the adopters and the non-adopters in terms of frequency of contact with extension agents. This indicated that the more frequent to extension contact was the more adoption groundnut production technology packages.

Accessibly to inputs: For Roger, a technology composed of two parts: hardware and software. Hardware is "the tool that embodies the technology in the form of a material or physical objects [13]. In this study the hardware was different inputs like, improved seed, fertilizer. Respondent farmers' access to inputs was measured using percentage, out of 185 farmers, 64.8% (120) were accessed to inputs and 35.2% (65) were not accessed to inputs. Accessibly to input was assumed to be positively affected the adoption decision of groundnut production technology. The χ^2 test showed that access to inputs significant correlation with adoption of groundnut production package. The result showed that there was percentage difference between adopters and non-adopters in terms of accessibly to inputs.

Access to training: Training was one of the independent variable that affects the adoption of any agricultural technology. It supplies farmers with new knowledge and skill, which help them to perform new practice properly. If a farmer has no skill and know-how about certain technology, he/she may have less probability of adoption. The skill acquired through training helps to carry out a new technology effectively and efficiently. According to the respondents of the study area, in the year training was provided two times by DA's and district agricultural experts for farmers. That was during meher time (in March) for rain feed crops including groundnut production and the second was given at September for the irrigation purpose. The data of the interviewer showed that out of total 185 farmers interviewed only 50.8% of them were found to attend and the rest 49.2% did not attend in the program (Figure 3). So the result of χ^2 showed that there was no significant percentage different between the adopters and the non-adopters in terms of training on groundnut production technologies and the study was opposite with findings of [17]. The reason behind is that the training was not given at the intended time. It was given after the farmers were already sowing their own local seed. The training given by the expert was not for the purpose of target group but for achieving the direction given from Zonal agricultural offices. The focus group discussions result support this idea.

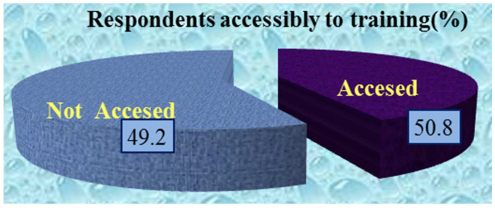

Figure 3. *Access to training.*

Farmers' perception: Ohemeng, F. L. et al. [12] stated perception as the process that organizes and interprets by our sensory in order to give meaning about the environment. It is the set of processes by which an individual become aware of and interprets information about the environment. Perception was measured and responses of sample respondents on the perception related questions were analyzed using Likert type scale. In this study five positive and five negative groundnut production related question was developed for interview. Accordingly, the ratings such as very high (5), high (4), medium (3), low (2), and very low (1) indicates how farmer perceives the characteristics being presented for evaluation of the given question in a decreasing manner. According to the result of the interview, most of the respondents perceived that using improved seed, fertilizer and appropriate spacing for groundnut production to increasing the productivity of the crop. The overall χ^2 test indicated that there was positive relationship between perception of respondents about groundnut production packages and the results were statistically significant at 5% as explained in (Table 2).

Access to media: As declared by [13], mass media and interpersonal communication are the two communication channels. While a mass media channel includes TV, radio, or newspaper, interpersonal channels consist of a two-way communication between two or more individuals. In this study mass media (radio) was hypothesized positively in affecting the adoption of groundnut production technology. The result of the sample respondent showed that out of 185 households 53.5% (99) respondents had access to radio 46.5% (86) had no access to media (radio). The χ^2 square result of the study showed that there was no relation between mass media (radio) and adoption of groundnut production technology package. The study is consistence with the findings [2]. The reason is that they use their radio only for following of news and recreational purpose (listening music). The focus group discussion also replied that, they use the radio while they returned from the agricultural activity for recreational purpose and following news. They did not know when the program of agricultural activity was transmitted.

Table 2. *Descriptive statistics of dummy variables.*

Variables	Characteristics	Non adopters (79)		Adopters (106)		Total (185)	χ^2	p-value
		Fre	%	Freq	%			
Sex	male	72	38.9	97	52.43	169	0.08^{NS}	0.99
	female	7	3.78	9	4.86	16		
Marital status	Married	70	37.8	103	55.67	173	$.694^{NS}$	0.71
	Divorce	4	2.2	3	1.62	7		
	Widowed	5	2.7	0	0	5		
Access to train	No	45	24.32	46	24.86	91	$.039^{NS}$	0.18
	Yes	34	18.38	60	32.43	94		
Access to cooperatives	Yes	58	31.35	51	27.57	109	17.6***	0.00
	No	21	11.35	55	29.73	76		
Frequency of extension contact	Daily	4	2.16	28	15.12	32	89.7***	0.00
	Weekly	9	4.86	59	31.9	68		
	Twice a week	23	12.4	16	8.65	39		
	Monthly	15	8.1	3	1.62	18		
	No contact	28	15.12	0	0	28		
Access to media	No	42	22.7	44	23.78	86	2.47^{NS}	0.14
	Yes	37	20	62	33.5	99		
Farmers perception	Very low	27	14.59	23	12.43	50	9.57**	0.05
	Low	16	8.65	18	9.73	34		
	Medium	9	4.86	27	14.59	36		
	High	8	4.32	18	9.73	26		
	Very high	19	10.27	20	10.8	39		
Access to inputs	No	41	22.2	24	12.97	65	17.0***	0.00
	Yes	38	20.54	82	44.3	120		

Source; Software output, 2020 (***, **, significant at 1 & 5%; (NS), Non- significant).

5. Conclusions

New technologies of groundnut production comprised improved varieties and fertilizer have been introduced by SASAKAWA GLOBAL 2000 and governmental organization to the study area. From results of descriptive statistics the following points were concluded. In addition to agronomic practices, improved seed and inorganic fertilizer were very crucial for obtaining sufficient production in groundnut production technologies. In the study area there was variation in land allocation, seed usage, tillage practices and methods of sowing among adoption categories. Descriptive analysis result showed that, factors that are affect adoption, includes; age of households, education level of households, cooperative member, and distance from market center, accessibly to inputs,

farm experience and frequency of extension contacts affected both adoption decision of groundnut production technologies at 1%, 5%and 10% significant level. The adoption of all the technology components used in the production of groundnut was low among the farmers in the sample. Overall, from this study it was concluded that, identified socio-economic and bio physical variables that constraints and impede adoption decision of groundnut production technologies identified and in general it was concluded that, promotion of the agricultural sector needs a packages of course of action and need further intervention by governments and non-governmental organizations.

6. Recommendations

Based on results of descriptive statistics, recommendations are suggested for future research, development intervention activities to promote adoption and use of groundnut production so as to improve farmers' income from the technology. Therefore, the following recommendations were generalized based on results of this study.

Education has a significant and positive effect on adoption decision of improved groundnut production packages. In this regard, the district Education office and Agricultural office should responsible to facilitate all necessary materials to strengthen the existing provision of formal and informal education.

Farm experience increases probability of adoption of groundnut production technology. The study further established that, many farmers learnt about the package from other farmers. The study therefore recommends the need to strengthen farmer-to-farmer extension whereby few progressive farmers who adopt the technologies of groundnut by district extension experts. They would in turn disseminate the technology to the rest of the farmers in their neighbor kebele. The Agricultural office of district should strengthening experience sharing on best practices and scaling up to be importance among farmers.

Distance to nearest market was statistically significant and negatively affected adoption of groundnut production technologies. Hence, stockholders (district transport office & rich's of the locality), need to establish market linkage for the farmers through facilitation of transport which increase the probability of adoption of improved groundnut production packages.

Smallholder groundnut farmers should be also encouraged to form or join farmers based organizations as it offers them the opportunities to getting better attention from Institutions in the Agricultural sector for delivery of inputs.

For groundnut production technologies, timing of the planting, spacing of the rows, weeding, pest management and timing of the harvesting are all critical practices. So based on the existing gap of knowledge effective production package training should be provided to overcome the agronomic problem of the particular crop.

Smallholder farmers typically do not have access to marketing information and, rely on local brokers. The market must be made more efficient to ensure that all farmers have access to price information and reduce the margin extracted by traders and brokers. The district trade office should responsible for registering the crop under the Ethiopian Commodity Exchange (ECX) in which market information can be delivered directly from ECX to farmers as for coffee and sesame.

District Cooperative office should support producers to cooperate and sell their produce directly to processor or central market.

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