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Factors Determining the Yield of White Pea Bean (Phaseolus vulgaris L.) and Identifying the Corresponding Roles of the Value Chain Actors in Adami Tulu Jido Kombolcha District, Ethiopia

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Abstract
White pea beans (*Phaseolus vulgaris* L.) are widely adapted to low and mid altitude areas at an altitude of 900-2100 meter above sea level, optimum temperature of 24^0c and average rainfall of 200-600 mm per annum. Ethiopia is the major supplier of this crop among the world white pea bean exporting countries. Our objective for this study was to analyze factors determining yield of white pea bean and identification of the roles of the respective actors in the value chain. The study used both primary and secondary data. To identify the roles of the actors, value chain approach was used and OLS model was used to analyze factors determining yield of white pea beans at the farm gate. From result of the analysis, white pea bean producers, local assemblers, wholesalers (suppliers), primary cooperatives, cooperative unions and exporters are identified to be the major actors in the value chain. OLS estimation results designates that age of household, livestock holdings, household head education level, Extension service and use of fertilizer being significant factors influencing yield. Having the result of the study, some pertinent points has been recommended to improve the yield of white pea bean at the farm gate.
Keywords: White pea bean, Value chain, Ordinary Least Square, Yield

1. INTRODUCTION

Agriculture is the core component and driver for Ethiopia's growth and long-term food security. The contributions are high: 15 to 17 percent of the Government of Ethiopia's expenditures are committed to the sector (AEMFI, 2010). Agriculture directly employs 80 percent of the total population, 43 percent of gross domestic product (GDP), and over 70 percent of export value (UNDP, 2013). Despite the considerable progress made in the sector, ensuring commercialized production remains one of the major challenges facing millions of people. There are also challenges which are associated with food security in some part of the country. A report developed by USAID (2012) on value chain analysis of white pea ben revealed that, the constraints of are mainly concentrated in the production areas, and the poorest sub-sector of rural households which are chronically reliant on social safety net programs and food aid. To alleviate these constraints agricultural sector is believed to play an important role in both overall economic performance and poverty alleviation. Hence, Ethiopian government has paid due attention to the sector through allocation of more than 15% of the total budget. Under the CAADP and PIF strategic plan also a significant portion of this is spent on the disaster risk management and food security (DRMFS) program. Furthermore, PIF (2010) illustrates that, the Ethiopian agricultural value chains are dominated by a subsistence, low input as well as rain fed farming system in which droughts periodically reverse the profitability of the sector with devastating effects on household food security. Therefore, there is an urgent need to improve productivity, production and market linkages in the value chain to bring economic reforms of the country.

The agricultural sector determines the growth of all other sectors in the country and consequently, the whole national economy. On average, livestock accounts for 47% percent crop production and others contribute 53 percent to the total agricultural value added (IGAD, 2013). As Atsbaha and Tesema, (2010) study shows, the land tilled by the Ethiopian small scale farmer accounts for 95 percent of the total area under agricultural use and these farmers are responsible for more than 90 percent of the total agricultural output.

Cereal crops are most important in Ethiopian agriculture which provides staple diet to the population and also important components of crop production (Alemitu, 2011). Next to cereals, pulses have a larger proportion in supplementing smallholder farm households and providing cheaper sources of protein for poor farmers (Ferris and Kaganzi, 2008). Moreover, white pea beans replace red meat; these beans are a good source of protein when combined with a whole grain such as whole wheat pasta or brown rice, provide protein comparable to that of meat or dairy foods without the high calories or saturated fat found in these foods. It is

produced for its green pod and dry seed form, both edible. White pea beans are edible when boiled, fried, or in the form of soups. It is also milled or grounded to make stews (Firehiwot, 2010). Beside their nutritional values, pulse crops play a vital role to improve the fertility status of the soil through biological nitrogen fixation in cropping systems (George *et al., 2014*). Among the commonly consumed pulse crops, haricot bean is the most widely cultivated and consumed crop in the world and play an important role in human nutrition in East and Great Lakes Regions of Africa by improving the nutritional status of many low income populations (Shimelis *et al*., 2006).

There are a wide range of haricot bean types grown in Ethiopia including white, mottled, red, and black varieties (Shaun *et al.,* 2010). Among the red bean, the most favored and most commercially recognized varieties in Ethiopia comprises *Red Melka*, *a mottled medium sized red*; *Red Wolaita*, a medium sized pure light *red*; and *Nasser*, *a small pure dark red variety* (Frehiwot, 2010). The white haricot bean is often known as white pea beans, due to white seed color; they are otherwise known as navy beans. A commonly grown white pea bean variety in Ethiopia includes: *Awash 1*, *Awash Melka* and *Mexican 142* (Ferris S and Kaganzi E, 2008). White pea beans became the first important crop from pulse category in its export volume as well as foreign export earnings. For instance, in Ethiopia it contributed 6.3% of the total export earnings. As a result, the government has made an intervention by establishing new rule so that it should be transacted exclusively through the ECX platform. The major exporting countries in the world includes: China, Myanmar, Canada, USA and Argentina and their corresponding market share was 26.7%, 18.4%, 1 0.9%, 10.4% and 9.4%, respectively. Ethiopia took the sixth position in the world white pea bean export market with a market share of 2.4% (Frehiwot, 2010)**.** As indicated above, the pulse crops mainly the white pea bean is the major source of hard currency for Ethiopia, of which the yield at the farm gate is sounded by challenges of different kinds.

2. MATERIALS AND METHODS

2.1. Study Location

Adami Tulu Jido Kombolcha district (Fig 2), is located in the heart of Central Rift Valley (CRV) of Ethiopia (Fig 1), Southwest of Lake Ziway at altitude of 1500-2300 m a.s.l. Ziway, one of the major towns in central rift valley, is the capital of this district. It is located at 163 km from the capital of Ethiopia, Addis Ababa. There are several seasonal and permanent rivers. Bulbula, the main river in the district, joins the upstream Lake Ziway and the terminal Lake Abiyata. The population density of the district is 139 person/km^2. Of the total land area 27% is cultivated with crops, 22% is used for pasture, 10% is covered by forest, 16% is swampy and the remaining 25% is unproductive or degraded (CSA, 2005). Different types of small- and large-scale irrigated and rain-fed farming systems can be identified (Scholten, 2007). Usually, both farming systems are combined, i.e. rain-fed smallholder farmers also have irrigated plots. The district consists of 43 Kebeles among which some frequently experience food insecurity. Minimum and maximum annual mean temperatures are 14 and 27^{o}C, respectively. The district is characterized by bimodal pattern of rainfall; with short rainy season running from February to April and long rainy season from June to September. However, the pattern of rainfall is usually erratic with fluctuations in the start and end of the season. The study areas have a mixed crop-livestock farming system. The major crops grown include maize, sorghum, teff, wheat, barley, field peas, fava beans, sweet potatoes and other vegetables. The main types of livestock kept include cattle, sheep, goats and chickens. Potential region for white pea bean production in this area lies on the east of Lake Ziway and white pea beans are typically rain-fed, grown without chemicals. As there is no irrigated production, yields are highly dependent on rainfall.

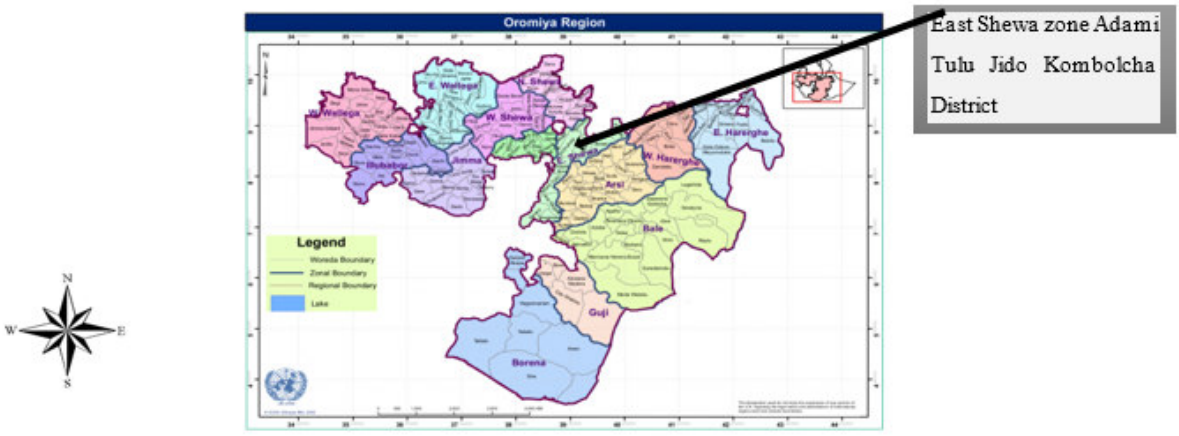

Figure 1. Map of the Study Area
Source: OCHA (2013)

Primary and secondary data were used to conduct this study. Primary data were collected using formal

survey. The nature of the study demands involvement of numerous actors engaged in white pea bean value chain at different stages along the chain, thus, the data was collected from input suppliers, small scale white pea bean producers, and primary cooperatives participating in white pea bean marketing, cooperative unions, local assemblers, wholesalers and Exporters. Hence, the information collected includes inputs, production, yield, transportation, product handling, the marketing system and value addition by each actor. Secondary data was collected from different sources such as from government institutions available in the district, Ethiopian Commodity Exchange Authority and non-governmental organizations operating in the study area. Besides, relevant published and unpublished reports, bulletins and websites were investigated to generate pertinent secondary data on determinants of yield of white pea bean and to analyze the roles of the respective actors in the value chain. Discussion was made with the concerned experts and other officials to pursue additional information and/or cross check the data. Additionally, data on production, lists of kebeles and households was obtained from OoARD and list of cooperatives and wholesalers (suppliers) engaged in white pea bean marketing was obtained from trade and market development office of the district.

To determine and understand the roles and the characteristics of the chain actors, the relationships exists between them, including the identification of all actors in the chain; the flow of product through the chain; the work features and the destination; information was obtained by survey data and by collecting secondary data from various sources. The study has employed value chain analysis which is very effective in tracing product flows, this could be captured through mapping the value chain. Mapping the value chain facilitated understanding of sequence of activities, key actors, relationship involved and volume of product flow in the value chain. This analysis was undertaken in qualitative and quantitative terms.

A two stage sampling technique was employed to analyze factors affecting the yield of white pea bean. In the first stage, three major white pea bean producing Kebeles found in the Adami Tulu Jido Kombolcha district were selected purposively based on information obtained from the district office of agriculture and rural development. In the second stage using probability proportional to size technique, potential producers of white pea bean were selected from each selected sample *Kebeles*. A total of 115 sample white pea bean producers were randomly selected from the three *kebeles* administrations.

To analyze factors determining the yield of white pea bean at farm gate OLS regression analysis was used.

2.2. Model Specification

Based on Greene (2003), the multiple linear regression model is specified as:

Y= f (age, sex, hhsize, exper, livestock, seed_ type, hhedu, credit, extension, Fertilizer labor, offinco.)

The econometric model specification of yield function in matrix notation is estimated by

$Y_i = (X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{10}, X_{11}, X_{12}, X_{13}, X_{14})$

Y_i = Yield

X_1 = Age of the household head

X_2 = Sex of the household head

X_3 = white pea bean farming experience

X_4 = livestock owned

X_5 = seed type used

X_6 = household education

X_7 = Access to credit service

X_8 = household size

X_9 = Use of fertilizer

X_{10} = Extension contact

X_{11} = labor

X_{12} = of farm income

The model has been specified in such a way:

$$Y = x'\beta + u \qquad (1)$$

Where Y_i = white pea bean yield

β = a vector of estimated coefficient of the explanatory variables

X' = a vector of explanatory variables

u_i = disturbance term

The parameter estimates of the above model may not be Best Linear Unbiased Estimator (BLUE) when some of the assumptions of the Classical Linear Regression (CLR) models are violated, thus, it is important to check the presence of multicollinearity among the variables that affect yield of White pea bean in the area. Hence, before fitting significant variables into the model, it was necessary to check these problems among the continuous and dummy variables and see the association between the discrete variables, which

seriously affect the parameter estimates. In this study, Variance Inflation Factor (VIF) was employed to estimate the degree of multicollinearity among the explanatory, continuous and dummy variables of the yield function. On the other hand, test for heteroscedasticity was undertaken in the study. Among the many test statistics for heteroscedasticity, the Breusch and Pagan test of hetroscedasticity was used especially for its simplicity.

3. RESULT AND DISCUSSION

3.1. White Pea Bean Value Chain Actors and their Corresponding Roles

Value chain actors are categorized under two important sections, these are direct and indirect actors. According to KIT *et al*. (2006), the direct actors are those involved in commercial activities in the chain (input suppliers, producers, traders, retailers, consumers) and indirect actors are those that provide financial or non-financial support services, such as credit agencies, business service providers, government, NGOs, cooperatives, researchers and extensionists. In the study area, there are different actors involved along the white pea bean value chain, upstream from input supply to downstream exporters, playing different roles. The major actors participating in white pea bean value chain and their roles are discussed below.

Input suppliers: The District Agricultural office, Meki cooperative union, Melkassa Agricultural Research Centre and NGOs operating in the district are the main responsible actors for the delivery of inputs like improved seed and fertilizers in the study area. Development agents and district agricultural experts are playing facilitation role in collecting farmers input requirement demand and surrendering to the district agriculture office, then they communicate with the stakeholders to fulfill the input demands of the farmers. They also play the same role during input distribution.

White pea bean producers: All white pea bean producers in Adami Tulu Jido Kombolcha are small scale producers. These farmers are the major actors who perform most of the value chain functions right from farm inputs preparation on their farms or procurement of the inputs from other sources to post harvest handling and marketing. The major value chain functions that white pea bean growers perform include ploughing, planting, fertilization, weeding, pest/disease controlling, harvesting and post-harvest handling. The suitable climatic conditions can make production of white pea beans highly demanded and competitive, and provide enormous opportunities in the study areas. However, these opportunities have not been exploited by the farmers due to low quality supply resulted to the lower price they receive for their produce in the markets, as well as bearing the cost of post-harvest losses because of the labor intensive nature of the crop. White pea bean production in this district was based on rain fed system and sole cropping is also the most popularly practiced production system in the district.

Post-harvest handling, which includes different activities like threshing, winnowing, grading, packing, storing, transportation, loading and unloading, is done by the farmers themselves or traders or local collectors and primary cooperatives. If white pea bean are sold at the farm gate, all the aforementioned activities are performed by the buyer (traders or local collectors). Most of the farmers use sacks to store white pea beans in their residential house. The study conducted by USAID (2012) on cost benefit analysis of white pea bean value chain, postharvest losses due to improper harvesting, Handling, packaging and poor facilities to market is estimated to be 5% in the study area.

Local assembler's: Local assemblers operate at Batu and Bulbula white pea bean market most of them was operate in informal way. Currently the marketing operation is held under white pea bean market shed, and they are engaged in buying of white pea bean from farmers and sell it to wholesalers. They add value by assembling and transporting white pea bean. Some of them do not have sufficient capital so that they operate as agents of wholesalers and some of them are licensed with the help of wholesalers to buy white pea bean in the market. Their major sales outlets are wholesalers who buy about all of the assemblers' total sales.

Primary cooperatives: Primary cooperatives are established by farmers from different kebeles**.** The cooperatives purchase from their members and non-members. There are few primary cooperatives in the district who purchase white pea bean at time of harvest from white pea bean producing farmers at a better price (10% increment) than the market price during peak marketing time. Cooperatives in the study area perform collecting, transporting and selling functions. After purchase they sell directly to cooperative union.

Cooperative union: Cooperative unions are engaged in grain marketing, input distribution and training the management members of primary cooperatives. The cooperative union purchase white pea bean directly from primary cooperatives. In the study area, there is a cooperative union called Meki Bora. The union is located in Meki 134 km away from the capital city and operates in many districts of Eastern Shewa Zone and engaged in marketing of maize, wheat, red haricot bean and white pea bean. White pea bean is potentially supplied from Adami Tulu Jido Kombolcha district.

Wholesalers (Suppliers): The wholesalers operating in Adami Tulu Jido Kombolcha district obtain their supplies of white pea bean either from farmers or/and local assemblers. They mainly operate in Batu and Bulbula markets. They handle the lion share of total white pea bean sold by farmers. They assemble, sort, store and transport their white pea beans before supplying to ECX warehouse in Adama branch for inspection on quality

and grading.

Ethiopia Commodity Exchange (ECX): The Ethiopia Commodity Exchange is a market place, where buyers and sellers come together to trade, assured of quality, delivery and payment. The suppliers of ECX market are potential farmers, suppliers, primary cooperatives and cooperative unions. On the other hand the buyers are food processors, exporters and international food aid organizations. ECX offers an integrated warehouse system from the receipt of commodities on the basis of industry accepted grades and standards for each traded commodity by type to the ultimate delivery. At the ECX warehouse, commodities are sampled, weighed and graded using state-of-the-art technology grading and weighing equipment (appendix). ECX inventory management system guarantees the quality and quantity of the commodity throughout the pre-determined period of storage. Further, ECX warehouses are insured at maximum coverage to protect against loss and damage of deposits.

Exporters: These are traders who buy white pea bean at ECX trading floor through auction. They also purchase and export other crops simultaneously. They obtain white pea bean from wholesaler agents, and cooperative unions. After exporters buy and process to meet standard of exports they sell it to importers.

Supportive actors: Value chain supporters or enablers provide support services and represent the common interests of the value chain operators. They remain outsiders to the regular business process and restrict themselves to temporarily facilitating a chain upgrading strategy. Typical facilitation tasks include creating awareness, facilitating joint strategy building and action and the coordination of support activities (like training, credit, input supply, etc.). The main supporters of the white pea bean value chain in the study area are district's Office of Agricultural and Rural Development (OoARD), International Development Enterprise (IDE) Meki catholic, Busa Gunufa (SC.), WALCO, GRAD (USAID project), SNV, Melkasa and Adami Tulu research center, and Batu district Trade development office and cooperative development office. OoARD support though providing inputs and technical advice on white pea bean production. Melkasa research center assists white pea bean value chain through providing training to farmers, extension services and identifying and disseminating new varieties of white pea bean. Even though cooperative development office and trade development office is inefficient to support white pea bean value chain, it aims to support through providing market information, strengthening available cooperatives, disseminating ECX contract and quality standards of white pea bean, developed by ministry of trade and organizing new producers cooperatives.

To illustrate the role of respective actors in the value chain, mapping plays a significant role to depict the interaction of the actors involved in white pea bean value chain and activities performed by different value chain actors (McCormick and Schmitz, 2001). It also demonstrates that flow of white pea bean production inputs from input suppliers to producers as well as flow of the product from farmers through different value chain actors to the exporters. There is also information flow regarding the quality and price of white pea bean from cooperatives, OoARD to producers. Information on quality and price of exportable white pea bean flows to both sides from exporters to importers as well as importers to the exporters. Information on grade and price also flows from supporting actors like ECX to main value chain actors.

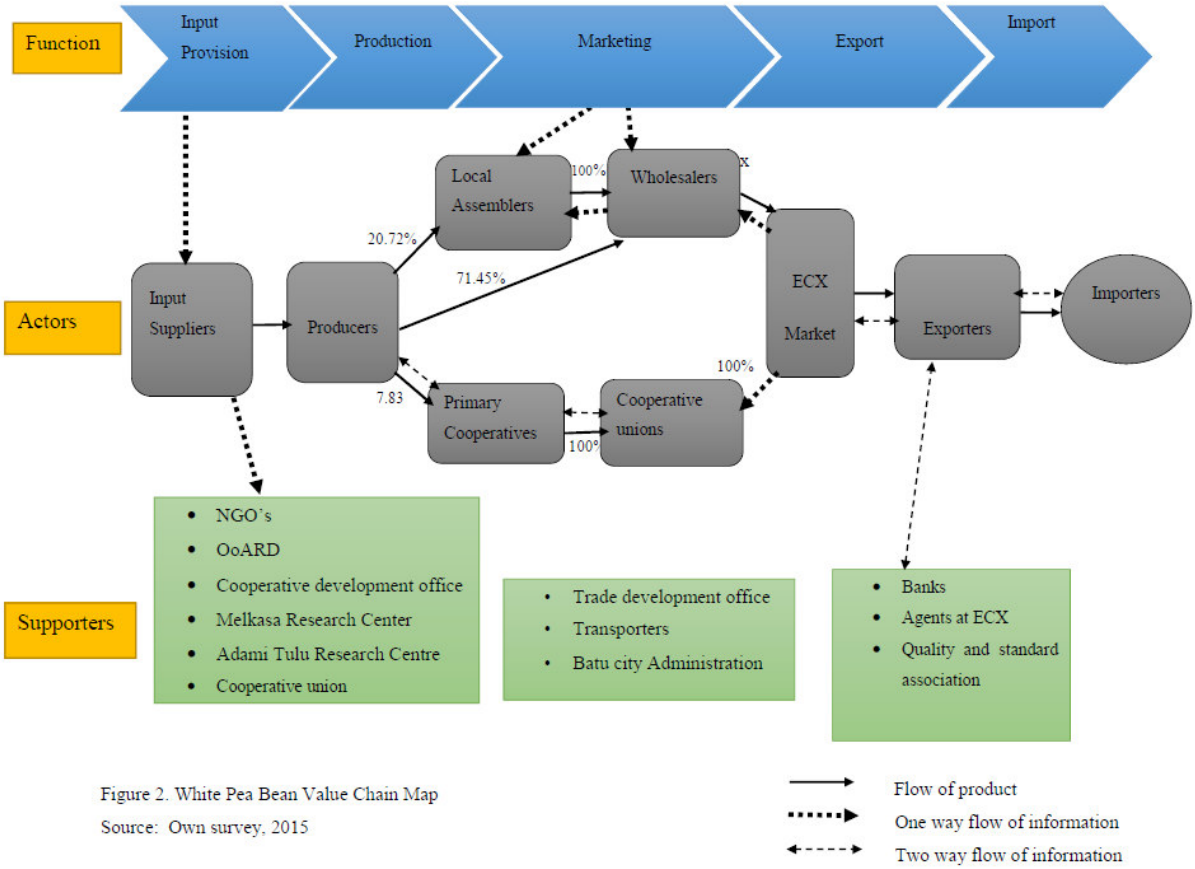

Figure 2. White Pea Bean Value Chain Map
Source: Own survey, 2015

3.2. Governance of White pea bean Value chain

The dominant value chain actors play facilitation role. They play significant role in the flow of commodities and level of local market prices. In effect they govern the value chain and most other chain actors subscribe to the rules set in the marketing process. The study result indicates that the exporters and wholesalers assisted by the brokers are the key value chain governors. The local market is heavily dependent on white haricot bean export price, and therefore the white pea bean value chains are highly influenced by the export market price. In most cases, the business relations between the various operational actors are not free market exchange but it is uncoordinated at all marketing stages except at ECX floor. Due to the lack of a proper market information system and minimal bargaining power, farmers are forced to sell their product at the price offered by brokers assigned by local assemblers. Wholesalers in Adami Tulu Jido Kombolcha District usually refer to ECX markets for price fixation but some times the price is fixed by brokers residing farmers. There is no strong vertical linkage between value chain actors, but there is horizontal linkage between wholesalers, cooperative unions and primary cooperatives, farmers with farmers and exporters with each other also. In some cases, there are complaints on ECX by suppliers regarding payment delayance and primary cooperatives have also complaints on cooperative unions. On the other hand, poor quality coordination in the district was observed from the collected data. Overall, the governance of the white pea bean value chain is export market driven with minimum trust between various actors. Wholesalers and exporters at ECX market are always complaining that the farmers are not providing quality product while farmers are blaming the wholesalers and local collectors for offering low prices. The exporters are complaining ECX because of inappropriate grading system, the exporters prefer the quality grading system to be set by the origin of production area because they have information that all white pea bean produced in Ethiopia does not have naturally the same quality.

3.3. Determinants of White Pea Bean Yield

White pea bean is produced mainly for market and the main cash crop for Adami Tulu Jido Kombolcha district producers. Very recently, the white pea bean international markets have become so attractive that many actors are involved in white pea bean export market. International prices served as the main driving force for white pea bean production. The study clearly indicated that almost 100% of white pea bean production of the 2014/15 production year has been supplied to the market, but very few farmers retain for seed for the next farming season

Table 1.OLS regression, list of variables affecting yield of white haricot bean

yield	Coef.	Std. Err.	t	P>t
_cons	14.99	4.99	3.00***	0.003
age	-.072	.0321	-2.24**	0.027
sex	.646	.979	0.66	0.511
exper	.027	.041	0.65	0.515
livestock	.240	.048	5.03***	0.000
seed_type	.458	.538	0.85	0.397
hhedu	.983	.538	1.83*	0.070
credit	-.212	.532	-0.40	0.691
hhsize	.055	.115	0.47	0.636
Fertilizer	5.469	.650	8.42***	0.000
extension	5.980	1.209	4.95***	0.000
labor	-.554	4.176	-0.13	0.895
offinco	.00005	.00006	0.82	0.412

F = 13.28, R^2= 0.6098, adjusted R^2 = 0.5639 and n= 115, [1] *, ** and *** denotes level of significance at 1%, 5% and 10% respectively

Based on the OLS model result, analysis of determinants of farm level yield of white pea bean was found to be important to identify factors determining white pea bean productivity. In this regard, 12 variables were hypothesized to affect the yield of white pea bean. Multiple linear regression model was employed to identify the factors. For the parameter estimates to be efficient, assumptions of Classical Linear Regression (CLR) model should hold true. Hence, multicolliniarity and heteroscedasticity detection test were performed using appropriate test statistics for each. The VIF values are less than 10 which is 1.58. This indicates absence of serious multicollinearity problem among independent continuous variables.

The results obtained from analysis shows that R^2 value of 0.6098 and the adjusted value is 0.5639. The number of significant variables are five (Table 1), which are age at 5% significance level, livestock at 1% significant level, household head education at 10% significant level, use of fertilizer at 1% significance level and extension service at 1% significance level. However, since there is no heteroscedasticity problem in the data set, these parameter estimates of the coefficients of the independent variables are BLUE.

The F-value for the model from this analysis, is 13.28 and it is significant at 1% significance level which indicates that the model fit is good. R^2 value of the model is 0.6098 and adjusted value is 0.5639. This result indicates that about 60.98 percent of the variation in farm level yield of white pea bean was attributed to the hypothesized variables. However, all the signs of the parameter estimates of the significant variables are as expected.

Although aged household heads are believed to be wise in resource use, and expected to have a positive effect on yield, on the other hand, older households may also be tradition bound and reluctant to take up new technologies, as a result its negatively significance at 5% probability level indicates that, a unit increase of age of the household head decrease productivity of white pea bean by 0.072 quintal, while other factors held constant. In similar way it has been reported by Adugna (2009) in his study analysis of fruit and vegetable market chains in Alamata woreda founded that age of household head negatively affected the elasticity of onion production.

Household head education positively affected the productivity as hypothesized before. Thus, holding other factors constant, educated household head increased the amount of white pea bean yield by 0.983 quintal than those who are not taken formal education. This implies that formal education usefully develops the household awareness level improve their knowledge of using agricultural inputs, as a result they increase productivity and supply more to market. In similar way Alemayehu (2012) showed in his study on analysis of production and market channel of ginger, household who have formal education observed to affect the volume of ginger supply to market.

Livestock owned also positively and significantly affected the yield at 1% significance level. Thus, holding other factors constant, a unit increase in number of livestock (TLU) increased the amount of white pea bean yield by 0.24 qt. The rationale is that an increased livestock obviously increases soil fertility by contributing manures. Improved fertility of land in turn results in increased per unit area productivity of white pea bean there by increased market supply. Moreover, households owning dairy cows might sell some dairy products (e.g. butter) and buy inputs like white pea bean seed, fertilizers and agricultural implements, thereby increase white pea bean production and its market supply. I a similar way, Alemayehu (2012) founded on his study conducted on analysis of production and marketed supply of ginger, reported that livestock ownership significantly and positively affected the production and marketed supply. In Similar way Abay (2007) confirmed the same fact on his study conducted on vegetable market chain analysis in Amhara National Regional State.

The relationship between use of fertilizer and yield was significantly positive and it strongly affected

the yield at 1% significant level. Under the assumption of cetris puribus, for house hold head being of user of fertilizer, the amount of white pea bean yield becomes increased by 5.47 quintal than those not users. a study was conducted by Birachi *et al*. (2011) on factors influencing small holder farmers' bean production is consistent with this finding, and also Wegayehu and Tewodros (2015) revealed the same fact on study conducted on factors affecting bean production.

As hypothesized, contact with extension agents positively influenced the yield and was strongly affected at significance level of 1%. In this study farmers who take extension contact brought a significant difference than those not received the service. It is believed that farmers who have frequent contact with their respective extension agents have more knowledge and understanding on proper use of inputs and other technologies to increase productivity. Therefore holding other factors constant, being of extension user increased the productivity of white pea bean by 5.98 quintal than those not received extension service. Similar study has been conducted by Alemayehu (2012), which a marginal increase in number of extension visit increased the amount of ginger production and supply.

4. CONCLUSION AND RECOMMENDATION

Ethiopia has good track record in exporting pulse crops in the international market. Factors associated with this improved performance of the country's export of pulse crops is attached mainly with the resource potential, the existence of conducive agro climatic condition to plant and grow such high value crops. Similarly consistent increase in the private sector engagement in pulse crops export business and allied packaging input supply venture has brought paramount importance in busting the export volume from this crop. Alike to other commodities the strategic location of the country to the major pulse crop importing target markets and the country's comparative advantage of having least cost of production relative to major competitors like China and Canada contributes to competitiveness of the actors engaged in this business venture vis-a vis increasing the export volume .

Based on the model findings we tried to forward the following points

- As the age of farmers increases the rate of adoption of technology might decrease, so that introducing simple farming practices at household level to improve productivity which is easily adopted by elders, strengthening horizontal linkages in the value chain among white pea bean producers and promoting peer learning should have to be employed in the study area.
- household livestock holding is positively and significantly affected the yield, this gives implication to the way that strengthening the livestock holding of farmers increase the financial performance of farmers to purchase inputs at a given time. Additionally, it has paramount contribution to improve fertility of the farm to maximize per unit area yield of white pea bean.
- In case of production, household heads with very limited education encounter difficulty in successfully managing the field, fertilizer and pesticide applications, post-harvest value addition, scanning the market and also fail to understand what to produce in line with taste and preference of consumers demand, especially in the presence of ineffective extension services. So stakeholders' and Agricultural and Rural Development Offices have to create awareness about the specialty of white pea bean market. Continuous education and training on productivity will have a positive impact on their attitudes.
- From the analysis result extension contact is the significant factor which determine the yield of white pea bean, so to strengthen the existing extension service provided to farmers, efforts should be made to train farmers for relatively longer period of time. As it has been discussed on descriptive part of this research, there is high turnover of extension workers in the study area, so through providing incentives and appropriate promotion to extension agents their capacity has to be built to increase the productivity of this commercial crop.
- Lastly, farmer's trend of using chemical fertilizer for white pea bean has to be strengthened, this can be achieved through supplying appropriate commercial fertilizers or strengthening extension service to promote the use of organic fertilizers to increase the productivity of white pea beans.

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