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Common beans production for improved livelihoods of peasants in Tanzania's smallholder farming system

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Abstract

Agricultural has continued to be a major economic and production activity enabling poor communities in Sub-Saharan Africa to sustain. Common bean (*Phaseolus vulgaris* L.) is an important legume for the livelihood of smallholder farmers in northern Tanzania and it is a main source of protein for low-income households. In upland areas of Kilimanjaro regions, common beans are grown both as food and cash crop replacing the coffee crop off which its production and market value has tremendously dropped in recent years. This study was conducted to investigate both social and economic contribution of this crop to livelihood of peasant farmers in this area. A total number of 300 farmers were interviewed face-to-face using a pre-tested structured questionnaire. The results found that majority of farmers depend on common beans as source of protein and has significant contribution to the income of households. Similarly, it was also observed that common beans were significantly cultivated by women (61 %) compared with men (39 %) supporting previous studies that bean is a women crop in African smallholder farming system and it's contribution to livelihood of women in low-income communities is huge. This study argue that farming and management activities that support sustainable bean production such as access to improved varieties and inputs should be encouraged to increase yield for improved livelihood of peasants in this agro-land.

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Introduction

Agriculture has continued to remain a major economic and production activity enabling poor communities in Sub-Saharan Africa (SSA) to sustain. A large group of people in this region depend on agriculture for food and as source of income for their living (Davis *et al.*, 2017). Although limited large-scale farming do exists, most farmers are small-scale holders practicing rain-fed agriculture in small sized farms (Cooper *et al.*, 2008). Smallholder or subsistence farming has enormous contribution to food security of African low-income households (Baiphethi and Jacobs, 2009). Modern and sustainable production technologies such as drip irrigation and improved seeds are less practiced in this region (Binswanger-Mkhize and Savastano, 2017). For the past few decades, agricultural production in this region has become challenging due to increased effect of diseases and pest infestation as a result of increased environmental strains (Ghini *et al.*, 2011; Arndt *et al.*, 2012; Kutywayo *et al.*, 2013). Although climate change has already affected agricultural production due to rainfall fluctuations, increased temperature and prolonged dry seasons (Ngaira, 2007), their projected impacts in this sector is much worse (Schlenker and Lobell, 2010; Asafu-Adjaye, 2014).

Main crops cultivated in this region include both local and breed variety of cereals, legumes and nuts (Altieri, 2004). While maize, millet and sorghum are main staple cereals in Africa (Haggblade *et al.*, 2017; Magrini *et al.*, 2017; Porteous, 2017), common bean (*Phaseolus vulgaris* L) is abundantly grown and compared with other sources it comprises an economical source of protein with many other essential elements (Dzudie *et al.*, 2002; Margaret *et al.*, 2014). Common beans are the most important legume crop and are consumed as the main source of protein in many low-income households (Katungi *et al.*, 2009; Gurmu, 2013). Common beans are consumed in various forms and provides up to 15% and 30% of the total amount of energy and protein intake respectively required in daily basis (Katungi *et al.*, 2009; McConnell *et al.*, 2010). In agricultural soil where Nitrogen nutrient continue to downgrade with time, common beans have bean grown in a mixed stand as green manure to increase Nitrogen level in the soil by fixing free available atmospheric nitrogen to usable form (Mureithi *et al.*, 2003; Yoseph *et al.*, 2014). It can also be used for feeding ruminants because it takes short time to mature and it has high protein content (Dos Santos *et al.*, 2019). In crop-livestock farming systems, residues of common beans remained after harvest are used as feedstuffs for livestock (Yoseph *et al.*, 2014; Dejene *et al.*, 2018). Apart from protein which is the chief element in this grain, it also provides other essential elements required by the body for its normal function (Gurmu, 2013; Margaret *et al.*, 2014). Being essential and most preferred dietary protein in developing countries (Hillocks *et al.*, 2006), intervention on production systems is highly needed to increase yields. Although the crop is mainly grown for food in Africa, it is also a source of income to low-income households enabling them to afford basic life needs (Hillocks *et al.*, 2006; Yoseph *et al.*, 2014; Nakazi *et al.*, 2017).

Like in other East African countries, agriculture is the backbone of Tanzania's economy and has enormous contribution to the livelihood of people particularly in the rural communities (Levira, 2009; Mkonda and He, 2016). Among other basic crops, common bean is the most important grain legume crop grown in smallholder farming systems in Tanzania (Hillocks *et al.*, 2006). However, most famers still grow local varieties which make the overall common beans production low and below the average (Bucheyeki and Mmbaga, 2013). The crop is largely cultivated in lakes zone and northern part of the country serving as a cheap protein source especially in low-income households (Hillocks *et al.*, 2006; Katungi *et al.*, 2009). It is also grown for income generation and about 40% of the total beans produced by households are sold in the local markets (Binagwa *et al.*, 2018). Although common bean is among important food crops in northern Tanzania, its potential contribution to gender equality and livelihood of peasant farmers in this region has been quiet limited. This study aim at exploring how important this crop is for the

improved life of poor households in this agri-system. Although some reports shows that women contribute to over 50% of agricultural labour work in sub-Saharan Africa (Thamaga-Chitja, 2012), their role as crop producers particularly in this region has not been well recognized. This study also discusses the involvement of women in bean production and how this crop has influenced their decision-making in the households.

Materials and methods

Study area

The study was conducted from May to October 2017 in a smallholder farming system located in Moshi Rural District, in Northern Tanzania. The area receives two rainfall patterns where the long rains fall between March and May while the short rains fall between October and December (Zorita and Tilya, 2002; Røhr and Killingtveit, 2003). Agriculture is the main economic activity but most farmers also keep livestock mainly cattle and goats for milk and organic manure for their crops. The most common crops are common beans and maize although crops such as traditional banana, sweet and Irish potatoes, coffee, sunflower and varieties of vegetables are also grown in the study area (Soini, 2005; Hemp, 2006; Maghimbi, 2007). The most common variety of beans recorded in the area included Uyole njano, Lyamungo 90, Kijivu local variety, Jesca, Rose coco and Kariasii.

Survey designing and data collection

Prior to this study, research permits were granted by village government authority. The survey involved smallholder farmers growing a bean crop in the study area. The area was categorized into three cultivation zones based on elevation gradient; low zone (<1000m), mid zone (1000-1500m) and high zone (1500-1800m). Farmers' names were obtained from the village offices located in each zone with the help of the local agricultural extension officers from each village. In each zone, 100 farmers who were willing to participate in this study were selected, with the principal criterion being that they grew beans. With their consent, farmers were interviewed face-to-face using a pre-tested structured questionnaire in Swahili language off which all farmers speak and understand it very well.

The questionnaire was comprised of two main sections: demographic information and main questions of the study. The main questions were framed to explore the socio-economic importance of bean crop in improving livelihood of smallholder farmers.

Training of interviewers

Prior to actual data collection, a total number of 10 interviewers were trained by researchers for two days at Nelson Mandela African Institution of Science and Technology (NM-AIST), Arusha, Tanzania on ethics and data collection techniques so as to obtain quality data while maintaining a good relationship with the farmers' community. After training, the interviewers undertook two days pilot session in a nearby village in order to test questionnaires, familiarise with questions but also for researchers to evaluate the ability of each interviewer to do the work before sent to the field for actual data collection.

Data analysis

Farmers responses were analysed using R statistical software (R Core Team, 2017). To test significant differences between farmers' responses on the importance of common beans to the livelihood of people in three zones, a Kruskal-Wallis rank sum test (KW) was used (Sheskin, 2011).

Results and discussion

Age of all respondents

The results showed that most farmers who grow common beans had age ranging between 21 and 60 years. About 45% of the bean producers had age between 21 and 40 followed by those with age ranging between 41 and 61 years (44%). Also, about 10% of bean producers had age above 60 years whereas 0.67% was below 20 years of age.

It was also observed that the low and high zones had higher number of old bean producers compared with the mid zone (Table 1).

Table 1. Age of respondents.

Zone	Respondents' age (year)				Total
	0-20	21-40	41-60	Above 60	
Low	2	37	46	15	100
Mid	0	54	44	2	100
High	0	44	41	15	100
Column Total	2	135	131	32	300

This study has revealed that the middle age group mostly does bean production activities and the explanation could be that they are most experienced and energetic group compared with people below 20 and above 60 years of age. It was also reported by Jayne *et al.* (2017) that more than 30% of the agricultural labour force is under 35 years of age. For the young people below 20 years of age, the reason could be that they are still depending on their parents for living but also spend most of their time in schools and colleges rather than farming. Another explanation could be that most young people in Africa are now unable to inherit lands from their elders as it used to be because agricultural land is increasingly limited in smallholder farming systems due to increased population (Jayne *et al.*, 2017). Therefore, most youths might have migrated to other rural areas to search for wage employment or to urban areas for alternative source of income rather than farming (Wineman and Jayne, 2017).

Table 2. Gender of respondents.

Zone	Female respondents	Male respondents	Total
Low	77	23	100
Mid	57	43	100
High	48	52	100
Total	182	118	300

Gender of respondents

The results presented in Table 2 found significant differences between gender of the respondents who were interviewed in this study where 61% (182) were female and 39% (118) male (KW = 10.087, df = 1, p = 0.0015). Our results agree with previous studies that more women grow beans compared with men (Broughton *et al.*, 2003).

It was also reported by Thamaga-Chitja (2012) that women contribute to over 50% of agricultural labour work in sub-Saharan Africa. The results indicated that women play major role in production of common beans in Tanzania's smallholder farming systems.

Household's decision making

The results showed that in all three zones, women makes final decision on how harvested beans could be used in the households compared to other family members (Fig. 1). Overall, the results indicates that farmers in all three zones have same outlooks because we found no significant differences across the zones regarding who make final decision on the use of harvested common beans in the households (KW = 3.1849, df = 2, p = 0.2034). About 41%, 37% and 59% of interviewed farmers in the low, mid and high zones respectively, mentioned that women (mother) are responsible for controlling consumption of harvested beans in the household. About 46%, 55% and 39% of farmers in the low, mid and high zones respectively, mentioned that both mother and fathers (parents) make final decision on how harvested beans could be used by the household. However, about 12%, 8% and 2% of farmers in the low, mid and high zones respectively, mentioned father being decision maker on the same scenario. Only 1% of farmers in the low

zone mentioned that decision making on how beans could be consumed in the household is the matter of the whole family while no farmers in both mid and high zones mentioned so. The results indicate that common beans production has at least empowered women in this area in decision-making in the household. This could have high impact in food security and improvement in nutrition status of children in particular households due to wise use of the harvested food resources.

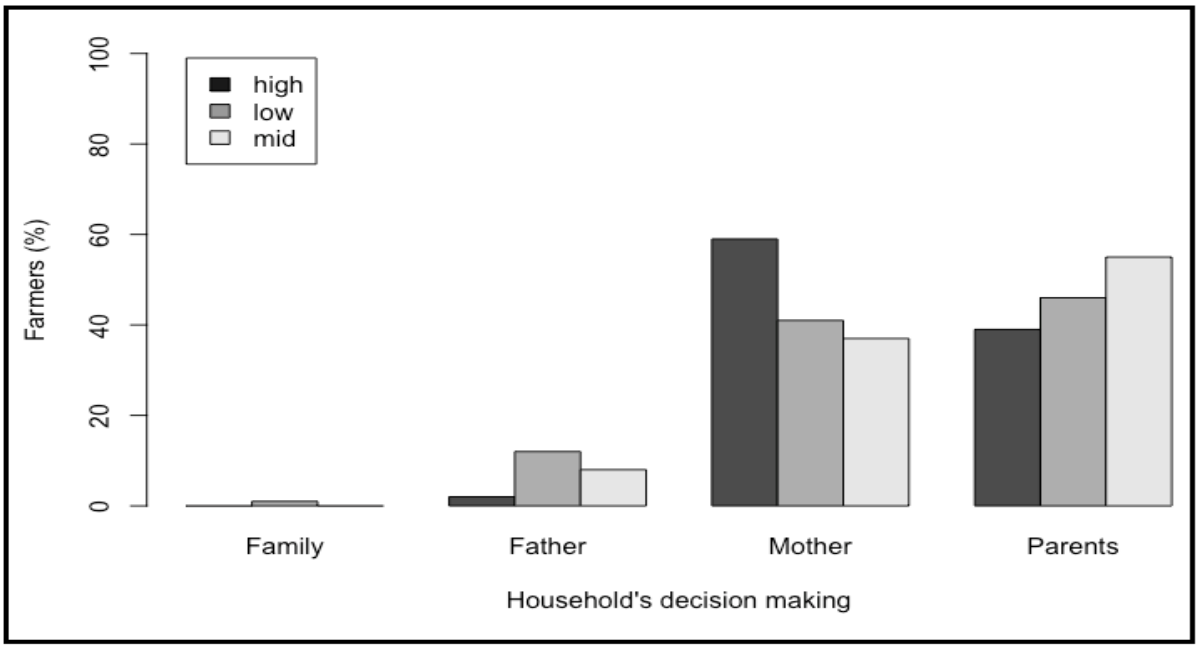

Fig. 1. Farmers' responses on who took final decision on how beans harvest could be used in the households.

Beans consumption per week

We found common beans being an important source of protein in the study area and most farmers consume a meal with beans at least three times a week (Fig. 2).

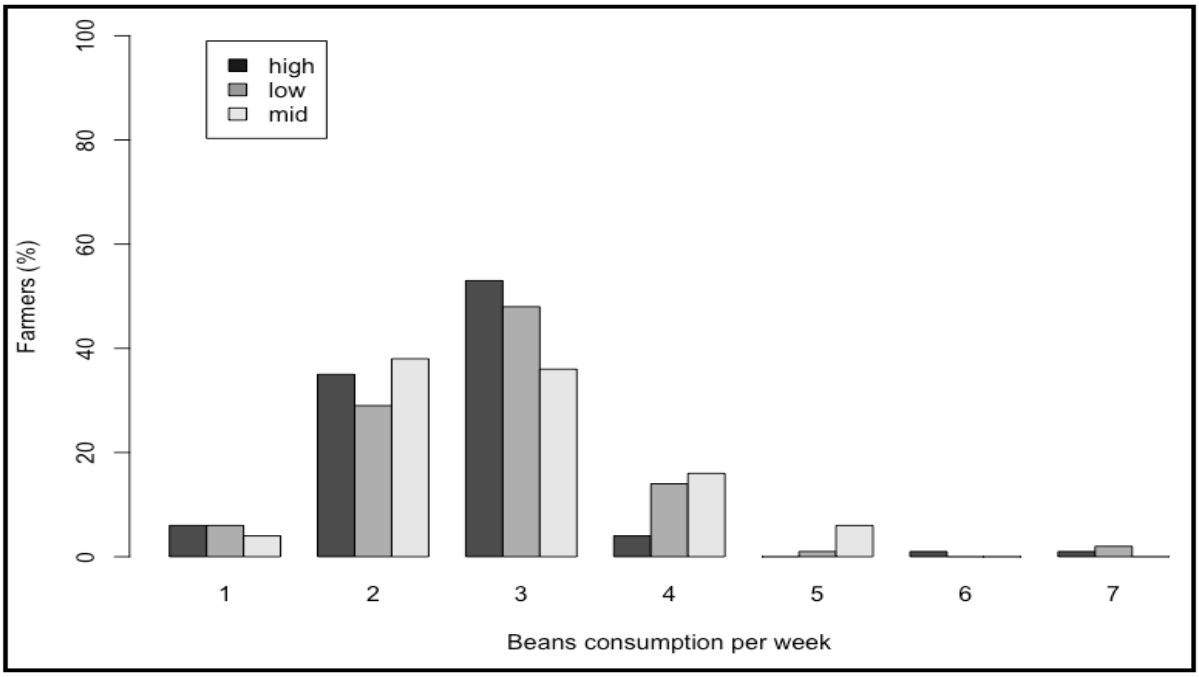

Fig. 2. Number of meals consumed with beans per week in farmers' households.

The minimum number of meals consumed with beans in a household was one and the maximum being seven per week. A large group of farmers about 53%, 48% and 36% in the high, low and mid zones, respectively consume meals with beans at least three times per week. Also, we found a relative small group of farmers who consumed beans almost every day (Fig. 2). However, we found no significant differences in consumption of beans per week among farmers across three zones (KW= 2.5383, df = 2, p = 0.2811).

Common bean (*P. vulgaris*) is an important and preferred source of dietary protein for poor households in many African countries (Broughton *et al.*, 2003). In the study area, we found smallholder farmers growing common beans mainly for food and have significant contribution to the diet of smallholder farmers. Similarly, Gurmu (2013) also reported common beans being the major source of protein to smallholder farmers in Ethiopia.

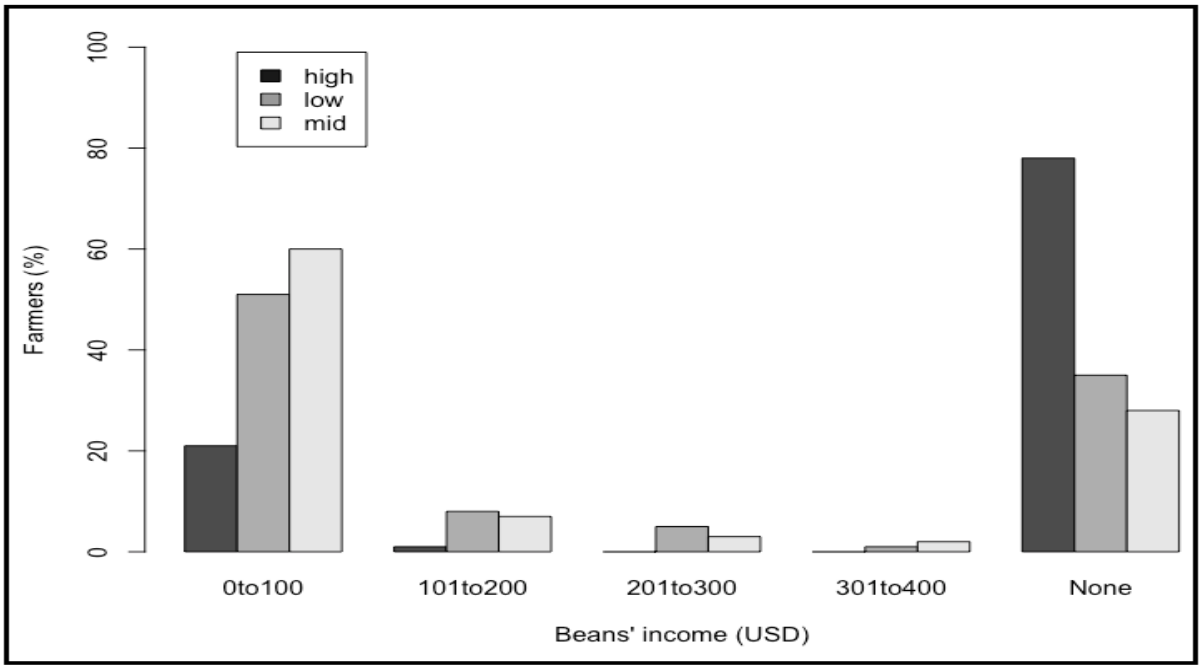

Fig. 3. Income generated by smallholder farmers after selling their beans during first season of 2017.

Although it is a major legume crop cultivated in most areas of Tanzania (Hillocks *et al.*, 2006), most farmers in this area grow beans in a small portion of land less than one acre. To ensure that each household harvests sufficient beans for their own consumption within small portion of land they have, there is a need to train farmers on best and sustainable production techniques that can be used to increase yields per unit area. This will eventually help to ensure food security among poor households in this region without expanding their agro-lands that may degrade the environment.

Beans' income

Apart from being an important meal in the households, beans have been used as an alternative cash crop replacing a long time coffee crop particularly in highland area. The results found significant variations in income earned by farmers across three zones after selling beans during this season (KW= 49.564, df = 2, p < 0.001). Our results found higher number of farmers (21%, 51% and 60%) in high, low and mid zones respectively, making an income between to 100 USD after selling beans in the local market during first season of 2017. Although we found some farmers earning more than 300 USD in the mid and low zones (Fig. 3), majority of farmers particularly in the high zone didn't earn any income from selling beans in that season. However, beans harvests were very low and farmers didn't have enough beans to sell for income generation that's why only 2% of farmers in the mid, 1% in the low and none

of them in the high zone earned more than 300 USD during that season. According to farmers, the major reasons for low harvest were bad weather, pests and shortage of land for cultivation in this area. Although they planted beans during this season, the amount of beans harvested was low enough to satisfy household's protein requirement and there was no extra beans for selling in the market.

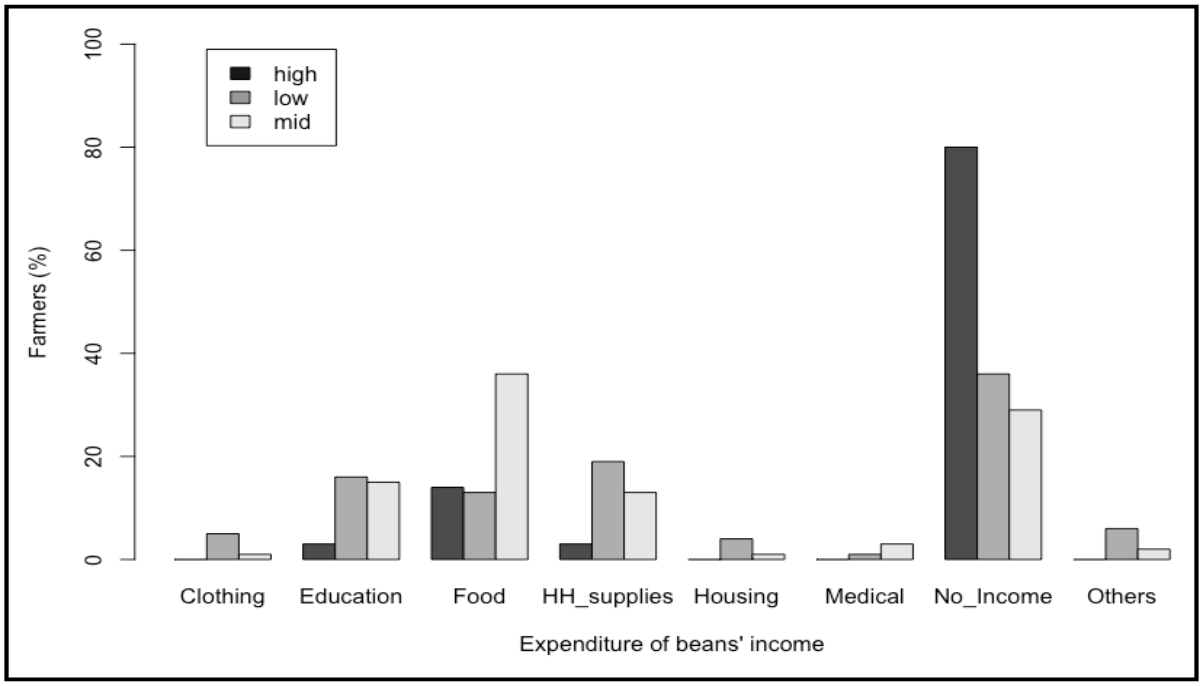

Fig. 4. Farmers' responses on the expenditure of income generated by selling beans. HH_supplies= Household supplies.

Beans were found to be an important income generating crop in the area and the same observation was reported by (Maghimbi, 2007). In similar farming systems in Uganda, it was also reported that beans is important source of income to poor households (Nakazi *et al.*, 2017). Also, our results are in line with those by Gurmu (2013) who reported that common bean has significant contribution to the total income of smallholder farmers in the southern part of Ethiopia. Moreover, our results are also supported by the fact that about 40% of the total bean harvests by households in Tanzania are sold in the local markets for income generation (Binagwa *et al.*, 2018). Since we have observed the economic importance of beans in improving the livelihood of people in this region, intervention to increase its production is highly needed. Undoubtedly, increase in bean production in this area will have high impact on the healthy and income for the whole community. Because, beans are the most essential grain legumes consumed almost everywhere in the world (Broughton *et al.*, 2003) therefore, increasing production in the country would create great opportunities for smallholders to sell their produces in world markets and generate more income.

Expenditure of beans' income

The results showed that farmers largely depend on income generated from selling common beans to support livelihood of households. The income generated from selling beans harvested during first season of 2017 were used by smallholder farmers to access basic services such as clothes, foods, household supplies, paying school fees for their children, building and renovating their homes and medical facilities (Fig. 4). It was also observed that farmers also spent the income by opening small businesses, buying livestock such as cattle and goats, paying labourers who work in their farms, purchasing agro inputs such as fertilizers and pesticides, buying and/renting land as well as paying their debits. However, we found a relative large group of farmers

about 80%, 36% and 29% in high, low and mid zones respectively, who didn't earn any income because they had no enough beans to sell due to low harvest obtained during that particular season. The expenditure of beans' income by farmers varied significantly across three zones (KW= 49.564, df = 2, $p < 0.001$) whereas much of cash was used to buy foods, in education and households' supplies.

Conclusion

Common beans were found to be an important food and cash crop in the study region. Therefore, this study calls upon researchers, agricultural organizations, and research institutions for capacity building and training on better production strategies that would help to increase yields per unit area. Increasing yields will eventually help to increase income per household and guarantee food security for improved livelihood of people in the region. The fact that about 70% of the national bean production is done by peasant farmers, increasing production would ensure high supply of common beans in the local and national markets which are important for feeding the urban communities.

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