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# Effect of different level of farm yard manure on the growth, yield and yield components of haricot bean (*Phaseolus vulgaris* L.) at adancho condition, Kambata Tembaro Zone, Southern Ethiopia

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**Key words:** Growth, Farm yard manure, Haricot bean, Yield

**Abstract**

Haricot bean is an important food crop. Low rates of organic fertilizers and inappropriate row spacing are among the major problems for low productivity. This experiment has conducted during 2022 cropping season. Experiment has consisted of five level of farm yard manure (FYM) (0, 3, 6, 9 and 12 ton $ha^{-1}$) and lay out by RCBD in three replication times. The result revealed that most of the yield and yield component parameters were significantly influenced by the effect of FYM rates. The result revealed that most of the yield and yield component parameters were influenced by the effect of FYM. Days to 50% flowering, 90% maturity, plant height (PH), number of branches pet plant (NB), seed weight (SW) and grain yield (GY) were significantly influenced by FYM. The highest PH (55.47cm), highest NB (5.78) and highest GY (3.02 t) were recorded at increased rates of FYM while the lowest was from control treatment. The highest net benefit value of (26,475.00 ETB was recorded at FYM rate of 3 ton. The least net benefit 14,250.00 ETB) was obtained from control treatment. This reveals that application of FYM rate of 3ton ha-1 for haricot bean production are economically feasible when compared to the production of haricot bean without the application of FYM in the study area. However, the larger increment of application of FYM has not revealed this much important feasibility on the economic value of the crop at the study area.

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**Introduction**

Haricot bean (*Phaseolus vulgaris* L.) is an important pulse crop in Ethiopia and in the world. The crop ranks second next to faba bean in the country. Some people say it is considered as 'a poor man's meat' because it is high in protein content. Moreover, their amino acid composition is useful to complement the amino acid profile of cereal proteins. And also this crop is one of the most important food legumes in Latin America and Africa. It is highly rich with an important source of trace elements, phosphorus, iron, vitamin B, fiber, and is free of cholesterol for nearly five hundred million people in Africa, Latin America and the Caribbean; in particular, for low-income earners (Suge *et al*., 2011). This crop is an attractive one for large number of farmers, because of its adaptability to different cropping systems and short growing cycle. Haricot bean suffers from several biotic and a biotic production constraints (Saad *et al*., 2009). Haricot bean has an interesting use for both economic and nutritional value. Thus, it is an important crop in addressing the issue of nutrition security in Southern Ethiopia people's diet is dominated with maize, wheat, root and tuber crops (Misgana and Tadesse, 2017). This crop could have several advantages such as it allows double cropping in a season using early maturing cultivars, serves for consumption and as a source of cash to farmers, contributes towards a balanced diet because of its high protein content, it is convenient for inter cropping because of its short growth duration and diverse growth habit, can serve as a rescue crop whenever long duration crops fail due to unfavorable factors and it serve also as an export commodity to earn foreign currency and it is assumed as the main exported crop in the country (Misgana and Tadesse, 2017). It clearly indicates that the Ethiopian economy is highly depending on agricultural development strategies. It is the first point to be considered in order to bring desirable economic growth of for highly increasing Ethiopian population, following an appropriate agronomic practices for the yield increment of the crops is must and modern industry sector could operate appropriately based on various input obtained from agriculture.

Haricot bean has been an export pulse crop for Ethiopia for more than 50 years and probably been grown as a food crop for much longer period in the low and mid land altitude areas of the country (Ferris and Kaganzi, 2008). The crop is widely grown in areas between 1400-2000 masl. The main production areas include the East Hararghe, West Wolega, East Shewa, West Arsi, Sidama, Wolayita, Wolo, East Gojam and Kembata in some amount (FAO, 2015). The crop is grown either as a sole crop and/or intercropped with other either cereals or perennial crops (Negash, 2007). There are a wide range of Haricot bean types grown in Ethiopia including the mottled red, white and black varieties. The leading white bean varieties are the Awash1, Awash melka and Mexican 142 varieties. The pure red and pure white colored beans are the most common commercial varieties (Negash, 2007).

In 2010, the world production of the crop was approximately 23,816,123 tones, with 24.4 and 17.7% of the world production in Latin America and Africa, respectively and its average yield is 0.80 tones per hectare which is lower than the national average yield. However, its national average yield in Ethiopia is about 1.26 tones or 12.6 quintals per hectare while that of the Southern region is about 1.14 tones or 11.4 quintals per hectare. But, its production in our country Ethiopia is very low when compared with the others world leading producer countries such as Latin America, Africa and Caribbean.

However, farmers can increase the productivity of a crop to 3 tons per hectare or more by using improved production technologies, which is an important indicator to improve the productivity of a crop. Peoples in our country were still getting a lower yield from this crop. These relatively low yields can be mainly due to many kinds of constraining factors such as biotic and abiotic stresses. These are diseases, insect pets and weeds, climate condition, soil condition, temperature, rain fall and atmospheric humidity which can affect its production during its cultivation (FAO, 2014). Additionally, sowing out of the proper time, inadequate land preparation, not

using the correct planting density, inadequate weed control, poor disease and insect pest protection, lack of using improved varieties, inadequate use of both organic and inorganic fertilizers, loss of soil fertility, drought, low emphasis in concerned bodies in terms of training, inputs provision and follow-up, as compared to cereals (Vary *et al.*, 2000).

Legumes including haricot bean have high requirement for both organic due to the production of protein containing compounds, in which nitrogen and phosphorous are important constituents, and phosphorous and some other nutrients concentration in legumes is generally much higher than that found in grasses. High seed production of legumes primarily depends on the amount of phosphorous absorbed (Khan *et al.*, 2003). The yield of haricot bean increases with P application (Meseret, 2006) and its nodulation and fixation of Nitrogen can be improved with the application of Phosphorous and other nutrients (Khalil and Jan, 2002). Therefore, application of organic fertilizer is very important to maximize the yield of bean.

In recent years, use of this fresh organic fertilizer has been developed to obtain sustained agricultural production and can significantly increase the yield of the crop. Because, it is a well-known source of nutrients along with other fertilizers to give higher productivity and monetary returns in this crop (Zeleke *et al.*, 2017). Further, its sources unlike chemical fertilizer have substantial residual effect on succeeding crops. Its effect involves achieving sustained crop production and maintaining better soil health as well as fertility improvement. It is a best approach for better utilization of resources and to produce crops with less expenditure (Aziz *et al.,* 2018). Consequently, the soil of Shamba area at Angacha Woreda is very low both in organic matter and inorganic matters because of different factors like soil erosion, continuous farming practice of the farmers and higher consumption of crops that were growing in the area and also, the disorganized use of some management practices at some farmers' field and the limited practice to use this organic fertilizer or this crop to get maximum yield per unit area (AWANRDOR, 2019). And also there is no trial conducted in regards to this tittle specifically at Shambaarea. However, the application of this organic fertilizer has a well-known contribution to improve the productivity of crops in sustainable ways and enhances soil organic matter more than the application of the same amount of nutrient as inorganic fertilizer. So, current work is devoted to conduct an experiment on different levels of farm yard manure to see its effect on better growth performance, yield and yield components of haricot bean at Shamba condition, Angacha Woreda.

Therefore, this experiment was conducted with the objectives to study the effect of different levels of farm yard manure on the growth, yield and yield components of Haricotbean at Shamba conditions.

**Material and methods**

*Description of the experimental site*

This study was conducted in Adancho Kebele Condition at Angacha Woreda during the main cropping season of 2022.The Adancho is located at 7°58'East" and 37° 29'North" with an altitude ranges between 1906 to 2100 meter above sea level. The area receives a mean annual rain fall of 1200 mm with mean maximum temperature of 18-20°C and minimum of 16°C (CSA, (2018). The dominant type of soil in the study area is characterized by well-drained loam. And its textural classis silty loam soil with PH of 6.4. The most commonly cultivated crops in its surrounding areas are: Food barley, Bread wheat, Field pea, common bean, Irish potato, Carrot, Head cabbage, Ensetare the predominant crops and staple food crops in both study areas.

*Experimental materials*

For this experiment the available variety of haricot bean, namely "Red wolyta" and currently this is popular in the study area and used as planting material. And seed tuber of medium sized and non-infected was planted. Its source was from Areka agricultural research center. This variety can adapt to the altitude of 1600 to 2100 m.a.s.l., high yielding and

resistant to insect pests. It matures in about 90 to 100 days (MoARD, 2012). It is preferred by Angacha area farmers for its growth characteristics, early maturity and short dormancy period that make it suitable for more than two cycles of haricot bean production in a year. In addition, Farm yard manure (FYM) was used as a source of Phosphorous fertilizer

*Treatments and experimental design*

This experiment was carried out at Shamba farmers training center (FTC) during 2019 main cropping season in randomize complete block design (RCBD) with three replications. The size a single plots area was 2 m × 2 m = 4m². And the total area of the experiment was 155 m². Seed rate for variety of Nasir as a rate of 100 kg ha-1 on flat beds was sown by using the spacing of 40 × 10 cm and the distance of 1 m between blocks and 1 m between each plot was used and planting was done on mid-March at one seeds per hole manually. The number of rows in a single plot was 5 and number of seed per a single row was 19 seeds. And the total number of seeds in a single plot was 95. Farm Yard Manure rates (FYM1 = control (0), FYM2 = 3 t $ha^{-1}$, FYM3 = 6 t $ha^{-1}$, FYM4 = 9 t $ha^{-1}$, FYM5 = 12 t $ha^{-1}$, FYM6 = 15 t $ha^{-1}$) was applied 15 days before sowing. All the other agronomic practices were applied uniformly to all the plots.

*Data collection*

*Days to 50% flowering*

This was done by counting the number of days from planting up to the time when 50% of plants bear flower by counting the number of seeds that bear flower.

*Days to 90% physiological maturity*

This was done by counting the number of days from planting up to the time when 90% of plants attain its physiological maturity.

*Plant height (cm)*

Length of the central axis of the stem was measured from the soil surface up to the tip of the stem.

*Number of branches per plant*

The numbers of primary branches of five randomly taken plants from each of the three middle rows excluding the main plant was counted at maturity and the average was taken per plot.

*Hundred seed weight*

Weight of 100 seeds in gram drawn randomly from the bulk of seeds of each plot when seed moisture content was adjusted to10-12%.

*Grain yield (ton /ha)*

Grain yield in kilogram of plants from the three middle rows adjusted to 10-12% moisture level was measured.

*Pod length (cm):*

Pod length from base to tip of four random pods from each of four random plants per plot was measured and expressed as average of five plants per plot.

*Pods number per plant*

Average number of mature pods, wascounted at harvest on five randomly taken plants.

*Number of seeds per pod*

Average number of seeds per pod, wascounted at harvest in five randomly taken pods per plant.

*Data analysis*

The data of the experiment was subjected to analysis of variance (ANOVA) of RCBD in a single arrangement using SAS statistical package updated version 9.2 (SAS Institute Inc. Cary NC, 2008). Treatment means that exhibited significant differences was separated using LSD test at 5% level of significance.

**Results and discussion**

*Phenology parameters*

The analysis of variance (ANOVA) revealed that the effect of different rates of farm yard manure (FYM) had high significant ($P$<0.01) influence on days to 50% flowering and 90% maturity of haricot bean.

*Days to 50% flowering*

Increasing farm yard manure application from 0 to 15 tone $ha^{-1}$ significantly delayed the time required to attain 50% flowering of haricot bean plants which

ranged on average from 61.00 to 73.66 days. The lowest and the highest number of days to reach days to 50% flowering were recorded for the application of 15 and 0 tone farm yard manure ha$^{-1}$, respectively (Table 1). Here, there is an indication of such much increment on days to 50% flowering due the increased application of farm yard manure. The result of present study was supported by the earlier studies of Kinde and Asfaw (2016) who reported that increased application of farm yard manure fertilizer had shown delayed time on potato crop flowering by 10 days. And this might be the role of Nitrogen nutrient in extending the flowering time of a crop by providing continuation of vegetative growth and photosynthesis.

**Table 1.** Effect of different rates of farm yard manure on days to 50% flowering and 90% physiological maturity of haricot bean at Adancho condition

| Main effect | Days to 50% flowering | Days to 90% maturity |
|---|---|---|
| FYM (tone ha$^{-1}$) | | |
| 0 | 61.00$^{d}$ | 100.33$^{cd}$ |
| 3 | 58.66$^{d}$ | 97.00$^{d}$ |
| 6 | 64.33$^{c}$ | 102.00$^{c}$ |
| 9 | 66.66$^{c}$ | 108.66$^{b}$ |
| 12 | 70.66$^{b}$ | 110.33$^{b}$ |
| 15 | 73.66$^{a}$ | 118.00$^{a}$ |
| LSD (0.05) | 2.37 | 4.62 |
| CV | 2.98 | 2.39 |

Whereas, means followed by the same letter(s) are not significantly different at $P$<0.05, FYM = Farm yard manure, LSD= Least significance difference, CV= Coefficient of variation

**Table 2.** Effect of different rates of farm yard manure on plant height and number of branches per plant of haricot bean at Adancho condition

| Main effect | Plant height (cm) | Number of branches per plant |
|---|---|---|
| FYM (tone ha$^{-1}$) | | |
| 0 | 25.20$^{e}$ | 2.20$^{f}$ |
| 3 | 35.88$^{d}$ | 2.48$^{e}$ |
| 6 | 41.44$^{c}$ | 3.81$^{d}$ |
| 9 | 43.35$^{c}$ | 4.51$^{c}$ |
| 12 | 47.20$^{b}$ | 5.15$^{b}$ |
| 15 | 55.47$^{a}$ | 5.78$^{a}$ |
| LSD (0.05) | 3.60 | 0.18 |
| CV | 5.72 | 8.61 |

Whereas, means followed by the same letter(s) are not significantly different at $P$<0.05, FYM = Farm yard manure, LSD= Least significance difference, CV= Coefficient of variation

In this experiment the change of 50% flowering time due to different rates of FYM has both statistical and practical importance with the day difference of 12.66 days. This result is consistent with the findings of Kifle *et al.* (2017) who reported that increasing N fertilizer rates resulted in delaying the time required to reach 50% flowering of common bean.

*Days to 90% maturity*

Application of different rates of farm yard manure had significant influence on maturity of the potato crop which delayed the time required to reach 90% physiological maturity. Increased application of farm yard manure from 0 to 15 tone ha$^{-1}$ significantly delayed days to 90% physiological maturity 100.33from to 118.00 days with significant difference of about 17.67 days (Table 1). This might be due to the role of different nutrients that could exist in this organic fertilizer and that can extend the physiological maturity of haricot bean. The result of the present investigation was supported by the earlier studies where organic fertilizer was reported to be related with delaying maturity of potato (Erdogan *et al.*, 2010; Hogy and Fangmeier, 2009). However, the findings of Yousaf and Ali (2010) oppose the result of present study and who reported that there is no significant difference on physiological maturity of potato crop with the increased application of organic fertilizer.

*Growth parameters*

*Plant height (cm)*

The effect of farm yard manure has significantly ($P$< 0.01) influenced the height of haricot bean plant (Table 2). The highest plant height (55.47 cm)was recorded when 15 tone farm yard manure ha$^{-1}$ was applied than the plant height which was recorded when farm yard manure rate of 0 tone ha$^{-1}$or control was applied and at which the least plant height of 25.20 cm was obtained (Table 2). There is significant and linear increase in plant height in response to increasing the rate of farm yard manure application may be attributed to the critical role phosphorus, Nitrogen, potassium and other nutrients plays in enhancing cell division, growth, and elongation to

meet the demand for the increased plant height at increased application of this organic fertilizer (Hakoomat *et al.,* 2006; Marschner, 2012; Pessarakli, 2001; Harnet *et al*., 2014).

Consistent with the results of this study, Isreal *et al.* (2012) have found that increasing application of inorganic and organic fertilizer has significantly increased plant height. The high response of haricot bean to this inorganic fertilizer application in terms of growth in height is consistent with the findings of Yousaf and Ali *(*2010) that the crop requires high phosphorus and would require application of ample amounts of phosphorus for maximum growth and productivity. The availability and absorption of this nutrient have enhancing effect on the vegetative growth of plants by increasing cell division and elongation (Tohamy *et al*., 2006). Many researchers have found direct relationships between both organic and inorganic fertilizers availability and crops growth (Ali *et al.,* 2004; Adane *et al.,* 2010; Anil *et al.,* 2008). Generally, increased application of farm yard manure stimulated plants to grow taller by supplying sufficient Phosphorus, Nitrogen, potassium and other nutrients to the soil in order to meet the demand of the crop because these nutrients can play a critical role in cell elongation. The higher the rates of Nitrogen, the longer on the days to crop maturity.

*Number of branches per plant*

Analysis of variance indicates a significant difference in number of branches per plant on haricot bean among the different rates of farm yard manure. And also this has no this much different value recorded at each rates. Plots treated without using this fertilizer (control) resulted in reduced number of branches per plant (2.20) than those treated with different rates and which was not significantly similar with 3, 6, 9, 12 and 15 tons $ha^{-1}$ and the larger number of branches (5.78) were recorded from 15 tons $ha^{-1}$. Plots treated with farm yard manure of 15tonsrevealed increased number of branches and followed by 11 tons of FYM $ha^{-1}$and which were statistically alike with each other (Table 2).

These varied values on the number of branches of haricot bean due to the increased application of FYM fertilizers could be attributed to higher organic matter build up, efficient microbial activity, synergistic interaction between organic manures resulting in more supply and availability of nutrients. In consistent to this finding the result of Hailu *et al*., 2008 also observed that the increased application of different rates of organic fertilizers like farm yard manure increased leaf number and number of branches in a given crop.

*Yield components*

*Hundred seed weight*

The analysis of variance revealed that different rates of FYM have significant influence on the hundred seed weight of haricot bean (Table 3). In this experiment the higher seed weight of (g) for hundred seed of haricot been was obtained in the treatment that contained the increased application of 12 ton FYM $ha^{-1}$but the extreme application of farm yard manure to 15 ton $ha^{-1}$ revealed the immediate reduction the weight of hundred seeds in this crop, while the lower weight for hundred seeds of a crop was recorded in the application rate of zero tone $ha^{-1}$ or in control treatment. Similar result was reported in the experiment of Saad *et al.,* 2009 that the higher seed weight of (286.27) gram was recorded at the increased application of FYM of 2.5 tone $ha^{-1}$ when compared with the control treatment. This might be due to the role of different components like Phosphorus, Nitrogen, Potassium, Sulfur and others that could exist in this organic fertilizer and that supplies a variety of macro- and micronutrients to the soil in addition to the improvement of the physio-chemical and biological properties of the soil, which helps to maintain the soil productivity and soil health and also better performance in the grain filling of a crop.

*Grain yield (ton $ha^{-1}$)*

The analysis of variance revealed that application of different rates of farm yard manure has shown significant ($P< 0.05$) influence on the grain yield of haricot crop (Table 3).

**Table 3.** Effect of different rates of farm yard manure on 100 seed weight, grain yield, pod length, pod number per plant and need number per plant of haricot bean at Adancho condition

| Main effect | 100 seed weight (g) | Grain yield (t ha$^{-1}$) | Pod length (cm) | Pod number per plant (Cout.) | Number of seed per seed |
|---|---|---|---|---|---|
| FYM (tone ha$^{-1}$) | | | | | |
| 0 | 271.13$^{d}$ | 1.49$^{d}$ | 6.42$^{c}$ | 11.38$^{e}$ | 4.44$^{c}$ |
| 3 | 279.11$^{c}$ | 2.62$^{cd}$ | 7.99$^{b}$ | 12.80$^{d}$ | 4.66$^{c}$ |
| 6 | 288.26$^{b}$ | 2.74$^{bc}$ | 8.64$^{ab}$ | 13.63$^{c}$ | 5.21$^{b}$ |
| 9 | 293.69$^{a}$ | 2.78$^{b}$ | 8.97$^{ab}$ | 15.10$^{b}$ | 5.76$^{a}$ |
| 12 | 296.12$^{a}$ | 3.02$^{a}$ | 9.25$^{a}$ | 16.16$^{a}$ | 5.90$^{a}$ |
| 15 | 273.12$^{d}$ | 2.60$^{d}$ | 8.85$^{ab}$ | 16.76$^{a}$ | 4.55$^{c}$ |
| LSD (0.05) | 2.82 | 0.12 | 1.04 | 0.78 | 0.35 |
| CV | 5.72 | 9.54 | 6.84 | 2.99 | 8.61 |

Whereas, means followed by the same letter(s) are not significantly different at $P<0.05$, FYM = Farm yard manure, LSD= Least significance difference, CV= Coefficient of variation

**Table 4.** Economic or partial budget analysis of FYM on Haricot bean yield at Adancho condition at cropping season of 2011/12Angacha Ethiopia

| FYMt ha$^{-1}$ | AV.GY(t ha$^{-1}$) | Adj.GY (t ha$^{-1}$) | GB. Of TY (ETB) | CFYM (ETB) | TVC (ETB) | NB (ETB) | MRR (%) |
|---|---|---|---|---|---|---|---|
| 0 | 1.49 | 1.341 | 16,762.50 | 0 | 0 | 16,762.50 | - |
| 3 | 2.62 | 2.358 | 29,475 | 3,000 | 3,000 | 26,475.00 | 9,712.50 |
| 6 | 2.74 | 2.466 | 30,825 | 6,000 | 6,000 | 24,825.00 | D |
| 9 | 2.78 | 2.502 | 31,275 | 9,000 | 9,000 | 22,275.00 | D |
| 12 | 3.02 | 2.718 | 33,975 | 12,000 | 12,000 | 21,975.00 | D |
| 15 | 2.60 | 2.34 | 29,250 | 15,000 | 15,000 | 14,250.00 | D |

Data regarding biological yield is shown in (Table 3). Statistical analysis of data revealed that effect of FYM significantly affected grain yield. Mean values showed that the maximum grain yield (3.02ton ha$^{-1}$) was found in the plot treated with 12ton ha$^{-1}$ FYM, while minimum (2.49)ton ha$^{-1}$ was recorded from plot treated without FYM ton ha$^{-1}$. This result in lines with the finding of Yousaf and Ali 2010 that the higher grain yield of 5.70 ton ha$^{-1}$ was recorded at the increased application of FYM of 4.5 tone ha$^{-1}$ when compared with the control treatment in a wheat crop.

*Pod length (cm)*

The analysis of variance revealed that effect of FYM has shown significant influence on the pod length of haricot bean. The larger pod length (cm) on haricot bean was obtained by the increased application of farm yard manure (FYM) at a rate of 12 ton ha$^{-1}$, while the shorter pod length (cm) on this crop was recorded in the treatment which was sown without using this organic fertilizer or control treatment. In this experiment the extra increase of this fertilizer revealed a reduction on the pod length of a crop. The finding of the present study in line with the findings of (Aziz *et al.*, 2018; Saad *et al.*, 2009; Negash, 2007) and they reported that increased application of farm yard manure has increased the pod number and its length on haricot bean crop. This could be due to the beneficial effect of this organic fertilizer (FYM) on soil nutrients availability and it can supply different nutrients to the soil by the process of mineralization. It also can act as a chelating agent, thereby preventing the formation of insoluble phosphates.

*Pod number per plant*

The analysis of variance (ANOVA) value resulted that application of different rates of FYM has no significant effect on the pod number of haricot bean (Table 3). However, the figures obtained at each rates of farm yard manure ha$^{-1}$ have no similar values. That somewhat the raised number of pods was obtained in the treatment that contained the increased application rate of FYM (15 ton per hectare); while reduced number of pods in this crop was obtained in the treatment that was sown without using this fertilizer or at control treatment (Table 3). The finding of the present study opposes the finding of Hailu *et al.*, 2008 who observed that the increased application of organic fertilizers (farm yard manure) from 0 to 3.5 ton ha$^{-1}$ has increased the number of pods in a this crop.

*Number of seed per pod*

The analysis of variance (ANOVA) value revealed that increased application of farm yard manure fertilizer has significant ($P<0.05$) influence the number of seeds per pod in haricot bean (Table 3). In this experiment there is a significant difference on the number of seeds per pods due to the application of different rates of FYM on haricot bean and the higher number of seeds per an individual plant (5.90) was recorded in the treatment that contained the application rate of 12 ton FYM $ha^{-1}$; while the lower number of seeds per plant (4.44) was obtained from the treatment that was sown by using the application rate of zero tone FYM $ha^{-1}$ or in control treatment (Table 3). This increment in the number of seeds per plant or pods of haricot bean with the increased application of farm yard manure could be due to the contribution of a fertilizer in improving the soil fertility and further facilitation of the well performance of a crop. The result of the current experiment in lines with the findings of Yousaf and Ali 2010; Suge *et al.,* 2011; Saad *et al.,* 2009 who reported that increased application of organic fertilizer has resulted the increase in total yield and the number of seeds of haricot bean.

*Economic or partial budget analysis*

The primary objective of producers in applying this organic fertilizer by providing the others management practices as the way of their requirement is to make profit. The extent to which the use of fertilizers contributes to this objective depends not only upon the kinds and upon amounts of fertilizer they apply and the yield, but also upon the cost of fertilizer, seeds and price of yields. Both the physical and economic realities must be recognized. In the locality the demand and market price of haricot bean yield is relatively low while the average yield that could be obtained from a given area is high. Due to this fact increasing grain yield of a crop can increase farmers' income. In this experiment, the results of economic analysis revealed that there were higher marginal rate of returns due to applied FYM fertilizers. The average economic yields and added benefits as influenced by FYM fertilizer on haricot bean had been calculated as CIMMYT, 1988 and presented on Table 4.

The results of partial budget analysis data revealed that application of different rates of FYM fertilizer were feasible for haricot bean production in Shamba Kebele (Table 4). The highest net benefit value of (26,475.00 ETB $ha^{-1}$) was recorded at application of FYM rate of 3 ton $ha^{-1}$.Nevertheless,application of 6ton per hectare had also resulted optimum net benefit 24,825.00 ETB $ha^{-1}$).

The least net benefit 14,250.00 ETB) was obtained from control treatment. However, in this study the increase of FYM rate from zero to 12ton $ha^{-1}$ revealed better increment of total yield on haricot bean production and an immediate reduction at 15 t FYM $ha^{-1}$but, the analysis shows that the value of the increase in yield is not enough to compensate for the increase in costs for that extent of FYM fertilizer application in the study area. Though, the analysis of marginal rate of return (MRR) revealed that the application of FYM fertilizer on the profitability of haricot bean. Therefore, the highest Net benefit (26,475.00) was recorded in the treatment with application of 3 ton $ha^{-1}$ which shows it is feasible when compared with the application of other rates of FYM fertilizer.

When the application of FYM fertilizer surpassed the practice of not using this fertilizer, it is said to be undominated. While, the alternative that yields lower benefit, it is said to be dominated CIMMYT, (1988). From this result, it is advisable to apply fertilizer for potato production with the FYM rate of ton $ha^{-1}$and this could be more effective. This reveals that application of FYM rate of 3 ton $ha^{-1}$for haricot bean production are economically feasible when compared to the production of haricot bean without the application of FYM fertilizer in the study area. However, the larger increment of application of FYM fertilizer has not revealed this much important feasibility on the economic value of the crop at the study area.

**Recommendation**

Haricot bean is considered as highly an important pulse crop in most of the areas in our country Ethiopia and in the world as well.

These crop ranks second next to faba bean in the country. Some people reported it is considered as 'a poor man's meat' because it is high in protein content. An experiment was also conducted during summer cropping season of 2019/2020 at Farmers training center in Shambakebele at Angacha Woreda in Southern Ethiopia. The objective for this study was determining the effects of different rates of farm yard manure on yield and yield components of haricot bean in the study area.

The haricot bean variety Red Wolayta was used in the experiment. The six different levels of FYM fertilizer (0, 3, 6, 9, 12 and 15 tons $ha^{-1}$) were used as treatments. The single experiment was conducted using a randomized complete block design with three replications. The plant phenology, growth parameters, yield and yield-components of haricot bean such as days to 50% flowering, and days to 90% physiological maturity were delayed in response to increasing the rates of FYM application. The highest grain yield was recorded at the rate of 12tonFYM $ha^{-1}$. Whereas, the lowest grain yield was recorded from the control treatment. Similar increases were recorded on the plant height, number of branches, hundred seed weight, and pod length and on number of pods per plant in response to increasing the rate of FYM fertilizer application from zero to 15 ton $ha^{-1}$. In general, the overall growth parameters and yield and yield components were highly influenced and revealed a linear increment by varying the application rates of FYM fertilizer from zero to 15 ton $ha^{-1}$. In this study, economic analysis was also done by considering total variable costs, net benefit and marginal rate of return. The result indicated that the application rate of FYM fertilizer at 3ton $ha^{-1}$ produce the highest net benefit value of (26,475.00 ETB $ha^{-1}$). Nevertheless, application of 6 ton FYM $ha^{-1}$ had also resulted optimum net benefit (24,825.00 ETB $ha^{-1}$). Hence, to obtain optimum economic return from the production of haricot bean at the study area FYM rate of3ton $ha^{-1}$ could be recommended. But the rates indicated could be used based on availability of this organic fertilizer and the soil fertility level of the areas farmer field.

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