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Impact of Different Levels of Chicken Manure on the Growth and Yield of Common Bean (*Phaseolus vulgaris-L.*) under the Agro-Climatic Conditions of Kabul

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ABSTRACT: Common bean (*Phaseolus vulgaris-L.*) is one of the most popular pulse crops, providing substantial economic benefits in the farming communities of Afghanistan, and it is for both food security and income generation. it is an important source of calories, proteins, dietary fibers, minerals, and vitamins for millions of people in both developing and developed countries worldwide. Organic fertilizers play an important role in the growth, yield, and yield attributes of beans. To study this, an experiment was conducted at the Agriculture Faculty of Kabul University during, (2025) growing season, examining the effects of three different levels of chicken manure (control, 10 t/ha^{-1}, 15 t/ha^{-1}, and 20 t/ha^{-1}) on the yield and yield components of common beans (*Phaseolus vulgaris -L.)* under Kabul's Agro-climatic conditions. Different crop agronomic traits, including to the growth and yield parameters such as plant height, number of branches per plant, number of leaves per plant, number of pods per plant, number of seeds per pod, biological weight t/ha^{-1} 100-seeds weight, and grain yield t/ ha^{-1}. The experiment was conducted in a Randomized Complete Block Design (RCBD), and the data were analyzed with Statistical Tools for Agricultural Research (STAR 2.0.1) software. The results of research indicated that different levels of chicken manure had significant effects on all studied traits (plant height, number of branches/plant, leaves number/plants, number of pods/ plants, number of seeds /pods, one hundred seed weight and seed yield t/ha^{-1}), According to statistical analysis, 20 t/ha^{-1} chicken manure improved growth and yield characters of common bean. For increased productivity of common beans in Kabul climate, the farmers are recommended to apply a proper dose of chicken manure.

KEYWORDS: agriculture, chicken manure, common bean, growth, yield, Kabul.

INTRODUCTION

The world's population is increasing faster than it has ever done in human history. It took 250,000 years to reach 1 billion, more than a century after that to reach 2 billion (in 1927) and 33 years more to reach 3 billion. By 2050, the world will have over 9 billion people in it and the number will still be rising.(Franklin, D., & Andrews, J., 2012).Introduction Extreme poverty is afflicting 1.1 billion people, a disproportionate number of which live in rural areas and depend on agriculture for a living.(Bourgault, M.,2009). The common bean *(Phaseolus vulgaris* L.) is one of the most important pulse crop in the world. It is an important source of calories, proteins, dietary fibers, minerals, and vitamins for millions of people in both developing and developed countries worldwide. (Singh, 2013). Common bean (Phaseolus vulgaris) was domesticated 8000 years ago in the Americas and today is a staple food which has been consumed worldwide for its edible seeds and pods. (Dida & Etisa, 2019). The common bean is cultivated primarily for its green pods, green shelled seeds, and dry seeds. The cultivars for green-pod harvests are also called French, garden, green, snap, or stringless bean, but here they will be referred to as snap bean. Fully developed green pods of these cultivars have reduced fibers or no fibers in the pod walls and sutures. In some Central and Eastern African and Latin American countries, young tender leaves or flowers are also harvested as fresh vegetables. In addition, green leaves, stems, and shelled pods are fed to cattle and dry plant stubbles are used as feed for cattle, ploughed under in order to increase soil organic matter, or used as fuel for cooking. (Singh, 1999).

The crop has a vital role in providing a source of antioxidants, dietary protein, energy, dietary fiber, minerals (iron, zinc, potassium, magnesium, copper, calcium), and some water-soluble vitamins such as thiamin (vit. B1), riboflavin (vit. B2), pyridoxine (vit. B6), and folic acid (vit. B2). (Asrat, & Abera, D. 2025). Among the cultivated species, the common bean is

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dominant with a growing area ratio of 90%. It is not only used as a dry grain and snap bean as vegetables but is also in the market as a canned product like industrial crops. Global production as a dry grain is 26.8 million tons, while production as a vegetable or snap bean is 23.5 million tons according to the database of the Food and Agriculture Organization (FAO) in 2016. (Celmeli, et al.,2018). The common bean can also fix more than 160 kg of atmospheric nitrogen per ha into soil via interactions with Rhizobium bacteria. Because of their high protein, mineral and fiber content, beans are consumed instead of meat in underdeveloped and developing countries. (Celmeli, et al., 2018). Common beans (*Phaseolus vulgaris* L.) are a greater source of polyphenolic compounds with numerous health promoting properties. Polyphenol-rich dry common beans have potential effects on human health, and possess anti-oxidant, anti-diabetic, anti-obesity, anti-inflammatory and anti-mutagenic and anti-carcinogenic properties. (Ganesan& Xu., 2017). Thusly, future use of soil amendment and organic manure beneficially for both environment and soil, organic amendment acting to improving soil fertility, nutrient availability, nutrient uptake, and growth performance are exceptional (Soremi et al., 2017; Widodo et al., 2019). Chicken manure is an organic manure and an important soil conditioner, it increases the soil 's moisture-holding and nutrient-holding capacities,manure is rich in plant nutrients such as N, phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulfur (S)and is usually applied to soils as a fertilizer for agricultural production in many regions, concentrations of chicken manure proper rate increasing soil CEC and soil properties. (Oagile & Mufwanzala., 2010; McCall., 1980).

In recent decades, organic farming has been advocated as an alternative form of agriculture for sustainable food production by removing the impact of CF on the environment. Organic farming is supportive of the environment, health, and sustainability and produces food without the use of any chemical inputs such as CF. This agriculture system makes use of eco-friendly fertilizers such as organic manures instead of CF. Organic farming preserves biodiversity, decreases the environmental pollution of soil, water, and air and increases soil organic carbon, essential nutrients content, microbial population, and enzymatic activity of soil. (Rostaei, et al.,2024). N is the fundamental element in the formation of amino acids, which, in turn, are the basic components of proteins. This element makes up 78% of the air in the atmosphere where it is practically inert and largely unreactive, existing mostly in molecular form (N_2). Nitrogen gas in the atmosphere is unsuitable for uptake by living matter. Human protein intake depends on the capacity of plants to take N into the food chain, and it requires certain transformations to be used by plants and later by animals for this to happen. (Martínez, et al., 2021). Phosphorus (P), an essential macronutrient, plays a pivotal role in the growth and development of plants. However, the limited availability of phosphorus in soil presents significant challenges for crop productivity, especially when plants are subjected to abiotic stresses such as drought, salinity and extreme temperatures. (Khan, et al., 2023). Potassium (K) is an essential nutrient that affects most of the biochemical and physiological processes that influence plant growth and metabolism. It also contributes to the survival of plants exposed to various biotic and abiotic stresses, In many cases, K-deficient plants tend to be more susceptible to infection than those with an adequate supply of K. (Wang, et al., 2013). Twenty years and frequent drought occurrences have adversely influenced food security and agriculture in Afghanistan. (Habibi, et al., 2025). This tells us that we need much more water in the future. It is estimated that 60% of common bean production occurs under the risk of intermittent or terminal drought stress,These conditions cause yield losses of between 10% and 100%.(Baghlani, et al., 2025). Legume crops have played a significant role in the historical dietary regime of Afghan peoples. (Hussaini, et al., 2021). An organic fertilizer is a fertilizer that is derived from organic sources, including organic compost, cattle manures, poultry droppings and domestic sewage. Organic fertilizers have been widely used in tilapia ponds, especially in Asia. (Ali, et al., 2023)., therefore this study will conduct to determine the appropriate organic manure amount for bean production in Kabul Agro-climatic conditions.

MATERIALS AND METHODS

The experiment was performed during, (2025) in research sites at the experimental farm of the Agriculture Faculty, Kabul University (34◦ 31'1"N, 69◦8'21" E, which is 1782 m above sea level) from May to August. Total precipitation from May to August in seasonal duration in 2025, was 13.3 mm. the average minimum, and maximum temperatures and relative humidity from May to August were 26.25 -36.25°C and 51.75% in 2025. bean seedlings emerge 8-10 days after sowing (DAS). The topsoil (0–30 cm) properties of the study field were tested. The soil was sandy loam in texture with the following characteristics: organic matter – 2.7%, P_2O_5 – 1.83 ppm, TN,(%)0.02, $CaCo_3$(%) 12 , EC – 0.259 ms cm^{-1}, pH – 8.3, and cation exchange capacity – 16.4 meq 100 g^{-1}. The experimental design for this study was a randomized complete block design (RCBD) with three replications. The

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bean variety "Capsoly" was sown. Two seeds were sown manually in each hole with a depth continuously in line, broadcasted. The direction of the line was north and south. Plant-to-plant distance was maintained at around 20 cm, while row-to-row distance was approximately 40 cm for each treatment. The size of each plot was 2m x 2 m ($4m^2$). Seeds were sown on the 9 th of May 2025. harvested on the 12 th of August 2025. All chicken manure-organic fertilizers at the respective treatments plots were applied as a broadcasting application method and then mixed thoroughly with soil before 15 days at sowing the final land preparation/harrowing before seed planting. The experiment was conducted with the following four treatments (T1 no- fertilizer- $T2_{10\ t\ /ha^{-1}}$ -$T3_{15\ t\ /ha^{-1}}$ -$Ta_{20\ t\ /ha^{-1}}$-) Some agriculture practices (gap filling, thinning, irrigation, and weeding) were done due to the need for common beans during the growing season. The parameters considered and evaluated in this experiment were: plant height, number of leaves/plants, number of branches/plants, number of pods/plants, number of seeds/pods, biological weight, 100 seeds weight, and grain yield. To determine grain yield at maturity, pods were harvested from the plot area dried in the sun for 14 days to approximately 15% water contents, threshed, and weighed. At the 5% significance level, the F-test and coefficient of variance values were computed for the significant displayed parameters. ANOVA and the least significant difference (LSD) were used to represent the results of the data analysis, which was conducted using the Statistical Tools for Agricultural Research (STAR 2.0.1).

RESULTS

Growth parameters.

The results obtained from the research, one - year field experiment (2025), The data on plant height, number of branches per plant, and number of leaves per plant is presented in Table 1. The application of various chicken manure had significantly affected the studied growth parameters. The highest plants were growing under, (20 t/ha^{-1}), manure treatment (the average plant height – 48.53 cm), while the lowest under control treatment (the average plant height – 31.95 cm). The similar results were also found for the average number of branches per plan, under20 t/ha^{-1} treatment it was the highest (9.60) while under control treatment – the lowest (6.23). 20 t/ha^{-1} Application also resulted in the highest average leaf number per plant (56.60), compared to the control treatment which resulted in the significantly lowest leaf number per plant (32.77).

Table 1. common bean plant parameters under different treatments.

Treatments	Plant height (cm)	Number of branches (pcs $plant^{-1}$)	Number of leaves (pcs $plant^{-1}$)
control	31.95d	6.23 d	32.77 d
10 t/ha^{-1}	37.32 c	7.40 c	41.07 b
15 t/ha^{-1}	41.32 b	8.23 b	43.27 b
20 t/ha^{-1}	48.53 a	9.60 a	56.60 a
F-test	*	*	*
LSD (0.05)	0.72	0.7	3.0
CV (%)	3.65	7.29	5.50

CV (%) = Coefficient of variation, LSD= Least significant difference, * = Significant level at ($P<0.05$). Different letters indicate the groups with significant differences.

Yield parameters

According to statistical analysis, the studied treatments differed significantly ($P<0.05$) in the average number of pods per plant, number of grains per pod, 100 seed weight, and grain yield (Table 2). The 20 t/ha^{-1} treatment resulted in the highest number of pods per plant (15.20), while the control treatment had the lowest number of pods per plant (8.80). The highest number of grains per pod also product 20 t $/ha^{-1}$ chicken manure with, (4.60), control produced the lower (3.37), the different between T2 & T3 were non significant with, (4.07 – 4.07) grain per pods. The 100 seed weight also high in 20 t/ha^{-1} with, (57.20 gr), while control product the lowest, (50.25gr), also T3 & T2 product serially, The highest grain yield was recorded in 20 t $/ha^{-1}$ treatment (1.9292 t $/ha^{-1}$), and the lowest – in control (1.5427 t $/ha^{-1}$) While treatments, T2 & T3 product respectively,(1.7209 and 1.8543 t $/ha^{-1}$).

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Table 2. common yield parameters under different treatments

Treatments	Number of pods plant^{-1}	Number of grains pod^{-1}	100,seed weight	Grain yield (kg ha^{-1})
control	8.80 c	3.37 c	50.25 d	1.54 d
10 t /ha^{-1}	11.80 b	4.07 b	54.33 c	1.72 c
15 t /ha^{-1}	13.53 ab	4.07 b	55.43 b	1.85 b
20 t /ha^{-1}	15.20 a	4.60 a	57.20 a	1.92 a
F-Value	*	*	*	
LSD (0.05)	1.7	0.4	0.7	0.03
CV (%)	11.28	8.03	1.04	0.95

CV (%) = Coefficient of variation, LSD= Least significant difference, * = Significant level at (P<0.05). Different letters indicate the groups with significant differences.

The biological yield of common bean was significantly (P<0.05) higher in the 20 t /ha^{-1} treatment compared to the, (10 t/ha $^{-1}$,15 t /ha^{-1}) treatments, which control produced the lowest biological yields (Fig. 1). (Melati & Syukur.,2024), finding similar resulted that increasing chicken manure rate increased yield components such as fresh and dry biomass, pod size, pod weight per plant and per plot, number of pods per plot, and overall productivity of young pods in winged bean.

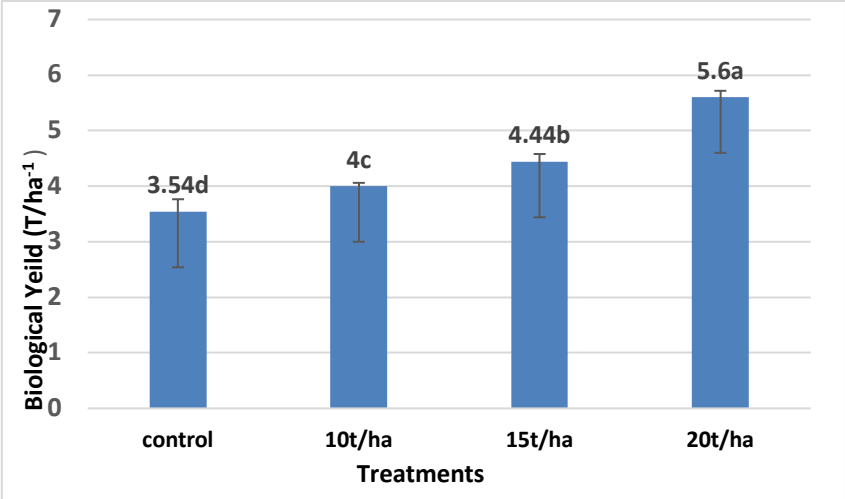

Figure 1. common bean biological yield under different treatments.

DISCUSSION

A similar result finding, (Taofik.et al., 2021). increasing chicken manure significantly increase bean growth parameters. (Widodo et al., 2019) also obvious increasing rates of chicken manure significantly affected several growth and yield parameters, including the highest plant height (35.61 cm), (Syahban et al., 2024) reported Chicken manure significantly improved plant height at 10 days after planting, seed weight per plant, and seed yield. (Tunc et al., 2023), application of 3 t ha^{-1} chicken manure combined with 40 kg N + 100 kg P ha^{-1} at 65 days after emergence product highest dry biomass, stem and leaf weight, and leaf area. (Feleafel & Mirdad.,2014), reported similar result. Application of chicken manure at 100 kg N ha^{-1} significantly increased vegetative growth traits such as leaf number per plant. (Kanu & Norman., 2014) reported that increasing chicken manure rates significantly enhanced vegetative growth parameters, including, number of mature leaves, in cowpea due to nutrient use efficiency. (Melati & Syukur., 2024,) reported that 30t/ha chicken manure increase number of leaves per plant of winged bean. (Silveira da SILVA, et al ., 2024) reported chicken manure promoted number of leaves, branches, and all mass of plant than other organic fertilizers in common bean. (Tunc et al., 2023) reported that chicken manure with N, P, fertilizers combined increased significantly primary and secondary branches of common bean.

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These results are in general agreement with those reported by (Qadiri et al., 2023) and (Widodo et al.,2019). who reported that the effect of the chicken manure and combined application of chicken manure with chemical fertilizers on pod number was found significant and pod number/plant with 40 t/ha and 30 t/ha was higher than other levels. Who reported that chicken manure application improves soil physical, chemical, and biological properties, which in turn enhances productivity of bean crops. (Jasim &Mhanna., 2014, Silva et al., 2024, Feleafel & Mirdad., 2014). also reported chickem manure superior significantly increases in pod number per plant by 62.3%, respectively in bean. (Melati & Syukur., 2024) also reported increasing chicken manure level significantly increased number of pod per plant of bean. (silva.et al., 2024). who reported that organic fertilizer application, especially chicken litter, enhances nutrient availability, vegetation indices and grain yield of common bean, particularly when applied in under favorable soil moisture conditions. . (Horiuchi & Matsui., 2010) got similar resulted that carbonized chicken manure (CCM) had significant effects on common bean biomass P content. (Melati & Syukur., 2024) reported increasing chicken manure significant increased bean Yield components such as fresh and dry biomass. The 100 seed-weight gram is a major contributor to the final grain yield. (Widodo et al. (2019), reported that increasing chicken manure significantly increased 100 seed weight in large red bean. (Tadesse, et al., 2022), who reported that chicken manure (CM) and banana hump liquid organic fertilizer (LOF) on mung bean (*Vigna radiata* L.). increasing seed weight per plant, and seed yield. The enhanced plant vigor and potential for improved productivity. (Kanu & Norman., 2014) reported similar result increasing chicken manure significantly increased pod size, kernel size, 1000-grain weight. Similer result reported by (Widodo et al., 2019 & Silva et al., 2024), chicken maure increased 100 seed weight, grain yield, and other yield components in bean. (Kanu & Norman., 2014) reported appropriate chicken manure increased in cowpea. Also similar to (Feleafel & Mirdad., 2014), (Widodo et al.,2019). (Salama et al., 2017) and (Lima et al., 2021) reported that chicken manure with biochar application significantly increased soil phosphorus availability, enzymatic activity, water use efficiency, and grain yield of

CONCLUSION

The results of this investigation suggest that organic fertilization reduced fluctuations in soil water availability during flowering and grain filling stages and increased nutrient concentrations, particularly phosphorus and potassium in common bean. also chicken manure significantly increased earthworm density, soil fertility (pH, organic C, N, P, K, Ca, Mg, Na, and CEC), and bean pod number of climbing bean compared to other treatments. Organic fertilizer also eco- friendly with sustainable agriculture practices reduce soil erosion, compaction, and make soil structure, increasing water holding capacity to safe plant in harsh condition.

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