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Enhancing *Vigna aconitifolia* Growth with Sustainable Chicken Waste Manure Fertilizer

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

It appears that chicken manure is a cutting-edge, environmentally friendly waste treatment technique that has enormous potential for the future of solid waste management. For 90-100 days, the intestinal material from *Gallus gallus domesticus* which is degraded and turned into chicken waste manure/ fertilizer. The pH values observed in chicken waste manure is 7.3 respectively. Apart from being a major source of nutrients for crop growth, chicken manure also harbours a number of human diseases. The *Vigna aconitifolia* is consumed as food and fodder and is known for having a high protein content along with an excellent amino acid, mineral, and vitamin profile. The purpose of the study was to determine how chicken waste manure affected *Vigna aconitifolia* roots, nodes, leaves, plant height, pods, and seeds. After 150 days of the study, it was shown that all treated groups that were exposed to a high dose of chicken waste manure showed a significant increase in the number of nodes, leaves, roots, shoot length, leaf length, number of pods, length of pod, and number of seeds.

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Keywords: Gallus gallus domesticus; organic waste decomposer; chicken waste manure; Vigna aconitifolia.

1. INTRODUCTION

Increasing poultry farming has been prompted by the increasing demand for chicken meat, which has resulted to a rise in the consumption of organic waste as fertilizer/ manure [1]. Chicken waste manure appears to be an innovative sustainable technology for waste treatment, which holds a promising future in the field of solid waste management. It's the process of breaking down the waste organ i.e. the intestine with the aid of a waste decomposer, converting the waste into nutrient-rich material that can support plant growth. The capacity of intestinal waste to transform organic waste into nutrient-rich material lessens the requirement for artificial fertilizer [2]. The developing range of poultry production can represent the improving the agricultural economy in many countries or many cities. It improves the physical, chemical and biological properties of soil [3]. Due to the high levels of nitrogen, phosphate, and potassium in chicken waste, its use as fertilizer has exceeds that of other waste products from animals, such as pig manure [4].

The Moth bean, or *Vigna aconitifolia*, is a small, drought-tolerant legume of the Fabaceae family [5]. The moth bean, or *Vigna aconitifolia*, is an orphan legume of to the *Vigna* genus [6-9]. It is highly adaptable and can grow successfully in arid and semi-arid regions, primarily in different geographic areas of India and other Asian countries [10]. Grown on 13.19 lakh hectares, it yields 1,753 lakh t of output and 133 kg/ha of yield in India [11][7]. Its hairy, closely spaced branches can spread out to a maximum distance of 150 cm, and its stem can grow as high as 40 cm. After yellow blooms, a brown pod that is 2.5 to 5 cm long and contains 4 to 9 seeds grows [10]. The *Vigna aconitifolia* is consumed as food and fodder and is known for having a high protein content along with an excellent amino acid, mineral, and vitamin profile [12]. The lysine and leucine-rich moth beans and the sulfur-containing grains help to make up for each other's inadequacies in amino acids [6]. Because research and development have given them little attention, there is not enough information accessible on them, so they are also known as "orphan" or "neglected" crops [13]. Moth bean provides anti-hypertensive, anti-oxidant, anti-cancer, antibacterial, diuretic, and hypocholesterolemic effects among its pharmacological properties [14]. In regions devoid of meat or predominantly vegetarian, the fully grown seeds offer a priceless supply of digestible protein for human use [15]. *Vigna aconitifolia* a legume that fixes nitrogen and phosphorus, it may produce a lot of biomasses — up to 11–20 kg N/ha [5].

A pilot study has been carried out to determine the quality of chicken waste manure obtained from organic waste decomposer after using them by chicken intestinal waste. The study also aims to determine the impact of manures on the growth of *Vigna aconitifolia* cultivated in pots under laboratory conditions and nutrient status, ultimately leading to cost-effective agricultural crop production.

2. MATERIALS AND METHODS

The mature *Gallus gallus domesticus* specimen's intestine weighs 12.8 grammes. The intestinal waste was stored in sizable trays filled with substrate material and preserved between 28 and 31^0C in a laboratory. A sample of soil from a barren terrain was obtained from the Satara District. The National Centre for Organic Farming in Ghaziabad, Uttar Pradesh, provided the organic waste decomposer. which are rich in macro- and micronutrients that can be used to benefit soil and plants. The manure was placed in an invading round plastic tank. Wastes from chicken intestines were put into the tank, and organic waste decomposer was added. A circular plastic tank was loaded with a mixture of chicken intestinal waste and an organic waste decomposer. Add the contents of the bottle to the solution (mix 20 grammes of jaggery with 2 litres of water in a plastic jar), and stir daily. Line the container with plastic wrap. Decomposer prepares in seven days. This decomposer is combined with chicken intestine waste in a tank; add water as needed. Put sheets over the tank to allow for adequate decomposition. To guarantee homogeneous decomposition, the decomposing components were thoroughly stirred once throughout the three days using a wooden rod. Decomposition takes 90–100 days once the decomposer becomes available.

Thirty *Vigna aconitifolia* seeds were purchased and kept in water bowl for 24 hrs for sprouting, after sprouting the seeds were transplanted into plastic container (10 seeds in each container),

Subsequent manuring for 5 times was done respective organic manure in each plastic container at an interval of 10 days with different concentration of 10ml, 20ml, 30ml, 40ml. The plant in fifth group were not provided with any manure and maintained as control. Subsequently a transplantation of chicken waste manure into a plastic container for 10–10 days, all of the parameters related to the *Vigna aconitifolia* plants were counted during an interval of 10–10 days, observing the number of roots, nodes, leaves, pods, number of seeds, length of leaves as well as length of pods, and length of plant from root to apex. These results were subsequently recorded for comparison between day 0 to day 150.

3. RESULTS and DISCUSSION

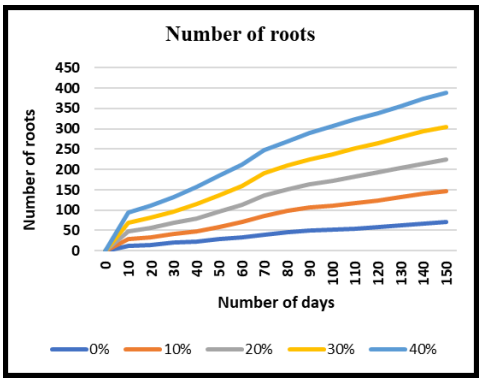

Fig. 1. Average number of roots of *Vigna aconitifolia* w.r.t varying Concentration Concentration of manure

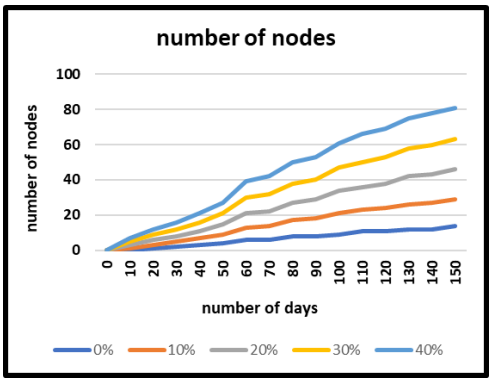

Fig. 2. Average number of nodes of *Vigna aconitifolia* w.r.t varying of manure.

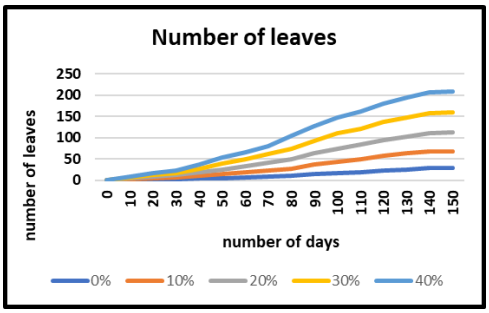

Fig. 3. Average number of leaves of *Vigna aconitifolia* w.r.t varying Concentration of manure

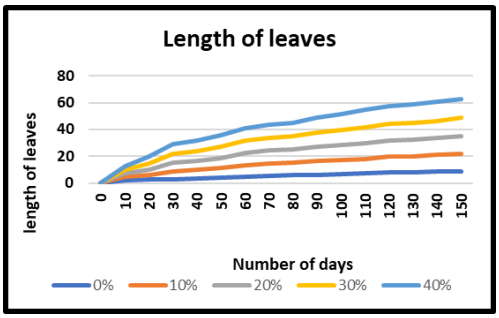

Fig. 4. Average length of leaves of *Vigna aconitifolia* w.r.t varying Concentration of manure

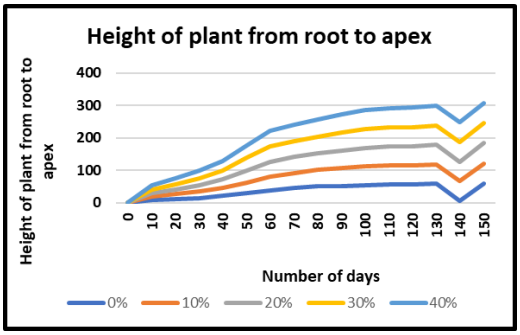

Fig. 5. Average height of plant from root to apex of apex of *Vigna aconitifolia* w.r.t varying Concentration Concentration of manure

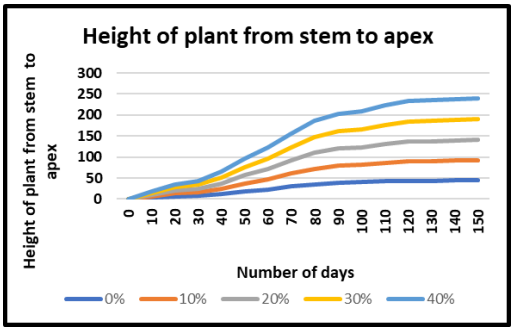

Fig. 6. Average height of plant from stem to *Vigna aconitifolia* w.r.t varying of manure

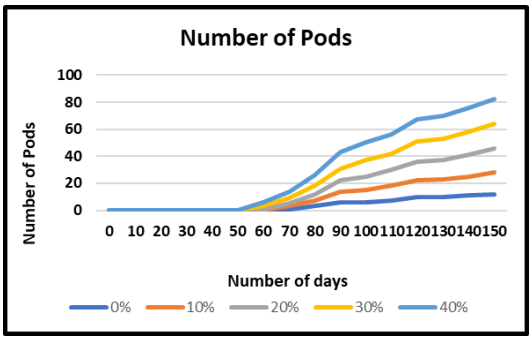

Fig. 7. Average number of pods of *Vigna aconitifolia* w.r.t varying Concentration manure

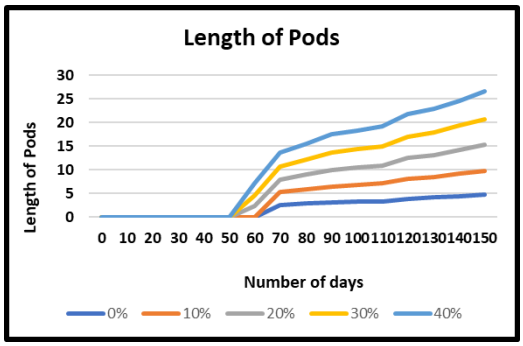

Fig. 8. Average length of pods of *Vigna aconitifolia* w.r.t varying Concentration manure

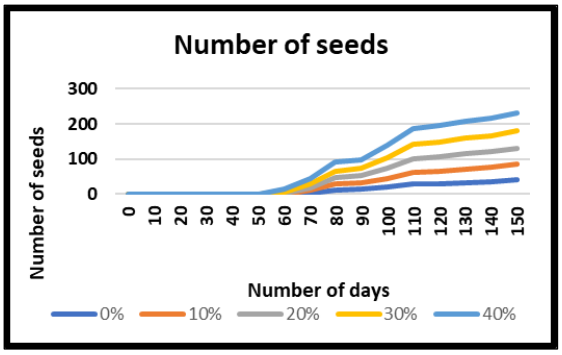

Fig. 9. Average number of pods of *Vigna aconitifolia* w.r.t varying Concentration manure

Table 1. Variation in the values of regression coefficient

Parameters	t value		Significance
Number of roots (Total number of days in relation with 40% manure concentration)	6.36	*P*< 0.01	Significant
Length of leaves (Total number of days in relation with 40% manure concentration)	5.31	*P*< 0.01	Significant
Height of plant from root to apex (Total number of days in relation with 40% manure concentration)	3.60	*P*< 0.01	Significant
Number of Pods (Total number of days in relation with 40% manure concentration)	-3.57	*P*< 0.01	Significant
Number of Seeds (Total number of days in relation with 40% manure concentration)	-3.42	*P*< 0.01	Significant

The above Figures show that over the period of 150 days, it was discovered that the concentration of chicken manure that was applied to the *Vigna aconitifolia* seeds directly correlated with the growth rate of the plants. On the day 150 it was observed that, the slowest growth rate of the plant in terms of number of roots, leaves, pods, nodes, seeds, length of leaves, as well as length of pods, length of plant from root to apex, and height of plant from stem to apex in the sample containing 10% of manure. This growth rate was faster than the control group, but less than the samples containing 20%, 30%, and 40% concentration of manure. However, when the sample was treated with 40% manure concentration, it grew at the highest rate possible, outpacing both the control and the samples treated with other concentrations, such as 10%, 20%, and 30% concentration. It was determined that, when 40% chicken waste manure was added over the course of 150 days, all the growth metrics of the *Vigna aconitifolia* plant increased dramatically.

The significance of variation in the values of regression coefficient was tested using the t-test and is presented in the Table 1. The regression values obtained were found to be highly

significant ($P < 0.01$), showing a good relationship between Total number of days with 40% concentration of Chicken waste manure in the certain parameters like number of roots, length of leaves, height of plant from root to apex, number of pods as well as number of seeds of plant *Vigna aconitifolia.*

The present study was carried out to the effect of chicken waste manure (organic fertilizer) on the growth rate of *Vigna acontifolia*. The above study observed that to establish the quality of chicken waste manure obtained from organic waste decomposer after using them by chicken intestinal waste the chicken waste manure a study provides evidence for positive result is shown that all the parameters of *Vigna acontifolia* is significantly increased, over a period of 150 days. The above experiment also showed that poultry manure contains micronutrients such as carbon, nitrogen, potassium, chlorine, sulphur, and zinc which were helpful for improving fertility of soil. The research conducted by D. Thyagarajan [16], it was observed that, Poultry offal make use of by various method like manifest, incineration, inhumation, and controlled dumping ground, composting and decomposition in absence of oxygen. Which was helpful for reduces pathogens and acts as soil conditioner or fertilizer.

Chicken intestine is waste also called poultry waste contain higher concentration of nitrogen, calcium, phosphorus than the waste of other animal species and presence of nutrient provides more incentive for the utilization of this resource. It can be used as ecofriendly technique for the conversion of poultry waste into valuable manure or compost. They have been numerous experiments in which plants have been grown in pots with different fertilizer / manure, where increases in plant growth have occurred.

According to A.H. Sipai [5] , FYM (farm yard manure) considerably improved or enhanced all-growth parameters of the plant *Vigna aconitifolia* as well as nitrogen intake by seed. This was observed in comparison to other chemical fertilizers. Comparative study conducted by Ruheentaj [11], during the Kharif season. They found that vermicompost and other organic fertilisers significantly improve plant parameters such as plant height at harvest, dry matter accumulation, pod number, pod length, grain yield, and straw yield more than inorganic fertilizers and nitrogen treatment on plants. The research conducted in South India, as per research the plant growth promoting Rhizobacteria from vermicompost affect yield on green gram was significantly increased number of flowers per plant but number of branches very slowly [17].

Application of FYM and Biofertilizer on *Vigna aconitifolia* was demonstrated to considerably improve plant height, number of branches, number of root nodules, number and length of pod, seed yield, and stover yield [18]. U. Dani [19] have shown that the application of chicken waste manure on the *Allium ascalonicum* were significantly improve or increases the height of plant, tube diameter, average tuber, dry weight per hill. Similar studies were conducted by applying chicken manure as a source of fuel. The results showed a positive outcome, with all *Vigna radiata* parameters showing a considerable growth over a 65-day period [20].

The research carried out in Bikaner by Shishupal Singh [21] showed that the *Vigna aconitifolia* was fertilised with phosphorus at varying concentration. The findings indicated that phosphorus concentrations between 20% and 40% can considerably increase a number of plant characteristics, including height, number of pods, number of branches, and nutritional intake from seeds. Apart from that, however, additional phosphorus levels were not notably advantageous.

Another study by Ozleum Atuntas [22], found that, in comparison to other inorganic fertilisers, the effect of chicken manure on the growth rate of lettuce plants significantly increased the plant's parameters, including root length, leaf length, root wet weight, root dry weight, leaf counts, and stem diameter. The study by Le Ngoc Tuan [23], found that adding lime to chicken dung greatly enhanced the plant *Vigna radiata* nutritional level and all other growth indicators. It also dramatically increased the soil's fertility [24].

4. CONCLUSION

Manure from chicken excrement seems to be a novel and workable method for decomposing trash, which lessens the burden on solid waste management [20]. The study found a direct correlation between the growth rate of *Vigna aconitifolia* seeds and the varied concentrations of chicken waste manure given to the seeds. It was determined that, when 40% chicken waste manure was added over the course of 150 days, all the growth metrics of the *Vigna aconitifolia* plant such as number of roots, nodes, leaves,

pods, seeds as well as length of leaves, length of plant from root to apex , length of plant from stem to apex, length of pods increased dramatically. Chicken waste manure treated biologically with the help of microbes to improve the micronutrients in the waste which can be used as chicken waste manure/ fertilizer for sustainable agricultural purpose.

CONFERENCE DISCLAIMER

Some part of this manuscript was previously presented and published in the conference: An International Conference on Coastal and Marine Conservation CMC-2024 dated from 1st and 2nd March, 2024 in Mumbai, India. Web Link of the proceeding: https://mithibai.ac.in/wp-content/uploads/2024/02/CMC2024-CONFERENCE-brochure..pdf

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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