

Review Form 3

Journal Name:	Journal of Agriculture and Ecology Research International
Manuscript Number:	Ms_JAERI_127282
Title of the Manuscript:	Efficacy of bat guano as a plant fertiliser on growth of Fenugreek (<i>Trigonella foenum-graecum</i> L.) in sustainable agriculture
Type of the Article	Original Research Article

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This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty**', provided the manuscript is scientifically robust and technically sound. To know the complete guidelines for the Peer Review process, reviewers are requested to visit this link:

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PART 1: Review Comments

<u>Compulsory</u> REVISION comments	Reviewer's comment	Author's Feedback <i>(Please correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)</i>
Please write a few sentences regarding the importance of this manuscript for the scientific community. Why do you like (or dislike) this manuscript? A minimum of 3-4 sentences may be required for this part.	The manuscript used bat guano, a multipurpose, environmentally friendly fertilizer that promotes sustainable farming, improves soil health, and raises crop yields. This help farmers to attain greater production and reduced expenses. Thus, farmers can use this organic fertilizer to get financial advantages.	
Is the title of the article suitable? (If not please suggest an alternative title)	Suggested title: Effects of bat guano fertilizer levels on the growth and soil physiochemical properties of fenugreek (<i>Trigonella foenum-graecum</i> L.)	

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<p>Is the abstract of the article comprehensive? Do you suggest the addition (or deletion) of some points in this section? Please write your suggestions here.</p>	<p>Synthetic/chemical fertilizers has been rapidly increased due to extensive agricultural activities to meet the demand for food to sustain an ever-expanding global population which has become a pressing concern. There is a need for development of sustainable agricultural practices which promote the use of natural fertilizers to improve soil health and support high value crops for cultivation. Fenugreek (<i>Trigonella foenum-graecum</i>), a versatile annual herb, with multifarious uses can be used for exploring natural fertilizers for enhancing quality and crop productivity. Bat guano, an organic fertilizer composed of bat excrement, has gained attention as a promising substitute for synthetic fertilizers, offering numerous benefits to plants and soil health as it's highly rich in nutrient contents.</p> <p>- Too much background material that isn't specifically related to your main point (green fonts) - make at least two sentences - you may use bat guano as background information.</p> <p>Hence present study was under taken to examine the impact of bat guano (BG) plus autoclaved (AS) soil application on the growth and physicochemical properties of fenugreek.</p> <p>- physicochemical must be included in the abstract.</p> <p>- The experiment was laid out in completely randomized design (CRD) in single factor with three replicates. The includes the following; T1- AS + 10% BG; T2- AS + 20% BG; T3- AS + 50% BG; T4- AS+ 100% BG; T5- vermicompost; T6- AS + control.</p> <p>- sentences in blue fonts must be included.</p> <p>Amongst all the treatments, the highest germination was recorded in 50% AS + BG with soil amendments treatment resulting in 99% germination rate followed by 100% guano (96.3%). Least germination rate was observed in control with only 85.3%. Also, significant (P<0.05) results indicate that 50% BG + AS was the best treatment, with a maximum plant height of about 16.3 cm in within 4 weeks, as compared to vermicompost (15.9 cm) and control (11.3 cm). Similarly, leaves number per plant was also maximum in 50% BG + AS (10.33 leaves/plant) followed by vermicompost (10 leaves/plant). In contrast, the treatments had a non-significant effect on fresh weight and dry weight.</p> <p>In contrast, lower treatments revealed no significant relationship between macro-elements (NPK concentration) and soil properties (pH, EC, and OC levels) indicates the critical need for adapted soil amendments to improve nutrient availability and soil health.</p> <p>. Further studies were recommended to assess the benefits from the use of AS + 50% BG compared to vermicompost and control as a plant fertilizer in sustainable agriculture.</p> <p>- Please ensure that the significant (P<0.05) influence is indicated such as plant heigh and number of leaves -and non-significant result should also be mentioned, such as fresh weight and dry weight. - suggested specific name of treatments (in blue fonts) - Suggested words/phrases/sentences are also in blue fonts.</p>	
<p>Are subsections and structure of the manuscript appropriate?</p>	<p>Yes, but with minor comments such as the following:</p> <p>2.2 Effect of bat guano concentrations on fenugreek seed germination and growth To assess the impact of bat guano on fenugreek seed germination and seedling growth, seeds were pre-soaked overnight in water and sowed in different treatments for germination. Potting mixture consists of autoclaved red soil and river sand (1:1) was mixed with guano in different ratios in polybags. The treatments included: T1- autoclaved soil + 10% bat guano; T2- autoclaved soil + 20% bat guano; T3- autoclaved soil + 50% bat guano; T4- autoclaved soil+ 100% bat guano; T5- vermicompost; T6- autoclaved soil + control, respectively. All the treatments were taken in triplicates. The polybags were watered (sterile water) twice a day until harvest (4 weeks). Germination percentage was recorded at the end of four weeks period. On uprooting the seedlings shoot length and number of leaves were determined.</p> <p>- Discussion on treatments (red fonts above) should be transferred to 2.5 experimental design.</p> <p>2.5 Experimental design, data collection and analysis The experiments were performed in completely randomized design (CRD) with six treatments. The treatments included: T1- autoclaved soil + 10% bat guano; T2- autoclaved soil + 20% bat guano; T3- autoclaved soil + 50% bat guano; T4- autoclaved soil+ 100% bat guano; T5- vermicompost; T6- autoclaved soil + control, respectively. All the treatments were taken in triplicates. Each treatment consists of 3 replicates and each replicate has 50 seeds for germination studies. Observations were recorded every week for germination studies. To compare plant growth and productivity among the</p>	

treatments and the control, plant height (cm) and total number of leaves were measured at the end of the experiment (4 weeks after transplanting). The experiment was repeated twice and the data was pooled together and variance (one way or single factor analysis) in treatment means and standard errors were determined, followed by the least significant difference (LSD) test at P 0.05 to compare means

- discussion regarding the treatments should be transferred in this subsection (blue fonts).

3.2 Effect of bat guano concentrations on fenugreek seed germination and plant growth

It was observed that the germination in *T. foenum* started from 2nd day. The highest germination was recorded in 50% AS + BG with soil amendments treatment resulting in 99% germination rate followed by 100% guano (96.3%). Least germination rate was observed in control with only 85.3% (Table 1 and Fig 3A). The results of *T. foenum* plant growth showed that plant height was significantly (P<0.05) increased due to application of different concentrations of guano and vermicompost as shown in Tables 1, but it did not show any significant difference in the plant leaf number because of application of either Guano or vermicompost (Tables 2). It was observed that Bat guano applications enhance overall plant growth even though the NPK content was low.

Amongst all the treatments, 50% AS + BG was best treatment with maximum plant height of about 16.3 cm within 4 weeks period compared to vermicompost (15.9cm) and control (11.3cm). The plant height was almost similar in 100% guano and control. Similarly, leaves number per plant was also maximum in 50% AS + BG (10.33 leaves/plant) followed by vermicompost (10 leaves/plant) (Fig 2). Shetty *et al.*, (2013) reported that lower quantities of soil: guano ratio (20:0.5) is better for crop production. It is also evident from the obtained results that, the bat guano in lower quantities increased the biomass significantly. Likewise amending the guano with farmyard manure in appropriate ratios may help overcome the nutrient deficiencies to improve crop production (Sridhar *et al.*, 2006). Levina and Levinsh, (2015) reported that the addition of bat guano to vermicompost fertilizer enhanced its positive effect on plant growth, although high guano concentrations increased the proportion of potentially plant pathogenic fungi. Jumao-As *et al.*, (2022) identified a diverse bacterial community in bat guano, including plant-growth promoters and biodegraders of hazardous environmental contaminants, but also pathogenic species. Seena, (2006) demonstrated that the incorporation of low amounts of bat guano into soil significantly enhanced crop production.

- suggested specific name of the treatments (blue fonts).

3.3 Fresh and dry weight (g/plant) of *Trigonella foenum-graecum*

Among all treatments (Table 3), 100% AS + BG recorded maximum fresh weight 21.24g/ plant followed by 50% AS + BG (18.51g/plant) and maximum dry weight was 3.21g/ plant followed by 50% AS + BG (2.80g/plant). Similarly, Singh *et al.*, (2023) reported that 100% RDF+FYM gave maximum fresh weight (83.43g/plant) in Indian mustard.

Table 1: Effect of different concentrations of bat guano on germination and plant growth

Sl.N	Treatments	*Germination percentage	Plant height (cm) (Mean ± SE)			
			1 st week	2 nd week	3 rd week	4 th week
1	10% BG + AS	85.7	3.2 ± 0.12 example: b	6.1 ± 0.12 -	9.3 ± 0.18 -	14.2 ± 0.27-
2	20% BG + AS	88	3.1 ± 0.06 ^b	6.1 ± 0.06 -	9.1 ± 0.07 -	13.9 ± 0.23-
3	50% BG + AS	99	3.4 ± 0.03 ^a	6.7 ± 0.12 -	10.1 ± 0.07 -	16.3 ± 0.09-
4	100% BG + AS	96.3	2.1 ± 0.07 ^c	4.4 ± 0.03 -	7.9 ± 0.15 -	11.7 ± 0.15-
5	Vermicompost	95.3	3.4 ± 0.09 ^a	6.7 ± 0.15 -	9.9 ± 0.12 -	15.9 ± 0.09-
6	Control + AS	85.3	2.3 ± 0.15 ^c	4.9 ± 0.06 -	8.0 ± 0.09 -	11.3 ± 0.15 ^(/)

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LSD (α at 5%)	-	0.23	0.25	0.29	0.44
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Means having common superscripts are non-significantly different at 5% level of significance using LSD.

Note:

BG – bat guano

AS – Autoclaved soil

*Get the average of the germination percentage. However, it cannot determine whether it is significant or non-significant

^s - significant and ^{ns} – non significant

Table 2: Effect of different concentrations of bat guano on number of leaves per plant

SI.N	Treatments	Number of leaves per plant (Mean ± SE)			
		1 st week	2 nd week	3 rd week	4 th week
1	10% BG + AS	2.33 ± 0.33 ^(?)	3.33 ± 0.33 -	9.0 ± 0 -	9.67 ± 0.33 -
2	20% BG + AS	2.67 ± 0.33 -	3.67 ± 0.33 -	8.33 ± 0.33 -	9.0 ± 0.58 -
3	50% BG + AS	2.67 ± 0.33 ^a	4.0 ± 0 -	9.33 ± 0.33 -	10.33 ± 0.33 -
4	100% BG + AS	2.0 ± 0 ^c	3.33 ± 0.33 -	6.33 ± 0.33 -	7.0 ± 0.58 -
5	Vermicompost	2.33 ± 0.33 ^b	3.33 ± 0.33 -	9.0 ± 0 -	10.0 ± 0 -
6	Control + AS	2.0 ± 0 ^c	3.33 ± 0.33 -	5.67 ± 0.33 -	7.67 ± 0.33 ^(?)
LSD (α at 5%)		0.69	0.76	0.68	1.02

Means having common superscripts are non-significantly different at 5% level of significance using LSD.

Note:

BG – bat guano

AS – Autoclaved soil

^s - significant and ^{ns} – non significant

Table 3: Effect of different concentrations of bat guano on fresh and dry weight of plant after germination.

SI. No	Treatments	(Mean ± SE)	
		Fresh weight (g/plant)	Dry weight (g/plant)
1	10% BG + AS	13.62 ± 1.61 ^(?)	2.52 ± 0.13 -
2	20% BG + AS	13.48 ± 1.20 -	2.51 ± 0.08 -
3	50% BG + AS	18.51 ± 1.41 -	2.80 ± 0.05 -
4	100% BG + AS	21.24 ± 2.38 -	3.21 ± 0.17 -
5	Vermicompost	18.16 ± 2.21 -	2.81 ± 0.13 -
6	Control + AS	19.73 ± 1.09 -	2.96 ± 0.11 ^(?)
LSD (α at 5%)		4.17	0.29

Means having common superscripts are non-significantly different at 5% level of significance using LSD.

Note:

BG – bat guano

AS – Autoclaved soil

^s - significant and ^{ns} – non significant

Table 4: Effect of different concentrations of bat guano on macro elements of plant after germination.

SI.N	Treatments	Macro elements of plant (Mean ± SE)
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		N	P	K
1	10% BG + AS	1.87 ± 0.10 ^(?)	0.48 ± 0.17 -	0.39 ± 0.04 -
2	20% BG + AS	1.89 ± 0.17 -	0.44 ± 0.17 -	0.40 ± 0.02 -
3	50% BG + AS	1.98 ± 0.15 -	0.56 ± 0.15 -	0.41 ± 0.06 -
4	100% BG + AS	1.81 ± 0.11 -	0.77 ± 0.11 -	0.44 ± 0.03 -
5	Vermicompost	2.03 ± 0.09 -	0.49 ± 0.05 -	0.52 ± 0.04 -
6	Control + AS	1.87 ± 0.09 -	0.48 ± 0.17 -	0.46 ± 0.04 ^(?)
LSD (α at 5%)		0.296	0.356	0.099

Means having common superscripts are non-significantly different at 5% level of significance using LSD.

Note:

BG – bat guano

AS – Autoclaved soil

^s - significant and ^{ns} – non significant

Table 5: Effect of different concentrations of bat guano on macro elements of soil.

SI.N	Treatments	Macro elements of soil (Mean ± SE)		
		N	P	K
1	10% BG + AS	233.75 ± 6.79	27.1 ± 2.23	250.88 ± 42.74
2	20% BG + AS	263.11 ± 9.42	26.22 ± 2.43	226.24 ± 33.45
3	50% BG + AS	234.2 ± 11.67	32.22 ± 5.99	206.62 ± 5.94
4	100% BG + AS	253.81 ± 17.62	34.42 ± 5.89	201.56 ± 18.49
5	Vermicompost	262.59 ± 10.24	31.24 ± 1.72	236.54 ± 6.53
6	Control + AS	163.11 ± 18.83	22.19 ± 2.24	265.26 ± 32.17
LSD (α at 5%)		33.20	9.73	68.25

Means having common superscripts are non-significantly different at 5% level of significance using LSD.

Note:

BG – bat guano

AS – Autoclaved soil

^s - significant and ^{ns} – non significant

Table 6: Effect of different concentrations of bat guano on soil properties of potting medium.

SI.N	Treatments	Soil properties (Mean ± SE)		
		pH (?)	EC (?)	OC (?)
1	10% BG + AS	6.95 ± 0.22	0.58 ± 0.135	0.12 ± 0.006
2	20% BG + AS	6.91 ± 0.18	0.35 ± 0.069	0.15 ± 0.009
3	50% BG + AS	6.89 ± 0.10	0.46 ± 0.07	0.33 ± 0.064
4	100% BG + AS	6.87 ± 0.18	0.54 ± 0.14	0.44 ± 0.018
5	Vermicompost	6.63 ± 0.03	0.22 ± 0.06	0.62 ± 0.062
6	Control + AS	6.62 ± 0.11	0.15 ± 0.04	0.15 ± 0.015
LSD (α at 5%)		0.38	0.23	0.10

Means having common superscripts are non-significantly different at 5% level of significance using LSD.

Note:

BG – bat guano; AS – Autoclaved soil; pH – (?); EC – (?); OC – (?)

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	<p>^s - significant and ^{ns} – non significant</p> <p>- suggested specific name of the treatments (in blue fonts) - use appropriate functions (statistical superscript)</p> <p>4.0 Conclusion</p> <p>The findings of the study showed that AS + 50% BG compared to vermicompost and control, had non-significant on fresh and dry weight in fenugreek. Regarding growth, lower treatment revealed no significant relationship between macro-elements (NPK concentration) and soil properties (pH, EC, and OC levels), suggesting a critical need for adapted soil amendments to improve nutrient availability and enhance soil health.</p> <p>- Fonts in blue are suggested statements taken from the author's manuscript in green fonts.</p> <p>presence of a wide range of elements in the guano of bats. Especially 5: 800 (5gm Gauno: 800 gm Soil) concentration showed good growth of fenugreek plant including the length and number of leaves. Nitrogen, potassium (K), and magnesium (Mg) in guano are adequate for crop production across various bat feeding habits. An analysis of bat guano revealed that it has higher nitrogen content compared to phosphorus. Additionally, in farming, Guano based fertilizers can improve availability of nutrients in the soil, increases growth and yield of vegetable crops. Further, studies are essential to investigate the occurrence of plant-promoting microbes in the bat guano and their applications. Also more in-depth assessments are necessary to tackle the associated health risk to the farmers for proper utilization of this organic fertilizer over chemical fertilizers.</p> <p>References</p> <p>- open and close parentheses on the years (references number 3, 15, and 22).</p>	
<p>Please write a few sentences regarding the scientific correctness of this manuscript. Why do you think that this manuscript is scientifically robust and technically sound? A minimum of 3-4 sentences may be required for this part.</p>	<p>The statistical tool used is appropriate in this study. Moreover, it has a significant result. Overall, the manuscript can not only benefit the farmers but also the environment for sustainable farming.</p>	
<p>Are the references sufficient and recent? If you have suggestions of additional references, please mention them in the review form.</p>	<p>Yes, the references are sufficient.</p>	
<p>Minor REVISION comments</p> <p>Is the language/English quality of the article suitable for scholarly communications?</p>	<p>No comment</p>	
<p>Optional/General comments</p>	<p>No comment</p>	

PART 2:

	Reviewer's comment	Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)
<p>Are there ethical issues in this manuscript?</p>	<p><i>(If yes, Kindly please write down the ethical issues here in details)</i></p>	

Reviewer Details:

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