

Original Research Article

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HEN EGGSHELL WASTE AS FERTILIZER FOR THE GROWTH OF *PHASEOLUS VULGARIS* (COW PEA SEEDS)

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ABSTRACT: Everyday huge quantity of eggshells is generated as bio-waste around the globe. Eggshell waste disposal contributes to environment pollution and also the disposal includes cost, availability of disposal sites. Odour of eggshell provides site for flies and abrasiveness. Eggshells are waste materials collected from house. They were collected, purified and powdered by mixer. Eggshell powder was used as a fertilizer for growth of cow pea plants. Further, the experiment was carried out to measure the effects of eggshell on plant growth. Five groups of six pots were filled with the same amount of soil and 25 seeds were planted in an each of the pots. Each group had different amounts of eggshell mixed in with the soil: without eggshell(control), 2g, 4 g, 6 g, 8 g and 10 g. As they grow, the plants were watered with the same amount of water and the experiment was conducted over a period of 20 days. After the period of 20 days, the plant growth with shoot and root length was measured. The plant leaves were collected to measure the weight and to analyse the biochemical constituents present in it like chlorophyll, free amino acid, total protein and total phenols. As a result of this study there was an increase in biochemical constituents from A1 - A5 pots than control pot. So we can conclude that a small amount of eggshell enhances the growth of cow pea plants. It also increases the nutritional intake of plants. The purpose of this particular project is to use eggshell in different application like fertilizer and reduce the pollution in the globe.

KEYWORDS: *Phaseolus vulgaris*, Hen egg shell, Chlorophyll and Fertilizer.

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1. INTRODUCTION

Plants are mainly multicellular, predominantly photosynthetic eukaryotes of the kingdom plantae. Green plants have cell walls containing cellulose and obtain most of their energy from sunlight via

photosynthesis by primary chloroplast derived from endosymbiosis with cyanobacteria. [17] Plants are reducing carbon dioxide level, certain pollutants levels and airborne dust levels. Plants are also increasing the humidity. *Phaseolus vulgaris*, also known as the common bean and green bean, among other names, is a herbaceous annual plant grown worldwide for its edible dry seeds or unripe fruit. [2] These plants have medicinal properties like diuretic and contain a substance that reduces the blood sugar level. It is used in the treatment of diabetes. It is used externally in the treatment of ulcers. It is used in the treatment of rheumatism and arthritis, plus disorders of the urinary tract. The plant contains phaseolin, which has fungicidal activity. Bean leaves have been used to trap bedbugs in houses. A microscopic hair (trichomes) on the bean leaves entrap the insects. An eggshell is the outer covering of a hard-shelled. The bird egg is a fertilized gamete (or, in the case of some birds, such as chickens, possibly unfertilized) located on the yolk surface and surrounded by albumen, or egg white. [3] The chicken eggshell is 95-97% calcium carbonate crystals, which are stabilized by a protein matrix. While the bulk of eggshell is made of calcium carbonate, it is now thought that the protein matrix has an important role to play in eggshell strength. In an average laying hen, the process of shell formation takes around 20 hours. The US food industry generates 150,000 tons of shell waste a year. The disposal methods for waste eggshells are 26.6% as fertilizer, 21.1% as animal feed ingredients, 26.3% discarded in municipal dumps, and 15.8% used in other ways. [17] Country hen's eggshell contains calcium and trace amounts of other micro elements Country hen eggshell calcium is best natural source of calcium and it is about 90% absorbable, than limestone or coral sources. The whole medium eggshell makes about one teaspoon of powder. This can be used as fertilizer to treat Blossom End Root (BER) plants and also as calcium supplement tablet for human beings.

2. MATERIALS AND METHODS

2.1. Seed Material and Chemicals

Healthy seeds of *Phaseolus vulgaris* of uniform size were used for this study. Analytical grade chemicals were used.

2.2. Experimental design

Twenty five healthy seeds of uniform size were sown in each plastic pot at a depth of 4-5 cm in the soil. All planted pots were kept in the open garden in about 34/22⁰ C day/night temperature and irrigated with 100 ml of the tap water per day. The hen eggshells were collected, washed and dried. It was grinded to a fine powder in a mixer grinder and this powder was used for the experiments. The pots were subdivided into six types as follows and the experiment was conducted over a period of 20 days.

Table 1: shows that experimental design of this work

S. No	Type of seeds	Soil content	Irrigated with	Sample (Country hen eggshell)
control	Cow pea seeds	200gm	Tap water	Nil
A1	Cow pea seeds	200gm	Tap water	2.0g
A2	Cow pea seeds	200gm	Tap water	4.0g
A3	Cow pea seeds	200gm	Tap water	6.0g
A4	Cow pea seeds	200gm	Tap water	8.0g
A5	Cow pea seeds	200gm	Tap water	10 g

Plants thus treated were harvested and analyzed for the morphological and biochemical parameters which were divided into the following phases at different growth stages:

2.3. Morphological Analysis (Growth parameters)

a) Germination percentage: The number of seeds germinated was calculated on 10th day. The germination percentage was calculated by using the following formula:

$$\text{Germination percentage} = \frac{\text{Number of seed germinated} \times 100}{\text{Total number of seed sown}}$$

b) For Shoots: The length of the shoot of each plant in each (pot) was measured with the thread and the scale on 20th day after sowing. The length of the shoot of each plant was measured and recorded on the date sheet and the shoot length of the plant is calculated.

c) For Roots: The plants were smoothly uprooted from the pots, cleaned from soil residues and prepared for measurements. The length of the root of each plant in each pot was measured with the thread and the scale on 20th day after sowing. The length of the root of each plant was measured and recorded on the date sheet and the root length of the plant is calculated.

d) Leaf area: The leaf area was calculated by measuring the length and breadth of the leaf was described by yoshida.

$$\text{Leaf area (cm}^2\text{)} = K \times \text{length} \times \text{breath}$$

Where = Kemp's constant (dicot leaves = 0.66).

e) Fresh weight and Dry weight of plants (g): Fresh weight (g/plants) was taken with the help of an electrical single pan balance. The collected plant materials were kept in air for 24 hours and electrical single pan balance was used for weighing.

2.4. Metabolite Analysis

a) Extraction of Proteins: 0.2 g of the plant tissue is crushed thoroughly with 5ml of 0.5 ml M Tris HCl buffer pH 7.5 (chilled condition) and the volume was made up to 10ml using Tris HCl buffer and centrifuged at 10,000 rpm for 20 minutes. The supernatant was collected and used for the estimation.

b) For estimation of free amino acids and Total phenol: The tissues were cut into pieces and plunged into a boiling alcohol and allow boiling for 10 minutes. 10ml alcohol was used over 0.2 gram of tissue. The extraction was done on top of a steam bath. Extract was cooled and the tissues were crushed in a mortar and pestle to a fine paste and made up with alcohol. The extract was passed on a cheese cloth. Extraction was repeated twice and the filtrates were pooled. The volume was raised by addition of the alcohol or reduced by evaporation of alcohol to represent 5-10 ml of every 0.5 gram of tissue used.

2.5. Analysis of Biochemicals: The chlorophyll, free amino acid, total protein and total phenol present in the experimental plant leaf are estimated by Acetone method, Ninhydrin method, Lowry's method and Folin - Ciocalteu reagent method respectively.

3. RESULTS AND DISCUSSION

Pot culture was conducted and role of different concentration of hen eggshell on growth parameters, Biochemical content of cow pea plant, were studied the experiment were carried out at 20th day after showing.

3.1. Morphological Analysis (Growth parameters)

Table 2 and Figure 1 of my study show the role of different concentration of hen eggshell on germination% of Cowpea plants. The Percentage of germination increases with increasing the concentration of hen eggshell.

Table 2: Results show that Germination Percentages of Cow pea plants

Samples	Germination Percentage
Control	50
A1	60
A2	80
A3	80
A4	85
A5	90

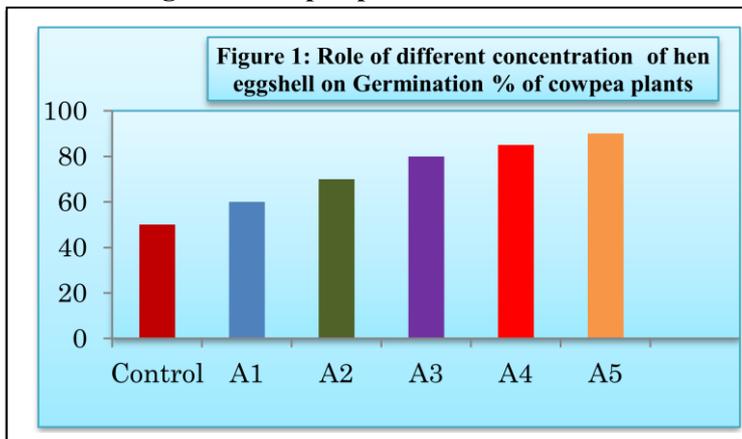


Table 3 and Figure 2 shows role of different concentration of hen eggshell concentration on Shoot and Root length of cowpea plants. In my study the shoot and root length increases with increasing the concentration of hen eggshell.

Table 3 and Figure 3 show the role of hen eggshell concentration on number of leaves of cowpea plants. The number of leaves increases with increasing concentration of hen eggshell.

Table 3: Results show those Morphological parameters of cow pea plants

Samples	Shoot Length (m)	Root Length (cm)	Number of leaves	Fresh weight (g)	Dry weight (g)
Control	6.0	3.4	30	0.05	0.01
A1	8.0	6.0	45	0.06	0.03
A2	9.5	7.0	50	0.07	0.04
A3	9.8	8.0	69	0.08	0.05
A4	10	9.0	75	0.09	0.06
A5	12	9.5	80	0.1	0.07

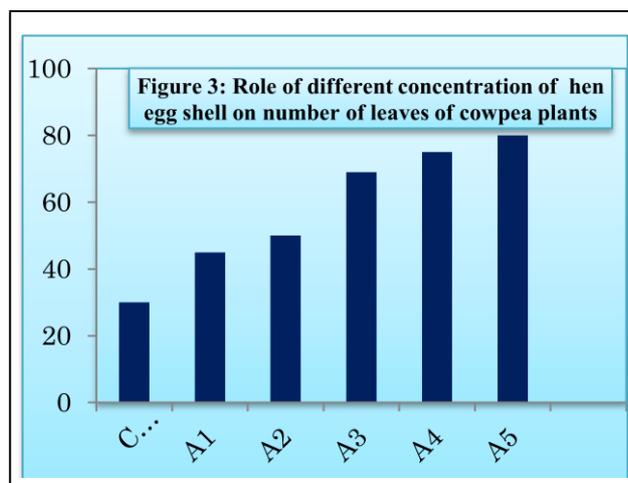
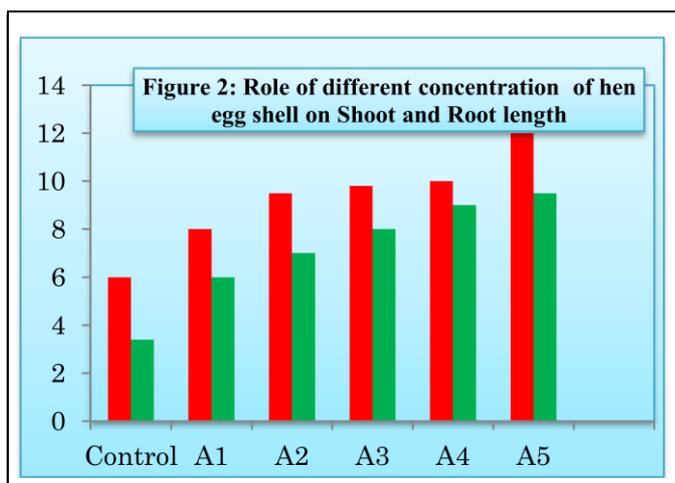


Table 3 and Figure 4 shows role of different concentration of hen eggshell on fresh and dry weight of cowpea plants. The Fresh and dry weight increases with increasing concentration of hen eggshell.

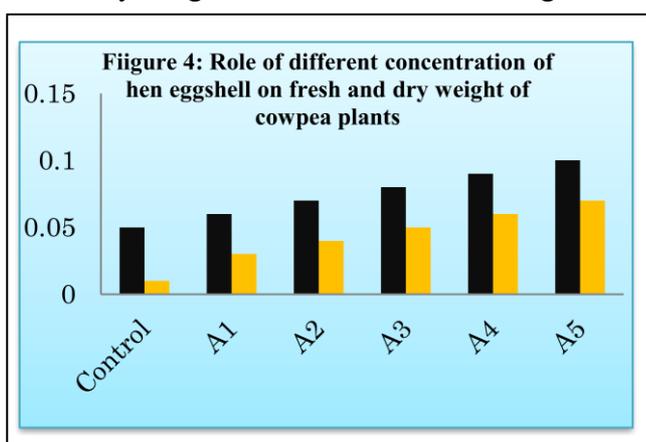
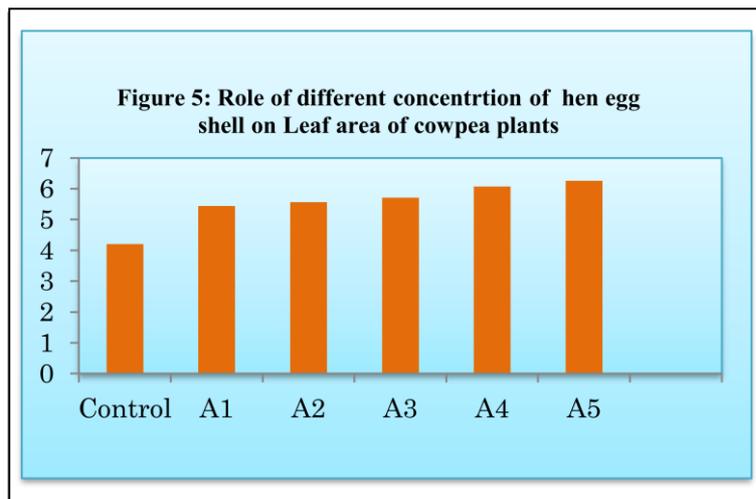
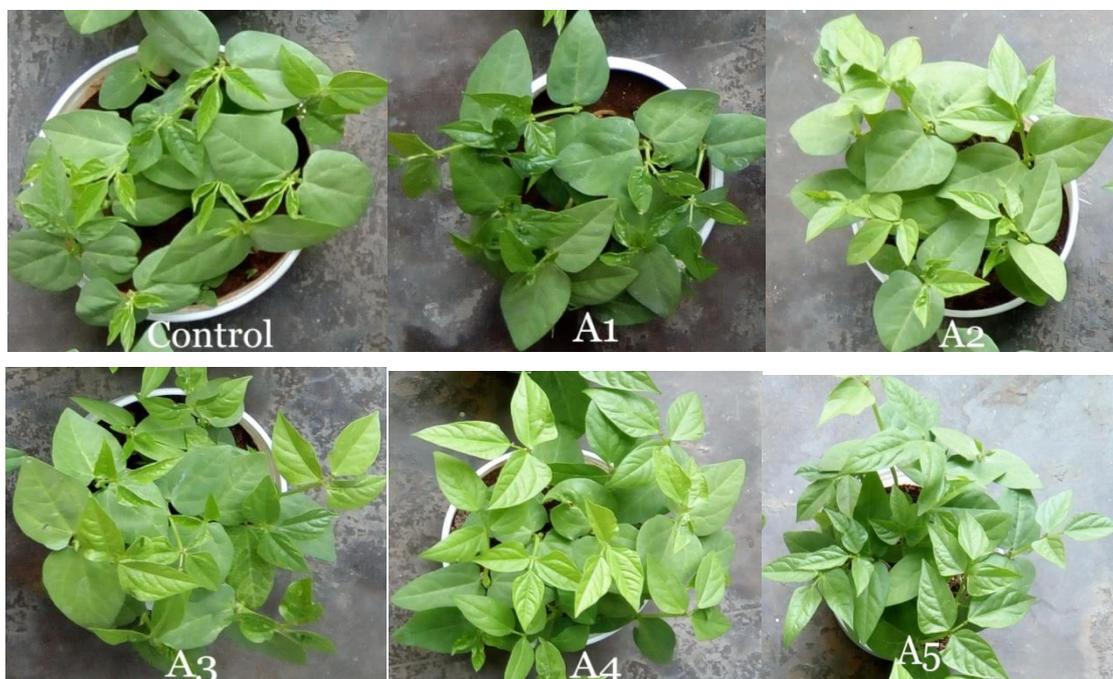


Table 4 and Figure 5 show the role of different concentration hen eggshell concentration on Leaf area of cowpea plants. The leaf area increases with increasing the concentration of hen eggshell.

Table 4: Results show that Leaf area of cow pea plants

Samples	Leaf area (m)
Control	4.21
A1	5.44
A2	5.56
A3	5.71
A4	6.07
A5	6.26

**Figure 6: Results shows Growth of cow pea seedling at 20th day**

3.2. Biochemical parameters: The biochemical parameters in response to role of different concentration of hen eggshell on cow pea plants are presented in Table 3.

Table 5: Results shows that Biochemical parameters of Cow pea plant

Samples	Total chlorophyll (mg/g)	Free Amino acid (mg/g)	Protein Content (mg/)	Total Phenol (mg/g)
Control	0.10	32.0	2.0	0.5
A1	0.06	35.0	3.0	0.5
A2	0.07	40.0	4.0	0.75
A3	0.08	48.0	5.0	1.5
A4	0.10	62.0	5.5	1.75
A5	0.12	64.0	5.8	2.0

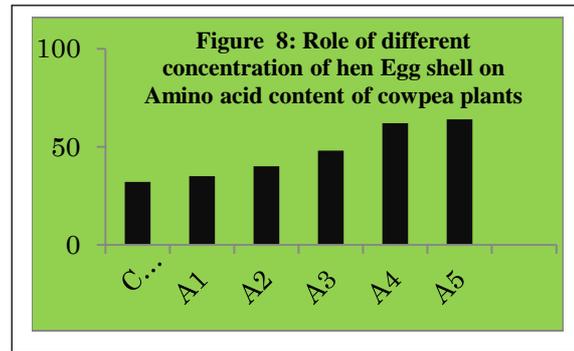
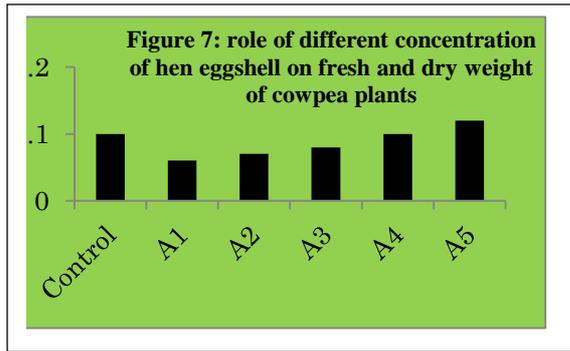


Table 5 and Figure 7 shows role of different concentration of hen eggshell on fresh and dry weight of cowpea plants. The Chlorophyll increases with increasing concentration of hen eggshell.

Table 5 and Figure 8 shows role of different concentration of hen eggshell on amino acid content of cowpea plants. The Amino acid content increases with increasing concentration of hen eggshell

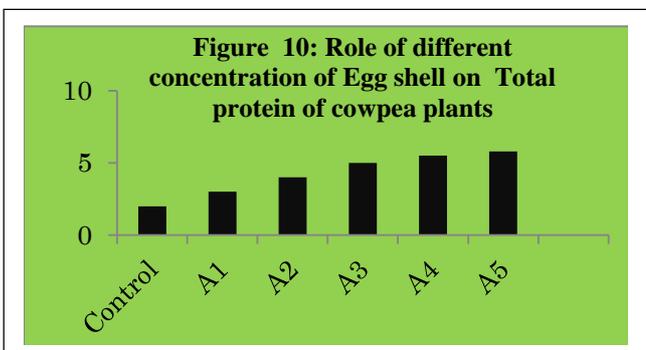
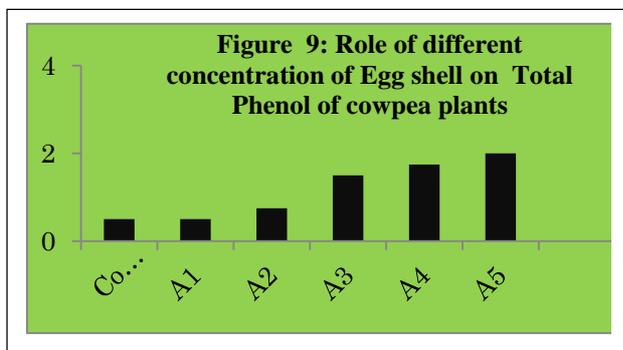


Table 5 and Figure 9 shows role of different concentration of hen eggshell on total phenol and of cowpea plants. The Total phenol increases with increasing concentration of hen eggshell.

Table 5 and Figure 10 shows role of different concentration of hen eggshell on protein content of cowpea plants. The protein content increases with increasing concentration of hen eggshell.

4. CONCLUSION

Agriculture sector plays an important role to improve the economic growth of developing countries apart from fulfilling the food security of the growing population globally. [23] Though nitrogen, phosphorous and potassium are most vital for healthy growth of plants calcium is also essential for building healthy cell walls of a plant. In the present study calcium was given in the form of calcium carbonate from eggshells. Eggshells contain calcium and trace minerals. [2] The physical parameters like germination percentage, root length, shoot length, number of leaves, fresh weight and dry weight of cowpea plants increased with increasing concentration of hen eggshell from 2.0g to 10.0g. The calcium carbonate in eggshells is similar to the common soil additive lime, which is probably the best natural source of calcium for plants. The biochemical parameters like chlorophyll, amino acid, protein and total phenol also increase with increasing concentration of hen eggshell. From my present investigation it may be concluded that egg shells can be used as manures for increasing the calcium content of the soil. Calcium carbonates in the eggshell are excellent sources for introducing this mineral into the soil. It fulfills the mineral requirement for the plants which supports the growth,

disease free quality and reducing the soil pollution overall. It is excellent organic manure for garden plants, vegetable plants and fruit plants. Hen eggshells can be replaced with lime in future aspects.

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CONFLICT OF INTEREST

Authors have no any conflict of interest.

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