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A Comparative Study of Bittern as Fertilizer and Also as Solid Fertilizer to Magnesium Demanding Crop Like Green Chillies

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Abstract

Common salt plays a major role in the global economy particularly in domestic utility (J.C. Hocquet *et al.*, 1987, L.G.M. Bass Becking, 1931) Salt is crucial for physiological activities of humans, which emphasize the importance in having the knowledge of solar salt-pans. During the salt production, equal quantity of unwanted and unavoidable toxic material, i.e., bittern is being discharged. As the bittern is enriched with magnesium, sulphate, calcium, potassium etc. and also traces metals other than the usual ions like sodium and chloride, it can either be used as such as fertilizer or can be transformed into various useful solid fertilizers. As predominantly having magnesium, bittern was tried as a fertilizer as such and in the form of solid fertilizer to magnesium demanding crop like green chillies.

***Key words*:** Common salt, Salt-pan, Toxic material, Bittern, Solid fertilizer

Plants can synthesize their own food through photosynthesis. However, for the healthy growth of plants, incorporation of fertilizers is mandatory. Indeed, while plants have the remarkable ability to synthesize their own food through photosynthesis, relying only on sunlight, carbon dioxide, and water to produce glucose and oxygen, their nutritional requirements go beyond what they can produce internally [1]. For robust and healthy growth, plants also need essential minerals and nutrients from the soil, which they cannot synthesize on their own. This is where fertilizers play a crucial role [2]. Regarding fertilizers, NPK is considered as the major nutrients, which are needed for a healthy growth [3]. Along with NPK, it is in need of secondary nutrients like magnesium, calcium, sulphate, molybdenum etc. [4]. Fertilizers supply vital nutrients that are often insufficient in natural soil, especially in intensive farming scenarios where repeated cropping depletes soil nutrient levels. While plants primarily use photosynthesis for energy production, they require several macro and micronutrients to support various physiological processes essential for development and resistance to stress [5]. Trace elements like, iron, manganese, copper, zinc, boron, cobalt etc. also plays a crucial role in providing a steady growth for the plants [6]. As agricultural systems intensify, the need for a balanced micronutrient profile becomes even more critical. Trace elements help plants build resistance to environmental stressors, reduce the need for chemical pesticides, and contribute to higher quality and yield [7]. They're an important part of sustainable agriculture practices, enabling growers to produce nutrient-rich crops that support both ecosystem health and food security. While needed in small quantities, trace elements are indispensable to plant growth and development. Their roles in enzyme activation, chlorophyll synthesis, and disease resistance highlight their importance, underscoring the need for balanced micronutrient management in soil and plant care [8].

These metals are extremely essential, but in large quantities, they may cause physiological disorders [9]. To avoid trace metal toxicity, practices such as regular soil testing and targeted fertilization are essential. In cases where soil tests reveal high levels of a particular metal, techniques like liming to adjust soil pH, adding organic matter, and using balanced fertilizers can help buffer plants from toxic levels [10]. Crop rotation and selecting plants with specific tolerances can also help mitigate issues in soils with high metal content. While trace metals are crucial in small amounts, managing their levels carefully is vital for plant health [11]. Excessive amounts can lead to toxicity, impairing growth, reducing yields, and ultimately affecting the sustainability of agricultural practices. The unwanted and unavoidable commodity during salt making i.e., bittern is enriched with almost all the above nutrients [12]. Therefore, bittern which is discharged as a by-product in solar salt-pans can be utilized directly as a fertilizer or it can be further converted into different solid fertilizers, which can be used for various magnesium demanding crops like ladies' finger, onion, tomato, green chillies, radish etc.

MATERIALS AND METHODS

The study deals with the effect of bittern and the solid fertilizer derived from bittern on green chillies by growing the plants in various pots. Bittern, an unavoidable material formed during salt production was found to be toxic when released in concentrated form [13]. However, bittern is rich in magnesium, sulphate and traces of calcium, sodium, potassium and trace metals like iron, manganese, copper and zinc [14]. Regarding the bittern samples used for the study, it was collected from

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Puthalam salt-pan of Kanyakumari district, Tamil Nadu. All the pots were one feet high and 30 cm wide. Soil, sand and organic mixture was mixed in the ratio 1:1:1 and this mixture was filled 3/4th in all pots. This mixture is the humus fraction, which improves the soil structure, and texture. Ten pots were utilized for the study, of which 5 for bittern as fertilizer and 5 for magnesium ammonium orthophosphate fertilizer prepared by using bittern as raw material.

This experimental set-up was kept in the open terrace so that all the pots can have the same exposure of sunlight. Seeds were sown and were watered daily for 2 times a day. The number of days for germination was even in all the pots and the entire experiment was carried out for ninety days. The plant height, total number and weight of fruits in the plants, of the five different pots were recorded. A dilute metacid (2ml in one litre of water) solution was applied using a hand-sprayer once in every fifteen days to eliminate harmful pests. Throughout the study, the yield of fruits and enlarging of leaves were not uniform in all the pots. The total number of flowers and leaves were recorded on the 91st day, as the study was carried for ninety days.

The well matured leaves of the plants were carefully cut-off and dried at room temperature for 3 to 4 days. Of the dried leaves, 3 gm of each was weighed and further dried in an oven at a temperature of 110º −140ºC and were made to ash in silica crucibles. The ash of the five different samples was then digested with triple acid i.e., HNO_3, H_2SO_4 and $HClO_4$ in the ratio 7:2:1. The contents in the crucibles were heated in sand-bath and were made up to 25 ml in S.M Flask with double distilled water (AI Vogel, Quantitative Inorganic Analysis). All the different samples were subjected to various analysis for the determination of percentage of calcium, magnesium, and potassium by standard methods [15].

a) *Method to prepare solid fertilizer using bittern*

To 10 ml of bittern, added 10 ml of ammonium hydroxide and to this mixture a saturated solution of ammonium phosphate was added and stirred continuously. The white solid formed was filtered and dried. The presence of Mg^{2+}, NH_4^+ and PO_4^{3-} were analyzed qualitatively and the yield was formed to be 6.21 g. The solubility was found to be 300 mg in 100 ml of distilled water.

i) *Bittern*

GB-Control – Control pot containing the soil mixture alone
GB-1 – Soil mixture + 5 ml of bittern evenly mixed
GB-2 – Soil mixture + 10 ml of bittern evenly mixed
GB-3 – Soil mixture + 15 ml of bittern evenly mixed
GB-4 – Soil mixture + 20 ml of bittern evenly mixed

- G denotes green chillies
- B denotes bittern used as fertilizer

ii) *Solid fertilizer prepared from bittern*

GS-Control- Control pot containing the soil mixture alone
GS-1 – Soil mixture + 5 g of solid fertilizer evenly mixed
GS-2 – Soil mixture + 10 g of solid fertilizer evenly mixed
GS-3 – Soil mixture + 15 g of solid fertilizer evenly mixed
GS-4 – Soil mixture + 20 g of solid fertilizer evenly mixed

- G denotes green chillies
- S denotes solid fertilizer prepared from bittern

RESULTS AND DISCUSSION

i) *Bittern as fertilizer*

The bittern as such was tried as fertilizer to magnesium demanding crop like green chillies. Five different pots were evenly mixed with 5, 10, 15 and 20 ml of bittern by having a control pot (Fig 1). The plant height was recorded for every 15 days until a total period of ninety days (Table 1). Regarding the plant height on 16th day, GB-Control was found to be 4.3 cm while GB-1, GB-2 and GB-3, the values were found to be 4.4, 4.5 and 4.6 cm respectively. A maximum value of 5.1 cm was observed for GB-4 [16].

Considering the plant height on the 31st day, GB-Control was found to be 6.2 cm while for GB-1, GB-2 and GB-3, the values were found to be 6.5, 7.1 and 7.8 cm respectively. A maximum value of 8.1 cm was reported for B-4.

Regarding the plant height on 46th day, S-Control was found to be 10.5 cm while B-1, B-2 and B-3, the values were found to be 11.9, 13.2 and 14.1 cm respectively. A maximum value of 15.1 cm was observed for GB-4.

On 61st day, GB-Control was found to have a plant height of 18.3 cm while GB-1, GB-2 and GB-3, the values were found to be 20.0, 21.2 and 22.5 cm respectively. A maximum value of 22.8 cm was reported for GB-4.

Regarding the plant height on 76th day, GB-Control was found to be 25.5 cm while GB-1, GB-2 and GB-3, the values were found to be 25.9, 26.3 and 27.0 cm respectively. A maximum value of 32.7 cm was reported for GB-4.

On 91st day GB-Control was found to have a plant height of be 30.2 cm while GB-1, GB-2 and GB-3, the values were found to be 32.4, 36.8 and 42.0 cm respectively. A maximum value of 48.1 cm was reported for B-4.

Table 1 Height of plants using bittern as fertilizer

Classification	Day 16	Day 31	Day 46	Day 61	Day 76	Day 91
GB-Control	4.3	6.2	10.5	18.3	25.5	30.2
GB-1	4.4	6.5	11.9	20.0	25.9	32.4
GB-2	4.5	7.1	13.2	21.2	26.3	36.8
GB-3	4.6	7.8	14.1	22.5	27.0	42.0
GB-4	5.1	8.1	15.1	22.8	32.7	48.1

ii) *Solid fertilizer prepared from bittern*

The solid fertilizer synthesized from the raw material bittern was also tried to the same magnesium demanding crop i.e., green chillies. For this also, the same pattern of observation was followed. Each pot was added with 5 gm, 10 gm, 15 gm and 20 gm of the solid fertilizer prepared by having a control pot (Fig 2). The plant height was recorded for every 15 days until a total period of ninety days (Table 2).

Regarding the plant height on 16th day, GS-Control was found to be 7.6 cm while GS-1, GS-2 and GS-3, the values were found to be 9.2, 10.4 and 11.3 cm respectively. A maximum value of 12.7 cm was reported for GS-4.

On the 31st day, the plant height for GS-Control was found to be 20.3 cm while GS-1, GS-2 and GS-3, the values were found to be 23.6, 24.9 and 25.9 cm respectively. A maximum value of 26.8 cm was reported for GS-4.

Regarding the plant height on 46th day, GS-Control was found to be 21.9 cm while GS-1, GS-2 and GS-3, the values were found to be 25.9, 26.3 and 27.9 cm respectively. A maximum value of 28.7 cm was reported for GS-4.

On the 61st day, the plant height for GS-Control was found to be 24.8 cm while GS-1, GS-2 and GS-3, the values were found to be 28.3, 29.5 and 31.4 cm respectively. A maximum value of 32.7 cm was reported for GS-4.

Regarding the plant height on 76th day, S-Control was found to be 29.1 cm while S-1, S-2 and S-3, the values were found to be 35.6, 37.2 and 42.7 cm respectively. A maximum value of 44.9 cm was reported for S-4.

On the 91st day the plant height for GS-Control was found to be 32.6 cm while GS-1, GS-2 and GS-3, the values were found to be 35.6, 39.3 and 46.8 cm respectively. A maximum value of 49.0 cm was reported for GS-4.

The study on the use of bittern as a fertilizer for magnesium-demanding crops, specifically green chillies, suggests that bittern application can enhance plant growth, as evidenced by incremental increases in plant height across different concentrations. Over a 90-day period, plants treated with varying amounts of bittern (5, 10, 15, and 20 ml) exhibited a progressive increase in height compared to the control group, with the highest dose (GB-4 at 20 ml) consistently yielding the greatest growth. Observations were recorded at 15-day intervals, showing that at each stage, plants treated with bittern grew taller than the control. For instance, on Day 16, GB-4 (20 ml bittern) plants measured 5.1 cm, exceeding the control (4.3 cm) and each lower concentration group. The trend continued throughout the study, with significant growth differences appearing by Day 46, where GB-4 plants reached 15.1 cm, while the control was only at 10.5 cm. By Day 91, GB-4 plants reached a height of 48.1 cm, compared to the control's 30.2 cm, indicating a nearly 60% increase in growth. The results indicate a positive correlation between bittern concentration and plant growth, with higher doses supporting significantly greater growth. The substantial increase in height with 20 ml of bittern (GB-4) suggests that this concentration is particularly effective for promoting the growth of green chillies, likely due to its magnesium content which is crucial for these crops. Thus, bittern appears to be a promising fertilizer option for enhancing the growth of magnesium-demanding crops like green chillies, though further studies on long-term effects and optimal dosing are recommended [17-20].

Fig 1 Growth of green chillies using bittern

Table 2 Height of plants using solid fertilizer

Classification	Day 16	Day 31	Day 46	Day 61	Day 76	Day 91
GS-Control	7.6	20.3	21.9	24.8	29.1	32.6
GS-1	9.2	23.6	25.9	28.3	35.6	35.6
GS-2	10.4	24.9	26.3	29.5	37.2	39.3
GS-3	11.3	25.9	27.9	31.4	42.7	46.8
GS-4	12.7	26.8	28.7	32.7	44.9	49.0

Fig 2 Growth of green chillies using solid fertilizer

Yield report

i) For bittern

The yield of fruits began from the 75th day. The number of fruits and weight of fruits were recorded as and when the fruits were plucked. Since the yield of fruits were not uniform, measurements were made and a consolidated table comprising of the total number of fruits and the total weight of fruits is presented (Table 3). GB-Control had the minimum number of fruits i.e., 13. The total weight of fruits was 64 g. GB-1 yielded 16 fruits and the total weight was 72 g. GB-2 yielded 20 fruits and the total weight is 84 g. The number of fruits in GB-3 was 24 and the total weight was 101 g. But the maximum of 26 fruits were observed for GB-4 and the total weight of the fruits was 123 g [21].

Table 3 Yield of fruit using solid fertilizer

Classification	Total number of fruits	Total weight of fruits (grams)
GB-Control	13	64
GB-1	16	72
GB-2	20	84
GB-3	24	101
GB-4	26	123

ii) *For solid fertilizer*

The yield of fruits began from the 75th day. The number of fruits and weight of fruits were recorded as and when the fruits were plucked. Since the yield of fruits were not uniform, measurements were made and a consolidated table comprising the total number of fruits and the total weight of fruits is presented (Table 4). GS-Control had the minimum number of fruits i.e., 14. The total weight of fruits was 69 g. For GS-1, GS-2 and GS-3 had the yield of 18 fruits with 82 g, 21 fruits with 91 g, and 26 fruits with 114 g respectively. The maximum yield was reported on GS-4 with 30 fruits weighing about 132 g. The gradual increase in the total number of fruits and their total weight clearly indicated that the increased addition of bittern and solid fertilizer which is enriched with secondary nutrients and micro nutrients served as a good fertilizer by enhancing the fertility of soil and in turn the yield [22-23].

Table 4 Yield of fruits using solid fertilizer

Classification	Total number of fruits	Total weight of fruits (grams)
GS-Control	16	81
GS-1	19	89
GS-2	23	108
GS-3	28	124
GS-4	33	148

Ash analysis

The well matured leaves of the five different pots were cut off and dried well at room temperature for 3 to 4 days. Of the dried leaves, 3 gm of each was weighed and further dried in an oven at a temperature of 110ºC to 140ºC and were made to ash in silica crucibles. The ash was digested with triple acid i.e., HNO_3, H_2SO_4 and $HClO_4$ in the ratio 7:2:1. The contents in the crucibles were heated in sand-bath and were allowed to cool in desiccators. The extract was made up in 25 ml S.M. Flask with double distilled water (AI Vogel, Quantitative Inorganic Analysis). The five different samples were subjected to various analysis viz., percentage of calcium. Magnesium and potassium by standard methods (AI Vogel, Quantitative Inorganic Analysis).

i) *For bittern*

The analysis of ash samples from five different pots revealed the percentages of calcium, magnesium, sulphate, and potassium (Table 5). The percentage of potassium slightly increased from GB-Control to GB-4 due to the complete supply of potassium from soil, sand, and organic mixture. The soil mixture supplies the necessary potassium, but the addition of bittern leads to a marginal increase in potassium intake (Table 5). GB-Control had the minimum percentage of potassium i.e., 3.2%. For GB-1, GB-2 and GB-3 it was 3.8, 4.1 and 4.2% respectively. Maximum value of 4.6% was observed for GB-4. From the earlier observations, it was learnt that the sufficient requirement of potassium was 3.5% to 5.0% [24]

The percentage of calcium in all five different ash samples was found to increase gradually from GB-Control to GB-4. The soil provides the required calcium, but the increasing addition of bittern activated a marginal increase in the intake of calcium. GB-Control had the minimum value of calcium i.e., 1.5% and for GB-1, GB-2 and GB-3 it was 2.3, 2.5 and 2.7% respectively. A maximum value of 3.2% was observed for GB-4. From the earlier observations, it was learnt that the sufficient requirement of calcium for green chillies is 1.5% to 4.0% [25].

The percentage of magnesium was found to increase significantly from 0.33% to 0.57% since magnesium needed for the plant was exclusively supplied by bittern. GB-Control had the minimum percentage of magnesium i.e., 0.35%. But for GB-1, GB-2 and GB-3 it was 0.41, 0.45 and 0.52% respectively. Maximum value of 0.56% was observed for GB-4. The values were found to be in the range with previous findings suggesting that green chillies require between 0.3% and 1.0% of magnesium [26].

The sulphate percentage significantly increased from GB-Control to GB-4 due to bittern providing the necessary sulphate requirement. GB-Control had the minimum percentage of sulphate i.e., 0.53% and GB-1, GB-2 and GB-3 it was 0.58% 0.61% and 0.65% respectively. But GB-4 recorded the maximum percentage of sulphate i.e., 0.71%. The above values were in agreement with the earlier observations that 0.50% to 1.0% of sulphate is sufficient for green chillies [27]. The amount of various nutrients like calcium, magnesium and potassium in the different pots are also presented in the (Table 5).

Table 5 Percentage of different ions in plants grown by using bittern

Classification	K^+ (%)	Ca^{2+} (%)	Mg^{2+} (%)	SO_4^{2-} (%)
GB-Control	3.2	1.5	0.33	0.53
GB-1	3.8	2.3	0.41	0.58
GB-2	4.1	2.5	0.45	0.61
GB-3	4.2	2.7	0.52	0.65
GB-4	4.6	3.2	0.56	0.71

ii) *For solid fertilizer*

The analysis of ash samples from five different pots revealed the percentages of calcium, magnesium, sulphate, and potassium. The potassium percentage slightly increased from GS-Control to GS-4 due to the complete supply of potassium from soil, sand, and organic mixture. The soil mixture supplies the necessary potassium, but the addition of bittern leads to a marginal increase in potassium intake (Table 6).

Table 6 Percentage of different ions in plants grown by solid fertilizer

Classification	K^+ (%)	Ca^{2+} (%)	Mg^{2+} (%)	SO_4^{2-} (%)
GB-Control	3.6	1.7	0.35	0.55
GB-1	4.1	2.3	0.44	0.64
GB-2	4.3	2.5	0.51	0.70
GB-3	4.6	3.1	0.63	0.80
GB-4	4.7	3.3	0.70	0.82

GS-Control had the minimum percentage of potassium i.e., 3.6%. For, GS-1, GS-2 and GS-3, it was 4.1, 4.3 and 4.6% respectively. Maximum value of 4.7% was observed for GS-4. From the earlier observation, it was learnt that the sufficient requirement of potassium was 3.5% to 5.0%. The percentage of calcium in all ten different ash samples were found to increase gradually from GS-Control to GS-4. GS-Control had the minimum value of calcium i.e., 1.7%. For GS-1, GS-2, and GS-3, 2.3, 2.5 and 3.1 respectively. A maximum value of 3.3% was observed for GS-4. From the earlier observation it was learnt that the sufficient requirement of calcium for green chillies is 1.5% to 4.0%. GS-Control had the minimum percentage of magnesium i.e., 0.35%. But for GS-1, GS-2 and GS-3, it was 0.44, 0.51 and 0.63 respectively. Maximum value of 0.70% was observed for GS-4. The findings align with previous observations suggesting that green chillies require between 0.3% and 1.0% of magnesium. GS-Control had the minimum percentage sulphate i.e., 0.55% and for GS-1, GS-2 and GS-3, it was 0.64, 0.70 and 0.80% respectively. But GS-4 recorded the maximum percentage of sulphate i.e., 0.82%. The above values were in agreement with the earlier observations that 0.50% to 1.0% of sulphate is sufficient for green chillies.

The analysis of ash samples from pots treated with varying amounts of bittern revealed a gradual increase in potassium, calcium, magnesium, and sulfate levels from GS-Control to GS-4. Potassium rose from 3.6% (GS-Control) to a peak of 4.7% (GS-4), aligning with the sufficient requirement of 3.5-5.0%. Calcium levels similarly increased, with GS-Control at 1.7% and GS-4 at 3.3%, meeting the 1.5-4.0% sufficiency range. Magnesium and sulfate percentages also showed consistent rises, reaching optimal levels by GS-4. This indicates that bittern application can enhance nutrient content within the ideal range for green chillies [28-29].

The (Table 7) provides the data which indicates the low, sufficient, and high values of calcium, magnesium, sulphate, and potassium concentrations for green chillies. The data depicted in (Table 7) outlines the required nutrient concentration ranges for green chillies, providing a standard for determining whether nutrient levels fall into low, sufficient, or high categories for potassium (K^+), calcium (Ca^{2+}), magnesium (Mg^{2+}), and sulphate (SO_4^{2-}). This classification aids in identifying whether green chillies are receiving adequate nutrients for optimal growth, which directly impacts their health, yield, and nutritional quality [30].

Table 7 Required percentage of nutrients by green chillies-standard values

Classification	Low value	Sufficient value	High value
K^+ (%)	3.00-3.49	3.5-5.0	>5.0
Ca^{2+} (%)	1.00-1.49	1.5-4.0	>4.0
Mg^{2+} (%)	0.25-0.29	0.3-1.0	>1.0
SO_4^{2-} (%)	0.30-0.49	0.5-1.0	>1.0

E. R. Beaufils, Diagnosis and Recommendation Integrated System (DRIS), Univ, Natal Pietermaritzburg, South Africa, 132, 1973

Potassium (K^+)

Low value (3.00–3.49%): Green chillies with potassium levels in this range may exhibit signs of potassium deficiency. Potassium is critical for water regulation, enzyme activation, and photosynthesis, so low levels could result in reduced growth and yield [31].

Sufficient value (3.5–5.0%): This range indicates an adequate potassium supply. Plants in this category are likely to have optimal turgor pressure, stress tolerance, and overall growth rates.

High value (>5.0%): Potassium levels above 5.0% might indicate an excess, which can lead to nutrient imbalance and impact the uptake of other essential nutrients like calcium and magnesium.

Calcium (Ca^{2+})

Low value (1.00–1.49%): Calcium in this range may be insufficient for green chillies, potentially leading to physiological disorders like blossom-end rot or poor cell wall structure [32].

Sufficient value (1.5–4.0%): Adequate calcium levels are essential for cell division, root development, and stress resistance, making this range ideal for healthy plant growth.

High value (>4.0%): Excessive calcium can interfere with the absorption of magnesium and potassium, potentially leading to nutrient imbalances and growth issues.

Magnesium (Mg^{2+})

Low value (0.25–0.29%): A deficiency in magnesium might hinder chlorophyll production, leading to leaf yellowing and reduced photosynthesis [33].

Sufficient value (0.3–1.0%): Green chillies with magnesium in this range are expected to have sufficient chlorophyll and energy transfer capabilities, supporting vibrant growth.

High value (>1.0%): While excess magnesium is less common, too much can disrupt soil pH and negatively impact the availability of calcium and potassium.

Sulphate (SO_4^{2-})

Low value (0.30–0.49%): Sulphate deficiency can impact chlorophyll formation and protein synthesis, leading to slower growth [34].

Sufficient value (0.5–1.0%): This range supports the formation of chlorophyll, amino acids, and enzymes, all vital for green chilli development.

High value (>1.0%): High sulphate levels may lead to salt stress and may impact nutrient uptake, particularly nitrogen and phosphate.

Significance of nutrient balancing in green chilli cultivation

By categorizing nutrient levels, (Table 7) serves as a guide for maintaining ideal soil fertility for green chillies. These values enable farmers and agricultural specialists to make targeted fertilization decisions, improving growth outcomes. However, while sufficient levels ensure healthy growth, excess levels could introduce imbalances, demonstrating the importance of monitoring and managing each nutrient in relation to the others [35].

CONCLUSION

The present study was concluded that the unavoidable bittern formed during salt production was found to be rich in magnesium, sulphate and traces of calcium, sodium, potassium and trace metals like iron, manganese, copper and zinc. This toxic material was tried as fertilizer to magnesium demanding crop like green chillies. Despite the gradual increase in the percentage of all nutrients viz., calcium, magnesium, sulphate, potassium and micro nutrients viz., iron, manganese, copper and zinc, the percentage of magnesium and sulphate also increased significantly in both the ash samples being derived by the application of bittern as such as fertilizer and also solid fertilizer from bittern regarding the green chillies. The study examined the impact of bittern concentration and effect of solid fertilizer prepared from bittern on plant growth and yield by growing green chilli plants in various pots. Excessive bittern caused leaf scorching, while lower concentrations resulted in gradual growth rate and increased yield increase with increasing bittern concentration. The growth and yield were found to be satisfactory.

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