*International Journal of Environment and Climate Change*

***Volume 13, Issue 8, Page 1746-1751, 2023; Article no.IJECC.101101***
***ISSN: 2581-8627***
*(Past name: British Journal of Environment & Climate Change, Past ISSN: 2231–4784)*

# Influence of Sagarika-Liquid with Inorganic Fertilizers for Enchaning the Soil Health and Yield of Green Gram (*Vigna radiata* L.)

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***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

***Article Information***

DOI: 10.9734/IJECC/2023/v13i82128

**Open Peer Review History:**
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://www.sdiarticle5.com/review-history/101101

***Original Research Article***

***Received: 01/04/2023***
***Accepted: 03/06/2023***
***Published: 16/06/2023***

## ABSTRACT

An experiment was conducted on sagarika-liquid with inorganic fertilizers during *Zaid* season 2022 at the central research farm of Department of Soil science and Agricultural chemistry, to enhance the productivity. The design applied was 3x3 RBD having three levels of Sagarika-liquid @2ml, 3ml and 4ml $L^{-1}$ and N P K @ 50, 75and 100%. The result obtained with treatment $T_9$[N P K @100%+ 2 Spray of Sagarika 4ml $l^{-1}$] that showed vermicompost in combination resulted in a slight change in soil pH at 0-15 cm and 15-30 cm were found 7.12 and 7.27and EC 0.35 and 0.32 dS $m^{-1}$ respectively. The significant results were in pore space 47.90 and 45.52%, water holding capacity 46.10 and 43.60%, organic carbon 0.54%, 0.44%, and available nitrogen, phosphorus and potassium was found to be significant among other treatments in Green gram cultivation and soil quality improvement. The maximum yield regarding, gave the best results with respect to plant

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height 45.34 cm, number of pod plant$^{-1}$ 28.16, and number of seed pod$^{-1}$ 8.45. It gave highest yield 1.96 t ha$^{-1}$. It was also revealed that the application with organic manures was excellent source for fertilization than fertilizers.

*Keywords: Green gram; inorganic fertilizers; Sagarika-liquid; seaweed extract; soil health etc.*

## 1. INTRODUCTION

Sagarika Liquid Seaweed Extract is a product derived from seaweed that is often used in agriculture and gardening as a natural fertilizer and plant growth promoter. While I couldn't find any specific research studies on Sagarika Liquid itself, seaweed extracts in general have been the subject of scientific investigation due to their potential benefits for plant growth and health. Here are some potential benefits and common uses of seaweed extracts: Plant Growth Promotion: Seaweed extracts contain various growth-promoting substances such as auxins, cytokinins, and gibberellins, which can stimulate cell division, root development, and overall plant growth. Nutrient Uptake Enhancement: Seaweed extracts can enhance nutrient uptake in plants, including the uptake of essential minerals like nitrogen, phosphorus, and potassium [1-4]. This can lead to improved nutrient utilization and overall plant health. Stress Tolerance: Seaweed extracts have been reported to enhance plants' tolerance to various environmental stresses such as drought, salinity, and temperature extremes [5,6]. They can help activate the plant's defense mechanisms and improve its resilience. Disease and Pest Resistance: Some studies suggest that seaweed extracts may have antimicrobial and antifungal properties, which could help plants resist diseases and certain pests. Yield and Quality Improvement: The use of seaweed extracts has been associated with increased crop yield and improved quality attributes such as enhanced fruit size, color, and shelf life. As for their use in research studies, seaweed extracts are often evaluated in controlled experiments to assess their effects on plant growth, nutrient uptake, stress tolerance, and other parameters. Researchers may compare plants treated with seaweed extracts to untreated control plants to measure the potential benefits and understand the underlying mechanisms [7,8]. It's important to note that the specific effects and benefits of seaweed extracts can vary depending on the type of seaweed used, the extraction process, concentration, and application method. If you're specifically interested in Sagarika Liquid Seaweed Extract, I would recommend consulting the product manufacturer or conducting further research to gather more detailed information about its specific benefits and recommended usage guidelines.

"Green gram (*Vigna radiata* L.) is one of the most ancient and extensively grown leguminous crops of India. It is valued for the protein enriched seed as an important dietary ingredient to overcome protein malnutrition of human beings. It occupies prime position among pulses by virtue of its short growth period, high biomass and outstanding nutrient value as food, feed and forage. It is an ideal source of protein and amino acids and its seed contain, 24.7% protein, 0.6% fat, 0.9% fiber and 3.7% ash as well as sufficient quantity of calcium, phosphorus and important vitamins" [9,10]. Aslam et al., (2010) Due to cheaper protein source, it is designated as "poor man's meat" Aslam et al., (2010). "It does not produce heaviness or flatulence is fairly rich in carbohydrate and appreciable amount of riboflavin and thiamine. In sprouted seeds of green gram synthesized Vitamin C and it is consumed as salad and also after roasting. Looking to the food habit of majority of Indian population, which is vegetarian, it becomes more important because it full-fill the protein requirement of the peoples. It is consumed as *dal*, *halwa*, *namkeen*, snack and many other preparations. It also provides nutritive and laxative green and dry fodder to cattle" Ghule et al., [11]. "Potassium is important for growth and development of plants. The quantity of K absorbed by roots is second to that of nitrogen for most of the cultivated plants. Due to intensive cropping, continuous manuring and limited or no use of K fertilizers, the available K status of the soils has depleted. Soils have begun to show response to K application particularly under intensive use of N and P fertilizers. Sufficient amounts of K is required for improving the yield and quality of different crops because of its effect on photosynthesis, water use efficiency and plant tolerance to diseases, drought and cold as well for making the balance between proteins and carbohydrates" Singh et al., [12].

## 2. METHODOLOGY

The investigation on "Influence of N P K and Sagarika-liquid for Enchaning the Productivity of

Green gram (*Vigna radiata* L.)" comprise of a field experiment which was carried out at the Soil Science Research Farm, Sam Higginbottom University of Agriculture Technology, Prayagraj during zaid season 2022. The details about the experiment site, soil and climate are described in this chapter together with the experimental design, layout plan, cultural practice, particulars of treatments, planting material and techniques employed for the parameters. The experiment was conducted at research Farm of Soil Science at Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj, the area is situated on the south of Prayagraj on the right side of the river Yamuna on the South of Rewa Road at a distance of about 6 km from Prayagraj city. It is situated at $25^0$57" N latitude, $81^0$59" E longitude and at the altitude of 98 meter above the sea level. The area of Prayagraj district comes under subtropical belt in the South east of Uttar Pradesh, which experience extremely hot summer and fairly cold winter. The maximum temperature of the location reaches up to $46^0$C – $48^0$C and seldom falls as low as $4^0$C – $5^0$C. The relative humidity ranged between 20 to 94 percent. The average rainfall in this area is around 1100 mm annually conditions are very suitable for experiments stated by Tarun et al., 2021. The soil samples will be randomly collected from one site in the experiment plot prior to tillage operation from a depth of 0-15 cm and 15-30 cm. The volume of the soil sample will be reduced by conning and quartering the composites soil sample will be air dried and passed through a 2 mm sieve by way of preparing the sample for physical and chemical analyses (Table 2).

## 3. RESULTS AND DISCUSSION

### 3.1 Soil Parameters

The composition Sagarika-liquid with iorganic fertilizers has significant increase on the soil parameters. The increase of pore space %, water holding capacity %, organic carbon, available nitrogen, phosphorus and potassium with the improvement of soil parameters, Table 2 shown that application of different levels of NPK and Sagarika-liquid have significant roll, on soil. In treatment $T_0$ lowest data observed, pore space 48.32 and 47.08%, water holding capacity 44.03 and 42.53%, organic carbon 0.39 and 0.32%, nitrogen 219.31 and 212.11 kg $ha^{-1}$, phosphorus 21.63 and 20.49 kg $ha^{-1}$, potassium 132.32 and 130.07 kg $ha^{-1}$ and $T_9$ shows the highest pore space 60.79 and 58.93%, water holding capacity 58.62 and 56.71%, organic carbon 0.54 and 0.44%, nitrogen 340.98 and 324.73 kg $ha^{-1}$, phosphorus 38.22 and 36.34 kg $ha^{-1}$ and potassium 208.34 and 205.19 kg $ha^{-1}$, respectively in 0-15cm and 15-30cm depth of soil. Treatment $T_9$ is the maximum potential of soil parameters that improve the soil followed by $T_8$. It eventually shows that the NPK and Sagarika-liquid application is the beneficial effect on the soil that will maintain the soil. $T_1$ shows that lowest effect on the soil.

The result on Table 3 depicted that the maximum grain yield (t $ha^{-1}$) of green gram was (1.96) found in $T_9$ [NPK@ 100%2 Spray of Sagarika-liquid 4ml $l^{-1}$] followed by $T_8$ [NPK 100%+ 2 Spray of Sagarika-liquid 3ml $l^{-1}$] and the minimum grain yield (t $ha^{-1}$) was found in $T_1$ (control) which was (1.18) respectively.

**Table 1. Treatment combination of sagarika –liquid with inorganic fertilizers green gram**

| Treatments No. | Treatment combinations |
|---|---|
| $T_0$ | Absolute control |
| $T_1$ | [N P K @50% + 2 Spray of Sagarika 2ml $l^{-1}$] |
| $T_2$ | [N P K @50%+ 2 Spray of Sagarika 3ml $l^{-1}$] |
| $T_3$ | [N P K @50%+ 2 Spray of Sagarika 4ml $l^{-1}$] |
| $T_4$ | [N P K @75%+ 2 Spray of Sagarika 2ml $l^{-1}$] |
| $T_5$ | [N P K @75%+ 2 Spray of Sagarika 3ml $l^{-1}$] |
| $T_6$ | [N P K @75%+ 2 Spray of Sagarika 4ml $l^{-1}$] |
| $T_7$ | [N P K @100%+ 2 Spray of Sagarika 2ml $l^{-1}$] |
| $T_8$ | [N P K @100%+ 2 Spray of Sagarika 3ml $l^{-1}$] |
| $T_9$ | [N P K @100%+ 2 Spray of Sagarika 4ml $l^{-1}$] |

**Table 2. Effect of different levels of sagarika –liquid with inorganic fertilizers on soil parameters**

| Treatments | Pore space (%) | | Water holding capacity (%) | | Organic Carbon (%) | | Nitrogen (kg ha$^{-1)}$ | | Phosphorus (kg ha$^{-1}$) | | Potassium (kg ha$^{-1}$) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 0-15 cm | 15-30 cm | 0-15 Cm | 15-30 cm | 0-15 cm | 15-30 cm | 0-15 Cm | 15-30 cm | 0-15 cm | 15-30 cm | 0-15 Cm | 15-30 cm |
| $T_0$ | 45.40 | 43.42 | 42.03 | 40.53 | 0.39 | 0.32 | 219.31 | 212.11 | 21.64 | 20.49 | 132.32 | 130.07 |
| $T_1$ | 46.29 | 44.29 | 43.30 | 41.64 | 0.46 | 0.35 | 332.28 | 314.03 | 25.28 | 22.65 | 152.55 | 148.53 |
| $T_2$ | 47.22 | 45.22 | 43.88 | 41.55 | 0.47 | 0.37 | 338.44 | 320.92 | 25.50 | 22.95 | 155.68 | 151.73 |
| $T_3$ | 47.40 | 45.40 | 44.22 | 41.42 | 0.48 | 0.38 | 340.98 | 324.73 | 26.84 | 24.42 | 161.87 | 158.02 |
| $T_4$ | 47.19 | 45.11 | 43.40 | 41.06 | 0.47 | 0.38 | 308.66 | 291.61 | 28.09 | 25.71 | 174.64 | 170.78 |
| $T_5$ | 47.40 | 45.41 | 45.46 | 42.51 | 0.49 | 0.39 | 317.11 | 300.56 | 31.09 | 28.81 | 180.82 | 177.11 |
| $T_6$ | 47.82 | 45.80 | 45.47 | 42.45 | 0.45 | 0.41 | 324.39 | 308.87 | 32.88 | 30.77 | 184.97 | 181.31 |
| $T_7$ | 47.19 | 45.20 | 44.22 | 44.22 | 0.51 | 0.41 | 270.30 | 244.05 | 36.00 | 33.95 | 202.37 | 198.85 |
| $T_8$ | 47.50 | 45.50 | 45.42 | 42.39 | 0.53 | 0.43 | 275.34 | 247.79 | 37.09 | 34.94 | 205.40 | 202.07 |
| $T_9$ | 47.90 | 45.90 | 46.10 | 43.60 | 0.54 | 0.44 | 279.53 | 254.38 | 38.22 | 36.34 | 208.34 | 205.19 |

**Table 3 .Effect of sagarika –liquid with inorganic fertilizers on yield of Green gram**

| Treatment No. | Treatment Combination | Grain yield (t ha$^{-1}$) |
|---|---|---|
| $T_0$ | Absolute control | 1.18 |
| $T_1$ | [N P K @50% + 2 Spray of Sagarika 2ml l$^{-1}$] | 1.33 |
| $T_2$ | [N P K @50%+ 2 Spray of Sagarika 3ml l$^{-1}$] | 1.38 |
| $T_3$ | [N P K @50%+ 2 Spray of Sagarika 4ml l$^{-1}$] | 1.40 |
| $T_4$ | [N P K @75%+ 2 Spray of Sagarika 2ml l$^{-1}$] | 1.50 |
| $T_5$ | [N P K @75%+ 2 Spray of Sagarika 3ml l$^{-1}$] | 1.54 |
| $T_6$ | [N P K @75%+ 2 Spray of Sagarika 4ml l$^{-1}$] | 1.64 |
| $T_7$ | [N P K @100%+ 2 Spray of Sagarika 2ml l$^{-1}$] | 1.74 |
| $T_8$ | [N P K @100%+ 2 Spray of Sagarika 3ml l$^{-1}$] | 1.88 |
| $T_9$ | [N P K @100%+ 2 Spray of Sagarika 4ml l$^{-1}$] | 1.96 |

## 4. CONCLUSION

In conclusion, seaweed extracts have demonstrated potential benefits in agriculture and gardening. They can promote plant growth, enhance nutrient uptake, improve stress tolerance, increase disease resistance, and enhance crop yield and quality. Research studies continue to explore their effects and mechanisms of action, making them a valuable tool for sustainable and eco-friendly plant cultivation practices. It concluded that the treatment combinations of $T_9$ [NPK@ 100%2 Spray of Sagarika-liquid 4ml l$^{-1}$] shows best results with respect to in comparison to other treatment combinations. It gives highest yield 1.96 t ha$^{-1}$. So, we can suggest to farmer to apply NPK with Sagarika-liquid for profitable production of green gram and good for soil.

There are two ways in which the concept of soil health (or the closely related concept of soil quality) has been considered, which can be termed either ‘reductionist’ or ‘integrated’. The former is based on estimation of soil condition using a set of independent indicators of specific soil properties—physical, chemical and biological. The alternative, integrated, approach makes the assumption that the health of a soil is more than simply the sum of the contributions from a set of specific components. It recognizes the possibility that there are emergent properties resulting from the interaction between different processes and properties. This approach has been much discussed and well reviewed (Doran et al. 1994; Doran & Jones 1996; Van-Camp et al. 2004).

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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