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Effect of seaweed extract and humic acid granules on yield attributes of buckwheat (*Fagopyrum esculentum* Moench)

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Abstract

A present investigation was carried out during the *Rabi* Season of 2024 at Himalayan University farm, Jollang, Itanagar, to determine the response of seaweed extract and humic acid granules on productivity and quality of buckwheat (*Fagopyrum esculentum* Moench). The experiment was outlined in a Randomized Block Design (RBD) with eight treatments and three replications. The treatment includes 100% RDF and 80% RDF along with seaweed extract granules and humic acid granules. The study recorded significance difference among treatments in terms of yield *i.e.* grain yield, straw yield and harvest index after harvesting of the buckwheat. The result revealed that the treatment T₅ (100% RDF + SWEG @ 40 kg/ha) was found to be best treatment for obtaining maximum grain yield (kg/ha), straw yield (kg/ha) and harvest index (%) thus indicating the combined effect of recommended dose fertilizer (RDF) and seaweed extract granules (SWEG).

Keywords: Seaweed extract granules (SWEG), Humic acid granules (HAG), Buckwheat, Randomized block Design (RBD), Recommended dose of fertilizer (RDF)

1. Introduction

Buckwheat (*Fagopyrum esculentum* Moench), a pseudocereals known for its rich nutritional profile and adaptability to diverse agro-climatic conditions, has garnered renewed interest in sustainable agriculture. Despite its potential, productivity levels of buckwheat remain low due to limited use of modern agronomic inputs. To enhance its yield attributes, the use of bio-stimulants like seaweed extract and humic acid granules has emerged as a promising alternative to conventional fertilizers.

Seaweed extracts, derived from brown, red, or green marine macroalgae, are rich in plant growth regulators such as cytokinins, auxins, and gibberellins, along with micro-and macronutrients, amino acids, and vitamins. These bioactives compounds influence physiological and metabolic processes in plants, improving nutrient uptake, chlorophyll synthesis, root development, and stress resistance (Kumar and Sahoo, 2011; Sharma *et al.*, 2014) ^[13, 21]. Several studies have reported the positive influence of seaweed extracts on yield attributes such as number of grains, seed weight, and harvest index in cereals and pseudocereals (Crouch and Van Staden, 1993; Thirumaran *et al.*, 2009) ^[9, 23].

Seaweed extract are derived from macroalgae such as *Ascophyllum nodosum*, *Sargassum*, and *Gracilaria* species, and contain diverse bioactive compounds including alginates, laminarins, betaines, phenolics, and natural plant hormones (Khan *et al.*, 2009) ^[12]. These compounds stimulate seed germination, enhance chlorophyll content, and promote floral development and fruit set, ultimately improving yield parameters (Blunden *et al.*, 2003; Craigie, 2011) ^[3, 8].

In their study on tomato and pepper crops, Zodape *et al.* (2011) ^[26] demonstrated that foliar application of *Kappaphycus alvarezii* extract improved the number of fruits and average fruit weight. Similar enhancement in yield components have been reported in wheat, maize, and millet, suggesting a broad-spectrum effect of seaweed extracts on both cereals and pseudocereals (Kumari *et al.*, 2011) ^[14].

On the other hand, humic substances, particularly humic acid, are naturally occurring organic materials resulting from the decomposition of plant and animal matter. When applied to soil in granular form, humic acid granules enhance soil structure, cation exchange capacity, water-holding capacity, and microbial activity, all of which contribute to improved plant growth and productivity (Chen and Aviad, 1990)^[6]. Humic acid is known to stimulate root elongation and improve nutrient absorption, thereby positively effecting yield components such as number of seeds per plant and 1000-seed weight (Canellas *et al.*, 2015)^[5].

Humic acid, a major fraction of humic substances found in organic matter, plays a significant role in soil fertility and plant development. Granular humic acid improves soil physical properties, enhances root growth, and increases nutrient bioavailability, particularly of phosphorous and micronutrients (Nikbakht *et al.*, 2008)^[16]. It acts as a natural chelator and hormone-like substance, influencing key plant processes such as photosynthesis, enzyme activation, and cell elongation (Eyheraguibel *et al.*, 2008)^[10].

In a controlled pot experiment, Fatima *et al.* (2015)^[11] found that humic acid application significantly enhanced plant height, root volume, and grain weight in maize. Similarly, Shah *et al.* (2006)^[19] observed improved yield and biomass in sunflower when humic acid was applied to the soil, attributing this to better nutrient uptake and photosynthetic efficiency.

When used in combination or independently, seaweed extract and humic acid have been shown to significantly enhance crop yield attributes across various species. Their application may hold particular promise for improving the performance of underutilized crops like buckwheat, especially in low-input farming systems.

One such promising intervention is the application of biostimulants, such as seaweed extracts and humic acid granules, which improve plant performance without adverse environmental effects. These inputs are increasingly recognized in sustainable agriculture for their ability to enhance plant growth, yield, and stress tolerance (Calvo *et al.*, 2014)^[4].

However, despite the increasing use of these bio-stimulants, limited research has been conducted on their combined or comparative effects on buckwheat, particularly with respect to key yield attributes such as number of branches, flowers per plant, seed per plant, 1000-grain weight, and overall grain yield. This research aims to fill this gap by investigating the effects of seaweed extract and humic acid granules on the yield attributes of buckwheat under Jollang field conditions.

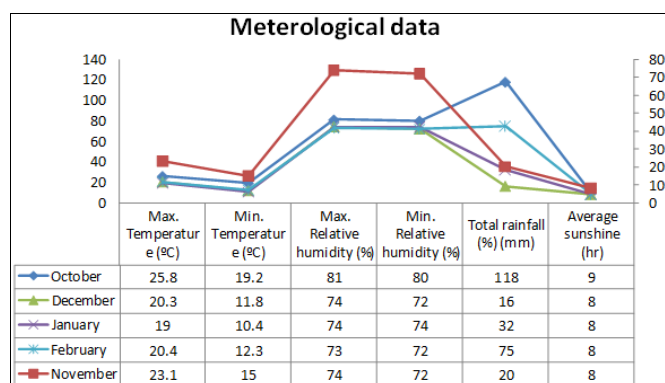
2. Materials and Methods

The experiment was carried out at agriculture field, Jollang, college of Agriculture, Himalayan University, during the period of Rabi season. The experimental farm is situated at 27.074684 N latitude and 93.652878 E longitude with an average elevation of 320 meters. It was undertaken with the objective to analyze the different buckwheat varieties and to assess their performance in Rabi season.

The treatment include, T₁ - Control, T₂ - 100% RDF, T₃ - 100% RDF + SWEG @ 20 kg/ha, T₄ - 100 RDF + SWEG @ 30 kg/ha, T₅ - 100% RDF + SWEG @ 40 kg/ha, T₆ - 80% RDF + HAG @ 20 kg/ha, T₇ - 80% RDF + HAG @ 30 kg/ha, T₈ - 80% RDF + HAG @ 40 kg/ha. The experimental design was carried out in Randomized Block Design with three row replication. Each replication consisted of eight different plots where seeds were treated with the respective treatments. Standard agronomic practices were followed throughout the cropping season to ensure optimal crop management.

2.1 Weather and Climate

The climatic condition of Jollang was humid subtropical climate with moderate temperature ranging from 12°C and 28°C during the cropping season. The crop was sown on October 28 2024 during Rabi season. The relative humidity levels remained same, averaging between 70- 80%. The site received light to moderate post-monsoon rainfall during the experimental period of 90-120 mm. The region received an average of 5 to 8 hours of bright sunshine per day, contributing to enhanced photosynthetic activity and overall crop vigor. The mean minimum and maximum temperature recorded during the cropping season was 10.4 °C and 25.8 °C, respectively. The meteorological data of weather parameters recorded during the period of experimentation from October to February of the year 2024-2025 were obtained from meteorological observatory and have been presented in the graph.



Graph 1: Meteorological data of weather parameters and total rainfall during the cropping season (Rabi 2024-2025)

3. Yield attributes

Grain yield

The Buckwheat plants collected from each plot were manually threshed to remove the grains. After threshing, the grains were cleaned and dried under the sun until they reached a standard moisture content to ensure accurate and uniform weight measurements. The dried grain from each plot was weighed and recorded in kilograms. To allow for comparison between different treatments, the grain yield was then converted into kilograms per hectare (kg/ha).

Straw yield

After harvesting, buckwheat plants from each plot were threshed to separate the grains, leaving behind the remaining plant parts such as stems, leaves, and unfilled grains and these referred as straw. This straw was then dried properly, and the total amount from each plot was measured using a digital weighing scale. The straw weight was recorded in kilograms per plot and later it was converted to kilogram per hectare (kg/ha).

Harvest Index

The ratio of economic yield (seed yield or grain yield) to biological yield was worked out to estimate harvest index as per formula given by Singh and Stoskopf, 1971^[22].

$$\text{Harvest index (\%)} = \frac{\text{Economic Yield}}{\text{Biological Yield}} \times 100$$

4. Results and Discussion

The yield and development parameters of buckwheat were recorded under a Randomized Block Design (RBD) with three

replications. Observations were taken for various traits such as Grain yield (kg/ha), Straw yield (kg/ha), and harvest index (%). The data were statistically analyzed to compute the general mean, standard error difference (SEd), and critical difference (CD) for each trait.

Grain Yield (kg/ha)

The grain yield (kg/ha), were recorded at harvested and presented in table 1. The data shows that there is significant effect of different treatment on grain yield and this data are displayed in table.

At harvest maximum grain yield was recorded at 1803.3 kg/ha, was found in the treatment T₅, (100% RDF + SWEG @ 40 kg/ha, which was statistically significant. This was followed by T₄, (100% RDF + SWEG @ 30 kg/ha with grain yield recorded at 1751.6 kg/ha. The lowest grain yield was recorded in the control treatment (T₁), which received no additional nutrient supplementation, showed the lowest grain yield at 1243.2 kg/ha. The probable reason for the maximum grain yield of buckwheat in T₅ (100% RDF + SWEG @ 40 kg/ha, is due to sufficient availability of macronutrients in RDF like nitrogen, phosphorous, and potassium, which are critical for reproductive development, resulting in improved grain formation and filling in buckwheat (Patel *et al.*, 2020) [17]. Seaweed extract granules contains naturally occurring plant hormones and micronutrients that improve physiological functions such as photosynthesis and enzymatic activity, enhancing reproductive efficiency, which results in increased number of grains per plant (Yadav *et al.*, 2021). [25]

Table 1: Effect of Seaweed extract and Humic acid granules on grain yield of Buckwheat

Treatments	Grain Yield (Kg/ha)
T ₁ - Control	1243.3
T ₂ - 100% RDF	1500
T ₃ - 100% RDF + SWEG @ 20 kg/ha	1648.3
T ₄ - 100% RDF + SWEG @ 30 kg/ha	1751.6
T ₅ - 100% RDF + SWEG @ 40 kg/ha	1803.3
T ₆ - 80% RDF + HAG @ 20 kg/ha	1548.3
T ₇ - 80% RDF + HAG @ 30 kg/ha	1605
T ₈ - 80% RDF + HAG @ 40 kg/ha	1703.3
F- test	S
SEd±	8.011648
CD (P=0.05)	17.18328

Straw yield

The straw yield (kg/ha), were recorded at harvested and presented in Table. The data shows that there is significant effect of different treatment on straw yield.

At harvest maximum Straw yield was recorded at 1526.6 kg/ha, was found in the treatment T₅, (100% RDF + SWEG @ 40 kg/ha), which was statistically significant. This was followed by T₄, (100% RDF + SWEG @ 30 kg/ha with straw yield recorded at 1501.6 kg/ha. The lowest straw yield was recorded in the control treatment (T₁), which received no additional nutrient supplementation, showed the lowest grain yield at 1393.3 kg/ha. The straw yield of buckwheat was to be maximum under T₅ (100% RDF + SWEG @ 40 kg/ha), followed by T₄ (100% RDF + SWEG @ 30 kg/ha). This enhanced straw yield under T₅ treatment is because Seaweed extract contains growth-promoting hormones like cytokinins and gibberellins, which accelerate cell division and elongation, promoting vigorous stem and leaf development. This result in greater above-ground dry matter and thus, more straw (Meena *et al.*, 2022) [15]. The lowest stalk yield was recorded under the control treatment

(T₁) kg/ha, which was significantly lower than all other treatments. This reduced performance may be because of lower chlorophyll content and photosynthetic activity due to the absence of both nutrient inputs and seaweed biostimulants, which restricts biomass production and contributes to lower straw accumulation (Sharma *et al.*, 2023) [20].

Table 2: Effect of Seaweed extract and Humic acid granules on Straw yield of Buckwheat.

Treatments	Straw Yield (Kg/ha)
T ₁ - Control	1393.3
T ₂ - 100% RDF	1403.3
T ₃ - 100% RDF + SWEG @ 20 kg/ha	1450
T ₄ - 100% RDF + SWEG @ 30 kg/ha	1501.6
T ₅ - 100% RDF + SWEG @ 40 kg/ha	1526.6
T ₆ - 80% RDF + HAG @ 20 kg/ha	1422.3
T ₇ - 80% RDF + HAG @ 30 kg/ha	1425
T ₈ - 80% RDF + HAG @ 40 kg/ha	1488.3
F test	S
SEd±	9.821421
CD (P=0.05)	21.06485

Harvest Index

The harvest index (%), were recorded at harvested and presented. The data shows that there is significant effect of different treatment on harvest index and this data are displayed in table and pie chart.

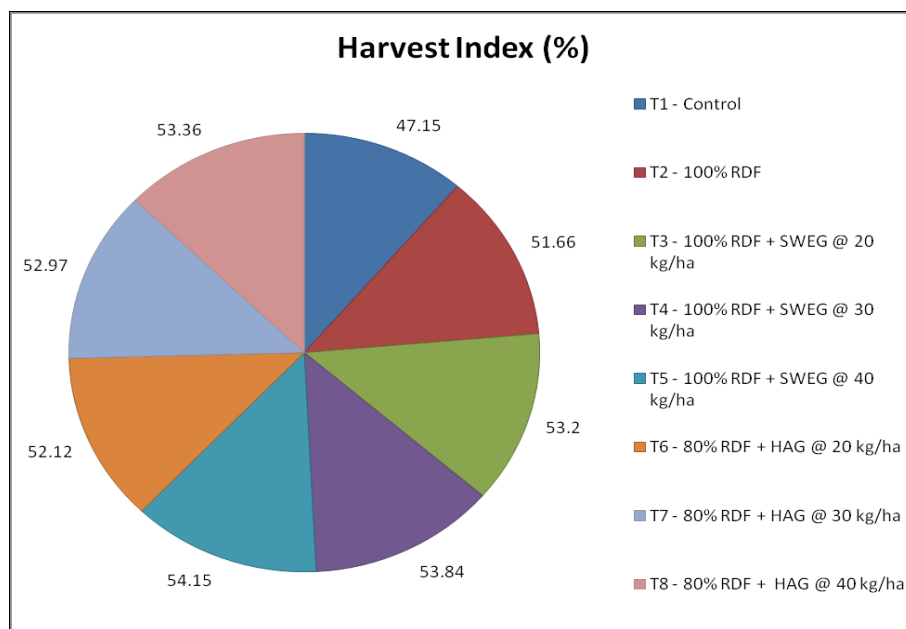
At harvest maximum harvest index was recorded at 54.15%, was found in the treatment T₅, (100% RDF + SWEG @ 40 kg/ha, which was statistically significant. This was followed by T₄, (100% RDF + SWEG @ 30 kg/ha) with harvest index recorded at 53.84%. The lowest harvest was recorded in the control treatment (T₁), which received no additional nutrient supplementation, showed the lowest grain yield at 47.15%.

The harvest index was observed highest under T₅ (100% RDF + SWEG @ 40 kg/ha), while the lowest was under T₁ (Control). Treatment (T₅) resulted in the maximum harvest index (HI%) in buckwheat due to the combined effect of enhanced grain yield and optimized dry matter portioning between economic (grain) and biological (total plant) yield. Seaweed extract in conjunction with a full dose of fertilizers improves not only total biomass but ensures more efficient translocation of assimilates toward the grain, thereby increasing harvest index (Bhagat *et al.*, 2022; Choudhary *et al.*, 2023) [2, 7].

T₁ (control) recorded the lowest harvest index in buckwheat due to poor grain yield relative to total biomass. In the absence of seaweed extract, which provide natural plant growth regulators (like cytokinins and auxins), the plant fails to effectively redirect assimilates from vegetative to reproductive parts, reducing the grain-to-total biomass ratio (Verghese *et al.*, 2022) [24].

Table 3: Effect of Seaweed extract and Humic acid granules on Harvest Index of Buckwheat.

Treatments	Harvest Index (%)
T ₁ - Control	47.15
T ₂ - 100% RDF	51.66
T ₃ - 100% RDF + SWEG @ 20 kg/ha	53.2
T ₄ - 100% RDF + SWEG @ 30 kg/ha	53.84
T ₅ - 100% RDF + SWEG @ 40 kg/ha	54.15
T ₆ - 80% RDF + HAG @ 20 kg/ha	52.12
T ₇ - 80% RDF + HAG @ 30 kg/ha	52.97
T ₈ - 80% RDF + HAG @ 40 kg/ha	53.36
F test	S
SEd±	0.220059
CD (P=0.05)	0.471979



Graph 2: Effect of Seaweed extract and Humic acid granules on Harvest Index of Buckwheat

5. Conclusion

The present investigation revealed that the combined application of 100% Recommended Dose of Fertilizer (RDF) along with Seaweed Extract Granules (SWEG) at 40 kg/ha significantly enhanced the growth, yield attributes, and overall productivity of buckwheat (*Fagopyrum esculentum* Moench) under the agro-climatic conditions of Jollang, Itanagar during the Rabi season.

Treatment (T₅) was found to be the most effective in enhancing the overall yield performance of buckwheat. This treatment significantly improved key yield attributes such as grain yield (1803.3 kg/ha), straw yield (1526.6 kg/ha), and harvest index (54.15%) compared to all other treatments. The synergistic effect of balanced fertilization through RDF and the bioactive compounds present in seaweed extract led to enhanced vegetative growth, reproductive efficiency, nutrient uptake, and photosynthetic activity. These improvements collectively resulted in higher biomass production and efficient assimilate partitioning, thereby maximizing the economic yield of buckwheat.

Thus, integrating 100% RDF with seaweed extract granules at 40 kg/ha can be recommended as a promising strategy for achieving sustainable productivity and better resource use efficiency in buckwheat cultivation.

6. References

- Battacharyya D, Babgohari MZ, Rathor P, Prithiviraj B. Seaweed extracts as biostimulants in horticulture. *Sci Hortic*. 2015;196:39-48.
- Bhagat RK, Sharma V, Meena NL. Effect of organic and inorganic nutrient sources on yield and quality of buckwheat. *J Hill Agric*. 2022;10(1):45-50.
- Blunden G, Jenkins T, Liu YW. Enhanced chlorophyll levels in plants treated with seaweed extract. *J Appl Phycol*. 2003;15:209-10.
- Calvo P, Nelson L, Kloepper JW. Agriculture uses of plant biostimulants. *Plant Soil*. 2014;383:3-41.
- Canellas LP, Olivares FL, Aguiar NO, Jones DL, Nebbioso A, Mazzei P, Piccola A. Humic and fulvic acids as biostimulants in horticulture. *Sci Hortic*. 2015;196:15-27.
- Chen Y, Aviad T. Effects of humic substances on plant growth. In: *Humic Substances in Soil and Crop Sciences: Selected Readings*. ASA and SSSA; 1990. p. 161-86.
- Choudhary S, Patel RS, Kumar D. Influence of bio-stimulants and nutrient management on growth and productivity of pseudo-cereal crops. *Indian J Agric Sci*. 2023;93(3):321-6.
- Craigie JS. Seaweed extract stimuli in plant science and agriculture. *J Appl Phycol*. 2011;23:371-93.
- Crouch IJ, Van Staden J. Evidence for the presence of plant growth regulators in commercial seaweed products. *Plant Growth Regul*. 1993;13:21-9.
- Eyheraguibel B, Silvestre J, Morard P. Effects of humic substances derived from organic waste enhancement on maize growth. *Bioresour Technol*. 2008;99(10):4206-12.
- Fatima Z, Zia M, Chaudhary MF. Effect of humic acid on growth and nutrient uptake of maize under different salt stress levels. *Pak J Bot*. 2015;47(1):207-16.
- Khan W, Rayirath UP, Subramanian S, Jithesh MN, Rayorath P, Hofges DM, *et al*. Seaweed extracts as biostimulants of plant growth and development. *J Plant Growth Regul*. 2009;28:386-99.
- Kumar G, Sahoo D. Effect of seaweed liquid extract on growth and yield of *Triticum aestivum* var. Pusa Gold. *J Appl Phycol*. 2011;23:251-5.
- Kumari R, Karthikeyan K, Somasundaram E. Effect of foliar application of seaweed extract on growth and yield of green gram (*Vigna radiata* L.). *Madras Agric J*. 2011;98(4-6):175-8.
- Meena R, *et al*. Effect of seaweed extract and organic inputs on productivity and quality of buckwheat. *Int J Chem Stud*. 2022;10(1):350-4.
- Nikbakht A, Kafi M, Babalar M, Xia YP, Luo A, Etemadi N. Effect of humic acid on plants growth, nutrient uptake, and postharvest life of gerbera. *J Plant Nutr*. 2008;31(12):2155-67.
- Patel M, *et al*. Effect of graded levels of RDF and bio-fertilizers on growth and yield buckwheat. *J Pharmacogn Phytochem*. 2020;9(4):1986-9.
- Sabir A, Sari E, Kafkas E. Combined application of humic acid and seaweed extract improved the yield quality of strawberry grown under high tunnel. *Sci Hortic*. 2014;168:27-31.

19. Shah Z, Shah SH, Peoples MB, Schwenke GD, Herridge DF. Crop residue and fertilizer N effects on nitrogen fixation and yield of legume-cereal rotations. *Field Crops Res.* 2006;98(2-3):139-50.
20. Sharma D, *et al.* Impact of biostimulants on yield and yield attributes of buckwheat under temperate conditions. *Indian J Agron.* 2023;68(1):52-6.
21. Sharma HSS, Fleming C, Selby C, Rao JR, Martin T. Plant biostimulants: A review on the processing of macroalgae and use of extracts for crop management to reduce abiotic and biotic stresses. *J Appl Phycol.* 2014;26:465-90.
22. Singh S, *et al.* Impact of nutrient omission on yield and harvest index of buckwheat in hill agriculture. *J Agroecol Nat Resour Manage.* 2021;8(3):135-9.
23. Thirumaran G, Arumugam M, Arumugam R, Anantharaman P. Effect of seaweed liquid fertilizer on growth and pigment concentration of *Abelmoschus esculentus* (L) Medikus. *Am-Eurasian J Agron.* 2009;2(2):57-66.
24. Verghese S, *et al.* Role of biostimulants in improving yield efficiency and harvest index in underutilized crops. *Indian J Plant Physiol.* 2022;27(4):456-62.
25. Yadav D, *et al.* Influence of seaweed extract on growth and productivity of buckwheat. *J Hill Agric.* 2021;12(2):289-94.
26. Zodape ST, Mukhopadhyay S, Eswaran K, Reddy MP, Chikara J. Enhanced yield and nutritional quality in green gram (*Phaseolus radiate* L.) treated with seaweed (*Kappaphycus alvarezii*) extract. *J Sci Ind Res.* 2011;70:215-9.