



Enhancing Various Variety of Strawberry (*Fragaria X ananassa*) Yield with Seaweed Extract and Biochar under Prayagraj Agro Climatic Conditions

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Authors' contributions

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

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ABSTRACT

The present investigation was carried out during 2021-22 and 2022-23 at Central Research Farm, Department of Horticulture, NAI, Sam Higginbottom University of Agriculture Technology and Sciences, Naini, Prayagraj was carried out with two factors having four of each in FRBD. The

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factors are Varieties (V1 - Winter Dawn, V2 - winter star, V3 - Sweet Charlie, V4 - Chandler) Organic Manures (M0 - No manures, M1 - Biochar 100 %, M2 - Seaweed extract 100%, M3 - Biochar + seaweed extract 50:50 %) which in combination makes 16 treatments. Among the treatments applied the combination of V1M3 (Winter Dawn + Biochar + Sea weed extract 50:50) was found to be best during 2021-22, 2022-23 and pooled data in terms of fruit set % with (8.17, 66.46 and 67.32 %), Number of fruit/plant (35.33, 32.40 and 33.87), Weight of fruit (36.36, 34.90 and 35.63 kg, Yield/plant (812.49, 791.14 and 801.81kg, Yield/plot (9.75, 9.49 and 9.62) kg, and yield/hectare (22.13, 21.51 and 21.82) ton.

Keywords: Strawberry; seaweed extract; biochar; yield; and yield attributes.

1. INTRODUCTION

The contemporary cultivated strawberry, *Fragaria x ananassa* Duch., is a hybrid produced by crossing *Fragaria virginiana* with *Fragaria chiloensis*. According to early Romans, the strawberry (*Fragaria x ananassa*) was the greatest fruit ever created. The strawberry, contrary to popular belief, is not a true berry. Botanically, it is classified as a "false fruit" or "aggregate accessory fruit." The juicy, crimson component we like is actually the receptacle, a fleshy base that formerly housed tiny flowers. The yellow "seeds" on the surface are actually single-seeded fruits known as achenes.

Strawberry farming relies heavily on mulch. Various forms of mulch, both synthetic and biological, are utilized across India depending on the environment and available resources. Organic mulches have also been shown to improve strawberry output [1,2]. Strawberries are a widely sought-after fruit known for its smooth texture, pleasant taste, and unique perfume. They are high in vitamin C and iron, and are often taken fresh. Jams and syrups are common derivatives.

Biochar is a porous, carbonaceous substance formed by the pyrolysis of plant biomasses and used in such a manner that the contained carbon acts as a long-term carbon sink or replaces fossil carbon in industrial manufacture. Seaweeds, particularly brown algae such as *Ascophyllum nodosum*, play an important role in coastal ecosystems. Expand more. For generations, farmers near coasts have used them as a useful supply of organic matter for diverse soil types and crops to grow more Seaweed treatment rates generally vary from 0.2 to 1.5 kg solids per hectare, with early applications frequently being the most helpful in helping crops cope with temperature and disease stress while maximising yield potential.

2. MATERIALS AND METHODS

The present investigation was carried out during 2021-22 and 2022-23 at Horticulture Research Farm, Department of Horticulture, NAI, Sam Higginbottom University of Agriculture Technology and Sciences, Naini, Prayagraj was carried out with two factors having four of each in FRBD. The factors are Varieties (V1 - Winter Dawn, V2 - winter star, V3 - Sweet Charlie, V4 - Chandler) Organic Manures (M0 - No manures, M1 - Biochar 100 %, M2 - Seaweed extract 100%, M3 - Biochar + seaweed extract 50:50 %) which in combination makes 16 treatments. The research was carried out with the objectives of studying the effect of seaweed extract and biochar on fruiting and yield parameters of strawberry.

2.1 Data Collection

Five tagged plants were chosen from each treatment, and the results were recorded for the specified growth and blooming criteria.

3. RESULTS AND DISCUSSION

The maximum fruit set % in pooled analysis was found in V₁M₃ (Winter Dawn + Biochar + Sea weed extract 50:50) with (67.32%) and the minimum fruit set % was found in V₃M₀ (Sweet Charlie + Biochar + Sea weed extract 50:50) with (56.93) respectively. The highest fruit set percentage may be due to the increased chlorophyll content in the leaves by the organic manures application which ultimately increase the photosynthetic of the crop which leads to increase in fruit number as compared to flower. The use of biochar has also been discovered to increase soil structure and texture, which aids in the mass movement of nutrients, which is particularly effective in boosting blooming and fruiting characteristics [3].

Table 1. Impact of seaweed extract and biochar on Fruit set %, no. of fruit per plant and fruit weight of strawberry

	Fruit set %			No. of fruit/plant			Fruit weight (g)		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
V1	63.00	61.19	62.09	29.11	26.23	27.66	32.21	30.70	31.45
V2	55.32	53.66	54.49	24.62	21.68	23.13	28.42	26.95	27.68
V3	44.17	42.36	43.26	22.15	19.20	20.64	20.36	18.90	19.63
V4	58.37	56.64	57.51	27.90	25.01	26.42	27.54	25.93	26.66
F Test	S	S	S	S	S	S	S	S	S
SE(d)	0.118	0.128	0.102	0.007	0.047	0.023	0.014	0.034	0.015
CD@5%	0.242	0.263	0.209	0.014	0.10	0.05	0.028	0.07	0.03
M0	51.40	49.75	50.58	22.87	19.96	21.40	23.29	21.82	22.55
M1	53.91	52.03	52.97	24.42	21.46	22.90	26.80	25.20	25.96
M2	56.53	54.81	55.67	27.08	24.26	25.67	28.59	27.12	27.85
M3	59.00	57.27	58.14	29.40	26.43	27.88	29.85	28.33	29.07
F Test	S	S	S	S	S	S	S	S	S
SE(d)	0.15	0.16	0.158	0.04	0.05	0.03	0.02	0.03	0.02
CD@5%	0.30	0.32	0.31	0.07	0.09	0.05	0.03	0.06	0.03

Table 2. Impact of seaweed extract and biochar on yield/plant, yield/plot and yield/ha of strawberry

	Yield/plant (g)			Yield/plot(kg)			Yield/ha (t)		
	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled	2021-22	2022-23	Pooled
V1	954.96	823.64	889.30	11.46	9.89	10.67	21.25	20.63	20.94
V2	702.92	587.88	644.95	8.44	7.05	7.74	14.13	13.51	13.82
V3	454.87	366.70	410.09	5.46	4.40	4.92	11.40	10.78	11.09
V4	772.99	653.21	710.22	9.28	7.84	8.52	14.52	13.90	14.21
F Test	S	S	S	S	S	S	S	S	S
SE(d)	0.14	0.15	0.15	0.31	0.31	0.32	0.29	0.26	0.54
CD@5%	0.28	0.29	0.30	0.62	0.62	0.63	0.58	0.51	1.07
M0	538.37	441.34	489.40	6.46	5.30	5.87	14.77	14.15	14.46
M1	661.45	548.12	602.72	7.94	6.58	7.23	15.06	14.44	14.75
M2	788.66	672.91	730.79	9.46	8.08	8.77	15.49	14.87	15.18
M3	897.26	769.06	831.67	10.77	9.23	9.98	15.98	15.36	15.67
F Test	S	S	S	S	S	S	S	S	S
SE(d)	0.14	0.14	0.15	0.32	0.32	0.32	0.32	0.28	0.55
CD@5%	0.28	0.28	0.29	0.64	0.63	0.64	0.64	0.56	1.10

The maximum number of fruit per plant in pooled analysis was found in V₁M₃ (Winter Dawn + Biochar + Sea weed extract 50:50) with (33.85) and the minimum number of fruit per plant was found in V₃M₀ (Sweet Charlie + Biochar + Sea weed extract 50:50) with (22.89) respectively. The maximum number of fruits per plant might be due to the fact that the seaweed extract would have increases the sex cell division which have leads to maximum number of flower that results in increased in number of fruit. While the biochar would help in supplying.

The maximum fruit weight (g) in pooled analysis was found in V₁M₃ (Winter Dawn + biochar + Sea

weed extract 50:50) with (35.63 g) and the minimum fruit weight was found in V₃M₀ (Sweet Charlie + biochar + Sea weed extract 50:50) with (21.49) respectively. The increase in fruit weight is due to intrinsic and extrinsic factors such as genotype [4]. Intrinsic factors such as meiosis cell division might have been helped in increasing the fruit weight of the fruit, which is lead, by the supply of liquid seaweed extract fertilizer. Extrinsic factors such as soil moisture and capacity of soil to supply nutrients which might have been helped by the stored nutrients which is present in biochar The maximum yield/plant (g) in pooled analysis was found in V₁M₃ (Winter Dawn + biochar + Sea weed extract

50:50) with (1208.71 g) and the minimum yield/plant was found in V₃M₀ (Sweet Charlie + biochar + Sea weed extract 50:50) with (493.91 g) respectively. Intrinsic factors such as meiosis cell division might have been helped in increasing the fruit weight of the fruit, which is lead, by the supply of liquid seaweed extract fertilizer [5]. Extrinsic factors such as soil moisture and capacity of soil to supply nutrients which might have been helped by the stored nutrients which is present in biochar. Increase in weight of fruit simultaneously increases the yield per plant [6].

The maximum yield/plot (kg) in pooled analysis was found in V₁M₃ (Winter Dawn + biochar + Sea weed extract 50:50) with (14.50 kg) and the minimum yield/plot was found in V₃M₀ (Sweet Charlie + biochar + Sea weed extract 50:50) with (5.93 kg) respectively.

The maximum yield/ha (t) in pooled analysis was found in V₁M₃ (Winter Dawn + biochar + Sea weed extract 50:50) with (21.82 t) and the minimum yield/ha was found in V₃M₀ (Sweet Charlie + biochar + Sea weed extract 50:50) with (11.63t) respectively. Intrinsic factors such as meiosis cell division might have been helped in increasing the fruit weight of the fruit, which is lead, by the supply of liquid seaweed extract fertilizer. Extrinsic factors such as soil moisture and capacity of soil to supply nutrients which might have been helped by the stored nutrients which is present in biochar [7]. Increase in weight of fruit simultaneously increases the yield per plant which ultimately increases the inclusively yield of the strawberry.

4. CONCLUSION

Based on our experimental results, we determined that the treatment V₁M₃ (Winter Dawn + Seaweed extract + biochar (50:50%)) performed best in terms of plant height, number of leaves, leaf area, number of flowerings, and days to first flowering. It may also be inferred that seaweed extract is an excellent source of nutrients, and biochar aids in nutrient absorption and carbon sequestration, hence lowering carbon concentrations in the atmosphere.

FUTURE PROSPECTS

The population increase generates significant climatic change, which leads to changes in the farming system. As a result, there is a need for a more sustainable approach to farming in order to

safeguard the land and ecosystem for future generations. Seaweed extract is a liquid organic fertilizer that provides all of the key elements needed for crop growth and development in a sustainable manner. biochar, on the other hand, acts as a carbon sequester, helping to reduce the amount of carbon in the environment. Biochar acts as a nutrient adsorbent, slowly releasing nutrients [8]. Finally, we may conclude that the usage of seaweed extract with biochar promotes sustainable farming practices.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology.

Details of the AI usage are given below:

1. Chat GPT

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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