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Comparative study on the effect of kitchen waste compost & Naphthalene Acetic Acid (NAA) on the growth and biochemical changes of *Coriandrum sativum* under two different treatments

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Abstract
This study investigates the individual and combined effects of kitchen waste compost and the synthetic auxin, Naphthalene Acetic Acid (NAA), on the growth and biochemical responses of *Coriandrum sativum*. Through comparative analyses of growth parameters, carbohydrate accumulation, and chlorophyll content under two treatments Soil + Compost and Soil + Compost + NAA the study aims to assess the synergy between organic and synthetic growth stimulants. Results showed that while compost alone improved growth metrics, the addition of NAA significantly enhanced plant morphology, photosynthetic capacity, and biochemical composition, suggesting a synergistic benefit.

Keywords: NAA, Coriandrum, kitchen waste, compost, growth

Introduction
Coriandrum sativum (coriander) is a culinary and medicinal herb with increasing global demand. Sustainable cultivation of coriander necessitates alternatives to synthetic fertilizers, such as organic compost derived from kitchen waste, which improves soil health and reduces environmental burden. On the other hand, plant growth regulators like NAA stimulate growth at the cellular level by mimicking natural auxins.
This study investigate show kitchen waste compost and NAA, alone and in combination, influence the growth and physiology of *C. sativum*, highlighting their role in promoting sustainable agriculture, Main objective of this paper are:

- To evaluate the effect of kitchen waste compost on coriander growth
- To assess the influence of NAA on morphological and physiological traits.
- To compare the efficacy of organic and synthetic treatments.
- To analyze biochemical changes, specifically carbohydrate and chlorophyll content.
- To explore the synergistic potential of compost and NAA.

Materials and Methods
Compost and NAA Preparation
- **Compost:** Made from layered kitchen waste with cocopeat and neem leaves, decomposed over 2-3 months.
- **NAA Solution:** Prepared as 5% (w/v) in ethanol with NaOH for solubility

Experimental Setup
Two treatments: (1) Soil + Compost (KWC), (2) Soil + Compost + NAA. Coriander seeds were sown and monitored over5weeks.NAA was foliar-sprayed weekly.

Biochemical Assays

Carbohydrates: Estimated using the an throne method at 620 nm. Chlorophyll: Measured using Arnon's method at645and 663nm.

Results and Discussion

Growth Parameters

Table 1: Growth of coriander in 4th week

S. No.	Growth Parameters	Treatment 1 Soil+KWC	Treatment 2 Soil+KWC+NAA
1.	Plant height	Minimum-4cm Maximum-7cm	Minimum-8cm Maximum-10cm
2.	No of branches	2	3
3.	Length of stem	Minimum-4cm Maximum-7cm	Minimum-8cm Maximum-10cm
4.	No of leaves	11 true leaves	24 true leaves

The data clearly show that the addition of NAA (Naphthalene Acetic Acid) to Soil+Kitchen Waste Compost (KWC) significantly improved the growth of *Coriandrum sativum*:

- Plant Height increased from 4-7cm (Treatment 1) to 8-10cm (Treatment 2), indicating enhanced vegetative growth.
- Number of Branches rose from 2 to 3, suggesting that NAA promotes better branching and shoot development.
- Stem Length followed a similar trend as plant height, increasing from 4-7 cm to 8-10cm, reflecting stronger and more elongated stems.
- Number of leaves more than doubled from 11 to 24 true leaves, showing improved leaf development and overall plant vigor.

Table 2: Growth of coriander in 4th week

S. No.	Growth Parameters	Treatment1 Soil+KWC	Treatment 2 Soil+KWC+NAA
1.	Plant height	Minimum-7cm Maximum-10cm	Minimum-12cm Maximum-16cm
2.	No of branches	4-6	5-7
3.	Length of stem	Minimum-7cm Maximum-10cm	Minimum-12cm Maximum-16cm
4.	No of leaves	18	36

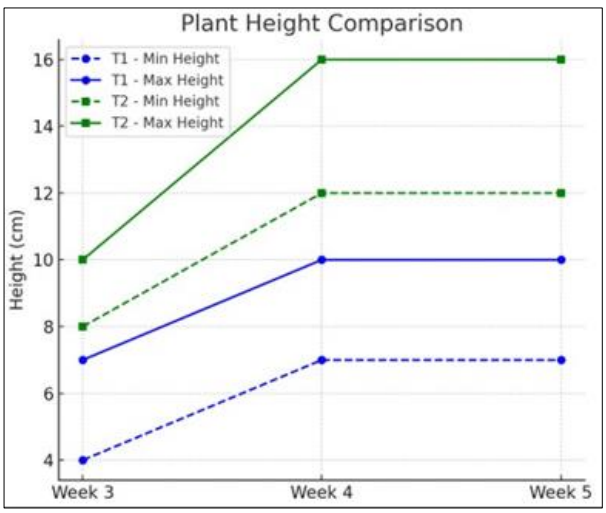
The growth data at the 4th week show a significant improvement in *Coriandrum sativum* under Treatment 2 (Soil+KWC+NAA) compared to Treatment1 (Soil+KWC):

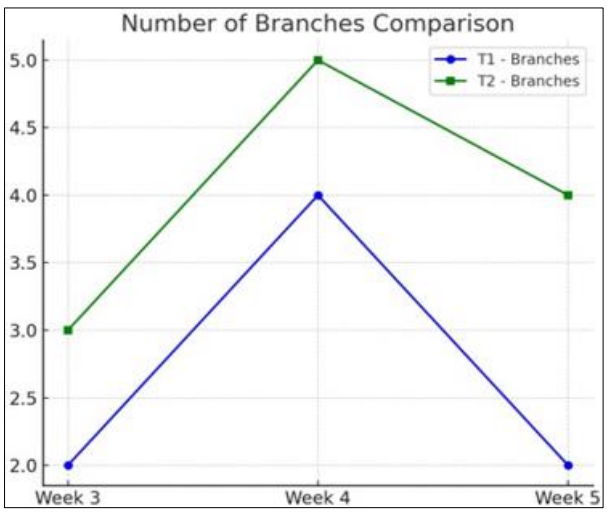
- Plant Height increased from 7-10cm to 12-16cm, indicating enhanced vertical growth due to the stimulatory effect of NAA.
- Number of Branches increased slightly from 4-6 to 5-7 suggesting better shoot proliferation.
- Stem Length, like plant height, increased from 7-10cm to 12-16cm, showing stronger and elongated stem development.
- Number of Leaves doubled, from 18 to 36, reflecting significantly improved leaf production and overall plant biomass.

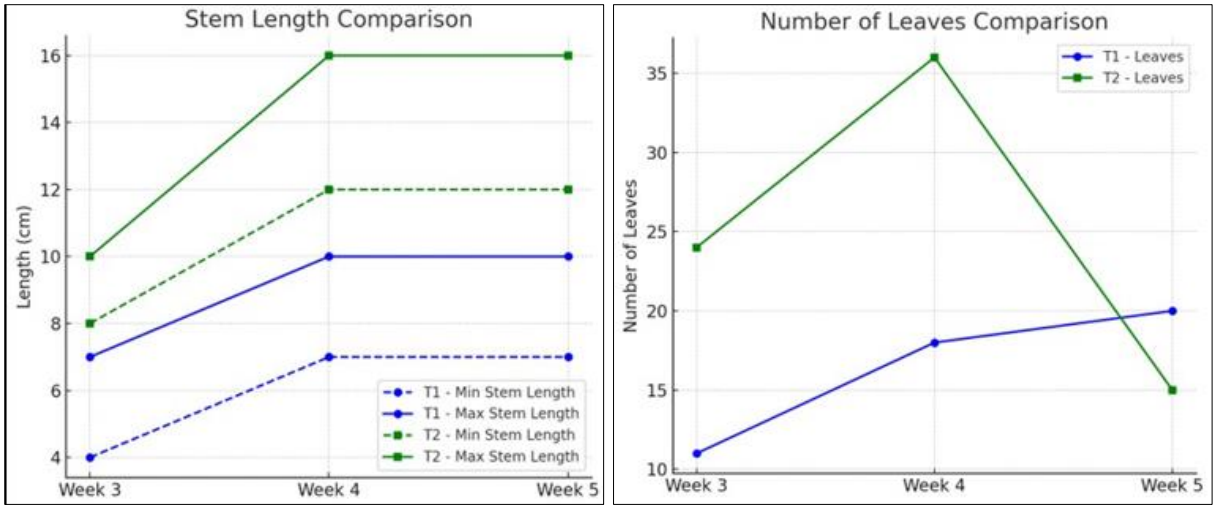
Table 3: Growth of coriander in 5th week

S. No.	Growth Parameters	Treatment 1 Soil+KWC	Treatment 2 Soil+KWC+NAA
1.	Plant height	Minimum-7cm Maximum-10cm	Minimum-12cm Maximum-16cm
2.	No of branches	2-4	4-6
3.	Length of stem	Minimum-7cm Maximum-10cm	Minimum-12cm Maximum-16cm
4.	No of leaves	20	15
5.	Fresh weight	1.55g	0.53g
6.	Length of the root	2cm	4.2cm

1. Plant Height and Stem Length remained the same as in the 4th week, with Treatment 2 (Soil +KWC+NAA) plants maintaining a higher range (12-16 cm) compared to Treatment 1 (7-10 cm), indicating sustained vegetative growth due to NAA.
2. Number of Branches increased from 2-4 in Treatment 1 to 4-6 in Treatment 2, showing improved shoot development under NAA treatment.
3. Number of Leaves, however, was higher in Treatment 1 (20 leaves) compared to Treatment 2 (15 leaves). This may suggest a shift in energy allocation in NAA-treated plants towards stem and root development rather than leaf proliferation at this stage.
4. Fresh Weight was unexpectedly higher in Treatment 1 (1.55 g) compared to Treatment 2 (0.53 g). This might be due to water retention or leaf mass being greater in compost-only treatment at this point, or due to temporary stress or faster drying in NAA treated plants.
5. Root Length was significantly longer in Treatment 2 (4.2 cm) than in Treatment 1 (2cm), indicating that NAA strongly promotes root elongation, which may support better nutrient uptake in the long term





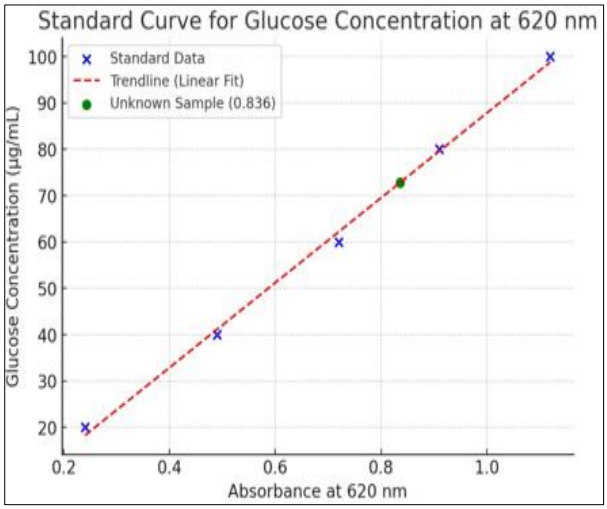


Graphs 1: Difference in growth parameters

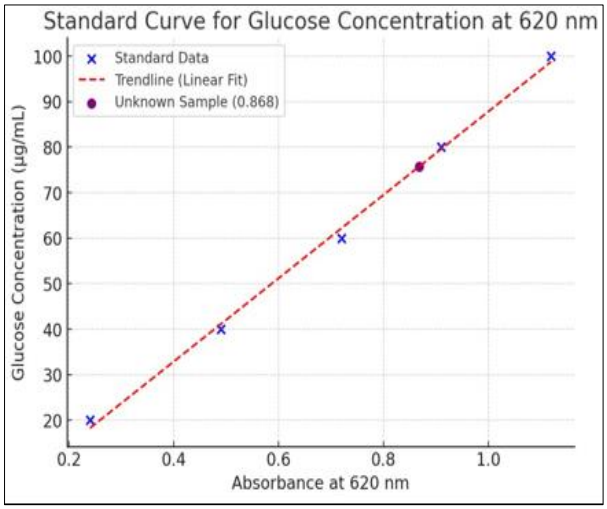
Carbohydrate Content

Soil+Compost: 74.18mg/L

Soil+Compost+NAA: 77.09mg/L



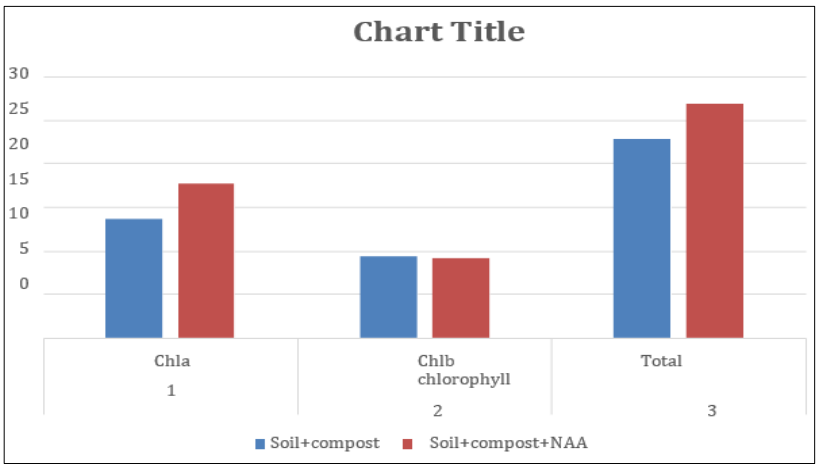
Graphs 2: Graph showing Absorbance of known & unknown sample (Soil+Compost)



Graphs 3: Graph showing Absorbance of known & unknown sample (soil+compost+NAA)

The slight increase in carbohydrate content with the addition of NAA suggests that Naphthalene Acetic Acid enhances photosynthetic activity, leading to greater synthesis and accumulation of carbohydrates. NAA, as a plant growth regulator, promotes cell division and metabolic activity, which can result in improved carbohydrate production and energy storage in the plant. This indicates a positive impact of NAA on the plant's overall physiological performance.

Chlorophyll Content



Graphs 4: Graph showing chlorophyll content

Table 4: Chlorophyll content

S. No.	Chlorophyll type	Soil+compost	Soil+ compost+ NAA
1.	Chla	13.56	17.81
2.	Chlb	9.28	9.12
3.	Total chlorophyll	22.84	26.93

1. Chlorophyll A

Chlorophyll a, the primary pigment involved in photosynthesis, increased significantly when NAA was applied. This suggests that NAA may enhance photosynthetic efficiency and promote better growth by stimulating chlorophyll synthesis.

2. Chlorophyll B

Chlorophyll b, which functions as a naccessory pigment by absorbing additional light wavelengths, showed a slight decrease with NAA. This minor change suggests that NAA may preferentially enhance chlorophyll a synthesis or alter pigment balance slightly.

Total Chlorophyll

The total chlorophyll content increased notably under the combined treatment with NAA. This indicates a positive effect of NAA on overall chlorophyll biosynthesis, possibly due to enhanced nutrient uptake, hormonal regulation, or increased cell division in leaf tissues.

Conclusion

The combined application of kitchen waste compost and NAA was more effective than compost alone in promoting the growth and biochemical development of C. sativum.

Compost improved soil health and microbial activity, while NAA stimulated physiological processes like cell division and chlorophyll biosynthesis. Together, they yielded higher biomass, carbohydrate, and chlorophyll content.

This integrated approach offers a sustainable model for enhancing coriander cultivation, demonstrating the potential of combining organic waste recycling with precise use of plant hormones.

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