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Effect of biostimulant on growth, yield and quality of green chilli (*Capsicum annuum*)

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Abstract
The present investigation, entitled Effect of Foliar Biostimulant on Growth, Yield and Quality of Chilli (*Capsicum annuum* L.) Cv. PBNC-17, was conducted during the Kharif season of 2024-2025 at the Oilseed Research Station, Latur, under Vasantrao Naik Marathwada Krishi Vidyapeeth (VNMKV), Parbhani. The study aimed to evaluate the influence of various foliar biostimulants on the growth, yield and quality of the chilli cultivar PBNC-17. The experiment was laid out in a Randomized Block Design (RBD) with ten treatments replicated thrice. The treatments included foliar applications of amino acid (Isabion), humic + fulvic acid (Humiffco), seaweed extract (Biozyme Crop+), Panchagavya and Jivamrut at two different concentrations each.
Observations were recorded on growth parameters (plant height, stem girth, number of branches and leaves), flowering traits (flower count, fruit set, flower drop, days to flowering) and yield components (number of fruits, fruit yield per plant, per treatment and per hectare). Among the treatments, T2 (Amino acid @ 3 ml/l) consistently outperformed others by recording the maximum plant height (65.69 cm), leaf count (170.01), number of fruits per plant (63.51) and yield (74.28 q/ ha). T4 (Humic + Fulvic acid @ 3.5 ml/l) showed early flowering (34.09 days) and earliest harvest (65.00 days), while T10 (Jivamrut @ 25 ml/l) was most effective in enhancing fruit set (55.68%) and reducing pest and disease incidence.
The study concludes that foliar biostimulants significantly influence chilli growth and productivity. Amino acid at 3 ml/l is recommended for enhanced yield and quality, while Jivamrut and humic-based formulations offer complementary benefits in pest management and phenological advancement. These findings advocate the integration of biostimulants as a sustainable and efficient approach in chilli cultivation.

Keywords: Chilli, foliar Biostimulant, growth, yield, PBNC-17

Introduction
Vegetables are essential components of the human diet, providing carbohydrates, proteins, vitamins, minerals and antioxidants that promote health and protect against diseases. In India, the per capita daily availability of vegetables is about 237 g, which is considerably lower than the recommended 350 g per person per day (ICMR, 2019). Enhancing vegetable production and productivity is therefore crucial for ensuring nutritional security. India, the second-largest producer of vegetables globally after China, produces nearly 200 million metric tons annually from about
11.28 million hectares. Major producing states include Uttar Pradesh, West Bengal, Madhya Pradesh, Bihar and Maharashtra (Jha *et al*., 2019) [17].
Among vegetable crops, chilli (*Capsicum annuum* L.) holds great economic and nutritional importance. Belonging to the Solanaceae family, chilli is cultivated across tropical and subtropical regions, though it is less suited to temperate climates. The genus Capsicum comprises about 30 species, of which five (*C. annuum*, *C. frutescens*, *C. chinense*, *C. pubescens* and *C. baccatum*) are widely cultivated (Bosland & Votava, 2000) [6]. Native to Tropical America and introduced to India in the 16th century (Pruthi, 1976) [26], chilli is consumed both as fresh green fruits and as dried spice. The fruits are rich in vitamins A and C, thiamine, folate, potassium, carotenoids, flavonoids and dietary fiber (Lee & Kader, 2000 [21]; Chuah *et al*., 2008) [9]. Capsaicin, the pungent principle, has pharmaceutical applications, while capsanthin, the red pigment, is used as a natural food colorant.

Despite its high demand, chilli productivity is often limited by poor nutrient use efficiency, abiotic stress and pest disease incidence. Heavy dependence on chemical fertilizers and pesticides also poses environmental concerns. In this context, biostimulants have emerged as sustainable inputs to enhance growth, yield and quality. Biostimulants are substances or microorganisms that stimulate natural plant processes to improve nutrient uptake, stress tolerance and productivity, without being direct sources of nutrients (Traon *et al*., 2014) [32].

Different categories of biostimulants are in use, including humic and fulvic acids, seaweed extracts, amino acids and traditional formulations like Panchagavya and Jivamrut. Humic and fulvic acids enhance photosynthesis, root growth, nutrient absorption and stress resilience (Aikpo *et al*., 2024). Seaweed extracts, derived mainly from brown algae, contain bioactive compounds and growth regulators that improve flowering, yield, chlorophyll content and stress tolerance (Godlewska *et al*., 2016 [12]; Ali *et al*., 2021). Amino acids are readily absorbed through leaves and support photosynthesis, nutrient transport, flowering and stress resistance (Naroozlo *et al*., 2019) [23]. Panchagavya, prepared from cow-based products and Jivamrut, a fermented biofertilizer, are rich in growth-promoting substances, enzymes and beneficial microbes that improve plant vigor, immunity and productivity (Selvaraj *et al*., 2007 [29]; Dhama *et al*., 2017) [11]. Given their potential, foliar application of biostimulants may serve as an eco-friendly strategy to boost chilli growth and yield while reducing reliance on synthetic inputs. However, their efficacy depends on concentration, crop type and field conditions.

Therefore, the present study was undertaken with the following objectives:

1. To study the effect of biostimulants on growth parameters of chilli.
2. To study the effect of biostimulants on yield and quality parameters of chilli.

Materials and methods

The present study, Effect of Foliar Biostimulant on Growth, Yield and Quality of Chilli (Capsicum annuum L.) Cv. PBNC-17, was conducted during the Kharif season of 2024-25 at the Oilseed Research Station, Latur (18°50' North latitude and 77°25' East longitude, 636 m AMSL). The site has a semi-arid climate, with 900-1000 mm annual rainfall, hot summers (42°C) and mild winters (11°C). The soil was deep black clay (Vertisol), slightly alkaline (pH 7.7), medium in nitrogen (231 kg/ha), very low in phosphorus (18.2 kg/ha) and high in potassium (498.58 kg/ha).

The experiment was laid out in a Randomized Block Design (RBD) with 10 treatments and 3 replications. Treatments consisted of foliar sprays of amino acids, humic + fulvic acid, seaweed extract, Panchagavya and Jivamrut, each at two concentrations (Table 3.1). The chilli variety PBNC-17 was transplanted on 22 September 2024 at 60 x 45 cm spacing, with 10 plants per treatment. Standard cultural practices were followed, including FYM application (15 x 20 kg), recommended NPK dose (150:75:75 kg/ha), hand weeding and protective irrigation. Foliar sprays were applied at 30, 45 and 60 days after transplanting.

Observations were recorded from five tagged plants per treatment. Growth parameters included plant height, stem girth, number of branches and leaves. Flowering traits (flower count, fruit set %, flower drop %, days to flowering and 50% flowering, days to first harvest) were noted. Yield attributes (fruits per plant, yield per plant, yield per treatment and per hectare) were measured. Pest and disease incidence was calculated using McKinney's (1923) formula, while quality parameters (chlorophyll content, vitamin C, carotenoids and capsaicin) were assessed using standard AOAC (2005) procedures.

Statistical analysis was performed using ANOVA for RBD as per Panse and Sukhatme (1985).

Table 1: Treatments combination

Treatment number	Biostimulant	Dose
T1	Amino acid based (isabion)	@ 2 ml / liter
T2	Amino acid based (isabion)	@ 3 ml / liter
T3	Humic + fulvic acid (Humiffco)	@ 2.5 ml / liter
T4	Humic + fulvic acid (Humiffco)	@ 3.5 ml / liter
T5	Panchagavya	@ 15 ml/ liter
T6	Panchagavya	@ 25 ml/ liter
T7	Seaweed extract (Biozyme crop +)	@ 3ml / liter
T8	Seaweed extract (Biozyme crop +)	@ 5 ml / liter
T9	Jivamrut	@ 15 ml / liter
T10	Jivamrut	@ 25 ml / liter

Results and discussion

The present study investigated the influence of foliar biostimulants on the growth, yield and quality of chilli cv. PBNC-17 under field conditions. The results obtained are presented under the following sub-headings, supported by statistical analysis and relevant literature.

Growth Parameters

Plant height (cm)

Significant variation in plant height was observed among treatments (Table 2). Maximum height was recorded in T2 (Amino acid @ 3 ml/l), with 65.69 cm at final harvest, statistically at par with T1 (Amino acid @ 2 ml/l, 64.13 cm). Treatments with humic + fulvic acid (T3 and T4) also performed well, recording 62.50 cm and 60.57 cm respectively. The lowest height was recorded in T9 (Jivamrut @ 15 ml/l, 55.65 cm). The improvement in plant height under amino acid treatments may be attributed to enhanced protein synthesis, chlorophyll formation and hormonal activity (Shazia *et al*., 2021 [30]; Jan *et al*., 2020) [16]. Similar results were reported by Ruban *et al*. (2019) [27] in brinjal and Baloch *et al*. (2014) [4] in chilli, confirming the growth-promoting role of amino acids.

Table 2: Effect of biostimulant on Plant height (cm)

Treatment	45 DAT	75DAT	At final harvest
T1-Amino acid (Isabion) @ 2ml/lit	43.53	53.32	64.13
T2-Amino acid (Isabion) @ 3ml/lit	44.10	55.34	65.69
T3- Humic acid + fulvic acid (Humiffco) @ 2.5ml/lit	40.33	50.34	62.50
T4- Humic acid + fulvic acid (Humiffco) @ 3.5ml/lit	40.68	50.02	60.57
T5- Panchagavya @ 15 ml/lit	37.46	46.64	56.54
T6- Panchagavya @ 25 ml/lit	37.47	47.58	57.62
T7- Sea weed (Biozyme crop +) @3ml/lit	40.07	50.87	60.67
T8- Sea weed (Biozyme crop +) @5ml/lit	39.47	50.71	61.49
T9- Jivamrut @ 15 ml/lit	37.37	46.50	55.65
T10- Jivamrut @ 25 ml/lit	38.30	47.00	56.20
SE ±	1.07	1.1	0.58
CD at 5%	3.2	3.28	1.76

Stem girth (mm)

Biostimulant application also significantly influenced stem girth (Table 3). Maximum girth was obtained in T4 (Humic + fulvic acid @ 3.5 ml/l), with 9.52 mm at harvest, followed by T8 (Seaweed extract @ 5 ml/l, 9.13 mm). Minimum girth was recorded in T1 (Amino acid @ 2 ml/l, 7.88 mm). The positive effect of humic and fulvic acids on stem diameter may be linked to improved nutrient absorption and hormonal activity, as also reported by Abdel-Mawgoud *et al*. (2007) [1] in green beans.

Number of branches per plant

Branching was significantly enhanced by amino acid treatments (Table 4). T2 recorded the maximum (11.50 branches), at par with T1 (11.17), followed by T4 (10.05). The minimum number of branches was noted in T9 (8.00). Amino acids stimulate cytokinin activity and cell division, leading to enhanced branching (Deori *et al*., 2023) [10].

Table 3: Effect of biostimulant on Stem girth (mm)

Treatment	45 DAT	75DAT	At final harvest
T1-Amino acid (Isabion) @ 2ml/lit	3.34	7.00	7.88
T2-Amino acid (Isabion) @ 3ml/lit	4.02	8.10	8.82
T3- Humic acid + fulvic acid (Humiffco) @ 2.5 ml/lit	4.44	7.99	8.92
T4- Humic acid + fulvic acid (Humiffco) @ 3.5 ml/lit	5.03	8.81	9.52
T5- Panchagavya @ 15 ml/lit	3.64	7.34	7.98
T6- Panchagavya @ 25 ml/lit	4.01	8.07	8.17
T7- Sea weed (Biozyme crop +) @ 3ml/lit	3.91	7.54	8.37
T8- Sea weed (Biozyme crop +) @5ml/lit	4.34	8.44	9.13
T9- Jivamrut @ 15 ml/lit	3.84	7.06	7.90
T10- Jivamrut @ 25 ml/lit	4.01	8.01	8.20
SE ±	0.06	0.05	0.07
CD at 5%	0.19	0.15	0.21

Table 4: Effect of biostimulant on Number of primary branches per plant

Treatment	45 DAT	75DAT	At final harvest
T1-Amino acid (Isabion) @ 2ml/lit	5.91	8.50	11.17
T2-Amino acid (Isabion) @ 3ml/lit	6.44	9.07	11.50
T3- Humic acid + fulvic acid (Humiffco) @ 2.5 ml/lit	5.55	7.90	9.72
T4- Humic acid + fulvic acid (Humiffco) @ 3.5 ml/lit	5.92	8.12	10.05
T5- Panchagavya @ 15 ml/lit	4.73	6.90	8.55
T6- Panchagavya @ 25 ml/lit	4.93	6.91	8.56
T7- Sea weed (Biozyme crop +) @3ml/lit	5.37	7.70	9.47
T8- Sea weed (Biozyme crop +) @5ml/lit	5.40	7.90	9.73
T9- Jivamrut @ 15 ml/lit	4.32	6.06	8.00
T10- Jivamrut @ 25 ml/lit	4.70	6.45	8.21
SE ±	0.10	0.16	0.20
CD at 5%	0.30	0.48	0.60

Number of leaves per plant

T2 (Amino acid @ 3 ml/l) recorded the maximum leaf count (170.01), followed closely by T1 (167.74) and T3 (152.60). The minimum leaf production was observed in T9 (125.51). Increased leaf area due to amino acids and humic substances has been linked to enhanced photosynthesis and assimilation, in agreement with Kiran *et al*. (2021) [19] in chilli and Avinash *et al*. (2017) [3] in capsicum.

Table 5: Effect of biostimulant on Number of leaves per plant

Treatment	45 DAT	75DAT	At final harvest
T1-Amino acid (Isabion) @ 2ml/lit	66.71	128.59	167.74
T2-Amino acid (Isabion) @ 3ml/lit	67.48	131.51	170.01
T3- Humic acid + fulvic acid (Humiffco) @ 2.5ml/lit	53.34	121.11	152.60
T4- Humic acid + fulvic acid (Humiffco) @ 3.5ml/lit	51.53	118.58	143.10
T5- Panchagavya @ 15 ml/lit	44.52	94.22	133.66
T6- Panchagavya @ 25 ml/lit	44.96	95.85	137.90
T7- Sea weed (Biozyme crop +) @3ml/lit	48.16	96.32	135.14
T8- Sea weed (Biozyme crop +) @5ml/lit	48.12	97.85	141.20
T9- Jivamrut @ 15 ml/lit	40.33	82.94	125.51
T10- Jivamrut @ 25 ml/lit	41.44	86.46	130.33
SE ±	0.83	1.34	1.47
CD at 5%	2.48	4.00	4.37

Flowering Characteristics

Number of flowers per plant

Biostimulant treatments significantly influenced flower production (Table 6). The maximum flowers per plant were recorded in T2 (Amino acid @ 3 ml/l, 129.72), statistically at par with T1 (124.42) and T7 (Seaweed @ 3 ml/l, 119.43). The minimum number was recorded in T9 (Jivamrut @ 15 ml/l, 89.05). Amino acids promote floral initiation by enhancing metabolic activity and protein synthesis, while seaweed extracts supply cytokinins and auxins that support floral differentiation. Similar findings were reported by Ali *et al*. (2021) [2] in tomato and sweet pepper using seaweed extract.

Fruit set (%)

The highest fruit set was recorded in T10 (Jivamrut @ 25 ml/l, 55.68%), at par with T9 (53.90%) and T3 (Humic + fulvic acid @ 2.5 ml/l, 53.19%). The lowest fruit set occurred in T2 (Amino acid @ 3 ml/l, 48.95%). The superior performance of Jivamrut could be due to its microbial consortia and growth-promoting metabolites that enhance pollination success and fruit initiation. Comparable outcomes were noted by Premprakash Singh *et al*. (2021) [25] in tomato with Jeevamrut sprays and Bharadwaj *et al*. (2023) in okra.

Table 6: Effect of biostimulant on number of flowers and fruit set %

Treatment	Number of flowers per plant	Fruit set %
T1-Amino acid @ 2ml/lit	124.42	49.38
T2-Amino acid @ 3ml/lit	129.72	48.95
T3- Humic acid + fulvic acid @ 2.5 ml/liter	101.20	53.19
T4- Humic acid + fulvic acid @ 3.5 ml/liter	106.20	52.41
T5- Panchagavya @ 15 ml/ lit	95.20	53.04
T6- Panchagavya @ 25 ml/lit	97.66	51.91
T7- Sea weed @ 3ml/lit	119.43	49.06
T8- Sea weed @ 5ml/lit	115.63	51.02
T9- Jivamrut @ 15 ml/lit	89.05	53.90
T10- Jivamrut @ 25 ml/lit	90.18	55.68
SE ±	3.64	1.33
CD at 5%	10.82	3.95

Flower drop (%)

Minimum flower drop was observed in T10 (44.32%), at par with T9 (46.01%) and T3 (46.81%), while the maximum was in T2 (51.05%). The reduction in flower abscission under Jivamrut and Panchagavya treatments may be attributed to hormonal balance and microbial metabolites enhancing nutrient uptake, as observed by Jakhar *et al*. (2022) [15] in okra.

Table 7: Effect of biostimulant on flower drop

Treatment	Flower drop % per plant
T1-Amino acid @ 2ml/lit	50.62
T2-Amino acid @ 3ml/lit	51.05
T3- Humic acid + fulvic acid @ 2.5 ml/liter	46.81
T4- Humic acid + fulvic acid @ 3.5 ml/liter	47.59
T5- Panchagavya @ 15 ml/lit	46.96
T6- Panchagavya @ 25 ml/lit	48.09
T7- Sea weed @ 3ml/lit	50.94
T8- Sea weed @ 5ml/lit	48.98
T9- Jivamrut @ 15 ml/lit	46.01
T10- Jivamrut @ 25 ml/lit	44.32
SE ±	1.31
CD at 5%	3.91

Days to flowering and harvest

Earliness was promoted by humic + fulvic acid treatments. T4 (3.5 ml/l) recorded the earliest flowering (34.09 days), 50% flowering (39.41 days) and first harvest (65.00 days), significantly earlier than T5 (Panchagavya @ 15 ml/l), which showed delayed flowering (41.73 days) and harvest (70.90 days). Humic and fulvic acids are known to enhance nutrient uptake and hormonal signaling, accelerating phenological events (Jan *et al*., 2020 [16]; Honnapa *et al*., 2025) [14].

Table 8: Effect of biostimulant on flowering character

Treatment	Days to first flowering	Days to 50% flowering	Days to first harvest
T1-Amino acid @ 2ml/lit	35.91	40.83	66.89
T2-Amino acid @ 3ml/lit	35.11	40.10	66.21
T3- Humic acid + fulvic acid @ 2.5 ml/lit	34.62	39.76	65.90
T4- Humic acid + fulvic acid @ 3.5 ml/lit	34.09	39.41	65.00
T5- Panchagavya @ 15 ml/lit	41.73	46.87	70.90
T6- Panchagavya @ 25 ml/lit	41.72	46.22	69.90
T7- Sea weed @3ml/lit	36.70	41.53	68.72
T8- Sea weed @5ml/lit	36.22	41.51	68.56
T9- Jivamrut @ 15 ml/lit	40.41	44.74	69.92
T10- Jivamrut @ 25 ml/lit	40.16	44.04	69.19
SE ±	1.16	1.44	1.26
CD at 5%	3.45	4.29	3.76

Yield Characteristics

Number of fruits per plant

T2 (Amino acid @ 3 ml/l) produced the maximum fruits per plant (63.51), statistically at par with T1 (61.44) and seaweed treatments (T7 and T8). Minimum fruit number was recorded in T9 (48.00). Protein hydrolysates (amino acids) improve fruit set and retention, as demonstrated by Noushad *et al*. (2024) [24] in chilli.

Fruit yield per plant (g)

The maximum fruit yield per plant was observed in T2 (208.00 g), followed by T1 (203.02 g) and T7 (196.77 g). The minimum was in T9 (173.30 g). Khan *et al*. (2018) [18] also reported increased fruit yield in bell pepper with amino acid sprays, while Chauhan *et al*. (2023) [7] demonstrated the role of seaweed extract in increasing pod yield in okra.

Fruit yield per treatment and hectare

T2 recorded the maximum yield per treatment (2.08 kg) and per hectare (74.28 q/ha), significantly superior to Jivamrut (T9: 61.78 q/ha; T10: 62.50 q/ha) and Panchagavya (T5: 63.91 q/ ha). These results confirm the efficiency of amino acid formulations in boosting yield, supported by Chooneea *et al*. (2009) [8] who demonstrated amino acid stimulants enhanced chilli yield and Bawya *et al*. (2025) [5] who found combined seaweed + humic sprays improved cluster bean productivity.

Table 9: Effect of biostimulant on Number of fruit per plant and fruit yield per plant

Treatment	No. Of fruit per plant	Fruit yield per plant(g)
T1-Amino acid @ 2ml/lit	61.44	203.02
T2-Amino acid @ 3ml/lit	63.51	208.00
T3- Humic acid + fulvic acid @ 2.5 ml/liter	53.83	188.00
T4- Humic acid + fulvic acid @ 3.5 ml/liter	55.66	189.20
T5- Panchagavya @ 15 ml/lit	50.50	179.70
T6- Panchagavya @ 25 ml/lit	50.70	181.20
T7- Sea weed @ 3ml/lit	58.60	196.77
T8- Sea weed @ 5ml/lit	59.00	194.51
T9- Jivamrut @ 15 ml/lit	48.00	173.30
T10- Jivamrut @ 25 ml/lit	50.22	175.61
SE ±	1.77	5.51
CD at 5%	5.27	16.38

Pest and Disease Incidence

Pest incidence (aphids and thrips)

Biostimulant treatments reduced pest incidence significantly (Table 11). Minimum aphid incidence was in T10 (10.00%) and T9 (13.33%), while maximum was in T2 (36.66%). Thrips incidence was also lowest in T5, T6 and T10 (13.33%). The effectiveness of Jivamrut and Panchagavya may be due to bioactive compounds and microbial metabolites that repel or suppress pests. Hameedi *et al*. (2022) [13] reported reduced pest incidence in bell pepper under organic biostimulant regimes and Vidanapathirana *et al*. (2021) [33] found panchagavya reduced pest-damaged leaves in capsicum.

Table 10: Effect of biostimulant on yield per treatment and yield per hectare

Treatment	Yield (Kg / treatment)	Yield (q / ha)
T1-Amino acid @ 2ml/lit	2.03	72.83
T2-Amino acid @ 3ml/lit	2.08	74.28
T3- Humic acid + fulvic acid @ 2.5 ml/liter	1.89	67.13
T4- Humic acid + fulvic acid @ 3.5 ml/liter	1.89	67.50
T5- Panchagavya @ 15 ml/lit	1.79	63.91
T6- Panchagavya @ 25 ml/lit	1.81	64.57
T7- Sea weed @ 3ml/lit	1.94	69.29
T8- Sea weed @ 5ml/lit	1.96	70.29
T9- Jivamrut @ 15 ml/lit	1.73	61.78
T10- Jivamrut @ 25 ml/lit	1.75	62.50
SE ±	0.07	2.72
CD at 5%	0.21	8.09

Table 11: Effect of biostimulant on incidence of pest

Treatment	Aphids %	Thrips %
T1-Amino acid @ 2ml/lit	33.33	36.66
T2-Amino acid @ 3ml/lit	36.66	33.33
T3- Humic acid + fulvic acid @ 2.5 ml/liter	30.00	23.33
T4- Humic acid + fulvic acid @ 3.5 ml/liter	26.66	26.66
T5- Panchagavya @ 15 ml/lit	20.00	13.33
T6- Panchagavya @ 25 ml/lit	16.66	13.33
T7- Sea weed @ 3ml/lit	23.33	26.66
T8- Sea weed @ 5ml/lit	23.33	23.33
T9- Jivamrut @ 15 ml/lit	13.33	16.66
T10- Jivamrut @ 25 ml/lit	10.00	13.33
SE ±	3.18	1.39
CD at 5%	9.47	4.13

Disease incidence (anthracnose and leaf curl)

Anthracnose incidence was lowest in T5, T6 and T10 (10.00%), while maximum was in T3 and T7 (20.00%). Leaf curl incidence was minimized in T6 and T10 (16.66%) but maximum in T1 (40.00%). These results align with Lekshmi (2011) [22], who reported reduced chilli disease incidence with organic formulations and Sugandhika *et al*. (2021) [31], who highlighted seaweed extracts in capsicum for enhancing disease tolerance.

Quality Attributes

Chlorophyll content

Amino acid sprays recorded the highest chlorophyll content (T2: 51.90 SPAD; T1: 51.85 SPAD), while the lowest was in Jivamrut (T9: 30.00; T10: 30.13 SPAD). Amino acids play a direct role in chlorophyll synthesis and photosynthetic activity, as also shown by Sayaf *et al*. (2024) [28] in chilli. Seaweed (T7, T8) and humic acid treatments (T3, T4) showed moderate improvement. Kumar *et al*. (2023) [20] reported similar findings with *Ascophyllum nodosum* extract in okra, confirming the role of seaweed in enhancing photosynthesis.

Table 12: Effect of Biostimulant on incidence of disease

Treatment	Anthracnose %	Leaf curl %
T1-Amino acid @ 2ml/lit	16.66	40.00
T2-Amino acid @ 3ml/lit	16.66	36.66
T3- Humic acid + fulvic acid @ 2.5 ml/liter	20.00	36.66
T4- Humic acid + fulvic acid @ 3.5 ml/liter	16.66	33.33
T5- Panchagavya @ 15 ml/lit	10.00	20.00
T6- Panchagavya @ 25 ml/lit	10.00	16.66
T7- Sea weed @ 3ml/lit	20.00	26.66
T8- Sea weed @ 5ml/lit	16.66	26.66
T9- Jivamrut @ 15 ml/lit	13.33	20.00
T10- Jivamrut @ 25 ml/lit	10.00	16.66
SE ±	1.68	3.16
CD at 5%	5.00	9.39

Table 13: Effect of biostimulant on chlorophyll content of leaves

Treatment	Chlorophyll (SPAD)
T1-Amino acid @ 2ml/lit	51.85
T2-Amino acid @ 3ml/lit	51.90
T3- Humic acid + fulvic acid @ 2.5 ml/lit	41.44
T4- Humic acid + fulvic acid @ 3.5 ml/lit	46.68
T5- Panchagavya @ 15ml/lit	33.00
T6- Panchagavya @ 25 ml/lit	33.99
T7- Sea weed @ 3ml/lit	37.11
T8- Sea weed @ 5ml/lit	40.00
T9- Jivamrut @ 15 ml/lit	30.00
T10- Jivamrut @ 25 ml/lit	30.13
SE ±	1.67
CD at 5%	4.97

Conclusion

The application of foliar biostimulants significantly influenced the growth, flowering, fruiting, pest and disease management and overall productivity of chilli cv. PBNC-17. Among all treatments, the following conclusions were drawn:

- T2 (Amino acid @ 3 ml/lit) emerged as the most promising treatment across a broad range of parameters, including plant height, branching, flower number, fruit count, yield per plant and total yield per hectare.
- T4 (Humic acid + fulvic acid @ 3.5 ml/lit) was effective in promoting early flowering and harvesting, as well as improving stem girth.
- T10 (Jivamrut @ 25 ml/lit) demonstrated its potential in minimizing pest and disease incidence and improving fruit set percentage.
- Seaweed extracts (T7 and T8) exhibited moderate effectiveness across most growth and yield parameters.
- Panchagavya treatments (T5 and T6) showed limited impact on growth and yield but contributed to disease resistance.

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