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Short Communication

Field efficacy of Semia biostimulant on the growth and yield of Pechay (*Brassica rapa* subsp. *chinensis*)

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ABSTRACT

A field efficacy trial was conducted to assess the effect of Semia biostimulant on pechay in the farmer's field. Variables such as plant height, leaf length, leaf width, number of leaves, root length, and root biomass have increased by as much as 2.46, 2.47, 8.08, 3.61, 17.52, and 56.93%, respectively, relative to inorganic fertilizer treatment alone. In terms of its feasibility in pechay production, 3 L/ha foliar spray of Semia biostimulant in addition to inorganic fertilization is recommended to increase yield by 32.12%.

Keywords: Biomass, foliar amendment, fruit, pechay, root, yield

INTRODUCTION

One of the most popular leaf vegetables in the Philippines is pechay (*Brassica rapa* subsp. *chinensis*) (Jimenez et al., 2021). Its production should be boosted to address local demand for which correct fertilizer application is required. A plant food supplement that can help with quick nutrient absorption such as a biostimulant (Kocira et al., 2020; Vasconcelos et al., 2020; Sible et al., 2021), is required for the growth of pechay (Fernandez & Andigan, 2017). Semia biostimulant is a patented high-analysis biostimulant formulation with plant nutrients complexed by bioactive polyphenols that enhances nutrient availability to plants and provides a biostimulant effect to improve plant vitality and activate natural bio-defenses to protect the plant from stresses (SCL Italia, 2020). Semia biostimulant also contains copper, manganese and zinc, trace elements that are essential for various stages of crop development. It is designed to enhance crop growth, improve yield, and increase tolerance to abiotic stresses such as drought, salinity, and extreme temperatures. These biostimulants typically work by improving nutrient uptake, enhancing root growth, and stimulating natural plant processes (Vasconcelos et al., 2019). The study was conducted to evaluate the bio-efficacy of Semia biostimulant on the growth and yield of pechay in farmer's fields.

The trial was conducted on an open-pollinated pechay cv. Pavito, for one season at Oogong, Sta. Cruz, Laguna Philippines from November 2021 to January 2022. The experimental field was plowed and harrowed twice. Twenty plots each measuring 2m x 5m were made. The experiment followed a randomized complete block design with four replications. The inorganic fertilizer was applied basally during the seed sowing while Semia biostimulant was directly sprayed to the crop using a hand sprayer during the 10th and 20th days after sowing. The recommended rate (rr) of Semia biostimulant is 0.2 mL/m^2. The liquid solution is mixed with 0.5-1.0 water depending on plant growth/size. For the treatments with half dosage (½ rr) and one and one-half dosage (1½ rr), the amount of Semia biostimulant is 0.1 and 0.3 mL/m^2, respectively. On the other hand, the recommended rate (RR) of inorganic fertilizer is 425 kg per hectare (42.5 g/m^2) complete NPK fertilizer plus 200 kg/ha (20 g/m^2) urea fertilizer. The mixture was applied basally to the trenches then covered with a layer of soil, where the pechay seeds were sown. The treatment detail is presented in Table 1.

Five rows per meter were lined drill covering the five meters stretch of the plot with 20 cm distance between the rows. Pechay seeds were directly sown in the soil using drill method at 1 g/2 m^2. The sown seeds were covered with soil and dusted with carbaryl to prevent

Table 1 : Treatment design of the bio efficacy trial

Treatment (granular fertilization)	Semia biostimulant
T_1: Inorganic fertilizer alone (1RR) 425 kg 14-14-14 & 200 kg urea/ha	
T_2: Inorganic fertilizer (1RR) 425 kg 14-14-14 & 200 kg urea/ha	1rr Semia 0.2 mL/m^2 (2 L/ha)
T_3: Inorganic Fertilizer (1RR) 425 kg 14-14-14 & 200 kg urea/ha)	½ rr Semia 0.1 mL/m^2 (1 L/ha)
T_4: Inorganic Fertilizer (1RR) 425 kg 14-14-14 & 200 kg urea/ha)	1½ rr Semia 0.3 mL/m^2 (3 L/ha)
T_5: Control (no fertilizer or Semia biostimulant applied)	

ants from foraging. The standard cultural practices such as watering and pest control were implemented (Jimenez et al., 2021). The pechay plants were harvested ~28 days after planting. The fresh weight yield of the above-ground plant biomass was expressed in kg/ha and recorded. Growth parameters such as plant height, number of leaves, leaf length, leaf width, root length, and biomass were also recorded from a sample of 40 plants per treatment (10/replication). Yield advantages were computed using the formula:

$$\frac{yield^1 - yield^2}{yield^2}$$

The generated data was subjected to statistical analysis using Genstat 64-bit Release 21.1. Analysis of variance and treatment mean comparison using Tukey's Test was done at 5% probability level. Two-way tables were prepared to show the means and their corresponding alphabet notations. Interpretations were done while the conclusions and recommendations were formulated based on the results generated.

The total yield fresh of pechay was derived from the 10 m^2 plot area and converted to fresh yield per hectare (Table 2). The results revealed that pechay plants were responsive to 3 L/ha Semia biostimulant application (T_4), which recorded yield increases of 8.54 and 24.28 t/ha over T_5 and T_1, respectively. On the other hand, at the recommended rate of 2 L/ha Semia biostimulant (T_2), yield advantages of 4.19 and 19.93 t/ha over T_5 and T_1, respectively, were obtained. This only supported the fact that Semia biostimulant is already effective at 2 L/ha, but higher rates could provide better yield if used. This is attributed to the presence of polyphenols in addition to other minerals, which can stimulate growth by improving nutrient uptake and enhancing photosynthetic efficiency. Zinc is involved in auxin synthesis and enzyme activation which promotes healthy growth and development (Alloway, 2008). Manganese's role in photosynthesis boosts the plant's ability to convert light energy into chemical energy, promoting robust growth (Marschner, 2012). While, copper is involved in the photosynthetic electron transport chain, impacting chlorophyll production and overall photosynthetic efficiency (Moreira et al., 2022). The presence and interaction of these minerals lead to increased pechay biomass production.

The data revealed that better height, leaf length and width of pechay were exhibited by plants treated with 3 L/ha Semia biostimulant but were comparable with the Semia Biostimulant treated plants at any rate except for the control (Table 2). The increase in plant height, leaf length and width could be attributed to the presence of polyphenols and other minerals from Semia biostimulant. Polyphenols help enhance photosynthetic efficiency by protecting chlorophyll from oxidative damage and improving nutrient availability. This also results in better photosynthesis results in higher energy production, which supports growth and development of the plant (Zagoskina et al., 2023). Zinc contributes to better growth, higher yields, and improved quality of pechay by supporting essential physiological and biochemical processes (Alloway, 2008).

The highest number of leaves were obtained in the plants treated with inorganic fertilizer alone while, the least number were obtained in the control (Table 2). All the plants treated with either inorganic fertilizer alone or with Semia biostimulant, at any rate, are comparable with each other except the control plants. By adding Semia biostimulant to pechay, adequate copper levels support healthy root and shoot growth, leading to more vigorous plants (Moreira et al., 2022).

The data revealed that the longest root lengths were produced in the pechay plants treated with 3 L/ha Semia biostimulant, which is comparable to inorganic fertilization and Semia biostimulant treated plants at any rate (Table 2). This could be attributed to the application of Semia biostimulant with polyphenols

Table 2 : Pechay growth and yield data as affected by the different treatments

Treatment	Yield (t/ha)	Plant height (cm)	Leaf length (cm)	Leaf width (cm)	No. of leaves	Root length (cm)	Root biomass (g)
Inorganic Fertilizer alone (IF)	26.59^{b}	27.66^{b}	19.46^{b}	15.23^{b}	7.48^{b}	11.07^{a}	5.48^{ab}
IF + 1 rr Semia @ 0.20 mL	30.78^{bc}	28.51^{b}	19.80^{b}	16.26^{bc}	7.95^{b}	12.34^{ab}	7.35^{ab}
IF + ½ rr Semia @ 0.10 mL	26.72^{b}	28.13^{b}	19.64^{b}	15.60^{bc}	7.53^{b}	12.23^{ab}	6.28a^{b}
IF + 1½ rr Semia @ 0.30 mL	35.13^{c}	28.34^{b}	19.94^{b}	16.46^{c}	7.75^{b}	13.01^{b}	8.60^{b}
Control	10.85^{a}	22.83^{a}	15.43^{a}	11.25^{a}	6.85^{a}	10.61^{a}	4.33^{a}
C.V.	7.6	1.8	13.6	12.9	1.4	2.2	8.9
p-value	<0.001	<0.001	<0.001	<0.001	<0.001	0.03	<0.001

*Means with the same letter are not significantly different at $\alpha = 0.05$

which can enhance root development by promoting cell division and elongation in the root system. A well-developed root system increases the plant's ability to absorb water and nutrients from the soil, leading to better overall growth and higher yield (Zagoskina et al., 2023).

The data revealed that the heaviest root biomass was produced in the T_4 plants which is comparable to T_2 and T_3 plants (Table 2). On the other hand, the shortest roots were observed in the T_5 plants and are significantly different from the rest of the treatments. The presence of polyphenols in Semia biostimulant was able to promote better root growth and development, ensuring more effective water and nutrient absorption from the soil (Zagoskina et al., 2023). Manganese acts as an activator for enzymes in growth processes and supports the conversion of nitrate (a form of nitrogen) that can be readily utilized by the crop (Alejandro et al., 2020).

The study also reveals that pechay plants treated with Semia biostimulant at various rates did not differ significantly from one another in most growth parameters, suggesting that even lower doses of the biostimulant can be effective. This flexibility in application rates can be advantageous for farmers looking to optimize input costs while still achieving enhanced crop performance.

Pechay is very responsive to granular fertilization and application of Semia biostimulant. The data also revealed that inorganic fertilization generally dictates the growth and performance of pechay but the addition of a biostimulant would further improve and quantity and quality of harvested pechay. At a very conservative amount of 3 L/ha, it recorded a yield advantage of 8,540 and 24,280 kg/ha over the full dose of inorganic fertilizer alone and the control, respectively. This could be translated to an additional income of PhP 213,500 (USD 4,357.14) to PhP 607,000 (USD 12,387.75) at Php 25/kg (as of December 2021 farm gate price) over the full dose of inorganic fertilizer alone and the control, respectively. This economic analysis emphasizes the cost-effectiveness of integrating Semia biostimulant into pechay cultivation.

CONCLUSION

The new product, Semia biostimulant performed well in the trial by giving yield advantages over the control and slightly to the conventional inorganic fertilization. The study revealed that the application with 3 L/ha Semia biostimulant was able to enhance pechay production in terms of total fresh yield, plant height, leaf length, leaf width, number of leaves, root length, and root biomass with an estimated increase of 32.12, 2.46, 2.47, 8.08, 3.61, 17.52 and 56.93%, respectively, relative to inorganic fertilizer treatment alone. In addition, all variable showed significant differences with the control. The results of this study highlight the positive impact of Semia biostimulant on the growth and yield of pechay, demonstrating its potential as an effective supplement to inorganic fertilization. The significant improvements in key growth parameters affirm the biostimulant's efficacy. The yield data underscore that the addition of Semia biostimulant to the standard inorganic fertilization regimen can lead to substantial yield gains.

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