INNSPUB

Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 18, No. 1, p. 113-119, 2021
http://www.innspub.net

RESEARCH PAPER OPEN ACCESS

Frequency application of fish amino acid (FAA) on the growth and yield performance of pechay (*Brassica rapa* L.)

Narcisa S Aganon*[1], Gerald M Duza[2]

[1]*Quirino State University, Maddela Campus, Dipintin Maddela Quirino , Philippines*

[2]*Cagayan State University, Piat Campus, Baung, Piat Cagayan, Philippines*

Article published on January 30, 2021

Key words: Fish amino acid (FAA), Frequency, Pechay, Growth, Yield

Abstract

Good timing of application is essential for the successful production of many crops and this is through on the application of controls and depends on knowing how to coordinate spraying with the stages of plant growth. Thus, this study conducted to evaluate the effects of Fish Amino Acid (FAA) at a different frequency of application under field condition, specifically to determine the best time of application of FAA on pechay, and its effects on the agronomic growth and yield performance of the test crop. The experiment was laid out in RCBD with five treatments replicated three times. The treatments evaluated were follows; No application (T1); Every 5 days (T2); Every 7 days (T3); Every 10 days (T4); and Every 14 days (T5). Effectiveness of such treatments was based on the Average Plant Height at Harvest, Average Number of Marketable Leaves per plant at harvest, Average Leaf Area of Plants per harvest (cm2), Average fresh weight of RS Plants at Harvest (kg), Weight of plants per sampling area (SA) in kg, and Computed yield per hectare. Result revealed that T2 obtained the highest mean on plant height, Longer leaf area, average fresh weight, and obtained the highest yield per hectare, compared to other treatments. A non-significant result was obtained on the marketable leaves that range from 6.07 to 7.01. Based on the study every after five days of application is recommended for pechay production until harvest.

***Corresponding Author:** Narcisa S Aganon ✉ narcisaaganon@yahoo.com

Introduction

Pechay also is known as snow cabbage, Chinese chard, or Chinese white cabbage, scientifically known as *Brassica rapa* is a popular vegetable in the Philippines. It is a major vegetable crop, rich in vitamin C and contains a significant amount of nitrogen-containing compounds as indoles, as well as fiber- both of which appear to lower the risk of various forms of cancer (Murray, 2005). It is consumed both raw and cooked. Pechay can be eaten raw, to prevent the loss of its nutritional content compared when pechay heated. It is also an excellent source of income for farmers and households with a limited area for planting by using recycled containers as potting media. However, to produce high yield, most growers use synthetically- based products, thus, the possibility of pesticide and chemical residue accumulation is very serious that possess a threat to human health. According to Mendoza (2004), the main expenditure in a conventional farm in agrochemical inputs is 65% for fertilizer and 18.2% for pesticides.

Production management which promotes agro-ecosystem health that includes soil biological activity, biodiversity, water quality, and agronomic production is a major component for Organic agriculture, (FAO/WHO Codex Alimentarius Commission, 1999). Organic farming also promotes nutrient in the soils which nourish the plants, keeping chemicals off the land and the same time protecting water quality and biodiversity, through the Republic Act 10068 in the Philippines, this endeavor strengthens the state's policy to promote, propagate, develop further and implement the practice of organic agriculture, this is to ensure the community for sustainable farming and ensure the cumulative condition and enrich the fertility of the soil, increase from productivity, reduce pollution and destruction of the environment, prevent depletion of natural resources and protect the health of farmers, and of the general public, Alipulo (2017).

Nitrogen (N) is a macro element that is needed for the growth and development of pechay, Fish Amino Acid (FAA) is a liquid made from fish trash that contains abundant amounts of nutrients such as nitrogen and some various types of amino acid. It is absorbed directly by the crops and it stimulates the activity of microorganisms. The proper application of Fish Amino Acid (FAA) is an important factor for the growth and development of the crop. Being a nitrogen fertilizer, FAA boosts the growth of crops during the vegetative growth period when applied on both soil and leaf. It is not advisable to use it during the reproductive stage if worried about the overgrowth. However, it can be used continuously with leafy vegetables such as pechay, cabbage, and mustard. The concept of this study is to determine the response of pechay (*Brassica rapa* L) using Fish Amino Acid (FAA) applied to a different frequency of application. Specifically determine the best frequency of application time using Fish Amino Acid (FAA) and its efficacy on the growth and yield performance of pechay, hence this study.

Materials and methods

Acquisition of Seeds

The seeds of pechay was purchased from a reliable Agricultural-Farm Supply at Maddela, Quirino. The seed selected has a purity of 99% and 85% up germination rate, the seeds were also adaptable to the kind of environment.

Preparation of Fish Amino Acid (FAA)

One (1) kilogram of Fish waste (bones, head, skin, and other tankage parts) was placed along with a one (1) kilogram brown sugar/molasses in a plastic pail, container pail was covered with manila paper and was tied with a string. It was fermented for 10-15 days at room temperature. The juice was stored in a clean bottle after extraction.

Experimental Treatment

One hundred (100ml) of Fish Amino Acid (FAA) concentration was prepared, the homeopathic dose was used in the study 1:1000 parts water. It was mixed thoroughly and using a sprayer, it was applied and spray to both sides of the plant leaf, following the required different Treatments. Treatment 1- Control (No application), Treatment II (Every after Five days of spraying), Treatment III (Every after seven days of spraying), Treatment IV (Every after ten days of spraying), and Treatment V (Every after fourteen days of spraying).

Experimental Lay-Out and Design

Three equal blocks, a dimension of 4m x 7m, having a one-meter alleyway between the block and a half meter between plots. Each block was further subdivided into five plots each measuring 1m x 1m with a half-meter distance between plots. The experimental treatments were randomly allocated in the different plots following the randomization procedure for Randomized Complete Block Design (RCBD).

Data Gathered

Different Parameters were collected in the study such as

A. Average Plant height at Harvest (cm), this was obtained by getting the plant height of the plants by measuring from the base mark to the tip of the highest leaf of pechay.

B. Average number of Leaves at Maturity per sample, the plant was obtained by getting the average number of leaves by counting the marketable leaves of the 10 representative samples.

C. Average Leaf Area of the plant in cm^2 (Pi= LXW) was obtained by getting the leaf area of the leaf by using the given formula with the use of a ruler.

D. Weight of RS plants per plot (kg), was recorded by getting the weight of the representative sample plants per plot and it was weighed in a platform weighing balance.

E. Weight of Plant per sampling Area (SA) (kg), was obtained by getting the weight of the plants per sampling area and it was weighed with the use of platform weighing balance. This was used in projecting the yield per hectare basis.

F. Computed yield per Hectare was computed based on the yield from the sampling area of 1square meter. The yield per hectare in kilograms and tons will be computed using the given formula.

$$Yield\,per\,Hectare = \frac{10{,}000 \text{square meter x yield per sampling Area}}{Sampling\,Area}$$

G. Other observations include Number of Days to Seed Germinate, Number of Days to Seedling Emergence, Stand and Vigor of the Crop, and number of days to harvest.

Occurrence of Insect Pest

All abnormalities or pest occurred during the conduct of the study was recorded and documented, Assessment of damage was done using the NCT for vegetable manual:

Table 1. Rating Scale and Description of Damage as affected by the application of Fish Amino Acid (FAA) at Different Frequency of Application.

1	Highly resistant	None of the total plant population per plant was infected or infested
2	Moderately resistant	1-10% of the total plant population per plant was infected or infested
3	Intermediate	26-50% of the total plant population per plant was infected or infested
4	Susceptible	61-75% of the total plant population per plant was infected or infested
5	Very susceptible	76-100% of the total plant population per plant was infected or infested

Data Analysis

The gathered was collated, tabulated, and analyzed following the Analysis of Variance (ANOVA) of the Randomized Complete Block Design (RCBD). The Duncan's Multiple Range Test (DMRT) was used for the comparison of means on treatments with significant results.

Result and discussion

Average Plant Height at Harvest (cm)

Table 2. Data on the Average Plant Height at Harvest as affected by different frequency of application using Fish Amino Acid (FAA).

Treatment	Mean
I	13.99^{c}
II	30.26^{a}
III	22.59^{b}
IV	20.61^{b}
V	18.20^{b}
C.V.(%)	5.96

Means with the same superscript are not significantly different with each other using DMRT.

Table 2 shows the height of plants at harvest which revealed a highly significant result as affected by different frequency of application using Fish Amino Acid (FAA). The data showed that the plants treated with Fish Amino Acid (FAA) every after five days (T2)

obtained the tallest height with a mean of 30.26cm, followed by the plant treated with Fish Amino Acid (FAA) every after 7, 10, and 14 days after planting with a means of 22.59cm, 20.61cm, and 18.20cm, respectively. However, the untreated plants (T1) obtained the shortest height with a mean of 13.99cm, the study shows that application of FAA boost growth and development of pechay compared to untreated test plant, literature shows that Fish Amino Acid (FAA) is a great foliar fertilizer for plant leaves and soil because it is abundant/rich in Nitrogen (N) which essential to help improve the growth and development of the crops during vegetative stage, Hubilla (2020). Moreover, this fertilizer reduces input cost for farmers since the ingredients are fish waste that is the majority or usually free from the locality/market, study shows that the efficacy is to apply every five days of spraying for a better result in terms of plant height.

Average Number of Marketable Leaves per plant at Harvest

Table 3. Data on the Average Number of Marketable Leaves per plant at Harvest as affected by different frequency of application time using Fish Amino Acid (FAA).

Treatment	Mean
I	6.37
II	7.01
III	6.96
IV	6.81
V	6.45
C.V.(%)	5.15

Means with the same superscript are not significantly different with each other using DMRT.

Table 3 shows the number of marketable leaves per plant. Results showed that the experimental plants did not vary with each other in terms of the number of marketable leaves per plant, number of leaves means ranging from 6.37 to 7.01. Comparison among treatments means, treatment 1 obtained the least number of marketable leaves compared to other treatments for those treatments hows that using FAA continuously to leafy vegetables such as pechay, cabbage, and mustard resulting in the plant healthier and high number of leaves produced. Weiner, (2014), stated that the application of FAA as a source of nitrogen during the early or vegetative growth boost growth and size of leafy vegetable, because they are processed to be readily available for plant to absorb, the efficacy is to apply every five days of spraying for a better result in terms of the marketable number of leaves, as indicated in the table.

Average Leaf Area of the Pechay at Harvest in cm²

Table 4. Data on the Average Leaf Area of the Pechay at Harvest in cm²as affected by different frequency of application time using Fish Amino Acid (FAA)

Treatment	Mean
I	177.38^{c}
II	354.05^{a}
III	247.52^{b}
IV	221.50^{b}
V	218.09^{b}
C.V.(%)	2.83

Means with the same superscript are not significantly different with each other using DMRT.

Analysis of variance shows a highly significant result in terms of the leaf area of the test plants, wherein the longest leaf area was obtained by the plant treated with Fish Amino Acid (FAA) applied every five days (T2) with a mean of 354.05cm². Further mean comparison showed that Treatment 3, 4, and 5 were insignificant with each other with a means of 246.52cm², 221.50cm², and 218.09cm². However, the shortest leaf area was obtained by the untreated plants with a mean of 177.38cm² (T1) as reflected in the table, the incorporation of Fish Amino Acid (FAA) increase N availability in plant or in the soil which improves yields while sustaining soil and water quality (Weiner, 2014). Proper application time must also consider, Foley *et al.* (2012) stated that improper or excessive use of N fertilizer can lead to nitrate pollution of ground or surface water. Paper revealed that efficacy to pechay is to apply every five days of spraying till harvest this frequency application offers immediate benefit to plant as food with a long lasting effect as source of nutrient and also increased microbial activity in soil.

Average Fresh Weight of R.S. Plants (kg) and Weight of Plants per Sampling Area (SA) kg

Table 5. Data on the Average Fresh Weight of R.S. Plants at Harvest (kg) and Weight of plant per sampling area as affected by different frequency of application time using Fish Amino Acid (FAA).

Treatment	Average Fresh Weight of R.S. Plants at Harvest (kg)	Weight of Plants per Sampling Area (SA) kg
	Mean	Mean
I	1.87[c]	5.20[c]
II	5.07[a]	14.07[a]
III	3.41[b]	9.47[b]
IV	2.90[b]	8.04[b]
V	2.68[b]	7.44[b]
C.V.(%)	3.18	8.54

Means with the same superscript are not significantly different with each other using DMRT.

Table 4 shows the data on the Fresh Weight of R.S. Plants at Harvest (kg) and Weight of plant per sampling area, *a*nalysis of variance showed a significant effect on the weight of plants. It was found out that the plant treated with Fish Amino Acid (FAA) every five days (T2) obtained the heaviest weight with a mean of 5.07kg. Further mean comparison showed that Treatment 3, 4, and 5 were insignificant with each other with a means of 3.41kg, 2.90kg, and 2.68kg, respectively but significantly difference with treatment 2 and Treatment 1. However, the untreated plants (T1) obtained the lightest weight with a mean of 1.87kg as shown in the Table and significantly difference among all the treatments.

On the other hand, highly significant result was obtained in terms the weight of plants per sampling area wherein the heaviest plants were obtained by the plants treated with Fish Amino Acid (FAA) every five days with a mean 14.07kg, and followed by T3, T4, and T5 with a means of 9.47kg, 8,04kg, and 7.44kg, respectively. However, T1 obtained the lightest weight per sampling area with a mean of 5.2kg as reflected in the table. Result revealed that application of FAA acid at five days of application significantly produced higher yield of pechay.

Computed Yield per Hectare

Table 6. Data on the Computed Yield per Hectare as affected by different frequency of application time using Fish Amino Acid (FAA).

Treatment	Yield per Hectare (kg)
I	52,000
II	140,700
III	94,700
IV	80,400
V	74,400

The computed yield per hectare as affected by the different frequency of application time using Fish Amino Acid (FAA) is presented in Table 6. The yield per treatment were as follows: T1- 52,000kg, T2- 140,700kg, T3- 94,700kg, T4- 80,400kg, and T5- 74,400kg. Application every five days produce higher yield compared to other treatments study shows that foliar spray of fish amino acid significantly influenced the various physiological prameters of the study this is also accordance that FAA promotes growth crop roots and leaves and enhances photosynthesis and increases crop yield to 10% to 40%. In addition to this, FAA synthesis of various enzymes in plants, to enhance the ability of plant anabolic metabolism, accelerate the production and development of plants, and make plants have a high yield and early maturity (Dora Agri-tech, 2020). Thus, FAA shown significant effect on pechay because of their biological important in nutrition and as known that FAA are used in nutritional supplements, fertilizers, feed, and food technology.

Other Observations

Number of Days to Seed Germinate

It was observed that the seeds were germinated five days after sowing.

Number of Days to Seedling Emergence

It was observed that the seedling did not emerge from the soil at the same time. The seedling emerged four to five days after planting. An 85-95% seedling emergence was observed.

Stand and Vigor of the Crop

The plants appeared uniformly and vigorously in all plots in terms of height during the vegetative stage or from 2-3 weeks after emergence. However, the plants treated with Fish Amino Acid (FAA) had bigger and larger leaves.

Occurrence of Insect Pest and Diseases

The occurrence of Diamond Backmonth (*Plutella xylostella),* aphids (*Brevicoryne brassicae),* and green soldier bug (*Nezarra viridula)* were observed during the vegetative stage of the plants. Description of Damage shown that Treatment 1 damage scale is Intermediate while remaining treatments are Moderately resistant, Madende (2020), stated that individual Amino Acid can stimulate plant growth, and these amino acids can protect the plant from environmental stresses like insect pest by metabolic signaling by regulating nitrogen acquisition from the leaves or roots which induced resistance of the plant from insect pest infestation. No sign of particular diseases was observed from the plants during the duration of the study.

Table 7. Data on the Scale and Description of Damage as affected by the application of Fish Amino Acid (FAA) at Different Frequency of Application.

Treatment	Damage Scale
I	Intermediate
II	Moderately resistant
III	Moderately resistant
IV	Moderately resistant
V	Moderately resistant

Number of Days to Harvesting- The marketable plant was harvested at 40th days after transplanting.

Conclusion

Based on the result, it is concluded that pechay is responsive to the spraying of Fish Amino Acid (FAA) every five-day of application, as obtained better results in terms of plant height, leaf area, weight, darker color of leaves, number of leaves produced and yield per hectare. Also, the application of the FAA minimizes insect pest infestation. Thus, farmers should use fish amino acid as an organic fertilizer to have a lesser expenses and safer to health farm inputs. Likewise, raw recipes for pechay are more nutritious, hence, safer if organically grown due to the absence of chemicals. Moreover, growing organically is helping maintain a clean and safe environment to live. Similar studies along this line should be conducted to have a more conclusive result on the uses of Fish Amino Acid (FAA).

References

Dora Agri-Tech. 2020. Fish Amino Acid Fertilizer Organic Fertilizers Supplier | Manufacturer. https:// doraagri.com/product/fish-amino-acid-fertilizer.

El-Tarabily KA, Nassar AHJ, Hardy GES, Sivasithamparam K. 2003. Fish emulsion as a food base for rhizobacteria promoting growth of radish (*Raphanus sativus* L. var. sativus) in a sandy soil. Plant and Soil.

Foley KM, Doniger AR, Shock CC, Horneck DA, Welch TK. 2020. Nitrate Pollution in Groundwater: A Grower's Guide. College of Agricultural Sciences. https://agsci.oregonstate.edu /mes/article/nitrate-pollution-groundwater-growers

Hubilla EK. 2020. Nutrients found in fish waste can improve plant growth. Agriculture Monthly. https://www.agriculture.com.ph/2020/05/26/nutrients-found-in-fish-waste-can-improve-plant-growth/

Ling F, Silberbush M. 2002. Response of maize to foliar vs. soil application of nitrogen-phosphorus-potassium fertilizers. Journal of Plant Nutrition **25(11),** 2333-2342. https://doi.org/10.1081/pln

Madende M, Hayes M. 2020. Fish By-Product Use as Biostimulants: An Overview of the Current State of the Art, Including Relevant Legislation and Regulations within the EU and USA. Molecules **25(5),** 1122. https://doi.org/10.3390/molecules2

Makkar C, Singh J, Parkash C. 2017. Vermicompost and vermiwash as supplement to improve seedling, plant growth and yield in *Linum usitassimum* L. for organic agriculture. International Journal of Recycling of Organic Waste in Agriculture **6(3),** 203-218. https://doi.org/10.1007/ s40093-017-0168-4

Mendoza TC. 2004. Evaluating the Benefits of Organic Farming in Rice Agroecosystems in the Philippines. Journal of Sustainable Agriculture **24(2),** 93-115. https://doi.org/10.1300 /j064v24

Murray MT, Pizzorno J, Pizzorno L. 2005. Encyclopedia of Healing Foods (Illustrated ed.) [E-book]. Atria Books. https://www.amazon.com/Encyclopedia-Healing-Foods-Michael-Murray-ebook/dp/B003L77UES

Sandakan KM. 2017. The effect of Organic Fertilizer on the Growth of Pechay (*Brassica rapa*). Saudi Arabia: ROY Agribest Philippines Incorporated.

Weinert JrE, Miller SA, Ikeda DM, Chang KCS. 2014. Natural Farming: Fish Amino Acid. Https://www.Ctahr.Hawaii.Edu/Oc/Freepubs/Pdf/SA-12.Pdf.