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Field efficacy of Alka Foliar 5-5-8 foliar fertilizer on the growth and yield of *Brassica rapa* subsp. *chinensis* (Pechay)

Joel L. Adorada[1,4]*, Arlan L. Adorada[2,4], Jessamyn Recuenco-Adorada[3]
[1]Department of Agriculture, Bureau of Plant Industry Los Baños NCRDPSC, Laguna Philippines 4030
[2]National Crop Protection Center, University of the Philippines Los Baños, College, Laguna Philippines 4031
[3]Institute of Weed Science, Entomology and Plant Pathology, College of Agriculture and Food Science, University of the Philippines Los Baños, College, Laguna Philippines 4031
[4]These two authors contributed equally to this work and were designated as co-first authors.
Email address: jladorada@alum.up.edu.ph

***Abstract*—** *Alka Foliar 5-5-8, a well-balanced natural foliar fertilizer derived from seaweed extracts enriched with different naturally sourced minerals, was evaluated under field condition for its effect on the growth and yield of pechay. Its best level for the optimum growth and yield of pechay was also determined. A field trial laid-out in a Randomized Complete Block Design (RCBD) was conducted with six treatments replicated three times. Results showed that Alka Foliar 5-5-8 performed well in comparison with the control, by giving a yield advantage comparable with the positive control, 19-19-19. In full recommended rate, it was able to enhance pechay production in terms of total fresh yield, marketable yield, plant height, leaf width and number of leaves when applied as supplement to inorganic fertilizer. Plants treated with Alka Foliar 5-5-8 can significantly improve the yield and quality of pechay. In addition, the bioefficacy data for all measured parameters showed significant differences to the control, while no significant differences were found among all other treatments, although the pechay plants treated with Alka Foliar 5-5-8 were noticeably better than those in the control. In terms of feasibility in pechay production, double dose of Alka Foliar in combination with reduced amount of an appropriate inorganic fertilizer is highly recommended to obtain the highest possible income. These data will also be used for full product registration with the Fertilizer and Pesticide Authority in the Philippines.*

***Keywords*—** *Pechay; organic; Alka Foliar 5-5-8; foliar fertilizer; Brassica rapa; seaweed extracts.*

I. INTRODUCTION

Pechay (*Brassica rapa* subsp. *chinensis*) is one of the most common leaf vegetables in the Philippines, popularly known as pechay. It is a Napa cabbage, a form of Chinese cabbage also known as bok choy and pak choi (1). Popular in southern China and Southeast Asia, these Chinensis Group cultivars do not form heads; rather, they have smooth, dark green leaf blades forming a cluster like celery or mustard (2). Being winter hardy, they are increasingly grown in Northern Europe (3). They are a member of the family of Brassicaceae or Cruciferae, also commonly known as the mustards, the crucifers, or the cabbage family (4).

Pechay plant is an erect, biennial herb, cultivated as an annual of about 15- 30 cm tall in vegetative stage (3). The leaves are ovate which are arranged spirally and spreading. The petioles are enlarged and grow upright forming a subcylindrical bundle. Inflorescence is a raceme with pale yellow flowers. Seeds are 1 mm in diameter and are reddish to blackish brown in color. The leaves are less crisp than other cabbages, green in color with mild flavor. It is a short duration crop; thus, it requires an immediate source of nutrients. In the organic production of pechay, a plant food supplement that can assist in immediate absorption of nutrients is needed.

To achieve optimum production, efficient use of fertilizer is an important factor in vegetable growing. It is recommended to use complete fertilizer (14-14-14) to give the plants enough nutrients, additionally organic fertilizer, such as animal manure and compost, should be applied to the plants (5). In one hectare, inorganic fertilizer at the rate of 240 kilograms of nitrogen, sixty kilograms of phosphorus, and sixty kilograms of potassium is applied. Afterwards, side dressing the plant with 120 kilograms of nitrogen a month after transplanting. Using organic fertilizers is encouraged as well because of its natural benefits and less environmental effects. Organic fertilizers also play an important role in improving the soil quality by providing basic macro and micronutrients (6). However, due to large scale cultivation of vegetables and cereal crops, nutrients occurring from the soil are being deleted, thus an alternative approach to this is to use foliar fertilizer sprays which is more effective and cost less (7). Organic fertilizers are applied either directly to soil or as foliar spray for improving crop growth and quality. Consequently, the limited availability of soil fertilizers makes the foliar fertilizers more important (8), and the increasing demand for higher yield and quality product at a low-cost pave way for the exploration of effective foliar fertilizers for agricultural crops (9).

There exist several organic foliar fertilizers currently available in the market, with compost on top of the list as the best organic foliar fertilizer, using decomposing organic material to return nutrients to the soils (10, 11). The AZ41 foliar fertilizer is made from aloe vera, melaleuca (Australian Bark Tree) and D-limonine (citrus peel) which can boost pechay yield significantly, and has fungicidal and insecticidal properties (12). The Green Herds organic-based foliar

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fertilizer applied together with NPK recommended rate under field condition increased pechay plant height and length of leaves as much as 45%, width of leaves by 40%, leaf number by 20%, fresh weight up to two times and yield by three times higher (8). Biozyme Organic Foliar Fertilizer is a plant growth regulator containing mostly natural plant extracts (13). In a local study, the potential of wild sunflower as organic fertilizer for pechay was demonstrated. One type of organic foliar fertilizer that is gaining popularity is the one made from seaweed (14).

Liquid seaweed fertilizer, apart from being organic, also comes from a sustainable source and can be sourced without damaging the environment (15). Most seaweed-based fertilizers are made from kelp, a seaweed variety that can grow to lengths more than fifty feet. Organic seaweed fertilizers contain trace elements such as magnesium, potassium, zinc, iron, and nitrogen—all of which are beneficial to plants. Seaweed is a natural product harvested in a way that will not have any negative impact on the environment or the sustainability of the seaweed itself.

Alka Foliar 5-5-8 is a new foliar fertilizer that is finding its way in the market. It is a well-balanced natural foliar fertilizer made from seaweed extracts enriched with different minerals derived from natural sources. It is a neutral (pH 6.9) liquid foliar fertilizer which is compatible with any fertilizer, insecticide, and fungicides. It can be applied at any stage of any plant species and contains the following nutrients: Total Nitrogen (5.05%), Total Phosphorus (5.71%), Total Potassium (8.02%), Magnesium (0.27%), Sodium (0.12%), Copper (2.45%), and Calcium (0.01%). Besides macro and micronutrient contents, it also has auxin which assists the plants in growth and development by enhancing cell elongation of plant shoots. Thus, the product would eventually increase yield of the crop and help farmers become productive.

This study was conducted with the aim of evaluating the bio-efficacy of Alka Foliar 5-5-8 on the growth and yield of pechay under farmer's field condition, and being a newly introduced product, this study also aimed at generating field data for use in its full product registration with the Fertilizer and Pesticide Authority of the Philippines.

II. METHOD

The trial was conducted for one season at Puypuy, Bay, Laguna Philippines from November 2018-January 2019. An open-pollinated pechay cultivar, Pavito (Appendix Figure 2) was used as the test crop cultivar. Prior to preparing the seedbeds, surface (0-15 cm) soil samples were randomly collected from five different points on the trial site for physical and chemical analysis. Complete soil physical and chemical analyses were requested from an accredited soil testing laboratory. The levels of organic matter, nitrogen, phosphorus, and potassium were determined while moisture and pH were also measured. The field for the trial was plowed and harrowed twice in different directions. Seedbeds were prepared manually, and eighteen plots measuring 2x5 m^2 were made.

The field trial was laid-out on a randomized complete block design with three replications (Figure 1). The inorganic fertilizer was applied basally during the seed sowing while the foliar fertilizers were sprayed on the 10th and 20th days after sowing. Treatment assignment is shown in Table 1.

T1R1	T2R2	T6R3
T2R1	T6R2	T5R3
T3R1	T5R2	T4R3
T4R1	T3R2	T2R3
T5R1	T4R2	T1R3
T6R1	T1R2	T3R3

Figure 1. Layout of the field trial in a Randomized Complete Block (RCBD) with three replications

TABLE 1. Treatment assignments for the field efficacy trial of Alka Foliar 5-5-8 foliar fertilizer's effect on the growth and yield of *Brassica rapa* subsp. *chinensis* (Pechay).

Treatments	Granular fertilization	Liquid Fertilization
1	Inorganic Fertilizer alone @ 8.5 bags 14-14-14 & 4 bags urea/ha	None
2	Inorganic Fertilizer @ 8.5 bags 14-14-14 & 4 bags urea/ha	1rr Alka Foliar 5-5-8 60 ml/ha@ 10 and 20 DAS
3	½ Inorganic Fertilizer @ 4.25 bags 14-14-14 & 2 bags urea/ha	1rr Alka Foliar 5-5-8 60 ml/ha @ 10 and 20 DAS
4	½ Inorganic Fertilizer @ 4.25 bags 14-14-14 & 2 bags urea/ha	2rr Alka Foliar 5-5-8 120 ml/ha @ 10 and 20 DAS
5	Inorganic Fertilizer @ 8.5 bags 14-14-14 & 4 bags urea/ha	1RR 19-19-19 500 grams/ha @ 10 and 20 DAS
6	Control	

Seed Sowing: Five rows per meter were line drilled covering the 5-meter stretch of the plot. The distance between rows is 20 cm. Pechay seeds were directly sown to the soil using drill method at 1 gram per $2m^2$. The sown seeds were covered with soil. The plots were dusted with carbaryl to prevent ant foraging.

Cultural Management. The following cultural practices were implemented as needed:

- Irrigation. Watering was done every day depending on soil moisture content and weather condition.
- Weeding. Weeds were removed at weekly intervals to avoid competition with the crop.
- Cultivation. Tilling the soil was done to aerate the soil and to control some weed pests.
- Disease Control. Diseases were prevented by applying fungicides only when necessary.
- Insect Pest Control. Insect infestation was managed by applying insecticides appropriate to the target insect pest only when necessary.

Harvesting. The pechay plants were harvested 30 days after planting. The harvested plants were sorted into either marketable or non-marketable based on appearance. Non-marketable yield was classified based on plants whose leaves had holes ≥ 1 cm in diameter.

Data Gathering. Fresh weight yield of the above-ground biomass plants was expressed and recorded as kg/ha. In addition, the non-marketable yield was expressed as percent (%) of the total (marketable + non-marketable) yield. Growth parameters such as plant height, number of leaves and leaf

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width were also gathered from a sample of thirty plants per treatment (10 samples/replication). Data were gathered as follows:

- Fresh weight yield – Total yield was derived from matured plants harvested per treatment per replication. The plants for each plot were weighed using a standard weighing scale.
- Percent marketable and non-marketable yield – These were computed after separating the marketable from non-marketable plants. Non-marketable plants are plants which are deformed, small and damaged by insects or other organisms (≥ 1 cm holes).
- Plant height – The distance between the base of the plant and the longest/highest leaf was measured using a ruler after harvesting. Samples of ten plants per replication were measured.
- Number of leaves – The number of mature leaves not smaller than one inch diameter were counted. Sample of ten plants per replication were measured. Leaf width – This was done by getting ten sample plants per replication and measuring the biggest leaf for each plant.

Data Analysis and Interpretation. The data were analyzed statistically using Genstat for Windows 22nd Edition (16). Analysis of variance and treatment mean comparison using Tukey's HSD Test were performed at 5% level of probability. Two-way tables were prepared to show the means and their corresponding alphabet notations. Interpretations were done by comparing all pairs using a studentized range distribution that evaluated every pair of all groups. Conclusions and recommendations were formulated based on the results generated.

III. RESULTS

Effect on total fresh yield of pechay

The total yield was derived from the $10m^2$ plot area and converted to fresh yield per hectare. The highest fresh yield was obtained from the plants treated with inorganic fertilizer + 1RR 19-19-19 which is not significantly different from the plants treated with inorganic fertilizer + 1rr Alka Foliar, ½ inorganic fertilizer + 2rr Alka Foliar, and inorganic fertilizer alone; but significantly different with the plants treated with ½ inorganic fertilizer + 1rr Alka Foliar and the control plants. On the other hand, the lowest yield was obtained from the control plants which is comparable with the plants treated with ½ inorganic fertilizer + 2rr Alka Foliar, ½ inorganic fertilizer + 1rr Alka Foliar and inorganic fertilizer alone.

The results revealed that pechay is responsive to inorganic fertilization and application of Alka Foliar 5-5-8 gave a yield advantage of 70% and 33% over the control and the inorganic fertilizer alone, respectively. However, the application of full dose inorganic fertilizer + 1RR 19-19-19 provided the best combination by exhibiting more than 36% increase in yield compared to the granular inorganic fertilization alone. This is due to the high levels of NPK applied in the positive control as compared to the test product.

TABLE 1. Total fresh yield of pechay treated with inorganic fertilizer and Alka Foliar 5-5-8 combinations.

TREATMENTS	TOTAL YIELD (kg/ha)			MEAN*
	1	2	3	
T1 - Inorganic Fertilizer alone	49,100	20,900	41,100	37,033.33 abc
T2 - Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	55,700	59,700	50,100	55,166.67 ab
T3 - ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	42,500	23,500	26,600	30,866.67 bc
T4 - ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8	36,500	46,000	31,700	38,066.67 abc
T5 - Inorganic Fertilizer + 1RR 19-19-19	44,400	64,900	63,800	57,700.00 a
T6 - Control	15,000	19,300	16,100	16,800.00 c

cv=23.91592; p=0.0016
*Means with the same letter under the same column are not significantly different at $\alpha = 0.05$.

On the other hand, the application of half dose granular inorganic fertilizer in combination with 1rr and 2rr Alka Foliar gave a range of 46-56% in yield increase over the control plants. These values proved the advantage of fertilization over the non- fertilizer application on pechay plants.

Effect on marketable yield of pechay

The marketable yield of pechay was gathered by selecting superior quality undamaged whole plants of pechay (Table 2). The highest marketable yield was obtained in the inorganic fertilizer + 1RR 19-19-19 while the lowest marketable yield was derived from the control plots which conformed to the trend in the total fresh yield data. The results revealed that at harvest period (30 days after sowing), only the plants treated with full dose inorganic fertilizer in combination with Alka Foliar 5-5-8 or 19-19-19 gave significantly difference with the control plants. All treatments except the control are comparable with each other. The basis for this difference is that the pechay plants in the control plots are smaller and light green in color, making it unacceptable in the market.

TABLE 2. Marketable yield and percent marketable yield of pechay treated with inorganic fertilizer and Alka Foliar 5-5-8 combinations

TREATMENTS	MARKETABLE YIELD (kg/ha)			MEAN*
	1	2	3	
T1 – Inorganic Fertilizer alone	48,732	20,862	41,055	36,882.97 ab
T2 – Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	55,644	59,527	50,060	55,077.03 a
T3 - ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	42,432	23,383	26,440	30,751.63 ab
T4 - ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8	36,456	45,862	31,415	37,910.97 ab
T5 - Inorganic Fertilizer + 1RR 19-19-19	44,267	64,738	63,704	57,569.62 a
T6 - Control	14,970	19,275	16,073	16,772.51 b

cv =6.714151; p=0.0234
*Means with the same letter under the same column are not significantly different at $\alpha = 0.05$

Effect on percent non-marketable yield of pechay

The percent non-marketable yield was computed by

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determining the non- marketable yield over the total yield and presenting in the table below (Table 3). The highest percent non-marketable plants were obtained in the plants treated with ½ inorganic fertilizer + 2rr Alka Foliar 5-5-8 while the lowest non-marketable plants were obtained in the plots treated with inorganic fertilizer + 1rr Alka Foliar 5-5-8, however, the data shows no significant differences across all treatments.

TABLE 3. Percent non-marketable yield of pechay treated with inorganic fertilizer and Alka Foliar 5-5-8 combinations

TREATMENTS	NON-MARKETABLE YIELD (%)			MEAN
	1	2	3	
T1 – Inorganic Fertilizer alone	0.75	0.18	0.11	0.35
T2 – Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	0.10	0.29	0.08	0.16
T3 - ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	0.16	0.5	0.60	0.42
T4 - ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8	0.12	0.30	0.90	0.44
T5 - Inorganic Fertilizer + 1RR 19-19-19	0.30	0.25	0.15	0.23
T6 - Control	0.20	0.13	0.17	0.17

cv =66.9178; p=0.4572

The deformities, damaged and unacceptable pechay plants were due to insect damage and non-application of fertilizer specifically in the control plants. During the trial, weekly application of insecticides was done, and no insecticide application was done prior to harvesting.

Effect on plant height of pechay

The plant height was gathered during harvesting by measuring the length between the base of the plant and the tallest leaf. The data revealed that the tallest plants were obtained from the plots treated with inorganic fertilizer + 1RR 19-19-19 but were not significantly different with the rest of the treatments except the control. The control gave the shortest plants among inorganic fertilizer + foliar fertilizer treated plants. All inorganic fertilizer + foliar fertilizer treated plants are taller than the control plants.

On the other hand, the shortest plants were obtained from the control but were not significantly different from the rest of the treatments except for the plants treated with full dose of inorganic fertilizer in combination of either Alka Foliar or 19-19-19.

TABLE 4. Plant height of pechay treated with inorganic fertilizer and Alka Foliar 5-5-8 combinations at harvest

TREATMENTS	PLANT HEIGHT (cm)			MEAN*
	1	2	3	
T1 – Inorganic Fertilizer alone	21.00	16.70	21.30	19.67 ab
T2 – Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	21.50	22.60	22.60	22.23 a
T3 - ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	20.80	17.00	18.60	18.80 ab
T4 - ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8	19.80	22.40	18.40	20.20 ab
T5 - Inorganic Fertilizer + 1RR 19-19-19	20.80	23.60	24.00	22.80 a
T6 - Control	16.20	16.40	15.50	16.03 b

cv= 8.691588; p=0.0052

*Means with the same letter under the same column are not significantly different at α = 0.05

Effect on leaf width of pechay

The leaf width was gathered from the biggest leaf of each plant sample (Table 5). The data revealed that the widest leaves were obtained from the plots treated with full inorganic fertilizer + 1rr Alka Foliar but were not significantly different with the rest of the treatments except the control. The control produced the narrowest leaves among the treatments but is not significantly different with the plants treated with inorganic fertilizer alone, ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8 and ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8. Only the control and the full dose inorganic fertilizer treated plants were found to be significantly different from each other.

TABLE 5. Leaf width of pechay with inorganic fertilizer and Alka Foliar 5-5-8 combinations at harvest.

TREATMENTS	LEAF WIDTH (cm)			MEAN*
	1	2	3	
T1 – Inorganic Fertilizer alone	11.70	8.60	9.70	10.00 ab
T2 – Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	11.50	12.10	9.90	11.17 a
T3 - ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	10.10	8.80	9.30	9.40 ab
T4 - ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8	9.60	10.20	8.50	9.43 ab
T5 - Inorganic Fertilizer + 1RR 19-19-19	10.60	11.30	11.20	11.03 a
T6 - Control	8.50	8.60	7.10	8.07 b

cv = 9.967294; p<0.0197

*Means with the same letter under the same column are not significantly different at α = 0.05

Effect on number of leaves of pechay

The number of leaves was done by counting all matured leaves bigger than one inch in size and summarized in the table below (Table 6). The data revealed that significant differences were found among all the treatments evaluated. The greatest number of leaves was obtained in the plants treated with full inorganic fertilizer + 1rr Alka Foliar combinations while the least number was obtained in the control. The plants treated with full inorganic fertilizer + 1rr Alka Foliar and full inorganic fertilizer + 19-19-19 are both significantly different with the control but comparable with the plants treated with inorganic fertilizer alone, ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8 and ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8.

TABLE 6. Number of leaves of pechay with inorganic fertilizer and Alka Foliar 5-5-8

TREATMENTS	NUMBER OF LEAVES			MEAN*
	1	2	3	
T1 – Inorganic Fertilizer alone	8.00	6.50	6.70	7.07 ab
T2 – Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	7.90	8.30	7.00	7.73 a
T3 - ½ Inorganic Fertilizer + 1rr Alka Foliar 5-5-8	7.40	7.00	6.90	7.10 ab
T4 - ½ Inorganic Fertilizer + 2rr Alka Foliar 5-5-8	7.20	7.50	6.90	7.20 ab
T5 - Inorganic Fertilizer + 1RR 19-19-19	7.70	7.90	7.80	7.80 a
T6 - Control	6.30	6.60	5.90	6.27 b

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cv= 6.714151; p=0.0234
*Means with the same letter under the same column are not significantly different at α = 0.05

IV. Discussion

The effect of fertilization on the yield of crops is important. However, due to large scale cultivation of crops, nutrients occurring from the soil are being deleted, thus an alternative approach to this is to use foliar fertilizer sprays which is more effective and cost less (7). Foliar fertilization can be advantageous (17) as it can be applied throughout the growing season, enabling spraying with small quantity of the nutrient solution appropriate to the specific requirements in different phases of the crop development (18; 19). Among various fertilizers available in the market, seaweed is one of the most environmentally friendly organic fertilizers.

In the present study, seaweed application has been shown to provide positive effects on the growth, development, and yield of pechay. The same results have been previously demonstrated in its beneficial effects in coriander (20). The seaweed extracts that are considered as bio stimulants have positive effects on the growth and development of plants (21). The importance of organic fertilizers or bio stimulants has increased in recent years due to several reasons. Bio-organic matters or bio stimulants more popularly known as biofertilizers are used for improving nutrient intake, stimulating growth, and rising plant tolerance to environmental stresses (22, 23). Apart from improving plant growth, seaweed can increase yield and quality, and improve the chemical composition of secondary metabolites (24).

Environment-friendly natural organic products such as seaweed fertilizers are gaining acceptance for wider use in agriculture (25). Seaweed liquid extracts have been recently used as foliar fertilizers for many plants (26). It was claimed that these extracts had positive effects on germination, root growth, leaf size, tolerating unfavorable soil conditions and nutrient uptake from the soil (27, 28). Seaweed foliar fertilizers can increase cell division and growth rate and can also be applied as liquid on the soil surface. Seaweed is a rich source of micro and macronutrients, amino acids, vitamins, which can positively affect cellular metabolism, plant growth, and yield (20, 25).

The most used seaweed as a bio stimulant is *analga*, originating from the North Atlantic Ocean and known as *Ascophyllum nodosum*, rich in polysaccharides (alginate, fucoi-dan and laminarin), minerals, and vitamins. It is also rich in bioactive compounds like polyphenols, lipids, and proteins (29). Chemical analysis of seaweed and their extracts have shown the presence of diversified plant growth regulators like auxins and cytokinin in various amounts (30). Furthermore, it is considered that extracts of seaweed can be used as an alternative for chemical fertilizers (21).

Lawson (2023) have summarized the very reasons why using liquid seaweed fertilizer should be considered for foliar fertilization of plants: seaweed contains more than seventy minerals, vitamins and enzymes, and are especially useful in organic gardening; that it can also be used as a rooting solution, and can be used to water the plants; it contains every micro-nutrient in readily available form and is full of carbohydrates that serve as plants' building block; the alginates in liquid seaweed fertilizers can function as soil conditioners as they can retain moisture for a long time; and, seaweed extracts are eight to twenty times more effective when applied to the leaves than when broadcast on the soil since plants can immediately absorb organic foliar fertilizer, thus the effect happens immediately upon contact with either the plants' foliage or the soil itself (15).

Seaweed extracts are 8-20 times more effective when applied to the leaves than when broadcast on the soil since plants will immediately absorb organic foliar fertilizer thus the effect happens immediately upon contact with either the plants' foliage or the soil itself (15).

Liquid seaweed fertilizers are made from various species of seaweed, and conscientious harvesting methods are implemented to ensure the sustainability of the natural crop (15). Extracting liquid from seaweed is done without any harmful chemicals, thus a truly organic product that has been extensively used in organic grower trials (31).

Based on the results of this investigation, pechay responds positively to the organic Alka Foliar 5-5-8 foliar fertilizer, and we can consider its foliar application as an efficient and effective method of administering liquid seaweed fertilizer to the plants.

V. Conclusion

The new product, Alka Foliar 5-5-8 performed well in the present trial in comparison with the control, by giving a yield advantage comparable with the positive control, 19-19-19. The study revealed that the test product, in full recommended rate, was able to enhance pechay production in terms of total fresh yield, marketable yield, plant height, leaf width and number of leaves with an estimated increase in marketable yield of more than 3% and 33% for treatments 4 and 2, respectively, relative to the application of full dose granular fertilizer alone. The plants treated with Alka Foliar 5-5-8 can significantly improve the yield and quality of pechay. In addition, the bio efficacy data for all measured parameters showed significant differences to the control, while no significant differences were found among all other treatments, although the pechay plants treated with Alka Foliar 5-5-8 were noticeably better than those in the control.

In general, pechay is very responsive to granular fertilization and the application of Alka Foliar 5-5-8 at 60 ml/hectare gave a fresh yield advantage of 18,133.13 and 38,366.67 kgs/ha over the full dose of inorganic fertilizer alone and the control, respectively. This could be translated to additional income of PhP 453,333.33 (US$ 8,757.10) to PhP 959,166.67 (US$ 18.528.35) at Php 25/kg (as of January 2019 farm gate price) over the full dose of inorganic fertilizer alone and the control, respectively.

Pechay normally requires a full dose of granular fertilizer and reducing it into half dose would reduce its fresh yield. However, the data revealed that the application of 2rr Alka Foliar can substitute a significant amount of granular fertilizer hence, improving its fresh yield at reduced cost. Thus, in terms of its feasibility in pechay production, double dose of Alka

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Foliar in combination with reduced amount of an appropriate inorganic fertilizer is highly recommended to obtain the highest income possible.

Alka Foliar 5-5-8 foliar fertilizer, made from seaweed extract can boost pechay yield. Apart from that although not measured in this study, as demonstrated in previous studies, can improve resistance to plant diseases, improve tolerance to insects, increase uptake of inorganic constituents from the soil, and bolster resistance to stress conditions.

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