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Effect of AGROFER Organic Fertilizer on the Growth, Yield and Biomass of Lowland Rice (*Oryza sativa*) and Pechay (*Brassica chinensis*)

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Abstract

Efficacy tests were conducted to generate information on the growth and yield of lowland rice and pechay applied with 15 bags and 20 bags per hectare AGROFER organic fertilizer respectively. Two sets of trials were laid-out in separate locations. Rice was set-up at Quarry, Tugbok, Davao City. Pechay was established at Catalunan, Pequño, Davao City. These were conducted from March to July 2001. Results showed that growth parameters and yield of rice and pechay applied with AGROFER organic fertilizer alone (T5) was comparable with growth parameters and yield of rice and pechay in treatments 2 (RR alone), 4 (1/2 RR + AGROFER) and 6 (RR + AGROFER). Yield in treatment 3(1/2 RR alone) were significantly lower compared with the yield of rice and pechay in treatments 2, 4, 5 and 6. Generally growth and yield of pechay and rice in treatment I (control) were significantly lower compared with the growth and yield in treatments 2, 3, 4, 5 and 6.

Keywords: Organic fertilizer, efficacy, growth, yield, biomass, test product, reference product

Introduction

One way of maintaining the organic matter content of the soil is to replace what had been lost. The availability organic matter in the soil is a simple gauge in determining soil fertility. It is because organic matter represents tne macro elements especially nitrogen needed by plants. The number one cause of organic matter losses is erosion. To remedy this, is to return it by means of applying organic fertilizers.

The organic fertilizer named AGROFER may help recondition eroded soils and increase crop yields. AGROFER is made of decomposed farm wastes, which is believed to boost yield of rice and leafy vegetables. In order to evaluate its effectiveness, these trials were therefore conducted.

Objectives

General:

To generate information on the agronomic effectiveness of 15 bags and 20 bags per hectare AGROFER to lowland rice and pechay respectively.

Specific:

1. To evaluate the yield responses of lowland rice and pechay to different rates and combinations of AGROFER and inorganic fertilizers.
2. To determine the effects of AGROFER on the production capacity of lowland rice.

Methodology

Duration, Location and Site Description

The whole duration of the two trials was 4 1/2 months. It covered the activities from land preparation to report writing.

The studies were located in two farms. Rice was conducted at Quarry, Tugbok, Davao City. The set-up for pechay was located at Catalunan, Pequefio, Davao City.

Both areas are situated in Type IV climate, with sandy to day loam soil suitable for lowland rice and leafy vegetables.

Description of AGROFER and Traditionally Used Fertilizer for Lowland Rice and Pechay

The test product AGROFER organic fertilizer is derived from high quality farm wastes materials and mixed with special additives that contain macro-nutrients (NPK) and micro/trace elements such as B, Ca, Mg, Mn, Zn, S, Al, MO and Na. Other essential vitamins, some grovÄh hormones and antibiotics are also present. AGROFER organic fertilizer provides plants with needed nutrients for plant growth and development. Increase water-retaining capacity of soil thus inhibiting soil losses. Improves aeration especially on heavier soils thus producing better soil structure or tilth.

The reference product or the traditionally used fertilizers are usually made of chemical/mineral synthetic materials which formed into inorganic fertilizer. Inorganic fertilizers are believed to have quicker effect than organic fertilizer.

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Test Crops

Test crops were rice and pechay. Rice variety IR66 and pechay variety Black Behi were used in these two separate trials.

Experimental Design aid Treatments

There were six treatments in each trial, arranged in Randomized Complete Block Design (RCBD) replicated four times (see Fig. 1 and 2).
Treatments were as follows:

For rice:
T1 - control, no fertilizer applied
T2 - Recommended Rate (RR) inorganic fertilizer based on soil analysis
Reference Product

- Urea (46-0-0) = 1 bag/ha (basal)
- Urea (46-0-0) = 1 bag/ha (topdress)

T3 - ½ Recommended Rate (½ RR)

Reference Product

- Urea (46-0-0) = ½ bag/ha (basal)
- Urea (46-0-0) = ½ bag/ha (topdress)

T4 - ½ RR plus manufacturer's recommended rate of AGROFER organic fertilizer

Reference Product		Test Product
➢ Urea (46-0-0) = ½ bag/ha (basal)	+	15 bags/ha AGROFER organic fertilizer (basal)
➢ Urea (46-0-0) = ½ bag/ha (topdress)		

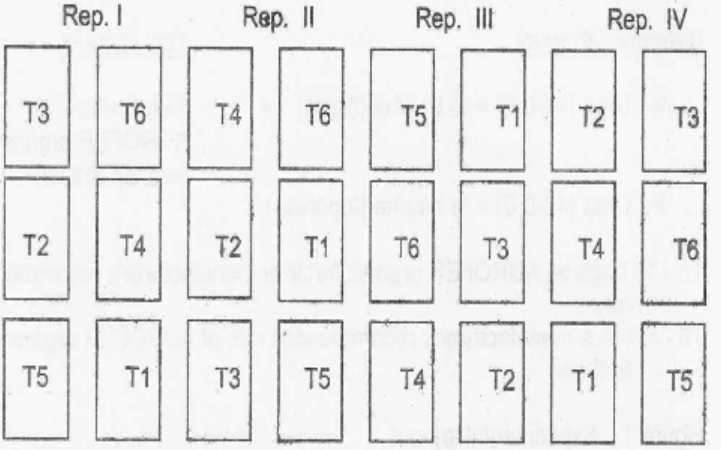
T5 - 15 bags/ha AGROFER organic fertilizer manufacturer's recommended rate
T6 - RR plus manufacturer's recommended rate of AGROFER organic fertilizer

Figure 1. Experimental lay-out
Design- RCBD
Test Crop-Lowland Rice

Rep. I		Rep. II		Rep. III		Rep. IV	
T2	T4	T3	T6	T5	T3	T1	T2

Number of hills per plot – 320

Figure 2. Experimental Lay-out:
Design – RCBD
Test Crop – Pechay



Area per plot = 10 m^2 (2x5m)
Total effected area = 240 m^2
Total area including gaps = 400 m^2
Plant spacing = .5m x .25 m
No. of rows per plot = 4
No. of plants per row = 20
Total no. of plants per plot = 80

Reference Product		Test Product
➢ Urea (46-0-0) = 1 bag/ha (basal)	+	15 bags/ha AGROFER organic fertilizer (basal)
➢ Urea (46-0-0) = 1 bag/ha (topdress)		

For pechay:
T1 - Control, no fertilizer applied
T2 - Recommended Rate (RR) inorganic fertilizer based on soil analysis

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Reference Product

- Urea (46-0-0) = 1 ¼ bags/ha (basal)
- Ammonium phosphate (16-20-0) = 3 bags/ha (basal)
- Muriate of potash (0-0-60) = 1 bag/ha (basal)
- Urea (46-0-0) = 4 ½ bags/ha (sidedress)

T3 - 1/2 Recommended Rate (1/2 RR)

Reference Product

- Urea (46-0-0) = .625 bag/ha (basal)
- Ammonium phosphate (16-20-0) 1 ½ bags/ha (basal)
- Muriate potash (0-0-60) = .5 bag/ha (basal)
- Urea (46-0-0) = 2.25 bags/ha (sidedress)

T4 - 1/2 RR plus manufacturer's recommended rate of AGROFER organic fertilizer

Reference Product

- Urea (46-0-0) = 625 bag/ha (basal)
- Ammonium phosphate (16-20-0) = .5 bags/ha (basal)
- Muriate of potash (0-0-60) = . 5 bag/ha (basal)

Test Product

20 bags/ha + AGROFER organic fertilizer (basal)

- Urea (46-0-0) = 2.25 bags/ha (sidedress)

T5 - 20 bags/ha AGROFER manufacturer's recommended rate

T6 - RR + manufacturer's recommended rate of AGROFER organic fertilizer

Reference Product

- Urea (46-0-0) 1 ¼ bags/ha (basal)
- Ammonium phosphate (16-20-0) = 3 bags/ha (basal)
- Muriate of potash (0-0-60) 1 bag/ha (basal)

Test Product

20 bags/ha + AGROFER organic fertilizer (basal)

- Urea (46-0-0) 4 ½ bags/ha (sidedress)

Treatment Application

Test Product

The recommended rate of test product (AGROFER) for rice and pechay were computed/quantified appropriate to the plot size of each experiment (rice = 20 sq. m. and pechay = 10 sq. m.).

Reference Product

Reference product applications were determined based on the recommendation for the test crops (rice and pechay) prepared by the DA-Soil Laboratory. The recommended rate of inorganic fertilizers involved as reference product were quantified appropriate to the plot size of each trial;

Time and Mode of Application

The time of application of test product and reference product were during planting and vegetative stage of the test crops.

The mode of application was through basal and topdressing side dressing.

Care and Maintenance of the Experimental Plants

All recommended cultural practices for both rice and pechay were followed uniformly except fertilizer treatment being studied.

Data Gathered

Rice:

<u>Plant data before harvest</u>

- **Average height (cm) of rice plants per hill, 45 DAT.**

  Height of rice plants were gathered from 4 corners of each plot at 4 hills per corner. It was done by measuring the plant height from the base to the tip of the tallest and newest leaf of every hill. The average height of rice plants per hilt were derived per treatment.

- **Average number of rice tillers per hill, 45 DAT**

  These were taken from where the plant heights were measured. The average number of rice tillers were derived per hill per treatment.

<u>Plant data at harvest</u>

- **Average number of rice panicles per hill at harvest**.

  Panicle counts were taken from 50 sample hills harvested at random

per plot and the average number of rice panicles per hill per treatment were derived.

- **Average weight (kg) of fresh rice straws per hill at harvest.**

  These were taken from 50 hills harvested at random where the number of rice panicles and weight of dried rice grains per hill were gathered.

- Average dry (14% moisture content) weight (kg) of rice grains per hill.

  Weights of dried rice grains were taken from the same hills where the number of panicles were counted. The average dry weight of rice grains per hill were derived.

- **Yield (kg) computed per hectare from the average weight (kg) of dried rice grains per hill.**

  The average weight of dried rice grains per hill per treatment were convened to yield per hectare by multiplying it to the estimated number of hills per hectare of lowland rice (152,000).

Pechay:

- **Average length (cm) of harvested pechay plants.**

  These were taken during harvest. Length of harvested pechay plants were measured from the base to the tip of the longest leaf. Data were taken from the same sample plants used in getting size of leaves. The average length per plant was determined per treatment.

- **Average size of leaves (cm) of pechay plants.**

  These were gathered during harvest; Cross section of the leaves were measured. Data were taken from the three fully expanded leaves per plant at three sample plants per plot. The average size of leaves of pechay were determined per treatment.

- **Average weight (kg) of pechay plants.**

  These were gathered by weighing each of the twenty sample plants taken at random per plot. The average weight per plant were determined per treatment.

- **Yield (kg) computed per hectare of fresh pechay plants.**

  These were obtained by multiplying the average weight of plant per treatment by the estimated population of pechay per hectare

(60,000).

Results and Discussion

Rice

Average height of rice plants per hill, average number of rice tillers per hill, average number of rice panicles per hill, average weight of fresh rice straws per hill, average dry weight of rice grains per hill and yield computed per hectare of rice are shown in Table 1.

a. Average height (cm) of rice plants per hill 45 DAT.

Analysis of variance shows that the effect of different fertilizer rates and combinations significantly influenced height of rice plants 45 days after transplanting (DAT) (refer to Appendix Table la). Average of rice plants in treatment 6 (RR+AGROFER) were statistically the same compared with the average height of rice plants in treatment 2 (RR alone). While average height of rice plants in treatment 4 (h RR+AGROFER) and treatment 5 (AGROFER alone) were significantly shorter compared with the average height of rice plants in treatment 6 but were statistically the same average height with rice plants in treatment 2. Average height of rice plants in treatment 3 (h RR alone) were comparable with average height of rice plants in treatment 5 and were statistically the same compared with the average height of rice plants in treatment 1 (no fertilizer applied). Treatment 1 obtained the shortest average height of rice plants per hill among the six treatments compared.

b. Average number of rice tilters per hill 45 DAT.

Analysis of variance shows that the effect of different fertilizer levels and combinations significantly influenced tiller count of rice plants per hill 45 days after transplanting (DAT) (refer to Appendix Table 2a). The average number of tillers of rice plants per hill in treatments: 6 (RR + AGROFER), 2 (RR alone) and 4 (1/2 RR + AGROFER) were statistically the same. However, average number of rice tillers per hill in treatment 5 (AGROFER alone) were statistically comparable with the average tillers of rice plants per hill in treatments 2 and 4. While average number of tillers of rice plants per hill in treatment 3 (h RR alone) were statistically the same compared with average number of tillers of rice plants per hill in treatments 4 and 5 as well as in treatment 2 Treatment 6 gave the most number while treatment 1 obtained the least number in the average number of tillers of rice plants per hill. These results were similar with the, results in the average height of rice plants per hill.

c. Average number of rice panicles per hill at harvest

A highly significant difference shown in the analysis of variance on

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the influence of fertilizer variables on the average number of rice panicles per hill (refer to Appendix Table 3a). Treatment 6 (RR alone) gave the highest average number of panicles of rice, however, statistically, it did not vary significantly with the average number of rice panicles per hill in treatments 4 (h RR + AGROFER) and 2 (RR alone). Treatment 6 was followed by treatment 4 arithmetically. However, average number of rice panicles per hill in treatment 4 were statistically comparable with the average number of rice panicles per hill in treatments 2, 5 (AGROFER alone) and 3 (1/2 RR alone). Treatment 1 (no fertilizer applied) gave the lowest number of rice panicles per hill; however, it did not differ significantly with the average number of rice panicles per hill in treatments 2, 5 and 3.

d. Average weight (kg) of fresh rice straws per hill at harvest.

The computed F obtained in the analysis of variance show that the average weight of fresh rice straws per hill was significantly influenced by the different levels and combinators of fertilizers applied (refer to Appendix Table 4a). The differences of treatments 6 (RR + AGROFER), 2 (RR alone), 5 (AGROFER alone) and 4 (h RR + AGROFER) on the average weight of fresh rice straws per hill did not vary significantly. However, average weight of fresh rice straws per hill in treatment 4 did not differ statistically with the average weight of fresh rice straws per hill in treatment 3 (Y2 RR alone). Treatment 1 (no fertilizer applied) gave the lowest average weight of fresh rice straws per hill but were statistically comparable with the average weight of fresh straws of rice per hill in treatment 3.

e. Average dry weight (kg) of rice grains per hill and yield (kg) computed per hectare.

Analysis of variance shows that the effect of different fertilizer variables significantly influenced average weight of dried rice grains per hill and its resulting yield computed per hectare (refer to Appendix Table 5a). The average weight of dried rice grains per hill and its resulting yield computed per hectare in treatments: 6 (RR + AGROFER), 2 (RR alone), 4 (h RR + AGROFER) and 5 (AGROFER alone) were statistically the same. Although arithmetically, T6 and T2 got the highest followed by T4 with a very slight difference and then T5. Yields of rice in treatments 3 and 1 were significantly lower compared with the yields in T6, T2, T4 and T5. However, average weight of dried rice grains per hill and its resulting yield computed per hectare in treatment 3 was significantly higher compared with the yield in Tl (control). The average weight of dried rice grains per hill and its resulting yield computed per hectare in treatment 1 was the lowest among the 6 treatments tested.

Table 1. Summary data on the agronomic parameters and yield of rice.

Treatments	Ave. Ht.(cm) per plant	Ave. no. of Tillers per hill	Ave. no. of Panicles per hill	Ave. wt. (kg.) of fresh straws/hill	Ave. wt. (kg.) of dried grains per hill	Computed Yield (kg.) per ha***
T1	68.85^{c}	18.31^{d}	15.50^{c}	.025^{c}	.024^{c}	3,648.00
T2	76.36^{ab}	24.59^{ab}	18.75^{abc}	.040^{a}	.041^{a}	6,232.00
T3	70.83^{cb}	20.52^{cb}	16.50^{bc}	.029^{bc}	.030^{b}	4,560.00
T4	73.90^{b}	23.00^{abc}	19.50^{ab}	.035^{ab}	.040^{a}	6,080.00
T5	72.85^{b}	22.36^{bc}	18.00^{bc}	.039^{a}	.038^{a}	5,776.00
T6	78.68^{a}	24.89^{a}	21.50^{a}	.041^{a}	.041^{a}	6,232.00
% Level of Significance	**	**	**	**	**	
CV%	2.51	5.51	8.35	9.90	7.14	

** - Highly significant

Numbers with the same superscript letter(s) has no significant difference at 1% level (DMRT).

*** - Based on 152,000 hills estimated population per nectare.

Treatments:

T1 - control, no fertilizer applied

T2 - Recommended Rate (RR) inorganic fertilizer based on soil analysis

Reference Product

- Urea (46-0-0) = 1 bag/ha (basal)
- Urea (46-0-0) = 1 bag/ha (topdress)

T3 - ½ Recommended Rate (½ RR)

Reference Product

- Urea (46-0-0) = ½ bag/ha (basal)

- Urea (46-0-0) = ½ bag/ha (topdress)

T4 - ½ RR plus manufacturer's recommended rate of AGROFER organic fertilizer

Reference Product
- Urea (46-0-0) = ½ bag/ha (basal)
- Urea (46-0-0) = ½ bag/ha (topdress)

Test Product
+ 15 bags/ha AGROFER organic fertilizer (basal)

T5 - 15 bags/ha AGROFER organic fertilizer manufacturer's recommended rate

T6 - RR plus manufacturer's recommended rate of AGROFER organic fertilizer

Reference Product
- Urea (46-0-0) = 1 bag/ha (basal)
- Urea (46-0-0) = 1 bag/ha (topdress)

Test Product
+ 15 bags/ha AGROFER organic fertilizer (basal)

PECHAY

Average length of harvested pechay, average size of leaves of harvested pechay, average weight per plant of pechay and computed yield per hectare of pechay are shown in Table 2.

Table 2. Summary data on the agronomic parameters and yield of pechay.

Treatments	Ave. length per plant (cm)	Ave. size of leaves (cm)	Ave. wt. per plant (kg.)	Computed Yield per ha (kg)*
T1	23.63 ^{c}	14.47 ^{d}	.188 ^{c}	11,280.00
T2	32.54 ^{ab}	19.54 ^{bc}	.328 ^{a}	19,680.00
T3	27.29 ^{c}	17.62 ^{c}	.233 ^{b}	13,980.00
T4	31.38 ^{ab}	20.71 ^{ab}	.329 ^{a}	19,740.00
T5	30.00 ^{bc}	19.71 ^{abc}	.324 ^{a}	19.440.00
T6	33.67 ^{a}	22.25 ^{a}	.340 ^{a}	20,400.00
% Level of Significance	**	**	**	
CV%	4.31	6.47	7.40	

* - Based on 60,000plants population per hectare of pechay.

** Highly significant

Numbers with the same superscript letter(s) has no significant difference at 1% level (DMRT).

Treatments:

T1 - Control, no fertilizer applied
T2 - Recommended Rate (RR) inorganic fertilizer based on soil analysis

Reference Product
- Urea (46-0-0) = 1 ¼ bags/ha (basal)
- Ammonium phosphate (16-20-0) = 3 bags/ha (basal)
- Muriate of potash (0-0-60) = 1 bag/ha (basal)
- Urea (46-0-0) = 4 ½ bags/ha (sidedress)

T3 - 1/2 Recommended Rate (1/2 RR)

Reference Product
- Urea (46-0-0) = .625 bag/ha (basal)
- Ammonium phosphate (16-20-0) 1 ½ bags/ha (basal)
- Muriate potash (0-0-60) = .5 bag/ha (basal)
- Urea (46-0-0) = 2.25 bags/ha (sidedress)

T4 - 1/2 RR plus manufacturer's recommended rate of AGROFER organic fertilizer

Reference Product	Test Product
Urea (46-0-0) = 625 bag/ha (basal)	
Ammonium phosphate (16-20-0 = .5 bags/ha (basal)	+ 20 bags/ha AGROFER organic fertilizer (basal)
Muriate of potash (0-0-60) = . 5 bag/ha (basal)	
Urea (46-0-0) = 2.25 bags/ha (sidedress)	

T5 - 20 bags/ha AGROFER manufacturer's recommended rate
T6 - RR + manufacturer's recommended rate of AGROFER organic fertilizer

Reference Product	Test Product
Urea (46-0-0) 1 ¼ bags/ha (basal)	+ 20 bags/ha AGROFER organic fertilizer (basal)
Ammonium phosphate (16-20-0)	
= 3 bags/ha (basal)	
Muriate of potash (0-0-60) 1 bag/ha (basal)	
Urea (46-0-0) 4 ½ bags/ha (sidedress)	

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a. Average length (cm) of harvested pechay plants.

The computed F obtained in the analysis of variance on the average length of harvested plants shows that the influence of different fertilizer variables was highly significant (refer to Appendix Table 6a). The average length of harvested pechay plants in treatment 6 (RR + AGROFER) was significantly high, however, it failed to surpass statistically with length of harvested pechay plants in treatments 2 (RR alone) and 4 (1/2 RR + AGROFER). The average length of harvested pechay plants in treatment 5 (AGROFER alone) was statistically comparable with length of harvested pechay plants in treatments 2 and 4 but were significantly shorter compared with plants in treatment 6. Average length of harvested pechay plants in treatment 3 (h RR alone) did not vary significantly compared with the average length of harvested pechay plants in treatment 5. Treatment 1 (no fertilizer applied) gave significantly shorter average length of harvested pechay compared with the rest of the treatments.

b. Average size of leaves (cm) of harvested pechay plants.

Analysis of variance shows that the effect of different rates and combinations of fertilizers applied significantly influenced the average size of leaves of harvested pechay plants (refer to Appendix Table 7a). Average size of leaves of harvested pechay plants when compared with each other in treatments 5 (AGROFER alone), 4 (h RR + AGROFER) and 6 (RR + AGROFER) were statistically the same. Although arithmetically, treatment 6 got the highest average, followed by treatment 4 and then treatment 5. Average size of leaves of harvested pechay plants in treatment 2 (RR alone) did not differ significantly compared with the average size of leaves of harvested pechay plants in treatments 4 and 5 as well as in treatment 3 (1/2 RR alone). Treatment 1 (no fertilizer applied) gave significantly lower average size of leaves of harvested pechay plants compared with the rest of the treatments.

c. Average weight (kg) of fresh pechay plants and yield (kg) computed per hectare.

Analysis of variance shows frat the effect of fertilizer levels and combinations applied significantly influenced the average weight of fresh pechay plants and its resulting yield computed per hectare (refer to Appendix Table 8a). Comparison among Weight averages of fresh pechay plants and its resulting yields computed per hectare in treatments 6 (RR + AGROFER), 4 (1/2 RR + AGROFER), 2 (RR atone) and 5 (AGROFER alone) did not vary significantly. This means, yield of pechay applied with AGROFER alone (T5) is comparable with the yield of pechay applied with either inorganic fertilizer alone (T2-RR alone) and/or inorganic plus AGROFER. (T6-RR + T4AGROFER or h RR + AGROFER). Average weight of fresh pechay

plants or its yield computed per hectare in treatment 3 (h RR alone) was significantly far behind the average weight of fresh pechay plants or its yield computed per hectare in treatments 5, 2, 4 and 6 but was significantly high compared with the yield in treatment 1 (no fertilizer applied). Among the six treatments tested to pechay, treatment 1 significantly got the lowest yield computed per hectare.

Summary and Conclusion

Based on the findings of-these two studies, it was found out that the growth parameters and yield of both rice and pechay applied with AGROFER organic fertilizer alone (T5) were statistically the same with the yield and some growth parameters of rice and pechay treated with full recommended rate inorganic fertilizer (T2) and combinations of full and h recommended rate inorganic fertilizer and AGROFER organic fertilizer (T6 and T4). It is therefore concluded, that applying AGROFER organic fertilizer alone at 15 and 20 bags per hectare to lowland rice and pechay respectively would likely increase yield of rice grains and fresh harvested marketable pechay. Based on the results in treatments 4 and 6, it is also concluded that combining 15 and 20 bags per hectare AGROFER for rice and pechay respectively to both full and one half of the recommended rate inorganic fertilizers would provide better yield to said test crops.

Recommendation

The promising effect of AGROFER organic fertilizer to lowland rice and pechay would automatically add another effective material for use in sustainable farming system. In order to expand more wider proof of effectiveness, it is recommended to try AGROFER organic fertilizer to other horticultural crops.

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