

EFFECT OF BIO-EXTRACTS ON GROWTH AND QUALITY OF LETTUCES

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ABSTRACT: The aim of this work was to determine the effects of bio-extracts on growth and quality of lettuces. The experimental design was RCBD (Randomized Complete Block Design) with 3 treatments and 4 replications include chemical fertilizer (16-16-16), bio-extract of fish meal and bio-extract of soybean meal. This experiment was conducted at The Division of Crop Production, Faculty of Agricultural Technology, Rajamangala University of Technology Thanyaburi. The result of this study showed that the vegetative yield of butter head and red oak lettuces treated with bio-extract of fish meal and soybean meal was similar to chemical fertilizer. There was no statistically difference on the vegetative yield of red coral and green oak lettuces. Both of bio-extract of fish meal and soybean meal could increase the color of leaves in red oak and green oak lettuces than chemical fertilizer. Bio-extract of fish meal could increase the color of leaves in red coral and butter head lettuces than bio-extract of soybean meal and chemical fertilizer respectively.

Keywords: Bio-extract, Red Oak, Green Oak, Red Coral, Butter Head

1. INTRODUCTION

Vegetables are plants which everybody consumes everyday more or less differently. Due to the fact that vegetables are composed of several kinds of essential nutrient. Therefore, vegetables are favored for every household. As we can see in almost every kind of food, there are vegetables as ingredients to flavor better taste of food. They are also used as decoration and make dishes look beautiful and appetizing. As to the value of vegetable consumption of general people is selecting vegetables without traces of worms' destruction or pest, so farmers have to beautify their vegetables to meet the demands of consumers. Once buyers eat those vegetables, they may obtain the danger of toxic residue remained in them. Currently, bio-extract has been used in agricultures in many aspects, especially vegetable and plant production.

Reference [1] shows that bio-extract is fermented water derived from decomposition of remained materials from various parts of plants or animals by the fermenting procedure of anaerobic condition. Microorganisms decomposes plants and animals waste and transforms them to solution as well as uses enzyme generated naturally or adding enzyme to accelerate decomposing [2]. Bio-extract will adjust the condition of acids and bases in soil and water. It helps create plants' hormones and decompose organic matters [3]. To produce numerous quantities of plants, it's necessary to use high chemicals causing hazard to consumers and producers. Using chemicals benightedly of agriculture will affect ecological system both physical and biological ways, especially human's

health and life quality [4]. To use chemicals is convenient and easy to find in markets as well as increases products of plants quickly.

On the other hand, using chemicals in agriculture will be slowly decomposed. Therefore, they will be accumulated and spread around which will turn into pollution of environment. They will ruin the balance of soil, water, air and will transmit into food chain. Plus, there will be remained chemicals in agricultural products. The lasted long remained chemicals will enable pest to adjust itself and resist drug action [5]. There will be the dissemination of pest which destroys agricultural products. Agricultural area will be deteriorated. According to these reasons, it's a start-up of making bio-extract to replace chemicals in order to create safety for manufacturers and consumers. Consequently, the study of bio-extract using for lettuce's production may help leverage the capability of vegetable's production safely as well as reduce the cost of vegetable's production because lettuce are popular consuming extensively among groups of people who love their health. The aim of this research was to examine the vegetative yield of lettuces when treated with bio-extracts.

2. MATERIALS AND METHODS

2.1 Experimental details

The experiment was conducted at The Division of Crop Production, Faculty of Agricultural Technology, Rajamangala University of Technology Thanyaburi. To study on effect of bio-extracts on vegetative growth and quality of 4 cultivars lettuces

(red oak, green oak, red coral and butter head). The experimental design was RCB with 4 replications and 3 treatments include chemical fertilizer (16-16-16), bio-extract of fish meal and bio-extract of soybean meal which were applied at 3 weeks after planting. Chemical fertilizer was applied 2 g./pot and both of bio-extracts which were applied 200 ml./plant/week. Sample plants were observed for vegetative growth, plant height, shrub width, number of leaves, fresh weight and color of leaves.

3. RESULTS

3.1 Red oak lettuce

Red oak lettuce grown in media with chemical fertilizer had the widest average of shrub width (26.03 cm.) while the treatments with bio-extract of soybean meal and bio-extract of fish meal showed 25.1 and 24.63 cm. respectively. The maximum number of leaves (14.92) was from treatment with chemical fertilizer, whereas bio-extract of soybean meal and bio-extract of fish meal presented 13.93 and 13.87, respectively. There is no significant difference between three treatments (Table 1). However, comparison of height among three treatments found that the maximum average of height red oak is growing with bio-extract of soybean meal (15.92 cm), bio-extract of fish meal (14.58) and chemical fertilizer (13.50), respectively.

Table 1 The vegetative yield of red oak lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

Treatment	Vegetative yield			
	Height (cm)	No.of leaves	Shrub width (cm)	Fresh weight (g)
Chemical fertilizer(16-16-16)	13.50 b	14.92	26.03	122.20 a
Bio-extract of fish meal	15.92 a	13.87	25.21	118.37 b
Bio-extract of soybean meal	14.58 ab	13.93	24.63	117.42 ab
F test	*	ns	ns	*
CV(%)	5.40	16.73	4.67	21.32

Means followed by the same letter at the same column were not significantly different by LSD
* significant at P<0.05 and ns not significant

Treatments with chemical fertilizer and bio-extract did not show color differences of lettuce leaves using necked eyes. However, lettuce leaves had color differences using color chart (RHS) by leaves of red oak with chemical fertilizer showed greyed-orange (166A) and with bio-extracts are greyed-purple(187A) (Fig. 1, Table 2).

Table 2 The color of leaves in red oak lettuce (Greyed-Red Group)

Treatment	Color of leaves
Chemical fertilizer (16-16-16)	Red(Greyed-Orange 166A)
Bio-extract of fish meal	Red (Greyed -purple 187A)
Bio-extract of soybean meal	Red (Greyed -purple 187A)



Chemical fertilizer (16-16-16) Bio-extract of fish meal Bio-extract of soybean

Fig. 1 The color of leaves in red oak lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

3.2 Green oak lettuce

Green oak lettuce grown in media with chemical fertilizer had the maximum number of leaves (15.00), whereas bio-extract of soybean meal and bio-extract of fish meal presented 12.58 and 10.58, respectively. The widest average of shrub width (22.50 cm) was from treatment with chemical fertilizer while the treatments with bio-extract of soybean meal and bio-extract of fish meal showed 20.46 and 19.79 cm respectively. There is no significant difference between three treatments (Table 3). However, comparison of fresh weight among three treatments found that the maximum average of fresh weight is growing with chemical fertilizer (55.90 g.), bio-extract of soybean meal (35.96 g.) and bio-extract of fish meal (25.86 g.), respectively.

Table 3 The vegetative yield of green oak lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

Treatment	Vegetative yield			
	Height (cm)	No. of leaves	Shrub width (cm)	Fresh weight (g)
Chemical fertilizer(16-16-16)	16.42	15.00 a	22.50	55.90 a
Bio-extract of fish meal	15.33	10.58 b	19.79	25.86 b
Bio-extract of soybean meal	16.92	12.58 ab	20.46	35.96 ab
F test	ns	*	ns	*
CV(%)	12.30	16.73	10.03	36.31

Means followed by the same letter at the same column were not significantly different by LSD
* significant at P<0.05 and ns not significant

Treatments with chemical fertilizer and bio-extract did not show color differences of lettuce leaves using necked eyes. However, lettuce leaves had color differences using color chart (RHS) by leaves of green oak with chemical fertilizer showed Yellow-Green group (144 B) and with bio-extracts are Yellow-Green group (145 A) (Table 4, Fig. 2).

Table 4 The color of leaves in green oak lettuce (Green Group)

Treatment	Color of leaves
Chemical fertilizer(16-16-16)	Green (Yellow-Green group 144 B)
Bio-extract of fish meal	Green (Yellow-Green group 145 A)
Bio-extract of soybean meal	Green (Yellow-Green group 145 A)



Chemical fertilizer (16-16-16) Bio-extract of fish meal Bio-extract of soybean meal

Fig. 2 The color of leaves in green oak lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

3.3 Red coral lettuce

Red coral lettuce treated with bio-extract of soybean meal had the widest average of shrub width (27.35 cm.) while the treatments with chemical fertilizer and bio-extract of fish meal showed 21.16 and 20.33 cm. respectively. The maximum number of leaves (10.41) was from treatment with bio-extract of soybean meal, whereas chemical fertilizer and bio-extract of fish meal presented 10.16 and 9.57, respectively. There is no significant difference between three treatments (Table 5). However, comparison of height among three treatments found that the maximum average of height red coral is growing with bio-extract of soybean meal (13.66 cm.), bio-extract of fish meal (12.41) and chemical fertilizer (11.91), respectively. There is no significant difference between three treatments.

However, comparison of fresh weight among three treatments found that the maximum average of fresh weight is growing with bio-extract of soybean meal (16.93 g.), chemical fertilizer (15.39 g.) and bio-extract of fish meal (12.01 g.), respectively.

Table 5 The vegetative yield of red coral lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

Treatment	Vegetative yield			
	Height (cm)	No. of leaves	Shrub width (cm)	Fresh weight (g)
Chemical fertilizer(16-16-16)	11.91a	10.16	21.16	15.39
Bio-extract of fish meal	12.41a	9.57	20.33	12.01
Bio-extract of soybean meal	13.66a	10.41	27.35	16.93
F test	ns	ns	ns	ns
CV (%)	10.59	17.99	18.88	22.94

Means followed by the same letter at the same column were not significantly different by LSD ns= not significant

However, lettuce leaves had color differences using color chart (RHS) by leaves of red coral with chemical fertilizer showed greyed-red (178A) and with bio-extracts are greyed-red (181B and 182A) (Table 6, Fig.3).

Table 6 The color of leaves in red coral lettuce (Greyed-Red Group)

Treatment	Color of leaves
Chemical fertilizer (16-16-16)	Red(Greyed-Red 178A)
Bio-extract of fish meal	Red (Greyed -Red 182A)
Bio-extract of soybean meal	Red (Greyed -Red 181B)



Chemical fertilizer (16-16-16) Bio-extract of fish meal Bio-extract of soybean meal

Fig. 3 The color of leaves in red coral lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

3.4 Butter head lettuce

Butter head lettuce grown in media with bio-extract of soybean meal had the widest average of shrub width (27.03 cm) while the treatments with chemical fertilizer and bio-extract of fish meal showed 21.11 and 20.33 cm respectively. The maximum number of leaves (19.66) was from treatment with chemical fertilizer, whereas bio-extract of fish meal and bio-extract of soybean meal presented 15.58 and 15.08, respectively. There is no significant difference between three treatments (Table 7). However, comparison of height among three treatments found that the maximum average of height butter head is growing with bio-extract of soybean meal (22.12 cm), chemical fertilizer (21.80 cm) and bio-extract of fish meal (18.99 cm), respectively. There was a significant difference between three treatments. However, comparison of fresh weight among three treatments found that the maximum average of fresh weight is growing with bio-extract of fish meal (53.49 g.), bio-extract of soybean meal (50.27 g.) and chemical fertilizer (47.60 g.), respectively. There is no significant difference between three treatments.

Table 7 The vegetative yield of butter head lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

Treatment	Vegetative yield			
	Height (cm)	No. of leaves	Shrub width (cm)	Fresh weight (g)
Chemical fertilizer(16-16-16)	21.80a	19.66	21.16	47.60
Bio-extract of fish meal	18.99b	15.58	20.33	53.49
Bio-extract of soybean meal	22.12a	15.08	27.03	50.27
F test	*	ns	ns	ns
CV (%)	5.41	14.14	6.10	12.40

Means followed by the same letter at the same column were not significantly different by LSD * significant at $P < 0.05$ and ns not significant

Treatments with chemical fertilizer and bio-extract did not show color differences of lettuce leaves using necked eyes. However, lettuce leaves had color differences using color chart (RHS) by leaves of butter head with chemical fertilizer showed Green group (141 B) and with bio-extracts were Green group (138 A) (Table 8, Fig. 4).

Table 8 The color of leaves in butter head lettuce (Green Group)

Treatment	Color of leaves
Chemical fertilizer(16-16-16)	Green (Green group 141 B)
Bio-extract of fish meal	Green (Green group 138 A)
Bio-extract of soybean meal	Green (Green group 138 A)



Chemical fertilizer (16-16-16) Bio-extract of fish meal Bio-extract of soybean meal

Fig. 4 The color of leaves in butter head lettuce treated with chemical fertilizer, bio-extract of fish meal and soybean meal.

4. DISCUSSION

The availability of nutrients in the bio-extract could promote plant growth [6]. However, using only bio-extracts did not enhance plant growth, because the amount of macronutrients and micronutrients in the bio-extract was low and insufficient for plant growth [7]. This finding was similar to the study by [8]. However, the quantity of nutrients in the bio-extract was quite low and insufficient to support plant growth. In addition, soybean and fish meal may contain some specific groups of microorganisms that can promote plant growth as plant growth promoting bacteria (PGPB). Several investigations reported that PGPB can produce plant growth regulators, such as indole acetic acid (IAA), gibberellic acid, cytokinins and gaseous phytohormone (ethylene) [9]. Moreover, some groups of PGPB can fix nitrogen gas, dissolve unavailable phosphate and produce siderophore as an iron chelator, as well as deter plant pathogens [10]. According to the Sustainable Agriculture Forum (SAF) [11], bio-extracts can help to lessen the impact of disease, viruses and water pollution affecting fisheries. Bio-extracts also can enhance soil substance and fertility, reduce insects, viruses and other infestation. Plants can absorb only nutrients that are in solution. Nutrients in chemical fertilizers are usually immediately available to plants. Organic fertilizers may take more time to release the nutrients as they need some microbial activity to get them working [12], [13].

However, the use of bio-extract for cultivation compared to chemical fertilizer is environmentally friendly, low cost and an appropriate way to dispose of agricultural wastes. Further study of different combinations of soybean meal bio-extract and fish meal bio-extract is warranted, and the optimal dilution ratios of these bio-extracts still need to be investigated.

5. CONCLUSION

All lettuces growth rates increased slowly and showed significant differences after 21-28 days of cultivation. The vegetative growth in fresh weight of red oak lettuce similar to chemical fertilizer with difference statistically significant when treated with bio-extract of fish meal and soybean meal. There were no statistically difference on the vegetative growth of green oak lettuce. Both of bio-extract of fish meal and soybean meal could increase the color of leaves in red oak, red coral and butter head lettuces than chemical fertilizer.

6. ACKNOWLEDGEMENTS

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