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Response of Pechay (*Brassica napus* L.) to Different Levels of Compost Fertilizer

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Abstract- Organic fertilizer is a good source of nutrients for the soil. It improves the soil's physical, chemical and biological characteristics. This study was conducted to evaluate the growth and yield performance of pechay applied with different levels of compost as organic fertilizer and determines the effect of organic fertilizer in terms of plant height, number of leaves per plant, fresh weight per plant and leaf area. The pot experiment was laid out in randomized complete block design (RCBD) with five treatments and replicated three times. Significant differences between treatments means were determined using the Duncan Multiple Range Test (DMRT). The analysis of variance (ANOVA) showed, that there were no significant differences in the plant height and number of leaves. However, leaf area of pechay was significantly affected by application of T3 = 50% pure garden soil: 50% pure compost (OF) in combination and in terms of yield, the fresh weight of pechay was significantly increased with the application of T4 = 75% pure garden soil: 25% pure compost (OF). Application of 50% pure garden soil: 50% pure compost (OF) and 75% pure garden soil: 25% pure compost (OF) significantly affected the leaf area and fresh weight of pechay. This implies that compost application greatly increased or influenced the growth and development of the pechay plant.

Index Terms- compost, goat manure, organic fertilizer, pechay (*Brassica napus* L.)

I. INTRODUCTION

The agriculture sector is deemed unsustainable by various studies as the main focus of the current development agenda is feeding the ever-expanding population. It loses sight of the negative environmental consequences it creates, particularly on soil health. Land use is optimized through technologies and management practices that fall short of requirements for sustainability. The current practice in agriculture is basically chemical-based farming that makes a considerable contribution to the degradation of our natural resources especially soils. Heavy application of fertilizers has polluted surface and groundwater resources (dela Cruz, 2006).

Growing vegetables has been a practice for centuries in civilized countries. Vegetables are a very important food commodity. Aside from playing a major role in meeting our vitamin, mineral and protein requirements, they also serve as a reliable source of income of farmers (Chauburg, 1984 as cited by Torrefiel, 2006). The income derived from growing vegetables is relatively higher than other crops, because growers can produce more crops from a small area in a very short period of time.

Pechay (*Brassica napus* L.) belongs to the Brassiceae family and one of the most known vegetables in the Philippines. It is also known as one of the oldest green vegetables in Asia. It therefore plays an important role in the Philippine economy as well as in the nutrition of the Filipino people. Pechay is used mainly for its immature, but fully expanded tender leaves. The succulent petioles are often the preferred part. It is used as main ingredient for soup and stir-fried dishes. In Chinese cuisine, its green petioles and leaves are also used as garnish (http://www.darfu4b.da.gov.ph/pechay.html).

Fertilizer application using either inorganic or organic fertilizer sources is one of the most common cultural management practices in vegetable production. According to Lampkin (1990) as cited by Masarirambi, (2010) that the commercial and subsistence farming has been and is still relying on the use of inorganic fertilizers for growing crops. This is because they are easy to use, quickly absorbed and utilized by crops. However, these fertilizers are believed to contribute substantially to human, animal food intoxication and environmental instability or degradation (Masarirambi, 2010).

Inorganic fertilizers are the most common fertilizers used by the farmers. However, its use incurs a high cost and its supply is sometimes limited that many farmers now are still adapting the idea of using organic fertilizers no matter how long and laborious is the preparation. Brady (1974) reported that organic matter increases the cation exchange capacity of the soil. Aside from its ability to supply nutrients, organic fertilizers are also capable of improving the physical, chemical and biological properties of the soil which could significantly improve the growth and development of plants.

Among the potential sources of organic fertilizers is compost. Composts are a form of organic fertilizer; they are considered low-analysis fertilizers because they contain about 1% N and P and their organic nitrogen mineralization rate is about 10% (Sikora and Enkiri, 2001 as cited by Espiritu, 2011). Organic fertilizer has been defined as any product of plant and/or animal origin that has undergone.

There is increased demand of organically produced vegetables in view of its health and nutritional benefits. There is paucity of information on the use of organic fertilizers for vegetable production and therefore this study aimed to evaluate the effect of different levels of compost as a source of organic fertilizers on the growth and yield performance of pechay.

II. METHODOLOGY

A. Procurement of Different Sources of Organic Materials

Goat manure was secured from the Goat and Sheep Project of the Department of Animal Science of Visayas State University, Visca, Baybay City, Leyte. Rice straw and carbonized rice hull ash was procured from the Rice Project of the Department of Agronomy and Soil Science. These organic materials were processed to allow decomposition for easy release of nutrients.

B. Composting Process

Three piles were prepared using different raw materials from several origins. This includes, 4 sacks goat manure, 2 sacks rice straw and 1 sack carbonized rice hull ash. The entire pile was covered with plastic sheet completely in a shade to maintain the heat of decomposition and minimizes water evaporation and ammonia volatilization. Twice a week the organic materials were mixed thoroughly to prevent overheating and aerate the pile for faster decomposition process. Watering was done regularly to add moisture content in the composting materials. The compost was harvested after 2 months of decomposition.

C. Seedling Production

Seeds of pechay were sown in seedling trays filled with garden soil and compost at 1:1 ratio. The seed boxes were placed under structure to protect the seedlings from rain and direct sunlight. The seedlings were hardened by gradual exposure to sunlight and withdrawal of water until they showed signs of temporary wilting.

D. Transplanting

The seedlings were transplanted into the pots 7 days after germination. One seedling was planted per pot. The media was filled to ¾ of the volume of the plastic pot. Transplanting of seedling was done late in afternoon to minimize transplanting stress. The seedlings were watered adequately before and immediately after transplanting.

E. Experimental Design and Treatment

Seventy-five polyethylene pots were used in the study with a size of 20 cm. The pot experiment was laid out in Randomized Complete Block Design (RCBD) with five treatments and replicated three times. There were five sample plants per replication. The treatments were as follows:

T1 = Pure Garden Soil (control)
T2 = Pure Compost (OF)
T3 = 50% Pure Garden Soil: 50% Pure Compost (OF)
T4 = 75% Pure Garden Soil: 25% Pure Compost (OF)
T5 = 85% Pure Garden Soil: 15% Pure Compost (OF)

F. Harvesting

Pechay plants were harvested at 21 days after transplanting and were done early in the morning to minimize weight loss. This was done by cutting the base of the plants with a sharp knife to avoid damage of the plants.

G. Data Analysis

Data were analyzed using the analysis of variance (ANOVA) and significant differences between treatments means were determined by Duncan Multiple Range Test (DMRT) using the Statistical Package for Social Sciences (SPSS) ver. 15 and Statistic 6.

III. RESULTS AND DISCUSSIONS

General Observations

Three weeks after composting, the height of the pile has fallen to about 70 cm. A week later, rice straw and rice hull ash was totally decomposed but goat manure was not yet decomposed. The heat was still high one month after composting. This coincide with the report of Pace (1995) that the temperature of the composting materials generally follows a pattern of rapid increase to 120-140 ºF where it was maintained for several weeks depending on the materials.

The decomposition was attained two months after composting considering that there was enough moisture that support the metabolic processes of the microbes. It was reported by Pace (1995) that composting materials should be maintained within a range of 40% to 65% moisture. He showed that the composting process becomes inhibited when the moisture content is below 40% and water displaces much of the air in the pore spaces of the composting materials when the moisture content is above 65%. This limits air movement and leads to anaerobic conditions.

Reduction of the volume of the pile was observed and the organic materials used were changed color to dark brown. The temperature drops and little heat is produced. The compost was then successful and was ready to use as an organic fertilizer source.

Horticultural Characteristics

The result showed that T4 obtained the highest plant height, number of leaves/ plant and leaf area (Table 1). On the other hand, it was noted that T1 got the lowest growth performance.

Analysis of variance of leaf area resulted to highly significant differences between treatments means. All treatments that were applied with compost did not differ with each other but showed significant difference compared to control. However, a non-significant statistical result was found out on the plant height and number of leaves of pechay plant as affected by application of different levels of compost application. Although most plant nutrients in compost are in organic form, it only contains 2% each of nitrogen, phosphorous or potassium and these nutrients are released slowly over a long period of time. Nutrients become available to plant roots at a slower rate with compost, therefore the nutrients are less likely to leach out of the soil. Only a fraction of the nitrogen, phosphorus and potassium applied as compost is usable by the crop the first year with more becoming available in the years that follow (Pace, 1995). According to the studies by Rao (1991) showed that the soil could be enriched by application of higher amounts of organic materials which tends to decompose large amounts of nitrogen into the soil before planting each fresh crop to boost yield.

Treatments	Mean Plant Height (cm)	Number of leaves/plant	Leaf Area
T1 = Pure Garden Soil (control)	25.57	5.17	21.81b
T2 = Pure Compost (OF)	30.77	5.67	40.69a
T3 = 50% Pure Garden Soil: 50% Pure Compost (OF)	29.1	5.17	42.6a
T4 = 75% Pure Garden Soil: 25% Pure Compost (OF)	32.5	5.83	42.17a
T5 = 85% Pure Garden Soil: 15% Pure Compost (OF)	31.7	5.33	39.97a
p-value	0.1414ns	0.1865ns	0.0062**

ns= not significant
**= highly significant
Note: Treatment means within the same column having common letters (s) designations are not significantly different from each other at 5 % level of significance, DMRT

Yield Performance

The data on the fresh weight of pechay as affected by different level of compost as fertilizer showed that T4 obtained the highest mean of 29.9, it was followed by T2, T3, T5 and T1 having the lowest fresh weight with the mean of 26.6, 23.5, 23.17 and 12.93 respectively as shown in Table 2.

Analysis of variance showed that there was highly significant difference between treatments means. This implies that fresh weight of pechay was greatly influenced by the application of different levels of compost. It was noted that this study used of goat manure as raw material for compost. According to the study of Awodun et al. (2007) that, the goat manure was quite high in OM and had more N than K, Ca and Mg. The low OM and available P and acidic nature of soils were expected to benefit from application of goat manure.

Table 2. Fresh weight of pechay as applied with different levels of compost fertilizers.

Treatments	Mean Fresh weight/plant (g)
T1 = Pure Garden Soil (control)	12.93b
T2 = Pure Compost (OF)	26.6a
T3 = 50% Pure Garden Soil:50% Pure Compost (OF)	23.5a
T4 = 75% Pure Garden Soil:25% Pure Compost (OF)	29.9a
T5 = 85% Pure Garden Soil: 15% Pure Compost (OF)	23.17a
p-value	0.0074**

**= highly significant
Note: Treatment means within the same column having common letters (s) designations are not significantly different from each other at 5 % level of significance, DMRT

The higher increase in yield parameter such as fresh weight of pechay could be attributed to the nutrient contents of the organic fertilizers used which encouraged better seedlings growth. This observation agreed with the report of Adebayo and Akoun (2000) and Moyin-Jesu (2007) stated that organic manures supported crop growth performance and increased crop yield. In the study of Xu et al. (2005) revealed that the yield and quality of leafy vegetables grown with organic fertilizers grew better and resulted in a higher total yield than those grown with chemical fertilizers.

H. CONCLUSION

Based on the above results, it can be concluded that the application of T4 (75% Pure Garden Soil: 25% Pure Compost (OF) provided the best growth and yield performance of pechay in terms of leaf area and fresh weight. None among the treatments used gave the better growth in terms of producing more leaves and height of the plant. The result of this study showed that application of organic fertilizer greatly enhanced growth and yield performance of pechay. The application of organic fertilizer in pechay specifically, compost is recommended since it influences its growth and yield, especially on the leaf area and fresh weight.

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