RATES OF FORMULATED ORGANIC LIQUID PLANT SUPPLEMENTS FOR CARROT (*Daucus carota*) GROWN IN FARM UNDER CONVERSION TO ORGANIC PRODUCTION[1]

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[1]Part of a PCAARRD-funded project, titled “Organic Fertilizers and Microbials for Improved Soil Fertility in Organic Vegetable Production Areas in CAR”

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ABSTRACT

The study was conducted to develop nutrient management strategies for carrot in farms under conversion to organic production. Specifically, the study determined: 1) the effects of formulated organic liquid plant supplements on the growth and yield of carrot in farm under conversion to organic production, 2) the best rate of the formulated organic liquid plant supplements for the production of carrot in farm under conversion to organic production, and 3) the effects of the formulated organic liquid plant supplements on some physical and chemical properties of the soil in farm under conversion to organic production. The effect of the different rates of formulated organic liquid plant supplements on carrot grown in a farm under conversion to organic production differed significantly in terms of the marketable and total yield of carrots. Application of formulated organic liquid plant supplements at the rate of 70:20:10, 20:70:10, and 10:20:70 during seedling, vegetative, and root bulking stage, respectively, produced the highest marketable and total yield. Application of formulated organic liquid plant supplements significantly affected the organic matter and total nitrogen content of the soil in farm under conversion to organic production wherein the rate 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB) resulted to the highest organic matter content of the soil after harvest. The application of formulated organic liquid plant supplements at different rates did not differ significantly in terms of plant height, insect pest infestation, and powdery mildew infection, soil bulk density, soil pH, available phosphorus content, and potassium content.

INTRODUCTION

Intensive farming removes most of the nutrients and plant residues from the soil. To replenish the soil nutrients, application of inorganic fertilizers is employed in order to continue producing good yield. Application of heavy dosage of inorganic fertilizers however led to soil degradation in terms of soil acidity, conversion of some nutrients to unavailable forms, and to greater extent soil erosion and leaching of elements that eventually polluted the underground or surface water resources. Problems such as soil-borne diseases have aggravated the problem as a result of poor soil conditions (Brady and Weil, 2008).

The use of organic fertilizers and organic plant supplements is one alternative seen to protect the soil and the environment from further degradation.

Organic fertilizers are not expensive and are abundantly available in the locality. The application of organic fertilizer will also help maintain soil fertility by improving the soil’s physical and chemical properties (Schjonning *et al.,* 2004).

There is also a growing consumer demand for agricultural products that are free of toxic chemical residues. It was proven that using heavy chemical inputs in agriculture production affects human health as residues are found to cause various diseases (Reyes and Laurean, 2007). This is the reason why the informed publics are willing to pay a good price for organically grown food.

Thompson and Kelly (1975) stated that a yield of 9,072 kg of carrots will remove about 45.36 kilograms of potash, 14.52 kg of nitrogen and 8.16 kg of phosphorus from the soil used. Brady and Weil (2002) claimed that the removal of nutrients in crop or timber harvest reduces the soluble ion pool, and it may need to be replenished with manures or chemical fertilizers to avoid nutrient deficiencies.

However, chemical fertilizers generally have acidifying effects on soils and aside from this, they are becoming expensive. They also contribute to the accumulation of toxic materials in the underground water reserves. Further, chemical fertilizers make crops more attractive to pests since they change the quality of plant sap (Bawang, 2009).

In 2008, Brady and Weil reported that the worldwide use of fertilizers increased dramatically since the middle of the twentieth century, accounting for a significant dramatic increase in crop yields during the same period. PCARRD (2006) reported that most of the chemical fertilizers used on agricultural crops in the Philippines are imported. Lately, the government has been encouraging the use of a combination of organic and inorganic fertilizers for rice, called the “balanced fertilization” wherein five bags of organic fertilizers are applied with chemical fertilizers. Furthermore, the application of organic materials is a common agricultural practice for maintaining nutrient levels and ameliorating soil physical properties to sustain crop production (Laurean *et al*., 2012).

Organic agriculture features the diminishing use of chemical fertilizers and pesticides in the production schemes in favor of cheaper and locally abundant agricultural waste products, like organic fertilizers and materials such as compost to recondition, revitalize and maintain soils acidic balance, structure stability, desirable chemical properties and plant life sustaining capacity (Bawang, 2009). However, in using organic fertilizers, as Parnes (1986) stated, two major questions confront most people — what organic fertilizers should be used and how much should be spread. According to Sahadevan (1987), more frequent and smaller doses should be applied generally on a sandy soil as compared to clayey one. Fertilizers can be applied through the foliage instead of the conventional fertilizer soil. If a quick response is needed, such as with a sudden deficiency of a nutrient or a very rapid use of nutrients during a period of intense growth, the former is practical.

This study was conducted to determine the effects of formulated organic liquid plant supplements on the growth and yield of carrot in farm under conversion to organic production, the best rate of the formulated organic liquid plant supplements for the production of carrot in farm under conversion to organic production, and the effects of the formulated organic liquid plant supplements on some physical and chemical of the soil in farm under conversion to organic production.

MATERIALS AND METHODS

The materials used in the study included carrot (var. Kuroda Gold) seeds, fresh sunflower leaves, fresh azolla, fish scraps, molasses, bones of grass-eating animal, shells, citrus wastes, banana peels, coconut vinegar, and molasses.

The study was conducted in a 75 m^2 area at the BSU Experiment Area in Balili, La Trinidad, Benguet from December 2010 to March 2011. The area was divided into three blocks. Each block was further subdivided into five plots measuring 1x5 m each. The experimental design used was the simple Randomized Complete Block Design (RCBD).

The treatments are the following:

T1- control

T2- 60:30:10 (seedling stage, SS)
30:60:10 (vegetative stage, VS)
10:30:60 (root bulking stage, RB)

T3- 70:20:10 (seedling stage, SS)
20:70:10 (vegetative stage, VS)
10:20:70 (root bulking stage, RB)

T4- 80:10:10 (seedling stage, SS)
10:80:10 (vegetative stage, VS)
10:10:80 (root bulking stage, RB)

T5- 90:5:5 (seedling stage, SS)
5:90:5 (vegetative stage, VS)
5:5:90 (root bulking stage, RB)

The organic liquid plant supplements were formulated prior to planting. The concoctions were prepared separately before mixing to produce a single organic liquid plant supplement containing the highest N, P or K contents.

Preparation of Organic Liquid Nitrogen Plant Supplement (Formulation 1)

The process that was followed in the preparation of liquid nitrogen plant supplement was derived from the ideas of Lim (2008) and Virlanie Natural Farming School (2009).

Fermentation of azolla. Two kilograms of azolla was gathered early in the morning and placed in a container. One kilogram of brown sugar was added. A stone was placed on top of the mixture to expel the air and bring the brown sugar and azolla into close contact. After five hours, the weight was removed and the container was covered with a clean Manila paper and tied with a string. The mixture was fermented for seven days in a cool dry shaded place, and after which, the liquid was drained and placed on clean plastic bottles.

Fermentation of sunflower. The procedure in fermenting the sunflower (*Helianthus annuus*) leaves was the same with the process of fermenting azolla, that is, one kg of sunflower leaves gathered early in the morning were chopped into smaller pieces before mixing with the one kg of brown sugar.

Fish Amino Acid. For the preparation of Fish Amino Acid (FAA), two kilograms of fresh fish wastes such as head, bone, and intestines were collected and placed in a container. Brown sugar of the same weight (1:1 ratio) was added. The container was then covered. After three to four days, the fish started to liquefy through the osmotic pressure generated by the molasses and underwent fermentation. The FAA was extracted and used after 15 days.

Preparation of Organic Liquid Calcium-Phosphorus (CalPhos) Plant Supplements (Formulation 2)

The preparation of CalPhos was based on the procedures developed by PABINHI Pilipinas (2006).

Bones. Fresh or uncooked bones of grass-eating animals were gathered. One kg of the animal bones was boiled to remove and separate the meat and fats. It was then air-dried, broiled until black, and crushed. The pulverized bones were placed in a container with 10 liters of coconut vinegar. After 30 days, the mixture was strained and the liquid parts were transferred into plastic bottlers.

Shells. One kg of oyster shells were gathered and prepared. The pulverized oyster shells were placed in a container with 10 liters of coconut vinegar. After 30 days, the mixture was strained and the liquid parts were transferred into plastice bottlers.

Preparation of Organic Liquid Potassium Plant Supplements (Formulation 3)

The preparation process was the same as in the preparation of fermented plant juice.

Banana peels. One kilogram of chopped banana peels (*saba*) and 1 kilogram of brown sugar were mixed. The mixture was placed in a container and then covered after which it was allowed to ferment for at least 7-10 days.

Citrus wastes. One kilogram of chopped pomelo peels and 1 kilogram of brown sugar were mixed. The mixture was placed in a container and then covered after which it was allowed to ferment in a cool shaded place for at least 7-10 days.

Seed Planting

Prior to planting, the BSU compost was applied in all treatments as a basal fertilizer at the reduced rate of five tons per hectare. The recommended rate of organic fertilizer for carrot is ten tons per hectare. Carrot seeds were sown in the plots with the use of wooden planting guide in order to have equal distance and number of hills. The pegs of the planting guide were spaced at 8 cm x 15 cm between hills and rows, respectively. Five to eight seeds were dropped in each hill and covered with a thin layer of soil. Three weeks after emergence, thinning was done to retain one plant per hill.

Application of Organic Liquid Plant Supplements

Application of foliar fertilizer was done at an interval of eight days. The application started 15 days after seedling emergence. For the vegetative stage, applications started at 39 DAP. The applications for the root bulking stage started at 60 DAP.

To prepare a ratio of 60:30:10, 600 ml of Formulation 1, 300 ml of Formulation 2, and 100 ml of Formulation 3 were mixed to come up with a liter of organic liquid plant supplements. From the mixture, 2 tablespoon was added in a liter of water and was applied to the foliage of carrots and on soil. The same preparation was done for the other ratios.

The data gathered were statistically analyzed using the ANOVA. The significance between means was analyzed using the Duncan's Multiple Range Test (DMRT).

Data Gathered

A. Analysis of Formulated Organic Liquid Plant Supplements

The different formulations were analyzed at the Bureau of Soils and Water Management (BSWM) in Quezon City. Formulation 1 (composed of fermented azolla, sunflower and fish amino acid); formulation 2 (composed of fermented animal bones and shells); and formulation 3 (from fermented citrus wastes and banana) were analyzed for their pH, total nitrogen, total phosphorus, total potassium, total calcium, total magnesium, sodium, zinc, copper, manganese, iron, and organic carbon contents.

B. Growth and Yield

Plant height (cm). This was measured from the base to the tip during its seedling, vegetative and root bulking stages of the 10 samples of the carrot plants.

Marketable yield (kg). This was taken by weighing all roots harvested per plot excluding the damaged roots.

Total yield (kg). It was taken by weighing all roots harvested per plot which includes the marketable and non-marketable roots.

C. Insect Pest Incidence

Insect pest occurrences were noted during the various growth stages of the plants. The insects attacking the carrots and the damage caused were monitored and recorded using he arbitrary rating scale by Halog and Molina (1981) as follows:

Scale	Description
1	Sound, leaves with no damage
2	Slight, 1-3 leaves affected
3	Moderate, 4-6 leaves affected
4	Severe, most of the leaves affected
5	Skeletonized, all leaves affected

D. Disease Incidence

Incidence of diseases was likewise recorded during various growth stages of the plants. Diseases like powdery mildew was rated using the arbitrary rating scale by Lasilas (2010) as follows:

Scale	Description
1	No infection
2	1-25% of the total plant
3	26-50% of the total plant
4	51-75% of the total plant
5	76-100% of the total plant

E. Soil Properties

Soil pH. The initial and final soil pH were determined using the electrometric method. Ten grams of soil was weighed in an ice cream cup and was mixed with 10 ml distilled water (or 1:1 ratio). The soil solution was stirred thoroughly and allowed to stand for 30 minutes. Before reading, the solution was stirred again, after which the electrode of the pH meter was placed into the solution.

Bulk density(g/cm3). The core method was used to determine the bulk density of the soil. The formula used to compute the bulk density was:

$$D_b = \frac{\text{Oven Dry Weight of the Soil (g)}}{\text{Volume of the Soil (cm}^3\text{)}}$$

Organic matter content (%). Walkley-Black method was used in determining the organic matter content of the soil. One gram of air-dry soil sample that passed to a 0.5 mm or 35- mesh sieve was measured and placed in a 500-ml flask. Exactly 10 ml of 1.0 N $K_2Cr_2O_7$ solution was added; after which 20 ml of sulfuric acid reagent was added as rapidly as possible.

The suspension was mixed thoroughly and allowed to stand for 30 minutes. The suspension was diluted with 200 ml water and 10 ml H_3PO_4 solution. One ml of diphenylamine indicator was added before titration. The suspension was titrated with standard $FeSO_4$ solution to a brilliant green color. A blank (without soil) was run simultaneously.

Total nitrogen content (%). The nitrogen content of the soil was determined using the formula:

Total N = % OM x 0.05

Available phosphorus content (ppm). Bray No. 2 method was used in determining the P content of the soil samples. Soil sample weighing 2.85 grams was placed into a 250 ml-Erlenmeyer flask. A 20 ml of the extraction solution (0.03 N NH_4F in 0.1 N HCl) using a pipette; was added. The suspension was shaken for 1 minute. The suspension was filtered immediately in a Whatman No. 2 filter paper. A 5 ml aliquot of the clear filtrate was transferred to a 25-ml volumetric flask. Boric acid (7.5 ml) and ammonium molybdate (5 ml) reagent were added to mixture. Finally, 2.5 ml of freshly diluted stannous chloride reagent was added and was immediately mixed.

The solution was diluted with distilled water. After 5 to 6 minutes and before 15 to 20 minutes, the sample was placed in the spectrophotometer. A reagent blank was prepared for each series of determination.

Exchangeable potassium content (ppm). The Flame Photometer method was used to determine the potassium content of the soil. Four grams of soil was placed in a 50 ml Erlenmeyer flask; then a 20 ml of ammonium acetate solution was added. The solution was shaken vigorously for 5 minutes. After 5 minutes, the suspension was filtered using Whatman No. 4 filter paper. The percent transmittance of the extract was determined. The K content of the filtrate from the standard curve was determined. The K contents of the soil samples were calculated with the following formula:Return on cash expenses (ROCE, %).This was determined by recording all the expenses and after which was computed using the formula below:

$$\text{ROCE (\%)} = \frac{\text{Gross Income – Total expenses}}{\text{Total expenses}} \times 100$$

Table 1. Chemical analysis of formulated organic liquid fertilizers

Content	Formulations		
	F1	F2	F3
Total Nitrogen (N), %	0.13	0.05	0.04
Total Phosphorus (P_2O_5), %	0.004	0.07	Trace
Total Potassium (K_2O), %	0.17	0.08	0.22
Total Calcium (CaO), %	0.08	0.99	0.02
Total Magnesium (MgO), %	0.05	0.08	0.03
pH	3.4	3.9	3.6
Sodium (Na), %	0.006	0.003	0.0003
Zinc (Zn), ppm	1.48	Trace	Trace
Copper (Cu), ppm	Trace	Trace	Trace
Manganese (Mn), ppm	39.07	13.88	5.20
Iron (Fe), ppm	64.79	16.01	12.30
Organic Carbon, %	21.16	21.06	21.81

Growth and Yield

Plant height. No significant differences were observed on the plant height as affected by the different formulations.

Computed total yield /ha. The application of formulated organic liquid plant supplements significantly affected the total yield (Figure 1). The highest harvested yield was obtained from plots applied at the rate of 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB) with a mean of 24.09 tons/ha. Plants that were not applied with formulated organic liquid plant supplements registered the lowest yield of 20.50 tons/ha. It is therefore implied that the application of formulated organic liquid plant supplements at any rate increases the yield of carrots. This could be attributed to the nutrients from the organic liquid plant supplements released and used by the plants.

Organic fertilizers are likely to contain all the essential plant nutrient elements (Singer and Munns, 2002). Moreover, Brady and Weil (2008) reported that organic compounds are absorbed by higher plants and that growth promoting compounds such as vitamin, amino acid, auxins, and gibberellins are formed as organic matter decays. These compounds then stimulate growth and yield in both higher plants and microorganisms.

Computed marketable yield (tons/ha). The marketable yield of carrot was enhanced with the application of formulated organic liquid plant supplements (Figure 1). The application of 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB) rate registered the highest marketable yield of 20.17 tons/ha, followed by the application of 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB) rate with a mean of 17.59 tons/ha. The control yielded the lowest with a mean of 15.00 tons/ ha.

It is implied that the application of formulated organic liquid at any rate increases the marketable yield of carrots. This could be attributed to the nutrients released and absorbed for photosynthesis.

It has been stated that for a quick response like a very rapid use of nutrients during a period of intense growth, foliar feeding responses are used. Donahue (1970) reported that most of the 16 elements essential for plant growth can be absorbed by the leaves and stems of plants when the elements are sprayed on them. Phosphorus, for instance, is capable of being utilized by the plant when it is sprayed on the leaves. One reason is that in most soils only a small percentage of phosphorus is recovered by the plant; whereas, when phosphorus is sprayed on the leaves, nearly all of it is absorbed.

Table 2. Plant height (cm) as influenced by rates of formulated organic liquid plant supplements

TREATMENTTS	Initial (24 DAP)	SS * (38 DAP)	VS * (59 DAP)	RB* (87 DAP)
Control	6.87[a]	10.91[a]	24.17[a]	38.14[a]
60:30:10 (SS)/ 30:60:10 (VS)/ 10:30:60 (RB)	6.51[a]	11.37[a]	25.17[a]	37.61[a]
70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB)	6.01[a]	10.81[a]	23.09[a]	37.55[a]
80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB)	6.17[a]	10.71[a]	23.90[a]	35.53[a]
90:5:5 (SS)/ 5:90:5 (VS)/ 5:5:90 (RB)	6.76[a]	11.19[a]	23.84[a]	39.13[a]

Means with the same letter/s are not significantly different by DMRT.

* SS – seedling stage; VS – vegetative stage; RB – root bulking stage

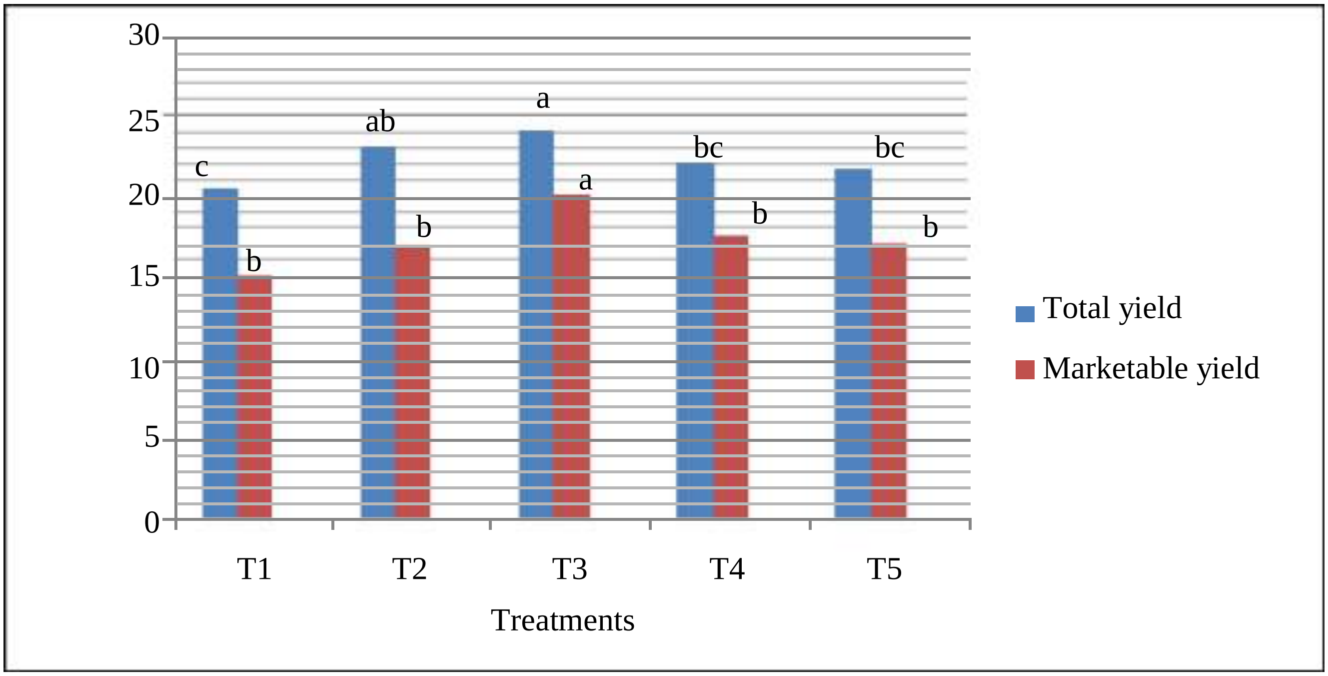

Figure 1. Yield of carrot as influenced by rates of formulated organic liquid plant supplements

Soil Properties

The soil in the treatments were similar in bulk density, soil pH, available P, and exchangeable K (Table 3). However, the treatments significantly differed among each other in OM and total N.

Bulk Density of the Soil. The bulk density of the soils decreased from the initial value of 1.65 g/cm3. This indicates that application of the formulated organic liquid plant supplements and the presence of crops improve the soil bulk density.

Table 3. Soil properties after harvest as influenced by rates of formulated organic liquid plant supplements

reatments TREATMENT	Bulk density g/cm^3	Soil pH	OM (%)	Total N (%)	Available P (ppm)	Exchangeable K (ppm)
T1 - Control	1.13^{a}	5.83^{a}	3.11^{d}	0.155^{d}	499.03^{a}	353.11^{a}
T2 - 60:30:10 (SS)/30:60:10 (VS)/ 10:30:60 (RB)	1.06^{a}	5.86^{a}	3.65^{ab}	0.183^{ab}	491.70^{a}	530.66^{a}
T3 - 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB)	1.09^{a}	5.78^{a}	3.63^{abc}	0.182^{abc}	495.30^{a}	504.00^{a}
T4 - 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB)	1.08^{a}	5.83^{a}	3.67^{a}	0.184^{a}	511.24^{a}	395.56^{a}
T5 - 90:5:5 (SS)/ 5:90:5 (VS)/ 5:5:90 (RB)	1.08^{a}	5.78^{a}	3.41^{abcd}	0.171^{abcd}	506.36^{a}	352.89^{a}
Initial	1.65	5.10	2.24	0.112	488.49	220.00

Means with the same letter/s within the column are not significantly different by DMRT (P>0.05).

Soil pH. The soil pH was not significantly affected by the application of formulated organic liquid plant supplements (Table 3). The pH of the soil increased however with the application of organic liquid fertilizers.

Organic matter content. Application of different rates of formulated organic liquid plant supplements significantly affected the organic matter content of the soil. The highest soil organic matter was obtained from the plots applied with 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB) followed by plots applied with 60:30:10 (SS)/30:60:10 (VS)/ 10:30:60 (RB). Further, the organic matter content of plots applied with formulated organic liquid fertilizer increased when compared to the initial of 2.24%.

Total nitrogen content. The total nitrogen content of the soil as affected by the rates of formulated organic liquid plant supplements is presented in Table 8. Results showed significant differences on the total nitrogen content of the soil as affected by the application of different rates of organic liquid plant supplements. The rate 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB) has the highest nitrogen content. This could be due to the higher organic matter content of the of the formulated plant liquid supplements applied to the plants and soil.

Organic matter is usually used as an index of soil fertility, and by itself, is a source of other major and secondary nutrient elements. Organic matter is a source of other major and secondary nutrient elements (PCARRD, 2006). About 92-94 % of soil nitrogen and 15-18 % of total phosphorus are released from organic matter.

Available phosphorus content. Available phosphorus content of the soil did not differ significantly as affected by the application of formulated organic liquid plant supplements as shown in Table 8. The application of 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB) however, registered the highest mean of 511.24 ppm and the lowest was from plots applied with 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB).

Further, the available phosphorus content of the soil compared to the initial of 488.49 ppm increased with the application of organic liquid plant supplements. It is implied that, organic liquid plant supplements and the presence of a crop improves the available phosphorus content of the soil as the case with the control plots.

Exchangeable Potassium Content. The different rates of formulated organic liquid plant supplements applied did not differ significantly on the potassium content of the soil as shown in Table 8.

Incidence of Pests and Diseases

Cutworm, Looper, and Semi-looper Infestation. No significant effect of the formulated organic liquid plant supplements was observed on cutworm and on looper infestation (Tables 4, 5, 6). Insect pest infestation was rated using the Halod and Molina (1981) scale: 1-Sound, leaves with no damage; 2- Slight, 1-3 leaves affected; 3- Moderate, 4-6 leaves affected; 4- Severe, most of the leaves affected; 5- Skeletonized, all leaves affected.

Table 4. Cutworm infestation as influenced by rates of formulated organic liquid fertilizers

TREATMENT	40 DAP	**50 DAP**
TREATMENTS	**40 DAP**	
T1 - Control	1.033^{a}	1.100^{a}
T2 - 60:30:10 (SS)/ 30:60:10 (VS)/ 10:30:60 (RB)	1.067^{a}	1.033^{a}
T3 - 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB)	1.133^{a}	1.033^{a}
T4 - 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB)	1.033^{a}	1.033^{a}
T5 - 90:5:5 (SS)/ 5:90:5 (VS)/ 5:5:90 (RB)	1.033^{a}	1.033^{a}

Means with the same letter/s within a column are not significantly different by DMRT (P>0.05).

Table 5. Looper infestation as influenced by rates of formulated organic liquid is application of formulated organic liquid plant supplements

TREATMENTS	50 DAP	60 DAP
T1 – Control	1.067^{a}	1.40^{a}
T2 - 60:30:10 (SS)/ 30:60:10 (VS)/ 10:30:60 (RB)	1.067^{a}	1.40^{a}
T3 - 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB)	1.000^{a}	1.23^{a}
T4 - 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB)	1.067^{a}	1.40^{a}
T5 - 90:5:5 (SS)/ 5:90:5 (VS)/ 5:5:90 (RB)	1.000^{a}	1.37^{a}

Means with the same letter/s within a column are not significantly different by DMRT (P>0.05).

Table 6. Semi-looper infestation as influenced by rates of formulated organic liquid plant supplements

TREATMENTTS	50 DAP	60 DAP
T1 – Control	1.100^{a}	1.267^{a}
T2 - 60:30:10 (SS)/ 30:60:10 (VS)/ 10:30:60 (RB)	1.033^{a}	1.300^{a}
T3 - 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB)	1.000^{a}	1.200^{a}
T4 - 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB)	1.133^{a}	1.200^{a}
T5 - 90:5:5 (SS)/ 5:90:5 (VS)/ 5:5:90 (RB)	1.000^{a}	1.400^{a}

Means with the same letter/s within a column are not significantly different by DMRT (P>0.05)

Powdery mildew (*Erysiphe polygoni*) infection 80 DAP and 87 DAP. Powdery mildew infection at 80 DAP and 87 DAP is presented in Table 7. No significant effect of the different rates of organic liquid plant supplements on powdery mildew infection was observed. The infection was rated using Lasilas' 2010 Scale as follows: 1-No infection; 2- 1 to 25% of the total plant was infected; 3 - 26 to 50% of the total plant was infected; 4- 51 to 75% of the total plant was infected; 5 - 76 to 100% of the total plant was infected.

Table 7. Powdery mildewinfection as influenced by rates of formulated organic liquid plant supplements

TREATMENTS	80 DAP	87 DAP
T1 – Control	1.87^{a}	2.27^{a}
T2 - 60:30:10 (SS)/ 30:60:10 (VS)/ 10:30:60 (RB)	1.67^{a}	1.87^{a}
T3 - 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB)	1.90^{a}	1.90^{a}
T4 - 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB)	1.63^{a}	1.80^{a}
T5 - 90:5:5 (SS)/ 5:90:5 (VS)/ 5:5:90 (RB)	1.83^{a}	1.90^{a}

Means with the same letter/s within a column are not significantly different by DMRT (P>0.05)

Return on Cash Expenses

Highest return on cash expense was noted from the application of 70:20:10 (SS), 20:70:10 (VS), 10:20:70 (RB) with a value of 149.05% which was due to higher marketable yield (Table 8). This means that for every peso spent to produce a kilogram of carrot, it generated a net income of 149.05. Whereas, the lowest return on cash expense was obtained from the control plots which was due to lower marketable yield. It is however presented that there is no significant difference on the return on cash expenses of plots applied with different rates of formulated organic liquid fertilizer in a farm under conversion. It was observed that there was a corresponding decrease in the yield of carrot in farms under conversion to organic production.

Carrot is the third most important crop in the Cordillera and some areas in the country (Bawang, 2006). It has the highest return on investment (R.O.I.) among the major vegetables in the industry.The average selling price of carrot is Php 80.00 basing on price for organically grown carrot in the market for the month of March 2011. Furthermore, the average price of the organic liquid fertilizers is Php 100.00 per liter.

Table 8. Return on cash expense of carrots as influenced by rates of formulated organic liquid plant supplements

TREATMENTreatments	ROCE((%))
T1 – Control	105.55[a]
T2 - 60:30:10 (SS)/ 30:60:10 (VS)/ 10:30:60 (RB)	108.95[a]
T3 - 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB)	149.05[a]
T4 - 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB)	117.49[a]
T5 - 90:5:5 (SS)/ 5:90:5 (VS)/ 5:5:90 (RB)	109.94[a]

Means with the same letter/s within a column are not significantly different by DMRT (P>0.05).

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The study was conducted at the Balili Experimental Area from December 2010 to March 2011 to determine the:1) effects of formulated organic liquid plant supplements on the growth and yield of carrot, 2) the best rate of the formulated organic liquid plant supplements for the production of carrot, and (3) the effects of the formulated organic liquid plant supplements on some physical and chemical properties of the soil. Results indicate that the chemical analysis of formulated organic plant liquid supplements contained all the essential plant nutrients; however, their concentrations were very low.

The application of formulated organic liquid plant supplements differed significantly on the total and marketable yield of carrot in a farm under conversion. Results showed that the control plots has the lowest total and marketable yield. Meanwhile, the plots applied with the rate of 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB) registered the highest total and marketable yield mean of 24.09 and 20.17.

Application of formulated organic liquid plant supplements at the rate of 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB) had the highest return on cash expense. However, it did not differ significantly with the control.

Similarly, the application of formulated organic liquid plant supplements at different rates differed `significantly effect on the soil organic matter and total nitrogen content of the soil. Results revealed that the highest organic matter and total nitrogen content of the soil were obtained from plots applied with the rate of 80:10:10 (SS)/ 10:80:10 (VS)/ 10:10:80 (RB).

Conclusions

Based on the findings, it is concluded that the application of formulated organic liquid plant supplements, although the plant nutrients are very low, can enhance better yield of carrot and improve soil properties in a farm under conversion to organic farming provided these are applied in stock solutions using the formulated liquid fertilizers at specific growth stages of the plants. Formulation with higher N content can be applied during seedling stage. The formulation with high P content can be applied during vegetative stage while the formulation with high K content can be applied during the root bulking stage.

Recommendations

It is therefore recommended that in farms under conversion to organic farming, the formulated organic liquid plant supplements at the rate of 70:20:10 (SS)/ 20:70:10 (VS)/ 10:20:70 (RB) can be applied to improve soil properties and produce higher yield of carrot. A follow-up study using the formulated organic liquid plant supplements at different rates is recommended to verify results and findings.

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