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EFFECT OF PARTIAL REPLACEMENT OF MINERAL N-FERTILIZER BY USING ORGANIC AND BIOFERTILIZERS ON GROWTH AND CHEMICAL COMPOSITION OF SOLO PAPAYA PLANTS

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ABSTRACT: ***An experiment was conducted under the full sun at the Research Tropical Farm, Kom Ombo, Hort. Res. Inst., Aswan, Egypt during 2016 and 2017 seasons to explore how far we can replace mineral N fertilizer which reduces the medicinal benefits of some plants by tea compost and EM biostimulant as safe and friend sources for human, animal and environment, and to study the effect of these sources when applying them at various rates in sole and combined treatments, including: control (no fertilization), 100 % NH_4NO_3 as a mineral N source (MN) at the recommend dose (8 g/plant), 75 % MN (6 g/plant) + 100 ml tea compost (TC) + 25 ml effective microorganisms (EM) solution, 50 % MN + 200 ml TC + 50 ml EM, 25 % MN + 300 ml TC + 75 ml EM and 400 ml TC + 100 ml EM as bioorganic treatment on growth and quality of 4-months-old seedlings of papaya (Carica papaya L. "Solo") grown in 20-cm-diameter black polyethylene bags filled with about 4 kg of loam. The previous treatments were applied as a soil drench per plant, four times with one month interval commencing from mid of June until mid of September.***

The obtained results indicated that the means of all vegetative and root growth parameters, contents of chlorophyll a, b, carotenoids, total carbohydrates and total soluble sugars in the leaves, as well as the uptake of N, P, K and Mg by plants were significantly increased in response to the different sole and combined fertilization treatments used relative to the control means in most cases of the two seasons. Incorporating both tea compost and EM biofertilizer with mineral N fertilizer at any rate in the former combinations gave better results than applying either mineral N fertilizer alone or tea compost with EM in the combined bioorganic treatment. In addition, means of the aforenamed measurements were progressively increased as the application rate of both tea compost and EM was increased, which was accompanied in the same time with a gradual decrement in rate of mineral N fertilizer.

Thus, the dominance in both seasons was for the combination of 25 % mineral N (2 g/plant) + 300 ml tea compost + 75 ml EM, which gave the highest values at all, except for the bioorganic combination (400 ml tea compost + 100 ml EM), that attained the utmost high content of chlorophyll a, b, carotenoids, total carbohydrates and total soluble sugars contents over all the other treatments.

Hence, it is advised to fertilize the four-months-old papaya seedlings planted in 20-cm-diameter black polyethylene bags with the low dose of mineral N fertilizer (2 g/plant) + 300 ml of compost tea + 75 ml of EM biostimulant to get the best growth and highest quality.

Key words: ***Papaya, mineral N-fertilizer, organic and biofertilizers.***

INTRODUCTION

Many fruit trees are used now for landscaping the private gardens due to its beautiful appearance. Among them may be papaya (*Carica papaya* L.) tree. It is a giant herbaceous plant resembling a

tree, but not woody in the Caricaceae family. Now is grown in tropical areas world-wide for its large sweet melon-like fruits which are consumed in fresh form or in the forms of juices, jams and crystallized dry fruit. It has a hollow green or purple stem, can reach height of 6-9 m. The long-petioled leaves of 30-105 cm long and 30-60 cm wide are deeply divided into 5-9 main segments which are further lobed (Bailey, 1976 and Huxley *et al*., 1992).

The fruits are riched in vit. A and C and calcium. Papain and chymopapain products were derived from young fruits, leaves and stem. Recent studies showed that papaya had beneficial effects as an anti-inflammatory agent, wound healing properties, anti-tumor, immunomochilatory effects and antioxidant. It was used for curing acute, subacute and chronic toxicity. The leaves contain cystatin, tocopherol, ascorbic acid, flavonoids and cyanogenic-glycosides glucosinolates. The alkaloids: flavonoids, saponins, tannins and glycosides are related with anti-inflammatory activity. Also, leaves have anti-bacterial effect, anti-tumor and immunomodulation activities (Agarwal *et al*., 2016; Pandey *et al*., 2016).

On the other side, indiscriminate use of the mineral fertilizers has a harmful effect on soil and human health, ground water health and environment. This will cause more dangerous effect for future possibility. So, we essentially need to safe quality of soil and ground water as well as healthy environment for better livelihood. These qualities are obtained by replacing the mineral inputs through the organic and bio-inputs which are more vital for present prospect and future outlook (Verma *et al*., 2017). Besides, the excessive use of mineral N fertilizers was found to cause a reduction in the medicinal benefits of papaya, and this has drawn the attention of scientific workers to use organic tea manure and effective microorganisms (EM), which are safe for human, animal and environment, to be a partial replacement for mineral N sources. In this respect, Miranda and Gil (2000) found that peat + organic nutrition was the most suitable treatment for better growth and development of papaya plants. Bhardwaj (2014) detected that the organic medium of vermicompost + sand + pond soil (1:1:1) with 2 cm cocopeat in top of polybags gave the tallest seedlings, leaf area, number of leaves, stem girth, number of roots, root length, root : shoot ratio and mineral uptake of papaya.

On ornamentals, Dhir *et al*., (2008) observed that the maximum plant height of *Aglaonema commutatum* was obtained by planting in the medium containing 100 % organic compost (rice husk) followed by cocopeat one. Likewise, Singh *et al*., (2009) reported that the overall best performance, flowering pattern and flower production of anthurium was recorded by the organic medium comprised of saw dust + brick pieces + wooden charcoal + sand + FYM (2:1:1:1:1). Recently, Wang *et al*., (2017) revealed that bio-organic fertilizer in continuous monoculture system of *Chrysanthemum morifolium* cv. Chuju significantly reduced *Fusarium oxysporum* population, but enhanced shoot biomass, flower diameter and flower yield in comparison with synthetic fertilizer.

Similar observations were also obtained on other crops by Kattimani (2004) on chilli, Kannan *et al*., (2006) on tomato, Sanwal *et al*., (2007) on turmeric, Vitakar *et al*., (2007), on chilli, Umesha *et al*., (2011) on *Solanum nigrum*, Tariq *et al*., (2013) on strawberry, Abd El-Wahab *et al*., (2016) on *Origanum vulgare*, Mukherjee and Sen (2017) on sesame, Santana *et al*., (2017) on guava and Cai *et al*., (2017) who mentioned that the

combination of organic and bio-fertilizers plus reducing chemical fertilizer application greatly improved plant growth and fungal diversity in cucumber monocropping system.

However, the current work aims to study the effect of combining between tea compost, biofertilizer (EM) and the different doses of mineral N fertilizer on growth performance and chemical composition of Solo papaya plant.

MATERIALS AND METHODS

In order to reveal the influences of heavy chemical N fertilizer application and the reduced doses of it supply with organic tea and EM biostimulant on growth and quality of Solo papaya plants, the present study was carried out at the Research Tropical Farm, Kom Ombo, Hort. Res. Inst., Aswan Governorate, Egypt throughout 2016 and 2017 seasons under the full sun.

Thus, the young uniform seedlings of *Carica papaya* L. "Solo" (4-months-old, about 25 cm long with 3-4 leaves) were planted on May, 15th for each season in 20-cm-diameter black polyethylene bags (one seedling/bag) filled with about 4 kg of loam. Some physical and chemical properties of the loam used in both seasons are shown in Table (a).

One month later (on mid of June), the following fertilization treatments were applied as a soil drench, four times with one month interval until September, 15th:

1- No fertilization, referred to as control.

2- Ammonium nitrate (33.5 % N) as a mineral N source (MN) at the recommended dose (8 g/plant, which represents 100 % MN).

3- Four combined treatments as follows:

a) 75 % MN (6 g/plant) + 100 ml of tea compost (TC) + 25 ml of the biostimulant EM/plant. EM is a commercial Japanese product contains more then 60 strains of Effective Microorganisms, viz., photosynthetic bacteria, lactic acid bacteria, yeast, actinomyces and various fungi and algae (Higa, 1991).

b) 50 % MN (4 g/plant) + 200 ml of tea compost (TC) + 50 ml of the biostimulant EM/plant.

c) 25 % MN (2 g/plant) + 300 ml of tea compost (TC) + 75 ml of the biostimulant EM/plant.

d) 400 ml of TC + 100 ml of EM/plant.

The tea compost was prepared by soaking 10 kg of Al-Bostan compost in 20 l of tap water for 4 days, then filtered and the filtrate was used as tea compost. The physical and chemical analysis of Al-Bostan compost used in this study are indicated in Table (b).

The routine agricultural practices were carried out in time as recommended for such plantation. The experimental design in the two seasons was a complete randomized design with three replicates of five seedlings for each (Mead *et al*., 1993). At the end of every season (on mid of October), the following data were recorded: plant height (cm), stem diameter at the base (mm), number of leaves/plant, root length (cm), as well as fresh and dry weights of leaves, stem and roots (g). In fresh leaf samples, the photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g f.w.) were determined according to the method of Moran (1982), while in dry ones, the contents of total carbohydrates % (Herbert *et al*., (1971), total soluble sugars as mg/g d.w. (Smith *et al*., 1956), as well as the uptake of N (Pregl, 1945), P (Cottenie *et al*., 1982), K (Jackson, 1973) and Mg (Dewis and Freitas, 1970) were measured.

Table (a). The physical and chemical analysis of the loam used in 2016 and 2017 seasons.

Soil texture	Particle size distribution (%)				S.P.	E.C. (mmhos/cm)	pH	Cations (meq/L)				Anions (meq/l)		
	Coarse sand	Fine sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
Loam	18.53	34.27	10.00	37.20	36.51	0.85	7.33	9.00	8.00	3.08	1.60	4.00	10.00	7.68

Table (b): Chemical and physical analysis of Al-Bostan compost used in the study.

Character	Content	Character	Content
Weight of m^3 (kg)	560	Organic carbon (%)	18.68
Humidity (%)	33	Ash (%)	67.79
pH (1-10)	7.94	C/N ratio	1:18.87
EC (1:10) dS/m	3.84	Total phosphorus (%)	0.83
Total nitrogen (%)	0.99	Total potassium (%)	1.02
NH4-N (ppm)	699	Weed seeds	-
NO3-N (ppm)	-	Nematode (pathogenetic)	-
Organic matter (%)	32.21	Nematode (non- pathogenetic)	-

Data were then tabulated and subjected to analysis of variance according to program of SAS Institute (2009), and the means were compared by the New L.S.D. method at 5 % level (Snedecor and Cochran, 1990).

RESULTS AND DISCUSSION

Effect of fertilization treatments on:

1. Vegetative and root growth characters:

It is obvious from data presented in Tables (1 and 2) that all fertilization treatments employed in this study greatly increased the means of plant height (cm), stem diameter (mm), No. of leaves/plant, root length (cm), as well as fresh and dry weights of leaves, stem and roots (g) with significant differences when compared to control means in most cases of the two seasons. However, incorporating both tea compost and EM biostimulant with mineral N fertilizer in the formulated combinations used gave better results than applying either mineral N fertilizer alone or tea compost with EM in combined treatment. This may be ascribed to lumping the benefits of mineral N fertilizer (ammonium nitrate) as a quick soluble source providing the plants with N in sufficient amount, tea compost as an organic source supplies the plants with the other macro-and micronutrients necessary for healthy growth and EM as a biofertilizer activating growth, inducing plant disease resistance, creating humus and regulating basic relations in the soil. It has ability to break down organic matter, thereby providing plant nutrients and enhancing soil physical and chemical properties (Janas, 2009). It may produce natural hormones, antibiotics, vitamins, organic matter and improve microbial activity, soil aggregation, water retention and N fixation (Bhasme *et al*., 2006; Cai *et al*., 2017).

Table (1): Effect of fertilization treatments on some growth traits of *Carica papaya* L. "Solo" plants during 2016 and 2017 seasons.

Fertilization treatments	Plant height (cm)		Stem diameter (mm)		No. leaves per plant		Root length (cm)	
	2016	2017	2016	2017	2016	2017	2016	2017
Control (No fertilization)	40.43	41.00	7.60	8.20	3.50	3.90	11.65	12.90
100 % mineral N (M N)	50.51	51.21	9.50	10.23	4.87	5.11	14.58	16.15
75 % MN + 100 ml TC + 25 ml EM	71.00	71.87	10.50	11.13	8.50	8.93	18.03	19.67
50 % MN + 200 ml TC + 50 ml EM	80.46	82.33	13.45	14.20	11.00	11.00	21.76	23.20
25 % MN + 300 ml TC + 75 ml EM	98.90	99.96	17.00	17.91	15.33	15.00	26.00	27.71
400 ml TC + 100 ml EM	46.00	47.50	8.86	9.50	4.10	4.36	13.79	15.73
New L.S.D. at 5 % level	2.91	3.31	0.71	0.81	0.80	0.80	1.40	1.21

TC = tea Compost, EM = Effective microorganisms and L.S.D. = Least significant difference.

Table (2): Effect of fertilization treatments on fresh and dry weights of *Carica papaya* L. "Solo" plants during 2016 and 2017 seasons.

Fertilization treatments	Fresh weight (g)			Dry weight (g)		
	Leaves	Stem	Roots	Leaves	Stem	Roots
First season; 2016						
Control (No fertilization)	3.31	17.30	7.12	1.23	5.73	2.41
100 % mineral N (M N)	4.16	21.63	8.89	1.55	7.21	3.10
75 % MN + 100 ml TC + 25 ml EM	10.00	24.50	12.10	3.56	9.10	4.21
50 % MN + 200 ml TC + 50 ml EM	15.51	41.31	18.09	5.61	13.41	6.50
25 % MN + 300 ml TC + 75 ml EM	23.00	62.00	29.51	7.11	22.33	8.17
400 ml TC + 100 ml EM	3.43	19.50	8.36	1.50	6.21	2.76
New L.S.D. at 5 % level	0.61	1.41	0.79	0.80	1.01	0.41
Second season; 2017						
Control (No fertilization)	3.55	17.59	8.01	1.28	6.41	2.91
100 % mineral N (M N)	4.47	22.00	10.00	1.63	8.03	3.75
75 % MN + 100 ml TC + 25 ml EM	10.51	24.91	13.29	3.59	9.92	4.98
50 % MN + 200 ml TC + 50 ml EM	16.30	41.39	19.31	5.70	14.10	7.25
25 % MN + 300 ml TC + 75 ml EM	23.41	62.46	30.73	7.19	23.07	8.86
400 ml TC + 100 ml EM	3.75	20.18	9.20	1.55	7.24	3.41
New L.S.D. at 5 % level	0.63	1.31	0.93	0.71	1.09	0.51

TC = tea Compost, EM = Effective microorganisms and L.S.D. = Least significant difference.

Data also exhibited that means of the previous characters were progressively increased with increasing the application rate of both tea compost and EM which was accompanied with a gradual decrease in the level of mineral N fertilizer. So, the superiority was for the combined treatment of 25 % mineral N + 300 ml tea compost + 75 ml EM, which recorded the highest values over control and all the other sole and combined treatments in both seasons. This may be due to the combination between the high rate of tea compost and EM along with the low level of mineral N. On the other hand, combining between the highest rate of tea compost (400 ml/plant) and the highest one of EM (100 ml/plant) scored averages of various growth parameters less than 100 % mineral N treatment. This means that combinations between organic and biofertilizers in the presence of the least amount of mineral N resulted better growth than using organic + biofertilizers only.

The previous results are in parallel with those explored by Miranda and Gil (2000) and Bhardwaj (2014) on papaya, Dhir *et al*., (2008) on *Aglaonema commutatum*, Singh *et al*., (2009) on anthurium and Wang *et al*., (2017) on *Chrysanthemum morifolium*. In this regard, Kattiamani (2004) stated that the application of organics, viz. FYM + chilli stalks with inorganic fertilizers (RDF) significantly improved growth, yield and quality of chilli and the magnitude of combined effect of organic and inorganics was higher than inorganic alone. Kannan *et al*., (2006) claimed that different organic N sources significantly influenced the growth and yield of tomato, and substitution of 100 % N as FYM recorded taller plant, more No. branches/plant and more yield comparable to that of 100 % N as urea. Moreover, Vitakar *et al*., (2007) mentioned that application of 50 % N through tea compost and 50 % through neem cake produced the tallest plant, highest No. branches and fruits/plant, fruit weight, fruit length and diameter and total yield per hectare compared to the recommended dose of mineral N in chilli. Recently, Mukherjee and Sen (2017) indicated that application of the full dose of SSm-39 as soil bioinoculant with low dose of mineral fertilizer in sesame cultivation greatly enhanced growth and the microbial diversity.

2. Chemical composition of the leaves:

A similar trend to that of vegetative and root growth parameters, was also obtained concerning chlorophyll a, b and carotenoids (mg/g f.w.), total carbohydrates (%) and total soluble sugars (mg/g d.w.) contents, which were significantly increased in response to the different individual and combined fertilization treatments used (Table, 3). However, the prevalence in the two seasons was for 400 ml tea compost + 100 ml EM bioorganic combination, that gave the utmost high content of the various aforenamed constituents at all. Also, a progressive increment in this components was induced as a result of increasing tea compost and EM rates, which was coupled with reducing the level of mineral N. This may be attributed to the synergistic effect of tea compost, EM and mineral N fertilizer to lump their positive effects in supplying the plants with sufficient nutrients and active materials which accelerate biosynthesis and improve nutritional status in the plants.

Data listed in Table (4) exhibited that uptake of N, P, K and Mg minerals (mg/plant) took as well a similar behaviour to those of vegetative and root growth traits as the uptake of these minerals was greatly increased by the various sole and combined treatments used with the mastership of 25 % mineral N + 300 ml tea compost + 75 ml EM combined application, which caused the highest uptake relative to control and all the other treatments in the two seasons. This may indicate the role of organic manures and their extracts in improving the electrical conductivity (EC), pH and humates content in the soil and increasing cation exchange capacity (CEC) and fertility of it (Handreck and Black, 2002). Besides, the role of EM as a biofertilizer contains more than 60 strains of microorganisms in enhancing soil fertility, fixing atmospheric N, mobilizing phosphate and other nutrients to be more available for plants, producing natural hormone-like substances and vitamins, plus increasing microbial activity and water relation (Higa, 1991).

On the same line, were those results detected by Bhardwaj (2014) on *Carica papaya*, Umesha *et al*., (2011) on *Solanum nigrum* and Abd El-Wahab *et al*., (2016) on *Origanum vulgare*. In this concern, Kattimani (2004) noticed that application of organics + inorganic fertilizers significantly improved nutrients uptake by chilli plants. Baliah *et al*., (2016) revealed that organic extracts as a partial replacement of mineral fertilizers positively increased chlorophyll content, glucose content, free amino acids, protein content and RNA in treated plants over control ones of okra. Furthermore, Santana *et al*., (2017) found that biofertilizer + 50 % of mineral N fertilizer promotes significant enhancement on vitamin C and pH of guava fruits. Mukherjee and Sen (2017) postulated that application of the full dose of *Candida* sp. SSm-39 with the low dose of mineral fertilizer enhanced the soil nutrient availability and nutrient uptake efficiency in sesame cultivation.

From the aforementioned gains, it is recommended to use a combination of 25 % mineral N fertilizer (NH_4NO_3) + 300 ml tea compost + 75 ml EM to fertilize papaya seedlings for the best growth with high quality.

Table (3): Effect of fertilization treatments on pigments, total carbohydrates and total soluble sugars contents of *Carica papaya* L. "Solo" plants during 2016 and 2017 seasons.

Fertilization treatments	Chlorophyll (a) (mg/g f.w.)		Chlorophyll (b) (mg/g f.w.)		Carotenoids (mg/g f.w.)		Total carbohydrates (%)		Total soluble sugars (mg/g d.w.)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
Control (No fertilization)	1.70	1.75	0.95	0.97	0.92	0.98	27.26	27.01	2.05	2.37
100 % mineral N (M N)	2.11	2.20	1.18	1.22	1.15	1.23	34.10	33.80	2.61	3.00
75 % MN + 100 ml TC + 25 ml EM	2.63	2.71	1.51	1.46	1.33	1.38	35.28	36.71	3.48	4.10
50 % MN + 200 ml TC + 50 ml EM	3.15	3.10	1.79	1.73	1.50	1.58	37.46	38.09	4.50	5.16
25 % MN + 300 ml TC + 75 ml EM	3.92	3.87	2.11	2.10	1.79	1.81	40.10	40.36	5.63	6.27
400 ml TC + 100 ml EM	4.25	4.12	2.50	2.39	1.89	1.99	41.33	41.50	7.30	7.15
New L.S.D. at 5 % level	0.41	0.43	0.21	0.20	0.18	0.16	1.03	1.21	1.01	0.93

TC = tea Compost, EM = Effective microorganisms and L.S.D. = Least significant difference.

Table (4): Effect of fertilization treatments on uptake of nitrogen, phosphorus, potassium and magnesium by *Carica papaya* L. "Solo" plants during 2016 and 2017 seasons.

Fertilization treatments	Uptake of N (mg/plant)		Uptake of P (mg/plant)		Uptake of K (mg/plant)		Uptake of Mg (mg/plant)	
	2016	2017	2016	2017	2016	2017	2016	2017
Control (No fertilization)	151.00	173.80	17.81	20.01	105.00	123.10	39.00	41.93
100 % mineral N (M N)	189.20	221.31	22.30	25.11	130.41	160.00	48.20	53.30
75 % MN + 100 ml TC + 25 ml EM	283.21	322.60	34.89	38.70	213.50	256.67	82.76	91.71
50 % MN + 200 ml TC + 50 ml EM	456.63	491.20	58.91	64.76	259.71	329.10	150.51	161.78
25 % MN + 300 ml TC + 75 ml EM	701.40	748.65	93.10	99.79	398.36	411.81	263.30	280.71
400 ml TC + 100 ml EM	232.31	269.46	26.50	31.78	172.70	216.73	79.25	97.33
New L.S.D. at 5 % level	11.90	12.31	2.71	3.01	12.11	12.31	13.29	14.11

TC = tea Compost, EM = Effective microorganisms and L.S.D. = Least significant difference.

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تأثير الاستبدال الجزئي للسماد الأزوتي المعدني باستخدام السماد العضوي والحيوي على النمو والتركيب الكيماوي لنباتات الباباظ (صنف سولو)

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الملخص العربي

أجريت تجربة تحت الشمس الساطعة بالمزرعة الاستوائية البحثية، معهد بحوث البساتين، كوم أمبو، أسوان، خلال موسمي ٢٠١٦، ٢٠١٧ لمعرفة إلى أي مدى يمكن استبدال السماد الأزوتي المعدنى والذي يؤدي إلى خفض الفوائد الطبية لبعض النباتات (ومنها الباباظ) باستخدام شاي الكومبوست والمنشط الحيوي EM كمصادر آمنة وصديقة للإنسان والحيوان والبيئة، ولدراسة تأثير الجمع بين هذه المصادر عند إضافتها بمستويات مختلفة في معاملات فردية أو مشتركة، تشتمل على: المقارنة (بدون تسميد)، ١٠٠ % نترات أمونيوم كمصدر للأزوت المعدني بالجرعة الموصى بها (٨ جم/نبات)، ٧٥ % أزوت معدني (٦ جم/نبات) + ١٠٠ مل شاي كومبوست + ٢٥ مل من محلول المنشط الحيوي EM، ٥٠ % أزوت معدني (٤ جم/نبات) + ٢٠٠ مل شاي كومبوست + ٥٠ مل من محلول EM، ٢٥ % أزوت معدني (٢ جم/نبات) + ٣٠٠ مل شاي كومبوست + ٧٥ مل من محلول EM و ٤٠٠ مل شاي الكومبوست + ١٠٠ مل من محلول EM كتوليفة عضوية حيوية (خالية تماماً من الأزوت المعدني) على نمو وجودة شتلات الباباظ *Carica papaya* L. ("Solo"، عمر أربعة أشهر النامية في أكياس بلاستيك سوداء عالية الكثافة قطرها ٢٠ سم ومملوءة بحوالي ٤ كجم طمي. ولقد أضيفت المعاملات السابقة أربعة مرات لكل نبات كإضافة أرضية بفاصل شهر بين كل مرتين بدءاً من منتصف يونيو وحتى منتصف سبتمبر.

أوضحت النتائج المتحصل عليها أن متوسطات جميع قياسات النمو الخضري والجذري، محتوى الأوراق من كلوروفيللي أ، ب، الكاروتينويدات، الكربوهيدرات الكلية والسكريات الكلية الذائبة، وكذلك امتصاص النباتات لعناصر النيتروجين، الفوسفور، البوتاسيوم والمغنسيوم قد زادت معنوياً استجابة لمختلف معاملات التسميد الفردية والمشتركة المستخدمة بهذه الدراسة عند مقارنتها بمتوسطات الكنترول في معظم الحالات بكلا الموسمين. ولقد أدى الجمع بين كل من شاي الكومبوست والمنشط الحيوي EM مع السماد الأزوتي المعدني بأي معدلات في التوليفات التى تم إعدادها في هذه الدراسة إلى إعطاء نتائج أفضل من إضافة الأزوت المعدني بمفرده أو شاي الكومبوست مع الـ EM في التوليفة الحيوية المشتركة. إضافة إلى ذلك، فإن متوسطات جميع القياسات سالفة الذكر قد زادت تصاعديا كلما زاد معدل إضافة كل من شاي الكومبوست والـ EM والذي كان مصحوباً في الوقت نفسه بانخفاض تدريجي في معدل إضافة السماد الأزوتي المعدني. لذلك، فإن السيادة في كلا الموسمين كانت للتوليفة المكونة من ٢٥ % أزوت معدني (٢ جم نترات أمونيوم/نبات) + ٣٠٠ مل شاي الكومبوست + ٧٥ مل من الـ EM والتي أعطت أعلى القيم على الإطلاق، باستثناء المعاملة الحيوية العضوية المشتركة (٤٠٠ مل شاي الكومبوست + ١٠٠ مل EM) والتي أحرزت أعلى محتوى من كلوروفيللى أ، ب، الكاروتينويدات، الكربوهيدرات الكلية، السكريات الذائبة مقارنة بجميع المعاملات الأخرى.

وعليه؛ يمكن النصح بتسميد شتلات الباباظ (صنف سولو)، عمر أربعة أشهر والمنزرعة في أكياس بلاستيك سوداء عالية الكثافة قطرها ٢٠ سم ومملوءة بحوالي ٤ كجم من الطمي بالجرعة الأدنى من السماد الأزوتي المعدني (٢ جم/نبات) + ٣٠٠ مل من شاي الكمبوست + ٧٥ مل من المنشط الحيوي EM للحصول على أفضل صفات نمو وأعلى جودة.

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