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Effect of Compost Tea and some Nutrient Supplements on Growth and Yield of Two Potato Cultivars

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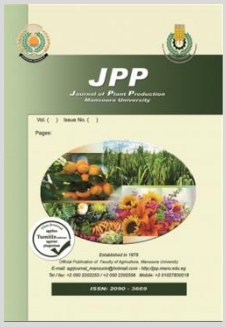

ABSTRACT

A field experiment was carried out during two summer seasons of 2017and 2018 at Private Farm, at El-Salhyia District, Sharkia Governorate, Egypt, to study the effect of compost tea and some nutrient supplements on growth and yield of some potato cultivars (Bavana and Eliance) grown in loamy sand soil conditions. The results showed that, Bavana cultivar gave higher number of main stems/plant, shoots dry weight/plant and total chlorophyll in leaf tissues, whereas Eliance cultivar gave higher values of plant height, number of tubers/plant, average tuber weight, tuber yield/plant and total yield/ fed. and spraying potato plants with compost tea supplemented with NH_4NO_3(0.5g/l) + molasses (0.5% v/v) led to increased number of leaves/plant, shoots dry weight, number of tubers/plant, average tuber weight, tuber yield/plant and total yield/ fed. In addition, spraying Bavana cultivar with compost tea supplemented with NH_4NO_3 + molasses or molasses or NH_4NO_3 gave the maximum values of number of main stems/plant, total chlorophyll, total carbohydrates and starch with no significant differences between them. On the other hand, spraying Eliance cultivar with compost tea supplemented with NH_4NO_3+molasses increased significantly plant height. Moreover, the interaction treatments between Bavana or Eliance plants and spraying compost tea supplemented with NH_4NO_3+ molasses or with molasses had significant effect on average tuber weight, tuber yield/plant, total yield/fed., DM% and P%. In addition, spraying Eliance cultivar with compost tea supplemented with NH_4NO_3 increased P and K contents in tubers, while, N and total protein in tubers were significantly enhanced due to spraying Bavana cultivar with compost tea supplemented with NH_4NO_3.

Keywords: potato, compost tea, some nutrient supplements, cultivars, growth and yield.

INTRODUCTION

Potato (*Solanum tuberosum* L.)is, generally, enlisted as promising crop for both local consumption and exportation. It is one of the most important vegetable crops in Egypt. Moreover, potato is an important source of food worldwide. Potato tubers are a rich source of nutrients , including carbohydrates, protein and amounts of certain groups of vitamins, fiber, trace elements and minerals. Also, it is a good source of antioxidants (Chen *et al*., 2007)and potato is used in many industries such as French fries, chips, starch and alcohol production (Abdel-Aal *et al*., 1977). Both total yield and quality factors of potato are affected by cultivars, environmental conditions and cultural practices.

The use of compost tea is becoming interesting for applications in agriculture and it is gaining importance as an alternative to chemical fertilizers and pesticides with current trend towards organic agriculture production (Theunissen *et al.*, 2010;Pane *et al*.,2014)

Compost tea is a highly concentrated microorganisms solution produced by extracting beneficial microbes from compost and its extraction period ranging from few hours to two weeks, with or without active aeration with the addition of some active nutrients i. e., molasses, casein, etc. It can use it as foliar or soil inoculation as organic nutrients (Zaccardelli *et al*., 2012). Moreover, consisting of essential components required for cell division and elongation due to being enriched in macro and microelements,vitamins and phytohormones to increase growth (Emino and Warman, 2004).

the benefits of using compost teas in agriculture are: biostimulation and improvement of crop yield and quality, suppression of plant pathogenic microorganisms and, supplying the plant with water-soluble nutrents and the stimulation of root and vegetative growth (Hibar *et al*., 2006 ;Hegazy *et al.*, 2013;Jamal and Ozra, 2014).Compost tea are widely used as an alternative nutrient supplement to improve the quality of plant production in field grown (Naidu *et al*., 2013).These crops, mostly field vegetables such as potatoes tend to be healthier and less susceptibility to diseases after compost tea application (Larkin, 2008).Also, the application of compost tea actually increased the use efficiency of mineral N fertilizer by crops and lower the environmental pollution through reducing the amounts of fertilizers added to the soil (Siddiqui *et al.*, 2011 and Moursy, 2013).

Several investigators reported that plants growth and yield were improved by compost tea application (Islam *et al.*, 2013; Samuel *et al*., 2013 ; El-Mougy *et al.*, 2014 on potato and Zaccardelli *et al.*, 2018 on pepper). Also, many reports regarded the direct implication of compost tea treatments on the chemical, physical and, especially, on the sensory properties of vegetables such as lettuce (Masarirambi *et al*., 2010) and potato (Wszelaki *et al*., 2005).In addition, due to compost tea, the physiological and nutritional status of the plants increased, as noticed by foliar chlorophyll content assessment measured during crop cycles (Pane *et al*., 2014).

Many compost tea producers include additives in order to increase the populations and diversity of

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microorganisms (Pane *et al*., 2012). Molasses, kelp extract, fish emulsion and rock dust have been used as cheap and commonly available nutritional sources (Scheuerell and Mahaffee, 2004; Ingham, 2005; Naidu *et al*., 2010).The additives would affect the C:N ratio and the forms of carbohydrates or nitrogen source in the extraction medium, which should change the composition of the microbial group such as bacteria, actinomycetes and fungi.

The objective of this study was to evaluate the effect of compost tea and some nutrient supplements on growth , yield and quality of two potato cultivars.

MATERIALS AND METHODS

This work was carried out during two summer seasons of 2017and 2018 at Private Farm, at El-Salhyia District, Sharkia Governorate, Egypt, to study the effect of compost tea and some nutrient supplements on growth and yield of some potato cultivars (Bavana and Eliance).The soil type of those seasons was loamy sand with pH(7.8- 8.2), E.C. (0.9-1.4) dsm^{-1}andorganic matter from 0.50- 0.96 %.

This experiment included eight treatments which were the combinations between two cultivars and three treatments of compost tea and some nutrient supplements as well as control (spraying with tap water) as follows:

A:Cultivars:

1.Bavana
2.Eliance

B: Compost tea and some nutrient supplements:

1.Control (spraying with tap water).
2.Compost tea (CT) + ammonium nitrate (AN) at 0.5 g/l + molasses (M) at 0.5%v/v
3.CT + M.
4.CT + AN.

These treatments were arranged in a split plot design system with three replications. The cultivars were randomly arranged in the main plots, while compost tea and some nutrient supplements as well as control were randomly distributed in the sub plots. Tuber seeds of Bavana and Eliance cultivars were sown on 10thJanuary in both seasons of the study at 20 cm apart. The experimental plot area was 27 m^2. It contains three dripper lines with 10 m length and 90 cm distance between each two dripper line. One line was used to measure the vegetative growth parameters and the other two lines were for yield determination. In addition, one line was left between each experimental plot as a guard area to avoid the overlapping spraying solution.

Preparation of compost tea:

Solid compost made up of town-refuse compost, which was obtained from the Cairo Organic Fertilizers Company, Cairo, Egypt. It has an organic carbon of 30%, total nitrogen of 1.0%, moisture of 35%, and pH 7.5±0.2. Compost tea (water extract of compost) was prepared in the Agric. Microbiology Department Laboratory Faculty of Agriculture, Zagazig University, Egypt, according to the method of Ingham (2005) with some modifications (Hegazy *et al*., 2015). One kilogram fresh weight of garbage compost was sealed in a cotton bag and submerged into 20 L of tap water in 40 L plastic bucket. The water used was pump aerated for 30 min to remove chlorine before addition to the compost. Compost soaking was done in the lab at room temperature (average 25°C) for 96 hours and it was continuously aerated (10 L/min air delivery per bucket through air stones). Three types of compost teas were prepared:

1- Compost tea + NH_4NO_3 (0.5g /l).
2- Compost tea + molasses (0.5% v/v).
3- Compost tea + NH_4NO_3 (0.5g /l) + molasses (0.5% v/v).

The parameters of pH, EC and percentages of total nitrogen, phosphorus and potassium were determined in compost tea at the end of incubation according to the method of A.O.A.C. (2002).These parameters are represented in Table 1.

Table 1. Properties of the compost tea used in this study

Treatments	pH	E.C. (dsm^{-1})	Total N (mg L-1)	Total P (mg L-1)	Total K (mg L-1)
compost tea + NH_4NO_3	7.3	2.65	35.22	16.73	451.0
compost tea + molasses (0.5% v/v).	7.4	1.67	1.73	16.80	453.0
compost tea + NH_4NO_3 (0.5g /l) + molasses (0.5% v/v).	7.3	2.75	37.22	16.78	452.0

Microbial populations in the compost teas i.e. bacteria, aerobic N_2-fixing bacteria, actinomycetes and fungal populations were determined. Bacteria were enumerated on nutrient agar (Difco,1985),Aerobic N_2-fixing bacteria (ANFB) was done using the most probable number (MPN) technique of Abd-El-Malek (1971) on Ashby modified medium. Actinomycetes were enumerated on starch casein agar (Conn and Leci, 1998),whereas fungi were enumerated on Martin's rose bengal agar (Martin, 1950).The microbial population in microbe-enriched compost teas are represented in Table 2.

Table 2. Microbial populations in microbe-enriched compost teas.

Microorganisms	Compost tea+ NH_4NO_3	Compost tea + molasses (0.5% v/v).	Compost tea + NH_4NO_3 (0.5 g /l) + molasses (0.5% v/v).
Bacteria (log10 CFU/ml)	7.48	7.71	8.12
N_2-fixing bacteria (ANFB) (log10 CFU/ml)	1.34	3.44	2.10
Actinomycetes (log10 CFU/ml)	2.72	2.35	2.50
Fungi(log10 CFU/ml)	2.50	2.72	3.10

All experimental units received equal amounts of commercial fertilizers(kg fed.) at the rates of 120 kg N, 80kgP_2O_5 and 100kg K_2O as ammonium sulphate (20.6%N),triple superphosphate (37%P_2O_5) and potassium sulphate (48% K_2O),respectively. One third of the commercial fertilizers was added at soil preparation along with FYM (20m^3/fed.).The rest of commercial fertilizers (two thirds) were added as fertigation by 7 days intervals beginning one month after planting. The normal agricultural practices were carried out as commonly followed in the district.

Data recorded:

Plant growth measurements:

A random sample of five plants was taken from every plot at 60 days after planting, in both seasons, for measuring the growth characters of potato plants expressed as follows: plant height (cm),number of main stems/plant, number of branches/plant, number of leaves/plant and dry weight of shoots/plant. Leaf Chlorophyll Content: total chlorophyll was determined using chlorophyll meter (SPAD502,Osaka,Japan) which estimate SPAD value according to the method of Castelli *et al*. (1996).

Yield and its components:

At harvesting time (120 days after planting), tubers from each plot were collected, weighted and counted and the following data were recorded: number of tubers per plant, tuber yield per plant, average tuber weight, total yield (ton/feddan) and relative yield(%).

Fruit quality:

1. **Minerals content (%):** Total nitrogen, phosphorus and potassium were determined according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Jackson (1970), respectively.
2. **Total protein (%):** It was calculated by multiplying total nitrogen x 6.25.
3. **Total carbohydrates (%):** It was determined colorimetrically using the methods described by Dubois *et. al.* (1956).
4. **Starch content:** It was determined according to the methods described by AOAC (1970).
5. **Dry matter (D.M. %):** One hundred grams of tubers were dried at 105°C till constant weight and the DM% was calculated.

Statistical analysis:

All the obtained data were statistically analysis using the COSTAT program and means separation were done by least significant value (L.S.D) at 0.05 level of probability according to Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Plant growth and total chlorophyll

a. Effect of cultivars

Data in Table 3 show that there were significant differences between two potato cultivars (Bavana and Eliance) with respect to plant height ,number of main stems /plant, shoots dry weight/plant and total chlorophyll, except shoots dry weight in the 2nd season, Eliance cultivar was higher plant height compared to Bavana, whereas Bavana cultivar was higher number of main stems /plant, shoots dry weight/plant and concentration of total chlorophyll in leaf tissues compared to Eliance cultivar .There were no significant differences between two cultivars with respect to number of both branches and leaves /plant in both seasons.

The differences among potato cultivars in different traits could be attributed to the genetic differences between cultivars, the growth habits and their ability for utilizing the environmental sources. These results are in agreement with those reported by Henricksen and Molgaard (2005)and Farag *et al*. (2013).

Table 3. Effect of cultivars on plant growth and total chlorophyll of potato plants during 2017 and 2018 seasons

Characters / Treatments	Plant height(cm)	Number of main stems/ plant	Number of branches / plant	Number of leaves/ plant	Shoots (aerial stems+ leaves) dry weight(gm)	Total chlorophyll (SPAD)
Cultivars			2017 season			
Bavana	37.29	3.51	1.65	21.41	18.53	39.90
Eliance	41.54	2.11	1.51	20.29	18.09	32.60
L.S.D at 0.05 level	0.82	0.91	N.S.	N.S.	0.44	2.20
			2018 season			
Bavana	37.25	3.26	1.56	21.70	18.56	38.75
Eliance	40.87	2.26	1.52	20.41	18.16	30.26
L.S.D at 0.05 level	3.66	0.28	N.S.	N.S.	N.S.	2.08

N.S.: Not significant at 0.05 level of probability.

b. Effect of compost tea

The obtained results in Table 4indicated that spraying potato plants with compost tea supplemented with NH_4NO_3 , molasses or NH_4NO_3 + molasses increased plant height , number of main stems/plant, number of branches/plant and number of leaves /plant as well as total chlorophyll in leaf tissues compared to control (spraying with tap water) in both seasons. Compost tea + NH_4NO_3 (0.5g/l) recorded the tallest plants and gave the highest values of number of main stems /plant , number of branches/plant and concentration of total chlorophyll in leaf tissues in both seasons with no significant differences with some treatments. Compost tea + NH_4NO_3 (0.5g/l) + molasses (0.5% v/v) increased number of leaves/plant and shoots dry weight/plant in both seasons with no significant differences with some treatments. The increases in shoots dry weight were about 14.40 and 14.75% for compost tea + NH_4NO_3 + molasses and 13.88 and 13.55% for compost tea + molasses over the control (spraying with tap water) in the 1st and 2nd seasons, respectively.

The favourable effect of compost tea treatments on plant growth and total chlorophyll might be attributed to the beneficial effects of compost tea that contains many macro and micro nutrients in available form, natural hormones such as cytokines, gibberellins, indoleacetic acid, vitamins and antioxidants that be available for plant and so reflect on plant growth and its composition (Meshref *et al*., 2010 ; Ertani *et al*., 2013; Zhang *et al*., 2013 and Pane *et al*., 2014).

Table 4. Effect of compost tea on plant growth and total chlorophyll of potato plants during 2017 and 2018 seasons

Characters / Treatments	Plant height (cm)	Number of main stems/ plant	Number of branches/ plant	Number of leaves/ plant	Shoots(aerial stems + leaves) dry weight(gm)	Relative increase in shoots dry weight (%)	Total chlorophyll (SPAD)
			2017 season				
Control	34.25	1.76	1.17	16.58	16.71	100	29.65
CT+AN + M	40.25	3.04	1.61	25.33	19.13	114.40	35.95
CT + M	37.41	3.24	1.66	19.50	19.06	113.88	40.00
CT+AN	45.75	3.20	1.89	22.00	18.34	109.75	39.41
L.S.D at 0.05 level	3.95	0.35	0.19	2.93	0.57	-	3.78
			2018 season				
Control	34.16	1.95	1.15	15.91	16.75	100	26.80
CT+AN + M	40.16	3.01	1.62	26.08	19.22	114.75	38.15
CT + M	37.91	3.03	1.76	20.41	19.02	113.55	37.46
CT+AN	44.00	3.06	1.64	21.83	18.46	110.21	35.61
L.S.D at 0.05 level	2.70	0.49	0.29	3.44	0.64	-	3.88

CT= compost tea , AN =ammonium nitrate , M= molasses , control (spraying with tap water).

Also, the favourable effect of combinations of compost tea and nutrient supplements (NH_4NO_3 and amolasses) treatments on plant growth might be attributed to might be attributed to the beneficial effects of nutrient supplements that increased the population and activity of microorganisms and improve quality of compost tea (Kavroulakis *et al*., 2005 ;Naidu *et al*., 2010 ;Pane *et al*., 2012 ; Zaccardelli *et al*., 2012 and Hegazy *et al*., 2015) and due to the chemical composition of the molass, which is a complex carbohydrate containing a variety of minerals (Castle and Watson, 1985).

The results were agreement with Naidu *et al*., (2013) who reported that microbial-enriched compost tea inciting a global physiological response in treated muskmelon plants, including increases in chlorophyll content, caused stimulation of growth , Bernal-Vicente *et al*. (2008) reported significant increases in melon biomass produced by roottreatments of nursery plants with compost extracts carrying auxinic and cytokininic-like compounds, also, due to an assessed auxin-like activity, humic-like substances from compost extracts promoted cucumber growth and increased chlorophyll content in leaves (Xu *et al*., 2012).In addition, increasing plant performance traits from foliar and soil application of compost teas were further reported for pepper (Zaccardelli *et al.*, 2018), and foliar spray of compost tea may be used as an alternative environment friendly means of plant disease control to increase crop growth and yield of potato with maximum profit (Islam *et al.* ,2013).

c. Effect of the interaction between cultivars and compost tea

The interaction between cultivars and foliar spray with compost tea supplemented with NH_4NO_3 , molasses or NH_4NO_3 + molasses, increased plant height, number of main stems/plant, number of branches/plant, number of leaves/plant and shoots dry weight /plant as well as concentration of total chlorophyll in leaf tissues compared to the interaction between two cultivars and control in both seasons (Table 5) .

The interaction between Bavana cultivar and foliar spray with compost tea + NH_4NO_3 (0.5 g/l) recorded the tallest plants and gave the highest values of number of main stems /plant , number of branches /plant , number of leaves/plant and total chlorophyll in both seasons with no significant differences with few treatments. In addition, The interaction between Bavana cultivar and spraying with compost tea + NH_4NO_3 + molasses increased shoots dry weight/plant with no significant differences with the interaction between Bavana cultivar and foliar spray with compost tea + molasses in both seasons.

The increases in shoots dry weight /plant were about 17.79 and 18.35 % for the interaction between Bavana cultivar and compost tea + NH_4NO_3 + molasses and 16.95 and 18.41% for the interaction between Bavana cultivar and compost tea + molasses over the interaction between Bavana cultivar and control in the 1st and 2nd seasons, respectively.

Table 5. Effect of the interaction between cultivars and compost tea on plant growth and total chlorophyll of potato plants during 2017 and 2018 seasons

Characters / Treatments		Plant height (cm)	Number of main stems/ plant	Number of branches / plant	Number of leaves/ plant	Shoots(aerial stems + leaves) dry weight(gm)	Relative increase in shoots dry weight (%)	Total chlorophyll (SPAD)
Cultivars x Compost tea				201 7 season				
Bavana	Control	31.33	2.25	1.19	15.33	16.63	100.00	32.86
	CT+AN + M	35.00	3.83	1.67	24.33	19.59	117.79	40.20
	CT + M	36.83	4.00	1.63	20.83	19.45	116.95	43.46
	CT+AN	46.00	3.97	2.12	25.16	18.48	111.12	43.06
Eliance	Control	37.16	1.27	1.15	17.83	16.79	100.96	26.43
	CT+AN + M	45.50	2.25	1.55	26.33	18.68	112.32	31.70
	CT + M	38.00	2.48	1.68	18.16	18.68	112.32	36.53
	CT+AN	45.50	2.43	1.66	18.83	18.21	109.50	35.76
L.S.D at 0.05 level		5.58	0.50	0.28	4.15	0.81	-	5.34
				201 8 season				
Bavana	Control	32.16	2.44	1.19	16.33	16.56	100.00	31.03
	CT+AN + M	34.50	3.33	1.49	25.00	19.60	118.35	41.23
	CT + M	36.83	3.50	1.84	21.00	19.61	118.41	40.66
	CT+AN	45.50	3.80	1.72	24.50	18.49	111.65	42.06
Eliance	Control	36.16	1.45	1.11	15.50	16.93	102.23	22.56
	CT+AN + M	45.83	2.69	1.75	27.16	18.85	113.82	35.06
	CT + M	39.00	2.56	1.67	19.83	18.43	111.29	34.26
	CT+AN	42.50	2.33	1.56	19.16	18.42	111.23	29.16
L.S.D at 0.05 level		3.82	0.69	0.41	4.874	0.90	-	5.49

CT= compost tea , AN =ammonium nitrate , M= molasses , control (spraying with tap water).

2.Yied and its components

a.Effect of cultivars

Data in Table 6 show that there were significant differences between Bavana and Eliance cultivars with respect to number of tubers /plant , tuber yield /plant and total yield /fed., but ther were no significant differences between two cultivars with respect to average tuber weight in 1st season. Eliance cultivar gave higher number of tubers/plant, yield /plant and total yield /fed.. than Bavana cultivar in both seasons.

The increase in total yield/fed. for Eliance cultivar may be due to increase in number of tubers /plant (Table 6) and plant height(Table 3).

The variability among the two cultivars might be due to the different genetic factors between them. The obtained results are in accordance with those of (Abdel -Aal and Imam,1984) who found that wide variation in yield and quality of tubers due to high genetic variability among different cultivars of potato.

Table 6. Effect of cultivars on yield and its components of potato plants during 2017 and 2018 seasons

Characters / Treatments	Number of tubers / plant	Average tuber weight (gm.)	Tuber yield / plant (g.)	Total yield (ton / fed.)
cultivars		2017 season		
Bavana	9.25	68.16	645.84	15.06
Eliance	11.35	70.99	798.89	18.64
L.S.D at 0.05 level	1.83	N.S.	137.46	3.20
		2018 season		
Bavana	9.30	67.59	638.96	14.90
Eliance	11.18	70.19	781.13	18.36
L.S.D at 0.05 level	3.03	2.52	135.36	3.26

N.S.: Not significant at 0.05 level of probability.

b. Effect of compost tea

Data in Table 7 illustrate that spraying potato plants with compost tea supplemented with NH_4NO_3 , molasses or NH_4NO_3 + molasses increased number of tubers/plant, average tuber weight, yield/plant and total yield/fed. compared to control (spraying with tap water) in both seasons. Foliar spray with compost tea + NH_4NO_3 (0.5g/l) + molasses (0.5%v/v) significantly increased number of tubers/plant, average tuber weight, yield/plant and total yield/ fed. with significant differences with compost tea + molasses in the 2nd season.

Table 7. Effect of compost tea on yield and its components of potato plants during 2017 and 2018 seasons

	Number of tubers / plant	Average tuber weight (gm.)	Tuber yield / plant (kg.)	Total yield (ton / fed.)	Relative increases in total yield(%)
			2017 season		
Control	9.20	51.71	476.02	11.10	100
CT+AN + M	12.16	78.74	958.32	22.36	201.44
CT + M	10.54	77.55	802.57	18.72	168.64
CT+AN	9.29	70.30	652.57	15.22	137.11
L.S.D at 0.05 level	1.30	2.07	78.61	1.83	-
			2018 season		
Control	9.87	51.08	503.52	12.02	100
CT+AN + M	11.08	78.11	864.92	20.18	167.85
CT + M	10.25	77.05	787.72	18.37	152.82
CT+AN	9.77	69.31	684.03	15.96	132.77
L.S.D at 0.05 level	1.27	2.70	87.49	2.00	-

CT= compost tea , AN =ammonium nitrate , M= molasses , control (spraying with tap water).

The increase in total yield fed. were about 101.44 and 67.88% for compost tea + NH_4NO_3 + molasses, 68.64 and 52.82% for compost tea + molasses and 37.11 and 32.77% for compost tea + NH_4NO_3 over the control.

The increase in total yield for compost tea + NH_4NO_3 + molasses treatment may be due to this treatment increased number of tubers/plant, average tuber weight and yield/plant (Table 7) and number of leaves/plant and shoots dry weight /plant (Table 4).

From the foregoing results, it could be concluded that, spraying potato plants with compost tea + NH_4NO_3 (0.5g/l) + molasses(0.5%v/v) increased number of tubers/plant, average tuber weight, yield/plant and total yield/ fed.

The favourable effect of compost tea and nutrient supplements on total yield might be attributed to positive effects to compost tea on the crops because contains many macro and micro nutrients in available form, natural hormones and the highest number of microorganisms that be available for plant and so reflect on plant growth and its composition (Meshref *et al*., 2010) that led to improve yield. Moreover, the highest yield was recorded with compost tea. This was probably due to increase in the number of tubers/plant, average tuber weight, yield/plant which might contribute to the increase in production .

These results confirm those reported by (Naidu *et al*., 2013 on muskmelon plants, Samuel *et al* ., 2013 and ElMougy *et al*., 2014 on potato plants), and Islam *et al.* (2013) found that, foliar spray of compost tea may be used as an alternative environment friendly means of plant disease control to increase crop growth and yield of potato with maximum profit .In addition, Moursy (2013)reported that tuber yield significantly increased by application 50% compost treatment with 50% chemical fertilizer as compared all treatment.

c. Effect of the interaction between cultivars and compost tea

The obtained results in Table 8 illustrate that, The interaction between two cultivars and foliar spray with compost tea + NH_4NO_3 + molasses or compost tea + NH_4NO_3 or compost tea + molasses increased number of tubers/plant, average tuber weight, tuber yield/plant and total yield/ fed. compared the interaction between two cultivars and control treatment in both seasons.

Table 8. Effect of the interaction between cultivars and compost tea on yield and its components of potato plants during 2017 and 2018 seasons

Characters / Treatments		Number of tubers / plant	Average tuber weight (gm.)	Tuber yield / plant (kg.)	Total yield (ton / fed.)	Relative increases in total yield (%)
Cultivar x Compost tea				2017 season		
Bavana	Control	7.00	51.54	360.23	8.40	100
	CT+AN + M	12.25	77.67	952.67	22.22	264.52
	CT + M	10.33	75.67	778.30	18.16	216.19
	CT+AN	7.41	67.77	492.17	11.47	136.54
Eliance	Control	11.41	51.89	591.80	13.80	164.28
	CT+AN + M	12.08	79.81	963.97	22.49	267.73
	CT + M	10.75	79.43	826.83	19.29	229.64
	CT+AN	11.16	72.84	812.97	18.96	225.71
L.S.D at 0.05 level		1.84	2.93	111.17	2.59	-
				2018 season		
Bavana	Control	8.16	51.53	420.40	9.80	100
	CT+AN + M	10.83	77.09	834.23	19.46	198.57
	CT + M	10.50	75.42	789.07	18.41	187.85
	CT+AN	7.70	66.30	512.13	11.94	121.83
Eliance	Control	11.58	50.63	586.63	14.24	145.30
	CT+AN + M	11.33	79.13	895.60	20.89	213.16
	CT + M	10.00	78.68	786.37	18.34	187.14
	CT+AN	11.83	72.32	855.93	19.97	203.77
L.S.D at 0.05 level		1.80	3.82	123.73	2.83	-

CT= compost tea , AN =ammonium nitrate , M= molasses , control (spraying with tap water).

The interaction between Bavana or Eliance cultivars and spraying with compost tea + NH_4NO_3 (0.5 g/l) + molasses (0.5%v/v) significantly increased number of tubers/plant, average tuber weight, yield/plant and total yield/ fed. with no significant differences with some the interaction treatments.

The increases in total yield/ fed. were about 164.52 and 98.57% for the interaction between Bavana cultivar and compost tea + NH_4NO_3 + molasses and 167.73 and 113.16% for the interaction between Eliance cultivar and compost tea + NH_4NO_3 + molasses over the interaction between Bavana cultivar and control treatment.

The results were agreement with Samuel *et al.*(2013) who suggested that compost tea can be used to produce optimum tuber yields in potato production of potato cultivars.

3.Tuber quality

a. Effect of cultivars

Data in Table 9 show that there were no significant differences between Bavana and Eliance cultivars with respect to DM%, total carbohydrates, total protein, starch, N,P and K contents in tubers in both seasons. b. Effect of compost tea

Table 9. Effect of cultivars on tubers quality of potato plants during 2017 and 2018 seasons

Characters / Treatments	Dry matter (D.M.) (%)	Total carbohydrates (%)	Total protein (%)	Starch (%)	Minerals content (%) N	P	K
cultivars			2017 season				
Bavana	25.71	81.52	12.66	71.72	2.20	0.234	3.25
Eliance	25.23	80.52	12.69	72.48	2.20	0.234	3.39
L.S.D at 0.05 level	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
			2018 season				
Bavana	25.82	81.44	12.77	70.65	2.22	0.237	3.27
Eliance	25.07	81.03	12.79	72.61	2.22	0.226	3.35
L.S.D at 0.05 level	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

N.S.: Not significant at 0.05 level of probability.

Spraying potato plants with compost tea + NH_4NO_3 or molasses or NH_4NO_3+ molasses increased DM%, total carbohydrates, total protein, starch, N,P and K contents in tubers compared to control (Table 10).

Compost tea + NH_4NO_3+ molasses and compost tea + molasses increased DM% and P contents in tubers, but there were no significant differences between spraying with compost tea + NH_4NO_3+ molasses or compost tea + molasses or compost tea + NH_4NO_3 with respect to total protein, N in first season and total carbohydrates, starch and K contents in tubers in both seasons

Similar results were reported by many other investigators like Abou-El-Hassan and Desoky (2013) on head lettuce and Naidu *et al.* (2013) on muskmelon plants.

Table 10. Effect of compost tea on tubers quality of potato plants during 2017 and 2018 seasons

Characters / Treatments	Dry matter (D.M.) (%)	Total carbohydrates (%)	Total protein (%)	Starch (%)	Minerals content (%) N	P	K
			2017 season				
Control	23.75	74.20	10.70	63.06	1.86	0.197	3.08
CT+AN + M	26.27	83.57	12.90	75.28	2.24	0.243	3.37
CT + M	26.64	84.31	13.18	76.10	2.29	0.261	3.46
CT+AN	25.22	82.01	13.92	73.96	2.42	0.236	3.37
L.S.D at 0.05 level	0.48	3.67	1.01	2.46	0.17	0.021	0.20
			2018 season				
Control	23.64	74.33	10.93	63.59	1.90	0.197	3.10
CT+AN + M	26.40	84.33	12.73	75.65	2.21	0.252	3.30
CT + M	26.19	84.07	13.21	74.89	2.29	0.245	3.49
CT+AN	25.54	82.19	14.25	72.40	2.47	0.232	3.35
L.S.D at 0.05 level	0.42	3.01	0.91	3.31	0.15	0.018	0.21

CT= compost tea, AN =ammonium nitrate, M= molasses, control (spraying with tap water).

c. Effect of the interaction between cultivars and compost tea

Data in Table 11 show that, in general, spraying Bavana and Eliance cultivars with compost tea + NH_4NO_3 or NH_4NO_3 + molasses or molasses increased DM%, total carbohydrates, total protein, starch, N,P and K contents in tubers compared to spraying these cultivars with tap water.

Table 11. Effect of the interaction between cultivars and compost tea on tubers quality of potato plants during 2017 and 2018 seasons

Characters / Treatments		Dry matter (D.M.) (%)	Total carbohydrates (%)	Total protein (%)	Starch (%)	Minerals content (%) N	P	K
Cultivars x Compost tea				2017 season				
Bavana	Control	23.77	73.38	10.65	62.74	1.85	0.195	3.14
	CT+AN + M	26.61	84.32	12.99	76.01	2.26	0.245	3.18
	CT + M	26.79	85.85	12.34	75.67	2.14	0.265	3.32
	CT+AN	25.68	82.53	14.66	72.48	2.55	0.233	3.35
Eliance	Control	23.74	75.02	10.75	63.39	1.87	0.199	3.02
	CT+AN + M	25.93	82.81	12.82	74.55	2.23	0.241	3.57
	CT + M	26.49	82.78	14.03	76.53	2.44	0.258	3.60
	CT+AN	24.76	81.50	13.18	75.44	2.29	0.239	3.39
L.S. D at 0.05 level		0.68	5.19	1.44	3.48	0.25	0.030	0.28
				2018 season				
Bavana	Control	23.76	73.24	10.71	63.55	1.86	0.200	3.15
	CT+AN + M	26.85	84.50	12.78	76.37	2.22	0.262	3.16
	CT + M	26.82	85.38	12.55	73.31	2.18	0.254	3.33
	CT+AN	25.84	82.63	15.04	69.37	2.61	0.230	3.44
Eliance	Control	23.52	75.42	11.15	63.64	1.94	0.195	3.05
	CT+AN + M	25.95	84.16	12.68	74.93	2.20	0.242	3.44
	CT + M	25.57	82.77	13.87	76.47	2.41	0.235	3.65
	CT+AN	25.24	81.76	13.45	75.43	2.34	0.234	3.27
L.S.D at 0.05 level		0.60	4.25	1.29	4.69	0.22	0.026	0.30

CT= compost tea , AN =ammonium nitrate , M= molasses , control (spraying with tap water).

CONCLUSION

Based on results obtained from this study, compost tea and some nutrient supplements could be recommended to induces of potato plant growth and yield.

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تأثير شاي الكومبست وبعض الإمدادات الغذائية على نمو ومحصول صنفين من البطاطس

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أجريت تجربة حقلية خلال موسمى صيف 2017/ ، 2018 بمزرعة خاصة بمنطقة الصالحية ، محافظه الشرقية وذلك لدراسة تأثير شاى الكومبست وبعض الإمدادات الغذائية على نمو ومحصول بعض أصناف البطاطس (بافانا ، اليانس) النامية تحت ظروف الأرض الطمييية الرملية. وقد أظهرت النتائج أن الصنف بافانا أعطى أعلى عدد للسيقان الرئيسية/ النبات ، الوزن الجاف للعرش والكلورفيل الكلى فى أنسجه الورقة، بينما أعطى الصنف اليانس أعلى القيم لارتفاع النبات ، عدد الدرنات / النبات، متوسط وزن الدرنة ، محصول الدرنات للنبات والمحصول الكلى للفدان . أدى رش نباتات البطاطس بشاى الكومبست مع سلفات النشادر بمعدل 0.5 جم / لتر+ المولاس بتركيز0.5 % حجم/ حجم الى زيادة عدد الأوراق / النبات ، الوزن الجاف للعرش ، عدد الدرنات / النبات، متوسط وزن الدرنة ، محصول الدرنات للنبات والمحصول الكلى للفدان. بالإضافة الى ذلك سجل رش الصنف بافانا بشاى الكومبست مع سلفات النشادر + المولاس أو المولاس أوسلفات النشادر الى الحصول على أعلى القيم عدد للسيقان الرئيسية/ النبات ، الوزن الجاف للعرش والكلورفيل الكلى فى أنسجة الورقة والكربوهيدرات الكلية والنشا وبدون فروق معنويه بينهم. على الجانب الاخر سجل رش الصنف اليانس بشاى الكومبست مع سلفات النسادر + المولاس الى زيادة معنويه فى إرتفاع النبات ، ومع ذلك سجلت التفاعلات بين الصنفين بافانا أو اليانس والرش بشاى الكومبست مع سلفات النشادر + المولاس أو مع المولاس تأثيرا معنويا على متوسط وزن الدرنة ، محصول الدرنات للنبات والمحصول الكلى للفدان ، نسبة المادة الجافة ، النسبة المئوية للفوسفور، بالإضافه الى ذلك فقد سجل رش الصنف اليانس بشاى الكومبست مع سلفات النشادر الى زياده محتوى الدرنات من الفوسفور والبوتاسيوم ، بينما إزداد معنويا محتوى الدرنات من النيتروجين والبروتين الكلى برش الصنف بافانا بشاى الكومبست مع سلفات النشادر .