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EFFECT OF FOLIAR AND SOIL APPLICATION OF SOME RESIDUALS OF SUGAR CANE PRODUCTS (MOLASSES AND VINASSES) WITH MINERAL FERTILIZER LEVELS ON GROWTH, YIELD AND QUALITY OF SWEET PEPPER

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ABSTRACT: *The present study was carried out to determine the effect of some* residuals of *sugar cane products i.e., molasses and vinasses* on the vegetative growth, *yield and quality of sweet pepper (Capsicum annuum L.) cv. California Wonder in the Experimental Farm of Kaha research Station, Qalubia Governorate during two summer seasons of 2017 and 2018 years were studied.* The experiment was set up using split-plot design with three replicates where the fertilization rates with three percents (50%, 75% and 100%) from the recommended mineral fertilization of sweet pepper were assigned in the main plots, while the foliar and the soil application of molasses and vinasses with two rates (4% and 6% as foliar spray) and applied to soil with two rates (60 and 120 L/ fed.) were distributed in the sub plots. *The results* of this study indicate that, *the highest rates from* recommended mineral fertilization *75 % and 100% compared with 50% showed significant increase* on the vegetative growth *characters, yield and its component as well as fruit quality. Concerning to the influence of the treatments* of foliar spray or soil application of molasses and vinasse*s recorded significant differences increases on the vegetative growth characters i. e.; plant length, stem diameter, number of branches and leaves / plant, leaf area/plant and dry weight of plant as well as fruit characters and fruit yield with best quality in both growing seasons. The best treatments were the highest rates from molasses or vinasses* (6% as foliar spray) or obtained from using (120 L/ fed. as soil application) *compared with the other treatments. Regarding to the interactions between* mineral fertilization levels and foliar spray or soil application of *molasses and vinasses. The same data clear significant effect of the previous treatment on all vegetative growth parameters and fruits yield with best quality of sweet pepper plants. The superior values were observed with 75 % and100 % of the recommended mineral fertilization with adding molasses or vinasses either soil application at the rates of 60 or 120 L/fed or foliar spray at rate of* 6% *comparing to mineral fertilizer alone.*

Generally it can said that, addition of some residuals of *sugar cane products i. e., molasses or vinasses improved the vegetative growth and fruits yield with best quality of sweet pepper plants compared with the control (mineral fertilization only) and save 25% from the fertilizer recommendation and recognized the highest benefit cost ratio.*

Key words: Sweet pepper, *mineral fertilizer,* molasses, vinasses, *fruits yield, quality* .

INTRODUCTION

In Egypt, sweet pepper (*Capsicum annuum* L.) is one of the most popular and favorite vegetable crop cultivated for local market and exportation. Pepper consider is the third important crop of Solanaceae family after tomatoes and potatoes. It is a valuable food, rich in antioxidants, vitamins and minerals. So, sweet pepper has occupied an important rank in Egyptian and world agriculture due to its high profit and nutritional values for human health (Mengel and

Kirkby (1982) and Rajput and Poruleker, 1998).

As a general the plants require nitrogen, phosphor and potassium as a certain mineral nutrients to grow and to produce yield, the pepper plants require largest quantities from its and some of these fertilizer losses through the soil, in addition availability of nutrient has been reported to be directly related to yield (Roberts, 2001). Devi *et al.* (2002) obtained better fruit weight and fruit yield of eggplant with the application of 120 kg (NPK) per hectare. Also Doss *el al.* (2015) revealed that the gradual increases of NPK fertilizer levels were accompanied with significant increases on sweet potato growth, yield and its components.

Recently, the high cost of fertilizers and concerns about environmental protection have been great incentives to focus on the possibility of using natural and safe agents for promoting growth and yield of vegetable crops, for example, utilizing organic residues in agriculture contributes to the conservation of natural resources by recycling carbon and mineral elements. Such as the organic residues produced through manufacture of the sugar and alcohol agro-industries whereas have great potential for use its in conservation agriculture. The production of sugar and alcohol generates large quantities of bio-products, such as vinasses, the quantity of vinasse production depends on the processing technique employed and also on the wine composition, which varying between 10 and 18 liters of vinasses per liter of alcohol production, it can be used it as soil improvers and substitutes for inorganic phosphorus and potassium fertilizers as mentioned by *Silva et al.* (2007) and Renato *et al.* (2013). Vinasses is an aqueous effluent of the distillation unit in the sugar-alcohol industry and it consider as problem to the sector and this due to producing high amounts of its and potential effects as an environmental pollutant. It is contain large amounts of water, organic matter, and mineral elements. The environmental damage caused by discharging vinasses into the soil or running waters causing big problem while it can using it as a economic applications for this residue as natural organic material and using its in agriculture. In this regard some investigators reported that, it can properly using vinasse contributes to improvement the soil quality Silva *et al.*(2006) and Gemtos *et al.* (1999) and agricultural productivity Zolin *et al.* (2011) Madejon *et al.* (2001) and Paulino *et al.* (2002). Vinasses in natural case is a dilute solution and its application to soil directly reach to high quantities, causing more use difficult in the sites of production. However, vinasses can be concentrated by evaporation, resulting in a product with higher economic viability that can be transported to distant locations or to the sandy soil. It was found that the organic matter, K, N, Ca, and Mg are the main chemical components of vinasses, K being the most important mineral element for the agricultural. Therefore, vinasses is a source of nutrients, organic matter, and by adding it can contribute to increased productivity of sugar cane Resende *et al* . (2006), with positive effects on the chemical Silva *et al.* (2006), physical, Jiang *et al.* (2012), and biological Laime *et al.* (2011) on soil attributes, moreover, Li *et al.* (2008) and Mo *et al.* (2009) In China, found that sugar cane plants treated with vinasses has increased productivity and sucrose yields. Also, In Brazil, Zolin *et al.* (2011) and Paulino *et al.* (2002) reported that, at long-term application of vinasses (150 m3 ha−1 year−1) in sugar cane production confirmed positive effects on productivity and increased potassium concentration in the soil. In Spain,

Madejón (2001) found that the yields of beets and maize were compared after treatments with an organic compound based on vinasses or a mineral fertilizer; they found that the crop production was similar in both treatments indicating that the utilization of vinasse is a viable alternative for mineral fertilizers. Therefore, conservation practices, like the employment of residues in agriculture can contribute to increased agricultural productivity whilst minimizing environmental pollution.

Another residues it can producing it by the sugar agro-industries and using it in agriculture, this product is molasses. Molasses is the residual syrup from the processing of sugar beet and sugar cane (Honma *et al.*, 2012). Molasses is produced annually in large amounts and were used in different industries including animal feeding, alcohol and fertilizers. The use of sugar beet molasses in agriculture stimulates nutrient elements uptake efficiency and soil biological contents because sugar beet molasses contains different amounts of humic, fulvic and amino acids (Samatav and Samatav, 2014). Humic and Fulvic acids have a significant effect on plant growth (Samatav and Samatav, 2014). The use of sugar beet molasses in agriculture is enhancing nutrient elements uptake efficiency and increasing soil biological activity. In sugar beet molasses, contain different amounts of humic, fulvic and amino acids. Fulvic acid due to the small molecular structure is more efficient to penetrate to the plant roots. Pujar (1995) reported that foliar application of molasses increased uptake of Zn, Cu, Fe and Mn in corn and wheat compared to the control. Chandraju (2008) reported that the using of a diluted solution of molasses will increase nutrient uptake and yield of leafy vegetables like cabbage. Mohammadi and Torkashv (2008) reported that using molasses increased total nitrogen, potassium and decreased unavailable phosphorus in the soil. It also, increased the growth of shoot length, leaf number per plant, leaf area and chlorophyll content of peas (Rani, and Vastava, 1990). Moreover, Şanlı *et al.* (2015) on sugar beet studied that, addition different concentrations of molasses to the soil and to the plant leaves at different doses (0, 25, 50, 75 and 100 kg/ha) 3 times during the vegetation period, and found that, Molasses applications significantly increased root yield and its quality compared to the control, at the same time soil applications were more effective than foliar applications for all parameters studied. So that molasses can be used effectively in order to increase sugar beet yield and its quality.

Therefore, the objective of this work was to study influence of using some residuals of sugar cane manufacture (molasses and vinasses) as a soil or foliar application on growth, yield, and quality of sweet pepper and reflect of that on increasing fruit yield and minimizing mineral fertilization rates.

MATERIALS AND METHODS

The experiment was conducted at the Experimental Farm of Kaha, Qalubia Governorate, Egypt to investigate the effect of using molasses and vinasses as a soil or foliar application on growth, yield, and quality of sweet pepper (Capsicum annuum L. cv. California Wonder.) under three rates, i.e., (50 %, 75% and 100%) from the recommended mineral fertilization of sweet pepper plants.

The present investigation was conducted during two successive summer seasons of 2017 and 2018. Seeds of sweet pepper (Capsicum annuum L. cv. California Wonder.) were sown under plastic house in nursery at the first week of February during both

2017 and 2018 seasons and received the recommended agricultural practices of the nursery. After 50 days from seeds sowing, healthy seedlings were selected and transplanted in the open field at 35cm apart between the seedlings in one side of the ridge (4.0 m length and 0.7 m width). The plot area was (8.4 m^2) which includes 3 ridges. The soil texture was clay characterized with the following characteristics: Coarse sand 13.9%, Fine sand 9.1%, Silt 26 %, Clay 51%, Organic matter 1.66%, pH 7.8, EC dS/m 2.2, available macronutrients (ppm): N 53.3, K 60.35, P 4.1, anions, HCO_3 – 3.5, CL- 11.0, SO_4-2 6.45 and cations Na+ 8.8, Ca+2 3.9, Mg+2 8.1 and K+ 0.15. Physical and chemical properties were analyzed as described by Piper (1950).

The experiment was set up using split-plot design with three replicates, whereas the fertilization rates (50%, 75% and 100%) from the recommended mineral fertilization of sweet pepper plants i.e., 130 kg N+ 45kg P_2O_5+72 kg K_2O / fed, were assigned in the main plots, while the foliar and the soil application of molasses and vinasses with two rates (4% and 6% as foliar spray) and applied to the soil with two rates (60 and 120 L/ fed.) which were distributed in the sub plots. Different concentrations of molasses and vinasses as mentioned were applied to the soil and to plant leaves as foliar spray 3 times during the vegetation period, the first time was at 30 days after transplanting and repeated each 15 days interval. The treatment of the residuals of sugar cane manufacture, i.e molasses and vinasses, which obtained that from El-Hawamidyah Integration Instruction Company (E S I I C). Its composition and its concentration are shown in Table (1) data was obtained from USDA nutrition table.

The experiment included 27 treatments, which were the combinations between the fertilization rates and molasses or vinasses treatments as follows:

A-The main plots:

Three rates of NPK (50, 75 and 100% from the recommended mineral fertilization of sweet pepper plants (130 kg N+ 45kg P_2O_5+72 kg K_2O / fed.)

Table (1): The compositions of the residuals of sugar can manufacture (molasses and vinasses)

Constituent	Molasses	Vinasses
Brix	86.50	11.01
pH	5.01	4.31
Ash (%)	39.5	25.00
Ca (%)	1.58	4.06
SO_4 mg/l	19	14
P (%)	0.3	0.24
N (%)	0.61	0.47
K (%)	1.5	1.6
Dry matter	66.8	29.31
Protein%	3.81	2.92
Reducing sugars (%)	24.9	4.43

B-The sub plots, which contained the following nine treatments:

1- Control, which fertilized by the recommended mineral fertilization only.
2- Molasses foliar spray 4% (MF).
3- Molasses foliar spray 6% (MF).
4-Molasses soil application 60 L / fed. (MS) (It added through three times i.e., 30, 45 and 60 days from transplanting).
5- Molasses soil application 120 L fed. (MS) (It added through three times i.e., 30, 45 and 60 days from transplanting).
6-Vinasses foliar spray 4% (VS).
7- Vinasses foliar spray 6% (VS).
8-Vinasses soil application 60 L/fed. (VS) (It added through three times i.e., 30, 45 and 60 days from transplanting).
9-Vinasse soil application 120 L/fed. (VS) (It added through three times i.e., 30, 45 and 60 days from transplanting).

Data recorded:

1- Vegetative growth parameters:

Three plants were chosen randomly from each sub plot treatments at the flowering stage (after 85 days from transplanting) in order to determine each of: plant height (the length of main stem cm), stem diameter (cm), number of leaves and branches /plant, leaf area/ plant as well as average plant dry weight (weights of leaves and stems/ plant (g).

The leaf area was calculated according to the following formula of Wallace and Munger (1965).

Leaf area (cm^2) = Leaves dry weight (g) x disk area / disk dry weight (g)

2- Fruit yield and its characteristics:

Five sweet pepper fruits were randomly selected from each sub plot at the second picking to determine the following data:

Fruit length (cm), fruit diameter (cm), fruit flesh thickness (cm), total soluble solids (TSS), average fruit weight (g) and dry matter percent in fruits. i.e 100 g from fruit was taken and dried at 70 C^o till constant weight and the dry weight was determined – Number of fruits / plant, fruits yield / plant (kg) and total fruits yield (ton/fed) were also estimated.

3- Chemical properties:

Total nitrogen, potassium and phosphor were determined in the dry fruits on the basis of dry weight according to the methods described by Bremner and Mulvaney (1982), Olsen and Sommers (1982) and Chapman and Pratt (1961), respectively.

Total ascorbic acid: (Vitamin C mg/100g fresh weight) content was determined using 2, 6 dichlorophenol indophenols pigment, as method described by Ranganna (1979).

Total leaf chlorophyll was measured using Minolta chlorophyll meter. SPAD-501as SPAD units.

4- Economic study:

Economic performance of sweet pepper yield, i.e., gross return, treatment cost, total variable cost, net return and benefit-cost ratio were calculated based on market prices as average of the two seasons. The benefit-cost ratio was determined according to Boardman *et al.,* (2001) by dividing the gross return (£E /fed)) on total variable cost (£E /fed).

5- Statistical analysis:

All data were subjected to the statistical analysis of variance and treatment means were compared according to the Least Significant Differences (L. S. D. at 5 % level) test method as described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

I- Effect of fertilization levels and foliar spray or soil application by some residuals of sugar cane

products (molasses and vinasses) treatments on the vegetative growth:

I.1 Effect of mineral fertilization rates:

The vegetative growth characters which determined in this study i. e., plant height, stem diameter, number of leaves and branches/plant, leaf area/plant as well as plant dry weight of sweet pepper plants were affected by different rates of the recommended mineral fertilization as shown in Table (2). The data revealed that, all different fertilization rates of (NPK) recorded a significant increase on the vegetative growth parameters in both growing seasons of the study. The highest values were obtained when adding 100% followed by 75% of the recommended doses of mineral fertilization. Many investigators reported that increasing the amount of NPK-fertilizer caused an increase in the vegetative growth of sweet pepper plants such as (Roberts, 2001) who reported that, as general the plants need nitrogen, phosphor and potassium as a certain mineral nutrients to grow and to produce yield, whereas its require its in the largest quantities.

I.2 Effect of foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) treatments:

The results in Table (2) show the vegetative growth parameters as affected by addition of molasses or vinasses either as foliar spray or as soil application. The data illustrated that, using the previous treatments recorded significant increases on the vegetative growth characters i. e.; plant length, stem diameter, number of branches and leaves / plant, leaves area/plant and dry weight of plant in both growing seasons when the plants were sprayed by molasses or vinasses with the two rates (4% and 6%) or by soil application of molasses and vinasses with the two rates (60 and 120 L/ fed.) comparing to the control treatment which gave the lowest values. But, Soil applications were more effective than foliar applications for all studied parameters. While, the highest values were obtained with soil applications from molasses and vinasses especially with the highest rate i, e., 120 L/ fed. The enhancing effect of vinasses may be due to its contain of several nutrients such as organic matter, K, N, Ca, and Mg are the main chemical components of vinasses. (Silva*, et al*., 2006*),* with its effect on the physical, (Jiang *et al*., 2012), on the biological (Resende *et al*., 2013), on the chemical and (Laime *et al.,* 2011) of the soil attributes. Another results indicate that, properly used, vinasses contributes to improvements the soil quality (Silva *et al*., 2006) and Gemtos *et al*. (1999) and agricultural productivity (Zolin *et al.* ,2011) Madejon *et al*., 2001) and Paulino *et al.,* 2002).

In addition, using sugar beet molasses in agriculture enhancing nutrient elements uptake efficiency and soil biological activity increases because sugar beet molasses which its contains different amounts of humic, fulvic and amino acids as remembered by (Samatav and Samatav, 2014), Pujar,1995) and Chandraju, 2008).

1-3 Effect of the interactions between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) on vegetative growth of sweet pepper plants:

Data illustrated in (Table 3) show the interactions between fertilization levels and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) on the vegetative growth characters. It is clear

Table 2

Table 3

that, the two materials in its combination induced significant effect on all vegetative growth parameters of sweet pepper plant i.e., plant length, number of branches and leaves / plant, leaves area/plant and dry weight/ plant except stem diameter in the second growing season. The superior values of vegetative growth were observed from the combination of 75 % and100 % of the recommended mineral fertilization with soil application of molasses at the rate of 60 or 120 L/fed and vinasses at the rate of 60 or 120 L/fed, comparing to fertilizer additions alone (control).

II - Effect of mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasse) on the fruit characters of sweet pepper plants.

II.1 Effect of mineral fertilization rates:

Data in Table (4) show that, the statistical analysis at ($p< 0.05$) reveal that the increasing fertilization rates from the low level to the highest one has a significant effect on the fruit quality characters of sweet pepper, i.e., fruit length, fresh fruit weight in both seasons. While fruit diameter and dry matter in the fruit were significant in the second season but not reach to significant level in the first season. T.S.S in the fruit not reached to significant level in the second season, while the flesh fruit thicknesses not reach to significant level in both season. This result are in the same line with Devi *et al*. (2002) obtained better fruit weight and fruit yield of eggplant with the application of 120 kg (NPK) per hectare. Also Doss *el al*. (2015) revealed that the gradual increases of NPK fertilizer levels were accompanied with significant increases on sweet potato yield and its components.

II.2 Effect of foliar spray and soil application by some residuals of sugar cane products (molasses and vinasses) treatments:

It is clear from Table (4) that foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) increased significantly fruit length , fruit diameter, fresh fruit weight, T.S.S in pepper fruits as well as dry matter % in the both growing seasons expect the fruit flesh thickness which not reach to the significance level. The best treatments in this respect were obtained from the highest rates of molasses and vinasses compared with the other treatments. This results are in the same line with Şanlı *et al.* (2015) on sugar beet found that, Molasses applications significantly increased root yield and its quality compared to the control, at the same time soil applications were more effective than foliar applications for all parameters studied. So that molasses can be used effectively in order to increase sugar beet yield and its quality.

II -3 Effect of the interaction between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) on the fruit characters of sweet pepper plants

The interactions between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products on the fruit quality are shown in Table (5). The data indicate that fruit length and fresh fruit weight increased significantly in all treatments of the interactions at the high level of fertilization by (100%) rate with soil application of molasses and vinasses at the rate of 60 L/fed or 120 L/fed followed by fertilization by75% rate with soil application of molasses at 120 L/fed in both growing seasons while, fruit

Table 4

Table 5

diameter and T.S.S of the fruits significantly increased in one season. But, it isn't notice significant in the fruit flesh thickness and dry matter in both seasons. The highest values were obtained by using soil application of molasses and vinasses with mineral fertilizer at rate of 100% and 75% from the recommended doses fertilization.

III- Effect of mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) on the total fruits yield of sweet pepper plants:

III.1 Effect of mineral fertilization rates:

According to the data in Table (6), the obtained results revealed that fruits number/plant, yield/plant (kg) and total fruit yield (ton/fed) were significantly increased with the high rates of fertilizations (75% and 100%) from the recommended doses of mineral fertilization of sweet pepper plants without significant level between them severally whereas, the increment reached to (11.076 -10.822 ton/fed.) and (12.017-11.656 ton/fed.) with75% and 100% comparing with the 50% which produced (8.154-7.859 ton/fed) at the two seasons respectively. The results are similar of that obtained by, Devi *et al.* (2002) who found that, better fruit yield of eggplant with the application of 120 kg (NPK) per hectare. Also Doss *el al.* (2015) revealed that the gradual increases of NPK fertilizer levels were accompanied with significant increases on sweet potato yield.

Table (6): Effect of mineral fertilization rates and foliar spray or soil application by residuals of some sugar cane products on the yield of sweet pepper plants during the two seasons of 2017 -2018

Treatments	N. of fruits / plant		Yield / plant (kg)		Total fruit yield (ton/fed)	
	2017	2018	2017	2018	2017	2018
Recommended fertilization:						
50% NPK	36.556	35.693	2.744	2.259	8.154	7.859
75% NPK	42.598	38.328	3.915	2.894	11.076	10.822
100% NPK	41.370	39.447	3.269	2.945	12.017	11.656
L.S.D at 5 % level	3.3981	2.8199	0167	0.232	0.1691	0.4778
Treatments						
Control	31.210	29.567	1.785	1.573	6.563	6.092
MF.4%	39.500	37.610	3.094	2.522	10.347	10.006
MF.6%	41.377	38.273	3.323	2.658	10.708	10.550
MS. 60L/F	38.333	36.680	3.447	2.606	10.828	10.586
MS. 120L/F	41.567	39.567	3.909	3.218	11.244	10.973
VF.4%	39.333	40.040	3.075	2.740	10.551	10.227
VF.6%	41.667	39.773	3.647	2.982	10.847	10.480
VS. 60L/F	42.333	38.600	3.393	2.845	11.182	10.812
VS. 120L/F	46.250	40.293	4.113	3.150	11.470	11.283
L.S.D at 5 % level	3.2187	1.9519	0.203	0.152	0.5520	0.4226

Molasses Foliar spray (MF) -Molasses Soil application (MS)
Vinasses Foliar spray (VF) -Vinasses Soil application (VS)

III-2- Effect of foliar spray and soil application by some residuals of sugar cane products (molasses and vinasses) treatments:

The results in Table (6) clear that, each of foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) treatments at the rate of (4% or 6% as foliar spray) or (60L/fed or 120L/ fed as soil application) recorded a significant increase in the fruits number/plant, the fruits yield/plant (kg) and the total fruits yield (ton/fed). Whereas, soil application of molasses and vinasses with the two rates (60 and 120 L/ fed.) were more effective than foliar applications on the fruits number/plant, yield/plant (kg) and total fruit yield (ton/fed). Also, foliar spray by molasses and vinasses with the highest rate 6% had a positive response compared to the other treatments in both seasons, These results are in the same line with those obtained by Li et *al.* (2008) and Mo *et al.* (2009) In China, which found that sugar cane treated with vinasse has increased its yields productivity. Also, In Spain, Madejón (2001) found that the yields of beets and maize were compared after treated with an organic compound based on vinasses or the mineral fertilizer, which showed that the crop production was similar in both treatments indicating that the utilization of vinasses is aviable alternative than mineral fertilizers. Moreover, Şanlı *et al.* (2015) on sugar beet studied the result of addition of different concentrations of molasses to the soil and to the plant leaves at different doses (0, 25, 50, 75 and 100 kg/ha) 3 times during the vegetation period, they found that, Molasses applications significantly increased root yield compared to the control.

III-3- Effect of the interactions between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) on the fruits yield of sweet pepper plants:

The data in Table (7) show the effects of the interactions between fertilization rates and different treatments of molasses or vinasses either as foliar spray or soil application on the fruits number/plant, yield/plant(kg) and total fruit yield (ton/fed). The previous treatments induced significant increases on yield of pepper fruits in the both seasons of the study compared with the control. All treatments either the soil application by molasses or vinasses at 60 L/fed. or 120 L/fed. or foliar spray by molasses and vinasses with the two rates i. e., 4% or 6% with the three rates of mineral fertilization (50%, 75% or 100%) had positive effect on the fruits number/plant, yield/plant(kg) and total fruit yield (ton/fed). The all interactions between mineral fertilizer rates at 75% and the high levels of the two compounds i.e., molasses or vinasses on sweet pepper fruits yield and its components were superior without significant level between 75% and 100% of fertilizer rates. The results are similar of that obtained by. Gemtos *et al.* (1999) on wheat, Madejón *et al.* (2001) reported that, yields of beets and maize were compared after treatments with an organic compound based on vinasses or a mineral fertilizer, showed that, the crop production was similar in both treatments, but indicating that the utilization of vinasses is a viable alternative than the mineral fertilizers.

Table (7): Effect of the interactions between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products on the yield of sweet pepper plants during the two seasons of 2017 and 2018.

Treatments		N. of fruits / plant		Yield / plant (kg)		Total fruit yield (ton/fed)	
		2017	2018	2017	2018	2017	2018
50% NPK Fertilization	Control	22.000	23.970	0.894	1.066	5.250	5.133
	MF.4%	35.000	35.100	2.511	1.931	7.910	7.730
	MF.6%	36.000	35.530	2.659	2.091	8.170	8.083
	MS . 60L/F	36.500	34.430	3.109	2.401	8.630	8.313
	MS. 120L/F	39.000	39.630	3.297	2.699	8.900	8.570
	VF.4%	40.000	41.500	2.707	2.596	8.250	7.593
	VF.6%	36.500	37.610	2.916	2.613	8.450	7.900
	VS . 60L/F	39.000	35.750	2.899	2.178	8.750	8.473
	VS. 120L/F	45.000	37.720	3.706	2.753	9.073	8.930
75% NPK Fertilization	Control	35.500	31.850	2.114	1.655	5.960	5.533
	MF.4%	43.500	38.590	4.017	3.105	11.400	10.850
	MF.6%	42.880	38.400	4.080	3.036	12.013	11.733
	MS . 60L/F	40.500	35.250	4.100	2.105	11.473	11.273
	MS. 120L/F	44.500	38.070	4.694	3.573	11.930	11.750
	VF.4%	38.000	40.320	3.150	2.886	11.267	11.183
	VF.6%	43.000	41.000	4.451	3.108	11.650	11.393
	VS . 60L/F	46.000	39.550	3.662	3.020	11.917	11.743
	VS. 120L/F	49.500	41.920	4.966	3.557	12.077	11.940
100% NPK Fertilization	Control	36.130	32.880	2.347	1.997	8.480	7.610
	MF.4%	40.000	39.140	2.753	2.529	11.730	11.437
	MF.6%	45.250	40.890	3.230	2.847	11.940	11.833
	MS . 60L/F	38.000	40.360	3.131	3.311	12.380	12.170
	MS. 120L/F	41.200	41.000	3.735	3.382	12.903	12.600
	VF.4%	40.000	38.300	3.367	2.737	12.137	11.903
	VF.6%	45.500	40.710	3.575	3.224	12.440	12.147
	VS . 60L/F	42.000	40.500	3.617	3.337	12.880	12.220
	VS. 120L/F	44.250	41.240	3.667	3.141	13.260	12.980
L.S.D at 5 % level		1.9606	1.1889	0.183	0.092	0.3362	0.2574

Molasses Foliar spray (MF) -Molasses Soil application (MS)
Vinasses Foliar spray (VF) -Vinasses Soil application (VS).

IV- Effect of mineral fertilization levels and foliar spray or soil application by some sugar residuals of cane products (molasses and vinasses) on chemical contents in the fruits and chlorophyll in the leaves of sweet pepper plants.

IV-1 Effect of mineral fertilization levels:

Data in Table (8) illustrate that, the effects of mineral fertilization rates on

chemical contents, i. e., N%, P%, K% as well as VC in the fruits and the chlorophyll in the leaves of sweet pepper plants showed significant increase especially fertilization the plants with the highest rates 75 % and 100% from recommended mineral fertilization rates of sweet pepper plants compared with 50% of recommended fertilization.

IV-2- Effect of foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) treatments:

Data in Table (8) reveale that, the effect of foliar spray or soil application by some residuals of sugar cane products (molasses or vinasses) on N, P, K% and VC content in the sweet pepper fruits and the chlorophyll in its leaves induced significant increases in all chemical constitutes in both growing seasons. All treatments either foliar spray or soil application by some residuals of sugar cane products gave positive response compared with the control. The results are in the same line with those obtained by Şanlı et *al*. (2015) which studied the effect of, addition of different concentrations of molasses to the soil and to the plant leaves at different doses (0, 25, 50, 75 and 100 kg/ha) 3 times during the vegetation period they found that, molasses applications significantly increased the quality of sugar beet compared to the control.

Table (8): Effect of mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products on chemical contents in fruits and chlorophyll in leaves of sweet pepper plants during the two seasons of 2017 and 2018.

Treatments	N%		P%		K%		VC(mg)		Chlorophyll SPAD	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Recommended fertilization:										
50% NPK	2.45	2.56	0.371	0.366	4.580	4.529	160.63	159.91	77.34	76.16
75% NPK	2.66	2.73	0.368	0.379	4.709	4.734	181.68	182.25	79.51	77.87
100% NPK	2.68	2.86	0.384	0.391	4.763	4.869	195.27	195.09	80.21	79.07
L.S.D at 5% level	0.01	0.02	0.011	0.017	0.084	0.011	0.46	0.96	0.93	1.37
Treatments										
Control	1.81	1.90	0.3100	0.3000	3.287	3.330	147.60	144.08	73.20	74.17
MF.4%	2.50	2.61	0.3733	0.3733	4.607	4.533	173.57	174.03	78.86	76.91
MF.6%	2.68	2.67	0.3800	0.3700	4.744	4.767	179.70	181.03	78.24	77.54
MS . 60L/F	2.68	2.79	0.3833	0.3833	4.880	4.880	185.77	186.43	80.56	80.87
MS. 120L/F	2.85	2.85	0.3900	0.3933	4.853	4.980	197.73	193.30	79.70	77.77
VF.4%	2.64	2.79	0.3644	0.3867	4.803	4.827	172.47	172.50	79.80	77.00
VF.6%	2.74	2.85	0.3667	0.3900	4.968	4.947	181.30	182.47	80.32	76.46
VS . 60L/F	2.85	2.92	0.4000	0.4000	4.933	5.043	179.33	182.53	80.07	79.47
VS. 120L/F	2.59	3.09	0.4022	0.4089	5.080	5.090	195.27	195.37	80.42	79.11
L.S.D at 5% level	0.02	0.01	0.018	0.02	0.016	0.016	2.25	2.10	1.85	1.87

Molasses Foliar spray (MF) -Molasses Soil application (MS)
Vinasse Foliar spray (VF) -Vinasse Soil application (VS).

IV-3- Effect of the interactions between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasses) on chemical contents in the fruits and the chlorophyll in the leaves of sweet pepper.

The interactions between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products on N, P, K% and VC in sweet pepper fruits and the chlorophyll in its leaves as shown in Table (9). The obtained results show clearly that, K% and VC in the fruits and the chlorophyll in the leaves were significantly increased in both growing seasons in addition of N% in the first season.

Table (9): Effect of the interactions between mineral fertilization rates and *foliar spray or soil application by some residuals of sugar cane products* on chemical contents in fruits and chlorophyll in leaves of *sweet pepper* plants during the two seasons of 2017 and 2018.

Treatments		N%		P%		K%		VC(mg)		Chlorophyll SPAD	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
50% NPK Fertilization	Control	1.65	1.75	0.29	0.25	3.08	3.00	125.3	123.1	69.50	67.40
	MF.4%	2.43	2.51	0.38	0.36	4.69	4.11	154.4	148.2	79.10	77.00
	MF.6%	2.48	2.55	0.39	0.35	4.65	4.50	162.6	159.7	79.32	78.00
	MS . 60L/F	2.50	2.72	0.38	0.38	4.62	4.73	171.7	172.3	81.47	83.57
	MS. 120L/F	2.56	2.72	0.39	0.39	4.70	4.83	174.7	173.9	76.80	75.80
	VF.4%	2.50	2.60	0.36	0.38	4.64	4.64	155.5	158.0	77.95	73.90
	VF.6%	2.55	2.64	0.37	0.39	4.80	4.89	168.2	166.7	77.97	74.00
	VS . 60L/F	2.65	2.70	0.39	0.39	5.03	5.00	157.8	159.3	77.20	78.37
	VS. 120L/F	2.70	2.85	0.39	0.40	5.01	5.06	175.5	178.0	76.77	76.90
75% NPK Fertilization	Control	1.89	1.89	0.30	0.32	3.28	3.57	142.3	138.5	75.10	78.20
	MF.4%	2.57	2.63	0.37	0.37	4.38	4.52	182.9	185.6	79.47	76.00
	MF.6%	2.61	2.70	0.36	0.37	4.72	4.75	184.2	187.2	79.40	76.43
	MS . 60L/F	2.69	2.75	0.38	0.38	5.01	4.78	187.9	187.0	80.40	78.90
	MS. 120L/F	2.80	2.91	0.38	0.38	5.01	4.98	197.2	195.4	81.60	78.20
	VF.4%	2.70	2.81	0.36	0.39	4.92	4.89	179.8	178.6	79.55	78.80
	VF.6%	2.81	2.86	0.36	0.39	5.13	5.06	185.6	187.1	79.90	76.90
	VS . 60L/F	2.89	2.93	0.400	0.40	4.83	5.00	184.9	188.5	79.45	78.70
	VS. 120L/F	2.95	3.10	0.400	0.41	5.10	5.06	190.3	192.3	80.70	78.70
100% NPK Fertilization	Control	1.90	2.05	0.340	0.330	3.500	3.420	175.2	170.6	75.00	76.90
	MF.4%	2.50	2.70	0.370	0.390	4.750	4.970	183.4	188.3	78.00	77.73
	MF.6%	2.96	2.76	0.390	0.390	4.860	5.050	192.3	196.2	76.00	77.70
	MS . 60L/F	2.85	2.89	0.390	0.390	5.010	5.130	197.7	200.0	79.80	80.13
	MS. 120L/F	3.19	2.92	0.400	0.410	4.850	5.130	221.3	210.6	80.70	79.30
	VF.4%	2.71	2.95	0.373	0.390	4.850	4.950	182.1	180.9	81.90	78.30
	VF.6%	2.87	3. 50	0.370	0.390	4.973	4.890	190.1	193.6	83.10	78.47
	VS . 60L/F	3.00	3.12	0.410	0.410	4.940	5.130	195.3	199.8	83.55	81.33
	VS. 120L/F	2.13	3.31	0.417	0.417	5.130	5.150	220.0	215.8	83.80	81.73
L.S.D at 5 % level		0.12	NS	NS	NS	0.095	0.097	1.373	1.282	1.13	1.14

Molasses Foliar spray (MF) -Molasses Soil application (MS)
Vinasse Foliar spray (VF) -Vinasse Soil application (VS).

Economic returns:

The economic performance of sweet pepper plants as affected by different levels of mineral fertilization and foliar spray or soil application by some residuals of sugar cane products (molasses or vinasses) are demonstrated in Table (10). The results reveal that foliar spray by vinasses or molasses at 6% with the rates of 75% from recommended mineral fertilization dose followed by the soil application by vinasses at 60L/fed or 120 L/fed. as well as molasses at 120L/ fed under the ratesof 100% from recommended mineral fertilization gave the highest benefit cost ratio in comparison with other treatments. The results are in the same line with those obtained by Labib *et al.* (2012) on potato, Kamal *et al.* (2013) on sweet pepper, El-Shimi and Byan (2015) on eggplants and El-Shimi *et al.* (2015) on sweet pepper; they mentioned that using the naturally deposited materials instead of mineral fertilizers would be very beneficial for both farmers as well as the national authorities which subsidize the high costs of mineral fertilizers.

Table (10): Economic performance of sweet pepper plants as affected by some fertilization rates and foliar spray or soil application by some residuals of sugar cane products (molasses and vinasse) during the average of two seasons, 2017 and 2018.

Treatments		Total yield (t/fed) (1)	Gross return (£E /fed) (2)	Treatment cost (£E /fed) (3)	Total variable cost (£E /fed) (4)	Net return (£E /fed) (5)	Benefit cost ratio (6)	Order
50% Fertilization	Control	5.1915	31149	2120	17350	13799	1.80	27
	MF.4%	7.82	46920	2240	17470	29450	2.69	25
	MF.6%	8.1265	48759	2300	17530	31229	2.78	23
	MS . 60L/F	8.4715	50829	2420	17650	33179	2.88	20
	MS. 120L/F	8.735	52410	2720	17950	34460	2.92	19
	VF.4%	7.9215	47529	2240	17470	30059	2.72	24
	VF.6%	8.175	49050	2300	17530	31520	2.80	22
	VS . 60L/F	8.6115	51669	2420	17650	34019	2.93	18
	VS. 120L/F	9.0015	54009	2720	17950	36059	3.01	17
75% Fertilization	Control	5.7465	34479	3180	18410	16069	1.87	21
	MF.4%	11.125	66750	3300	18530	48220	3.60	15
	MF.6%	11.873	71238	2360	17650	53648	4.05	1
	MS . 60L/F	11.373	68238	3480	18710	49528	3.65	12
	MS. 120L/F	11.84	71040	3780	19010	52030	3.74	9
	VF.4%	11.225	67350	3300	18530	48820	3.64	13
	VF.6%	11.5215	69129	2360	17650	51539	3.93	2
	VS . 60L/F	11.83	70980	3480	18710	52270	3.79	6
	VS. 120L/F	12.0085	72051	3780	19010	53041	3.79	7
100% Fertilization	Control	8.045	48270	4240	19470	28800	2.48	26
	MF.4%	11.5835	69501	4360	19590	49911	3.55	16
	MF.6%	11.8865	71319	4420	19650	51669	3.63	14
	MS . 60L/F	12.275	73650	4540	19770	53880	3.73	10
	MS. 120L/F	12.7515	76509	4840	20070	56439	3.81	5
	VF.4%	12.02	72120	4360	19590	52530	3.68	11
	VF.6%	12.2935	73761	4420	19650	54111	3.75	8
	VS . 60L/F	12.55	75300	4540	19770	55530	3.81	4
	VS. 120L/F	13.12	78720	4840	20070	58650	3.92	3

1)Total yield (t/fed) as average of two seasons,(2) Gross return as total yield (t/fed) x 6000 £E /ton,(3) Treatment cost as fertilizers cost + Molasses or vinasses cost as the following prices : Molasses = 5£E, vinasses= 5£E /L, super phosphate = 75 £E /50 kg, potassium sulphate=300 £E /25 kg, Ammonium sulphate =150 £E /50 kg,(4) Total variable cost (£E /fed) including Treatment cost plus agricultural practices which equal nearly 15230 £E /fed), (5) = (2) - (4), (6) = (2) / (4).

Conclusion

According to the previous results, it can concluded that, fertilizing sweet pepper plants by 100% or 75% from the mineral fertilizer recommendation and spraying the plants by molasses of 6% as well as adding molasses or vinasses at 120L/fed as soil application recognized the favorable economically significant values on the vegetative growth and fruits yield with best quality. This mean that decreasing the quantity of mineral fertilization by 25% without any reduction effect on sweet pepper fruit yield, at the same time, it increased the yield with high net income to the growers.

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تأثير الرش الورقى و الاضافة الارضية لبعض مخلفات منتجات تصنيع قصب السكر (المولاس و الفيناس) مع مستويات من التسميد المعدنى على نمو ومحصول الفلفل وجودته

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الملخص العربى

أجريت هذه الدراسة لتحديد تاثير بعض مخلفات منتجات قصب السكر ، مثل المولاس و الفيناس على محصول الفلفل الحلو صنف كاليفورنيا وندر خلال الموسم الصيفى لعامى 2017 و2018 فى محطة التجارب بقها محافظة القليوبية0 تم اعداد التجربة باستخدام تصميم القطع المنشقة بثلاث مكررات حيث وزعت معدلات التسميد بثلاث معدلات (50 %- 75% - 100 %) من التسميد المعدنى الموصى به للفلفل الحلو فى القطع الرئسية ، بينما تم توزيع معاملات المولاس و الفيناس بمعدلين(4%، 6% كرش ورقى) و اضافه ارضية بمعدلين 60 و 120لتر/فدان) لكل منهما فى القطع المنشقة والتداخل بينهما0تشير نتائج هذه الدراسة الى ان اعلى المعدلات من التسميد المعدنى الموصى به100% و 75% بدون فرق معنوى بينهما مقارنة مع 50% اظهرت زيادة كبيرة فى النمو الخضرى و المحصول الكلى ومكوناته وجودة الثمار0اما فيما يتعلق بالرش الورقى و الاضافه الارضية من المولاس و الفيناس سجل زيادة كبيرة فى النمو الخضرى ومكوناته مثل طول النبات و سمك الساق و عدد الافرع ومساحة الورقة و الوزن الجاف للنبات كذلك مواصفات الثمار و المحصول الكلى و جودته فى موسمى النمو 0و كانت افضل المعاملات هى المعدلات المرتفعة من المولاس و الفيناس (6% كرش ورقى) و الاضافه الارضية بمعدل(120 لتر/ للفدان) مقارنة بالمعدلات الاخرى 0و فيما يتعلق بالتفاعل بين معدلات التسميد مع الرش و الاضافه الارضية من المولاس و الفيناس0 اوضحت البيانات تاثير معنوى على جميع معدلات النمو الخضرى و المحصول وجودة ثمارالفلفل الحلو وقد سجلت اعلا القيم المتحصل عليها باضافة المعدلات 75% و100% من التسميد المعدنى الموصى به مع الاضافه الارضية من المولاس و الفيناس بمعدل 60 و 120 لتر/ للفدان او الرش الورقى باى من المركبين 6% مقارنة باضافة الاسمدة وحدها مع تحقيق اعلا عائد اقتصادى0

أسماء السادة المحكمين

أ.د/ عبدالرؤوف هويدى مركز البحوث الزراعية – الجيزة

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Table (2): Effect of mineral fertilization rates and foliar spray or soil application by someresiduals of sugar cane products on vegetative growth of sweet pepper plants during the two seasons of 2017 -2018

Treatments	Plant length (cm)		Stem diameter(cm)		No. of.branches/ plant		No. of. leaves / plant		Leaf area /plant (cm^2)		dry weight plant/(g)	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Recommended fertilization:												
50% NPK	33.74	35.10	1.11	1.11	14.0	14.111	123.17	119.37	270.10	270.15	31.756	32.792
75% NPK	38.94	39.54	1.23	1.22	18.4	18.148	136.67	137.52	338.85	335.36	34.824	35.678
100% NPK	44.26	44.71	1.26	1.29	19.7	19.481	154.94	157.13	359.64	350.20	36.936	37.336
L.S.D at 5 % level	0.71	0.27	0.03	0.07	0.70	0.72	2.2925	1.2021	1.86	1.14	0.4363	0.6306
Treatments												
Control	31.43	32.73	1.07	1.07	10.89	10.67	93.74	100.59	211.91	202.70	20.970	25.261
MF.4%	36.47	37.63	1.17	1.17	16.67	16.33	132.56	125.77	318.63	318.08	33.457	34.832
MF.6%	38.77	38.93	1.23	1.23	18.33	19.00	141.00	138.43	321.29	296.19	34.150	35.113
MS . 60L/F	39.53	39.97	1.17	1.20	18.33	16.89	142.00	144.78	339.74	341.17	36.223	37.003
MS. 120L/F	41.83	42.87	1.30	1.30	20.33	20.33	156.58	153.22	363.22	357.89	37.870	37.770
VF.4%	37.67	38.50	1.17	1.20	16.00	16.00	140.63	138.33	322.57	318.15	35.299	34.472
VF.6%	40.03	40.80	1.20	1.20	17.89	18.11	145.77	143.67	328.42	335.53	37.203	36.603
VS . 60L/F	41.77	42.73	1.21	1.20	17.67	17.67	141.58	146.33	341.89	342.90	37.260	37.416
VS. 120L/F	43.33	43.89	1.30	1.30	20.33	20.22	150.50	150.94	358.09	354.56	38.117	38.949
L.S.D at 5 % level	1.47	1.16	0.08	0.12	0.91	0.95	1.9272	1.803	3.47	3.95	1.2890	1.1732

Molasses Foliar spray (MF) -Molasses Soil application (MS)
Vinasse Foliar spray (VF) -Vinasse Soil application (VS).

Table (3): Effect of the interactions between mineral fertilization rates and foliar spray or soil application by some residuals of sugar cane products on vegetative growth of sweet pepper plants during the two seasons of 2017 and 2018.

Treatments		Plant length (cm)		Stem diameter (cm)		No. of. branches/ plant		No. of. leaves / plant		Leaf area /plant (cm^2)		dry weight plant/(g)	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
50% NPK Fertilization	Control	27.00	29.00	1.00	1.00	8.67	8.000	84.0	89.2	162.5	157.0	17.60	18.20
	MF.4%	31.00	33.00	1.10	1.10	13.00	14.00	114.5	109.0	255.9	261.0	31.30	34.24
	MF.6%	34.00	36.00	1.10	1.10	15.00	16.00	134.5	122.3	259.8	265.2	32.10	35.26
	MS . 60L/F	36.00	36.80	1.10	1.10	15.00	14.00	132.5	129.8	289.6	298.8	31.90	33.47
	MS. 120L/F	37.40	38.00	1.20	1.20	16.00	17.00	135.0	134.0	330.5	308.9	35.30	36.90
	VF.4%	31.50	33.00	1.10	1.10	13.00	13.00	126.9	116.0	253.3	266.9	34.60	33.87
	VF.6%	34.10	35.30	1.10	1.10	14.67	14.00	134.7	123.0	266.9	279.3	34.90	34.80
	VS . 60L/F	35.70	36.30	1.10	1.10	15.00	15.00	122.5	129.0	300.9	296.0	33.80	32.29
	VS. 120L/F	37.00	37.90	1.20	1.20	16.00	16.00	124.0	122.0	311.2	298.3	34.30	36.10
75% NPK Fertilization	Control	30.30	31.20	1.10	1.10	11.00	10.00	95.00	104.0	192.7	188.3	20.34	24.94
	MF.4%	35.80	36.70	1.20	1.20	18.00	17.00	135.4	127.0	349.5	338.2	33.66	34.34
	MF.6%	37.30	37.00	1.30	1.30	20.00	20.00	139.5	135.0	328.9	340.8	34.43	34.43
	MS . 60L/F	38.20	37.90	1.20	1.20	19.00	18.00	133.5	141.5	360.8	345.1	37.26	39.37
	MS. 120L/F	40.80	42.00	1.30	1.30	22.00	21.00	154.7	149.7	378.4	371.2	38.78	37.53
	VF.4%	38.50	38.90	1.20	1.20	17.00	17.00	136.0	140.0	355.5	347.1	35.35	34.23
	VF.6%	41.30	41.80	1.30	1.20	19.00	20.33	138.6	140.0	349.0	355.9	36.84	37.28
	VS . 60L/F	43.30	44.90	1.20	1.20	18.00	18.00	147.8	146.0	361.8	363.7	37.27	39.25
	VS. 120L/F	45.00	45.47	1.30	1.30	22.00	22.00	149.5	154.5	373.2	368.0	39.49	39.73
100% NPK Fertilization	Control	37.00	38.00	1.10	1.10	13.00	14.00	102.2	108.6	280.5	262.8	24.97	32.64
	MF.4%	42.60	43.20	1.20	1.20	19.00	18.00	147.8	141.3	350.5	355.1	35.41	35.92
	MF.6%	45.00	43.80	1.30	1.30	20.00	21.00	149.0	157.9	375.1	282.6	35.92	35.65
	MS . 60L/F	44.40	45.20	1.20	1.30	21.00	18.67	160.0	163.0	368.8	379.6	39.51	38.17
	MS. 120L/F	47.30	48.00	1.40	1.40	23.00	23.00	180.0	176.0	380.6	393.6	39.53	38.88
	VF.4%	43.00	43.60	1.20	1.30	18.00	18.00	159.0	159.0	358.9	340.4	35.95	35.32
	VF.6%	44.70	45.30	1.20	1.30	20.00	20.00	164.0	168.0	369.4	371.4	39.87	37.73
	VS . 60L/F	46.30	47.00	1.33	1.30	20.01	20.00	154.5	164.0	363.0	369.0	40.71	40.71
	VS. 120L/F	48.00	48.30	1.40	1.40	23.00	22.67	178.0	176.3	389.9	397.4	40.56	41.01
L.S.D at 5 % level		0.897	0.71	0.05	NS	0.552	0.58	1.2	1.1	2.1	2.4	0.785	0.720

Molasses Foliar spray (MF) -Molasses Soil application (MS)
Vinasse Foliar spray (VF) -Vinasse Soil application (VS).

Table (4): Effect of mineral fertilization rates and *foliar spray or soil application some residuals of sugar cane products* on the fruit quality characters of *sweet pepper* plants during the two seasons of 2017 and 2018.

Treatments	Fruit length (cm)		Fruit diameter (cm)		Fresh fruit weight (g)		Fruit flesh thickness (cm)		Tss in fruit		Dry matter in fruit %	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Recommended fertilization:												
50% NPK	6.14	5.97	5.26	5.34	74.63	70.11	0.402	0.406	4.74	4.59	6.20	6.37
75% NPK	6.30	6.51	5.46	5.34	83.11	77.63	0.432	0.428	4.63	4.69	6.60	6.67
100% NPK	6.41	6.39	5.44	5.44	85.76	80.45	0.444	0.438	4.86	4.74	6.90	6.78
L.S.D at 5 % level	0.14	0.25	NS	0.09	2.8	2.54	NS	NS	0.08	NS	NS	0.30
Treatments												
Control	5.12	5.00	4.27	4.37	57.96	52.53	0.383	0.380	4.21	4.46	5.03	5.12
MF.4%	6.07	6.18	5.27	5.33	75.97	70.39	0.427	0.413	4.93	4.14	6.44	6.51
MF.6%	6.40	6.33	5.54	5.38	82.08	74.75	0.423	0.430	4.50	5.28	6.68	6.79
MS . 60L/F	6.50	6.33	5.40	5.47	86.06	80.61	0.433	0.430	4.66	4.91	6.73	6.70
MS. 120L/F	6.67	6.67	5.70	5.80	87.61	82.71	0.433	0.433	5.03	4.56	7.00	7.05
VF.4%	6.40	6.30	5.23	5.30	79.61	75.19	0.423	0.430	4.80	4.70	6.48	6.63
VF.6%	6.24	6.74	5.60	5.53	86.98	78.46	0.433	0.427	4.67	4.44	6.68	6.89
VS . 60L/F	6.50	6.50	5.67	5.53	84.99	82.38	0.430	0.430	4.87	4.87	6.96	6.87
VS. 120L/F	6.66	6.57	5.80	5.67	89.23	87.53	0.450	0.440	5.03	4.70	7.06	6.92
L.S.D at 5 % level	0.27	0.36	0.28	0.18	4.17	3.31	NS	NS	0.33	0.80	0.52	0.44

-Molasses Soil application (MS) Molasses Foliar spray (MF)
Vinasses Foliar spray (VF) -Vinasses Soil application (VS).

Table (5): Effect of the interactions between mineral fertilization rates and foliar spray or soil application by some *residuals of sugar cane products* on the fruit characters of *sweet pepper* plants during the two seasons of 2017 and 2018.

Treatments		Fruit length (cm)		Fruit diameter(cm)		Fresh fruit weight (g)		Fruit flesh thickness (cm)		Tss in fruit		Dry matter in fruit %	
		2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
50% NPK Fertilization	Control	4.93	4.70	4.10	4.20	48.87	44.64	0.35	0.34	4.0	4.17	4.80	5.00
	MF.4%	5.60	5.93	5.20	5.10	71.83	64.99	0.40	0.36	4.5	4.33	6.03	6.00
	MF.6%	5.90	5.70	5.43	5.20	74.20	68.79	0.40	0.42	4.7	5.17	6.30	6.50
	MS . 60L/F	6.00	5.80	5.50	5.80	82.10	79.66	0.40	0.42	4.5	4.67	6.30	6.42
	MS. 120L/F	6.80	6.00	5.60	5.80	85.34	74.83	0.40	0.42	5.3	4.83	6.50	6.95
	VF.4%	6.50	5.90	4.90	5.30	72.84	72.53	0.40	0.42	4.7	4.50	6.13	6.40
	VF.6%	6.40	6.80	5.60	5.60	79.84	72.68	0.43	0.42	5.0	4.17	6.15	6.70
	VS . 60L/F	6.50	6.40	5.40	5.40	74.19	73.74	0.41	0.42	5.0	5.17	6.55	6.60
	VS. 120L/F	6.60	6.50	5.60	5.70	82.50	79.09	0.43	0.43	5.0	4.33	7.00	6.75
75% NPK Fertilization	Control	4.93	5.10	4.30	4.40	59.50	52.00	0.40	0.40	4.3	4.43	5.10	5.15
	MF.4%	5.60	6.30	5.40	5.60	82.58	71.50	0.43	0.43	5.0	4.17	6.40	6.53
	MF.6%	5.90	6.70	5.50	5.33	83.53	79.19	0.42	0.43	4.0	5.33	6.60	6.83
	MS . 60L/F	6.00	6.70	5.40	5.20	85.75	80.20	0.45	0.43	4.5	5.40	6.75	6.88
	MS. 120L/F	6.80	7.00	5.70	5.70	87.01	85.75	0.45	0.43	5.0	4.40	7.40	7.12
	VF.4%	6.50	6.70	5.50	5.40	82.83	76.55	0.43	0.43	4.7	5.00	6.47	6.70
	VF.6%	6.40	6.80	5.50	5.40	85.00	79.21	0.43	0.43	4.5	4.10	6.80	6.97
	VS . 60L/F	6.50	6.60	5.70	5.40	89.63	82.89	0.43	0.43	4.8	4.60	6.93	6.90
	VS. 120L/F	6.60	6.70	6.10	5.60	92.13	91.33	0.45	0.44	4.8	4.77	6.93	7.00
100% NPK Fertilization	Control	5.30	5.20	4.40	4.50	65.50	60.94	0.40	0.40	4.3	4.77	5.20	5.20
	MF.4%	6.50	6.30	5.20	5.30	73.50	74.68	0.45	0.45	5.3	3.93	6.90	7.00
	MF.6%	6.60	6.60	5.70	5.60	88.50	76.27	0.45	0.44	4.8	5.33	7.15	7.03
	MS . 60L/F	7.10	6.50	5.30	5.40	90.33	81.96	0.45	0.44	4.97	4.67	7.15	6.80
	MS. 120L/F	6.50	7.00	5.80	5.90	90.50	87.56	0.45	0.45	4.8	4.43	7.10	7.07
	VF.4%	6.21	6.30	5.30	5.20	83.17	76.50	0.44	0.44	5.0	4.60	6.85	6.80
	VF.6%	6.40	6.63	5.70	5.60	96.10	83.48	0.44	0.43	4.5	5.07	7.08	7.00
	VS . 60L/F	6.40	6.50	5.90	5.80	91.15	90.50	0.45	0.44	4.8	4.83	7.40	7.10
	VS. 120L/F	6.70	6.50	5.70	5.70	93.06	92.17	0.47	0.45	5.3	5.00	7.25	7.00
L.S.D at 5 % level		0.163	0.22	NS	0.11	2.541	2.016	NS	NS	0.199	NS	NS	NS

Molasses Foliar spray (MF) -Molasses Soil application (MS)

Vinasses Foliar spray (VF) -Vinasses Soil application (VS).