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Effect of NPK, Humic acid, Vinasse and Soyabean Amino Acid on Growth Performance and Mineral Content of Fig "White Adci" Seedlings

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ABSTRACT

This study was carried out during 2014, on one years old of Fig seedlings c.v White Adci grown in shade house of pomology department, National Research Centre, humate potassium and Green-power (Vinasse 80% + Soyabean amino acid 20%) were applied in different application (soil application, foliar application and combination between two techniques) at different rates. Both of humate potassium and greenpower as organic fertilizers had better and positives impacts on plant growth. They can be used to minimize amount of mineral fertilizers and consequences decreasing productivity cost and its hazards. Greenpower can consider more profitable than humate potassium. Humates and green power treatments had a positive impact on the most measured vegetative parameters (plant height, leaves number and leaf dry weight %) in comparison with control, however control treatment recorded high level of leaves moisture % comparing with other treatments. Foliar application surpassed soil application for humates treatments however soil application was surpassed foliar application for green power. The highest plant height increment recorded when green power applied at (10 cm in soil + 0.5 % foliar). Humates promote fig seedlings growth via increasing uptake of valuable nutrient and raised nitrogen, phosphorus, potassium leaf content and due to their chelating properties which reflected on better growth. Utilizing green power (Vinasse 80% + soyabean amino acid 20%) as fertilizer was more effective than humates and commercial mineral fertilizer in the form of Crystalon (20% N: 20% P: 20% K). Also, combination foliar and soil application together was more effective than applied foliar or soil separately.

***Key wards*:** Fig seedlings, Humates, NPK, Vinasse, Soyabean amino acid, vegetative parameters, leaf mineral content.

Introduction

The common fig tree has been cultivated since ancient times and grows wild in dry and sunny areas, with deep and fresh soil; also in rocky areas. It prefers light and medium soils, requires well-drained soil, and can grow in nutritionally poor soil. Moreover, fig fruit is mentioned as a sacred fruit in all of the holy books. *Ficuscarica* L. belongs to family of *Moraceae* with over 1400 species classified into about 40 genera (Baraket *et al*., 2009). This genus is an important genetic resource due to its high economic and nutritional values and also an important part of the biodiversity in the rainforest ecosystem. Good nurseries offer fig seedlings in good vegetative size. One of the main factors affecting plant growth is the types and amounts of fertilizers. However, the hazard of mineral fertilizers has been significantly growing up. Thereby, emergence strongly needed to find alternative compounds have stimulation effects on growth with decreasins hazards on our environment. Conservation practices, like the employment of residues in agriculture can contribute to increased agricultural productivity whilst minimizing environmental pollution (Madejón *et al.,* 2001). Many studies proved that organic fertilizers have become more popular, friendly for environments and far more effective in recent years (Abd el-A1 *et al*., 2005 and Erik *et al*., 2000), on onion plant and Hafez, (2003), on squash). One of the most popular organic fertilizers is humic acid and its derived compounds. The urgency to emphasize the importance of humic substances and their value as fertilizer ingredients has never been more important than it is today. Humic substances are recognized by most soil scientists and agronomists as the most important component of a healthy fertile soil. These substances are a good source of energy for beneficial soil microorganisms.

Humic acid improves the physical, chemical and biological properties of the soil, maximum efficiency of nutrient utilization and influences plant growth (Van Schoor *et al*., 2012). In many studies, humic acid and it substances preparations were applied to enhance the uptake of mineral elements (Mackowiak *et al*. 2001) to promote the root length (Cenellas *et al*., 2002) and to increase the fresh and dry weight of crops (Chen*, et al*., 2004a, b). Also, green power considered as one of the famous and an efficient organic fertilizer. Green power

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composed of (80%Vinasse + 20% amino acids of soyabean). Primary, alcohol production generates huge amount of agro industrial residues, the main one being Vinasse (Zolin*, et al*., 2011). Brito*, et al*., (2009) found that treated soil with Vinasse increased potassium concentrations. Another studies proved that, adding Vinasse to soil increased potassium in soil, organic carbon and it may to reduce the need for inorganic potassium fertilizers (zolin *et al*., 2011). Also, in Spain (Madejón *et al*., 2001) compared yields of beets and maize after treatments with an organic compound based on Vinasse or a mineral fertilizer. Results were similar in both treatments proving that the utilization of Vinasse is a viable alternative for mineral fertilizers. Prado *et al*., (2013) mentioned that the use of Vinasse should be optimized for each agricultural system and commitment with recommendations of responsible organizations to avoid environmental damage. Besides, Dromantienė *et al*., (2011) mentioned that Winter wheat grain yield were found to statistically significantly correlate with sprayed amino acid concentration. Abd El-Razek and Saleh. (2012) indicated that, foliar and/or soil application of amino acids had a positive effect on productivity and fruit quality, leaf mineral content and chlorophyll contents.

Current work aims to assessment effect of humates and "green power" fertilizer on vegetative growth of fig seedlings and identifying the more effective way to apply this fertilizer.

Material and Methods

This study was carried out in the experimental Research shade house of National Research Center, Dokki, Giza, Egypt during 2014. This study was carried out during one successive season 2014, on one years old Fig seedlings c.v of White adci cultivated in black polyethylene bags with 30 cm diameter fooled 12.5 kg washed sand. Humates and Green-power (Vinasse 80% + Soyabean amino acid 20%) were applied in different techniques (soil application, foliar application and combination between two techniques) at different rates 10 or 20 cm/seedling/15days as soil application and (1 or 2% for humates) (0.5 or 1% for greenpower) as foliar application as shown in table (1) whereas fig seedlings of control treatment received mineral fertilization only 180 g/ seedling/ seasonin the form of Crystalon (20% N: 20% P: 20% K) applied as soil application divided into 16 doses from March to October about one dose every 15 days.

Complete randomized design was applied. Seventeen treatments were applied in six replicates; all of the seedlings conducted in this study were vigorous and similar in growth and canopy.

The investigation aimed at studying the effect of different doses and applications time of Green-power and humates in order to reach to maximum vegetative growth in short time.

Table 1: applying both of humates and green power at different rates and different techniques (soil and foliar) applications on one years old Fig seedlings c.v White Adci.

Code	Trt	Soil application (Cm)	Folia application (%)
1	Control N:P:K		
2	Humate	10	0
3	Humate	20	
4	Humate	0	1%
5	Humate	10	
6	Humate	20	
7	Humate	0	2%
8	Humate	10	
9	Humate	20	
10	Green power	10	0%
11	Green power	20	
12	Green power	0	0.5%
13	Green power	10	
14	Green power	20	
15	Green power	0	1%
16	Green power	10	
17	Green power	20	

Results and Discussion

Growth measurements:

Data in Table (2) showed that the most humates and green power treatments had a positive impact on the most measured vegetative parameters (plant height leaves number and leaf dry weight) in comparison with control, however control treatment recorded high level of leaf water content comparing with other treatments.

In respect for plant height increments, results in table 2 indicated that Plant height increments in most treatments surpassed that for control treatment in its effect on plant height. Also, most green power treatments (except treatment 0.5% foliar alone) were caused higher increments in plant height in comparison with humates

treatments and control. Foliar application surpassed soil application for humates treatments however soil application was surpassed foliar application for green power. Meanwhile mixing soil and foliar applications resulted in better increments for plant heights in comparison individually applications especially in green power treatments. High rates whether in soil or foliar or even mixture soil and foliar applications gave more increments than low rates individually. The highest plant height increment recorded when green power applied at (10 cm in soil + 0.5 % foliar).

Table 2: Effect of applying humates and green power at different rates and different methods on of application vegetative parameters.

Treatment	Plant height increment %	Leaves number	Leaves dry weight %	leaves moisture %
T 1	18.00 d	17.00 hi	41.97 f	58.03 a
T 2	17.00 d	16.00 hi	51.83 bc	48.17 de
T 3	21.33 cd	22.67 g	51.53 bc	48.47 de
T 4	20.00 cd	15.33 hi	44.65 ef	55.35 ab
T 5	21.67 cd	13.33 i	55.17 b	44.83 e
T 6	16.33 d	13.67 i	55.11 b	44.89 e
T 7	30.00 c	20.00 gh	48.84 cde	51.16bcd
T 8	27.00 c	24.67 fg	60.12 a	39.88 f
T 9	29.33 c	23.67g	59.11 ab	40.89 ef
T 10	50.16 b	65.52 cd	51.85 b	48.15 e
T 11	48.50 b	61.74 de	49.61 cd	50.39 cd
T 12	7.11 e	29.34 f	49.86 cd	50.14 cd
T 13	77.10 a	96.30 a	49.73 cd	50.27 cd
T 14	55.71 b	71.17 b	47.52 cde	52.48bcd
T 15	20.00 c	16.64 hi	54.88 b	45.12 e
T 16	55.10 b	58.89 e	41.97 f	58.03 a
T 17	51.58 b	68.57 bc	46.19 def	53.81 abc

Means having the same letters within a column are not significantly different at 5% level.

In regard to leaves number, most of treatments led to better results than control. Also, most green power treatments produced higher number of leaves comparing with humats treatments. Higher levels of humates gave better results than lower levels whether as soil, foliar or mixture (soil and foliar together) however the trend was the obesity in green power whereas the lower level of green power produced higher number of leaves comparing with the higher level of green power. Soil application surpassed foliar application in humates and green power treatments at the same level. The highest number of leaves recorded when green power applied at (10 cm in soil + 0.5 % foliar). For leaf dry matter (%) humates treatment surpassed green power treatments in producing leaf dry matter. Soil applications of both of humates and greenpower were more better than foliar applications and high levels didn't produced markedly differences than lowers. The highest value of leaf dry matter obtained with humates at (10 or 20 cm in soil + 2% foliar). While data concerning with moisture content showed that control treatment and green power (20com in soil +1% foliar) treatment had the highest value of water content (58.03%) in comparing with the other treatments. Increasing foliar application level of humates caused decreasing in leaf water content whether alone or mixture with soil application. The trend of results was inversed in green power, the most higher levels gave higher values of leaf water content whether soil, foliar or even mixture (soil + foliar) application individually.

Leaf chemical content:

Data in Table 3, showed that most green power treatments cause a high leaf content in leaves comparing with other treatments especially soil application which resulted in increasing in leaf nitrogen content and the highest leaf nitrogen content was obtained with green power treatment (20 cm in soil + 0.5% foliar). Most of green power treatments improved of leaf phosphors content, however there was no clear trend for humates and green power treatments. For leaf potassium content, results in table 3 showed that all treatments increased leaf potassium content comparing with control and green power treatments surpassed humates treatments in this sense. Also, combining soil with foliar application reinforced the results of both of humates and green power. The highest value for leaf potassium content (3.85%) resulted from applying green power at (10 cm in soil +0.5% foliar). In regard to influence leaf carbohydrates with applied treatments, results in table 3 indicated that most of applied treatments resulted in increasing in leaf carbohydrates content, and higher carbohydrates content achieved with green power treatments whether as foliar or soil applications separately or even combining treatments. The highest leaf carbohydrates content obtained when green power was applied at (10 cm in soil + 0.5% foliar). Many reports mentioned that one way plant growth is improved is through the structural improvement of both clay and sandy soil allowing for better root growth development and consequence better nutrient uptake. Plant growth is also improved by the ability of the plant to uptake and receive more nutrients. Humic acid is especially beneficial in releasing nutrients in the soil so that they be facilitated to the plant as needed. Humates are formed from decayed plant residues with the aid of microorganisms (bacteria and fungi) in the soil. The composition of humates includes a lot of beneficiary compounds such as humus, humic acid, fulvic

acid and trace minerals, which are necessary for plant development (Stevenson, 1994). Humates are the salts of humic acid in which the exchange site is Ca^{++}, Na^{+}, Al^{+}, and Fe^{++} rather than hydrogen. Humic acid, had been utilized for growing plants, chelates with trace minerals to be facilitated to plant. According for aforementioned, Humates promote the growth in Fig seedlings via increasing uptake of valuable nutrient (i.e. nitrogen, phosphorus, and other nutrients due to their chelating properties) which inflected on better growth. These results came in the same line with that found by (Arancon *et al*., 2003 &2006 and Atiyeh *et al*., 2002]. Their reports hypothesized that plant growth hormones may become adsorbed on to humic fractions so the plant growth response is a combined hormonal/humic one.

Table 3: Effect of applying humates and green power at different rates and different methods of application on leaf chemical content.

Treatment	N%	P %	K %	Carbohydrate
T 1	1.74 cd	0.111def	1.54 h	6.10 f
T 2	1.41 efg	0.062 f	2.14 efg	9.98 de
T 3	1.45 efg	0.144 de	1.86 fgh	8.48 ef
T 4	1.55 de	0.456 b	2.11 efg	6.24 fg
T 5	1.17 h	0.083 ef	2.39 de	5.68 g
T 6	1.48 e	0.592 a	2.36 ef	5.38 g
T 7	1.61 cde	0.108def	1.66 gh	6.27 fg
T 8	1.39 fg	0.238 c	2.14 efg	5.01 g
T 9	1.48 ef	0.217 c	2.89 cd	6.32 fg
T 10	2.00 b	0.124 def	2.13 efg	13.75 ab
T 11	1.79 c	0.081 ef	2.97 c	6.33 fg
T 12	1.26gh	0.078 ef	2.09 efg	13.73 ab
T 13	2.11 b	0.147 d	3.30 bc	11.11 cd
T 14	2.49 a	0.15 d	3.85 a	9.97 de
T 15	1.39 f	0.136 def	2.20 ef	12.57 b
T 16	1.78 c	0.074 f	3.68 ab	15.51 a
T 17	2.09 b	0.140 de	3.30 bc	12.35 bc

Means having the same letters within a column are not significantly different at 5% level.

From tables (2-3),tabulated data indicated that, utilizing greenpower (Vinasse 80% + soyabean amino acid 20%) as fertilizerwas more effective than humates and commercial fertilizer (20:20:20). Also, combination foliar and soil together was more effective than applied foliar and soil separately. These positive effects for greenpower may be attributed to both of Vinasse and amino acids. Vinasse improves most factors involved in soil fertility, provides favoring conditions for nitrogen assimilation into the soil, protects nutrients against washing out in winter and maintains them as reserve nutrients as a slow release during the vegetative period. These are the most important affect, leading to increase growth (Hagagg *et al.,* 2013). Meanwhile, Amino acids as organic nitrogenous compounds are the building blocks in the synthesis of proteins (Davies, 1982). Amino acids are particularly important for stimulation cell growth, they act as buffers which help to maintain favorable PH value within the plant cell, since they contain both acid and basic groups; they remove the ammonia from the cell (Hagagg, *et al*., 2013).Moreover, Amino acids are applied through foliar feeding, absorbed through the plant's stomata or via the root area when incorporated into the soil. This also helps improve micro flora, which in turn, facilitates the nutrient assimilation. These results are in harmony with what found by Abd El-Razek and Saleh, (2012) who indicated that, foliar and/or soil application of amino acidshad a positive effect on productivity and fruit quality, leaf mineral content and chlorophyll contents. Application of amino acids as foliar spray combined with soil application at 0.50% for both is the promising treatment for improving growth and fruit characteristics of 'Florida Prince' peach. Also, Martín-Olmedo *et al*., (1996) mentioned high doses of Vinasse produced the highest yield and the highest concentrations of P and K in (*Festuca arundinacea*) plants. Khaled and Fawy, (2011) mentioned that N uptake increased in corn when humic acid added to soil while foliar application of humic acids increased the uptake of P, K, Mg, Na, Cu and Zn.

Conclusion

Both of humates and green power as organic fertilizers had better and positives impacts on both of plant growth and environment. They can be used to minimize amount of mineral fertilizers and consequences decreasing productivity cost and its hazards. However, from economic benefits green power can considered more profitable than humates because its effects on growth performance were better than those with humates, that will be expected to reflect on yielding and quality.

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