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Effect of Compost, Humic Acid and Amino Acids on Yield of Snap Beans

S.A. Shehata and M.A. El-Helaly

Department of Vegetable Crops, Faculty of Agriculture, Cairo University, Giza, Egypt

Abstract: This investigation was conducted at experiment station of the Faculty of Agriculture, Cairo University in plastic house during winter season of 2007/2008 and 2008/2009 to study the effect of compost, humic acid and amino acids on yield and some associated characters of snap beans cv. Hama . The planting dates were on 24th October 2007and 2008. This experiment included 10 treatments which were: mineral fertilizer (MF) recommended (control, 60kgN, 45kgP_2O_5 and 50kg k_2O/fed.); compost (CO) at 8ton /fed. ; CO 8ton /fed and humic acid (HA) foliar application at 1g/l; CO 8ton /fed and amino acid(AA) foliar application at 2 ml/l ; CO 8ton /fed and foliar application with HA and AA ; CO 4ton /fed and HA foliar application 1g/l; CO 4ton /fed and AA foliar application 2ml/l; CO 4 ton /fed and foliar application with HA and AA; half MF and CO 4ton /fed ; half MF and CO 4ton /fed with foliar application by HA and AA. Application of CO was once before planting, MF application was in three equal parts before planting, 30 and 45 days after planting .HA and AA application were in three times 30, 45 and 60 days after planting. The treatments of CO+AA and half CO+ HA+AA significantly increased the total yield. There were no significant differences between all treatments in the early yield, pod length and pod thickness.

Key words: Compost · Humic Acid · Amino Acids · Yield · Snap Beans

INTRODUCTION

Snap beans (*Phaseolus vulgaris*) are one of the major leguminous vegetable crops grown in Egypt for fresh local consumption and export especially during the period from December to May. Arancon *et al.* [1] reported that vermicompost can produce significant increases in overall plant growth and productivity independent of nutrient availability. Compost derived from a mixture of de-inking paper mill sludges is a potential source of nutrients for crops and can effectively improve chemical and biological properties of low fertility or degraded soils and a potential source of P and K for crops and could increase crop yield [2]. Potassium is needed for protecting plants from diseases and increasing the yield [3].

Cespedes Leon *et al.* [4] indicated that, the composted residuals at high rates had the lowest disease incidence (Snap bean common root rot) and produced healthy plants. Suwanarit [5] reported that, applied compost alone tended to be more effective than the lower rate of chemical fertilizers. The earthworm compost did not affect the pod characteristics and productivity [6]. Suwanarit [5] concluded that, the effect on crop yield of compost last longer than that of the humic material. All humic substances are composed of chemically complex, non-biochemical organic components, which are largely hydrophilic, amorphous, dark colored, liquid, or powder and resistant to chemical and biological degradation [7]. Humic acid's(HA) activity in promoting plant growth is not completely known, but several explanations proposed increasing cell membrane permeability, important for the transport and availability of micro-nutrients, nutrient uptake, oxygen uptake, respiration(especially in roots) and photosynthesis, phosphate uptake and root cell elongation [8]. Zhang and Ervin [9] reported that, HA contains cytokinins and their application resulted in increase endogenous cytokinin and auxin levels. Pinton *et al.* [10] concluded that, absorption of the humic compounds by the plant affects certain enzymatic activities and membrane permeability. HA applied to the plant growth medium at 1g to 1kg concentration increased seedling growth and nutrient content in the plant. However, high levels of HA arrested or decreased plant growth and nutrient contents, respectively. HA did not only increased macro-nutrient contents, but also enhanced micro-nutrient contents of the plant organs. HA plays a major role in plant nutrient uptake and growth parameters in plants in both vegetative and generative stages [11]. Sladky [12] reported that, HA stimulate photosynthesis. HA application improved crop yields [13]. Suwanarit [5] concluded that, HA could be used to replace farm yard manures and compost. HA (from vermin

Corresponding Author: S.A. Shehata, Department of Vegetable Crops, Faculty of Agriculture, Cairo University, Giza, Egypt.

compost) had an effect on plants similar to the effects of plant growth regulator such as IAA [1]. Tomato plants responded positively to the application of amino acids by increasing plant height, fruit quality and average fruit weight [14]. The improvement of snap bean growth and yield in response to the foliar application of active yeast may by attributed to its contents of amino acids and vitamins [15, 16]. Foliar and root application of commercial amino acids product from animal origin led to severe tomato plant growth depression on the contrary shoot and root fresh weights were not affected by addition of plant origin amino acids product [17]. The objective of this investigation was to study the effect of mineral fertilizers, compost, humic acid and amino acids on yield of snap beans.

MATERIALS AND METHODS

This investigation was conducted at Experiment Station of the Faculty of agriculture, Cairo University in plastic house during winter season of 2007/2008 and 2008/2009 to study the effect of Compost, (Compost analysis N 0.93, P 0.43, K 0.68 percentage)Humic acid (Hammer, Arabian Group for Agriculture Service (AGAS) Co. Egypt) (Hammer composition, humate potassium 86% and potassium oxide 6%) and Amino acids (Amino power, AGAS Co.) (Amino power composition, free amino acids, Citric acid 3%, potassium oxide 3.5%, L- Amino acids) on growth as well as yield and some associated characters of snap beans cv. Hama .The soil of the experimental area was clay. The planting dates were on 24th October 2007and 2008. A complete randomized blocks (CRB) design with three replications was adopted. Each experimental plot was 4.5 m^2 .This experiment included 10 treatments which were compared: mineral fertilizer (MF) at the recommended dose (control, 60kgN, 45kgP_2O_5 and 50kg k_2O/fed.); compost (CO) at 8ton /fed. ; CO at 8ton /fed and humic acid (HA) foliar application at 1g/l; CO at 8ton /fed and amino acid(AA) foliar application 2 ml/l ; CO at 8ton /fed and foliar application with HA and AA ; CO at 4 ton /fed and HA foliar application at 1g/l; CO 4ton /fed and AA foliar application at 2ml/l; CO 4 ton /fed and foliar application with HA and AA; half MF and CO 4ton /fed ; half MF and CO 4ton /fed with foliar application by HA and AA. Application of CO was once before planting, MF application was in three equal parts before planting, 30 and 45 days after planting .HA and AA application were in three times 30, 45 and 60 days after planting. In each year of the study stem length and number of branches per plant were recorded at 75days after planting. The following data were recorded: early yield, total yield, pod characters (pod length, thickness and average pod weight), T.S.S and pod potassium content was determined by flame photometry. Data were tabulated and statically analyzed according to Snedecor and Cochran [18] and means were compared by L.S.D at 5% level of probability.

RESULTS AND DISCUSSION

Pant Height and Number of Branches per Plant: There were no significant differences between treatments on plant height in the first season (Table 1). However, the MF had the highest plant in the second season. Treatment of the CO and HA increased the number of branches in the first season. Meanwhile, the treatment of half MF+ half CO+ HA+AA had the highest number of branches in the second season. The HA and CO when applied in combination were not effective in promoting growth of plants [5]. Abdel-Mawgoud *et al.* [19] reported that, plant height and number of branches were not significantly affected when tomato plants were applied by HA.

Pod Characters: There were significant differences between treatments on pod length and pod thickness (Table 2). The treatment of CO had the lowest pod length and pod thickness. Meanwhile, there were no significant differences in pod thickness in the second season. There were no significant differences between all treatments on average pod weight in the first season. However, the treatment of CO+HA+AA had the highest pod weight in the second season. That agrees with Santos *et al.* [6] who showed that, the earthworm compost did not affect the pod characteristics. El-Tohamy and El-Greadly [16] showed that, yeast (contains amino acids) treatment increased fresh weight of pods and pod length but pod diameter was not significantly affected.

The Yield: Data in Table 3 show that, there were no significant differences between all treatments in the early yield. The treatments of CO+AA and half CO+ HA+AA significantly increased the total yield. Baziramakenga and Simard [2] concluded that, compost is potential source of P and K for crops and could increase crop yield. Arancon *et al.* [1] reported that, vermicompost can produce significant increase in overall plant growth and productivity, independent of nutrient availability. There were no significant differences between treatments in T.S.S in the first season. However, the treatments CO, CO+HA+AA and half CO+HA significantly increased the T.S.S in the second season.

Table 1: Effect of Compost, Humic acid and Amino acids on plant height and number of branches per plant of Snap beans in 2007/2008 and 2008/2009 seasons.

	2007/2008 Season		2008/2009 Season	
Treatments	Plant height (cm)	No. of branches/plant	Plant height (cm)	No. of branches/plant
Control	120.2	2.73	141.0	2.73
CO	113.8	2.53	125.7	2.73
CO+HA	107.4	3.13	124.2	2.46
CO+ AA	110.5	2.40	122.1	2.86
CO+HA+AA	125.7	2.67	123.9	2.26
1/2 CO+HA	104.1	2.40	129.8	2.46
1/2 CO+ AA	122.2	2.93	120.5	2.40
1/2 CO+HA+AA	105.3	2.67	120.5	2.80
1/2 MF +1/2 CO	121.5	2.93	117.5	2.53
1/2 MF+1/2CO+HA+AA	107.5	2.8	129.1	2.93
$L.S.D_{at\ 5\%}$	NS	0.58	19.88	0.62

Table 2: Effect of Compost, Humic acid and Amino acids on pod length, thickness and average pod weight of Snap beans in 2007/2008 and 2008/2009 seasons.

	2007/2008 Season			2008/2009 Season		
Treatments	Pod length (cm)	Pod thickness (mm)	Pod weight (g)	Pod length (cm)	Pod thickness (mm)	Pod weight (cm)
Control	13.47	7.65	5.75	14.33	6.82	5.59
CO	13.40	7.14	5.77	13.53	6.82	5.32
CO+HA	13.67	7.41	5.87	14.43	6.92	5.38
CO+ AA	13.70	7.53	5.90	13.97	6.58	5.20
CO+HA+AA	13.53	7.31	5.88	14.23	6.75	5.70
1/2 CO+HA	13.50	7.39	5.91	13.83	6.79	5.24
1/2 CO+ AA	13.57	7.34	5.66	14.00	7.03	5.44
1/2 CO+HA+AA	13.23	7.27	5.76	14.13	6.71	5.39
1/2 MF +1/2 CO	13.47	7.69	5.70	14.03	6.58	6.26
1/2 MF+1/2CO+HA+AA	13.97	7.59	6.03	14.07	6.77	5.13
$L.S.D_{at\ 5\%}$	0.54	0.38	NS	0.69	NS	0.55

Table 3: Effect of Compost, Humic acid and Amino acids on early yield, total yield and T.S.S of Snap beans in 2007/2008 and 2008/2009 seasons.

	2007/2008 Season			2008/2009 Season		
Treatments	Early yield Kg/4.5m^2	Total yield Kg/4.5m^2	T.S.S(%)	Early yield Kg/4.5m^2	Total yield Kg/4.5m^2	T.S.S (%)
Control	2.74	13.09	5.66	2.73	11.43	4.19
CO	3.42	14.45	5.33	2.97	10.67	4.32
CO+HA	2.74	14.97	5.66	2.61	11.76	3.99
CO+ AA	2.87	17.20	5.67	2.51	12.29	4.26
CO+HA+AA	3.00	11.97	5.33	2.16	8.58	4.42
1/2 CO+HA	2.98	14.36	5.33	2.43	10.64	4.35
1/2 CO+ AA	2.43	13.45	6.00	2.46	10.34	4.18
1/2 CO+HA+AA	2.84	16.34	6.00	2.47	12.04	4.27
1/2 MF +1/2 CO	2.67	13.86	5.00	2.16	9.89	4.24
1/2 MF+1/2CO+HA+AA	2.826	14.250	5.33	2.49	8.946	4.27
$L.S.D_{at\ 5\%}$	NS	4.31	NS	NS	2.53	0.29

Table 4: Effect of Compost, Humic acid and Amino acids on potassium content of Snap beans pods in 2007/2008 and 2008/2009 seasons

Treatments	2007/2008 Season K (mg/g d.w)	2008/2009 Season K (mg/g d.w)
Control	24.58	22.95
CO	26.24	21.65
CO+HA	25.65	21.89
CO+ AA	24.40	25.13
CO+HA+AA	24.55	21.04
$^1/_2$ CO+HA	25.21	22.73
$^1/_2$ CO+ AA	27.02	20.99
$^1/_2$ CO+HA+AA	29.45	21.04
$^1/_2$ MF +1/2 CO	26.85	21.11
$^1/_2$ MF+1/2CO+HA+AA	25.77	21.53
L.S.D $_{at\ 5\%}$	2.59	NS

Pod Potassium Content: There were significant differences between treatments on pod potassium content in the first season (Table4). The treatment of half CO+HA+AA had the highest pod potassium content, Meanwhile.. There were no significant differences in the second season.

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