

THE ROLE OF HUMIC AND AMINO ACIDS IN IMPROVING GROWTH AND QUALITY OF PASPALUM TURF

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ABSTRACT: A field experiment was conducted at the nursery of Hort. Res. Inst., ARC., Giza, Egypt during 2014 and 2015 seasons to study the effect of spraying with humic acid at 0, 5 and 10 ml/l and adding mixture of amino acids as soil drench at 0, 1 and 2 g/pot individually or in combinations on growth, covering rate (%) and chemical composition of seashore paspalum (*Paspalum vaginatum*, Swartz.) plants grown in 40-cm-diameter plastic pots filled with sand medium.

The obtained results showed that all treatments caused improvement in plant height, covering rate, number of plants/pot and herb fresh and dry weights compared with control, also, chemical results of chlorophyll a, b and carotenoids content in the leaves and total sugars content in the herb. The best treatments used resulted from the combining between humic acid at 10 ml/l and mixture of amino acids at 2 g/pot which recorded the highest means.

Hence, in order to get the best growth and quality of paspalum plants, it could be recommended to spray with humic acid at 10 ml/l and adding a mixture of amino acids as soil drench at 2 g/pot six times with one month interval.

Key words: *Paspalum vaginatum* Swartz, humic acid, covering rate percentage, chemical composition.

INTRODUCTION

The importance of lawns, as the major part of gardens and public grounds, as well as the basis of landscape design is doubtless now well known. Many types of amenity grasses are now widely used for greening the lawns all over the year. Among them may be seashore Paspalum (*Paspalum vaginatum*, Swartz.) that belongs to Fam. Graminae. It is a succulent warm-season turf type grasses, but it retains a healthy appearance all year-around, unlike Bermudagrass that tend to go off-colour during cooler months and short days (Huxley *et al.*, 1992). It is easily propagated by cuttings and pre-prepared

rolls, and fast spreads with lateral growing stems called stolons. It makes an attractive perennial turf in tropical and subtropical areas and can tolerate irrigation water with high salinity levels, withstand mowing, treading, as well as wear and tear (Morton, 1974).

In this regard, Hunter and Butler (2005) reported that humic acid significantly increased fresh and dry weights of *Agrostis stolonifera* herb with improving leaf colour and P content. Nutrients leaching was also minimized when humic acid, was applied. Likewise, Muller and Kussow (2005) mentioned that humic acid greatly improved

colour and density of creeping bentgrass and increased soil microbial activity. On tifway bermudagrass, El-Sayed *et al.* (2008) revealed that actosol (a humic acid NPK liquid fertilizer) at 20 ml/l as a foliar spray significantly increased plant height, density, No. plants/m² as well as herb fresh and dry weights. A similar trend was also gained concerning chlorophyll a, b and carotenoids content in the leaves, and the percentages of total carbohydrates, N, P and K in the herb.

Many researchers examined the influence of amino acids on improving all characters of the plant such as Abd El-Aziz *et al.* (2009), Hashish *et al.* (2015) and El-Nagar *et al.* (2013). Amino acid as organic nitrogenous compounds are the building block in the process of protein synthesis (Smith, 1982), and can affect plant growth and development through their influence on IAA and GA biosynthesis. Also, amino acids may play an important role in plant metabolism and protein assimilation which are necessary for cell formation and consequently increase fresh and dry weights (Phillips, 1971; Russel, 1982 and Walter and Nawacki, 1987).

This trial aims to find out the role of spraying with humic acid and amino acids, alone or in combinations, in improving growth, colour, and performance of seashore Paspalum turf grass.

MATERIALS AND METHODS

Two pot experiments were performed at the Nursery of Hort. Res. Inst., ARC, Giza, Egypt through the two consecutive seasons of 2014 and 2015 to detect the response of

seashore Paspalum grass to foliar spraying with humic acid and amino acids.

So, pieces from prepared rolls of seashore Paspalum (*Paspalum vaginatum*, Swartz.) at a diameter of 10 cm (their fresh weights ranged between 40-45 g) were carefully taken and planted on March, 1st for each season in the center of 40-cm-diameter plastic pots filled with sand. The physical and chemical analyses of the used sand in both seasons are shown in Table (a). These pieces were planted in the soil and were then daily irrigated with 250 ml of a tap water/pot during the first two weeks after planting. The pots were afterwards irrigated once every two days with 400 ml of a tap water/pot throughout the course of this study.

After one month from planting (on April, 1st), the following fertilization treatments were monthly applied; humic acid as a foliar spray and amino acid as soil drench till the first of September (6 times) for each season:

- No fertilization, referred to as control.
- A humic acid NPK (10:10:10) liquid organic fertilizer (Actosol®) was added after each cut at the rate of 0, 5, 10 ml/l. The constituents of actosol were determined and illustrated in Table (b).
- Amino acid mixture (extract containing a mixture of amino acids, organic nitrogen, and potassium oxide) was added as soil drench monthly after each cut at the rates of 0, 1 and 2 g/pot the components of amino acids were measured and expressed in Table (c).

Table a. Some physical and chemical properties of the used sand during 2014 and 2015 seasons.

Soil texture	Seasons	Particle size distribution (%)						pH	Cations (meq/l)				Anions (meq/l)		
		Coarse sand	Fine sand	Silt	Clay	S.P.	EC (dS/m)		Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺	HCO ₃	Cl ⁻	SO ₄
Sand	2014	89.03	2.05	0.40	8.52	23.01	3.56	7.90	7.50	1.63	33.60	0.50	3.20	22.00	18.03
	2015	84.76	6.29	1.50	7.45	21.87	3.71	7.80	19.42	8.33	7.20	0.75	1.60	7.80	26.30

Table b. Main characteristics of the used liquid organic fertilizer during the two seasons.

Components	Value	Components	Value	Components	Value
Humic acid (%)	2.9	EC(dS/m)	59.30	B (ppm)	70.00
Organic matter/total solids (%)	42.51	N (%)	10.00	Fe (ppm)	900.00
Total H.A./total solids	165.80	P (%)	10.00	Mn (ppm)	90.00
Organic carbon (%)	24.65	K (%)	10.00	Zn (ppm)	90.00
C/N ratio	2.46	Ca (%)	0.06	Cu (ppm)	90.00
pH	8.20	Mg (%)	0.05		

Table c. The main components of the used amino acid during the two seasons.

Amino Acids	Percentage (%)	Amino Acids	Percentage (%)
Aspartic	3.29	Lysin	1.75
Tyrosine	0.52	Arginine	4.64
Gluamic	8.18	Histidine	0.56
Glycin	2.03	Proline	3.96
Alanine	2.26	Phenyl alanine	0.99
Valine	2.51	Serine	4.99
Leucine	2.03	Threonine	3.57

The treatments were as follow:

1. Control.
2. Humic acid at 5 ml/l.
3. Humic acid at 10 ml/l.
4. Amino acids at 1 g/pot.
5. Amino acids at 2 g/pot.
6. Humic acid at 5 and 10 ml/l was combined with each level of amino acid to form 4 combination treatments as follows:
 - a. Humic acid at 5 ml/l + amino acids at 1 g/pot.
 - b. Humic acid at 5 ml/l + amino acids at 2 g/pot.
 - c. Humic acid at 10 ml/l + amino acids at 1 g/pot.
 - d. Humic acid at 10 ml/l + amino acids at 1 g/pot.

After two months from planting (on May, 1st), the first cut was handly done with very sharp stainless steel cutter leaving stubbles with 1 inch long. Other four cuts were carried out monthly thereafter. The pots

were arranged in a completely randomized design (Mead *et al.*, 1993) with three replicates for each treatment, as each replicate contained five pots.

Before each cut in the two seasons, plant height (cm) was recorded, while number of plants/pot and fresh and dry weights (g) of the resulted herb after mowing were monitored after each cut. Moreover, the covering rate as percentage (density %) was determined by using a wooden quadrat (10×10 cm) called a gird, the gird divided in to 25 squares by cross-string, so that each square was 4% of the total area of this gird. The gird was dropped at random 5 times on the plot (turf). By careful estimation of number of the squares occupied by grass species, the percentage of covered area was determined (Mahdi, 1953).

However, means of each parameter mentioned above in the five taken cuts were collected and expressed in the tables as an average for all cuts. In fresh leaf samples taken from the last cut, photosynthetic pigments content (chlorophyll a, b and carotenoids, as mg/g f.w.) was measured

according to the method described by Moran (1982), while in dry samples taken also from the herb of last cut, the percentage of total sugars (Herbert *et al.*, 1976), as well as total indoles and total phenols (A.O.A.C., 1990) as mg/100 g f.w. were assessed. The obtained data were statistically analyzed according to SAS Program (1994) using Duncan's Multiple Range Test (1955) for elucidating the significant differences among means of various treatments.

RESULTS AND DISCUSSION

Effect of Humic acid and Amino acid treatments on:

Vegetative growth parameters:

From data averaged in Tables (1) and (2), it could be concluded that all individual humic acid and amino acid treatments clearly improved all vegetative traits of seashore *Paspalum* plants (expressed as plant height (cm), covering rate (%), No. plants/pot and fresh and dry weights (g) of herb) with significant differences when compared to control in most cases of both seasons.

The combining between humic acid and amino acids induced an additional improvement in all parameters mentioned before, with the superiority of the combination between humic acid at 10 ml/l and amino acids at 2 g/pot, which gave, in general the tallest plants, the best coverage,

the highest number of plants/pot and the heaviest fresh and dry weights over all other individual and combined treatments in the two seasons.

This may be attributed to the role of both humic acid in increasing the availability of nutrients in the soil through influences on soil microbial activity, besides it contains NPK and some micronutrients necessary for good growth (Dorer and Peacock, 1997), and amino acids which strengthen the immunity system of the plant and reduces the harmful effect of diseases. Moreover, it may play a role in balancing the hormonal control inside the plants, and so enhances the vegetative and root growth (Kim *et al.*, 1991).

The aforementioned results are in accordance with those attained by Canaway (1992) on *Lolium perenne* cv. Loretta, Hunter and Butler (2005) on *Agrostis stolonifera*, El-Sayed *et al.* (2008) on Tifway Bermudagrass and Bettoni *et al.* (2009) on *Kalanchoe*.

Chemical composition:

Data in Table (3) exhibit that spraying of humic acid and amino acids, individually or in combination caused a significant increment in the leaf content of chlorophyll a, b and carotenoids (mg/g f.w.) over control plants with few exceptions in the two seasons. A similar trend was also attained concerning total sugars content (mg/g d.w.),

Table 1. Effect of humic acid and amino acids on plant height, covering rate and number of plants/pot of *Paspalum vaginatum* Swartz. plants during 2014 and 2015 seasons.

Treatments	Plant height (cm)		Covering rate (%)		No. plants/pot	
	2014	2015	2014	2015	2014	2015
Control	10.15 h	10.65 g	43.05 g	49.28 g	20.21 i	22.10 g
Humic acid at 5ml/l (A)	13.24 g	11.11 g	51.24 f	58.19 f	21.99 h	23.00 g
Humic acid at 10ml/l (B)	15.72 f	15.62 f	64.54 d	71.02 d	25.21 g	26.11 f
Amino acid at 1g/pot (C)	20.30 e	19.22 e	59.34 e	65.32 e	26.73 f	26.99 f
Amino acid at 2g/pot (D)	21.99 d	21.99 d	80.82 c	82.12 c	30.27 e	29.12 e
A + C	22.22 d	25.33 c	87.50 b	92.74 b	35.00 d	35.67 d
A + D	24.31 c	27.20 b	97.89 a	97.33 a	40.12 c	40.22 c
B + C	27.53 b	28.00 b	100.00 a	100.00 a	42.15 b	42.31 b
B + D	30.79 a	33.21 a	100.00 a	100.00 a	45.72 a	46.37 a

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

Table 2. Effect of humic acid and amino acids on fresh and dry weights of plants/pot of *Paspalum vaginatum* Swartz. plants during 2014 and 2015 seasons.

Treatments	Fresh weight (g)		Dry weight (g)	
	2014	2015	2014	2015
Control	25.23 g	28.11 i	11.24 h	13.00 i
Humic acid at 5ml/l (A)	32.11 f	34.12 h	14.30 g	15.32 h
Humic acid at 10ml/l (B)	37.11 e	39.17 g	17.95 f	18.02 g
Amino acid at 1g/pot (C)	40.32 d	44.32 f	18.73 ef	19.99 f
Amino acid at 2g/pot (D)	41.29 d	51.21 e	19.23 e	23.21 e
A + C	44.31 c	54.00 d	22.33 d	25.10 d
A + D	45.99 c	57.20 c	24.32 c	26.11 c
B + C	57.32 b	59.34 b	27.95 b	28.00 b
B + D	60.31 a	65.20 a	33.52 a	34.20 a

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

Table 3. Effect of humic acid and amino acids on pigments content (mg/100g F.W.) in the leaves of plants/pot of *Paspalum vaginatum* Swartz. plants during 2014 and 2015 seasons.

Treatments	Chlorophyll (a)		Chlorophyll (b)		Carotenoids	
	2014	2015	2014	2015	2014	2015
Control	1.20 g	1.51 g	0.72 i	0.79 h	1.25 g	1.47 f
Humic acid at 5ml/l (A)	2.21 f	2.99 f	0.99 h	0.93 g	1.49 f	1.99 e
Humic acid at 10ml/l (B)	2.82 e	3.41 e	1.40 g	1.49 f	2.10 e	2.46 d
Amino acid at 1g/pot (C)	2.97 e	3.88 d	1.52 f	1.60 e	2.20 e	2.59 cd
Amino acid at 2g/pot (D)	3.81 d	3.99 cd	1.62 e	1.78 d	2.73 d	2.54 d
A + C	3.91 d	4.20 c	1.70 d	1.79 d	2.86 c	2.73 c
A + D	4.32 c	4.98 b	1.89 c	1.97 c	2.89 bc	2.73 c
B + C	4.80 b	5.00 b	1.99 b	2.31 b	2.99 b	2.93 b
B + D	5.99 a	6.22 a	2.43 a	2.45 a	3.72 a	3.29 a

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

as well as indoles and phenols content (mg/100 g f.w.) in the two seasons (Table, 4). The highest values were obtained from the combined treatments with humic acid as a foliar spray at 10 ml/l + amino acids as soil drench at 2 g/pot.

This may refer to the role of humic acid in supplying the plants with some nutrients necessary for healthy growth (Higa and Wididana, 1991). Also, amino acids as a buffer on the biosynthesis of other organic compounds i.e. pigments, vitamins, alkaloids, enzymes, coenzymes (Goss, 1973 and Kamar and Omar, 1987).

Briefly, to obtain the best growth and highest quality from commercial point of view, it is recommended to fertilize the plants with humic acid at 10 ml+ 2 g/pot as a

soil drench from amino acids 6 times with one month interval during growing season proved planting them in a sand.

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Table 4. Effect of humic acid and amino acids on total sugars, indoles and phenols content in the leaves of plants/pot of *Paspalum vaginatum* Swartz. plants during 2014 and 2015 seasons.

Treatments	Total sugars (%)		Indoles (mg/100g F.W.)		Phenols (mg/100g F.W.)	
	2014	2015	2014	2015	2014	2015
Control	2.72 g	4.99 g	0.32 g	0.41 g	0.04 b	0.03 c
Humic acid at 5ml/l (A)	5.99 f	5.21 g	0.39 f	0.49 f	0.05 ab	0.04 bc
Humic acid at 10ml/l (B)	6.09 f	5.99 f	0.40 f	0.49 ef	0.06 ab	0.05 bc
Amino acid at 1g/pot (C)	6.88 e	6.72 e	0.45 e	0.50 ef	0.06 ab	0.05 bc
Amino acid at 2g/pot (D)	6.89 e	6.98 e	0.49 d	0.52 e	0.06 ab	0.06 a-c
A + C	7.97 d	8.00 d	0.62 c	0.58 d	0.07 ab	0.06 a-c
A + D	8.52 c	8.99 c	0.69 b	0.62 c	0.07 ab	0.07 ab
B + C	9.73 b	9.32 b	0.72 b	0.78 b	0.07 ab	0.07 ab
B + D	11.24 a	11.99 a	0.93 a	0.89 a	0.08 a	0.09 a

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

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دور حمض الهيوميك والأحماض الأمينية في تحسين نمو وجودة مسطح البسبالم المنزرع في التربة الرملية

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أجريت هذه الدراسة بمشتمل قسم بحوث الزينة وتنسيق الحدائق، معهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر خلال موسمي ٢٠١٤ و ٢٠١٥ وذلك لدراسة تأثير الرش الورقي بـ حمض الهيوميك بمعدل صفر، ٥، ١٠ مل/لتر ومخلوط الأحماض الأمينية كإضافة أرضية بمعدل ١ و ٢ جم/لتر والتفاعل بينهما على النمو وجودة مسطح البسبالم المنزرع في أصص بلاستيك قطر ٤٠ سم ومملوء بالرمل حيث يتم اضافتها ٦ مرات خلال موسم النمو وبفاصل زمني شهر بين كل رشتين.

ولقد أوضحت النتائج المتحصل عليها أن جميع المعاملات موضع الدراسة أحدثت تحسناً واضحاً في ارتفاع النبات، الكثافة النباتية (معدل التغطية)، عدد النباتات/أصيص والوزن الطازج والجاف للعشب الناتج بعد القص بالمقارنة بالكنترول في كلا الموسمين، وكذلك زيادة محتوى النباتات من الكلوروفيلات أ، ب والكاروتينويدات والسكريات الكلية والأندولات

والفينولات ولكن أفضل معاملات هي معاملات التداخل بين حمض الهيوميك بمعدل ١٠ مل/لتر + مخلوط الأحماض الأمينية بمعدل ٢ جم/لتر والتي أعطت أعلى المتوسطات على الإطلاق.
وبناء على ذلك يوصى برش نباتات الباسبالم المنزرعة في الرمل بكلا من حمض الهيوميك بمعدل ١٠ مل/لتر + مخلوط الأحماض الأمينية بمعدل ٢ جم/لتر وذلك ٦ مرات بفاصل زمني شهر بين كل رشتين خلال موسم النشاط للحصول على أفضل نمو وأعلى جودة.