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EFFECT OF SOME NATURAL ACTIVATORS ON GROWTH AND QUALITY OF SEASHORE PASPALUM TURF

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ABSTRACT: This investigation was conducted under open field conditions at the Experimental Farm of Hort. Res. Inst., ARC, Giza, Egypt during 2013 and 2014 seasons to find out the response of seashore paspalum (*Paspalum vaginatum* Swartz) grown in 40-cm-diameter plastic pots filled with about 6 kg of an equal mixture of sand and clay (1:1, v/v) to some natural activators, viz. super blue green (SBG) at 3 ml/l, Ascobien at 1 g/l, BioHorm at 1 ml/l and to some combinations of them when applied as a foliar spray, five times with one month interval. The verdure of control plants was sprayed with the tap water.

The results of such investigation have shown that all vegetative growth traits were significantly improved over control in response to either sole or combined treatments applied in this study. Among the individual treatments, BioHorm at 1 ml/l was the best treatment, followed by SBG at 3 ml/l and then 1 ml/l of Ascobien treatment. An excessive improvement was obtained when combining the single treatments, especially combining between the three used activators (SBG at 3 ml/l + Ascobien at 1 g/l + BioHorm at 1 ml/l), as such combination gave the utmost high means of vegetative growth parameters at all in the two seasons. A similar trend to that of vegetative growth was also observed as well regarding the content of chlorophyll a, b, carotenoids, N, P, K, total soluble sugars and total indoles in the leaves, but the opposite was the right concerning total phenols content which was decreased by the various used treatments to reach the minimum values by the combination of 3 ml/l SBG + 1 g/l Ascobien + 1 ml/l BioHorm in the two seasons.

Hence, it is recommended to spray the verdure of seashore paspalum turf with a combination of SBG (3 ml/l) + Ascobien (1 g/l) + BioHorm (1 ml/l), five times with 1 month interval during the growth stage to score the best growth performance and highest quality.

Key words: *Paspalum vaginatum*, super blue green (SBG), Ascobien, foliar spray, vegetative growth, chemical composition.

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INTRODUCTION

Seashore paspalum (*Paspalum vaginatum* Swartz) is a succulent warm-season turf type grass that belongs to Fam. Gramineae, but it retains a healthy appearance all year-round, unlike bermudagrass that tends 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).

Turfgrass plants usually undergo many stresses, i.e., they are crowded together and compete with each other for water and nutrients. They are regularly mowed and their clippings are often removed. So, they must be well fertilized to face these competition and the un-natural demands placed on them. With proper fertilization, the lawn will maintain good colour, density and vigour and will not be easily succumb to insects, weeds or diseases (Peacock *et al*., 1985). Now using materials from natural sources was suggested to restore the natural biological balance which is disturbed by the misuse of chemical fertilizers, besides improving growth and keeping quality of the plants. In this regard, El-Sayed (2012a) found that fertilizing seashore paspalum turf with EM biostimulant at 1 ml/l in the presence of kristalon at 2 g/pot greatly improved plant height, covering rate, No. plants/pot, pigments content in the leaves and total soluble sugars, indoles and phenols in the herb. In other study, El-Sayed (2012b) on seashore paspalum reported that combining between humic acid at 20 ml/l and Oligo-X (an algae extract) at 1.5 ml/l level gave the tallest plants, best coverage, more No. plants/pot, heaviest fresh and dry weights, as well as the highest content of pigments in the leaves, and of total soluble sugars, indoles and phenols in the herb.

On the same line, were those results revealed by Shahin (2005) on seashore paspalum, El-Sayed *et al*. (2008) on Tifway sod, Canaway (1992) on *Lolium perenne* cv. Loretta and Munshaw *et al*. (2006) who pointed out that application of seaweed extract at 0.54 kg/ha + N (49 kg/h) + Fe (1 kg/ha) improved colour, density and cold tolerance of Tifway, Midiron, Princess-77 and Riviera bermudagrasses.

This work, however aims to elicite the role of some commercial products prepared from natural resources on improving growth, colour and quality of seashore paspalum turf under our local climatic conditions.

MATERIALS AND METHODS

The current investigation was performed under the open field conditions at the Experimental Farm of Hort. Res. Inst., ARC, Giza, Egypt throughout the two consecutive seasons of 2013 and 2014 to study the effect of some natural activators on growth, density and chemical composition of seashore paspalum turfgrass.

Thus, circle pieces from pre-prepared rolls of seashore paspalum (*Paspalum vaginatum* Swartz) at a radius of 10 cm (their fresh weights ranged between 90-100 g) were carefully taken and planted on April, 1st for each season in the center of 40-cm-diameter plastic pots (one piece/pot) filled with about 6 kg of an equal mixture of sand and clay. The physical and chemical analysis of the used sand and clay in the two seasons are shown in Table (1).

Table 1. The physical and chemical analyses of the used sand and clay during 2013 and 2014 seasons.

Soil type	Seasons	Particle size distribution (%)				S.P.	pH	E.C. (dS/m)	Cations (meq/l)				Anions (meq/l)		
		Coarse sand	Fine sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^-	Cl^-	SO_4^{--}
Sand	2013	89.03	2.05	0.40	8.52	23.00	7.92	3.72	7.50	1.63	33.60	0.50	3.20	22.00	18.03
	2014	90.10	1.95	0.50	7.45	22.86	7.89	3.75	19.42	8.33	7.20	0.75	1.60	7.00	27.10
Clay	2013	7.54	22.28	30.55	39.63	55.00	8.17	2.26	7.82	2.12	15.40	0.75	6.60	8.20	11.29
	2014	7.64	22.50	30.15	39.71	51.00	8.09	2.38	7.50	2.20	15.50	0.75	6.78	8.02	11.15

The pieces were gently pressed with hand to be more contact with the soil mixture and were then daily irrigated with about 300 ml of a tap water/pot during the first 2 weeks after planting, while afterwards were irrigated 2 times a week with 400 ml of water/pot till the end of experiment. After about 50 days from planting (on May, 20th), the verdure of plants was sprayed with the following treatments before cut till the solution was run-off, five times with one month interval (till 20th of September of each season).

1- The control treatment, as the verdure of plants was sprayed with the tap water.

2- The commercial liquid product of super blue-green (SBG), which contains amino acids, vitamins, minerals and auxins extracted from algae at the rate of 3 ml/l.

3- The natural activator Ascobien, that contains about 38% of ascorbic and citric acids plus about 62% of organic compounds stimulating growth at the rate of 1 g/l.

4- The natural enzymatic activators BioHorm, that contains cytokinin, riboflavin, niacin, thiamin, as well as citric, L-ascorbic and vulvic acids + L-free amino acids (20%) + Mo (4%) + Co (0.005 %) at the rate of 1 ml/l.

5- The previous treatments were combined to gave the following 3 combinations:

   a. SBG at 3 ml + Ascobien at 1 g/l (A).

   b. SBG at 3 ml + BioHorm at 1 ml/l (B).

   c. SBG at 3 ml + A + B.

After 2 months from planting (on June, 1st), the first cut was handly done with a very sharp stainless steal cutter leaving stubbles with 1 inch long, while the other 4 cuts were carried out monthly thereafter. This means that fertilization treatments were applied before each cut by about 10 days. The pots were arranged in a completely randomized design (Mead *et al*., 1993), with 3 replicates for each treatment, as each replicate contained 5 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 clippings after mowing were determined after each cut. Moreover, the covering rate as a percentage was evaluated using the method described by Mahdi (1953). However, the means of each parameter above named 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 (on October, 1st), photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g f.w.), as well as total indoles and total phenols (mg/100 g f.w.) were measured according to the methods of Saric *et al*. (1967), A.O.A.C. (1990) and William *et al*. (1965), respectively, while in dry samples, the percentages of nitrogen (Pregl, 1945), phosphorus (Cottenie *at al*., 1982), potassium (Jackson, 1973) and total soluble sugars (Dubois *et al*., 1956) were measured.

Data were then tabulated and subjected to analysis of variance using SAS Institute Program (1994), followed Duncan's Multiple Range Test (Duncan, 1955), to detect the significancy among means of various treatments.

RESULTS AND DISCUSSION

Effect of fertilization treatments on:

1- Vegetative growth parameters:

It is clear from data averaged in Tables (2 and 3) that all vegetative growth parameters pronouncedly increased in response to the different sole and combined treatments applied in such trial with significant differences in most cases of both seasons. Among the individual treatments, BioHorm at 1 ml/l was the best treatment, as it recorded higher means than the other two individual ones. The SBG at 3 ml/l single treatment occupied the second rank and then, followed by Ascobien (1 ml/l) one.

This may indicate the role of BioHorm in supplying the plants with vitamins and amino acids which directly influence the physiological activities in plant growth and

Table 2. Effect of fertilization treatments on vegetative growth traits of *Paspalum vaginatum* Swartz plants during 2013 and 2014 seasons.

Treatments	Plant height (cm.)		No. of plants/pot		Covering rate (%)	
	2013	2014	2013	2014	2013	2014
Control	33.82e	35.85f	26.43e	25.11e	58.20e	61.33e
SBG at 3ml/l (A)	36.10de	38.10de	30.00d	28.56d	67.00d	63.85e
Ascobien at 1g/l (B)	35.21e	37.10e	29.33de	28.00d	64.50de	62.90e
BioHorm at 1 ml/l (C)	37.50d	39.21d	35.10c	33.67c	78.00c	75.00d
A + B	44.08c	46.76c	37.76bc	38.33bc	82.94bc	83.67c
A + C	47.12b	49.45b	39.00b	40.56b	86.80b	90.32b
A + B + C	52.46a	52.97a	43.30a	44.72a	95.36a	100.00a

- SBG = Super blue-green.

- 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 fertilization treatments on fresh and dry weights of *Paspalum vaginatum* Swartz clippings during 2013 and 2014 seasons.

Treatments	Fresh weight (g)		Dry weight (g)	
	2013	2014	2013	2014
Control	29.15f	30.90f	13.10e	13.86e
SBG at 3ml/l (A)	34.60de	36.51de	15.39d	16.30d
Ascobien at 1g/l (B)	33.45e	35.23e	14.87de	15.67de
BioHorm at 1 ml/l (C)	36.91d	38.50d	19.93cd	20.80cd
A + B	41.80c	44.33c	21.24c	22.53c
A + C	50.68b	53.10b	26.96b	28.30b
A + B + C	56.50a	57.43a	34.22a	35.76a

- SBG = Surer blue-green.

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

development (Datir *et al*., 2012), with minerals necessary for healthy growth and trace elements (such as Mo and Co) essential for activating enzymatic systems and with cytokinin which induces cell division and differentiation, promoting proteins synthesis plus its ability to delay senescence by withdraw sugars and other solutes from older parts to new formed ones (Salisbury and Ross, 1974). Moreover, auxins presented in SBG product and organic compounds in Ascobien one stimulate vital processes, consequently increase assimilates which positively reflect on growth and production (Handreck and Black, 2002).

An extra improvement in growth and density of plants was noticed when combining between the single treatments, especially the combining between the 3 used activators (SBG at 3 ml/l + Ascobien at 1 g/l + BioHorm at 1 ml/l) which gave the utmost high means over all other combinations in the two seasons. This of course reasonable because of lumping the beneficial effects of the 3 natural products simultaneously. In this connection, Canaway (1992) reported that Alginure (a natural seaweed extract) improved growth, covering rate and playing tolerance of *Lolium perenne* cv. Loretta turf when applied at 50, 75, 100 , 150 and 175 g/m^2 to the sand rootzone. The resilience and hardness of the plants were linearly increased with increasing Alginure rate. Similar observations were also pointed out by Shahin (2005) and El-Sayed (2012 a, b) on seashore paspalum, El-Sayed *et al*. (2008) on Tifway bermudagrass and Munshaw *et al*. (2006) on Tifway, Midiron, Princess-77 and Riviera bermudagrasses.

2- Chemical composition:

It is shown from data illustrated in Tables (4, 5 and 6) that pigments content (chlorophyll a, b and carotenoids) in the leaves (mg/g f.w.),

Table 4. Effect of fertilization treatments on pigments content (mg/g f.w.) in the leaves of *Paspalum vaginatum* Swartz plants during 2013 and 2014 seasons.

Treatments	Chlorophyll (a)		Chlorophyll (b)		Carotenoids	
	2013	2014	2013	2014	2013	2014
Control	0.679e	0.815e	0.397e	0.477e	0.361c	0.410c
SBG at 3ml/l (A)	0.797d	0.937d	0.458d	0.546d	0.470bc	0.531bc
Ascobien at 1g/l (B)	0.769d	0.921d	0.443d	0.525d	0.457bc	0.520bc
BioHorm at 1 ml/l (C)	0.935c	1.122cd	0.547cd	0.623cd	0.494b	0.567b
A + B	0.979c	1.175c	0.603c	0.719c	0.510b	0.589b
A + C	1.506b	1.309b	0.815b	0.864b	0.781ab	0.816ab
A + B + C	1.621a	1.438a	0.938a	0.997a	0.845a	0.863a

- SBG = Super blue-green.

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

Table 5. Effect of fertilization treatments on N, P and K % in the leaves of *Paspalum vaginatum* Swartz plants during 2013 and 2014 seasons.

Treatments	N (%)		P (%)		K (%)	
	2013	2014	2013	2014	2013	2014
Control	1.24e	1.39d	0.095d	0.091d	1.16d	1.23d
SBG at 3ml/l (A)	1.50cd	1.50c	0.105cd	0.099c	1.39cd	1.49cd
Ascobien at 1g/l (B)	1.34d	1.42cd	0.099d	0.096c	1.27d	1.37d
BioHorm at 1 ml/l (C)	1.63c	1.73b	0.119c	0.107c	1.50c	1.62c
A + B	1.48cd	1.60bc	0.135b	0.126b	1.71b	1.70bc
A + C	1.97b	1.94ab	0.151a	0.139ab	1.85ab	1.81b
A + B + C	2.30a	2.16a	0.158a	0.153a	1.99a	2.04a

- SBG = Super blue-green.

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

Table 6. Effect of fertilization treatments on total soluble sugars, indoles and phenols in the leaves of *Paspalum vaginatum* Swartz plants during 2013 and 2014 seasons.

Treatments	Total soluble sugars (%)		Total indoles (mg/100 g f.w.)		Total phenols (mg/100 g f.w.)	
	2013	2014	2013	2014	2013	2014
Control	8.16c	7.63e	0.003d	0.003d	0.022a	0.023a
SBG at 3ml/l (A)	8.82bc	8.26d	0.014b	0.011b	0.018ab	0.014b
Ascobien at 1ml/l (B)	8.46c	7.91de	0.010c	0.008c	0.023a	0.019ab
BioHorm at 1 g/l (C)	9.51b	8.90cd	0.020a	0.020c	0.017ab	0.011c
A + B	9.76b	9.39c	0.018ab	0.019a	0.020a	0.015b
A + C	10.33a	10.38b	0.020a	0.020a	0.016b	0.011c
A + B + C	10.59a	11.21a	0.022a	0.021a	0.010c	0.011c

- SBG = Super blue-green.

- 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 the percentages of N, P, K and total soluble sugars were markedly increased as a result of applying the various sole and combined treatments with significant differences compared to control in most instances of both seasons. The individual application of BioHorm at 1 ml/l recorded better content than the sole application of either SBG at 3 ml/l or Ascobien at 1 g/l, whereas the content of these constituents scored by the combined treatments surpassed those recorded by single ones, with the superiority of 3 ml/l SBG + 1 g/l Ascobien + 1 ml/l BioHorm combination which gave the

highest content at all in the two seasons. This may be ascribed to the synergistic effect of the three activators in providing the turf plants with their needs of nutrients, vitamins amino acids and auxins that directly share in stimulating vital processes occurred in plant tissues (Kenneth, 1979). Presence of cytokinin in BioHorm increases carbohydrates and protein synthesis and causes transport of many solutes from older parts to the new ones (Salisbury and Ross, 1974). In this connection, Leopold and Kawase (1964) mentioned that cytokinins stimulate the movement of sugars, starch, amino acids and many other solutes from mature organs to primary tissues of other ones.

A similar trend occurred as well with regard to total indoles content (mg/100 g f.w.), as it was significantly increased in response to the different treatments employed in this work, with the mastership of BioHorm alone at 1 ml/l and all combinations that raised such component to the maximum values in the two seasons. The opposite was the right concerning the content of total phenols which slightly decreased in the 1st season by the individual treatments and the combination between SBG (3 ml/l) and Ascobien (1 g/l), whilst in the 2nd one, all individual and combined treatments significantly reduced content of such parameter, except for Ascobien at 1 g/l treatment that non-significantly decreased. However, the highest decrement in this trait was attained by combining between the 3 used activators, as such combination declined content of this constituent to 0.010 and 0.011 versus 0.022 and 0.023 mg/100 g f.w. for control in the 1st and 2nd seasons, respectively.

This may be attributed to the role of these natural activators on increasing the promoters in the plant tissues at the expense of the inhibitors to induce growth. In this regard, Kenneth (1979) reported that the total of plant growth is used not a single hormonal type-that of auxin, but is shared by several specially auxins, cytokinins, gibberllins and ethylene, and this further is subjected to modification by certain naturally occurring inhibitors, namely phenols, flavonols and absicsic acid, which have been known to modify the activity of IAA-oxidase and might therefore be acting on growth and production by way of changes in endogenous auxin levels. In addition, cytokinin has ability to prevent the emanation of some positive inhibitory influences from the leaves under non-inductive conditions (Audus, 1972).

From the previous gains, it is advised to spray the verdure of seashore paspalum turf with 3 ml/l super blue-green + 1 g/l of Ascobien + 1 ml/l of BioHorm, five times with one month interval for the best growth and highest quality.

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تأثير بعض المنشطات الطبيعية على نمو وجودة مسطح الباسبالم (شاطىء البحر)

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أجري هذا البحث تحت ظروف الحقل المفتوح بالمزرعة التجريبية لمعهد بحوث البساتين، مركز البحوث الزراعية، الجيزة، مصر خلال موسمي ٢٠١٣، ٢٠١٤ للتعرف على مدى استجابة نباتات مسطح الباسبالم (شاطىء البحر) (*Paspalum vaginatum* Swartz) النامى فى أصص بلاستيك قطرها ٤٠ سم، مملوءة بحوالي ٦ كجم من مخلوط الرمل والطين (بنسبة ١: ١حجما) لبعض المنشطات الطبيعية وهى: السوبر بلوجرين بمعدل ٣ مل/لتر، أسكوبين بمعدل ١ جم/لتر، بيوهورم بمعدل ١ مل/لتر، وكذلك لبعض التوليفات بينها عند إضافتها رشاً على الأوراق،خمس مرات خلال موسم النمو النشط وبفاصل شهر بين كل رشتين. وقد تم رش العشب الأخضر لنباتات المقارنة بماء الصنبور.

أظهرت النتائج المتحصل عليها أن جميع قياسات النمو الخضرى قد تحسنت معنوياً استجابة لمختلف المعاملات الفردية والمشتركة المطبقة بهذه الدراسة عند مقارنتها بالكنترول فى كلا الموسمين. من بين المعاملات الفردية كانت معاملة الرش بالبيوهورم بمعدل ١ مل/لتر هي الأفضل، تلتها معاملة السوبر بلو جرين (٣ مل/لتر) ثم معاملة الأسكوبين (١جم/لتر). ولقد أدى الجمع بين المعاملات الفردية إلى إحداث تحسن إضافي في جميع قياسات النمو الخضرى، خاصة عند الجمع بين المنشطات الثلاثة المستخدمة بالدراسة فى توليفة واحدة (السوبر بلو جرين بمعدل ٣ مل/لتر + أسكوبين بمعدل ١ جم/لتر + بيوهورم بمعدل ١ مل/لتر)، حيث أعطت هذه التوليفة أعلى متوسطات للنمو الخضرى على الإطلاق بكلا الموسمين. لوحظ أيضاً أن محتوى الأوراق من كلوروفيللى أ، ب، الكاروتينويدات، ن، فو، بو، السكريات الكلية الذائبة والأندولات الكلية قد أخذ اتجاهاً مشابهاً لاتجاه نتائج النمو الخضرى، بينما كان العكس صحيحاً فيما يتعلق بمحتواها من الفينولات الكلية والذى انخفض معنوياً متأثراً بمختلف المعاملات المطبقة بهذه الدراسة ليصل إلى أدنى القيم فى كلا الموسمين بالتوليفة المكونة من سوبر بلو جرين (٣ مل/لتر) + أسكوبين (١ جم/لتر) + بيوهورم (١مل/لتر).

وعليه، يمكن التوصية برش العشب الأخضر لنباتات مسطح الباسبالم (شاطىء البحر) بتوليفة من المنشطات التجارية التالية: سوبر بلو جرين بمعدل ٣ مل/لتر + أسكوبين بمعدل ١ جم/لتر + بيوهورم بمعدل ١مل/لتر، خمس مرات خلال فترة النمو النشط وبفاصل شهر بين كل رشتين أثناء موسم النمو النشط للحصول على أفضل مظهر للنمو وأعلى جودة للمسطح الناتج.