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THE POSSIBILITY OF SYNERGISM BETWEEN LISOPHOS AND BRASSINOSTEROID ON SOME CHARACTERISTICS OF "CRIMSON SEEDLESS" GRAPES UNDER FIELD CONDITION.

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Abstract:

This study was carried out in a private orchard in badr district, Behera governorate – Egypt, using six years old own rooted "Crimson seedless" grapevines. to examine the influence of brassinoloids (Br) and lisophos either individually or in combination on berrie quality at harvest time. Crimson grapevines were treated by brassinoloids and Lisophos and sprayed twice at version (15-20%) coloration and ten days later in both seasons.

The Br was used at (1 and 2 ppm) while the lisophos was sprayed at (100 or 200 ppm) in addition to the combinations between the concentration of both treatments. Thus, the total of nine treatments was applied including the control which was the surfactant. Tween 80 at (0.1% v/v) at harvest, each treatment resulted in Improving many fruit characteristics.

However, the combined application of Br and lisophos showed more effective rather than individual application especially the combination of Br (at 1 ppm) plus lisophos at 200 ppm with certain fruit berry properties such as: carotene contents in berry skins and total anthocyanin in berry skin. In a similar manner the combination of Br (at 2 ppm) plus lisophos (at 200 ppm) resulted a, significant a increment in TSS to acidity ratio as compared to individual application Such trends were consistent in both seasons. Thus, a possible synergism exists between Br and Lisophos when sprayed on grape berries at veraison.

Key words: Natural Compounds, Crimson grapes, Berry characteristics, color of berries, leaf vigor.

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Introduction:

Grape (*Vitis vinifera,* L.) is considered to be one of the utmost economically important crops in the world and one of the most widely cultivated crops in Egypt. Cultivation of grape is spread geographically in Egypt from Alexandria to Aswan combining with the production of early and late grapes, which lead to prolong availability of fresh table grapes from May to November. Moreover, Egypt ranks fourth in the world in table grape production. (FAO**, 2002**)

Furthermore, grape fruits are one of the most preferable in the world for its eligible odor and high content of soluble solids.

Fruit quality is more poignant as compared with yield in excellent table grapes production (**Peppi *et al*., 2006**). Moreover, grape berry composition is important to both growers and consumers which is fundamentally determined with organic acids, sugars as well as many secondary metabolites such as anthocyanin and aromatic compounds (**Conde *et al*., 2007**). Size, texture, taste and color are also among the most important characteristics that contribute in grape quality.

In Egypt, grape growers complain from grape berries poor coloration particularly under arid, rejoins grapevines have been exposed to trivial differences between day and night temperatures plus heat stress. In addition, grape growers face many problems such as berry shatter and browning. (AFM **EL-salhy *et al* ., 2021)** Physical and chemical quality characteristics could be modified with plant growth regulators (PGRs) use.

Previous studies displayed that PGRs play a substantial role in grape production like increase berry weight (**Casanova *et al*., 2009**), enlargement berry size (**Xu *et al.*, 2019**) as well as delaying ripening (**Ponce *et al*., 2002**).

A new group of polyhydroxyl steroids is called Brassinosteroids, which have been recognized as a class of phytohormones according to **Mitchell *et al*. (1970)** improved cell division and cell elongation of plant. **Sugiyama and Kuraishi (1989)** also showed that brassinosteroids resulted in delaying the abscission of leaf and fruit. Brassinosteroids increase yield, activity of carbonic anhydrase and rate of net photosynthetic of plants **(Hayat *et al*., 2000).** Moreover, brassinosteroids (BRs) play an fundamental role for plants recovery under abiotic stress conditions such as drought, heavy metals, salts, viruses and pesticides . These favorable effects can be explained by stimulating the defense system of the antioxidative in plants **(Wachsman *et al.*, 2000; Krishna, 2003; Ozdemir *et al.* 2004; Bajguz, 2009; Kanwar *et al*., 2012 and 2013; Sharma *et al*. 2015; Sharma *et al*. 2016 a and Shahzad *et al*., 2018).** Moreover, **Mussig (2005)** mentioned that brassinosteroids can regulate and merges various processes, which necessary for growth through synergistic interactions with phytohormones. **Swamy and Rao, (2008)** also demonstrated that brassinosteroids play notable functions in several developmental processes such as cell elongation, abscission, senescence and maturation. Furthermore, **Bajguz and Hayat (2009)** also declared that brassinosteroids increased growth, improved photosynthesis process efficiency and thus induced the yield. In addition, **Padashetti *et al*. (2010)** indicated that brassinosteroids (BRs) maintained fruit peel color and reduced the rate of total soluble solids, fruit acid degradation of " Arka Neelamani" and "Thompson seedless " grapes under cold storage. Moreover, Zhu ***et al*. (2010)** showed that brassinosteroids helps in slowing down the senescence of fruit by lowering the production of ethylene and the rate of respiration in other fruits. **Clouse (2011)** also showed that brassinosteroids (BRs) are participate in regulating a wide range of plant physiological processes. BRs enhanced high total anthocyanin content in grape berries **(Luan *et al.*, 2013)**. Furthermore, **Roghabadi and Pakkish (2014)** noticed that foliar application of Br increased skin color of fruit by increasing anthocyanin, phenol, organic acids and ascorbic acid content. **Champa *et al.* (2015)** observed that the exogenous application of brassinosteroids (BRs) considerably enhanced grape cluster weight and diameter as well as berry weight, length, and diameter plus maintained skin color and decreasing the degradation rate of total soluble solid as well as total acidity during cold storage and reduced decay, consequently delayed fruit senescence. Moreover, **Işçi and Gökbayrak (2015)** noticed that the high concentrations of 22S-, 23S-homobrassinolide caused a stronger attachment between the pedicel and the stalk in grape. Furthermore, **Saini *et al*. (2015)** showed that brassinosteroids furnishes several processes in a combination with other phytohormones like auxin, gibberellin, cytokinin, ethylene, abscisic acid, salicylic acid, jasmonic acid and polyamine in plants. . Moreover, **Isci and Gökbayrak (2015)** noticed that the application of 22S-, 23S-homobrassinolide at high concentration caused a strong attachment between the pedicel and the stalk, thus reduced fruit drop and improved fruit retention in grapes. **Xu *et al*. (2019)** found that preharvest application of 24-epibrassinolide gave better anthocyanin and color development in "Cabernet Sauvignon" grapes. In addition, **Liu *et al*. (2016)** indicated that brassinosteroids resulted in high berry firmness as well as low weight loss and berry decay in grapes during cold storage plus better postharvest quality and less occurrence of botrytis rot in grape berries. Brassinosteroids (BRs) modify the genes pigment expression and the biosynthesis of secondary metabolite under pesticide stress **(Sharma *et al*., 2016 b)**.

Lisophos, as the commercial name of lyso phosphatidyl ethanolamine (LPE), is a natural compound reported to improve fruit coloration without softening, alleviate the loss of firmness, retard the of tissue, reduce fruit abscission of several fruits and prohibit the activity of cell wall degrading enzymes (**Farag and Palta, 1989 and Parikh *et al*., 1990)**. Meanwhile, **Ryu *et al*. (1997)** indicated that LPE inhibited phospholipase -D activity, which has been increased during plant senescence period. Furthermore, **Amaro (2012)** proved that LPE inhibits the activity of phospholipase –D and decreases the production of ethylene as well as prolong shelf life of several horticultural commodities. Moreover, LPE delays the stimulation of ripening in table grape, increases postharvest longevity and prolongs shelf life.

Moreover, lisophos (LPE) improves fruit color and this has been attributed to enhance enzyme the activity of phenylalanine-ammonia-lyase (PAL) and so increases anthocyanin accumulation **(Farag and Palta 1991; Ozagen *et al*., 2004)** as well as increases carotenoid accumulation **(Kang et *al*., 2003)**. Meanwhile, **Farag and Palta 1993a** as well as **Cowan 2009** showed that LPE application has also been used to delay fruit senescence of fruits and LPE retards the activity of polygalacturonase, which mediated fruit softening **(Hong *et al*., 2008)**. In addition, fruit coloration has been accelerate by using (LPE) Lysophosphatidyl ethanolamine (LPE) and fruit shelf life is promoted **(Özagen *et al*., 2004)**. In addition, Lysophosphatidyl ethanolamine increased size, soluble solids content and firmness, while reduced titratable acidity of "Thompson Seedless" grape berries at harvest (**Hong *et al*., 2007)**. Pre and postharvest treatments with lysophosphatidyl ethanolamine (LPE) delayed the senescence and prolonged the shelf life of many fruits **(Ahmed and Palta, 2011)**. Furthermore, **Attia and Farag (2017)** mentioned that lisophos resulted in reduced both water berry disorder and ion leakage of cluster lateral and pedicels of " Thompson Seedless" table grape at harvest or after storage at ambient temperature as well as improved quality like cluster and berry weight, cluster and berry length as well as increased total soluble solid and total sugar content. In addition, using lisophos accelerated veraison and improved grape berry quality under field conditions. Lisophos improved the overall quality of "Thompson Seedless" grapes. **(Farag *et al*., 2020).**

It is probably clear from what's contextualized earlier that, grape producers are in critical need to non-genotoxic, nontoxic, safe and eco-friendly treatment that can be applied to improve cluster physical properties, enhance berry coloration, improve quality as well as reduce berry shatter and browning. Consequently, the objectives of this study were to evaluate the effectiveness of brassinosteroids, lisophos individually or in different combination at different concentrations on enhancing berry skin coloration as well as improving physical and chemical quality characteristics of "Crimson Seedless" grape at harvest.

Materials and Methods:

Six years old – own rooted "Crimson Seedless" grapevines (*Vitis vinifera* L.) grown in a private grown in a private orchard at Badr center, Beheira governorate, Egypt were chosen during 2019 and 2020 seasons for conducting this study. The chosen vines were planted at 2 × 3 meters and trellis system gable has been used. Grapevines were grown in a sandy soil and, subjected to drip irrigation system as well as received the standard agricultural recommended practices. Dormex (5% $H_2 CN_2$) application was applied after winter pruning in February to break bud dormancy. Thirty - six uniform in vigor and productivity grapevines, free from various physiological and obvious pathological disorders as possible were selected to carry out the experiment. The experiment was arranged in a randomized complete block design (RCBD) with nine treatments, and each treatment was replicated four times, one vine Per each replicate. The treatments consisting of :-

1)- Control (Only water with surfactant).
2)- Brassinoloid (1 ppm).
3)- Brassinoloid (2 ppm).

4)- Lisophos (lysophosphatidylethanolamine, LPE) (100 ppm).
5)- Lisophos (200 ppm).
6)- Brassinoloid (1 ppm) + Lisophos (100 ppm).
7)- Brassinoloid (2 ppm) + Lisophos (100 ppm).
8)- Brassinoloid (1 ppm) + Lisophos (200 ppm).
9)- Brassinoloid (2 ppm) + Lisophos (200 ppm).

Tween - 80 at 0.01% (v/v) was added to all applied treatments for increasing the contact angle of sprayed droplets and reducing the surface tension.

Grapevines were sprayed twice with the solutions of applied treatments at version stage (15- 20 % berry coloration) at 2 and 12 of August during the two seasons of study.

At harvesting four clusters were taken randomly from each replicate for estimate the following Physical Chemical properties:-

I- Physical properties:-

1) - Cluster weight (g) and weight of 100 berries (g) using sensitive scale.
2) - Size of 100 berries (cm^3) utilizing a graduated cylinder containing tap water.
3) - Cluster weight without berries (Cluster stem weight) using sensitive scale.

Π- Chemical characteristics:-

1) - Total soluble solids content (TSS) as Brix was determined using Carlzeiss hand refractometer.
2) - Titatable acidity content (%) percentage was determined by titration using 0.1 NaOH in presence of phenolphthalein as an indicator and expressed as grams tartatric acid (the dominant acid in grape) per 100 ml juice **(A. O. A. C., 2000)**.
3) -Vitamin C was estimated by the titration with 2,6 dichloro phenol lindophenol dye on five ml of fresh grape juice and expressed as mg L-ascorbic acid / 100 ml juice **(Egan *et al*., 1987)**.
4) - Berry skin chlorophyll A and B plus carotene content was estimated according to the procedure of **Wintermans and Mats (1965)**, where half gram of fresh peeling was extracted by 15 ml acetone 85% with 0.5 gram calcium carbonate, the mixture was filtered then completed to 25 ml, measured at wave length of 622, 644 and 440 nm for chlorophyll A , B and carotene, respectively using 20 D^+, Milton Roy, England spectrophotometer and the recorded values were used to determine the

content of chlorophyll A , B and carotene utilizing the following equations:-

Chl. A= 9.784 E. 662/ 0.99 E. 644 = mg/ L.

Chl. B= 21.426 E. 644/ 4.65 E. 662 = mg/ L.

Carotene= 4.695 E.440/ 0.268 (Chl. A + chl. B) = mg/ L.

Where, E. = Optical density at the indicated wave length.

5) - Berry skin anthocyanin content was extracted, measured, calculated and expressed as mg/ 100 g according to the method of **Fuleki and Francis (1968)**.

Moreover, there were some chemical characteristics of leaves determined at harvest such as:-

Leaf electrolyte leakage (EC %) was measured according to **Ahrrens and Ingram (1988)** utilizing conductivity meter and using the following equation: -

(Electrolyte leakage before killing/Electrolyte leakage after killing) × 100

Statistical analysis: -

The data of cluster weight, weight of 100 berries, size of 100 berries, leaf electrolyte leakage and leaf mineral content was analyzed as randomized complete block design (RCBD)., All the obtained data during the two successive seasons of study were subjected to statistical analysis described by **Snedecor and Cochran, (1972)** using SAS program **(SAS, 2000).** The means were compared according to the least significant difference (LSD) at 0.05 levels. Letters were used to distinguish various values, where values followed by the same letter/s were not significantly different.

Table 1: The effect of brassenoloid, lisophos either individually or in combinations on some physical characteristics of "Crimson" grapes during the two seasons 2019 and 2020.

Treatments	Cluster weight (g)		Cluster stem weight (g)		100-berries weight (g)		100-berries size (cm^3)	
	2019	2020	2019	2020	2019	2020	2019	2020
Control	574.18	548.66 a	8.52 de	6.79 e	419.15 cd	400.53 d	394.00 de	376.49 d
Brassinoloid 1 ppm	501.77 g	479.47 f	9.30bf	7.18 d	461.63 a	441.11 a	433.93 a	414.64 a
Brassinoloid 2 ppm	591.66 a	565.36 a	8.68 d	6.39 f	343.16 g	327.91 g	322.57 b	308.24 g
Lisophos 100 ppm	568.52 d	562.06 ab	9.71 a	6.79 c	409.34 d	404.68 d	384.78 e	380.40 g
Lisophos 200 ppm	581.92 bc	556.06 ab	8.89 c	7.18 d	360.79 f	344.76 f	339.15 g	324.07 e
Brassinoloid 1 + Lisophos 100	588.36 ab	569.18 a	9.25 b	7.58 c	388.32 e	375.66 e	365.02 f	353.12 e
Brassinoloid 2 + Lisophos 100	574.74 ed	561.97 ab	8.48 e	9.98 a	425.31 c	415.86 c	399.79 d	390.90 c
Brassinoloid 1 + Lisophos 200	542.80 e	518.68 d	7.79 f	7.18 d	439.67 b	420.13 bc	413.29 c	394.92 bc
Brassinoloid 2 + Lisophos 200	517.27 f	494.28 e	8.48 f	7.98 b	450.02 b	430.02 b	423.02 b	404.22 b
LSD 5 %	**8.94**	**9.14**	**0.20**	**0.37**	**11.27**	**10.98**	**9.47**	**10.20**

*Values within a column, of the similar letter(s) were not significantly different according to the least significant difference (LSD)at 0.05 levels.

Table2: The effect of brassenoloid, lisophos either individually or in combinations on Chlorophyll a and b of "Crimson" grapes during the two season 2019 and 2020.

Treatments	Chlorophyll-a(mg/100mg)		Chlorophyll-b(mg/100mg)		Mature leaves E.C%	
	2019	2020	2019	2020	2019	2020
Control	0.93 a	0.91 a	0.62 a	0.67 b	38.58 fg	35.50 a
Brassinoloid 1 ppm	0.84 b	0.82 b	0.54 b	0.61 b	20.45 g	22.13 g
Brassinoloid 2 ppm	0.70 c	0.69 c	0.52 b	0.52 c	27.88 g	22.75 f
Lisophos 100 ppm	0.65 de	0.67 c	0.47 c	0.45 cd	27.88 c	27.25 d
Lisophos 200 ppm	0.61 de	0.62 d	0.43 cd	0.41 cd	28.35 bc	27.50 cd
Brassinoloid 1 + Lisophos 100	0.46 g	0.47 f	0.26 f	0.28 f	29.73 b	29.50 b
Brassinoloid 2 + Lisophos 100	0.54 f	0.53 e	0.35 e	0.36 e	22.20 ef	23.25 ef
Brassinoloid 1 + Lisophos 200	0.45 g	0.47 f	0.25 f	0.23 g	26.45 d	27.90 c
Brassinoloid 2 + Lisophos 200	0.64 de	0.67 c	0.42 d	0.39 de	23.30 e	23.45 e
LSD 5 %	**0.05**	**0.05**	**0.04**	**0.05**	**1.41**	**0.59**

*Values within a column, of the similar letter(s) were not significantly different according to the least significant difference (LSD)at 0.05 levels.

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Table 3: The effect of brassenoloid , lisophos either individually or in combinations on some chemical characteristics (At harvest) of " Crimson " grapes during the two seasons 2019 and 2020

Treatments	TSS %		Aeidity %		TSS / aeidity ratio		Vitamin - c %		Carotene (mg/100g)		Anthocyanin (mg / L)	
	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020	2019	2020
Control	13.63 e	14.10 f	0.83 b	0.84 c	16.42 f	16.79 e	2.60 a	2.33 b	1.22 f	1.30 g	15.79 f	17.66 h
Brassinoloid 1 ppm	13.60 e	14.90 cd	0.73 e	0.75 e	18.63 d	20.41 b	2.50 b	2.33 b	1.32 e	1.40 f	19.83 e	20.85g
Brassinoloid 2 ppm	15.75 b	15.50 b	0.79 c	0.81 d	19.94 c	19.62 c	1.80 e	2.70 a	1.47 d	1.56 e	23.08 d	23.13 f
Lisophos 100 ppm	15.05 d	15.00 c	0.77 d	0.75 e	19.55 c	19.48 c	2.13 d	2.23 b	1.61 c	1.69 c	24.45 c	24.94 d
Lisophos 200 ppm	14.80 d	14.80 d	0.67 g	0.63 g	22.09 b	22.09 a	2.30 c	1.78 c	1.65 c	1.69 c	24.74 bc	24.07 e
Brassinoloid 1 + Lisophos 100	14.85 d	15.60 b	0.84 ab	0.86 b	17.68 e	18.57 d	2.13 d	1.70 c	1.81 a	1.86 b	28.29 a	28.43 b
Brassinoloid 2 + Lisophos 100	12.63 f	14.65 e	0.80 c	0.82 d	15.79 g	18.31 d	2.35 c	1.58 d	1.65 c	1.73 c	25.03 b	26.10 c
Brassinoloid 1 + Lisophos 200	15.45 c	16.00 a	0.86 a	0.88 a	17.97 e	18.60 d	2.63 a	1.20 e	1.85 a	1.93 a	28.56 a	29.31 a
Brassinoloid 2 + Lisophos 200	16.10 a	15.60 b	0.71 f	0.68 f	22.68 a	21.98 a	2.58 a	1.70 c	1.61 d	24.74 b	25.07 bc	25.07 d
LSD 5 %	0.29	0.15	0.02	0.02	0.59	0.43	0.07	0.12	0.05	0.05	0.39	0.45

* Values within a column, of the similar letter(s) were not significantly different according to the least significant difference (LSD) at 0.05 levels

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RESULTS

I. Physical characteristics:

I.1. Cluster weight

The influence of the various used treatments on cluster weight of "crimson" grapes at harvest was shown in table 1 the data revealed that there was significant increase at cluster weight in a consistent manner by the application of Br (at 1 ppm) plus lisophos (at 100 ppm). The application of Br (at 2 ppm) resulted in increasing cluster weight as compared to the control but such increase was significant only in the first season when compared with the control. Meanwhile, many treatments did not result in a significant increase in cluster weight such as lisophos (at 100 ppm),Br (at 2 ppm) plus lisophos (at 100 ppm). However, some other treatments resulted in a significant reduction in cluster weight at harvest such as the combination of Br (at 1 ppm) plus lisophos (at 200 ppm) as well as Br (at 2 ppm) plus lisophos (at 200 ppm).

I.2. Cluster stems weight:

the response of cluster weight to various treatments at harvest was also reported in table 1. The indicated the many treatments resulted in increasing cluster weight in a consistent manner by such as lisophos (at 200 ppm),Br (at 1 ppm) , and Br(at 2 ppm) plus lisophos (at 200 ppm). Meanwhile, some treatments caused a significant reduction in cluster weight such as Br (at 2ppm), especially in the second season. In addition to Br (at 1 ppm) plus lisophos (at 200 ppm) in the first season only as compared with the control.

I.3. Weight of 100 berries:

At harvest, variations in the weight of 100 berries of treated "crimson" berries was reported in table 1 . it was clear from data

At harvest that many treatments were able to increase the weight of 100 berries in a consistent way such as Br (at 1 ppm), Br (at 1 ppm) plus lisophos (at 200 ppm) in addition to Br (at 2 ppm) plus lisophos (at 200 ppm).Meanwhile, some other treatments caused reduction of berry weight at harvest in both seasons such as Br (at 2 ppm),lisophos (at 200 ppm), and Br(at 1 ppm) plus lisophos (at 100 ppm). Moreover, the application of lisophos (at 100 ppm) gave a similar 100 berry weight to that obtained with the control.

I.4. Size of 100 berries:

As shown in table 1, there were variations in the response size od "crimson" at harvest as reported in table 1. The data revealed that many treatments were able to cause a significant increase in berry size during both seasons relative to the control such Br (at 1 ppm), Br (at 1ppm) plus lisophos(at 200 ppm) and Br(at 2 ppm),Br (at 1ppm) plus lisophos(at 200 ppm). On the other hand, Some treatments resulted a significant reduction of berry size such as Br (at 1ppm) plus lisophos(at 200 ppm) in addition to Br (at 1ppm) plus lisophos(at 100 ppm). Moreover, the application of lisophos (at 100 ppm) resulted in a similar berry size to that obtained by the control berries in both seasons

II. Chemical characteristics

II.1. Chlorophyll a

The data in table 2. Indicated to some important chemical parameters at harvest time of "Crimson" berries during the two seasons. the data indicated that the untreated vines (control) present the highest level of chlorophyll a in their berries during the two experimental seasons. Furthermore, all other treatments caused a significant reduction in chlorophyll a with varied magnitude. The least chlorophyll a content was obtained with the combination of Br (at 1ppm) plus lisophos(at 100 ppm) as well as Br (at 1ppm) plus lisophos(at 200 ppm) .

There was a consistent trend of the reduction of the chlorophyll a by used treatments. However, Br (at 2 ppm) resulted in lower chlorophyll a than that obtained with Br (at 1 ppm) . Meanwhile, the applications of lisophos at 100 ppm or at 200 ppm did not vary in their resulting chlorophyll a in the first season with significant difference only on the second season.

II.2. Chlorophyll b

The effect of various applied treatments on chlorophyll b content when assessed at harvest was reported in table 2.it was evident again that the highest values were found with the control during both seasons. Moreover, all used treatments resulted in a significant reduction of chlorophyll b with different magnitudes. the data indicated that the highest reduction in chlorophyll b was found with, Br (at 1 ppm) plus lisophos (at 200 ppm). The second combinations were, BR (at 1 ppm) plus lisophos (at 100 ppm) was equally effective on the reduction of the chlorophyll b with Br (at 1 ppm) plus lisophos (at 200 ppm) in both seasons. Meanwhile, individual treat of each had higher chlorophyll b as compared with both compounds in a combination.

II.3. Electerical conductivity of mature leaves.

The percentage of electrolyte leakage as result of applying various treatments as an indicator to mature leaves vigor at harvest was reported in table 2. The data revealed that control leaves had the greatest leakage of electrolyte while the applications of Br 1 or 2 ppm resulted in the lowest electrolyte leakage in the both seasons.

When lisophos was used in combination with Br regardless the concentrations, both compounds further reduced the percentage of electrolyte leakage as compared with individual treatments of lisophos especially, the combinations of Br (at 2 ppm) plus lisophos (at 200 ppm) or the combinations of Br (at 2 ppm) plus lisophos (at 100 ppm).

III. More chemical characteristics at harvest:

III.1. Total soluble solids (TSS)

The changes in TSS of the fruit juice to various applications at harvest was shown in table3. The data revealed that the control fruits had the least TSS values in both seasons. Meanwhile, the combination of Br (at 2 ppm) plus lisophos (at 200 ppm) had higher TSS than the control. Similarly, the combination of Br (at 1 ppm) plus lisophos (at 200 ppm) caused a similar increase in the TSS in both seasons. Many other treatments caused an increase in the TSS but in lower magnitude than the mentioned combinations for example Br (at 2 ppm) were able to increase the TSS as compared to the control, In a similar manner, the applications of lisophos (at 100 ppm) caused a significant increase in TSS when compared with the control.

III.2. Juice acidity at harvest

Changes in juice acidity at harvest of "Crimson seedless" fruit reported in table 3. The data shows that a concealable reduction in titratable acidity of juice in almost all treated berries expect with the application of Br (at 1 ppm) plus lisophos (at 200 ppm) in both seasons relative to the control.

The magnitude of such reduction varied among used treatments , the acidity reduction with higher when fruits were treated with Br (at 2 ppm) plus lisophos (at 200 ppm) than all other treated fruits. The application of Br (at 1 ppm) plus lisophos (at 100 ppm) resulted in a similar juice acidity to that found in the control especially in the first season. All treatments applied individually were able to reduce juice acidity in a consistent manner in both seasons as compared with the control.

III.3. TSS / acidity ratio:

Variations in TSS / acidity ratio as a result of field applied treatments to "Crimson" grapes were reported in table 3. The result indicated that the general trend was the significant increase of such ratio with the highest increase obtained with the combination of Br (at 2 ppm) plus lisophos (at 200 ppm). Moreover, lisophos alone at 200 ppm caused a significant increase in TSS to acidity as compared with the control and with lisophos at 100 ppm, Br at 1 ppm and even Br at 2 ppm the combination the combination treatments did not necessary gave higher TSS to acidity ratio than the its individual treatment. Meanwhile, the application of lisophos at 200 ppm either alone or in combination with Br at 200 ppm resulted in the greatest increase in TSS to acidity ratio.

III.4. Vitamin C content:

The influence of preharvest treatments of "Crimson" grapes with various applications on vitamin C content in the juice was shown in table 3. The data revealed that the control berries was superior to the treatments except the applications of Br at 1 or 2 ppm plus lisophos at 200 ppm especially in the first season. Moreover, the combined influence was not necessarily better in vitamin C content. the combination of Br at 2 ppm plus lisophos (at 100 ppm) resulted in vitamin C similar to lisophos alone (at 200 ppm) in the first season only while compared with lisophos at 100 ppm alone there was no specific trend.

III.5. Carotene content:

The response of "Crimson" grapes berries to preharvest treatments in terms of carotene content was shown in table 3. The data indicated that the greatest increase was found the application of the combination Br (at 1 ppm) plus lisophos (at 200 ppm) in both seasons. Many other treatments were able to increase carotene relative to the control. For example, to the two individual treatments of lisophos (at 100 and 200 ppm) and Br at both used concentrations (1 and 2 ppm) resulted in a significant increase in carotene. Further increase in carotene was obtained when Br was combined with lisophos as was the case with the combination of Br (at 1 ppm) plus lisophos (at 100 ppm) in the two seasons, in comparison with the control.

III.6. Anthocyanin content:

With regard to the change in anthocyanin content in the skin of "Crimson" berries at harvest, the data in table 3. indicated that there was a great influence of the sprayed compounds in anthocyanin whether applied individually or in combinations in the two seasons. For example, the application of Br (at 1 ppm) plus lisophos (at 200 ppm) had a drastic increase in anthocyanin in both seasons as compared with the control . in a similar manner, the combination of Br (at 1 ppm) plus lisophos (at 100 ppm) almost caused a double increase in anthocyanin relative to the control . there was also a large increase in anthocyanin content of berries obtained by the other two combination, namely Br (at 2 ppm) plus either lisophos at 100ppm or at 200ppm but to less extent to the former two combination. Moreover, a significant increase in anthocyanin occurred by the individual treatments of lisophos at 100 ppm and at 200 ppm in addition to the sole application of Br at 1ppm or at 2ppm. The individual application of both lisophos concentrations resulted in a significant increase in anthocyanin content when compared with the application of Br (at 1 ppm) . thus, all applied treatments were successful in increasing anthocyanin content with varying levels of increase in both seasons.

Discussion

The study provides grape growers and producers with a new approach to solve the problems associated with improving grape quality especially with red berries. Meanwhile, grape production under arid conditions suffer from the lack of intense color development since the exposure to excessive heat exposure resulted in the inhibition of the enzyme phenylalanine ammonium lyase that is mainly responsible for the production of the anthocyanin in (**Zaharan, *et al*., 2012 and Sharma *et al*., 2022**) Moreover, the study assessed the possibility of using the two natural compounds, brassenoloid and lisophosphated, ethanolamine As safe alternative to applying the ethylene forming compound which is ethrel (**ethephon**) or spraying proton (ABA) at veraison (**Ahammed, *et al*., 2012, Zhu *et al*., 2016 and Ahmed, *et al* ,2017**) The use of ethrel lacks the efficiency in many areas of grape production . Ethrel is a high hydrophilic compound with low permeability across the fruit cuticle that is very hydrophilic **(Farag, 1989 and Ahammed, *et al*., 2012)**. This drawback of ethrel directed many grape producers to increase the number of applications which had many problems, such as leaf yellowing, leaf browning and abscission and fruit softening and berry shatter in addition to increasing the loss either following the shelf life whether at the ambient temperature or following the exposure to refrigerated shelf-life duration at 4-5^{o}C. on the other hand, the second available alternative is the spray of proton (ABA) lack the efficiency, corrosive, highly cost the producers in addition to the highly hydrophilic nature

The individual use of the natural compound, lisophos that is mainly extracted egg yolk or from the remains of extracting oil from soybean proved to be efficient on improving fruit quality of apples, cranberries and many vegetable crops **(Farag, 1989)**.

Such product has some hydrophilic nature and proved to enhance fruit ripening and coloration while reducing their respiration and to maintain the membrane integrity and inhibits the cell wall breaking enzymes which meant longer fruit storability (**Farag *et al*, 2018**)

Lisophos is a natural component of the living organisms which means it an edible compound.

The reduction of electrolyte leakage in grape leaves and clusters treated with lisophos (table 2) and the reduction in the percentage of berry shatter especially with the combination of Br at 2ppm plus lisophos at 2 ppm that was also beneficial in reducing the percentage of weight loss further explains the advantages of preharvest application on grape cluster. stem browning of clusters (Table 5) was significantly reduced by the application of lisophos at 100ppm (Table 5).

Furthermore, brassenoloids, the natural compound originally discovered in the brassica plants was found to effect many physiological properties especially its role on fruit coloration at very low concentration (**Zaharan, *et al*., 2012, Zhu, *et al*., 2016 and Sharma *et al*., 2022**)

The application of Br at 1 or 2ppm proved its positive role on enhancing anthocyanin at 1 and 2 ppm individually (Table3) while reduced the percentage of berry shelter especially with Br (at 2ppm) plus lisophos (at 100ppm) and the reduction of electrolyte leakage of the berries and that of the mature leaves (Table 2)

one must remember that Br proved its efficacy at very low concentration. The enhancement of carotene content by Br alone or in combination with lisophos further supported the earlier findings about the role of brassenoloids on enhancing the activity and the content of antioxidants of plants and the fruit (**Kościelniak, *et al*., 2014 and Li, *et al*., 2022**)

REFERENCES

A.O.A.C., (2000). Official Methods of Analysis. Association of Official Analytical Chemists, Inc. Vitamins and other nutrients. (17th ed.), Washington, D.C.16-20.

Ahammed, G.J.; S. Zhang; K. Shi; Y.H. Zhou and J.Q. Yu (2012). Brassinosteroid improves seed germination and early development of tomato seedling under phenanthrene stress. Plant Growth Regul., 68, 87–96.

Ahmed, M.K.A.; A.M. Mohamed and A.E. Hesham (2017). Trials for Solving the Problem of Poor Berries Colouration and Improving Yield of Crimson Seedless Grapevines. New York Science Journal;10(12): 91-103.

Ahmed, Z. F. A. and J. P. Palta (2011). Hormone-like effect of a natural lipid, lysophosphatidylethanolamine, can mitigate calcium deficiency injury in potato shoot cultures. HortScience, 46: 196.

Ames. Iowa, USA. Sugiyama, K. and S. Kuraishi (1989). Stimulation of fruit set of' 'Morita' navel orange with brassinolide. ActaHortic, 239:345-348

Attia, S. M and K. M. Farag (2017). Effect of Some Preharvest Treat-ments on the Incidence of Water-berry Disorder and on Fruit Qual-ity Characteristics of "Thompson seedless" Table Grapes. American-Eurasian J. Agric. & Environ. Sci., 17 (5): 392-400.

Ahrens, M.J. and D.L. Ingram (1988). Heat tolerance of citrus leaves. Hort .Sci,. **23**: 747-748.

Bajguz, A. (2009). Brassinosteroid enhanced the level of abscisic acid in Chlorella vulgaris subjected to short-term heat stress. Journal of Plant Physiology , 166 (8), 882–886.

Bajguz, A. and S. Hayat (2009). Effects of brassinosteroids on the plant responses to environmental stresses. Plant Physiology and Biochemistry, 47, 1-8

Casanova, L.; W. A. Rutala; D. J. Weber and M. D. Sobsey (2009). Survival of surrogate coronaviruses in water. J. Watres, 43(7):1893-1898.

Champa, W.A.H.; M.I.S. Gill1; B.V.C. Mahajan; N.K. Aror and S. Bedi (2015). Brassinosteroids improve quality of table grapes (*Vitisvinifera* L.) cv. Flame Seedless. Tropical Agril . Res., 26(2):368 – 379.

Clouse, S.D. (2011). Brassinosteroid Signal Transduction: From Receptor Kinase Activation to Transcriptional Networks Regulating Plant Development. The Plant Cell, 23: 1219-1230

Cowan, A.K. (2009). Plant growth promotion by 18:0-lyso-phosphatidylethanolamine involves senescence delay. Plant Signaling and Behav,. 4:324-327.

Egan, H.; R.S. Kird and R. Sawyer (1987). Pearson's Chemical Analysis of Foods. Eighth Edition. Longman Scientific and Technical Essex CM_{20}. 2 TE, England.

Farag, K. M. and J. P. Palta (1993a). Use of lysophosphatidylethanolamine, a natural lipid, to retard tomato leaf and fruit senescence. Physiologia Plantarum, 87: 515-521.

Farag, K.M. and J.P. Palta (1989). Enhancing effectiveness of ethephon on cranberry fruit by natural products, (ethanol, urea and lysophosphatidylethanolamine (LPE)). Proceedings of the 16th Annual M eeting of the Amer. Soc. for Plant Phys.

Farag, K.M; J. P. Palta (1991). Use of lysophosphatidylethanolamine, a natural lipid, to delay tomato fruit and leaf senescence. HortScience, 26: 67.

Farag. K. ; Leila A. Haggag; N. A. Abdel Ghany; Neven M.N. Nagy; R. S. Shehata (2018). Acceleration of Veraison and Enhancement of Berry Quality of "Crimson" Grapes Bypreharvest Treatments with Lysophosphatidylethanolamine, Protone and Magnesium. Assiut J. of Agric. Sci., 49(2):75-105.

FAO . (2022) Food and Agriculture Organization of the united nations internet site . Agricultural statistics . available at : www.fao.org.2024

Fuleki, T. and F.J. Francis (1968). Quantitative methods for anthocyanins. 1- Extraction and determination of total anthocyanin in cranberries. Journal of Food Science, 33: 72-77.

Hayat, S.; A. Ahmad; M. Mobin; A. Hussain and Q. Fariduddin (2000). Photosynthetic rate, growth, and yield of mustard plants sprayed with 28-homobrassinolide. Photosynthetica, 38(3), 469–471.

Hong, J. H.; H.K. Hwang; G.H. Chung and A.K. Cowan (2007). Influence of lysophosphatidylethanolamine application on fruit quality of Thompson seedless grapes. Journal of Applied Horticulture, 9: 112-114.

Hong, J.H.; S.K. Hwang and G.H. Chung (2008). Influence of lysophosphatidylethanolamine on reactive oxygen species, ethylene biosynthesis, and auxin action in plant tissue. Kor. J. Hort. Sci. Techol,. 26:209-214.

İşçi, B. and Z. Gökbayrak (2015). Influence of brassinosteroids on fruit yield and quality of table grape cv. 'Alphonse Lavalleé'. Vitis, 54, 17–19.

Kang, C. K.; Y. L.Yang; G. H. Chung and J. P. Palta (2003). Ripening promotion and ethylene evolution in red pepper (*Capsicum annuum*) as influenced by newly developed formulations of a natural lipid, lysophosphatidylethanolamine. Acta Horticulturae,. 28: 317-322.

Kanwar, M. K.; R. Bhardwaj; P. Arora; S. P. Chowdhary; P. Sharma and S. Kumar (2012). Plant steroid hormones produced under Ni stress are involved in the regulation of metal uptake and oxidative stress in *(Brassica juncea*) L. Chemosphere , 86(1), 41–49.

Kanwar, M. K.; R. Bhardwaj; S. P. Chowdhary; P. Arora; P. Sharma and S. Kumar (2013). Isolation and characterization of 24-Epibrassinolide from *(Brassica juncea*) L. and its effects on growth, Ni ion uptake, antioxidant defense of Brassica plants and in vitro cytotoxicity. Acta Physiologiae Plantarum , 35(4), 1351–1362.

Keller, M. (2010) Managing grapevines to optimize fruit development in a challenging environment: a climate change primer for viticulturists. Australian Journal of Grape and Wine Research, 16,56 –69.

Kościelniak, J. B.; M. Dziurka; S.A. Selvita ; **A. Ostrowska and M. Mirek (2014).** Brassinosteroid improves content of antioxidants in seeds of selected leguminous plants. Australian Journal of Crop Science, 8(3):378-388.

Krishna, P. (2003). Brassinosteroid-mediated stress responses. Journal of Plant Growth Regulation, 22(4), 289–297.

Li, M.; Y. Zhang; X. Xu; Y. Chen; J. Chu and X. Yao (2022). The combined treatments of brassinolide and zeaxanthin better alleviate oxidative damage and improve hypocotyl length, biomass, and the quality of radish sprouts stored at low temperature. Food Chem X., 15: 100394. doi: 10.1016/j.fochx.2022.100394.

Liu, Q.; Z. Xi; J. Gao; Y. Meng; S. Lin and Z. Zhang (2016). Effects of exogenous 24 epibrassinolide to control grey mould and maintain postharvest quality of table grapes. Interl . J. Food Sci. & Technol., 51(5):1236–1243

Luan, L.Y.; Z.W. Zhang; Z.M. Xi; S.S. Huo and L.N. Ma (2013). Brassinosteroids regulate anthocyanin biosynthesis in the ripening of grape berries. S . Afr . J . Enol . Vitic., 34(2):196-203

Mitchell, J.; N. Mandava; J. Worley; J. Plimmer and M. Smith (1970). Brassins – a new family of plant hormones from rape pollen. Nature, 225. 1065-1066.

Mussig, C. (2005). Brassinosteroid -promoted growth. Plant Biology, 7(2): 110-117.

Özagen, M.; K.M. Farag; S. Özgen and J.P. Palta. (2004). Lysophosphatidylethanolamine accelerates color development and promotes shelf life of cranberries. HortScience, 40:127-130.

Padashetti, B.S.; S.G. Angadi and S. Pattepur (2010). Effect of pre-harvest spray of growth regulators on growth, quality and yield of seedless grape genotypes. Asian Journal of Agricultural and Horticultural Research, 5 (1): 218-221.

Parikh, H.R.; G.M. Nair and V.V. Shah (1990). Some structural changes during ripening of mangoes (*Mangifera indica* var. Alphonso) by abscisic-acid treatment Annals of Botany, 65: 121-127.

Peppi, M. C.; M. W. Fidelibus and N. K. Dokoozlian (**2006**). Abscisic acid application timing and concentration affect firmness, pigmentation, and color of `flame seedless' grapes. American Society for Horticultural Science, 41(6):1440

Roghabadi, M. A. and Z. Pakkish, (2014). Role of brassinosteroid on yield, fruit quality and postharvest storage of "Tak Danehe Mashhad"sweet cherry (*Prunus avium* L.). Agricultural communication, 2(4):49 -56.

Ryu, S.B.; B.H. Karlsson; M. Özgen and J.P. Palta (1997). Inhibition of phospholipase D by lysophosphatidylethanolamine, a lipid-derived senescence retardant. Proc. Natl. Acad . Sci., 94:12717-12721.

Saini, S.; I. Sharma and P.K. Pati (2015). Versatile roles of brassinosteroid in plants in the context of its homoeostasis, signaling and cross talks. Frontiers in Plant Sci., 6(950):1-17

Shahzad, B.; M. Tanveer; Z. Che; A. Rehman; S. A. Cheema; A. Sharma and D. Zhaorong (2018). Role of 24-epibrassinolide (EBL) in mediating heavy metal and pesticide induced oxidative stress in plants: A review. Ecotoxicology and Environmental Safety, 147 , 935–944.

Sharma, A., V. Kumar; R. Singh; A.K. Thukral and R. Bhardwaj (2015). 24-Epibrassinolide induces the synthesis of phytochemicals effected by imidacloprid pesticide stress in *Brassica juncea* L. Journal of Pharmacognosy and Phytochemistry , 4, 60–64.

Sharma, A.; V. Kumar; M. K. Kanwar; A. K. Thukral and R. Bhardwaj (2016 a). Multivariate analysis reveals the role of 24-epibrassinolide in elemental uptake by Brassica juncea L. under imidacloprid toxicity. Pollution Research , 35, 749–756.

Sharma, A.; V.Kumar; A. K. Thukral and R. Bhardwaj (2016). Epibrassinolide-imidacloprid interaction enhances non-enzymatic antioxidants in *Brassica juncea* L. Indian Journal of Plant Physiology , 21(1), 70–75.

Sharma, H.: N. Chawla and A.S. Dhatt (2022). Role of phenylalanine/tyrosine ammonia lyase and anthocyanidin synthase enzymes for anthocyanin biosynthesis in developing Solanum melongena L. genotypes. Physiol Plant., 174(5):e13756. doi: 10.1111/ppl.13756.

Snedecor, G.W. and W.G. Cochran, (1982). Statistical methods 7th . Ed., The Iowa State Univ. Press.

Swamy, K.N. and S.S.R. Rao (2008). Influence of 28-homobrassinolide on growth, photosynthesis metabolite and essential oil content of geranium (*Pelargonium graveolens* L.) Herit. American Journal of Plant Physiology, 3:173 –174.

Wachsman, M. B.; E. M. López; J. A. Ramirez; L. R. Galagovsky and C. E. Coto (2000). Antiviral effect of brassinosteroids against herpes virus and arenaviruses. Antiviral Chemistry and Chemotherapy, 11(1), 71–77.

Wintermans, j. F. G. M. and D. E. Mats (1965). Spectrophtometeric characteristics of chlorophylls and their pheophytins in ethanol. Biochem. Biophys., Acta., 448-453.

Xu, Y.; X. Hou; J. Feng; M. Khalil-UrRehman and J. Tao (2019). Transcriptome sequencing analyses reveals mechanisms of eliminated russet by applying GA3 and CPPU on „Shine Muscat" grape. Scientia Horticulturae, 250: 94–103.

Zaharan, S.S.; Z. Singh; G.M. Symons and J.B. Reid (2012). Role of brassinosteroids, ethylene, abscisic acid, and indole-3- acetic acid in mango fruit ripening. J . Plant Growth Regul., 31:363–372. DOI :- 10.1007/s00344-011-9245-5

Zhu, T.; X.G. Deng; X. Zhou; L.S. Zhu; L.J. Zou; P.X. Li; D.W. Zhang and H.H. Lin (2016). Ethylene and hydrogen peroxide are involved in brassinosteroid-induced salt toler-ance in tomato. Sci. Rep-UK, 6, 35392. https://doi.org/10.1038/srep35392 .

Zhu, Z.; Z. Zhang; G. Qin and S. Tian (2010). Effects of brassinosteroids on postharvest disease and senescence of jujube fruit in storage. Postharvest Biology and Technology, 56: 50-55.

إمكانية وجود تأثير تشجيعي بين الليزوفوس و البراسينوستروويد علي بعض صفات حبات عنب "الكريمسون اللابذري" تحت ظروف الحقل.

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الملخص العربي

أجريت هذه الدراسة في بستان خاص في مركز بدر - محافظة البحيرة اثناء موسمي 2019، 2020 حيث استخدمت نباتات عنب الكريمسون اللابذري عمر ست سنوات بغرض دراسة تأثير البراسينولويد والليزوفوس كل على حده او خليط من كل منهما علي صفات الحبات الطبيعية والكيماوية وقت الحصاد. تم معاملة عناقيد عنب الكريمسون بالرش حقليًا مرتين، الأولى في بداية عملية اكتمال النمو (Veraison) عند 15 -20% في تلوين الحبات وبعدها بعشر أيام في كلا الموسمين. اشتملت المعاملات علي الكنترول (المادة الناشرة المسماة توين 80) والبراسينولويد بتركيز 2 و1 جزء في المليون، والليزوفوس بتركيز 200و100 جزء في المليون ثم بتوليفات من كلا منهما وبالتالي كان مجموع المعاملات تسعة شاملا الكنترول، وعند الجمع أدت المعاملات الفردية الي تحسين بعض صفات الجودة لحبات العنب. وكانت معاملات الخلط أكثر فعالية من المعاملات الفردية وبصفة خاصة خليط كل من البراسينولويد (1 جزء في المليون) + الليزوفوس (200 جزء في المليون) على بعض خصائص جودة الثمار مثل الكاروتينات ومحتوى الانثوسيانين في بشرة الحبات. ووجد أيضا ان خليط كل من البراسينولويد (2 جزء في المليون) مضاف اليه الليزوفوس بتركيز 200 جزء في المليون قد ادي الي زيادة نسبة المواد الصلبة الذائبة الي الحموضة فى عصير الحبات أكثر من تأثير المعاملات الفردية، ولقد كانت الاتجاهات والنتائج ثابتة في كلا الموسمين. وهكذا يمكن القول بوجود تأثير تشجيعي لخليط البراسينولويد مع الليزوفوس عند رشه على حبات العنب في مرحلة بداية التلوين وبداية عمليات اكتمال النمو.