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Response of two broccoli cultivars to foliar application of Lithovit fertilizer under two planting methods.

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ABSTRACT:

A field experiment was conducted in Agriculture Faculty Farm, El-Azhar University, Assiut Branch in 2010-2011 and 2011-2012 seasons to study the effect of foliar Lithovit fertilization at different doses on yield and growth of two broccoli cultivars using two planting methods. Randomized Complete Blocks Design (RCBD) in split-spilt-plot arrangements with three replicates was used. The two planting methods (direct sowing and transplants) occupied the main plots. While, the Broccoli cultivars (Calabrese and Waltham 29) were arranged in the sub- plots. The Lithovit levels were; 0% (control), 0.05%, 0.10 % and 0.20 %.These concentrations were distributed in the sub- sub-plots. The obtained results revealed that planting method affected significantly most of the studied traits. But insignificant differences were detected for number of branches/plant in both seasons and No. of curds/plant, main head weight and total head yield (ton/feddan) in the first season. Most of studied traits reacted significantly to transplanting method except plant height. The tallest plants were obtained from direct seed sowing method. Also, Broccoli cultivars varied significantly in all studied traits except plant height in the first season and number of days from planting to heading in both seasons. Here too, Calabrese cultivar surpassed Waltham 29 in all studied traits except number of branches /plant in both seasons. The foliar application of Lithovit enhanced significantly plant height, main head length, main head diameter, main head weight and total head yield (ton/feddan) in favor of 0.05% concentration in the two growing seasons. The highest broccoli yield was obtained from Calabrese cultivar planted with direct seeds and subjected to 0.05% Lithovit as foliar application. Also, transplanting the same cultivar without using Lithovit fertilizer gave better growth and higher yield.

Keywords: Broccoli, Foliar application, Lithovit; yield, Branching,Number of curds/plant.

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Introduction:

Broccoli (*Brassica oleracea* L.var. *italica*) belongs to family Brassicacea that comprises a number of cole vegetable crops including cabbage, cauliflower, chinese cabbage, brussels sprouts and kohlrabi. Broccoli has enormous nutritional and medicinal values due to its high contents of vitamins (A, B1, B2, B5, B6 and E), minerals (Ca, Mg, Zn and Fe) and antioxidant substances which prevent the formation of cancer causing agents (Beecher, 1994 and Abou El- Magd *et al.*2006). Broccoli is widely cultivated in many European and American countries. In Egypt, broccoli is grown in a very scattered areas and the total cultivated area is not presisly known. (Kunicki 2004) found that, in Poland, broccoli is cultivated from transplants produced under tunnels or in seedbeds. Also, direct sowing cultivation, recommended in the USA, makes it possible to increase plant density, and to produce a greater yield. This method is also cheaper than transplanting, but the latter intensifies the use of growing area.

Macro and micro nutrients are crucial in crop nutrition for achieving higher yields(Raun and Johnson,1999;Parvez *et al.*, 2009).

Lithovit is CO_2 foliar fertilizer that can be used successfully outdoors as well as indoors (zeovita GmbH, 2007).

The basic material for Lithovit is a calcareous rock consisting essentially of limestone calcium carbonate (Ca_2Co_3). In addition , it contains smaller productions of silica (SiO_2) ,dolomite(calcium-magnesium carbonate ($CaMg(Co_3)_2$), iron oxide (Fe_2O_3) , manganese (Mn), zinc (Zn), copper (Cu) and cobalt (Co) (Lefo institut, 2006).

Lithovit fertilizer consists of Calcium - Magnesium Carbonate $(Ca,Mg)CO_3$, supplemented by numerous important micro-nutrients. It is produced by milling natural limestone in special mills down to particle diameter < 10µ.The aqueous suspension (0.5%)of this fertilizer is very fine tribodynamic activated powder. On the foliage, the Lithovit particles penetrate in part directly through the stomata of the leaves into the intercellular compartments. The rest remains on the leaves as a film. Although, Lithovit acts as an excellent fertilizer, the mechanism of its action is still not totally clear. Most likely, it is due to supplying the plants with Carbon dioxide (CO_2) in much higher concentration than that in the atmosphere and so enabling the photosynthesis to take place with higher degree leading to a stronger natural growth and, consequently, increased yield. Furthermore, the supplements of micro-nutrients increase the enzymatic activity that plays a role in this process. The release of CO_2 from the Lithovit remaining on the leaves surface is probably due to its transformation to $(Ca,Mg)(HCO_3)_2$ during the night by means of CO_2 (produced by the plants in addition to that in

the atmosphere) and H_2O (which covers the leaves as dew in addition to that produced by the plants). During the day the temperature rises gradually, water evaporation occurs and the $(Ca,Mg)(HCO_3)_2$ is back transformed to Lithovit giving CO_2 on high concentration directly in the leaves surface. In that way Lithovit acts as quasi permanent catalytic depot (Bilal, 2010).

The interest in foliar fertilizers arose due to its multiple advantages such as rapid and efficient response to the plant, less product needed, and independence on soil conditions. It is also recognized that supplementary foliar fertilization during crop growth can improve the mineral status of plants and increase the crop yield (Kolota and Osinska, 2001). The absorption rate of mineral nutrients by aboveground plant parts considerably differs not only among plant species but also among varieties within the same species (Wojcik, 2004).

There is little information on the effect of the foliar application of Lithovit fertilizer on broccoli. Therefore, the main objective of this work was to study the effect of Lithovit fertilization at different doses and two planting methods on the growth and yield of two broccoli cultivars.

Materials and methods:

A field experiment was layout in Agriculture Faculty Research Farm of El-Azhar University- Assiut branch in 2010-2011 and 2011-2012 seasons to study the effect of Lithovit foliar fertilization utilized at different doses on broccoli growth and yield under two planting methods. Randomized Complete Blocks Design (RCBD) in split-spilt-plot arrangement with three replicates was used. The two planting methods (direct seeding and transplanting) were distributed in main plots while the Broccoli cultivars(Calabrese and Waltham 29) were arranged in sub plots. Also, the Lithovit levels were; 0%(control plots were sprayed with distilled water), 0.05%, 0.10 % and 0.20%). These levels were distributed in sub-sub plots. The seeds of previous cultivars were planting in 10th October in both seasons (direct seeding) and the transplanting were planted in the nursery in 1st September and transplanted in the same time (10th October) in both seasons. The sub-sub-plot was four rows 3.5 m long with 70cm apart. The distance between plants within each row was 50 cm. The Lithovit spray was done three times. For direct seed method, the spray was 21, 36 and 51 days after sowing. For transplanting method, the spray was after one, two and four weeks. The Lithovit was obtained from Agrolink Company as a powder .This powder was dissolved at rate of 0.5 g, 1g and 2 g per litter

of distilled water. All other cultural practices were carried out as recommended for broccoli production. Ten guarded plants were randomly taken from each sub-sub-plot and the following measurement were recorded plant height (cm),number of branches per plant , number of days from planting to heading, number of curds per plant , main head length, main head diameter, main head weight (g) and total head yield (ton per feddan) .

All data collected were statistically analyzed with analysis of variance (ANOVA) procedure using the MSTAT-C Statistical Software Package (Michigan State University, (1983). Differences between means were compared by LSD test at 5% level of significant and differences between the control and the other Lithovit treatments were compared by t Dunnet test at 5% level of significant (Gomez and Gomez, 1984).

Results and Discussion:

Vegetative traits:

The data presented in Table (1) reveal that direct seeds sowing surpassed significantly transplanting method and gave the tallest plants (96.500 and 97.050 cm in the first and second seasons, respectively). Also, the data show significant effect of cultivars on plant height in the second season only. Calabrese cultivar surpassed Waltham 29 in this respect (93.433cm). This may be due to the interaction between genetic and environmental condition which was suitable for Calabrese cultivar than Waltham 29. Some investigators confirmed the differences among broccoli cultivars on their vegetative growth characteristics. (Butt *et al.*, 1988; Liu and Shelp, 1993; MeCall *et al.*, 1996 ; Sanchez *et al.*, 1996; Rekowska , 1999; Aboul-Nasr and Ragab, 2000; Real Rosas *et al.*, 2002; Abou El-Magd *et al.*, 2005; Abou El-Magd *et al.*, 2006; Mostafa, 2006 ;Abou El-Magd *et al.*, 2010; and Hanaa *et al.*, 2010.

Also, the data show that Lithovit fertilizer had a significant effect on plant height in the two growing seasons as compared to control (untreated).All Lithovit concentration surpassed significantly untreated plant (control) in this respect. The tallest plants (94.733 and 96.000 cm in first and second seasons, respectively) were obtained from plant treated with 0.05% Lithovit. But, the control treatment registered the shortest plants (85.333 and 88.383 cm in first and second seasons, respectively). Here too, the second order interaction had a significant influence in this respect. The data show that the tallest plants (100.467 and 100.400 cm in the first and second seasons, respectively) were obtained from Waltham 29 cultivar when planting was done by direct seeds and subjected to 0.05% Lithovit.

Concerning number of branches per plant the data illustrated in Table (2) reveal that

effect of planting methods were not significant in both seasons. But, cultivars had a significant effect on this trait in the two growing seasons. Waltham 29 cultivar produced the highest values (14.575 and 15.150 branch per plant in the first and second seasons, respectively). Here too; the illustrated data in Table (2) reveal that Lithovit application had a significant effect in number of branches per plant in the second season only. Foliar application with 0.20% Lithovit gained the highest number of branches per plant (15.283 branches per plant). Also, the first order interaction between sowing methods and cultivars had a significant effect on number of branches per plant in the second season only whereas transplanting x Waltham 29 gave the highest number (15.383). Moreover, the first order interactions between cultivars and Lithovit had a significant influence in this respect in both seasons. The highest values of branches number per plant (16.033 and 17.067 in the first and second seasons, respectively) were obtained from 0.20% Lithovit and Waltham 29 cultivar. Here too, the first order interaction between Lithovit and planting method had a significant influence on number of branches per plant in the two growing seasons. The highest values (15.200 and 15.333 in the first and second seasons, respectively) were obtained from application 0.05% and 0.20% Lithovit in first and second seasons, respectively on transplanted plots.

Number of days from planting to heading:

The illustrated data in Table (3) show that planting method affected significantly number of days from planting to heading in the two growing seasons. Using transplanting method in planting gave the earlier plants (82.442 and 82.808 days in first and second seasons, respectively) as compared to direct seed method. Data exhibited in Table (3) reveal that the cultivars effect was not significant in both seasons. Also, Lithovit application had a significant effect in this respect in both seasons. Foliar application of 0.20% Lithovit decreased the period from planting to heading to 79.017 and 79.533 days in first and second seasons, respectively. On the other hand, the longest period from planting to heading (90.467 and 90.833 days in the first and second seasons, respectively) was obtained from untreated plants (control). Moreover, the first order interactions between cultivars and Lithovit had a significant influence in both seasons. The shortest period from planting to heading (78.400 and 79.433 days in the first and second seasons, respectively) was obtained from 0.20% Lithovit treatment with Waltham 29 cultivar in the first season and Calabrese cultivar in the second season.

Number of curds /plant:

The data illustrated in Table (4) reveal that sowing method had a

significant effect in number of curds per plant in the second season only. Transplanting method produced the highest values of the number of curds /plant (13.042) as compared to direct seed method (11.592). Also, the presented data show the significant effect of cultivars in this respect in both seasons. The highest number of curds/plant (13.292 and 13.133 in the first and second seasons, respectively) was gained by Calabrese cultivar. Otherwise, the lowest values in this respect (11.042 and 11.500 curds /plant in the first and second seasons, respectively) were obtained from cultivar Waltham 29. The interaction between cultivars and Lithovit was significant in the two growing seasons. The highest numbers of curds /plant (14.433 and 14.000) were obtained from Calabrese cultivar under control treatment. Moreover, the data show that the second order interaction had a significant effect on number of curds /plant in the second season only. The highest value (14.267) in this respect was obtained from untreated Calabrese cultivar planted with transplanting method.

Main head length:

Data presented in Table (5) declare that sowing methods had a significant effect on main head length in both seasons. The longest heads (19.033 and 19.358 cm in the first and second seasons, respectively) were obtained from transplanting method. Also, the data emphasize that the cultivars had a highly significant effect on the main head length in the two growing seasons. The longest main heads (19.708 and 20.200 cm in the first and second seasons, respectively) were obtained from Calabrese cultivar. Moreover, the illustrated data show the significant influence of Lithovit application on main head length in both seasons. Foliar application by 0.05% Lithovit surpassed the other concentrations and control in this respect and produced the highest main head length (19.167 and 19.400 cm in the first and second seasons, respectively). The first order interaction between planting methods and Lithovit application was significant in both seasons. The longest values in this respect (19.900 and 20.200 cm in the first and second seasons, respectively) were obtained from transplanting method when plants treated with 0.05% Lithovit in the first season and in untreated plants in the second season.

Main head diameter:

The data in Table (6) state that planting methods had a significant effect on main head diameter in both seasons. The highest values (8.862 and 9.029 cm in the first and second seasons, respectively) were obtained from transplanting method. Transplanting may be the most successful technique to achieve a desired plant stand (Lewis et al., 1995). Also, the data show that the cultivars studied had a highly significant influence on main head diameter in both seasons.

Calabrese cultivar surpassed the Waltham 29 in this respect and gave 10.546 and 10.710 cm in first and second season, respectively. Also, the illustrated data reveal that Lithovit application had a significant effect in the two growing seasons. The largest main head diameter (9.208 and 9.408 cm in the first and second seasons, respectively) was obtained from plants treated with 0.05% Lithovit. Here too, the first order interaction between planting methods and cultivars was significant in the first season only. The highest mean value (10.954 cm) was obtained from transplanting Calabrese plants. Also, the first order interaction between planting methods and Lithovit was significant in both seasons. The highest mean values (9.375 and 9.567 cm in the first and second seasons, respectively) in this trait were obtained from transplanting method untreated plants in the first season and from 0.05% Lithovit with direct seed sowing in the second season. Here too, the data show the significant effect of the first order interaction between cultivars and Lithovit in the first season only. The highest diameter (10.958 cm) was obtained from untreated Calabrese plants.

Main head weight (g):

The data in Table (7) show that planting methods had a significant effect on main head weight in the second season only. The highest value (372.917 g) was obtained from transplanting method. Also, the cultivars had a highly significant influence on this trait in both seasons. Calabrese cultivar surpassed the Waltham 29 in this respect (Table7). This cultivar gave the longest main head diameter and consequently main head weight. Also, the illustrated data reveal that Lithovit application had a significant effect in this respect in the two growing seasons. The heaviest main head weights (401.033 and 391.417g in the first and second seasons, respectively) were obtained from plants treated with 0.05% Lithovit. The illustrated data show that the first order interaction between planting methods and cultivars was significant in this respect in both seasons. The highest values 571.117 and 579.167 g in the first and second seasons respectively were obtained from transplanting Calabrese cultivar. Also, the first order interaction between planting methods and Lithovit was significant in both seasons. The highest values (435.833 and 448.333 g in the first and second seasons, respectively) in this respect were obtained from transplanting untreated plants. Here too, the first order interaction between cultivars and Lithovit was significant in the second season only. The highest value (587.167g) was obtained from Calabrese cultivar subjected to 0.05% Lithovit.

Total head yield (Ton/feddan):

Data in Table (8) show that planting methods had a significant effect on total head yield in the second season only. The

highest head yield (4.300 ton per feddan) was obtained from transplanting method. Similar results were reported by Sterrett *et al.*, (1991). Also, the data reveal that cultivars had a highly significant effect on this trait in both seasons. The highest yield values were (6.944 and 6.457 ton /feddan in the first and second seasons, respectively). These values gained by Calabrese cultivar. This cultivar gave the highest main head weight. Here too, the Lithovit application had a significant effect in total broccoli yield in the two growing season. The highest mean values of total yield (5.219 and 4.620 ton /feddan in the first and second seasons, respectively) were obtained from treated broccoli plants with 0.05% Lithovit as foliar application. This is logic since the same treatment gave the highest main head weight. Berdnikov, 2010 stated positive effect of the new preparation Lithovit to the yield output of the main field cultures. Efficiency basis is attributed to increase of the chlorophyll content in the leaves. Here too, the first order interaction between planting methods and cultivars was significant in the second season only. The highest value 6.985 ton per feddan was obtained from transplanting Calabrese cultivar. Also, the first order interaction between planting methods and Lithovit was significant in both seasons. The highest values (5.507 and 5.160 ton per feddan in the first and second seasons, respectively) were obtained from direct seed sowing plants treated with 0.05% Lithovit in the first season and from transplanting untreated plants in the second season. Here too, the first order interaction between cultivars and Lithovit treatments was significant in the second season only. The highest value, 7.088 ton per feddan, was obtained from Calabrese cultivar treated with 0.05% Lithovit.

In conclusion, foliar Lithovit fertilizer can result in an increase in the productivity of broccoli. The results indicate that the highest broccoli yield under the same conditions to plant Calabrese cultivar by direct seeds and subjected to 0.05% Lithovit as foliar application or transplanting of the same cultivar without fertilization. Also, to increase the early yields of those cultivars we recommended application of 0.20% Lithovit and using transplanting as a planting technique.

Table 1: Plant height (cm) of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	99.200	96.333	96.800	98.333	97.667	98.600	98.400	98.533	97.867	98.350
	(Waltham 29)	88.133	100.467	97.133	95.600	95.333	88.000	100.400	97.867	96.733	95.750
Mean		93.667	98.400	96.967	96.967	96.500	93.300	99.400	98.200	97.300	97.050
(Transplanting)	(Calabrese)	73.800	95.867	84.000	85.467	84.783	83.000	97.400	85.667	88.000	88.517
	(Waltham 29)	80.200	86.267	86.267	82.867	83.900	83.933	87.800	87.800	85.267	86.200
Mean		77.000	91.067	85.133	84.167	84.342	83.467	92.600	86.733	86.633	87.358
General Mean		85.333	94.733	91.050	90.567	-------	88.383	96.000	92.467	91.967	--------
BxC	(Calabrese)	86.500	96.100	90.400	91.900	91.225	90.800	97.900	92.100	92.933	93.433
	(Waltham 29)	84.167	93.367	91.700	89.233	89.617	85.967	94.100	92.833	91.000	90.975
F value of (A)		**					**				
F value of (B)		N.S.					*				
L.S.D. 0.05 of (C)		3.372					2.771				
L.S.D. 0.05 of (A x B)		N.S					N.S				
L.S.D. 0.05 of (A x C)		N.S.					N.S				
L.S.D. 0.05 of (B x C)		N.S					N.S				
L.S.D. 0.05 of (AxBxC)		6.745					5.542				
t Dunnet 0.05		4.134					3.397				

Table 2: Number of branches /plant of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	15.267	10.333	12.600	12.533	12.683	14.533	11.000	12.533	13.333	12.850
	(Waltham 29)	13.867	12.600	15.000	16.333	14.450	13.933	13.467	15.133	17.133	14.917
Mean		14.567	11.467	13.800	14.333	13.567	14.233	12.233	13.833	15.233	13.883
(Transplanting)	(Calabrese)	13.400	15.333	14.267	12.600	13.900	14.400	15.000	14.333	13.667	14.350
	(Waltham 29)	12.600	15.067	15.400	15.733	14.700	12.867	15.600	16.067	17.000	15.383
Mean		13.000	15.200	14.833	14.167	14.300	13.633	15.300	15.200	15.333	14.867
General Mean		13.783	13.333	14.317	14.300	-------	13.933	13.767	14.517	15.283	-------
BxC	(Calabrese)	14.333	12.833	13.433	12.567	13.292	14.467	13.000	13.433	13.500	13.600
	(Waltham 29)	13.233	13.833	15.200	16.033	14.575	13.400	14.533	15.600	17.067	15.150
F value of (A)		N.S					N.S				
F value of (B)		**					**				
L.S.D. 0.05 of (C)		N.S					0.880				
L.S.D. 0.05 of (A x B)		N.S.					0.402				
L.S.D. 0.05 of (A x C)		1.780					1.245				
L.S.D. 0.05 of (B x C)		1.780					1.243				
L.S.D. 0.05 of (AxBxC)		N.S					N.S				
t Dunnet 0.05		1.543					1.079				

Table 3: Number of days from planting to heading of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	98.333	94.333	93.467	83.800	92.483	98.267	95.400	94.333	83.867	92.967
	(Waltham 29)	92.600	91.533	94.333	82.000	90.117	93.133	92.133	94.933	83.733	90.983
Mean		95.467	92.933	93.900	82.900	91.300	95.700	93.767	94.633	83.800	91.975
(Transplanting)	(Calabrese)	85.400	85.400	82.133	75.467	82.100	86.133	85.867	82.000	75.000	82.250
	(Waltham 29)	85.533	85.133	85.667	74.800	82.783	85.800	85.867	86.267	75.533	83.367
Mean		85.467	85.267	83.900	75.133	82.442	85.967	85.867	84.133	75.267	82.808
General Mean		90.467	89.100	88.900	79.017	--------	90.833	89.817	89.383	79.533	--------
BxC	(Calabrese)	91.867	89.867	87.800	79.633	87.292	92.200	90.633	88.167	79.433	87.608
	(Waltham 29)	89.067	88.333	90.000	78.400	86.450	89.467	89.000	90.600	79.633	87.175
F value of (A)		*					**				
F value of (B)		N.S					N.S				
L.S.D. 0.05 of (C)		1.388					1.218				
L.S.D. 0.05 of (A x B)		N.S					N.S				
L.S.D. 0.05 of (A x C)		N.S					N.S				
L.S.D. 0.05 of (B x C)		1.963					1.722				
L.S.D. 0.05 of (AxBxC)		N.S					N.S				
t Dunnet 0.05		1.701					1.493				

Table 4: Number of curds of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	13.400	12.400	11.267	13.067	12.533	13.733	11.400	11.600	13.333	12.517
	(Waltham 29)	8.933	10.133	10.867	10.600	10.133	9.533	10.800	11.800	10.533	10.133
Mean		11.167	11.267	11.067	11.833	11.333	11.633	11.100	11.700	11.933	11.592
(Transplanting)	(Calabrese)	15.467	13.667	13.667	13.400	14.050	14.267	13.733	13.600	13.400	13.750
	(Waltham 29)	11.600	12.867	11.467	11.867	11.950	11.667	13.133	12.267	12.267	11.950
Mean		13.533	13.267	12.567	12.633	13.000	12.967	13.433	12.933	12.833	13.042
General Mean		12.350	12.267	11.817	12.233	-------	12.300	12.267	12.317	12.383	---------
BxC	(Calabrese)	14.433	13.033	12.467	13.233	13.292	14.000	12.567	12.600	13.367	13.133
	(Waltham 29)	10.267	11.500	11.167	11.233	11.042	10.600	11.967	12.033	11.400	11.500
F value of (A)		N.S.					*				
F value of (B)		**					**				
L.S.D. 0.05 of (C)		N.S					N.S				
L.S.D. 0.05 of (A x B)		N.S					N.S				
L.S.D. 0.05 of (A x C)		N.S					N.S				
L.S.D. 0.05 of (B x C)		1.359					0.831				
L.S.D. 0.05 of (AxBxC)		N.S					1.175				
t Dunnet 0.05		1.178					0.721				

Table 5: - Main head length (cm) of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	17.267	20.200	19.000	17.933	18.600	18.133	20.733	19.667	18.800	19.333
	(Waltham 29)	13.133	16.667	16.000	16.200	15.500	13.600	16.867	15.867	16.200	15.633
Mean		15.200	18.433	17.500	17.067	17.050	15.867	18.800	17.767	17.500	17.483
(Transplanting)	(Calabrese)	20.600	21.600	21.200	19.867	20.817	21.400	21.733	21.200	19.933	21.067
	(Waltham 29)	18.600	18.200	15.800	16.400	17.250	19.000	18.267	16.267	17.067	17.650
Mean		19.600	19.900	18.500	18.133	19.033	20.200	20.000	18.733	18.500	19.358
General Mean		17.400	19.167	18.000	17.600	-------	18.033	19.400	18.250	18.000	-------
BxC	(Calabrese)	18.933	20.900	20.100	18.900	19.708	19.767	21.233	20.433	19.367	20.200
	(Waltham 29)	15.867	17.433	15.900	16.300	16.375	16.300	17.567	16.067	16.633	16.642
F value of (A)		**					**				
F value of (B)		**					**				
L.S.D. 0.05 of (C)		1.072					1.022				
L.S.D. 0.05 of (A x B)		N.S					N.S				
L.S.D. 0.05 of (A x C)		1.515					1.445				
L.S.D. 0.05 of (B x C)		N.S					N.S				
L.S.D. 0.05 of (AxBxC)		N.S					N.S				
t Dunnet 0.05		1.313					1.252				

Table 6: Main head diameter (cm) of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	9.950	11.083	10.267	9.250	10.138	9.833	11.300	10.367	9.667	10.292
	(Waltham 29)	5.917	7.567	6.917	6.883	6.821	6.283	7.833	7.017	7.000	7.033
Mean		7.933	9.325	8.592	8.067	8.479	8.058	9.567	8.692	8.333	8.662
(Transplanting)	(Calabrese)	11.967	10.733	11.067	10.050	10.954	11.967	11.033	11.250	10.267	11.129
	(Waltham 29)	6.783	7.450	6.467	6.383	6.771	6.983	7.467	6.600	6.667	6.929
Mean		9.375	9.092	8.767	8.217	8.862	9.475	9.250	8.925	8.467	9.029
General Mean		8.654	9.208	8.679	8.142	-------	8.767	9.408	8.808	8.400	--------
BxC	(Calabrese)	10.958	10.908	10.667	9.650	10.546	10.900	11.167	10.808	9.967	10.710
	(Waltham 29)	6.350	7.508	6.692	6.633	6.796	6.633	7.650	6.808	6.833	6.981
F value of (A)		*					*				
F value of (B)		**					**				
L.S.D. 0.05 of (C)		0.350					0.438				
L.S.D. 0.05 of (A x B)		0.579					N.S				
L.S.D. 0.05 of (A x C)		0.495					0.619				
L.S.D. 0.05 of (B x C)		0.495					N.S.				
L.S.D. 0.05 of (AxBxC)		N.S					N.S				
t Dunnet 0.05		0.429					0.537				

Table 7: Main head weight (g) of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	441.000	588.667	493.667	427.000	487.583	478.667	556.333	516.000	415.333	491.583
	(Waltham 29)	121.333	395.667	168.333	195.333	171.917	129.667	206.000	167.667	192.333	173.917
Mean		281.167	395.667	331.000	311.167	329.750	304.167	381.167	341.833	303.833	332.750
(Transplanting)	(Calabrese)	667.667	608.800	554.667	453.333	571.117	689.333	618.000	554.000	455.333	579.167
	(Waltham 29)	204.000	406.400	130.000	124.000	165.500	207.333	185.333	139.333	134.667	166.667
Mean		435.833	406.400	342.333	288.667	368.308	448.333	401.667	346.667	295.000	372.917
General Mean		358.500	401.033	336.667	299.917	---------	376.250	391.417	344.250	299.417	---------
BxC	(Calabrese)	554.333	598.733	524.167	440.167	529.350	584.000	587.167	535.000	435.333	535.375
	(Waltham 29)	162.667	203.333	149.167	159.667	168.708	168.500	195.667	153.500	163.500	170.292
F value of (A)		N.S.					*				
F value of (B)		**					**				
L.S.D. 0.05 of (C)		47.472					33.837				
L.S.D. 0.05 of (A x B)		37.172					45.827				
L.S.D. 0.05 of (A x C)		67.135					47.852				
L.S.D. 0.05 of (B x C)		N.S.					47.852				
L.S.D. 0.05 of (AxBxC)		N.S					N.S				
t Dunnet 0.05		58.190					41.476				

Table 8: Total head yield (ton / feddan) of two Broccoli cultivars as affected by foliar applications of Lithovit under two planting methods.

Seasons		2010-2011					2011-2012				
Planting methods (A)	Treatment (C) / Cultivar(B)	Control	0.05%	0.10%	0.20%	Mean	Control	0.05%	0.10%	0.20%	Mean
(Seed sowing)	(Calabrese)	6.273	8.570	7.050	6.050	6.986	5.770	6.717	6.220	5.007	5.928
	(Waltham 29)	1.483	2.443	2.030	2.370	2.082	1.573	2.487	2.027	2.323	2.102
Mean		3.878	5.507	4.540	4.210	4.534	3.672	4.602	4.123	3.665	4.015
(Transplanting)	(Calabrese)	8.063	7.407	6.683	5.457	6.902	8.310	7.460	6.683	5.487	6.985
	(Waltham 29)	2.500	2.457	1.567	1.503	2.007	2.010	1.817	1.330	1.303	1.615
Mean		5.282	4.932	4.125	3.480	4.455	5.160	4.638	4.007	3.395	4.300
General Mean		4.580	5.219	4.333	3.845	------ -	4.416	4.620	4.065	3.530	------ --
BxC	(Calabrese)	7.168	7.988	6.867	5.753	6.944	7.040	7.088	6.452	5.247	6.457
	(Waltham 29)	1.992	2.450	1.798	1.937	2.044	1.792	2.152	1.678	1.813	1.859
F value of (A)		N.S					*				
F value of (B)		**					**				
L.S.D. 0.05 of (C)		0.654					0.406				
L.S.D. 0.05 of (A x B)		N.S					0.541				
L.S.D. 0.05 of (A x C)		0.925					0.574				
L.S.D. 0.05 of (B x C)		N.S					0.574				
L.S.D. 0.05 of (AxBxC)		N.S					N.S				
t Dunnet 0.05		0.801					0.498				

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إستجابة صنفين من البروكلى للرش الورقى بسماد الليثوفيت تحت طرقتى زراعة

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الملخص العربى

تم إجراء تجربة حقلية بمزرعة كلية الزراعة- جامعة الازهر- فرع اسيوط خلال موسمى 2010-2011 و 2011-2012 لدراسة تأثير الرش الورقى باستخدام سماد الليثوفيت بتركيزات مختلفة على صنفى البروكلى . تم استخدام تصميم القطاعات كاملة العشوائية بترتيب القطع المنشقة مرتين بثلاث مكررات . حيث تم وضع طرق الزراعة (بالبذرة أو بالشتلة) فى القطع الرئيسية بينما تم توزيع الاصناف (كالابريس ، والثام 29) فى القطع المنشقة وتم توزيع تركيزات محدودة من سماد الليثوفيت [0% (كنترول) ، 0.05% ، 0.10% ، 0.20%] فى القطع تحت المنشقة.

أظهرت النتائج أن:

أثرت طرق الزراعة معنويا" فى كل الصفات محل الدراسة عدا عدد الفروع / نبات فى كلا الموسيمين وصفات عدد الحوامل النورية ووزن الرأس والمحصول الكلى فى الموسم الأول فقط و إستجابت معظم الصفات لطريقة الشتل ايضا .إختلفت أصناف البروكللى معنويا" فيما بينها فى كل الصفات محل الدراسة عدا صفة إرتفاع النبات فى الموسم الأول و صفة عدد الأيام من الزراعة لتكوين الرأس فى كلا الموسمين.و تفوق الصنف كالابريس على الصنف والثام 29 فى الصفات المدروسة عدا صفة عدد الفروع للنبات .

أثر الرش بإستخدام الليثوفيت الورقى تأثيرا" معنويا" على صفات إرتفاع النبات وطول الرأس وقطر الرأس ووزن الرأس و المحصول لصالح الرش بتركيز 0.05% لكلا موسمى الزراعة .

تم الحصول على أعلى محصول من الصنف كالابريس المنزرعة بالبذرة والمعامل بتركيز 0.05% ليثوفيت أو المنزرعة بالشتل بدون رش .