

## Response of Growth and Yield of two Broad Bean (*Vicia faba L*) varieties for antioxidants and diammonium phosphate DAP fertilizer.

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### Abstract

In the fall agricultural season of 2021-2022, an experiment was conducted in two areas of Nineveh Governorate, the first experiment in Yarmgah and the second one in Badush, each experiment included two types of broad bean *Vicia faba L* to study their response to antioxidants and ammonium phosphate diphosphate fertilizer. The experiment included two factors, the first factor varieties (Aquadlge and Luz de otono) with antioxidants with seven levels. without the addition of catechins and DAP fertilizer, spray and soak at a concentration of 250 mg. L<sup>-1</sup> for each of AsA, B1, B6 with the addition of 20 kg DAP. Spray and soak at a concentration of 500 mg.L<sup>-1</sup> for each of AsA, B1, B6 with the addition of 20 kg DAP.H<sup>-1</sup>. spray and soak at a concentration of 250 mg.L<sup>-1</sup> for each of AsA, B1, B6 with the addition of 40 kg DAP.H<sup>-1</sup>, spray and soak at a concentration of 500 mg.L<sup>-1</sup> for each of AsA, B1, B6 with the addition of 40 kg DAP.H<sup>-1</sup>, spray and soak at a concentration of 250 mg.L<sup>-1</sup> for each of AsA, B1, B6 with the addition of 60 kg DAP.H<sup>-1</sup>, and Spray and soak at a concentration of 500 mg.L<sup>-1</sup> for each of AsA, B1, B6 with the addition of 60 kg DAP.H<sup>-1</sup>). The seeds were soaked in water with antioxidants for 6 hours before planting and sprayed with antioxidant until complete wetness took place 30 and 45 days of planting, and the results showed the superiority of the Aquadlge Variety over the Luz de otono variety morally at the Yarmgah and Badush experiment sites for all the studied qualities: the chlorophyll content, the number of pods in the plant, the number of seeds per pod, the number of seeds per plant, the weight of 100 seeds and the protein percentage. The seventh level of the fertilizer combination with antioxidants gave the highest value of all the studied qualities: the chlorophyll content, the number of pods in the plant, the number of seeds in the pod, the number of seeds in the plant, the weight of 100 seeds and the percentage of protein.

**Keywords:** ascorbic acid, thiamine, pyridoxine, broad bean, dab fertilizer



## Introduction

*Vicia faba* L broad bean is an important plant of the legume family Fabaceae, which is grown for its green pods, which are used in cooking, as well as for its dry and tender seeds, as these seeds have a high nutritional value (3). It is a sustainable source of high-protein food on a large scale all over the world, among legumes, broad bean are one of the oldest crops cultivated all over the world (7), it is an important food source for humans, and also as animal feed, and it has another importance as it stabilizes atmospheric nitrogen in agricultural soils, which significantly reduces the use of artificial fertilizers (15), broad bean contain a variety of biologically active compounds for example, macro-phenols, and flavonoids with antioxidant activity (13), Antioxidants have an important role in stimulating the growth of plants, including ascorbic acid, as it stimulates cells to divide even in cases of water and salt stress, because of its importance in activating and protecting enzymes under those conditions, in addition to the role of ascorbic acid in increasing nitrogen fixation in legume plants by increasing the resistance of membrane permeability in the root nodes to oxygen permeability and thus preventing the inhibition of nitrogenase by oxidation, ascorbic acid significantly delays the aging of Root nodes (6).

Thiamine is important for the primary metabolism of all living organisms, and its active form is thiamine pyrophosphate and is a cofactor for

enzymes involved in the synthesis of amino acids, the carboxylic acid cycle and the pentose phosphate pathway. Recently, thiamine has been shown to have a role in the basic processes of protecting plants from biotic and abiotic stress (12). Pyridoxine is important for the UV-B plant diet and pyridoxine was found to increase the activity of ascorbic acid. Dolatadian and Sanavy(5), Parveen *et al.*(10), Mohsen *et al.*(8) and Zamanipour(14) found a significant effect of antioxidants on plant growth. Di Paolo *et al.* (4) observed a significant effect of nitrogen fertilization on the biological yield and seed yield when adding (50 kg N. ha<sup>-1</sup>), Negasa *et al.* (9) found that phosphate fertilizer at a rate of (20 kg P<sub>2</sub>O<sub>5</sub>. Ha<sup>-1</sup>) gave a significant increase in seed yield, its components and growth qualities. The experiment aimed to find out the effect of antioxidants (ascorbic acid, thymine, pyridoxine) and ammonium phosphate diphosphate fertilizer on the growth and yield of broad bean.

## Materials and Methods

In the year 2021-2022 during the fall agricultural season, the experiment was carried out in two sites, Yarmgah and Badush region in Nineveh Gover norate, the experiment included two factors, the first factor (two varieties).

While the second factor was ammonium phosphate DAP fertilizer with seven-level antioxidants, thus we have fourteen factor treatment, the following is a description of the two treatments and their levels in the experiment.



The design of the full Randomized complete Block Design ( R.C.B.D ) was used with three replications RCBD by using sub plots, and with three block, Means were compared using Dunkin's multiple range test, the treatment of the combination of antioxidants with ammonium phosphate fertilizer DAP occupied the main Plots main plots, while the varieties were placed in the secondary plots Sub plots, the treatment of varieties included two varieties ( Luz de otono early maturing, Aquadlge), the treatment of the combination of antioxidants with ammonium phosphate fertilizer DAP included the following 7 levels: **1:** without the addition of antioxidants and DAP fertilizer, **2:** spray and soak at a concentration of  $250 \text{ mg.L}^{-1}$  for each of AsA, B1, B6 with the addition of  $20 \text{ kg DAP.H}^{-1}$ , **3:** Spray and soak at a concentration of  $500 \text{ mg.L}^{-1}$  for each of AsA, B1, B6 with the addition of  $20 \text{ kg DAP.H}^{-1}$ , **4:** spray and soak at a concentration of  $250 \text{ mg.L}^{-1}$  for each of AsA, B1, B6 with the addition of  $40 \text{ kg DAP.H}^{-1}$ , **5:** spray and soak at a concentration of  $500 \text{ mg.L}^{-1}$  for each of AsA, B1, B6 with the addition of  $40 \text{ kg DAP.H}^{-1}$ , **6:** spray and soak at a concentration of  $250 \text{ mg.L}^{-1}$  for each of AsA, B1, B6 with the addition of  $60 \text{ kg DAP.H}^{-1}$ , **7:** spray and soak at a concentration of  $500 \text{ mg.L}^{-1}$  for each of AsA, B1, B6 with the addition of  $60 \text{ kg DAP.H}^{-1}$ , the seeds were soaked for 6 hours and the plants were sprayed until complete wetting took place 30 and 45 days after planting, which was done on 18 and 19/11/2021.

## Results and Discussion

### Chlorophyll content index (spad)

As shown in Table 1 below, the aquadlge variety was significantly superior than Luz de otono variety in chlorophyll content index, and the chlorophyll content index for the aquadlge variety was in the Yarmgah location ( 40.34 spad ) and for the Badush location( 36.37 spad), while the Luz de otono variety gave the lowest average of the chlorophyll content index for the Yarmgah location(38.42 spad ) and for the Badush location35.28 (spad), may be the aquadlge variety is superior due to its nitrogen content (2).

The seventh level of fertilizer combination with antioxidants was significantly higher by obtaining the highest value , the average chlorophyll content index reached 39.37 , 42.70 spad in the Yarmgah and Badush sites , respectively, while the first level gave the lowest average chlorophyll content, reaching 32.50, 37.42 spad for the Yarmgah and Badush sites, respectively, perhaps due to the effect of nitrogen and phosphorus elements in increasing the plant content as well as the role of catechins in protecting plants from abiotic tensile conditions . The Interaction between the varieties with the combination of fertilizer and antioxidants reached the limit at the Yarmgah location, unlike the Badush site, the Interaction of the Aquadlge variety with the level of fertilizer and antioxidant combination gave the



seventh highest moral rate and amounted to 44.37 spad, while the Interaction of the Luz de otono variety with the combination of fertilizer and antioxidants of the first level resulted in the lowest moral difference and amounted to 36.90 spad.

The absence of a significant difference of Interaction between the varieties with the combination of fertilizer and antioxidants at the Badush location may be due to.

**Table 1.** The effect varieties and the synthesis of fertilizer with antioxidants and the interaction between them in the chlorophyll content Spad at Yarmgah and Badush location

Yarmgah location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	Aquadlge	Luz de otono	
Level 1	36.90 I	37.93G-H	37.42 F
Level 2	37.40 H-I	38.53 F-G	37.97 E
Level 3	37.90 H	38.77 F	38.34 E
Level 4	37.93 H	39.90 D-E	38.92 D
Level 5	38.53 F-H	40.35 C-D	39.53 C
Level 6	39.23 E-F	42.37 B	40.80 B
Level 7	41.03 C	44.37 A	42.70 a
Means of varieties	38.42 B	40.34 A	mean 39.38
Badush location			
Combination of fertilizer with antioxidants	varieties		The effect Combination of fertilizer with antioxidants
	Aquadlge	Luz de otono	
Level 1	32.00	33.00	32.50 F
Level 2	34.00	35.00	34.5 E
Level 3	34.50	35.50	35.00 D
Level 4	35.00	36.00	35.50 D
Level 5	35.70	37.00	36.35 C
Level 6	37.00	38.10	37.55 B
Level 7	38.00	40.00	39.37 A
Means of varieties	35.28	36.37	mean 35.28

\*means that share the same letter are not significantly different from each other

No. pods in a plant

Data in Table 2, Showed the superiority of the Aquadlge Variety Than the Luz de otono variety by giving it the highest

average of the characteristic of the number of pods for the two experiment sites, reaching 10.11 pods at the Yarmgah. Plant<sup>-1</sup>) and on Badush (6.98



Pods. Plant<sup>-1</sup>), while the Luz de otono variety gave the lowest average number of pods carried by the plant, and the average of this trait was for the Yarmgah location (9.79 pods. Plant<sup>-1</sup>) and for the location of Badush (6.78 pods. Plant<sup>-1</sup>), the superiority of the Aquadlge Variety over the Luz de otono variety may be due to the superiority of this variety in the chlorophyll content index (Table 1) and therefore this was positively reflected in the increase in photosynthesis and thus an increase in the manufacture of nutrients and then an increase in the number of pods carried by one plant.

The seventh level of combination the fertilizer with antioxidants achieved the highest significant rate of the number of pods carried by an individual plant<sup>-1</sup> (Table 2) compared to other levels, giving (11.42 pods. Plant<sup>-1</sup>) in the Yarmgah position and reached (7.62 pods. Plant<sup>-1</sup>) in Badush , Compare to the first level gave the lowest average of the number of Pods plant<sup>-1</sup> carried by the plant, reaching ( 8.54, 6.37 pods . Plant<sup>-1</sup>

<sup>1</sup>) for the Yarmgah and Badush, respectively, the reason for the significant increase in the number of pods carried by the plant may be due to the role of DAP fertilizer,

which contains Nitrogen and Phosphorus elements, as well as Antioxidants in increasing the chlorophyll content index ( Table 1 ) and thus increasing the Nutrients that move to the flowers to increase the fertility rate and thus increase the number of pods pointed out that increasing the amount of carbohydrates and Transition to areas effective in growth, including flowers, and thus early flowering and then increasing the percentage of nodes and an increase in the number of pods as a result of reducing the state of competition between vegetative and flowering plants for nutrences .

Results in Table No. 2, Shows that there was no interaction between the varieties and the combination of fertilizer with antioxidants for the the number of pods and for the experiment sites Yarmgah and Badush.

**Table 2.** The effect varieties and the synthesis of fertilizer with antioxidants and the interaction between them in the number of pods/ Plant<sup>-1</sup>.. at Yarmgah and Badush location



Yarmgah location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	Aquadlge	Luz de otono	
Level 1	8.37	8.70	8.54 G
Level 2	9.03	9.27	9.15 F
Level 3	9.27	9.60	9.44 E
Level 4	9.70	10.00	9.85 D
Level 5	10.00	10.40	10.20 C
Level 6	10.93	11.20	11.07 B
Level 7	11.20	11.63	11.42 A
Means of varieties	9.79 B	10.11 A	mean 9.95

  

Badush location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	Aquadlge	Luz de otono	
Level 1	6.20	6.33	6.27 F
Level 2	6.50	6.70	6.60 E
Level 3	6.60	6.80	6.70 D-E
Level 4	6.70	6.90	6.80 D
Level 5	6.90	7.10	7.00 C
Level 6	7.00	7.30	7.15 B
Level 7	7.53	7.70	7.62 A
Means of varieties	6.78 B	6.97 A	mean 6.88

\*means that share the same letter are not significantly different from each other

### Number of seeds

Aquadlge achieved the highest rate of the number of seeds for plant it was reached to 54.90 , 27.87 seeds in the Yarmgah and Badush it was reached to, while the Luz de otono variety gave the lowest mean of the number of seeds for plant in the Yarmgah and Badush sites to 51.83 , 24.54 seeds respectively, the Aquadlge variety surpassed the Luz de otono variety as a result of to increasing the number of seeds per pod ( table 3 ) and the number of pods (table 2)

The seventh level of treatment of the fertilizer combination with antioxidants

exceeds the number of seeds in the plant by producing the highest value of this trait, reaching 65.27 seeds, while the first level recorded the lowest average in the number of seeds in the plant, reaching 34.47 seeds at the location of Yarmgah, as for the Badush site, the seventh level also exceeded the of the same combination by obtaining the highest value of the average number of seeds in the plant reached 35.25 seeds, while the first level gave the lowest of the trait reached 20.82 seeds ,

The effect of fertilizer with antioxidants had a positive effect on the quality of the



number of pods in the plant Table 2 and therefore reflected positively on the quality of the number of seeds in the plant Table 3.

**Table 3.** The effect varieties and the synthesis of fertilizer with antioxidants and the interaction between them in relation to the number of seeds per plant. at Yarmgah and Badush location

Yarmgah location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	aquadlge	Luz de otono	
Level 1	32.50	36.43	34.47 G
Level 2	44.80	47.40	46.10 F
Level 3	50.87	53.47	52.17 E
Level 4	54.00	56.76	55.38 D
Level 5	55.63	58.93	57.28 C
Level 6	61.60	64.23	62. 92 B
Level 7	63.43	67.10	65.27 A
Means of varities	51.83 B	54. 90 A	mean 9.95
Badush location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	aquadlge	Luz de otono	
Level 1	19.50	22.13	20.82 F
Level 2	21.80	24.43	23.12 E
Level 3	21.80	24.70	23.24 E
Level 4	22.50	25.50	24.00 D
Level 5	25.40	28.90	27.15 C
Level 6	27.80	31.90	29.85 B
Level 7	33.00	37.50	35.25 A
Means of varities	24.54 B	27.86 A	mean 26.21

\*means that share the same letter are not significantly different from each other

Weight of 100 seeds (g):

Significant differences between the two varieties in the weight of 100 seeds, as the aquadlge variety was superior to the Luz de otono variety in the weight of 100 seeds in the Yarmgah and Badush location as shown in Table 4 ,The aquadlge variety Produced the highest average in the weight of 100 seeds , the average attribute for the Yarmgah

location was 99.46 g and for the Badush 106.44 g , while the Luz de The average weight of 100 seeds reached 98.46 g for the Yarmgah , and 103.34 g for the Badush site, the large leaf area , the plant can store nutrients in the seeds and thus increase the weight of the seeds, and this depends on the genetic traits carried by the Aquadlge variety.

The seventh level for the treatment of fertilizer combination with antagonists gave the highest moral value for the average weight of 100 seeds, reaching 105.08 , 115.35 g at the Yarmgah and Badush, respectively, while the third level gave the lowest moral average weight of 100 seeds at the Yarmgah and Badush sites, 92.34 g, while at the Badush location the first level gave the lowest moral average of the trait, which was 95.15 g , This may be due to the role of fertilizer synthesis with antioxidants in improving the photosynthesis process by increasing the chlorophyll content Table 1 and improving vegetative

growth, including leaf area Table 8, increasing the photosynthesis process and its transition from the source leaves to the sink

(seeds) and increasing their weight .it is noticeable that the number of pods formed by the plant as in the table 4 is different, so that plants with a larger number of pods have a reduced weight of 100 seeds compared to plants with a smaller number of pods per plant. It was Noted in table 4 that the interaction between the varieties and the synthesis of fertilizer with antioxidants did not reach the significant at the Yarmgah and Badush.

**Table 4.** The effect varieties and the synthesis of fertilizer with antioxidants and the interaction between them for a weight of 100 seeds (g ) . at Yarmgah and Badush location

Yarmgah location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	aquadlge	Luz de otono	
Level 1	97.75	98.75	98.25 D
Level 2	98.17	99.17	98.67 D
Level 3	91.84	92.83	92.58 F
Level 4	93.08	94.08	93.58 E
Level 5	101.00	102.00	101.50 C
Level 6	102.83	103.84	103.34 B
Level 7	104.58	105.58	105.08 A
Means of varities	98.46 B	99.46	mean 26.21
Badush location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	aquadlge	Luz de otono	
Level 1	93.70	96.60	95.15 F
Level 2	99.43	102.30	100.87 E
Level 3	101.20	104.03	102.62 D

Level 4	102.30	105.40	103.85 D
Level 5	104.70	107.93	106.32 C
Level 6	108.43	111.70	110.07 B
Level 7	113.60	117.70	115.35 A
Means of varieties	103.34 B	106.44 A	mean 104.89

\*means that share the same letter are not significantly different from each other

### 5- Seed yield (ton. H<sup>-1</sup>):

There was no difference at the Yarmgah site, but at the Badush The Aquadlge variety was superior than Luz de otono variety in the quality of the yield of seeds as in Table 5, the aquadlge variety gave the highest average value of the seed yield and amounted to 1.623 tons. E<sup>-1</sup>, while the Luz de otono variety gave the lowest average value for the quality of the seed yield 1.383 tons. E<sup>-1</sup> for the Badush site, the superiority of the Aquadlge Variety over the Luz de otono variety is due to its superiority in number of pods per plant Table 2, the number of seeds per plant Table 3 and the chlorophyll content index in Table 1.

The seventh level of the combination of fertilizer with antioxidants gave the highest significant value of the seed yield and amounted to 3.723 tons. H<sup>-1</sup> it did not differ. without differences with the sixth level in the Yarmgah site, as for the Badush site, it also surpassed the seventh level morally by obtaining the

highest Value reached to 2.222 tons. H<sup>-1</sup>, Compare with, the first level Which produced the lowest values for both experimental positions and amounted to 1.844 tons. H<sup>-1</sup> for a Yarmgah location and amounted to 1.079 tons. H<sup>-1</sup> at the Badush site, the reason for the superiority of the seventh level of fertilizer synthesis with antioxidants Was may be due to its superiority in the qualities of the components of the product, namely: the number of pods. Plant<sup>-1</sup> (watch Table 2) and the number of seeds.

Pod<sup>-1</sup> as we noted in (table 2), the number of seeds per plant as (Table 3) and the weight of 100 seeds (Table 4), as it is considered a function of the yield of seeds per unit area .

According to Table 5, there was no significant difference in interaction between the varieties with the combination of fertilizer and antioxidants at the Yarmgah and Badush.

**Table 5.** The effect of varieties and the synthesis of fertilizer with antioxidants and the overlap between them in the quality of the seed yield tons. H<sup>-1</sup> at Yarmgah and Badush location

Yarmgah location			
Combination of fertilizer with	Varieties		The effect Combination
	aquadlge	Luz de otono	

antioxidants			of fertilizer with antioxidants
Level 1	1.725	1.963	1.844 E
Level 2	2.413	2.519	2.466 D
Level 3	2.516	2.686	2.601 C-D
Level 4	2.721	2.881	2.801 C
Level 5	3.039	3.250	3.145 B
Level 6	3.445	3.605	3.525 A
Level 7	3.587	3.858	3.723 A
Means of varieties	2.778 B	2.966 A	mean 2.872
Badush location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	aquadlge	Luz de otono	
Level 1	1.000	1.157	1.079 E
Level 2	1.154	1.360	1.257 D
Level 3	1.189	1.372	1.281 D
Level 4	1.246	1.462	1.354 D
Level 5	1.434	1.682	1.558 C
Level 6	1.617	1.928	1.773 B
Level 7	2.042	2.401	2.222A
Means of varieties	1.383 B	1.446 A	mean 1.414

\*means that share the same letter are not significantly different from each other

#### Protein %:

The aquadlge variety, as As data shown in tale 6, was superior than Luz de otono variety in protein percentage at the Yarmgah site, And gave the highest value for this trait(26.59%), and the lowest percentage for the Luz de otono variety was 24.72% at the Yarmgah location, as for the Badush site, The Aquadlge variety was also given the highest moral value for this trait was 23.80% the Luz de Otono varieties gave the lowest average percentage 22.62%. This may be due to the ability of the Aquadlge variety to produce high amounts of carbohydrates due to its

superiority in the characteristic of the chlorophyll content index (Table 1), Thus, the increase in carbohydrates produced from chlorophyll, which is used by bacterial nodes, which have a beneficial exchange relationship with plants, and thus increases the supply of nitrogen to plants ( 1 and 11 ).

The sixth level for the treatment of fertilizer combination with antioxidants gave the highest moral average and amounted to 26.04% and Without significant differences with the fourth and fifth levels , where it reached 25.88% and 25.73%, respectively , while the third and seventh levels gave the lowest moral value of 25.15% and 25.30%, respectively, and did not



without significant in the Yarmgah , while in the Badush site, the sixth level gave the highest Percentage of protein reached 24.30 Compare to the third level Which gave the lowest moral value reached 22.13% ,

protein % in pea seeds depend on the percentage of nitrogen in the seeds, and this percentage may decrease as a result of the deposition of carbohydrate substances in a greater proportion in the seeds, and therefore we notice a relative decrease.

There are significant differences in interaction between the varieties with the combination of fertilizer and antioxidants at the Yarmgah and Badush sits (Table 6), where the interaction of the Aquadlge variety with the sixth level

of fertilizer combination with antioxidants at the Yarmgah location gave the highest significant value reached 27.30

While the interaction of the Luz de otono variety gave the lowest value for the third and seventh levels , it reached 23.90 and 24.03 respectively interaction, in Badush , the overlap of the Luz de otono variety with the sixth level of fertilizer combination with antioxidants gave the highest moral value of 24.70, which with the of the Aquadelge variety and the fifth level of fertilizer combination with antioxidants reached 24.60 the third level of the Luz de Otono variety was given the lowest value and the synthesis of fertilizer with antioxidants reached 20.93% .

**Table 6.** The effect varieties and the synthesis of fertilizer with antioxidants and the interaction between them in the protein ratio. at Yarmgah and Badush location

Yarmgah location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with antioxidants
	Aquadlge	Luz de otono	
Level 1	24.87 E-F	26,80 B	25.84 A-B
Level 2	24.87 E-F	26.43 B-C	25.65 B
Level 3	23.90 G	26.40 B-C	25.15 C
Level 4	25.33 D	26.43 B-C	25.88 AB
Level 5	25.27 D-E	26.20 C	25.74 A-B
Level 6	24. 77 F	27.30 A	26.04 A
Level 7	24.03 G	26.56 B-C	25.30 C
Means of varities	24.27 B	26.59 A	mean 25.66
Badush location			
Combination of fertilizer with antioxidants	Varieties		The effect Combination of fertilizer with
	Aquadlge	Luz de otono	

			antioxidants
Level 1	23.07 F	23.80 E-D	23.44 B-C
Level 2	23.07 F	24.23 C-B	23.65 B
Level 3	20.93 H	23.33 E-F	22.13 F
Level 4	21.83 G	23.40 E-F	22.62 E
Level 5	21.80 G	24.60 A-B	23.20 C-D
Level 6	24.70 A	23.90 B-C	24.30 A
Level 7	23.00 F	23.20 F	23.10 D
Means of varieties	22.63 B	23.78 A	mean 23.21

\*means that share the same letter are not significantly different from each other

## Conclusion

Soaking the seeds and foliar applied the plant with antioxidants (AsA 500mg+B1 500mg+B6 500mg. Liter-1) with the addition of DAP 60 kg. H-1 improved most of the characteristics of vegetative growth, yield and its components, superiority significant of the cultivar (Aquadlge) over the cultivar Luz De Otono in all the characteristics of the studied and in both locations.

## Conflict of interest

The authors have no conflict of interest.

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