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# RESPONSE OF SOME CANOLA CULTIVARS TO BIOFERTILIZATION TREATMENTS UNDER NORTH SINAI CONDITIONS

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## ABSTRACT

A field experiment was carried out at the Experimental Farm, Faculty of Environmental Agricultural Sciences, Rafah, North Sinai Governorate, Suez Canal University during the two successive winter seasons of 2011/2012 and 2012/2013; to study the response of 5 canola cultivars (Serw4, Pactol, Sakha1, Sakha2 and Sakha3) to five biofertilization treatments $B_1$ (100% mineral + 0% biofertilizer), $B_2$(75% mineral + 25% biofertilizer), $B_3$ (50% mineral + 50% biofertilizer), $B_4$(25% mineral + 75% biofertilizer) and $B_5$ (100% biofertilizer) on yield and yield components. The results showed that Serw4 cv., surpassed the other cultivars in plant height, No. siliquae/plantat the 2nd season. Pactol surpassed the other cultivars in 1000-seed weight at 1st season but $Sakha_1$ surpassed other cultivars in 1000-seed weight at 2nd season. Application of $B_1$ treatment, significantly increased, plant height, No. racemes/plant, No. siliquae/plant, while $B_3$ and $B_4$ treatments gave the heighst 1000-seed weight at both seasons. Generally, it could be concluded that $Serw_4$ cv. fertilized by 100% mineral and 0% biofertilizer gave the heights yield and could recommended under North Sinai conditions.

**Key words:** Canola, *Brassica napus*, cultivars, nitrogen fertilizations, Biofertilizer, *Azotobacter*, N -fixing bacteria.

## INTRODUCTION

Nitrogen fertilizer is the most important element for crop growth and high yield with good quality. Seed yield and yield attributes increased by increasing nitrogen levels **(Shahoo *et al*., 2000)**. The excessive use of nitrogen fertilizer has generated several environmental problems. Some of these problems can be tackled by using bio-fertilizers, which are natural beneficial and ecologically friendly **(Wu *et al*., 2005**). The bio-fertilizers provide nutrients to the plants and maintain soil structure. It has been revealed that the effect of nitrogen fixation induced by nitrogen fixers is not only significant for both legumes and non-legumes crops. Also, some microorganisms have multiple functions for plant growth like *Azotobacter* which may derive both from its nitrogen fixation and stimulating effect on root development. Soil microorganisms, viz. *Azotobacter*and *Azospirillum*as free $N_2$ -fixing bacteria could be a beneficial source to enhance plant growth and producing considerable amounts of biologically active substances that can promote growth **(Rodriguez *et al.*, 2004 and Ebrahimi *et al.*, 2007**). Chemical fertilizers have several negative impacts on environment and sustainable agriculture. Therefore, bio-fertilizers are recommended in these conditions and growth prompting bacteria uses as a replacement of chemical fertilizers (**Megawer and Mahfouz, 2010 and Naderifar and Daneshian, 2012**).

$N_2$-fixing may be important for plant nutrition by increasing N uptake by the plants and playing significant role as plant

growth promoting rhizobacteria (PGPR) in the bio fertilization of crops (**Rodriguez *et al.*, 2004**). **Yasari and Patwardhan (2006)** recorded that adding 60 kg N/ha resulted in the highest plant height, number of branches and pods per plant**. Moghadam *et al.* (2011)** evaluated six oilseed rape (*Brassica juncea* L.) genotypes (Rgs003, Sarigol, Dption500, Hayola 401, Hayola330 and Hayola420). They illustrated that there are a significant differences among genotypes. **Mekki (2013)** found that a positive relationship on number of pods, seed weight/pods, seed yield/plant and 1000 seed weight in some canola genotypes grown in newly reclaimed sandy soil.

**Elewa*et al.* (2014)** showed that Wan 25 variety was superior in seed yield and yield components than the other.

So, this study aimed was to investigate the effect of mineral and biofertilizer applications on yield and yield attributes and seed chemical composition of some canola cultivars grown in Rafah, North Sinai conditions.

## MATRIALS AND METHODS

A field experiment was carried out at the Farm of the Faculty of Environmental Agricultural Sciences, Rafah, Suez Canal University, North Sinai Governorate on canola (*Brassica napus* L.) during 2011/ 2012 and the 2012/2013 winter seasons.

The experiment was laid out in split-plot randomized complete block design with three replications.

The main plots were devoted to five canola cultivars ($Serw_4$, Pactol, $Sakha_1$, $Sakha_2$ and $Sakha_3$) all cultivars were obtained from Agricultural Research Center, Giza, Egypt. While, the sub - plot were devoted to 5 biofertilization treatments ($B_1$, $B_2$, $B_3$, $B_4$ and $B_5$) calculated from plant needs of nitrogen N/fed., in from Urea 46% and commercial biofertilizer (Biogen viz. *Azotobacter*) as follow in Table (1).

Plot area was 12 $m^2$ (1/350 fed.) containing 1 row 20 m length and 0.6 m width with 30 cm within row. Cultivars were sown on 30$^{th}$ and 17$^{th}$ October in the first and second seasons.

The plants were thinned twice, the 1$^{st}$ at 30 days after sowing (DAS), where, 3-4 plants per hill were left and the 2$^{nd}$ at 45 DAS, where, one plant per hill was left.

Drip irrigation system with underground saline water (3500 ppm) pumped from a well was used thereafter, irrigation period was longed till 7 days. The physical and chemical analysis of experimental soil site were determined according to **Richard's (1954)** as shown in Tables 2. The organic fertilization was applied at the rate of 20 $m^3$/fed., while phosphorus fertilizer was applied in the form of single superphosphate (15.5% $P_2O_5$) at the rate of 200 kg/fed., during land preparation. At harvesting time (10$^{th}$ and 20$^{th}$ April at the first and second seasons), ten plants were taken from each sub-plot and to determine the yield attributes, while, the plants of square meter from each unit area were taken for determining the seed yield (kg/fed.):

1.Plant height at harvest (cm).

2. Number of racemes per plant at harvest.

3. Number of siliqua per plant.

4. 1000-seed weight (g.).

Data of the two seasons were subjected to proper statistical analysis of variance (**Snedecor and Cochran, 1990)** using M-STATC program. Mean values were compared at $P<0.05$ using the multiple range test **(Duncan, 1955).**

## RESULTS AND DISCUSSION

### 1- Effect of canola cultivars

Data presented in Table (4) pointed out that all canola cultivars had no significance differences in plant height in harvest in the 1$^{st}$ season, while, it was significantly affected in the 2$^{nd}$ season under North Sinai winter conditions. $Serw_4$ gave the highest mean value of plant height (137.50 cm).

**Table (1): Nitrogen fertilization treatments.**

| Treatments | Types | | Rate and time of adding |
|---|---|---|---|
| | Mineral | Biofertilizer | |
| **$B_1$** | 100 % | 0 % | after thinning + beginning of flowering on all nitrogen fertilization regimes. |
| **$B_2$** | 75 % | 25% | before seeding. |
| **$B_3$** | 50 % | 50 % | before seeding + at thinning. |
| **$B_4$** | 25 % | 75% | before seeding + at thinning + beginning of flowering. |
| **$B_5$** | 0 % | 100% | before seeding + at thinning + next two weeks of thinning+ beginning of flowering. |

**Table (2): Chemical analysis of irrigation water.**

| pH | EC | Soluble ions (mq/L.) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | dS/m | Cations | | | | Anions | | | |
| 6.02 | 4.07 | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | K+ | $Cl^{-}$ | $HCO_3^{-}$ | $CO_3$-- | $SO_4^{--}$ |
| | 5.49 | 4.40 | 8.20 | 32.00 | 0.40 | 35.8 | 4.20 | - | 5.00 |

**Table (3): Physical and chemical properties of the experimental soil site during the two seasons.**

| Soil Properties | %Clay | %Loam | %Sand | Texture | Organic matter% | pH | EC (ds/m 1:5) |
|---|---|---|---|---|---|---|---|
| **Value** | 0.40 | 3.50 | 96.10 | Sand | 1.15 | 7.03 | 3.84 |
| **Cations (meq/l)** | $Ca^{++}$ | $Mg^{++}$ | $Na^{+}$ | $K^{+}$ | | | |
| | 10.00 | 11.00 | 21.00 | 2.00 | | | |
| **Anions (meq/l)** | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{--}$ | | | | |
| | 6.60 | 26.40 | 11.00 | | | | |

This, may refer to its superiority during vegetative growth. **Hassan and El-Hakeem (1996)** indicated that Cresor cultivar significantly surpassed all cultivars in plant height. Other investigators found that significant differences among oilseed rape cultivars (Duplo, Sedo, 56/16 and Serw-4) in most growth characteristics **(Afiah *et al*., 2007).**

**Gan *et al*. (2008)** studied five oilseed crops, namely *Brassica juncea*, *B. napus* and *B. rapa*. They recorded that canola (*Brassica napus*) produced the greatest average of some growth characters.

Data in Table indicated that number of racemes per plant was not differed among all canola cultivars at both seasons. Canola cultivars had highly significant differences in number of siliquae per plant at the 2nd season only. $Serw_4$surpassed all cultivars in number of siliquae per plant. The maximum number of siliqua per plant was obtained by Serw4, while the minimum was obtained by Sakha2 (Table 4). Similar findings were reported by **Mekki (2013)**, who found a positive relationship between number of pods per plant and quality of some canola genotypes.

Data in Table (4) indicate that the differences in 1000 seed weight (g) among all canola cultivars were significant at $p<0.01$ at both seasons. The maximum mean values of 1000-seed weight (4.63 and 4.49 g) were obtained with Pactol and $Sakha_1$.

This may refer to genetical performance among cultivars and susceptibility of varieties for growth under the environmental conditions of the studied area.

Results revealed that the effect of variety on 1000 seeds weight was found significant between the two varieties. **Bagheri *et al*. (2011)**.

Seed yield kg/fed. was significantly affected by canola cultivars, whereas the differences among the five cultivars under study were significant. $Serw_4$ produced an increase in seed yield kg/fed. compared to the other cultivars.

Such increases estimated by 27.41% & 36.36% compared with $Sakha_3$ at both seasons (Table 4). However, $Sakha_1$, $Sakha_2$ and $Sakha_3$ gave the minimum seed yield kg/fed., in comparison the other two cultivars. These increase may be due to the increase in number of racemes, number of siliqua per plant, seed yield per plant, l000-seed weight $Serw_4$ which reflected to increase the seed yield. Similar results were reported by **Elewa *et al.* (2014).**

**2. Effect ofbiofertilization treatments**

The results in Table (5) indicated that applying $B_1$ (100% mineral + 0% biofertilizer) had a highly significant effect on plant height at harvest (cm) at the 1st and 2nd seasons. Fertilizing canola by $B_1$ (100% mineral + 0% biofertilizer) produced the highest plant height (154.40 &139.90 cm), while the lowest (127.10 and 121.00 cm) was obtained with $B_5$ (100% biofertilizer) and $B_3$ (50% mineral + 50% biofertilizer) at the 1st and 2nd seasons.

These superiorities were by 11.63, 16.69, 14.27 and 21.55% for $B_1$ application as compared with $B_2$, $B_3$ and $B_5$, respectively.

This increase can be attributed to general function in the whole plant. Nitrogen application might have encouraged vegetative growth as plant height. Increasing nitrogen fertilizer application rates increased rapeseed plant height **(Shahin*et al.*, 2000)**

The number of racemes per plant responded significantly at 0.01% significant level to nitrogen fertilization treatments in both seasons. The maximum number of racemes (19.95 & 19.20) were obtained when canola plants was fertilized by $B_1$ (100% mineral + 0% biofertilizer) at both seasons. These superiorities were obtained by 55.73, 41.08, 56.66 and 23.83% with $B_1$ (100% mineral + 0% biofertilizer) as compared with $B_2$, $B_3$, $B_4$ and $B_5$, respectively, in both seasons. This finding may refer to the positive effect of biofertilization treatments on plant height.

**Table (4): Means of plant height (cm), No. racemes/plant, number of siliqua/plant, 1000-seed weight (g) and Seed yield (kg/fed.) for the five studied cultivars at the two seasons.**

| Canola Cultivars | Plant height (cm) | | No. racemes/ plant | | No. of siliqua/ plant | | 1000-seed weight (g) | | Seed yield (kg/fed.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2011/ 2012 | 2012/ 2013 | 2011/ 2012 | 2012/ 2013 | 2011/ 2012 | 2012/ 2013 | 2011/ 2012 | 2012/ 2013 | 2011/ 2012 | 2012/ 2013 |
| **$Serw_4$** | 143.03 | 137.50a | 16.28 | 17.86 | 372.90 | 323.60a | 4.33ab | 4.47a | 292.11a | 487.98a |
| **Pactol** | 134.77 | 136.20[a] | 14.93 | 16.00 | 308.70 | 277.90[ab] | 4.63[a] | 4.36[b] | 287.33[a] | 401.53[b] |
| **$Sakha_1$** | 140.73 | 126.00[ab] | 16.06 | 16.40 | 360.70 | 209.60[bc] | 4.31[b] | 4.49[a] | 262.53[b] | 327.37[c] |
| **$Sakha_2$** | 133.71 | 119.10[b] | 13.07 | 14.97 | 278.50 | 200.50[c] | 4.37[ab] | 4.46[a] | 224.36[c] | 326.69[c] |
| **$Sakha_3$** | 133.90 | 126.00[ab] | 15.49 | 12.73 | 258.60 | 170.40[c] | 3.93[c] | 3.81[b] | 212.03[c] | 310.53[c] |
| **Significant** | NS | * | NS | NS | NS | ** | ** | ** | ** | ** |

There were highly significant differences among the fertilization treatments for number of siliquae per plant at both seasons Table (5). Application of $B_1$ (100% mineral + 0% biofertilizer) gave the maximum number of siliquae (528.60 & 340.30 siliqua/plant) at the 1st and 2nd seasons.

While, the minimum number of siliquae per plant (168.00 & 209.50) were obtained with applying $B_4$ at the first season and $B_3$ at the second season. This is a logic phenomenon due to its importance of nitrogen in building up new cells as well as cell division. **Kappen*et al.* (2000)** and **El-Demerdash and Ali (2005)** found that increasing nitrogen fertilizer levels significantly increased number of pods/ plant.

Data presented in Table (5) shows that there were highly significantly effects of biofertilization treatments on 1000-seed weight at the 1st and 2nd seasons.

B3 (50% mineral + 50% biofertilizer) treatment recorded higher value (5.29 g) in the first season followed by $B_4$ treatment (4.57 g) at the 2nd season, while $B_5$ treatment gave the lowest value (3.59 & 3.83 g) at the 1st and 2nd season. Soil microorganisms, viz. Azotobacter as N2-fixing bacteria could be a beneficial source to enhance plant growth and producing considerable amounts of biologically active substances that can promote growth of reproductive organs and increase its productivity.

These results were in agreement with that reported by **Kappen *et al.* (2000).**

Response at seed yield kg/fed. to biofertilization treatments were highly significant in canola crop. A gradual increase in seed yield kg/fed. was noticed with applying of $T_1$( 100% mineral).

The increase in seed yield kg/fed. was estimated by 47.78 % & 54.12 % for $T_1$ regime compared to $T_5$ (100% biofertilizer) regime at the two seasons.

These increases in seed yield may be due to increase in some growth characters, which reflected to the adequate supply of photosynthesis for formation of plant height at harvest, number of racemes/plant at harvest, number of siliqua/plant, seed yield/ plant, 1000 seed weight and seed yield per plot and development at seeds then it increased seed yield kg/fed. So, biofertilizer leads to major negative affection between vegetative growth and yield production. Similar finding have been reported by **Afridi *et al.*, 2000; Kappen *et al.*,2000; Sharief and Kesheta 2000; Pennock Abd El-Moteleb and Gomma 2004 and El-Demdrash and Ali 2005**.

**Table (5): Effect of biofertilization treatments on plant height (cm), No. racemes/plant, number of siliqua/plant, 1000-seed weight (g) and Seed yield (kg/fed.) at the two seasons.**

| Bio fertilization Treatments | Plant height (cm) | | No. racemes/plant | | No. of siliqua/plant | | 1000-seed weight (g) | | Seed yield (kg/fed.) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2011/ 2012 | 2012/ 2013 | 2011 2012 | 2012/ 2013 | 2011/ 2012 | 2012/ 2013 | 2011/ 2012 | 2012/ 2013 | 2011/ 2012 | 2012/ 2013 |
| $B_1$ | 154.50$^{a}$ | 139.90$^{a}$ | 19.95$^{a}$ | 19.20$^{a}$ | 528.60$^{a}$ | 340.30$^{a}$ | 4.20$^{bc}$ | 4.40$^{a}$ | 348.75$^{a}$ | 568.75$^{a}$ |
| $B_2$ | 138.40$^{b}$ | 130.90$^{ab}$ | 12.81$^{c}$ | 16.29$^{ab}$ | 281.70$^{b}$ | 229.50$^{b}$ | 4.48$^{b}$ | 4.46$^{a}$ | 299.16$^{b}$ | 403.35$^{b}$ |
| $B_3$ | 132.40$^{b}$ | 121.00$^{b}$ | 14.14$^{c}$ | 11.46$^{c}$ | 282.60$^{b}$ | 168.00$^{b}$ | 5.29$^{a}$ | 4.34$^{a}$ | 258.44$^{c}$ | 331.69$^{c}$ |
| $B_4$ | 135.20$^{b}$ | 131.50$^{ab}$ | 11.97$^{c}$ | 14.91$^{bc}$ | 209.50$^{b}$ | 209.70$^{b}$ | 4.00$^{c}$ | 4.57$^{a}$ | 190.19$^{d}$ | 289.38$^{d}$ |
| $B_5$ | 127.10$^{c}$ | 121.30$^{b}$ | 16.96$^{b}$ | 16.11$^{ab}$ | 277.00$^{b}$ | 236.50$^{b}$ | 3.59$^{d}$ | 3.83$^{b}$ | 181.77$^{d}$ | 260.94$^{e}$ |
| Significant | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |

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## الملخص العربي

## استجابة بعض أصناف الكانولا لبعض معاملات التسميد الحيوي تحت ظروف شمال سيناء

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نفذت الدراسة في تجربة حقلية بمزرعة كلية العلوم البيئية الزراعية بمركز رفح بالعريش في الموسميين الشتويين ٢٠١٢/٢٠١١ و٢٠١٣/٢٠١٢م، حيث كان الهدف هو دراسة استجابة خمس أصناف من الكانولا لمعاملات التسميد الحيوي ببكتريا الازوتوبكتر على المحصول ومكوناته تحت ظروف شمال سيناء.

لقد أوضحت النتائج أن الصنف سرو٤ تفوق على باقي الأصناف لصفة ارتفاع النبات عند الحصاد وصفة عدد القرون/ النبات في الموسم الثاني وفي حين انه في الموسم الأول تفوق الصنف باكتول في صفة وزن ال١٠٠٠ بذرة/النبات بينما تفوق الصنف سخا١ في الموسم الثاني. كما نجد أن معاملة التسميد الأولي (تسميد معدني بدون تسميد حيوي) أعطت أعلى معنوية لصفة ارتفاع النبات عند الحصاد وصفة عدد الأفرع/النبات عند الحصاد وعدد القرون/النبات على العكس نجد ان معاملة التسميد الحيوي الثالثة (٥٠% تسميد معدني + ٥٠ % تسميد حيوي) ومعاملة التسميد الحيوي الرابعة (٢٥% تسميد معدني + ٧٥% تسميد حيوي) أعطت أعلى وزن لصفة ١٠٠٠ بذرة/النبات في الموسم الثاني علي التوالي.

يمكن أن نوصي بان زراعة صنف سرو٤ للكانولا تحت معاملة التسميد الأولى (التسميد المعدني بدون تسميد حيوي) تحت ظروف شمال سيناء.

**الكلمات الإسترشادية:** الكانولا، التسميد النيتورجيني، التسميد الحيوي، أصناف الكانولا، البكتريا المثبتة للنيتروجين، بكتريا الازتوبكتر.

**المحكمون:**

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