Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.2271

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **4 (2):** 238-244 (2016)

International Journal of Pure & Applied Bioscience

Research Article

OPEN ACCESS

Effect of different nitrogen (N) phosphorus (P) fertilizer and plant growth regulators gibberellic acid (GA3) and indole-3-acetic acid (IAA) on qualitative traits of Canola *(Brassica napus* L.) genotypes

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Received: 15.04.2016 | Revised: 21.04.2016 | Accepted: 25.04.2016

ABSTRACT

Plant hormones play a vital role in combination of many growths and behavior process of plants life. Plant growth regulators can help to manage balance of phytohormones. Auxin and gibberllic acid being known well plant growth promoting hormones have shown to be involved in a variety of plant growth and development. The field experiment was conducted to evaluate the effect of foliar application of nitrogen, phosphorus; gibberellic acid and indole-3-acetic acid with two canola mutants R00-125/14, W97-75/16 with their respective parents Rainbow and Westar were used in this experiment. The application of N, P fertilizers increased 67% seed yield in brassica. The early days to maturity was recorded under treatment of and maximum number of branches plant^{-1}, siliqua plant^{-1}, 1000 seed weight and seed yield kg ha^{-1} was recorded under the treatment of 90N-45P-1 0GA3-10 IAA while minimum number of branches plant^{-1}, sliqua plant^{-1} and 1000 seed weight were recorded under the treatment of 90N-45P-15GA3-15 IAA. It is recommended that brassica should be sown under the treatment of 90N-45P-10GA3-10 IAA to achieve best performance to produce more seed yield and quality trait in brassica.

Keywords: *N P, fertilizer, Gibberellic Acid (GA3), Indole-3- acetic acid (IAA), Canola (Brassica napus L.) genotypes*

INTRODUCTION

The plant growth regulators (PGR) have a significant role in directing plant developments, enhancing seed yield and quality traits. It has long been ascertained that plant hormones including auxins, gibberellic acid, cytokinin, abscisic acid and ethylene are involved in controlling developmental events such as cell division, cell elongation and protein synthesis. PGRs have been implicated in efficient utilization of nutrients and translocation of photo-assimilates. Canola seedlings relative with water content and photosynthetic activity in seedling for maximum level of germination, which is an important factor[9].

Cite this article: Siddiqui, M.A., Shah, Z.H., Tunio, S. and Chacchar, Q., Effect of different N P, fertilizer and plant growth regulators Gibberellic acid (GA_3) and Indole-3- acetic acid (IAA) on qualitative traits of Canola (*Brassica napus* L.) genotypes, *Int. J. Pure App. Biosci.* **4(2):** 238-244 (2016). doi: http://dx.doi.org/10.18782/2320-7051.2271

The plant breeders play an important role in the breeding of canola cultivars[26]. Several factors either endogenous or environmental conditions contribute to sink strength, but the sink activity can mainly be enhanced gibberellins[17]. In comparison to the large number of studies on the foliar application of PGRs, much less effort has been applied to understanding, how this exogenous application of GA_3 may elicit change in the allocation pattern with the leaf age. Mobin *et al.*[23] reported that foliar application of GA_3 enhance the flower number and create a balance between source and sink. The impact of GA_3 was most conspicuous and resulted in a higher growth, efficient translocation and utilization of nutrients. GA_3 increased partitioning of biomass to the leaves and stem. Gibberellic acid (GA_3) is a growth regulator that is needed in small quantities at low concentration to accelerate plant growth and development. GA_3 enhances growth activities of a plant, stimulates stem elongation, and increases the seed yield[1,8,18,20]. Like other photoperiodic or low temperature requiring plants, exogenous application of GA_3 promotes flowering in certain brassica varieties[4,5,10,14,25,30]. GA_3 is found to increase stem length and accelerate the bud development and flower per plant[15,19,] whereas IAA enlarge leaves and increasing photosynthetic activities in plants[27] and also activates the translocation of carbohydrates during their synthesis[6]. The major sites for auxin (IAA) production are root tips in plants[2,11]. Overall plant growth regulators have a positive impact in enhancing qualitative characters in plants. Based on this background a study was initiated to analyze the effect of foliar application of growth regulators on qualitative parameters and seed yield in canola.

MATERIAL AND METHOD

The experiment was conducted at Nuclear Institute of Agriculture (NIA), Tando Jam, Sindh, Pakistan during 2007-08 and 2008-09 to find out the effect of growth regulators on two mutants with their respective parents of Rainbow and Westar were used in this study. The different fertilizer levels of Nitrogen Phosphorus kg ha^{-1} along with concentrations of gibberellic acid and Indole-3-acetic acid were used with foliar application. The treatment are 00-00-00, 90-45-00-00, 90-45 05-00, 90-45-10-00, 90-45-15-00, 90-45-00-05,90-45-00-10,90-45-00-15,90-45-05-05,90-45-05-10,90-45-05-15,90-45-10-05,90-45-10-10, 90-45-10-15, 90-45-15-05, 90-45-1 5-10, 90-45-15-15 The experiments were conducted in randomized complete block design with three replications. Each plot consisted of 5 meter long, 5 rows 30 cm apart and five plants were randomly selected from each treatment to collect data on agronomic traits of canola at harvesting time. The parameters days to maturity, number of branches $plant^{-1}$, siliqua $plant^{-1}$, 1000 seed weight and seed yield were used in this study. The experimental data were recorded and subjected to analysis of variance (ANOVA) under linear models of statistics to observe statistical differences among different traits of brassica by using computer program, Student Edition of Statistix (SWX), Version 8.1 (Analytical Software, 2005). Further least significant difference (LSD) was also applied to test the level of significance among different growth regulators levels (Gomez and Gomez, 1984).

RESULTS AND DISCUSSIONS

Days to maturity: The data revealed Significantly ($P \leq 0.05$) results was observed that the minimum days to maturity (119.75) with the application of 90-45 kg ha^{-1}-10-10 g ha^{-1} was observed, followed by (120.13 days) with the application of 90-45 kg ha^{-1}- 05- 15 g ha^{-1} was observed in variety R00-125/14.This mutant was found 16 and 15 days earlier than the application of 00-00- g ha^{-1} (133.00 days) in Table 1. The performance of interactive was observed in the application 90-45 kg ha^{-1}- 15- 00 g ha^{-1} (1 18.1days) and 90-45 kg ha^{-1}-10-10g ha^{-1} (119.6 days) in variety R00-125/14 was recorded earlier. Early maturity in canola ensures as it allows the completion of seed development before the onset of terminal drought. Foliar application of growth regulators and chemicals increased the rates significantly enhanced plant traits of canola and among the treatments significantly increased the agronomic traits. GA_3 increases more value than IAA. At time of maturity pods were significantly responsive towards timing of flower the pods were remarkable increased in the GA_3 treated plants at spray time. Several investigations have positively correlated the initiation of flower with GA_3 treatment and endogenous level[7].

Table 1. Effect of different plant growth regulator combination on days to maturity of four canola genotypes

N - P - GA_3 - IAA Kg ha^{-1} g ha^{-1}	R00-125/14	W97-75/16	Rainbow (Parent)	Westar (Parent)	Mean
00 - 00 - 00 – 00	134.6 $^{c-g}$	132.3 $^{f-j}$	134.0 $^{d-h}$	134.8 $^{c-f}$	133.00
90 - 45 - 00 – 00	128.3 $^{m-o}$	136.0 $^{b-d}$	132.0 $^{h-k}$	135.6 $^{b-e}$	120.54
90 - 45 - 05 – 00	128.5 ^{gh}	121.0 $^{v-b}$	119.5 $^{z-f}$	122.0 $^{u-z}$	121.04
90 - 45 - 10 – 00	124.6 $^{q-t}$	122.5 $^{r-w}$	117.0 ^{f}	120.0 $^{w-e}$	121.38
90 - 45 - 15 – 00	118.1 $^{c-f}$	122.5 $^{r-w}$	119.3 $^{a-f}$	119.0 $^{a-f}$	133.13
90 - 45 - 00 – 05	133.5 $^{d-i}$	133.3 $^{e-i}$	130.6 $^{j-m}$	135.0 $^{c-e}$	133.75
90 - 45 - 00 – 10	130.3 $^{j-m}$	135.3 $^{b-e}$	130.6 $^{j-m}$	138.6 ^{a}	135.46
90 - 45 - 00 – 15	123.0 $^{r-v}$	135.0 $^{c-e}$	132.1 $^{g-j}$	137.0 $^{a-c}$	121.08
90 - 45 - 05 – 05	137.6 ^{ab}	122.3 $^{s-x}$	120.0 $^{w-e}$	119.0 $^{a-f}$	121.54
90 - 45 - 05 – 10	124.3 $^{q-u}$	120.8 $^{v-b}$	119.6 $^{y-e}$	121.3 $^{v-a}$	120.71
90 - 45 - 05 – 15	120.8 $^{v-b}$	120.6 $^{v-c}$	119.3 $^{a-f}$	122.0 $^{u-z}$	120.13
90 - 45 - 10 – 05	123.0 $^{r-v}$	120.0 $^{v-b}$	118.5 $^{b-f}$	118.0 $^{d-f}$	121.87
90 - 45 - 10 – 10	119.6 $^{y-e}$	123.0 $^{r-v}$	117.6 ^{ef}	121.0 $^{v-b}$	119.75
90 - 45 - 10 – 15	124.1 $^{q-u}$	120.3 $^{w-d}$	119.8 $^{x-e}$	121.1 $^{v-a}$	125.25
90 - 45 - 15 – 05	127.5 $^{n-p}$	126.3 $^{o-q}$	122.1 $^{t-y}$	125.0 ^{pr}	126.38
90 - 45 - 15 – 10	126.1 $^{o-q}$	128.1 $^{m-o}$	124.8 $^{q-s}$	126.3 ^{oq}	129.92
90 - 45 - 15 – 15	130.0 $^{j-n}$	131.0 $^{i-l}$	129.5 $^{k-n}$	129.11 ^{n}	129.90
Mean	126.47	126.58	123.93	126.19	
HSD Treatments= LSD (0.05%) (1.8782) Genotypes = LSD (0.05%) (0.614) T x V = LSD (0.05%) (2.643)					

In each column, means followed by common letter are not significantly different at 5% probability level

Number of branches plant^{-1}:

The data revealed that the maximum number of branches plant^{-1} was recorded (6.51) in application of 90-45 kg ha^{-1}-10-10g ha^{-1} followed by (6.36) with the application of 90-45-10-05 g ha^{-1} in Table-2. Minimum number of branches (2.19) was observed in application of 90-45-15-15 g ha^{-1}. However the number of branches plant^{-1} is the result of interactive of genotypes and treatment showed that the maximum number of branches plant^{-1} was recorded with the application of 90-45 kg ha^{-1}-10-10 g ha^{-1} (7.68) in variety R00-125/14 and followed by 90-45 kg ha^{-1}-05-00 g ha^{-1} (7.16) in variety Westar (parent). Plant growth regulators makes up of the crop and environmental conditions, which plays a remarkable role towards the final seed yield of the crop[21].

Table: 2 Effect of different plant growth regulator combination on number of branches plant^{-1} of four canola genotypes

N - P - GA_3 – IAA Kg ha^{-1} g ha^{-1}	R00-125/14	W97-75/16	Rainbow (Parent)	Westar (Parent)	Mean
00 - 00 - 00 – 00	5.78 $^{g-p}$	6.26 $^{d-i}$	1.95 ^{y}	4.41 ^{tu}	5.67
90 - 45 - 00 – 00	5.17 $^{p-s}$	5.21 $^{p-s}$	6.21 $^{d-j}$	6.73 $^{b-d}$	5.83
90 - 45 - 05 – 00	6.20 $^{d-k}$	6.68 $^{b-d}$	5.48 $^{l-r}$	7.16 ^{ab}	5.79
90 - 45 - 10 – 00	6.35 $^{c-g}$	5.38 $^{m-r}$	5.96 $^{e-m}$	6.98 ^{bc}	6.17
90 - 45 - 15 – 00	6.30 $^{d-h}$	5.38 $^{m-r}$	5.55 $^{k-r}$	5.46 $^{l-r}$	5.67
90 - 45 - 00 – 05	5.88 $^{f-o}$	5.96 $^{e-m}$	6.75 $^{b-d}$	5.26 $^{n-r}$	5.96
90 - 45 - 00 – 10	5.93 $^{e-m}$	4.56 $^{s-u}$	4.96 $^{r-t}$	5.88 $^{f-o}$	5.33
90 - 45 - 00 – 15	5.36 $^{m-r}$	4.06 ^{uv}	5.00 $^{q-t}$	5.41 $^{m-r}$	4.96
90 - 45 - 05 – 05	5.25 $^{o-r}$	6.51 $^{b-f}$	6.25 $^{d-j}$	5.03 $^{q-t}$	5.76
90 - 45 - 05 – 10	6.55 $^{b-e}$	6.65 $^{b-d}$	5.60 $^{j-r}$	4.96 $^{r-t}$	6.09
90 - 45 - 05 – 15	5.91 $^{e-n}$	5.48 $^{l-r}$	5.01 $^{q-t}$	5.05 $^{q-t}$	5.36
90 - 45 - 10 – 05	6.66 $^{b-d}$	6.65 $^{b-d}$	6.51 $^{b-f}$	5.61 $^{i-r}$	6.36
90 - 45 - 10 – 10	7.68 ^{a}	5.60 $^{j-r}$	5.65 $^{h-q}$	5.38 $^{m-r}$	6.51
90 - 45 - 10 – 15	4.96 $^{r-t}$	4.13 ^{u}	4.48 ^{tu}	6.11 $^{d-l}$	4.92
90 - 45 - 15 – 05	4.06 ^{uv}	3.28 ^{w}	4.13 ^{u}	3.26 ^{w}	3.68
90 - 45 - 15 – 10	2.95 ^{wx}	2.83 ^{wx}	3.41 ^{vw}	2.98 ^{wx}	3.04
90 - 45 - 15 – 15	2.40 ^{xy}	2.08 ^{y}	6.23 $^{d-j}$	2.33 ^{xy}	2.19
Mean	5.46	5.10	5.24	5.21	
HSD Treatments= LSD (0.05%) (0.3294) Genotypes = LSD (0.05%) (0.1598) T x V = LSD (0.05%) (0.658)					

In each column, means followed by common letter are not significantly different at 5% probability level

Siliqua plant^{-1}:

The siliqua plant^{-1} is the main agronomic parameter which directly influences the seed yield of the canola. The highest siliqua plant^{-1} (194.4) with the application of 90-45 kg ha^{-1}-10-10 g ha^{-1} followed by (192.1) with the application of 90-45 kg ha^{-1}-05-10 g ha^{-1} was observed in Table 3. As well as in the interactive effect the maximum sliqua plant^{-1} was observed (246.8) with the application of 90-45 kg ha^{-1}-10-10 g ha^{-1} and followed by (222.5) with the application of 90 45 kg ha^{-1}-05-00 g ha^{-1} in the variety R00-125/14 which was showed good performance than the other genotypes in Table 2. GA3 might have increased the translocation of assimilates to the reproductive organ which resulted in the maximum number of siliqua plant^{-1} up to certain levels of GA3 application[16,29].

Table: 3 Effect of different plant growth regulator combination on siliqua plant^{-1} of four canola genotypes

N - P - GA_3 – IAA Kg ha^{-1} g ha^{-1}	R00-125/14	W97-75/16	Rainbow (Parent)	Westar (Parent)	Mean
00 - 00 - 00 – 00	162.8 $^{f-r}$	165.2 $^{f-q}$	133.3 $^{n-z}$	173.7 $^{f-n}$	191.5
90 - 45 - 00 – 00	171.0 $^{f-o}$	104.7 $^{x-e}$	165.9 $^{f-q}$	131.9 $^{o-a}$	143.5
90 - 45 - 05 – 00	222.5 $^{a-d}$	197.7 $^{c-g}$	199.1 $^{c-g}$	158.3 $^{g-r}$	171.9
90 - 45 - 10 – 00	131.0 $^{o-a}$	114.3 $^{s-c}$	152.6 $^{j-u}$	189.7 $^{d-j}$	147.1
90 - 45 - 15 – 00	163.3 $^{f-r}$	143.3 $^{k-x}$	127.3 $^{z-b}$	144.9 $^{k-x}$	149.4
90 - 45 - 00 – 05	136.5 $^{m-y}$	169.7 $^{f-p}$	203.8 $^{e-f}$	133.1 $^{n-z}$	160.8
90 - 45 - 00 – 10	181.5 $^{d-l}$	100.8 $^{y-e}$	151.3 $^{j-u}$	105.9 $^{w-e}$	130.4
90 - 45 - 00 – 15	100.0 $^{y-f}$	132.2 $^{n-z}$	142.8 $^{t-x}$	142.6 $^{k-x}$	129.6
90 - 45 - 05 – 05	148.2 $^{k-v}$	195.3 $^{c-i}$	151.2 $^{j-u}$	174.2 $^{f-n}$	167.2
90 - 45 - 05 – 10	177.0 $^{e-m}$	196.7 $^{c-h}$	154.5 $^{i-s}$	240.7^{ab}	192.1
90 - 45 - 05 – 15	180.0 $^{e-l}$	127.3 $^{q-b}$	146.9 $^{k-w}$	140.6 $^{l-y}$	148.8
90 - 45 - 10 – 05	155.0 $^{h-s}$	236.8 $^{a-c}$	153.4 $^{j-t}$	176.1 $^{e-m}$	178.1
90 - 45 - 10 – 10	246.8 ^{a}	217.2 $^{a-e}$	183.0 $^{d-k}$	162.3 $^{g-r}$	194.4
90 - 45 - 10 – 15	172.2 $^{f-o}$	122.0 $^{r-b}$	129.8 $^{p-b}$	150.4 $^{j-v}$	143.9
90 - 45 - 15 – 05	90.9 $^{a-g}$	112.8 $^{t-d}$	79.33 ^{h}	109.7 $^{v-d}$	106.2
90 - 45 - 15 – 10	71.6 $^{d-h}$	88.8 $^{b-h}$	56.60 ^{h}	92.83 $^{z-g}$	83.1
90 - 45 - 15 – 15	48.5 ^{h}	59.5 $^{f-h}$	55.09 ^{i}	67.72 $^{b-h}$	58.1
Mean	149.01	148.03	143.69	146.78	
HSD Treatments= LSD (0.05%) (20.725) Genotypes = LSD (0.05%) (10.053) T x V = LSD (0.05%) (41.44)					

In each column, means followed by common letter are not significantly different at 5% probability level

1000 seed weight (g):

The weight of seed express the magnitude of seed development that is an important yield determinant and play a decisive role in showing of the yield potential. Seed size was increased (5.11 g) with the application of 90-45 kg ha^{-1}-10-10 g ha^{-1} and followed by (5.05 g) with the application of 90-45 kg ha^{-1}-05-10g ha^{-1} was recorded. As well as in the interactive effect showed that maximum 1000 seed weight was observed (5.29 g) with the application of 90-45 kg ha^{-1}-10-10g ha^{-1} followed by (5.21 g) in the application of 90-45-10-05 g h^{-1} in variety R00-125/14 which produced highest 1000 seed weight was increased due to effect of GA_3. Similar results were reported by Sinha *et al.,*[28] in Table 4.

Table: 4 Effect of different plant growth regulator combination on 1000 seed weight (g) for canola genotypes

N - P - GA_3 – IAA Kg ha^{-1} g ha^{-1}	**R00-125/14**	**W97-75/16**	**Rainbow (Parent)**	**Westar (Parent)**	**Mean**
00 - 00 - 00 – 00	3.99 $^{x-a}$	3.85 ^{ab}	3.46 ^{c}	4.44 $^{q-t}$	4.07
90 - 45 - 00 – 00	3.99 $^{x-a}$	4.20 ^{t}	3.98 $^{x-a}$	4.65 $^{n-r}$	4.20
90 - 45 - 05 – 00	4.15 $^{u-z}$	4.54 $^{o-s}$	3.91 ^{za}	4.73 $^{l-p}$	4.33
90 - 45 - 10 – 00	4.19 $^{t-y}$	4.81 $^{i-n}$	4.01 $^{x-a}$	4.65 $^{n-r}$	4.42
90 - 45 - 15 – 00	4.14 $^{v-z}$	4.51 $^{o-s}$	4.18 $^{t-y}$	4.92 $^{e-m}$	4.44
90 - 45 - 00 – 05	4.40 $^{r-u}$	5.15 $^{a-f}$	4.40 $^{r-v}$	5.05 $^{a-i}$	4.75
90 - 45 - 00 – 10	4.85 $^{h-n}$	4.94 $^{d-m}$	4.65 $^{n-r}$	5.17 $^{a-e}$	4.90
90 - 45 - 00 – 15	4.87 $^{g-n}$	5.26 ^{ab}	5.09 $^{a-h}$	5.23 ^{ac}	4.87
90 - 45 - 05 – 05	5.05 $^{a-i}$	4.76 $^{j-o}$	5.11 $^{a-h}$	5.07 $^{a-i}$	5.00
90 - 45 - 05 – 10	5.12 $^{a-g}$	4.99 $^{c-l}$	5.20 $^{a-d}$	4.89 $^{f-n}$	5.05
90 - 45 - 05 – 15	5.10 $^{a-h}$	5.06 $^{a-i}$	5.19 $^{a-d}$	4.76 $^{j-o}$	5.03
90 - 45 - 10 – 05	5.21 ^{ac}	5.01 $^{b-j}$	5.12 $^{a-g}$	4.51 $^{o-s}$	4.96
90 - 45 - 10 – 10	5.29 ^{a}	5.04 ^{bc}	5.20 $^{a-c}$	4.69 $^{m-q}$	5.11
90 - 45 - 10 – 15	5.00 $^{b-k}$	5.00 $^{a-h}$	5.05 $^{a-i}$	4.68 $^{m-q}$	4.96
90 - 45 - 15 – 05	4.48 $^{p-s}$	4.50 $^{o-s}$	4.35 $^{s-w}$	4.75 $^{k-o}$	4.52
90 - 45 - 15 – 10	4.21 $^{t-x}$	3.93 $^{y-a}$	4.13 $^{w-z}$	4.00 $^{x-a}$	4.07
90 - 45 - 15 – 15	3.57 ^{c}	3.59 ^{bc}	4.00 $^{x-a}$	3.33 ^{c}	3.49
Mean	4.57	4.67	4.53	4.68	
HSD Treatments= LSD (0.05%) (0.1327) Genotypes = LSD (0.05%) (0.0644) T x V = LSD (0.05%) (0.2655)					

In each column, means followed by common letter are not significantly different at 5% probability level

Seed yield (kg ha^{-1}):

The seed yield kg ha^{-1} is the main character on the developing of new variety. The seed yield per unit area in canola is a cumulative effect of various yield components. The data regarding seed yield of different treatments of growth regulators indicates that maximum seed yield (2744.9 kg ha^{-1}) was observed in the application of 90-45 kg ha^{-1}-05-05 g ha^{-1} and followed by (2517.1 kg ha^{-1}) in the application of 90-45 kg ha^{-1}-10-10 g ha^{-1} in Table 5. However, the interactive effect showed that maximum seed yield (3192.6 kg ha^{-1}) with the application of 90-45 kg ha^{-1}-10-10 g ha^{-1} followed by (3083.0 kg ha^{-1}) in R00-125/14 with the application of 90-45 kg ha^{-1}-1 0-05 g ha^{-1} was produced. Therefore, the variety R00-125/14 produced high seed yield kg ha^{-1}. The result supported by Hayat *et al.*[13] observed that GA_3 increased vegetative growth and seed yield.

Table: 5 Effect of different plant growth regulator combination on seed yield (kg ha^{-1}) of four canola genotypes

N - P - GA_3 – IAA Kg ha^{-1} g ha^{-1}	**R00-125/14**	**W97-75/16**	**Rainbow (Parent)**	**Westar (Parent)**	**Mean**
00 - 00 - 00 – 00	2694.4 $^{d-i}$	2344.4 $^{l-t}$	2275.9 $^{n-v}$	2425.9 $^{i-p}$	2435.2
90 - 45 - 00 – 00	2262.9 $^{o-w}$	2087.0 $^{t-z}$	2185.1 $^{o-y}$	2159.2 $^{p-y}$	2173.6
90 - 45 - 05 – 00	2761.1 $^{d-h}$	2120.3 $^{r-z}$	2264.8 $^{o-w}$	2279.6 $^{n-v}$	2356.4
90 - 45 - 10 – 00	2303.7 $^{m-u}$	2194.4 $^{o-x}$	2222.2 $^{o-x}$	2203.7 $^{o-x}$	2231.0
90 - 45 - 15 – 00	2718.5 $^{d-h}$	2214.8 $^{o-x}$	2157.4 $^{p-y}$	2151.8 $^{q-y}$	2310.6
90 - 45 - 00 – 05	2605.8 $^{f-l}$	2368.5 $^{k-r}$	2420.3 $^{j-q}$	2068.5 $^{u-z}$	2365.8
90 - 45 - 00 – 10	2601.8 $^{f-l}$	2724.0 $^{d-h}$	2440.7 $^{i-o}$	2207.3 $^{o-x}$	2493.5
90 - 45 - 00 – 15	2775.9 $^{c-h}$	2753.7 $^{d-h}$	2251.8 $^{o-w}$	2159.2 $^{p-y}$	2485.2
90 - 45 - 05 – 05	2892.5 $^{b-e}$	3053.6 ^{ab}	2087.0 $^{t-z}$	2946.6 $^{a-d}$	2744.9
90 - 45 - 05 – 10	2538.9 $^{h-n}$	2766.6 $^{c-h}$	2340.7 $^{l-u}$	2362.9 $^{k-s}$	2502.3
90 - 45 - 05 – 15	2663.3 $^{e-j}$	2164.8 $^{p-y}$	2225.9 $^{o-x}$	2227.7 $^{o-x}$	2425.3
90 - 45 - 10 – 05	3083.0 ^{ab}	2440.7 $^{i-o}$	2016.6 $^{v-z}$	1877.6 ^{z}	2249.5
90 - 45 - 10 – 10	3192.6 ^{a}	1957.4 $^{x-z}$	2822.2 $^{b-g}$	2096.2 $^{s-z}$	2517.1
90 - 45 - 10 – 15	3037.0 $^{a-c}$	2001.8 $^{w-z}$	2551.8 $^{g-m}$	2181.4 $^{o-y}$	2443.0
90 - 45 - 15 – 05	2746.3 $^{d-h}$	1914.8 ^{yz}	2259.2 $^{o-w}$	2385.1 $^{k-r}$	2326.3
90 - 45 - 15 – 10	2625.9 $^{e-k}$	2133.3 $^{r-z}$	2262.9 $^{o-w}$	2068.5 $^{u-z}$	2272.6
90 - 45 - 15 – 15	2837.0 $^{b-f}$	2170.3 $^{o-y}$	2361.0 $^{k-s}$	2087.0 $^{t-z}$	2363.8
Mean	2725.9	2318.3	2302.7	2228.7	
HSD Treatments= LSD (0.05%) (136.10) Genotypes = LSD (0.05%) (66.018) T x V = LSD (0.05%) (272.20)					

In each column, means followed by common letter are not significantly different at 5% probability level

Correlation studied:

The correlation coefficients generally highlight the pattern of association among yield components and growth attributes, depicting low yield, as a complex character is expressed highly significant positive correlation estimated were recorded with branches plant-1 (**0.1809), number of siliqua plant^{-1} (**0.1566), while significant correlation with 1000 seed weight (0.234), seed yield kg ha^{-1}(0.414) and oil content (0.916 %) with each other's. Whereas, negative correlation was observed in days to mature with plant height (cm), number of branches plant^{-1}, siliqua palnt^{-1} and oil content (%) simultaneous selection regarding oil content and seed yield plant^{-1} is possible to be done in (Table 6). Ozer et al.,[24] calculated significant correlation between seed oil content and seed yield plant^{-1}. Mailer and Wratten reported that glucuusionlate are determinant factor of seed cake quality and its desire level of concentration is less than 30 micro mol/g suitable for the edible oil.

Table: 6 Correlations studies on Growth regulators treatment of diffcrapeseed (*B. napus*) varieties/mutants

Traits	Maturity	Branches plant^{-1}	Plant height (cm)	Siliqua plant^{-1}	1000grain (wt)	GrainYield kg ha^{-1}	Oil content (%)
Branches plant^{-1}	-0.0970						
Plant height (cm)	-0.0334	0.1809					
Siliqua plant^{-1}	-0.1659	0.3346	0.1566				
1000 grain (wt)	0.0016	-0.1302	0.0324	-0.0883			
Grain Yield kg ha^{-1}	0.1112	0.0072	0.0414	-0.1810	0.1217		
Oil content (%)	-0.0392	-0.0698	0.0916	0.0199	0.3687	0.1409	0.0656

CONCLUSION

Overall performance of the genotypes for yield and yield components indicates that mutant R00-125/14 and application of 90- 45 kg ha^{-1}-10- 10 g ha^{-1} was enhance all the characters because of their high yield potential hold great performance in this mutant variety. Moreover, it suggests that the application of 90- 45 kg ha^{-1}- 10- 10 g ha^{-1} can be fruitfully applied for the improvement in agronomic characters in canola.

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