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EFFECT OF NITROGEN FERTILIZER LEVELS AND SIX CANOLA GENOTYPES ON PHYSICOCHEMICAL PROPERTIES OF (*Brassica napus* L.) CULTIVATED UNDER NORTH SINAI CONDITIONS

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ABSTRACT

Canola plant (*Brassica napus* L.) is an important oil seed crop, which takes the second place among oil crops after soybean which contributes as edible oils over the world. This study was conducted to investigate the effect of five levels of nitrogen fertilizer T1=organic fertilizer, T2= 37.5 Kg N/fed, T3= 75 kg N/fed, T4= 112.5 kg N/fed and T5= 150kg N/fed and six canola genotypes (Serw4, Serw6, Pactol AD201,Tobas, and Silvo) on viscosity, specific gravity, refractive index, fatty acid composition, acidity, saponification, peroxide, iodine values ,Unsaponifiable matter(USM), and followed its oxidative stability at 60^{o}C for 30 days. The results showed that increased of nitrogen fertilizer rate leading to decrease led to decreases d viscosity, specific gravity, acid, saponification and peroxide values, while increasing unsaponifiable matter. 150 kg N/fed was the optimum nitrogen dose for realizing the lowest acid and peroxide values for Silvo genotype, While this dose caused a negligible differences in iodine value and refractive index. In terms of genotype differences, the acid and peroxide value results revealed that Silvo genotype was the lowest , while Pactol variety was the highest one. All chemical properties improved that Silvo genotype gave the highest stability during storage at 60^o C compared to organic fertilizer.

Key words: *Brassica napus* L., nitrogen fertilizer, canola, physiochemical properties.

INTRODUCTION

Canola (*Brassica napus* L.) can play an important role in bridging the gap between demand and supply of edible oil in Egypt, where it's seeds contain a high amount of oil (30.4% to 49.72%) which is an important source of the unsaturated fatty acids which (oleic, linoleic and linolenic acids) of potential health benefits. canola is used in animal feed because it's seeds considered an important protein source (19.44%-54.8%). The total cultivated area of canola in the world is about 30.30 million ha **(FAO, 2007).** The average production is 57.86 million tons, while out of the approximate 392 million tons of the global vegetable oil production, 57.86 million tones have been met from canola **(OZ, KUSCU and KARASU, 2016)**. Nitrogen plays a vital role in healthy growth of plant and it absorbs in mineral form as ammonium or nitrate, so nitrogen considers the main source of making protein in canola like the other crops **(Hopkins, 2004), Hafez and Basyony (2001)** found that higher nitrogen rate resulted in an increase in seed oil refractive index, unsaponifiable matter, while acid value and saponification value tended to

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decrease, with increasing nitrogen rate. **El Kholy *et al.* (2007)** pointed that nitrogen rates up to 90 kg/acre caused a negligible differences in saponification values while, refractive index and iodine value of Serw4 and Serw6 were similar and exceeded those of Pactol. **Zakaria *et al.* (2006)** reported that after applying the higher N-rate (142.8 kg of N/ha) significantly increased the content of seed oil refractive index, unsaponifiable matter and total unsaturated fatty acids (oleic and linoleic) while acid value, saponification value, and total saturated fatty acids decreased. Oil stability is one of the most important factors that affect oil quality **(Redondo *et al.*, 2018)**. Since instable oils have undesirable taste and flavor, they may lose nutritional value and may produce toxic compounds. Crude oil quality is very important since it determines the upcoming processing and it is a good indicator of necessary treatments **(Ceriani *et al.*, 2008)**. Different physical or chemical properties of vegetable oils such as acidity, density, viscosity, color, refractive index, moisture, volatility, dielectric constant, total polar compounds, saponification, peroxide, iodine, ester and carbonyl values, determine the quality and the stability of oils which are necessary for any specific purpose **(Amin *et al.*, 2012)**. These physical parameters greatly vary in temperature on the stability, viscosity, peroxide value, and iodine value to assess the quality and functionality of the oil **(Pan *et al.*, 2011)**.

This study aimed to investigate the effect of nitrogen fertilizer levels on physicochemical properties of six canola genotypes cultivated under North Sinai conditions.

MATERIALS AND METHODS

Materials

Canola oil used in this study was obtained from seeds of Canola plants grown in 2016 at Farm of Arish university, North Sinai Governorate after treated with five levels of nitrogen fertilizer T1=organic fertilizer, T2= 37.5 Kg N/fed, T3= 75 kg N/fed, T4= 112.5 kg N/fed and T5= 150kg N/fed. The canola oil was obtained by the following procedure. Dried seeds were thoroughly cleaned to remove the foreign materials, undeveloped seeds and crushed by using the oil squeezing machine (a Compressor). All samples of canola oil were kept at deep freezer till they ready for analysis and using in the storage trails.

Determination of Physical Properties

Refractive index Specific gravity, Viscosity, Flash point were determined according to **(AOAC, 2005)**.

Determination of chemical properties

Acid value (AV)

Acid value was determined as described by **AOAC (2005)** as follow: a Known weight of canola oil (1.0 g) was dissolved in 20 ml ethyl alcohol. The mixture was boiled on water bath for 2 min. and then titrated with 0.1 of KOH solution in the presence of phenolphthalein indicator. The last drop is achieved when the color of indicator changed to pink for at least 30 seconds. Total acidity was expressed as percent of oleic acid. Acid value was calculated as mg of KOH per g of oil.

$$\text{Acid value} = \frac{V \times N \times 56.1}{\text{Weight of sample}}$$

Where:

V= Volume of standard KOH solution in ml

N =Normality of standard KOH solution.

Peroxide Value (PV)

The peroxide value was determined according to **AOAC (2005)**, it is a measure of the peroxides contained in a sample of fat, expressed as mill-equivalent of peroxide per 1000 g of the material. It is measure as follow 5 g of each sample was weighed into a 250 ml flask followed by addition of 30 ml of the acetic acid chloroform (3:2 *V/V*) solution and the flask swirled until the sample was dissolved in the solution. A 0.5 ml of saturated potassium iodide was added and swirled for 1 minute followed by 30 ml of distilled water. A duplicate titration with 0.01 N sodium thiosulphate solution was carried out with constant and vigorous shaking until the yellow color has almost disappeared. Thereafter, about 0.5 ml of starch indicator solution was added and titration continued until the blue color just disappeared. The blank test was also carried out in parallel with the PV determination. The results were calculated in mille moles per kilogram oil (meq.O_2.Kg oil-1) according to the following equation:

$$\text{Peroxide value} = \frac{V \times N \times 100}{\text{weight of sample}}$$

Where:

N= Normality of sodium thiosulphate solution

V=Volume in ml. of sod. Thiosulphate needed for titration

Saponification number (mg.g^{-1})

Saponification value (mg.g^{-1}) was determined as the method described by **AOAC (2005)** as follow: 2.0 g of canola oil was boiled with 25 ml alcoholic KOH (0.5 N). The flask was then connected to a reflux air condenser and heated on electric heating mantle for 30 min. The sample was heated gently but steadily until it was completely saponified as indicated by the appearance of clear solution. Then cooled and titrated with 0.5 N HCl in the presence of phenolphthalein indicator. The blank test was also carried out in parallel with the S.N. determination. The results were calculated to the following equation:

$$\text{Saponification number} = \frac{(V2-V1) \times N \times 56.1}{\text{weight of sample}}$$

Where:

N = Normality of hydrochloric acid

V_2 = Volume KOH needed for titration (Blank)

V_1 = Volume KOH needed for titration

Iodine value

Iodine value was determined using Hanus solution method as described by **AOAC (2005).** As follow : 0.5 g of canola oil was dissolved in 10 ml chloroform , then 25 ml of Hanus iodine solution was added and left in dark for 30 min. 10 ml of 15% KI solution was added followed by 100 ml freshly boiled and cooled water. The excess iodine was titrated by 0.1 N sodium thiosulphate until the color of the solution was straw yellow followed by addition of one milliliter of starch solution and the titration continued until the blue color formed disappeared after thorough shaking with the stopper on. The blank test was carried out simultaneously under similar experimental conditions.

Determination of canola stability

Canola oil samples were stored in the oven at 60°C for 30 days and measured Acid value, peroxide value.

Statistical analysis

All the obtained data were subjected to the proper statically analysis of variance using a randomized complete block design according to **Snedecor and Cochran (1990)** using SPSS computer program V.20. Mean values of treatments were differentiated by using least significant Range (Duncan's multiple range test) at 0.05 levels probability (**Duncan, 1955**).

RESULTS AND DISCUSSION

Physical Properties of Canola Oil After Treated With Nitrogen Fertilization

Results presented in Table 1 outline the response of physical properties of canola oil to different nitrogen fertilizer levels (from 0 to 150 kg N.fed^{-1}). It is clear that viscosity value and specific gravity affected significantly by nitrogen fertilization, where, increasing nitrogen levels from 0 to

Table (1): Effect of nitrogen fertilizer levels on physical properties of canola oil.

Treatment	Physical analysis			
	Viscosity	S. gravity	R. Index	Flash point
T1 (organic fertilizer)	5.6[a]	0.914[a]	1.467[d]	2.42[d]
T2 (37.5 kg $N.Fed^{-1}$)	5.3 [ab]	0.910[b]	1.467[cd]	3.13[c]
T3 (75 kg $N.Fed^{-1}$)	5.1[ab]	0.909[b]	1.468[c]	3.19[bc]
T4 (112.5 kg $N.Fed^{-1}$)	4.8[bc]	0.904[c]	1.472[b]	3.22[b]
T5 (150kg $N.Fed^{-1}$)	4.5[c]	0.901[c]	1.473[a]	3.33[a]

Means having the same letter within each column are not significantly differed at 0.05 level, according to Duncan's multiple range test.

150 kg $N.fed^{-1}$ decreased viscosity value and specific gravity. The highest viscosity value 5.605 and specific gravity 0.914, were observed in T_1 (organic fertilizer), while, lowest viscosity value 4.5 and specific gravity 0.901 were observed in T5 (150 kg $N.fed^{-1}$). Also the results showed that nitrogen rate at 150 kg $N.fed^{-1}$ increased refractive index and flash point, the highest refractive index (1.4738) and flash point (3.33) were observed in T5(150 kg $N.fed^{-1}$), while, lowest refractive index (1.467) and flash point (2.42) were observed in T_1 (organic fertilizer). These results agrees with those obtained by **Zakaria *et al.* (2006) and El-Nakhlawy (2009)** who showed that, nitrogen fertilizer rates affected significantly on physical properties of canola oil.

Chemical Properties of Canola Oil After Treated with Nitrogen Fertilizer

Results presented in Table 2 show the effect of nitrogen fertilizer levels on some chemical properties of canola oil, increasing nitrogen fertilizer from 0 to 150 kg N/fed significantly decreased acid value, peroxide value, iodine value and saponification number in canola oils and the values were 1.2% as oleic acid, 6.1 mq. O_2/kg, 122.88 and 113.94, respectively while, unsaponifiable matter (USM) increased by increasing nitrogen fertilizer compared with organic fertilizer. lowest unsaponifiable matter (1.12%) is being at organic fertilizer treatment while the highest unsaponifiable matter (1.64%) is being at T_5 (150 Kg $N.fed^{-1}$) treatment. These results are in harmony with those obtained by **Zakaria *et al.* (2001)** who found that higher nitrogen rate resulted in an increase in unsaponifiable matter. These treatments tended to decrease oil acid value and saponification value. **El-Kholy *et al.* (2007)** pointed that N fertilization had no effect on saponification values, while N rates up to 90 kg/acre caused a slight decrease in iodine value.

Physical Properties of Canola Oil as Affected by Canola Genotypes

Results in Table 3 reveled that there were slight differences among canola genotypes for the viscosity, specific gravity and flash point which being in the range (4.62 to 5.59), (0.904 to 0.911) and (2.86 to 3.19), respectively. On the other hand, results in the same table indicated that refractive index of the oil under the effects of genotypes did not differ significantly from one genotype to another. The same behavior of refractive index values were shown under different genotypes, it ranged from 1.470 to 1.4690. The refractive index was oil properties and related to the oil quality genetics more than the environmental

Table (2): Effect of nitrogen fertilizer levels on chemical properties of canola oil.

Treatment	chemical analysis				
	Acid V.	Peroxide V.	Iodine V.	S.N.	USM
T1 (organic fertilizer)	2.23 [a]	9.63 [a]	126.19 [a]	154.58 [a]	1.12 [d]
T2 (37.5 kg $N.Fed^{-1}$)	1.76 [b]	8.78 [b]	125.52 [b]	140.62 [b]	1.26 [cd]
T3(75 kg $N.Fed^{-1}$)	1.63 [b]	8.10 [c]	124.88 [c]	127.51 [c]	1.33 [bc]
T4(112.5 kg $N.Fed^{-1}$)	1.53 [b]	7.57 [c]	123.89 [d]	122.33 [d]	1.46 [b]
T5(150kg $N.Fed^{-1}$)	1.20 [c]	6.1 [d]	122.88 [e]	113.94 [e]	1.64 [a]

Means having the same letter within each column are not significantly differed at 0.05 level, according to Duncan's multiple range test.

Table (3): Effect of canola genotypes on physical properties of canola oil.

Genotypes	Physical analysis			
	Viscosity	Specific gravity	Refractive Index	Flash point
Serw4	5.59 [a]	0.911 [a]	1.4690 [a]	3.17 [a]
Serw6	5.36 [ab]	0.910 [a]	1.4698 [a]	3.00 [ab]
Pactol	5.06 [abc]	0.908 [ab]	1.470 [a]	2.86 [b]
AD201	4.91 [bc]	0.907 [ab]	1.470 [a]	3.08 [ab]
Tobas	5.11 [abc]	0.907 [ab]	1.470 [a]	3.06 [ab]
Silvo	4.62 [c]	0.904 [b]	1.470 [a]	3.19 [a]

Means having the same letter within each column are not significantly differed at 0.05 level, according to Duncan's multiple range test.

effects during plant growth in the field. These results are in agreement with those obtained by **Tariq (2012)** who stated that specific gravity for the crud canola was 0.9206, refractive index 1.474. And **Ahmed (2016)** found that canola seed oil had 1.474 refractive index, the specific gravity was 0.914 g/cm^3 at 20^{o}C.

Chemical Properties of Canola Oil as Affected by Canola Genotypes

The effect of genotypes on chemical properties of canola oil are given in Table 4. Free fatty acid values, expressed as oleic acid (%), varied between 1.07 and 2.15% oleic. This variation in acid value was attributed to improper handling and storage conditions of seed after harvest **(Appelqvist, 1971).** The highest free acid amount was obtained from Pactol variety followed by Serw6 and AD201 genotype, respectively. When oil quality is considered, the amount of free fatty acids is shown to be a good indicator **(Sharma *et al.,* 2009).** Oils, which have higher free fatty acids contents, posses poor quality, and significant losses occur during the refining process **(Cornelius, 1966).** Therefore, low free fatty acid in crude oil is a good physicochemical indicator for crude oil, and it could be useful for refining process. Low free fatty acid content of Serw4 variety and Silvo genotype shows their higher quality, and this can provide great advantage during the

Table (4): Effect of canola genotypes on chemical properties of canola oil.

Genotypes	Chemical analysis				
	Acid value	Peroxide value	Iodine value	Saponification number	Unsaponifiable matter
Serw4	1.41^{c}	7.42^{c}	124.87^{ab}	141.3^{a}	1.38^{b}
Serw6	1.95^{a}	8.80^{ab}	125.23^{a}	128.7^{bc}	1.18^{cd}
Pactol	2.15^{a}	9.06^{a}	123.66^{c}	137.5^{ab}	1.15^{d}
AD201	1.72^{b}	7.84^{bc}	124.76^{ab}	125.8^{bc}	1.31^{bc}
Tobas	1.70^{bc}	8.0^{bc}	125.42^{a}	133.7^{abc}	1.38^{b}
Silvo	1.07^{d}	7.1^{c}	124.08^{bc}	123.4^{c}	1.78^{a}

Means having the same letter within each column are not significantly differed at 0.05 level, according to Duncan's multiple range test.

refining process. **Esuoso (1995)** reported that free fatty acid contents of oils should not exceed 5% in order to be suitable for edibility. According to this view, Serw4, Serw6, Pactol, AD201, Tobas and Silvo genotypes are edible.

The peroxide value varied between 7.1 and 9.06 meq O_2/kg, indicating that the tested vegetable oils are fresh. These variations can arise from different factors such as the degree of unsaturation of the fatty acids present in the particular oil, storage, exposure to light, and the content of metals or other compounds that may catalyze the oxidation processes **(Choe and Min, 2006).** Pactol variety had the highest peroxide value, while Silvo genotype had the lowest one. The fresh vegetable oils normally have peroxide values below 10 meq O_2/kg **(Orhevba and Efomah, 2012)**.

High temperature, visible light and oxygen can easily increase the peroxide value of the oils. Only cooking oils with the lowest initial peroxide value are suitable for consumption. Oils with peroxide value higher than 9 meq O_2/kg cause undesirable health problems by increasing reactive oxygen species as well as secondary products of lipid peroxidation that stimulate cardiovascular and inflammatory diseases **(Lobo *et al.,* 2010).** Therefore, oils which have peroxide value should not be produced and some regulations must be put for sale of highly oxidized cooking oils. Generally, oils with peroxide levels higher than 10 meq O_2/kg are considered to be less stable, and they have short shelf life. The present study showed that Pactol and Serw6 varieties have higher initial peroxide value, indicating that they have very short shelf life and they will quickly become unsuitable for human diets when compared with Serw4 variety and Silvo genotype.

Considerable variability in iodine value was detected among the genotype oils tested. The iodine value varied between 123.66 and 125.42. The highest iodine value was obtained from Tobas genotype, and the lowest was obtained from Pactol variety. The iodine value is an indicator of the unsaturated fatty acid, that is iodine value is used as a indicator of unsaturation degree **(Pomeranz and Clifton, 1987; Nielson, 1994; Knothe *et al.,* 2003).** Among the genotype oils tested, the best unsaturated oil was Tobas genotype followed by serw6 and Serw4 variety. Pactol variety had low iodine value (123.66), indicating that it could be used for soap making and in human diets. Oils which have higher iodine values (about 190) are used for paint and varnish industries.

Table (5): Effect of the interaction between genotypes and treatments on cid value of canola oil.

Treatment Genotypes	T1 (organic fertilizer)	T2 (37.5 KgN.fed^{-1})	T3 (75 KgN.fed^{-1})	T4 (112.5 KgN.fed^{-1})	T5 (150 KgN.fed^{-1})
Serw4	7.332	6.815	6.768	6.04	5.27
Serw6	9.024	7.614	7.302	7.056	5.5
Pactol	9.104	7.896	7.27	6.486	6.262
AD201	8.178	7.332	6.77	6.204	5.688
Tobas	7.614	7.05	7.05	6.328	4.922
Silvo	7.05	6.432	6.204	5.85	4.512

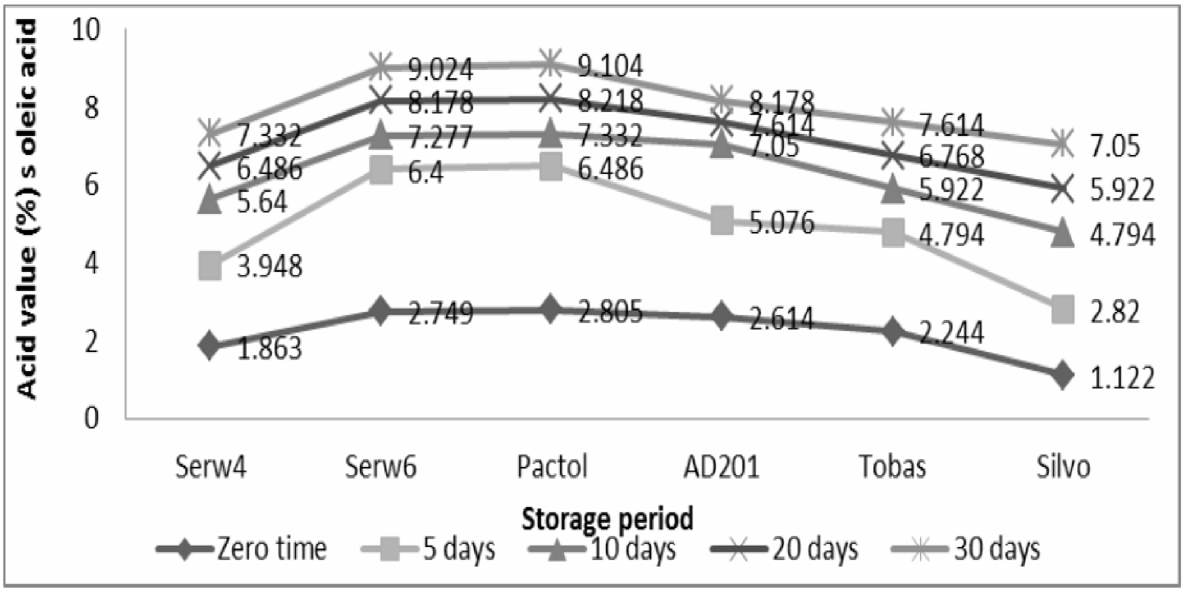

Fig. 1. Acid value of organic fertilizer treatment during storage at 60^{o}C for 30 days

Saponification number (S.N.) was significantly different among genotypes, being in the range between 123.4 to 141.3. As known this parameter is inversely proportional to the molecular weight of the oil. Replacement of long chain fatty acids such as erucic acid (C22:1) in canola oil by eicosenoic (C18) fatty acids increased the saponification number. The saponification values of canola seed oil for Serw4, Serw6, Pactol, AD201, Tobas and Silvo samples were 141.3, 128.7, 137.5, 125.8, 133.7 and 123.4, respectively. A high saponification value indicated that, canola oil possesses normal triglycerides and may be useful in the production of liquid soap and shampoo **Gunstone (2004).** The oil obtained from the Serw4 seeds has showed the highest saponification value of 141.3 compared to the oils from the other genotypes.

Unsaponifiable matter (USM) being of main role in the stability of vegetable oils as natural antioxidants **(Appelqvist, 1971; Co-operation, 2001)**. Results in Table 4 showed significant differences among genotypes. Unsaponifiable matter of the tested genotypes oils varied between 1.15 and 1.78%. The highest unsaponifiable matter content was obtained from Silvo genotype with 1.78%, and the lowest was obtained from Pactol variety with 1.15%. Unsaponifiable matters in the fats and oil are substances dissolved in oils. They cannot be saponified by the caustic alkalies but are soluble in the fat solvent.

Stability of Canola Oil after 30 Days of Storage at 60^{o}C

From the results in Table 5 it can be noticed that stability of canola oil improved with using different levels of nitrogen fertilization in all genotypes. Acid value of canola oil decreased from 7.332, 9.024, 9.104, 8.178, 7.614 and 7.05 in organic fertilizer to 5.27, 5.5, 6.262, 5.688, 4.922 and 4.512 in T5 after 30 days for Serw4, Serw6, Pactol, AD201, Tobas and Silvo, respectively.

Fig. 1 show the acid value of organic fertilizer treatment during storage at 60^{o}C for 30 days and indicate that the trend of acid value increases in general during storage period. Where they were 1.863%, 2.749%, 2.805%, 2.614%, 2.244%, and 1.122%, respectively at zero time of storage period and reached 7.332%, 9.024%, 9.104%, 8.178%, 7.614%, and 7.05%, respectively at the end of storage period. These results may due to the effect of lipase enzymes activity **(Wettasinghe *et al.*, 2001; Méndez *et al.*, 2002; Rotondi *et al.*, 2004).** Silvo genotype reveled the lowest acid value among the genotypes, while Pactol and Serw6 varieties produced the highest amounts. In addition, the amount of acid value in Serw4 variety, AD201 genotype are slightly higher than Silvo genotype and lower than Pactol and Serw4 varieties.

Fig. 2 show the acid value of T2 (37.5 Kg N.fed^{-1}) during storage at 60^{o}C for 30 days and indicate that the trend of acid value increases in general during storage period. Where they were 1.463%, 2.07%, 2.366%, 1.844%, 1.732% and 1.089%, respectively at zero time of storage period and reached 6.815%, 7.614%, 7.896%, 7.332%, 7.05%, and 6.432%, respectively at the end of storage period. Silvo genotype reveled the lowest acid value among the varieties, while Pactol variety produced the highest amounts.

Fig. 3 show the acid value of T3 treatment during storage at 60^{o}C for 30 days and indicate that the trend of acid value increases during storage period. Where they were 1.427%, 2.01%, 1.965%, 1.561%, 1.732% and 1.089%, respectively at zero time of storage period and reached 6.768%, 7.302%, 7.27%, 6.77%, 7.05% and 6.204%, respectively at the end of storage period. Silvo genotype reveled the lowest acid value among the varieties, while Serw6 variety produced the highest amounts.

Fig. 4 show the acid value of T4 during storage at 60^{o}C for 30 days and indicate that the trend of acid value increases in general during storage period. Where they were 1.263%, 1.87%, 1.845%, 1.415%, 1.68% and 1.054%, respectively at zero time of storage period and reached 6.04%, 7.056%, 6.486%, 6.204%, 6.328% and 5.85%, respectively at the end of storage period. Silvo genotype reveled the lowest acid value among the varieties, while Serw6 variety produced the highest amounts.

Fig. 5 show the acid value of T5 treatment during storage at 60^{o}C for 30 days and indicate that the trend of acid value increases in general during storage period. Where they were 1.06%, 1.085%, 1.781%, 1.207%, 1.049% and 1.03%, respectively at zero time of storage period and reached 5.27%, 5.5%, 6.262%, 5.688%,

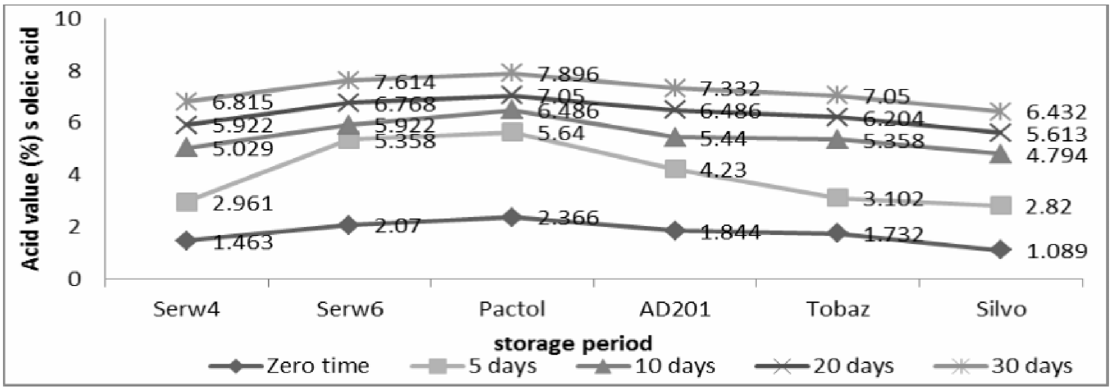

Fig. (2): Acid value of T2 (37.5 Kg N.fed^{-1}) during storage at 60^{o}C for 30 days.

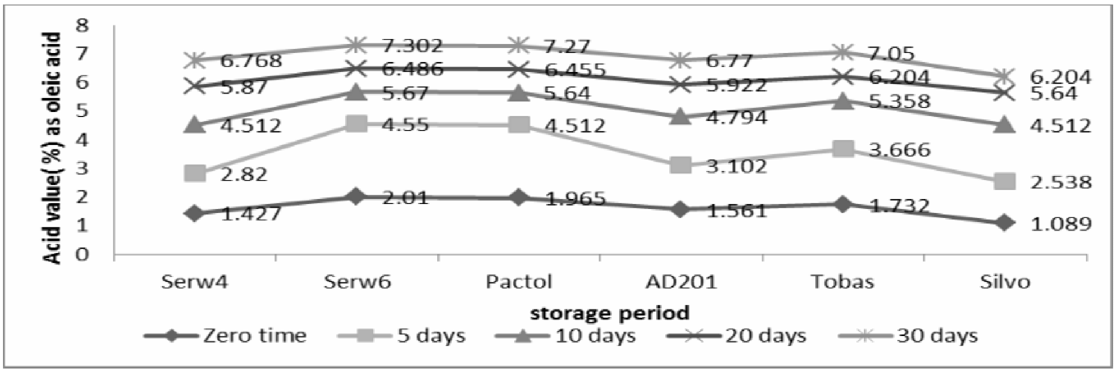

Fig. (3): Acid value of T3 (75 Kg N.fed^{-1}) during storage at 60^{o}C for 30 days.

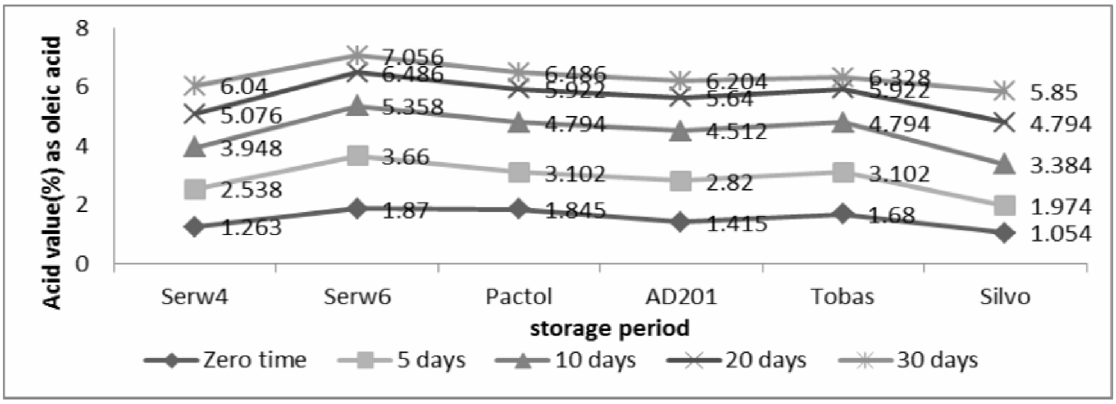

Fig. (4): Acid value of T4 (112.5 Kg N.fed^{-1}) during storage at 60^{o}C for 30 days.

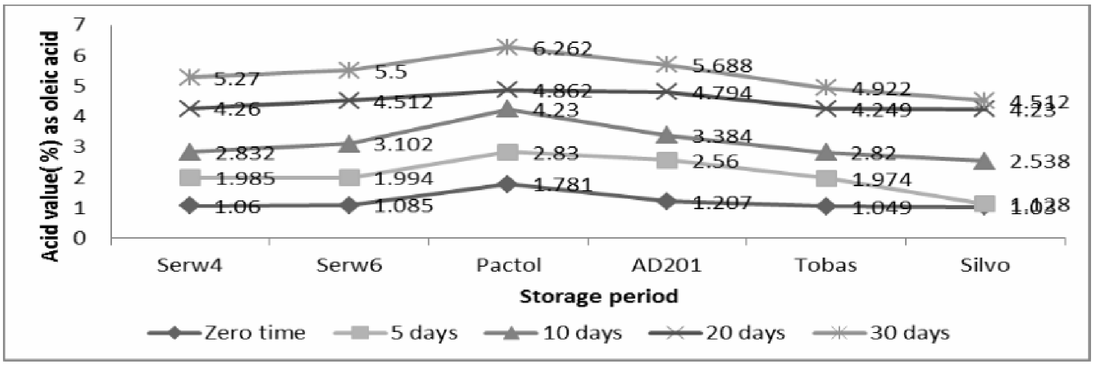

Fig. (5): Acid value of T5 (150 Kg N.fed^{-1}) during storage at 60^{o}C for 30 days.

4.922% and 4.512%, respectively at the end of storage period. Silvo genotype reveled the lowest acid value among the varieties, while Pactol variety produced the highest amounts.

From the results in Table 6 it can be noticed that stability of canola oil improved with using different levels of nitrogen fertilizer in all genotypes. Peroxide values decreased from 15.6, 17.4, 18.8, 17.0, 16.2 and 15.4 in organic fertilizer to 12.3, 13.5, 14.7, 14.0, 11.9 and 11.0 in T5 after 30 days for Serw4, Serw6, Pactol, AD201, Tobas and Silvo, respectively.

Fig. 6 show the peroxide value of organic fertilizer during storage at 60°C for 30 days and indicate that the trend of peroxide value increases in general during storage period. Where they were 8.8, 10.6, 11.2, 10, 9.2 and 8 meq O_2/Kg, respectively at zero time of storage period and reached 15.6, 17.4, 18.8, 17, 16.2 and 15.4 meq O_2/Kg, respectively at the end of storage period. Pactol variety produced the highest values, while Silvo genotype reveled the lowest peroxide value among the varieties.

Fig. 7 show the peroxide value of T2 treatment during storage at 60°C for 30 days and indicate that the trend of peroxide value increases in general during storage period. Where they were 7.8, 9.5, 10.7, 8.1, 9,and 7.6 meq O_2/Kg respectively, at zero time of storage period and reached 15.4, 16, 18, 15.8, 15.6, and 14.6 meq O_2/Kg respectively, at the end of storage period. Silvo genotype reveled the lowest acid value among the varieties, while Pactol variety produced the highest values.

Fig. 8 show the peroxide value of T3 treatment during storage at 60°C for 30 days and indicate that the trend of peroxide value increases in general during storage period. Where they were 7.4, 9.3, 8.7, 7.5, 8.4and 7.3 meq O_2/Kg, respectively at zero time of storage period and reached 14, 15.9, 15.6, 14.4, 14.9 and 13 meq O_2/Kg, respectively at the end of storage period. Silvo genotype reveled the lowest peroxide value among the varieties, while Serw6 variety produced the highest values.

Fig. 9 show the peroxide value of organic fertilizer T4 during storage at 60°C for 30 days and indicate that the trend of peroxide value increases in general during storage period. Where they were 7.1, 8.5, 7.92, 7.3, 7.6 and 7meq O_2/Kg, respectively at zero time of storage period and reached 13.4, 15.5, 15, 14.2, 14.5 and 12.6 meq O_2/Kg, respectively at the end of storage period. Silvo genotype revealed the lowest peroxide value among the varieties, while Serw6 variety produced the highest values.

Fig. 10 show the peroxide value of T5 during storage at 60°C for 30 days and indicate that trend of peroxide value increases in general during storage period. Where they were 6, 6.1, 6.8, 6.3, 5.8 and 5.6 meq O_2/Kg, respectively at zero time of storage period and reached 12.3, 13.5, 14.7, 14, 11.9 and 11 meq O_2/Kg, respectively at the end of storage period. Silvo genotype reveled the lowest peroxide value among the varieties, while Pactol variety produced the highest values.

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Table (6): Effect of the interaction between genotypes and treatments on peroxide value of canola oil.

Treatment / Genotypes	T1 (organic fertilizer)	T2 (37.5KgN.fed^{-1})	T3 (75 KgN.fed^{-1})	T4 (112.5KgN.fed^{-1})	T5 (150 KgN.fed^{-1})
Serw4	15.6	15.4	14.0	13.4	12.3
Serw6	17.4	16.0	15.9	15.5	13.5
Pactol	18.8	18.0	15.6	15.0	14.7
AD201	17.0	15.8	14.4	14.2	14.0
Tobas	16.2	15.6	14.9	14.5	11.9
Silvo	15.4	14.6	13.0	12.6	11.0

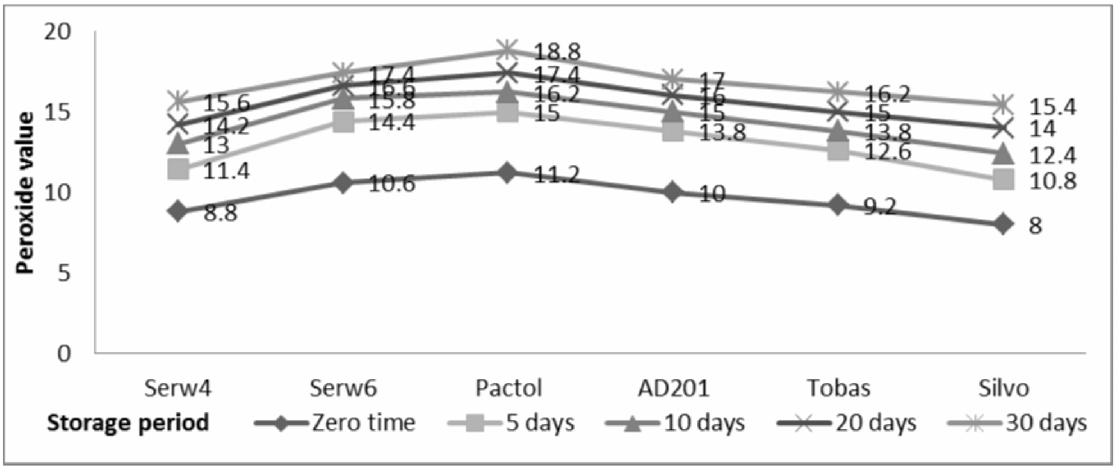

Fig. (6): Peroxide value of T1 (organic fertilizer) during storage at 60^{o}C for 30 days.

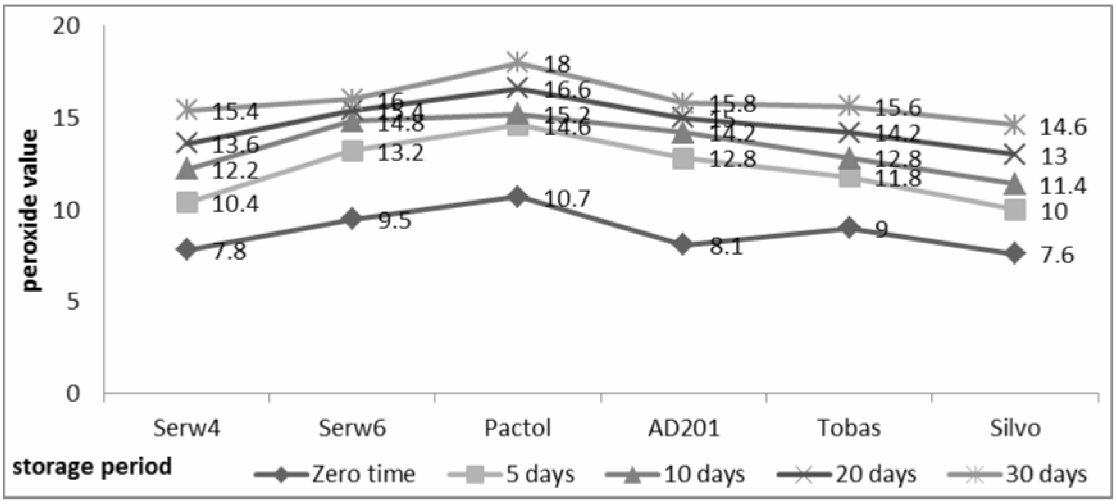

Fig. (7): Peroxide value of T2 (37.5 Kg N.fed^{-1}) during storage at 60^{o}C for 30 days.

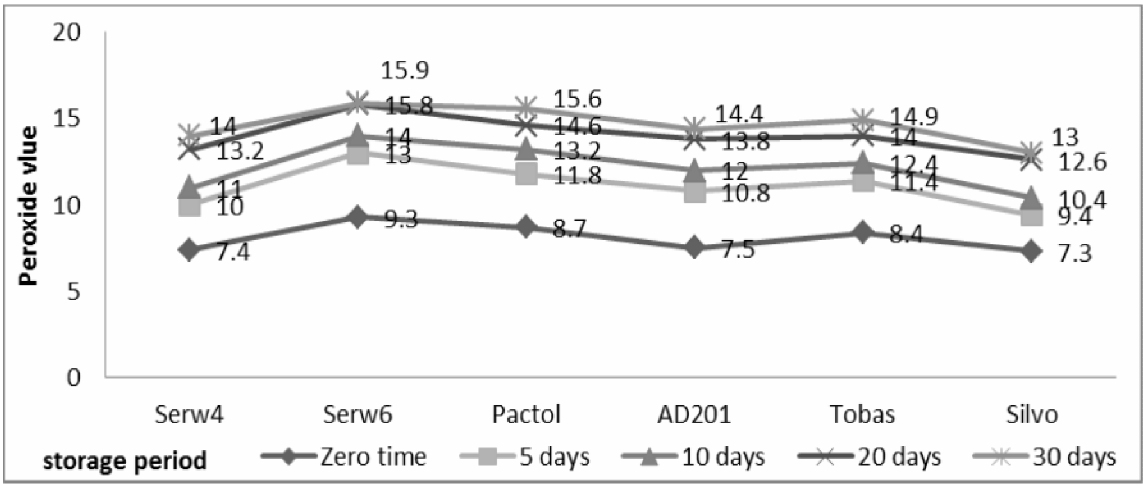

Fig. (8): Peroxide value of T3 (75 Kg $N.fed^{-1}$) during storage at 60^oC for 30 days.

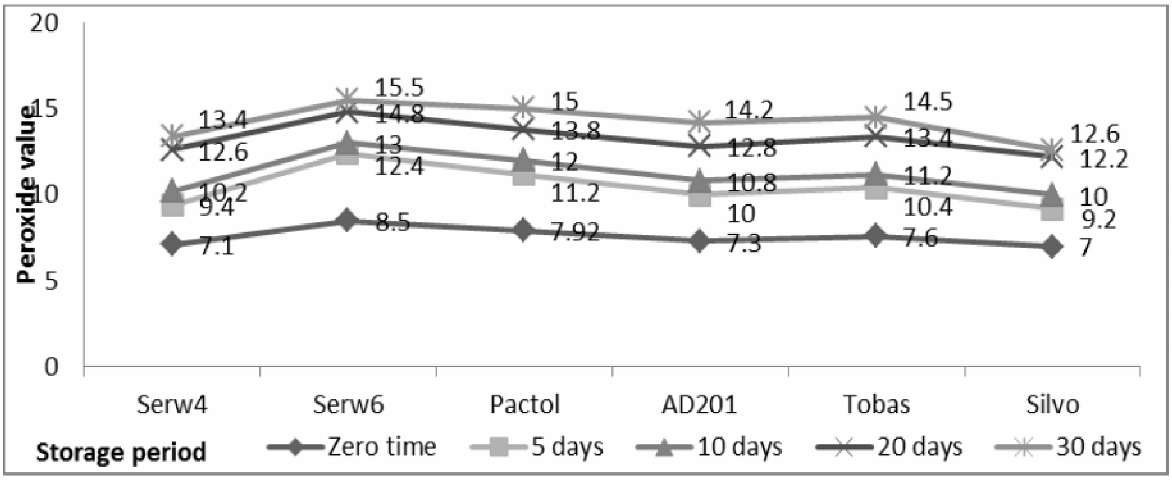

Fig. (9): Peroxide value of T4 (112.5 Kg $N.fed^{-1}$) during storage at 60^oC for 30 days.

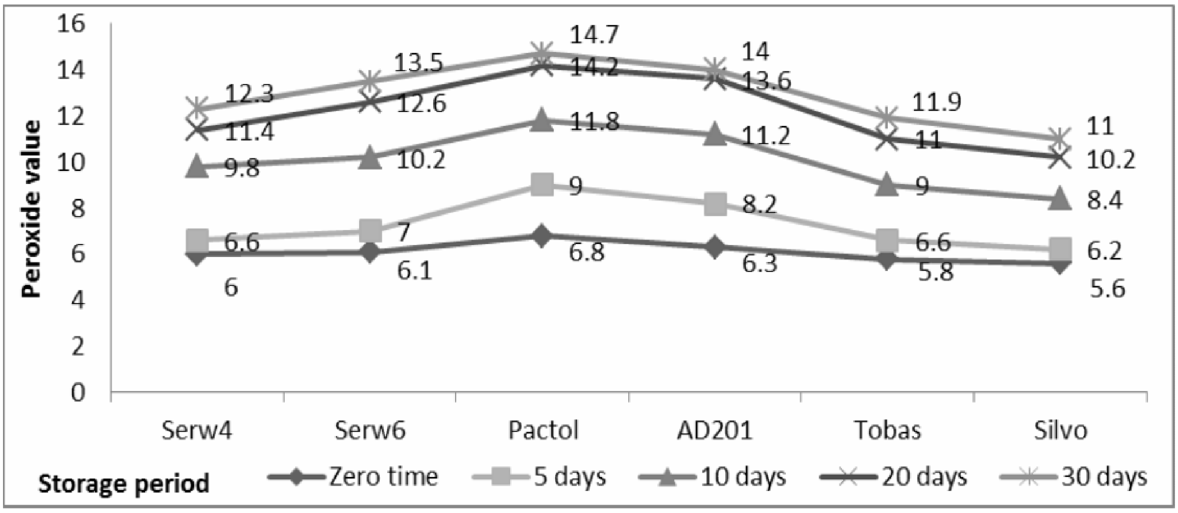

Fig. (10): Peroxide value of T5 (150 Kg $N.fed^{-1}$) during storage at 60^oC for 30 days.

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دراسة تأثير مستويات السماد النيتروجيني على الخواص الفيزيائية والكيميائية لبعض أصناف نبات الكانولا (*Brassica napus* L.) المزروعة تحت ظروف شمال سيناء

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الملخص العربي

يعتبر نبات الكانولا من أهم المحاصيل الزيتية، حيث يقع ترتيبه في المرتبة الثالثة في إنتاج الزيت بعد زيت فول الصويا وزيت النخيل. وانطلاقاً من أهمية هذا المحصول، فقد أجريت هذه الدراسة بهدف دراسة تأثير خمسة مستويات من السماد النيتروجيني T_1=organic fertilizer, T_2=37.5 KgN/fed, T_3=75 kgN/fed, T_4=112.5kgN/fed and T_5=150kgN/fed. علي ٦ تراكيب وراثية من بينهم ثلاثة أصناف من نبات الكانولا (سرو٤، سرو٦ وباكتول) وثلاثة طرز جينية (AD201, Tobas, and Silvo) وذلك تحت ظروف شمال سيناء في شتاء موسم ٢٠١٦، كانت أهم النتائج التي توصلت إليها الدراسة هي أن زيادة معدل الأسمدة النيتروجينية أدى إلى انخفاض لزوجة الزيت، الوزن النوعي، الحموضة، رقم البيروكسيد، ورقم التصبن، وزيادة نسبة المواد غير المتصبنة بالزيت، كانت ١٥٠ كجم نترات الامونيوم/ فدان هي الجرعة الأمثل من السماد النيتروجيني لتحقيق أقل قيمة للحموضة والبيروكسيد. أدي زيادة معدل التسميد النيتروجيني إلي ١٥٠ كجم نترات الأمونيوم/فدان إلى حدوث اختلافات طفيفة في الرقم اليودي ومعامل الانكسار، أما من حيث الاختلافات بين الأصناف فقد أوضحت نتائج رقم الحموضة ورقم البيروكسيد أن الطرز الجيني Silvo كان أقل الأصناف حموضة ورقم بيروكسيد، بينما الصنف النباتي Pactol كان أعلاهم. وكذلك أوضحت النتائج المتحصل عليها أن زيوت الأصناف تحت الدراسة أعطت أرقام متقاربة في معظم الصفات والخصائص المدروسة. وكان الطرز الجيني Silvo هو الأكثر استقراراً من بين الأصناف وذلك بعد تخزينه على درجة حرارة ٦٠ درجة مئوية لمدة ٣٠ يوم.

الكلمات الاسترشادية: *Brassica nabus* L.، نبات الكانولا، السماد النيتروجيني، الخصائص الطبيعية والكيماوية.

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