EFFECT OF NPK AND ORGANIC FERTILIZERS ON YIELD AND SEED OIL CONTENT OF RAPESEED (*Brassica napus* L.)

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ABSTRACT

This study was conducted at two different research fields (Kanipanka and Qlyasan), at the Kurdistan region of Iraq during winter season (2019- 2020) to investigate the effects of NPK and organic fertilizer application on seed yield and its components, protein, oil content, oil yield, and some fatty acid compositions. The experimental design was a complete block design with three replications. The application of (0.00, 40, 80, and 120 kg NPK ha^{-1}) are the main plots. While three applications of (0.00, 600, 1200 kg organic fertilizer ha^{-1}) for subplots. The 120 kg NPK ha^{-1} had highest seed and oil yield of 2474.178, and 793.249 kg ha$^{-1,}$ respectively, the average of both locations. The application of 1200 kg organic fertilizer ha^{-1} gave the maximum seed yield, the oil yield of 2172.642, and 719.463 kg ha^{-1}, respectively, for the average of both locations. Results showed the significant effect of NPK and organic fertilizer applications on the percentage of oleic, linoleic, and stearic acids. The study was proved the significant and highest oil yield when NPK application rate increased from 40 to 120 kg ha^{-1} and from 600 to 1200 kg organic fertilizer ha^{-1}.

Keywords: Nutrient uptake, fatty acids, seed yield, oil yield.

مجلة العلوم الزراعية العراقية -2022 :53(4):878-889 **شكر وحمة**

تأثير الأسمدة المركبة (NPK) والعضوية على الحاصل والمحتوى الزيتي لبذور السلجم (*Brassica napus L.*)

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المستخلص

نفذت الدراسة في موقعين بحثين 2019–2020 خلال الموسم الشتوي لكاني بانكة و قلياسان في اقليم كوردستان–العراق لبيان تأثيرات اضافة الأسمدة المركبة (NPK) والعضوية على حاصل البذور ومكوناته,محتوى البروتين, محتوى الزيت, حاصل الزيت و بعض محتويات الأحماض الدهنية. نفذت التجربة وفق تصميم القطاعات العشوائية الكاملة بثلاثة مكررات ومستويات السماد المركب (صفر, 40, 80, و 120 NPK كغم هـ$^{-1}$) مثلت الألواح الرئيسة, فيما مثلت الألواح الثانوية مستويات التسميد العضوي (صفر, 600, و1200 كغم هـ$^{-1}$). اعطت المعاملة 120 كغم هـ$^{-1}$ NPK الحاصلين الأعلى للبذور والزيت بـ 2474.178 و 793.249 كغم هـ$^{-1}$ كمعدل للموقعين. اعطت اضافة 1200 كغم هـ$^{-1}$ سماد عضوي اعلى حاصلين للبذور والزيت بـ719.463 و2172.642 كغم هـ$^{-1}$. بينت النتائج التأثير المعنوي للتسميد الكمياويوالعضوي على نسب الأحماض اوليك, لينوليك, والستريك.

الكلمات المفتاحية: امتصاص المغذيات، الأحماض الدهنية، حاصل البذور، حاصل الزيت.

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INTRODUCTION

Rapeseed (*Brassica napus* L.) was related to the brassica family. It is grown for their oilseed. The seeds are used for human consumption and industrial purposes, and after oil extraction, the high protein seed residue can be used as cattle feed (20, 25, 35). The plant takes second place among vegetable oil crops cultivation after soybean in the world production (24). Rapeseed oil has a lower level of saturated fatty acids (5–10%), a higher level of monounsaturated fatty acids (44–75%), and a moderate level of α-linolenic acid (9–13%) (38). Increasing population levels and per capita consumption will require further significant production gains to meet food and non-food demand, but these gains will also impact the environment. Agricultural production must increase global crop yields dramatically to match growing demand from a predicted world population of ~9 billion people by 2050 (31). Fertilizers are essential sources of plant nutrients for increasing agricultural production. Nitrogen (N), phosphorus (P), and potassium (K) play a vital role in crop yield (17). Highest crop productivity depends upon the time, kind, and appropriate amount of fertilization. Nitrogen is one of the most crucial nutrient elements for crop growth and protein synthesis, cell size, protoplasm, and photosynthetic activity (39). Nitrogen fertilizer plays a vital role in seed yield rape production (27). Phosphorus and potassium are considered primary nutrients for the average growth and development of plants (16) and are needed to sustain optimum plant production and quality (40). Its vital role in chlorophyll synthesis and involvement in the plants various physiological and metabolic (12). Also, potassium is critical for promoting vigorous root growth (1). As an essential nutrient, organic fertilizer can be eco-friendly and play a direct role in plant growth as a source of plant nutrients in available forms released during mineralization (2, 9). Applying organic fertilizers to soil increases the organic matter content, soil's physical properties, and therefore, it increases crop yields (3, 8, 15, and 33). However, they have also been shown to suppress plant pest populations and control some crop diseases (32, 37). The study's objective was to investigate the effect of different application rates of NPK and organic fertilizer on yield and the chemical component of oilseed rapes at two Sulaimani region locations and determine which of them are mor suitable the region for obtaining the best outcome.

MATERIALS AND METHODS

Two field experiments were conducted during the winter of 2019-2020 to study the effect of different applications of NPK and organic fertilizers on the yield, yield components, oil content, some fatty acids composition, and oil yield of Heroz rapeseed variety. The first field experiment was carried out at the Kanipanka Agricultural Research Station (latitude: 35° 22' 22" N, Longitude: 045° 43' 22" E, altitude: 548 masL) in Sharazoor valley. In comparison, the second location was Qlyasan, the farm of Biotechnology and Crop Science Department, College of Agricultural Engineering Sciences, University of Sulaimani, located at (latitude: 35° 34' 17" N, Longitude: 045° 22' 00" E, altitude: 757 masL). Each experiment was set up in a randomized complete block design (RCBD) as a split-plot arrangement with three replications. The applied NPK fertilizer (20-20-20) at an application rate (0.00, 40, 80, and 120 kg NPK ha^{-1}) in the main plots. Three levels of organic fertilizer (0.00, 600, and 1200 kg ha^{-1}) of chicken manure were in the sub-plots. Each main plot was containing three subplots. Also, each subplot having six rows, 2m long and 0.25m apart between rows. The recommended seed rate of 12 kg ha^{-1} was sowing on 11and 13th November of 2019 at Qlyasan and Kanipanka locations. All other input and agronomic practices will carry out uniformly. Metrological data and soil analysis for both sites are shows in Tables 1 and 2, respectively.

Table 1. The Meteorological data of both locations during the growing season of 2019-2020

Month	Kanipanka Location Temp. C°			Qlyasan location Temp. C°		
	Max.	Min.	Rainfall mm	Max.	Min.	Rainfall mm
November	25.3	4.2	16.4	24.9	5.2	10.2
December	18.7	2.8	144.5	18.3	4.1	121.2
January	15.0	-0.9	104.1	13.1	0	96
February	18.6	-7.5	136.5	18.3	-6.2	138.6
March	23.5	3.5	188.0	22.7	3.5	148.2
April	27.8	7.8	71.2	26.6	7.4	65.6
May	38	15	13.4	38.5	11.7	21

***(Agro-Metrological Department- Sulaimani), Bakrajo**

Table 2. Some physical and chemical properties of soil analysis at experimental sites

Soil Properties			
Physical properties			
Soil Properties		Kanipanka Location	Qlyasan Location
Textural Class		Clay	Silty Clay Loam
Particle Size Distribution (g kg^{-1})	Sand	37.4	59.68
	Silt	500.30	619.17
	Clay	462.30	312.15
Chemical properties			
Soil Properties		Kanipanka Location	Qlyasan Location
PH		7.46	7.42
EC dS m^{-1} At 25 °C		0.27	0.38
Organic Matter (g kg^{-1})		22.50	19.59
Total Nitrogen (g kg^{-1})		1.03	1.07
Available Phosphate (mg kg-1)		7.44	9.61
$CaCO_3$ (mg kg-1)		215.50	215.68
Soluble Ions mmol L^{-1}	Calcium (Ca^{+2})	4.20	2.00
	Potassium (K^{+})	2.70	0.16
	Sodium (Na^{+})	0.80	0.46
	Mg^{2+}	0.90	0.81
	HCO_3^{-}	4.20	2.51
	$SO4^{2-}$	0.89	0.79

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Data collection

Five randomly mature plants were selected in each treatment at both locations to observe the number of pods $plant^{-1}$, the number of seeds pod^{-1}, seed weight $plant^{-1}$, 100 seed weight, and seed yield. The seed yield was recorded from net plots. The oil content in the seed was determined with (Digital Soxhlet instrument) (13).

Oil yield (kg ha^{-1}): The oil yield kg ha^{-1} is the product of seed yield kg ha^{-1} in oil divided by one hundred (6). as shown in the following equation:

$$\textbf{Oil yield } (\textbf{kg ha}^{-1}) = \frac{\textbf{Oil Content \%}}{100} \times \textbf{Seed yield } (\textbf{kg ha}^{-1})$$

Separation of fatty acids

Separation of fatty acids was done using High-Performance Liquid Chromatography HPLC (College of Agriculture / Salahaddin University- Erbil) on reversed-phase C-8 (50×2.6mm ID) column.3µm particle size, the mobile phase was acetonitrile: tetrahydrofuran: 0.1 percent phosphoric acid (51:37:12v/v), the flow rate 1ml/minute. The eluted peaks were mentioned by the UV detector set at 215 nm

and quantitatively analyzed by comparing the area of well-known standard with the sample area under the same separation condition (21).

$$\textbf{Concentration of sample } \mu\textbf{/ml} = \frac{\textbf{Area of samle}}{\textbf{Area of standard}} \times \textbf{Conc. of Standard} \times \textbf{Dilution Factor}$$

Statistical analysis

The data were statistically analyzed according to the split-plot design technique using XLSTAT (2016). (36) all possible comparisons among the means were carried out by using Least Significant Difference (LSD) test at levels of 0.05. For testing the main effects of NPK fertilizer application on rapeseed, the data were subjected to analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Effect on seed yield components: Seed yield components such as the number of pods plant^{-1}, the number of seeds pod^{-1}, seeds weight plant^{-1}, 100 seeds weight, and seeds yield were affected significantly by different application levels NPK. The level increasing of NPK application up to the highest amount resulted in improved yield attributing characters at both locations and their average (Table 3.). However, the 120 kg NPK ha^{-1} recorded the highest values of the studied characters at both locations and averages. The increase of the pod number plant^{-1} under the 120 kg NPK ha^{-1} application might increase the seed yield. Therefore, this causes increasing all yield components. The exceeding 120 kg ha^{-1} NPK application on 80, 40, and 0.00 kg NPK ha^{-1} for the number of pod plant^{-1} were 19.19%, 41.27%, and 54.96%, respectively, at averages of both locations. The results of the present investigation corroborate the findings of (10), who reported that seed yield increased in response to rising nitrogen rates up to a specific limit. Increasing the level of NPK application increased the yield and its components (19). Also, Iqbal et al. (2008) (19) reported a progressive increase in seed yield, and it is components with increasing levels of NPK.

Table 3. Effect of NPK fertilizer on yield and its components at both locations and their average

NPK fertilizer (kg ha^{-1})	Number of pods plant^{-1}	Number of seeds pod^{-1}	Seeds weight plant^{-1} (g)	100 Seeds weight (g)	Seed yield (kg ha^{-1})
			Kanipanka location		
0	**122.148 d**	**10.329 c**	**3.647 d**	**0.200 d**	**1660.767 d**
40	**159.333 c**	**11.980 b**	**4.516 c**	**0.225 c**	**2188.867 c**
80	**206.073 b**	**12.618 b**	**5.371 b**	**0.247 b**	**2772.433 b**
120	**243.259 a**	**14.534 a**	**6.264 a**	**0.275 a**	**3412.456 a**
LSD 0.05	**10.582**	**1.200**	**0.655**	**0.004**	**159.138**
			Qlyasan location		
0	**40.629 d**	**6.490 c**	**1.113 c**	**0.146 d**	**703.478 d**
40	**52.944 c**	**9.725 b**	**1.536 c**	**0.157 c**	**885.111 c**
80	**86.000 b**	**11.051 a**	**2.415 b**	**0.193 b**	**1152.356 b**
120	**118.167 a**	**11.846 a**	**3.319 a**	**0.226 a**	**1535.900 a**
LSD 0.05	**10.984**	**0.822**	**0.441**	**0.006**	**101.247**
			Average of both locations		
0	**81.389 d**	**8.410 d**	**2.380 d**	**0.173 d**	**1182.122 d**
40	**106.139 c**	**10.852 c**	**3.026 c**	**0.191 c**	**1536.989 c**
80	**146.037 b**	**11.834 b**	**3.893 b**	**0.220 b**	**1962.394 b**
120	**180.713 a**	**13.190 a**	**4.792 a**	**0.251 a**	**2474.178 a**
LSD 0.05	**6.791**	**0.647**	**0.352**	**0.003**	**83.979**

The results obtained from the data variance analysis indicated that the organic fertilizer application influenced all studied characters significantly (Table 4.). Each organic fertilizer application had a positive effect on the studied character. Among the three-level organic fertilizers, the application of 1200 kg ha^{-1} achieved superior values for seed yield and its components at both locations and their average. The treatment of non-organic fertilizer application recorded the minimum values. In our study, the exceeding 1200 kg organic fertilizer ha^{-1} on 600 and 0.00 kg organic manure ha^{-1} for seed yield was 17.55% and 35.43%, respectively, at the average of both locations. There are numerous researches exist on yield response to organic fertilizer (4, 5 and 23). However, both researchers (22,42)

reported that manure-based fertilization could represent an alternative to mineral fertilizer to achieve high maize yields and improve the soil environment and soil quality.

Table 4. Effect of organic fertilizer on yield and its components at both locations and their average

NPK fertilizer (kg ha^{-1})	Number of pods plant^{-1}	Number of seeds pod^{-1}	Seeds weight plant^{-1} (g)	100 Seeds weight (g)	Seed yield (kg ha^{-1})
Kanipanka location					
0	122.148 d	10.329 c	3.647 d	0.200 d	1660.767 d
40	159.333 c	11.980 b	4.516 c	0.225 c	2188.867 c
80	206.073 b	12.618 b	5.371 b	0.247 b	2772.433 b
120	243.259 a	14.534 a	6.264 a	0.275 a	3412.456 a
LSD 0.05	10.582	1.200	0.655	0.004	159.138
Qlyasan location					
0	40.629 d	6.490 c	1.113 c	0.146 d	703.478 d
40	52.944 c	9.725 b	1.536 c	0.157 c	885.111 c
80	86.000 b	11.051 a	2.415 b	0.193 b	1152.356 b
120	118.167 a	11.846 a	3.319 a	0.226 a	1535.900 a
LSD 0.05	10.984	0.822	0.441	0.006	101.247
Average of both locations					
0	81.389 d	8.410 d	2.380 d	0.173 d	1182.122 d
40	106.139 c	10.852 c	3.026 c	0.191 c	1536.989 c
80	146.037 b	11.834 b	3.893 b	0.220 b	1962.394 b
120	180.713 a	13.190 a	4.792 a	0.251 a	2474.178 a
LSD 0.05	6.791	0.647	0.352	0.003	83.979

The interaction between NPK and organic fertilizer application on yield and its components were shows in Table 5. for both locations and their average. The interaction effect was significant for 100 seed weight and seed yield at both locations and their average. While the number of pods plant^{-1} and the number of seeds pod^{-1} was significant at Kanipanka and the averages of locations, and non-significant at Qlyasan location. Overall, the treatment with 120 kg NPK ha^{-1} and 1200 kg organic fertilizer showed the highest values for the traits mentioned above. The use of chemical fertilizer with manure results in the absorption of most elements and eventually created many pods plant^{-1} that affects most of the yield components. In this study, at the average of both locations, the interaction applied fertilizers between 120 kg NPK and 1200 kg organic fertilizer ha^{-1} gave the highest seed yield of 2990.467 kg ha^{-1}, which exceeded the treatment of 120 kg NPK with 600, and 0.00 kg organic fertilizer ha^{-1} reached 2462.950 and 1969.117 kg ha^{-1} respectively. These results agreed with previous studies of (26,42), who reported that yield components were affected by the fertilization, and consequently, crop yields were usually greater depending on the soil (18).

Table 5. Effect of the interaction between NPK and organic fertilizers on yield and its components at both locations and their average

NPK and Organic fertilizers (kg ha^{-1})		Number of pods plant^{-1}	Number of seeds pod^{-1}	Seed weight plant^{-1} (g)	100 Seed weight (g)	Seed yield (kg ha^{-1})
Kanipanka location						
0.00	0.00	93.000 i	9.178 i	2.710 a	0.181 g	1216.333 f
	600	119.889 h	10.155 h	3.757 a	0.201 f	1728.667 e
	1200	153.555 fg	11.655 fg	4.473 a	0.218 e	2037.300 d
40	0	113.000 h	11.410 g	3.423 a	0.205 f	1676.267 e
	600	166.000 ef	11.870 efg	4.533 a	0.224 e	2171.000 d
	1200	199.000 d	12.660 d	5.590 a	0.246 d	2719.333 c
80	0.00	148.775g	12.367 def	4.410 a	0.239 d	2152.333 d
	600	220.444 c	12.933 d	5.567 a	0.244 d	2796.733 c
	1200	249.000 b	12.553 de	6.137 a	0.259 c	3368.233 b
120	0.00	167.889 e	13.711 c	5.073 a	0.256 c	2835.833 c
	600	241.444 b	14.553 b	6.350 a	0.277 b	3384.533 b
	1200	320.444 a	15.337 a	7.370 a	0.291 a	4017.000 a
LSD 0.05		13.233	0.749	N. S	0.009	155.57
Qlyasan location						
0.00	0.00	32.555 a	5.524 a	0.855 a	0.134 f	594.033 h
	600	40.222 a	6.900 a	1.179 a	0.147 e	719.033 g
	1200	49.110 a	7.044 a	1.304 a	0.155 e	797.367 fg
40	0.00	42.500 a	8.900 a	1.013 a	0.147 e	712.667 gh
	600	49.555 a	9.430 a	1.463 a	0.154 e	848.067 ef
	1200	66.778 a	10.844 a	2.131 a	0.170 d	1094.600 d
80	0.00	73.667 a	9.997 a	2.043 a	0.166 d	933.067 e
	600	84.222 a	11.378 a	2.440 a	0.190 c	1140.633 d
	1200	100.111 a	11.778 a	2.761 a	0.224 b	1383.367 c
120	0.00	92.722 a	10.218 a	2.769 a	0.195 c	1102.400 d
	600	134.111 a	12.137 a	3.054 a	0.224 b	1541.367 b
	1200	127.667 a	13.184 a	4.134 a	0.260 a	1963.933 a
LSD 0.05		N. S	N. S	N. S	0.010	120.716
Average of both location						
0.00	0.00	62.778 h	7.351 i	1.783 a	0.158 i	905.183 h
	600	80.055 g	8.528 h	2.468 a	0.174 h	1223.850 g
	1200	101.333 f	9.350 g	2.889 a	0.187 g	1417.333 f
40	0.00	77.750 g	10.155 f	2.218 a	0.176 h	1194.467 g
	600	107.778 f	10.650 ef	2.998 a	0.189 g	1509.533 ef
	1200	132.889 e	11.752 cd	3.861 a	0.208 f	1906.967 c
80	0.00	111.221 f	11.182 de	3.227 a	0.203 f	1542.700 de
	600	152.333 d	12.156 c	4.003 a	0.217 e	1968.683 c
	1200	174.556 c	12.166 c	4.449 a	0.242 c	2375.800 b
120	0.00	130.305 e	11.964 c	3.921 a	0.225 d	1969.117 c
	600	187.778 b	13.345 b	4.702 a	0.251 b	2462.950 b
	1200	224.056 a	14.261 a	5.752 a	0.276 a	2990.467 a
LSD 0.05		10.495	0.630	N. S	0.006	94.638

The data shows in Table (6.) illustrates the effect of location on seed yield and its components. The results indicated that the Kanipanka location for rapeseed yield was statistically better than the Qlyasan location and increased the seed yield across all study characters. The number of pod plant^{-1}, number of seeds pod^{-1}, seed weight plant^{-1}, 100 seed weight, and seed yield responded significantly to the location effect. The Kanipanka location exceeded Qlyasan location significantly for all traits. The exceeding of seed yield 57.38%, and all its components in Kanipanka location may be due to the favorable environmental condition prevailing in this location to grow rapeseed oil crop. The number of pod and seed weight was affected by environmental factors, and final seed yield was significantly affected by environmental factors. Previous results confirmed that the variations in yield and yield components could occur because of variations in soil, weather, and other growing conditions (30).

Table 6. Effect of locations on yield and its components

Locations	Number of pod plant^{-1}	Number of seeds pod^{-1}	Seed weight plant^{-1} (g)	100 Seed weight (g)	Seed yield (kg ha^{-1})
Kanipanka	182.703 a	12.365 a	4.949 a	0.237 a	2508.631 a
Qlyasan	74.435 b	9.778 b	2.096 b	0.181 b	1069.211 b
LSD 0.05	6.990	0.460	0.221	0.001	54.764

Effect on oil percentage and fatty acids

The effect of NPK fertilizer application was found to be significant on fatty acid compositions, the oil%, and oil yield at both location and their average (Table 7.). Unsaturated fatty acids such as oleic and linoleic acids respond to the application of 80 kg NPK ha^{-1} at both locations and their average significantly. The highest values of 38.22% and 21.67 were recorded at the average of both locations. Also, the application of 80 kg NPK ha^{-1} obtained the maximum percentage of stearic acid in the study. However, α-Linolenic and oil percent were statistically at pair with each other. The non-fertilizer application of NPK ended up with the highest linolenic acid and oil content at both locations and averages (Table 7.) Also,others (14) confirmed that nitrogen fertilizer reduces the oil content of rapeseed. The maximum oil content of 35.52% was observed at the average of locations when 0.00 NPK was applied. These results agree with other findings (7) to clarify that the highest oil content was acquired in unfertilized oilseed rape. Besides nitrogen and phosphor, potassium fertilization has been accounted for to impact the efficiency of seed yield and its oil concentrations (29).

Table 7. Effect of NPK fertilizer on fatty acid compositions, oil%, seed yield and oil yield at both locations and their average

NPK fertilizer (kg ha^{-1})	Oleic acid (Omega 9) %	Linoleic acid (Omega 6) %	Linolenic acid (Omega 3) %	Stearic acid %	Oil %	Seed yield (kg ha^{-1})	Oil yield (kg ha^{-1})
Kanipanka location							
0	31.16 d	15.99 c	0.39 a	0.41 d	35.04 a	1660.767 d	581.101 d
40	33.14 c	17.93 b	0.35 b	0.42 c	33.94 b	2188.867 c	741.522 c
80	36.14 a	20.23 a	0.31 c	0.44 a	32.71 c	2772.433 b	906.067 b
120	34.68 b	19.84 a	0.30 d	0.43 b	31.63 d	3412.456 a	1078.389 a
LSD 0.05	0.844	0.554	0.010	0.005	0.051	159.138	53.763
Qlyasan location							
0	35.91 d	19.40 c	0.49 a	0.40 c	35.99 a	703.478 d	253.075 d
40	37.64 c	20.62 b	0.45 b	0.41 b	34.98 b	885.111 c	309.384 c
80	40.31 a	23.10 a	0.43 c	0.42 a	34.06 c	1152.356 b	392.171 b
120	39.52 b	22.85 a	0.40 d	0.42 a	33.12 d	1535.900 a	508.109 a
LSD 0.05	0.412	0.262	0.008	0.007	0.127	101.247	34.700
Average of both locations							
0	33.53 d	17.70 d	0.44 a	0.41 c	35.52 a	1182.122 d	417.088 d
40	35.39 c	19.28 c	0.40 b	0.42 b	34.46 b	1536.989 c	525.453 c
80	38.22 a	21.67 a	0.37 c	0.43 a	33.39 c	1962.394 b	649.119 b
120	37.10 b	21.34 b	0.35 d	0.42 b	32.38 d	2474.178 a	793.249 a
LSD 0.05	0.418	0.273	0.006	0.004	0.061	83.979	28.490

The variance analysis for three different organic fertilizer applications found to be significant on all studied traits. Such traits like the oleic, linoleic, linolenic, stearic acids, oil content, and the oil yield at both locations and their average (Table 8.). The elevated level of organic fertilizer from 0.00 to 1200 kg ha^{-1} causes to increase in the values for all studied characters but not α-Linolenic and oil%. The α-Linolenic is a fatty acid with 18 carbon atoms, is also considered an essential fatty acid. The highest percentage of 0.42% at the average of both locations was recorded when organic fertilizer was not applied. The results confirm the finding of Moghaddam et al., (2014), who reported the increased content of sesame α-Linolenic acid with no organic fertilizer and reduced α-Linolenic content with the application of organic fertilizer. On the other hand, the oil content reached the

maximum percentage of 34.18% and gradually decreased with the organic fertilizer application at the averages of both locations.the results collaborate the finding of Cheema, M.A., et al., (2001) reported the highest content of canola oil% with zero fertilizers. The oil yield with the availability of 1200 kg organic fertilizer ha^{-1} was more than 600 kg organic fertilizer ha^{-1}, notably was 993.884, 445.043, and 719.463 kg canola oil ha^{-1} at both location and their average. The application of organic fertilizer to soil has become a common practice depleted of organic matter due to continuous cropping. Another reserchers emphasizes the importance of high soil nutrients and especially nitrogen availability to determine the quantity and quality of the winter oilseed rape (28).

Table 8. Effect of organic fertilizer on fatty acid compositions, oil%, seed yield and oil yield at both locations and their average

Organic fertilizer (kg ha^{-1})	Oleic acid (Omega 9) %	Linoleic acid (Omega 6) %	Linolenic acid (Omega 3) %	Stearic acid %	Oil %	Seed yield (kg ha^{-1})	Oil yield (kg ha^{-1})
Kanipanka location							
0	**31.79 c**	**17.00 c**	**0.37 a**	**0.42 b**	**33.61 a**	**1970.192 c**	**654.212 c**
600	**33.60 b**	**18.41 b**	**0.34 b**	**0.43 a**	**33.34 b**	**2520.233 b**	**832.213 b**
1200	**35.95 a**	**20.08 a**	**0.31 c**	**0.43 a**	**33.05 c**	**3035.467 a**	**993.884 a**
LSD 0.05	**0.428**	**0.328**	**0.008**	**0.004**	**0.064**	**77.528**	**26.093**
Qlyasan location							
0	**35.01 c**	**20.00 c**	**0.46 a**	**0.41 b**	**34.74 a**	**835.542 c**	**288.287 c**
600	**38.70 b**	**21.50 b**	**0.44 b**	**0.42 a**	**34.55 b**	**1062.275 b**	**363.726 b**
1200	**41.32 a**	**22.98 a**	**0.42 c**	**0.42 a**	**34.33 c**	**1309.817 a**	**445.043 a**
LSD 0.05	**0.339**	**0.218**	**0.007**	**0.004**	**0.042**	**60.358**	**20.796**
Average of both locations							
0	**33.40 c**	**18.50 c**	**0.42 a**	**0.41 c**	**34.18 a**	**1402.867 c**	**471.249 c**
600	**36.15 b**	**19.95 b**	**0.39 b**	**0.42 b**	**33.94 b**	**1791.254 b**	**597.970 b**
1200	**38.64 a**	**21.53 a**	**0.37 c**	**0.43 a**	**33.69 c**	**2172.642 a**	**719.463 a**
LSD 0.05	**0.263**	**0.190**	**0.005**	**0.003**	**0.037**	**47.319**	**16.069**

Data in Table 9. illustrate the interaction between NPK and organic fertilizers application on the fatty acid compositions, oil content, and oil yield at both location and their average. The effect was significant for Omega-9 and seed yield at both locations and averages. The significant and highest percentage of oil content recorded when the interaction between the fertilizers was 0.00 kg NPK with 0.0.00 organic fertilizer ha^{-1} at Kanipanka and averages of locations, respectively. The values of oil% decreased gradually with increased NPK and organic fertilizer. Based on our results, rapeseed plants produce the highest oil content by not applying chemical and organic fertilizer. Oil yield is the primary purpose of oilseed cultivation of rapeseed in this study. The results show that the interaction between 120 kg NPK with 1200 kg organic fertilizer application ha^{-1} significant and gave the higher oil yield of 645.764 and 953.286 kg ha^{-1} at Qlyasan and the average of both locations, respectively. The use of NPK fertilizer combined with appropriate organic fertilization helps to maintain them. This positive effect of organic fertilizer on yield is generally due to a gradual improvement of soil physical properties (41).

Table 9. Effect of the interaction between NPK and organic fertilizers on fatty acid compositions, oil%, seed yield and oil yield at both locations and their average

NPK and Organic fertilizer (kg ha^{-1})		Oleic acid (Omega 9) %	Linoleic acid (Omega 6) %	Linolenic acid (Omega 3) %	Stearic acid %	Oil %	Seed yield (kg ha^{-1})	Oil yield (kg ha^{-1})
Kanipanka location								
	0.00	29.78 h	14.84 h	0.41 a	0.40 a	35.31 a	1216.333 f	429.349 a
0.00	600	31.30 g	16.11 g	0.39 a	0.41 a	35.05 b	1728.667 e	605.887 a
	1200	32.41 f	17.03 f	0.36 a	0.42 a	34.76 c	2037.300 d	708.069 a
	0.00	31.47 g	16.76 fg	0.39 a	0.41 a	34.35 d	1676.267 e	575.836 a
40	600	32.84 ef	17.69 e	0.35 a	0.42 a	33.90 e	2171.000 d	735.981 a
	1200	35.13 cd	19.34 c	0.32 a	0.43 a	33.56 f	2719.333 c	912.751 a
	0.00	33.38 e	18.39 d	0.35 a	0.43 a	32.92 g	2152.333 d	708.445 a
80	600	35.75 c	20.15 b	0.31 a	0.44 a	32.75 h	2796.733 c	915.845 a
	1200	39.28 a	22.14 a	0.28 a	0.45 a	32.48 i	3368.233 b	1093.909 a
	0.00	32.52 f	18.02 de	0.34 a	0.42 a	31.85 j	2835.833 c	903.219 a
120	600	34.52 d	19.69 bc	0.30 a	0.43 a	31.65 k	3384.533 b	1071.141 a
	1200	36.99 b	21.80 a	0.27 a	0.44 a	31.39 l	4017.000 a	1260.808 a
LSD 0.05		0.856	0.657	N. S	N. S	0.129	155.57	N. S
Qlyasan location								
	0.00	32.28 h	17.87 a	0.50 a	0.39 e	36.17 a	594.033 h	214.877 h
0.00	600	36.48 f	19.52 a	0.49 a	0.40 d	35.99 a	719.033 g	258.787 fg
	1200	38.96 d	20.81 a	0.46 a	0.42 b	35.81 a	797.367 fg	285.562 efg
	0.00	34.86 g	19.29 a	0.47 a	0.40 d	35.21 a	712.667 gh	250.935 gh
40	600	37.83 e	20.52 a	0.45 a	0.41 c	34.96 a	848.067 ef	296.463 ef
	1200	40.23 c	22.05 a	0.44 a	0.42 b	34.78 a	1094.600 d	380.755 d
	0.00	36.77 f	21.64 a	0.46 a	0.42 b	34.24 a	933.067 e	319.530 e
80	600	40.36 c	22.97 a	0.43 a	0.43 a	34.10 a	1140.633 d	388.893 d
	1200	43.78 a	24.69 a	0.41 a	0.43 a	33.84 a	1383.367 c	468.091 c
	0.00	36.12 f	21.19 a	0.42 a	0.41 c	33.36 a	1102.400 d	367.804 d
120	600	40.12 c	22.97 a	0.39 a	0.42 b	33.14 a	1541.367 b	510.760 b
	1200	42.33 b	24.37 a	0.39 a	0.42 b	32.88 a	1963.933 a	645.764 a
LSD 0.05		0.679	N. S	N. S	0.009	N. S	120.716	41.592
Average of both locations								
	0.00	31.03 i	16.36 i	0.46 a	0.40 a	35.74 a	905.183 h	322.113 f
0.00	600	33.89 g	17.82 h	0.44 a	0.41 a	35.52 b	1223.850 g	432.337 e
	1200	35.68 e	18.92 f	0.41 a	0.42 a	35.29 c	1417.333 f	496.815 d
	0.00	33.17 h	18.03 g h	0.43 a	0.41 a	34.78 d	1194.467 g	413.385 e
40	600	35.33 ef	19.11 f	0.40 a	0.42 a	34.43 e	1509.533 ef	516.222 d
	1200	37.68 cd	20.70 c	0.38 a	0.43 a	34.17 f	1906.967 c	646.753 c
	0.00	35.08 f	20.02 d	0.41 a	0.42 a	33.58 g	1542.700 de	513.988 d
80	600	38.06 c	21.56 b	0.37 a	0.43 a	33.42 h	1968.683 c	652.369 c
	1200	41.53 a	23.42 a	0.34 a	0.44 a	33.16 i	2375.800 b	781.000 b
	0.00	34.32 g	19.61 e	0.38 a	0.42 a	32.60 j	1969.117 c	635.511 c
120	600	37.32 d	21.33 b	0.35 a	0.42 a	32.39 k	2462.950 b	790.950 b
	1200	39.66 b	23.09 a	0.33 a	0.43 a	32.13 l	2990.467 a	953.286 a
LSD 0.05		0.526	0.380	N. S	N. S	0.074	94.638	32.139

Table 10. show the effect of locations on the percentage of fatty acid compositions, oil content, seed yield, and oil yield. This effect was significant on all traits. Kanipanka location exceeded Qlyasan location by 4.65%, 57.38%, and 55.77% for the trait's stearic acid, seed yield, and oil yield frequently. In comparison, Qlyasan predominated Kanipanka location for unsaturated fatty acids (omega-9, omega-6, and omega-3) and oil content by 13.5%, 16.16%, 29.41%, and 3.3%, respectively. It was clear from these results that the Qlyasan location suitable for improving the quality of canola oils than the Kanipanka location. Besides, the quantity of oil% significantly higher than the Qlyasan location. (11) concluded that productivity and quality are highly influenced by fertilizer, environment, and interaction.

Table 10. Effect of location on fatty acid compositions, oil%, seed yield and oil yield

Locations	Oleic acid (Omega-9) %	Linoleic acid (Omega-6) %	Linolenic acid (Omega-3) %	Stearic acid %	Oil %	Seed yield (kg ha^{-1})	Oil yield (kg ha^{-1})
Kanipanka	**33.78 b**	**18.50 b**	**0.34 b**	**0.43 a**	**33.33 b**	**2508.631 a**	**826.770 a**
Qlyasan	**38.34 a**	**21.49 a**	**0.44 a**	**0.41 b**	**34.54 a**	**1069.211 b**	**365.685 b**
LSD 0.05	**0.451**	**0.393**	**0.007**	**0.002**	**0.044**	**54.764**	**18.335**

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