PERFORMANCE OF TWO OIL SEED RAPE VARIETIES UNDER DIFFERENT RATES OF NITROGEN AND PHOSPHORUS FERTILIZERS

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Abstract: Two field experiments were conducted during 1997/98 and 1998/99 seasons to study the effect of nitrogen (30, 45 and 60 kg N/fed.) and phosphorus (0, 15.5 and 31.0 kg P_2O_5/fed.) fertilizers on seed quality of two oil seed rape (*Brassica napus*) varieties (AD201 and Tower seeds), under Assiut conditions. Sowing was carried out on Nov. 2 and Oct. 30 in the first and second season respectively, where seeds were sown on ridges 50 cm apart in hill spacing of 15 cm, leaving two plant/hill. The split-split plot design with four replicates was applied where varieties were located in the main plot, P and N fertilizers were randomly distributed in sub and sub-sub plots, respectively, with a plot area of 10.5 m^2. At harvest, seed samples were randomly taken from the different treatments and the following were determined oil and protein content were determined, where oil and protein yield/fed., were calculated by the multiplication of oil and/or protein percentage by seed yield/fed. All data were subjected to normal statistical analysis and comparison of means were done using LSD at 5%.

The data could be summarized as follows:

There were no significant differences between oilseed rape varieties in all characters under studies, except protein yield in both seasons. The protein yield of AD201 and Tower varieties in 1997/98 season were 169.20 and 158.1 kg/fed., 133.10 and 124.87 kg/fed. in 1998/99 season for the same respective varieties. Oil yield of AD201 and Tower varieties in 1997/98 season were 321.48 and 302.12 kg/fed. respectively, 255.51 and 231.58 kg/fed. for the same respective varieties in 1998/99 season.

The application of P fertilizer had no significant influence on all characters except protein yield/fed. in both seasons. Phosphorus application increased oil and protein yield/fed. in both season, and decreased protein % (both season) as compared to the check (zero P).

The application of N fertilizer had no significant effect on all characters except protein yield in both seasons. Increasing N rates from 30 to 45 or 60 kg/fed. increased protein % and protein and oil yield/fed. Increasing oil yield is mainly due to the increase in seed yield/fed.

In general, the highest oil yield/fed. in 1997/98 season was obtained from

AD201 variety when supplied with P and N at its highest rates, while in 1998/99 season this value was obtained from AD201 variety when received P at a rate of 15.5 kg P_2O_5/fed. and 45 kg N/feddan.

The highest protein yield/fed. was obtained from AD201 variety in 1997/98 season, when received zero P and 60 kg N/fed. while in 1998/99 season, this value was obtained from Tower variety when received P at a rate of 15.5 kg P_2O_5/fed and N at a rate of 60 kg/fed and/or from AD201 variety when supplied with P at a rate of 31.0 kg P_2O_5/fed and N at a rate of 60 kg/fed.

Introduction

There are a wide gap in Egypt between the production of edible oil and its consumption, where about 80% of the consumed oil in Egypt is imported because of the lack in production as a result of the reduction in land area cultivated by oil crops (FAO, 2000). Rapeseed crop was introduced recently in Egypt as a winter crop in order to increase oil production, because this crop produce a higher seed yield with a higher oil percentage in seed (40% or more). The effect of different agricultural practices is so important in order to increase seed yield and oil percentage and consequently oil yield.

The differences in chemical constituents between oil seed rape varieties were reported by many investigators (Farag *et al.*, 1986; Mohamed, 1989, El-Saidi *et al.*, 1992). El-Saidi *et al.* (1992) concluded that AD201 and western varieties had a higher oil content than Bruter variety. Racz *et al.* (1965) reported that P had no effect on nitrogen and phosphorus content in seed and straw. Holmes and Ainsley (1997) concluded that P had small effect on oil content. Nitrogen application to oilseed rape increased protein content in seeds (Kormin and Volkov, 1987, Jang *et al.*, 1987, Anderson *et al.*, 1996) and decreased oil content (Ibrahim *et al.*, 1989; Kormin and Volkov, 1988; Hassan, 1993; Zhao *et al.*, 1991, Anderson, 1996). Oil and protein yield increased by N application as a result of increasing seed yield per unit area (Taylor *et al.*, 1991; Nour El-Din *et al.*, 1995). Brennan *et al.* (2000) concluded that the application of nitrogen to oil seed rape decreased oil concomitantly with an increase in protein content.

Materials and Methods

Two field experiment were conducted at the experimental farm of Assiut University at Assiut during 1997/98 and 1998/99 season to study the effect of nitrogen and phosphate fertilizer on the seed

quality of two rape oil seeds under Assiut conditions. The seeds were sown on Nov. 2 and Oct. 30 in 1997/98 and 1998/99 season, on ridges 50 cm apart, in hill of 15 cm spacing, leaving two plants/hill after plant thinning. The proceeding crops were Maize and Soybean in the first and second season respectively. There were two oil seed rape varieties i.e. AD201 and Tower (the seeds of both varieties were supplied from the Agronomy Department, Fac. Agric., Cairo University) and there were the levels of nitrogen fertilizers (30, 45, 60 kg N/fed) in the form of ammonium nitrate (33.5%) in which was added just after thinning of plants, and there rate of phosphate fertilizer (zero, 15.5 31 kg P_2O_5/fed.) in the form of calcium superphosphate (15.5%) and added to the soil before planting.

The split split plot design was applied with four replicate with an plot area 10.5 m^2. Where the varieties were located in the main plot and phosphorus and nitrogen fertilizer rates were distributed randomly in the first and second sub plot respectively.

The physical and chemical analysis of the soil are present in Table 1.

Table (1): Chemical and physical properties of Experimental soil.

	1997/98	1998/99
Sand	26.6	26.4
Silt	25.0	24.0
Clay	48.4	44.6
Organic matter	1.83	1.83
PH	7.8	7.7
Total N %	0.72	0.73
Extractable P (ppm)	9.0	9.13
Extractable K (ppm)	350.0	352.0

A random sample of seeds were taken from each plot and the following characters were determined.

1-Oil % in which was determined by soxlet apparatus using petroleum ether as solvent according to A.O.A.C. (1982).

2 -Protein %, this was determined using macrokjeldahl according to A.O.A.C. 1982.

Oil and protein yield/fed., this was calculated by the multiplication of seed yield/fed in kilogram by oil and protein percentage.

All data obtained were subjected to normal statistical analysis according to Gomez & Gomez (1984) and mean comparing was done use LSD at 5% test.

Results and Discussion

Oil Content:

The data in Tables (2-5) show that oil content in oilseed rape was not significantly affected by varieties, in both seasons. However, seeds of AD201 (38.03%) variety had a higher value of oil percentage than Tower (36.93%), in 1998/99 season, while in 1997/1998 season, the oil percentage of AD201 (39.52%) and Tower (39.87%) were almost similar. The results here are in line with those obtained by Farag *et al.* (1986), Mohamed (1989) and El-Saidi *et al.* (1992).

The application of P fertilizer to oilseed rape had no significant influence on oil content in seed in both seasons. This results are in line with those obtained by Holmes and Ainsley (1977) who concluded that P application had a small effect on oil content. Also, Mekki (1990) concluded that oil content was not significantly affected by NP or PK fertilizer. However, a slight increase in oil content in 1997/98 season, as a result of increasing P rate from zero to 31 kg P_2O_5/fed, this results are in line with those obtained by Nour El-Din *et al.* (1995) who concluded that increasing P rate to 45 kg P_2O_5/fed. increased oil % in seed.

The application of N fertilizers to oil seed rape had a significant influence only on protein yield/fed, in both seasons. However, the application of N fertilizer decreased oil content in seeds, where the maximum value was obtained when N rates was applied at its lowest rate (30 kg N/fed). The reduction here may be due to the fact that the biosynthesis of fatty acids may be retarded by increasing N supply to the plants. The reduction in oil content on N rates increased were reported by Jang *et al.* (1987), Kormin and Volkov, 1987 and 1988 and Anderson (1996) who concluded that oil content was reduced as nitrogen supply increased.

Oil content in seeds was significantly affected by the interaction between varieties and nitrogen only in 1997/98 season, where the maximum value was obtained from Tower variety when supplied with N at a rate of 30 kg N/fed. Also, the second order interaction (VNP) in 1997/98 season, exerted a significant influence on oil

content, where the maximum value was obtained from Tower plants when supplied with P at a rate of 15.5 kg P_2O_5/fed and N at a rate of 30 kg/fed.

II- Oil yield (kg/fed.)

The data showed that oil yield/fed. was not significantly affected by varieties in both seasons. However, oil yield/fed. of AD201 variety was higher than Tower variety in both seasons, where the increases in oil yield of AD201 variety were 6.41 and 10.34% than Tower, in the 1997/98 and 1998/99 season, respectively. The increase here may be due to the increase in seed yield/fed. Mekki (1990) reported that there were no significant differences between oil seed rape varieties in oil yield.

Oil yield increased with the application of P fertilizer, where the increase in such trait as a result of increasing P rate from zero to 15.5 and 31.0 kg P_2O_5/fed. were 7.1 and 7.83% in 1997/98 season, 3.01 and 3.81% in 1998/99 season for the same respective rates. The increase in 1997/98 season is due to the increase in both oil percentage and seed yield/fed., while in 1998/99 season, the increase was mainly due to the increase in seed yield/fed. The results are in harmony with those obtained by Nour El-Din *et al.* (1995) who concluded that oil yield was the highest with the application of P at a rate of 45 kg P_2O_5/fed.

The data also showed that increase in N fertilizer rates increased oil yield/fed. insignificantly in both seasons, inspite of the reduction in oil as a result of increasing N rate. Thus, the increase in oil yield was mainly due to the increase in seed yield/fed. The increase in oil yield/fed in 1997/98 season, as a result of increasing N rate from 30 to 45 or 60 kg N/fed., were 1.63 and 5.54% respectively, while in 1998/99 season, there values were 3.09 and 9.09% for the same respective rates as compared to the lowest one (30 kg N/fed.). The increase in oil yield as a results of increasing N rate was reported by Geral *et al.* (1989), who concluded that oil yield was increased when N was applied up to 60 kg/ha.

The results revealed that oil yield/fed., was significantly affected by the interaction between varieties and nitrogen fertilizer, and the second order interaction in 1997/98 season.

Where the maximum yield of oil/fed. was obtained from AD201 variety when supplied with P at a rate of 31.0 kg P_2O_5 and N at a rate of 60 kg/fed.

III- Protein content:

The data in Tables (2-5) showed that protein content in oil seed rape

was not significantly affected by varieties in both seasons. Where protein content in seeds AD201 and Tower were 20.82 and 20.90% in 1997/98 season and 19.79 and 19.81% in 1998/99 season, respectively.

The results revealed that the application of P fertilizer decreased insignificantly protein % in seeds in both seasons, where the maximum value was obtained from the check plant (zero P). The reductions in oil % as a result of increasing P from zero to 15.5 and 31.0 kg P_2O_5/fed. were 3.7 and 2.16% in 1997/98 season, while in 1998/99 season, these values were 0.80 and 1.80% for the same respective rates as compared to the check (zero P).

Kumar (1995) reported that the application of P at 60 kg/ha increased protein content. The application of N fertilizer to oil seed rape increased protein content insignificantly in both seasons. The increases in protein content as a result of increasing N rate from 30 to 60 kg N/fed., in were 2.41 and 10.78% in 1997/98 and 1998/99 season, respectively.

Nitrogen is one of the main component of amino acids and consequently protein molecules, so the application of nitrogen fertilizer to oil seed rape crop increased the biosynthesis of amino acids and consequently increased protein concentration in seeds. The increase in protein content in seeds in result of increasing N rates was reported by many investigators (Asara and Scarisbock, 1995, Anderson *et al.*, 1996; and Bernnan *et al.*, 2000).

The data also showed that protein content in seeds was significantly affected by the interaction between N and P rates only in 1998/99 season, where the maximum value was obtained from the application of P at a zero rate (check) and N at a rate of 60 kg N/fed. The significant influence here is mainly due to the effect of N fertilizer.

IV- Protein yield:

The data showed that protein yield/fed was significantly affected by all factors under studies in both seasons.

It is also clear from these data that protein yield of AD201 variety was higher than Tower variety by 7.02 and 6.59% in 1997/98 and 1998/99 seasons, respectively. The increase in protein yield of AD201 may be due to the increase in seed yield/fed and/or protein content in seeds. The data of 1997/98 season, showed that protein yield were higher when P was applied at a rates of zero or 15.5 kg P_2O_5/fed. The increased in protein yield in check treatment may be due the increase in protein content in seeds where the highest value was obtained (21.28) while the

Table (2): Effect of nitrogen and phosphorus fertilizers on oil content of two oil seed rape varieties in 1997/98 and 1998/99 seasons.

Varieties	Phosphorus fertilizers kg P_2O_5/fed.	Nitrogen fertilizer (kg/fed.)							
		1997/98				1998/99			
		30	45	60	Mean	30	45	60	Mean
AD201	Zero	40.52	40.10	37.88	39.50	39.06	36.88	38.19	38.04
	15.5	38.19	36.79	37.46	37.48	37.96	38.65	36.31	37.64
	31.0	41.02	40.73	42.98	41.57	39.15	38.67	37.38	38.40
Mean		39.91	39.21	39.44	39.52	38.72	38.07	37.29	38.03
Tower	Zero	38.38	38.77	34.26	37.14	38.46	36.73	38.11	37.77
	15.5	45.32	40.26	41.39	42.32	40.41	37.14	35.58	37.71
	31.0	41.92	37.60	40.93	40.15	35.65	35.52	34.77	35.31
Mean		41.87	38.88	38.86	39.87	38.17	36.46	36.15	36.93
Phosphorus x Nitrogen Fertilizer	Zero	39.45	39.44	36.07	38.32	38.76	36.81	38.15	37.91
	15.5	41.75	38.53	39.42	39.90	39.19	37.89	35.94	37.67
	31.0	41.48	39.17	41.95	40.87	37.40	37.09	36.08	36.85
Mean		40.89	39.05	39.14		38.45	37.26	36.72	

L.S.D. 5% for

Varieties (V)	:	N.S.	**V x P**	:	N.S.	**Varieties (V)**	:	N.S.	**V x P**	:	N.S.
Phosphorus (P)	:	N.S.	**V x N**	:	2.03	**Phosphorus (P)**	:	N.S.	**V x N**	:	N.S.
Nitrogen (N)	:	N.S.	**P x N**	:	N.S.	**Nitrogen (N)**	:	N.S.	**P x N**	:	N.S.
			VPN	:	3.51				**VPN**	:	N.S.

Table (3): Effect of nitrogen and phosphorus fertilizers on oil yield (kg/fed.) of two oil seed rape varieties in 1997/98 and 1998/99 seasons.

Varieties	Phosphorus fertilizers kg P_2O_5/fed.	Nitrogen fertilizer (kg/fed.)							
		1997/98				1998/99			
		30	45	60	Mean	30	45	60	Mean
AD201	Zero	304.51	338.85	321.98	321.78	240.22	246.53	257.59	248.11
	15.5	305.52	320.07	301.55	309.05	249.59	266.00	247.81	254.46
	31.0	326.11	316.88	357.81	333.60	262.60	263.44	265.87	263.97
Mean		312.05	325.27	327.11	321.48	250.80	258.65	257.09	255.51
Tower	Zero	268.66	278.27	269.80	272.24	206.24	232.32	245.81	228.12
	15.5	326.30	324.09	331.12	327.17	229.33	220.24	258.89	236.15
	31.0	293.51	276.91	350.97	306.95	216.22	219.09	255.99	230.43
Mean		296.16	292.91	317.30	302.12	217.26	223.88	253.56	231.57
Phosphorus x Nitrogen Fertilizer	Zero	286.59	308.56	295.89	297.01	223.23	239.43	251.70	238.12
	15.5	315.91	322.08	316.34	318.11	239.46	243.12	253.33	245.30
	31.0	309.81	296.62	354.39	320.27	239.41	241.26	260.93	247.20
Mean		304.11	309.09	322.21		234.03	241.27	255.32	

L.S.D. 5% for

Varieties (V)	:	N.S.	**V x P**	:	N.S.	**Varieties (V)**	:	N.S.	**V x P**	:	N.S.
Phosphorus (P)	:	N.S.	**V x N**	:	28.28	**Phosphorus (P)**	:	N.S.	**V x N**	:	N.S.
Nitrogen (N)	:	N.S.	**P x N**	:	N.S.	**Nitrogen (N)**	:	N.S.	**P x N**	:	N.S.
			VPN	:	48.98				**VPN**	:	N.S.

Table (4): Effect of nitrogen and phosphorus fertilizers on protein content in seeds of two oil seed rape varieties in 1997/98 and 1998/99 seasons.

Varieties	Phosphorus fertilizers kg P_2O_5/fed.	Nitrogen fertilizer (kg/fed.)							
		1997/98				1998/99			
		30	45	60	Mean	30	45	60	Mean
AD201	Zero	21.20	19.21	22.20	20.87	18.60	20.19	21.25	20.01
	15.5	19.15	21.55	21.03	20.58	18.69	20.51	20.00	19.73
	31.0	20.89	21.22	20.94	21.02	19.08	19.19	20.57	19.61
Mean		20.41	20.66	21.39	20.82	18.79	19.96	20.61	19.79
Tower	Zero	21.53	21.66	21.89	21.69	18.56	19.53	21.63	19.91
	15.5	19.95	20.33	20.88	20.39	18.82	20.79	20.15	19.92
	31.0	21.45	20.20	20.21	20.62	18.87	19.03	20.88	19.59
Mean		20.98	20.73	20.99	20.90	18.75	19.78	20.89	19.81
Phosphorus x Nitrogen Fertilizer	Zero	21.36	20.44	22.04	21.28	18.58	19.86	21.44	19.96
	15.5	19.55	20.94	20.96	20.48	18.66	20.65	20.08	19.80
	31.0	21.17	20.71	20.58	20.82	18.96	19.11	20.73	19.60
Mean		20.69	20.70	21.19		18.73	19.87	20.75	

L.S.D. 5% for

Varieties (V)	:	N.S.	**V x P**	:	N.S.	**Varieties (V)**	:	N.S.	**V x P**	:	N.S.
Phosphorus (P)	:	N.S.	**V x N**	:	N.S.	**Phosphorus (P)**	:	N.S.	**V x N**	:	N.S.
Nitrogen (N)	:	N.S.	**P x N**	:	N.S	**Nitrogen (N)**	:	N.S.	**P x N**	:	1.32
			VPN	:	N.S.				**VPN**	:	N.S.

Table (5): Effect of nitrogen and phosphorus fertilizers on protein yield of two oil seed rape varieties in 1997/98 and 1998/99 seasons.

Varieties	Phosphorus fertilizers kg P_2O_5/fed.	Nitrogen fertilizer (kg/fed.)							
		1997/98				1998/99			
		30	45	60	Mean	30	45	60	Mean
AD201	Zero	159.0	162.0	188.0	169.6	114.4	134.9	143.3	130.8
	15.5	153.0	187.0	169.0	169.6	122.8	141.2	136.5	133.5
	31.0	166.0	165.0	174.0	168.3	127.9	130.7	146.3	134.9
Mean		159.3	171.3	177.0	169.2	121.7	135.6	142.0	133.1
Tower	Zero	150.0	155.0	172.0	159.0	99.5	123.5	139.5	120.8
	15.5	144.0	164.3	167.0	158.4	106.8	123.2	146.5	125.5
	31.0	150.0	148.0	173.0	157.0	114.5	140.1	130.5	128.3
Mean		148.0	155.7	170.6	158.1	106.9	128.9	138.8	124.87
Phosphorus x Nitrogen Fertilizer	Zero	154.5	158.5	180.0	164.3	106.9	129.2	141.4	125.8
	15.5	148.5	175.6	168.0	164.0	114.8	132.2	141.5	129.5
	31.0	158.0	156.5	173.5	162.6	121.2	135.4	138.4	131.6
Mean		153.6	163.5	173.8		114.3	132.2	140.4	

L.S.D. 5% for									
Varieties (V)	:	1.51	**V x P**	:	1.77	**Varieties (V)**	:	1.87	**V x P** : 0.92
Phosphorus (P)	:	0.93	**V x N**	:	1.77	**Phosphorus (P)**	:	0.65	**V x N** : 1.17
Nitrogen (N)	:	1.23	**P x N**	:	2.16	**Nitrogen (N)**	:	0.82	**P x N** : 1.43
			VPN	:	3.06				**VPN** : 2.03

increase in P rate of 15.5 kg P_2O_5/fed. is mainly due to the increase in seed yield per feddan. The data of 1998/99 showed that P applicate increased protein yield/fed. this is mainly due to the increase in seed yield. Noureldin *et al.* (1995) reported that P application increased protein yield.

The data also revealed that increasing N rates increase protein yield/fed in both seasons, this is due to the increase in seed yield and/or protein content. Protein yield/fed. was significantly affected by all interaction in both seasons, the highest value was obtained from AD201 variety when supplied with P at zero and N at its highest rate this is true in 1997/98 season, while in 1998/99 season this value was obtained from Tower variety when received P at a rate of 15.5 kg P_2O_5/fed. and N at a rate of 60 kg or from AD201 when received P and N at its highest rates.

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سلوك صنفين من الراب تحت مستويات مختلفة من التسميد الازوتى والفوسفاتى

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أجريت تجربتان حقليتان في موسمى النمو ١٩٩٨/٩٧ و ١٩٩٩/٩٨ لدراسة تأثير كل من التسميد الآزوتى (٣٠ ، ٤٥ ، ٦٠ كيلوجرام آزوت للفدان) والفوسفاتى (صفر ، ١٥,٥ ، ٣١,٥ كيلوجرام فوأه / للفدان) على جودة بذور صنفين من أصناف الراب Tower, AD201 تحت ظروف منطقة أسيوط . ولقد كانت الزراعة فى ٢ نوفمبر و ٣٠ أكتوبرفى الموسم الأول والثانى على التوالى حيث زرعت البذور على خطوط بمسافة ٥٠ سم فى جور المسافة بينها ١٥ سم مع ترك نباتين فى الجورة الواحدة . وكان تصميم القطع المنشقة هو المستخدم حيث وضعت الاصناف فى القطع الرئيسية ومعدلات الفوسفور والآزوت فى القطع المنشقة الاولى والثانية على التوالى مع مساحة للقطعة ١٠,٥ م٢ مع استخدام أربع مكررات . ولقد أخذت عينات من البذور ممثلة للمعاملات من كل المكررات وتم تحليل الزيت والبروتين بها . كما تم تقدير حساب محصول الزيت والبروتين وذلك بضرب محصول البذور فى نسبة الزيت أو البروتين ولقد تم تحليل البيانات احصائيا لكل موسم على حده وأستخدم أقل فرق معنوى عند ٥% لمقارنة المتوسطات .

ولقد أظهرت النتائج ما يلى :

- وجد أنه ليس هناك فروق معنوية بين الأصناف فى كل الصفات التى درست فى كلا الموسمين ماعدا محصول البروتين للفدان فى الموسمين حيث كان محصول البروتين للصنف AD201 والصنف Tower فى موسم ١٩٩٨/٩٧ هو ١٦٩,٢٠ و ١٥٨,١ كيلوجرام للفدان ، ١٣٣,١ و ١٢٤,٨٧ كيلوجرام فى الموسم ١٩٩٩/٩٨ وكان محصول الزيت للصنف AD201 والصنف Tower فى موسم ١٩٩٨/٩٧ هو ٣٢١,٤٨ و ٣٠٢,١٢ كيلوجرام للفدان أما فى موسم ١٩٩٩/٩٨ فكان ٢٥٥,٥١ و ٢٣١,٥٧ كيلوجرام للفدان للصنفين بنفس الترتيب . وهذا الاختلاف يرجع أساسا الى الاختلاف فى محصول البذور للصنفين بدرجة أكبر من نسبة الزيت أو البروتين

أثر التسميد الفوسفاتى معنويا فقط على محصول البروتين فى كلا الموسمين . ولقد أدى استخدام التسميد الفوسفات الى زيادة محصول الزيت والبروتين وأدى نقص نسبة البروتين فى كلا الموسمين ونقص نسبة الزيت فى موسم واحد .

وجد أن استخدام التسميد الآزوتى لم يؤثر معنويا على كل الصفات ماعدا محصول البروتين للفدان فى كلا الموسمين . وجد أن زيادة معدل السماد الآزوتى من ٣٠ إلى ٤٥ أو ٦٠ كيلوجرام للفدان أدى الى نقص نسبة الزيت وزيادة نسبة البروتين فى البذور ومحصول البروتين للفدان كذلك أدى الى زيادة محصول الزيت نتيجة زيادة محصول البذور للفدان بالرغم من نقص نسبة الزيت .

وعموما وجد أن أعلى محصول من الزيت فى موسم ١٩٩٨/٩٧ أمكن الحصول عليه من الصنف AD201 عندما سمدت نباتاته بكل من الفوسفور والآزوت بمعدلاتهم العالية . أما فى موسم ١٩٩٩/٩٨ فإن أعلى قيمة من محصول الزيت أمكن الحصول عليها من الصنف AD201

عندما سمدت نباتاته بمعدل ١٥,٥ كيلوجرام بو٢أه و ٤٥ كيلوجرام أزوت للفدان . كذلك وجد أن أعلى محصول من البروتين للفدان أمكن الحصول عليه من الصنف AD201 في موسم ١٩٩٨/٩٧ عندما سمدت نباتاته بمعدل صفر فوسفور ومعدل ٦٠ كيلوجرام أزوت للفدان . أما في موسم ١٩٩٩/٩٨ فكانت أعلى قيمة من محصول البروتين من الصنف Tower عندما سمدت نباتاته بمعدل ١٥,٥ كيلوجرام بو٢أه للفدان و ٦٠ كيلوجرام أزوت للفدان أما الصنف AD201 عندما سمدت نباتاته بالأزوت بمعدل ٦٠ كيلوجرام والفوسفور بمعدل ٣١,٥ كيلوجرام بو٢أه للفدان .