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EFFECT OF LEAF NUTRITION AT DIFFERENT STAGES OF DEVELOPMENT ON ACHENE AND OIL YIELD OF SUNFLOWER

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SUMMARY

Effect of nitrogen and phosporus nutrition applied to leaves was studied in field experiments at differents stages of development of sunflower during 1987–1988. In 1987, 5, 10, 15 and 20 kg/ha N and 5+5, 10+10, 15+15, 20+20 kg/ha N was used as chemical leaf fertilizer at the stage of budding and budding+10% flowering, respectively. In the next year, at budding stage all the plots were sprayed with dose of 10 kg/ha N as a basic treatment with the aim to increase the achene yield. At full bloom, these plots have additionally been treated with 1, 3, 5 and 7 kg doses of P for increasing the oil content. The greatest head diameter, achene yield/head and oil yield/head have been achieved with doses 10 kg/ha (at budding stage) and 10+10 kg/ha N (budding+10% flowering stage). Achene oil content was decreased by treatments with N, whereas doses of P applied at full bloom had no effect on it. Effect of increasing N–doses may be fitted to a quadratic equation.

Key words: nitrogen, phosphorus, leaf nutrition, bud stage, flowering

INTRODUCTION

Out of agrotechnical factors yield of sunflower is determined mainly by mineral nutrition, namely, by that of nitrogen. In the literature there are different opinions concerning N fertilization. With increase in N supply, the head diameter, 1000–seed weight and achene yield increase as well (Nur, 1975; Steer et al., 1986; Vannozzi et al., 1990). Kádár and Vass (1988) found that N fertilizers alone caused yield decrease on acidic sandy soil. Increasing doses of N had a negative effect on achene oil content (Usman et al., 1980; Szirtes, 1984; Lukács 1986;), whereas Vranceanu (1977) found that an adequate N supply during flowering might augment the achene oil content. The oil yield determined by achene yield and oil content may be positively influenced by proper timing of N supply (Steer et al., 1984).

As for phosphorus, which is closely related to N, Varghese et al., (1976) and Singh et al., (1977) stated that P fertilizers had no significant effect on yield; nevertheless, they had a positive effect on oil content.

Seed yield and its quality may be increased by regulating the nutrient supply according to the needs of the plant (Debreczeni, 1982), and one of the approaches is the nutrition through leaf.

The present study was designed to investigate the effect of N leaf fertilizers supplied at different stages of development as well as that of P applied in full bloom on achene and oil yield of sunflower.

MATERIALS AND METHODS

Effect of leaf nutrition by fertilizers was studied in 1987–1988 at the Experiment Station of Agricultural University of Gödöllö at Nagygombos situated 60 km the east of Budapest. This is a relatively humid region. Precipitation during vegetation period (from April to September) was in 1987 and 1988 390 mm and 289 mm, respectively. Experiments were conducted on the meadow chernoziom soil pH 6.6 (KCl) containing 2,6% humus and medium level of utilizable P and K. The experiments were accomplished as one–factorial randomized block design in 4 replications with sunflower hybrid Topflor. Both years the preceding crop was winter wheat, subsequently, the soil was supplied with 250 kg/ha NPK as basic fertilizer. Leaf fertilizers were sprayed from a portable pressure sprayer. Time of treatments applied in 1987: bud stage (R–1) and budding+10% flowering (R–1+R–5 10%); in 1988: R–1+R–6 (full bloom) (McBried et al., 1985). Treatments are summarized in Table 1. At maturity, head diameter, 1000–seed weight, achene yield/head, achene oil content were measured and oil yield calculated. Results were evaluated by variance analysis, regression analysis and correlation calculation.

RESULTS AND DISCUSSION

The effect of increasing doses of N supplied in 1987 during bud stage (R–1) and during R–1+10% flowering is shown in Table 2 and Table 3. In comparison with untreated control the head diameter increased with increasing N levels, except in 20+20 kg/N treatment. Maximum head diameters were found with 10 kg/ha N (R–1 stage, Table 2) and 10+10 kg/ha N (R–1+R–5 stage, Table 3). The effect of increasing N doses fits to the quadratic equation (Figure 1. a, b).

In 1987 the highest 1000–seed weight (59,3 g) was found with 5 kg/ha N in stage R–1 (Table 2) and (61,3 g) with 10+10 kg/ha N at R–1+R–5 stage (Table 3, Figure 1. c, d).

The achene yield/head had a similar tendency as head diameter and 1000–seed weight with the difference that its maximum value was found with 10 kg N at R–1 stage (78,0 g, Table 2). In stage R–1+R–5 the highest yield/head (85,7 g) was achieved with 10+10 kg/ha N (Table 3, Figure 1. e, f).

Achene oil content was negatively affected by different doses of N (Table 2). Its decrease was linear in R–1 stage (Figure 2.a), and in R–1+R–5 stage it slightly changed with increasing N doses (Figure 2.b).

The tendency of oil yield/head was similar to that of achene yield/head. Maximum oil yield in R–1 and R–1+R–5 stage was 36,3 g (Table 2, Figure 2. c) and 39,3 g (Table 3, Figure 2. d), respectively.

In 1988, the dose of 10 kg/ha N, found optimal in 1987 year's experiments, was applied to all plots as a basic treatment. At bud stage and in full bloom different doses of P were sprayed with the aim to increase achene oil content. The results are presented in Table 4. The head diameter was not significantly affected by the treatments. Nevertheless, the maximum value was found with 10 kg/ha N only in stage R–1 (Figure 3 a).

Achene yield/head, 1000–seed weight and oil yield reached maximum at the N level of 10 kg/ha (sprayed in R–1 stage) but it was not significantly different from the effect of P–doses sprayed on the plants during full bloom (treated already in R–1 with 10 kg/ha N as basic dose, Figure 3. b, c, d). Neither N nor P treatments had a significant effect on achene oil content.

Table 1. Treatments applied during vegetation period

1987				1988		
Carbamide (3%)= 46.3% N Stage R–1 N kg/ha	Hidronit–30(2%)= 15%Carbamide+15% NH_4NO_3 Stage R1 + R–5 N kg/ha			Carbamide(3%) 46.3% N Stage R–1 N kg/ha	+	Fitohorm P(2%) =18% P_2O_5 R–6 P kg/ha
0	0	+	0	0	+	0
5	5	+	5	10	+	0
10	10	+	10	10	+	1
15	15	+	15	10	+	3
20	20	+	20	10	+	5
				10	+	7

Table 2. Effect of different doses of nitrogen during bud formation (1987)

N treatment (kg/ha)	Bud formation /R–1/				
	Head diameter (cm)	1000 seed weight (g)	Seed yield (g/head)	Oil content (%)	Oil yield (g/head)
0	17.7	51.3	59.7	47.4	28.3
5	18.7	59.3	72.1	47.2	34.0
10	19.7	55.0	78.0	46.5	36.3
15	18.9	55.0	73.8	45.2	33.4
20	18.6	53.0	66.6	44.8	29.1
LSD5%	0.71	3.50	3.33	1.95	2.62

Table 3. Effect of different nitrogen doses during bud formation and in the beginning of flowering

N treatment (kg/ha)	Bud formation /R–1/ + 10% bloom (R–5)				
	Head diameter (cm)	1000 seed weight (g)	Seed yield (g/head)	Oil content (%)	Oil yield (g/head)
0	17.7	51.3	59.7	47.4	28.3
5 + 5	18.6	59.0	74.2	45.4	33.7
10 + 10	19.3	61.3	85.7	45.8	39.3
15 + 15	19.0	58.3	79.0	45.1	35.6
20 + 20	17.9	51.0	62.2	46.0	28.6
LSD5%	0.70	4.20	3.17	1.48	0.94

Table 4. Effect of 10 kg/ha nitrogen and different phosphorus doses applied during bud development and in full bloom, respectively

N+P treatment (kg/ha)	Bud formation (R–1) + full bloom (R–6)				
	Head diameter (cm)	1000 seed weight (g)	Seed yield (g/head)	Oil content (%)	Oil yield (g/head)
0 + 0	15.3	49.1	66.7	48.8	32.5
10 + 0	16.1	53.5	83.6	48.3	40.4
10 + 1	15.7	52.6	76.4	48.3	36.9
10 + 3	15.3	52.3	78.6	48.5	38.1
10 + 5	15.5	52.4	80.6	48.5	39.1
10 + 7	15.4	48.9	65.0	48.5	31.5
LSD5%	NS	2.83	7.2	NS	3.27

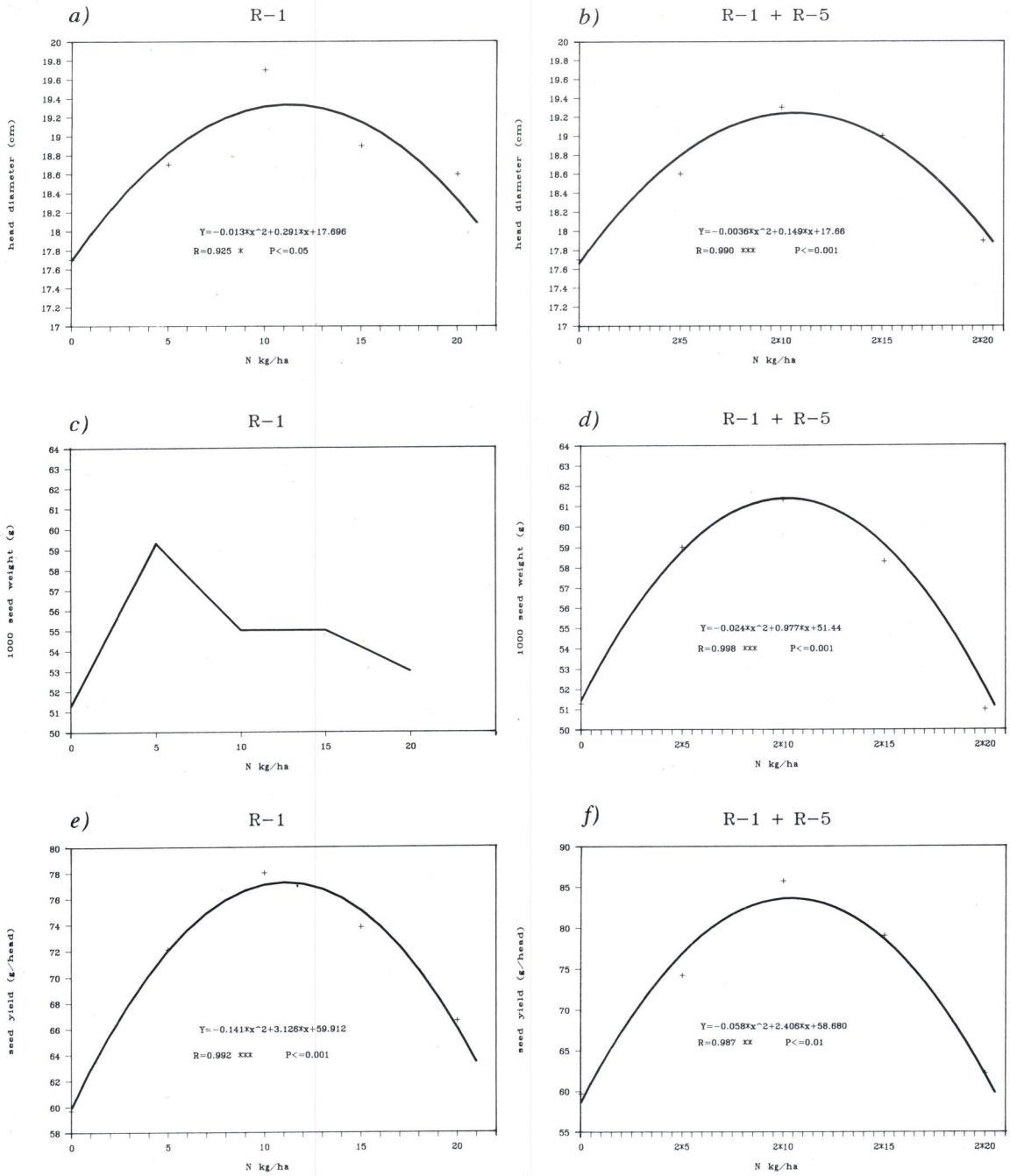

Figure 1. (a–f) Effect of different doses of nitrogen on head diameter, 1000–kernel weight and achene yield applied during bud formation (R–1) and at 10% flowering stage (R–1 + R–5 stages)

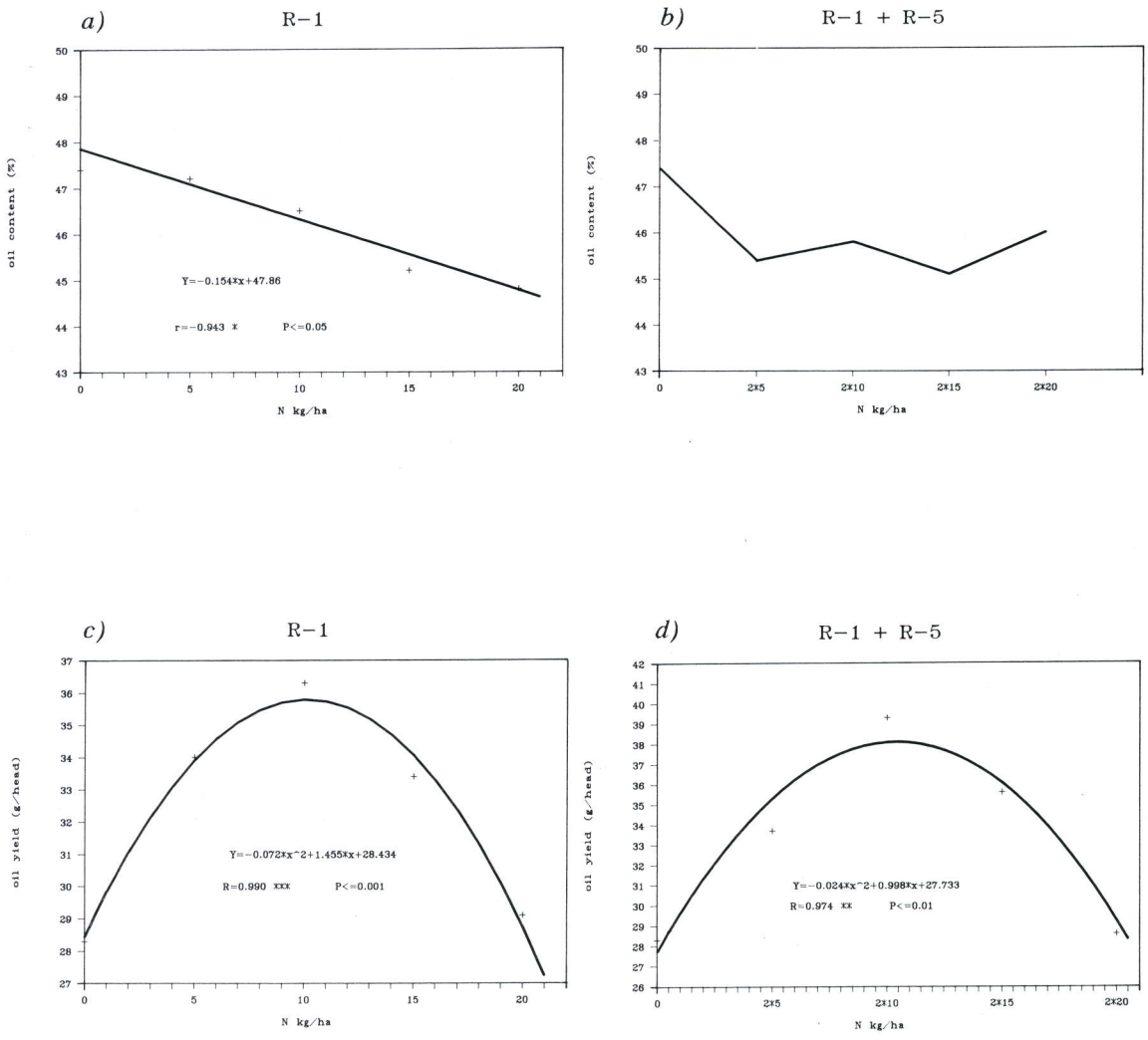

Figure 2. (a–d) Effect of nitrogen doses on achene oil content and oil yield applied at bud stage and at 10% blooming

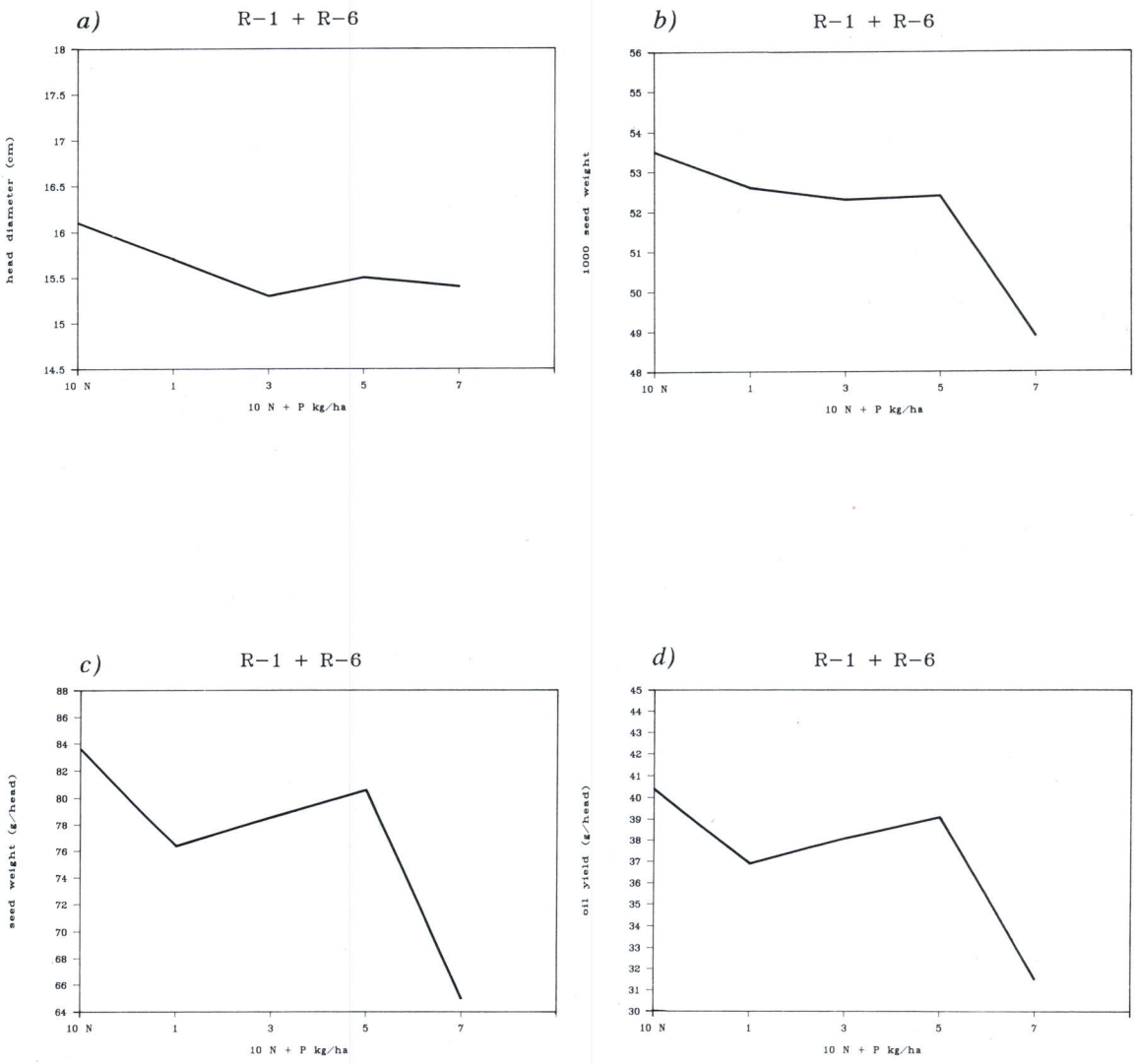

Figure 3. (a–d) Development of some yield components under the effect of 10 kg/ha nitrogen (at budding R–1 stage) + different phosphorus doses applied in full bloom (R–6 stage)

CONCLUSIONS

1. By treatment of leaves in bud stage with nitrogen fertilizer head diameter and 1000–kernel weight can be increased which in turn ensures higher achene yield.

2. In the beginning of flowering a further treatment with N had a slight positive effect on 1000–kernel weight and achene yield but the head diameter did not change significantly any more.

3. Correlation of N–doses and yield components may be fitted to the quadratic equation.

4. Achene oil content decreased due to treatments with N, nevertheless, oil yield increased in consequence to higher achene yield.

5. Treatments with P did not increase significantly the yield components studied.

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EFECTO DE LA NUTRICION FOLIAR SOBRE EL RENDIMIENTO EN AQUENIOS Y ACEITE DEL GIRASOL A DIFERENTES ESTADOS DE DESARROLLO

RESUMEN

El efecto de la nutrición de nitrógeno y fósforo aplicado a las hojas fue estudiado en experimentos de campo en estados diferentes de desarrollo de girasol durante 1987–1988. En 1987 5, 10, 15 y 20 Kg/Ha de N y 5+5, 10+10, 15+15 y 20+20 Kg/Ha de N fueron usados con fartilizante químico foliar en el estado de botón floral (prefloración) botón + 10% de floración respectivamente. En el próximo año, al estado de botón floral todas las parcelas fueron pulverizadas con dosis de 10 Kg/Ha N como un tratamiento básico con el objetivo de incrementare al rendimianto de aquenioc. En floración completa, estas parcelas fueron tratadas adicionalmente con dosis de 1, 3, 5 y 7 Kg de P para incrementar el contenido de aceite. Los mayores diámetros de capítulos, rendimiento de aquenios por capítulo y rendimiento de aeeite por capítulo fueron alcanzados con dosis de 10 kg/Ha (al estado de botón) y 10+10 Kg/Ha N (botón + 10% de floración). El contenido de aceite de aquenios decreció por tratamientos con N mientras dosis de P aplicados en completa floración no tuvieron efecto. El efecto del incremento en dosis do N puede ser ajustado a una ecuación cuadrática.

EFFET DE LA NUTRITION FOLIAIRE APPLIQUÉE À DIFFÉRENTS STADES DE CROISSANCE SUR LE RENDEMENT EN GRAINE ET EN HUILE.

RÉSUMÉ:

L'effet de la nutrition nitrogénée et phosphatée, appliquée au niveau foliaire à différents stades, a été étudié en parcelles expérimentales au cours des années 1987-1988. En 1987, 5, 10, 15 et 20 kg/ha d'azote ou 5+5, 10+10, 15+15 et 20+20 kg/ha d'azote ont été appliqués sous forme de fertilisant foliaire au stade boutonisation et boutonisation + 10% de plantes fleuries. L'année suivante, la parcelle a été traitée au stade boutonisation avec 10 kg/ha d'azote comme traitement de base afin d'augmenter le rendement en graines. A pleine floraison ces parcelles ont été traitées avec des doses de 1,3,5 et 7 kg de phosphore pour augmenter la teneur en huile.Le plus grand diamétre des capitules, les meilleurs rendement en graines et en huile par capitule ont été obtenus avec les doses de 10 kg/ha (stade boutonisation) et 10+10 kg/ha (boutonisation + 10% de plantes en fleur). Le contenu en huile des graines a été diminué par les traitements azotés alors que les doses de phosphore appliquées à pleine floraison n'ont eu aucun effet. L'effet de l'augmentation due à la fertilisation azotée a pu être estimé par une équation quadratique.