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# Effect of Nitrogen Fertilization Level and Foliar Application of Some Nutrient Compounds on Some Flax Varieties

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TWO field experiments were carried out at El-Gemmeiza Agricultural Research Station during 2002/2003 and 2003/2004 seasons to study the effect of nitrogen fertilization level ( 0, 30 and 60 kg N /fed) and foliar application of some nutrient compounds (without spraying, mixture of ascorbic acid and citric acid, nofatrin) on growth, yield and quality of three flax varieties ( *Linum usitatissimum* L.), *i.e.*, two local varieties (Sakha 1 and Sakha 2) and imported one (Blenka ).

The obtained results could be summarized as follows:

- Sakha 1 var. significantly surpassed Sakha 2 and Blenka in total plant height and straw yield per feddan and fiber length whereas Sakha 2 var. significantly surpassed Sakha 1 var. in main stem diameter, and seed and oil yields per feddan in both seasons.

- Blenka var. significantly surpassed Sakha 1 and Sakha 2 varieties in fiber yield per feddan and fiber fineness. Application of 60 kg N/fed gave the highest values for all studied characters , except fiber fineness.

- Spraying of organic acids surpassed other foliar treatments in plant height, straw and fiber yields per feddan and fiber fineness, while nofatrin was superior in seed and oil yields per feddan and main stem diameter in both seasons.

- The highest seed and oil yields/fed were obtained from Sakha 2 when fertilized with 60 kg N, whereas the highest value of fiber length was taken from Sakha 1 when fertilized with 60 kg N/fed. Finally, spraying Blenka and Sakha 1with organic acid under 30 kg N/fed gave the best fineness and fiber length.

**Keywords:** Flax, Nitrogen fertilizer, Nutrient compounds.

In Egypt flax ( *Linum usitatissimum* L. ) is ranked second after cotton as a fiber crop regarding the cultivated area or its importance in industry. In the recent years, many efforts were devoted to increase the productivity of the flax through improving the soil fertility by enhancing their macro elements particularly from ,

*i.e.*, nitrogen as it plays an important role during the different growth stages of flax plants and has significant effects on yield and its components.

Hella *et al.* (1987), Abo-Shatia *et al.* (1996) and Sharief (1999) observed that flax growth characters, *i.e.* total plant height, technical length, stem diameter as well as fiber yield / fed and seed index were significantly increased as nitrogen level was increased from 0 to 60 kg N/fed. Also , Freer (1992) reported that the increase of flax seed yield due to increasing N rate up to 120 kg N /ha, was associated with a slight decrease of seed oil content. Moreover, Aida *et al.* (1994) showed that, the best values of technical length, stem diameter, straw and seed yield / fed, number of capsules, seed yield / plant and seed oil content of flax were obtained with NPK mineral fertilization in combination with fungicide monceren conbi followed by single NPK mineral fertilization and dual bacterization in combination with fungicide, respectively.

Furthermore, spraying flax plants with some nutrient compounds, such as organic acids ameliorated the growth and yield characters due to their remarkable role in plant metabolism, El- Gazzar (2000) found that citric acid application significantly increased crop growth rate, relative growth and seed oil yield / fed of flax. Ascorbic acid is implicated in some nutritional cycles activity and some vital proeesses in plant such as electron transport system which affect plant growth and development

It is worthy to mention that, due to the decrease of micro- nutrient elements in Nile water after the construction of High Dam at Aswan, Nabhan (1966) reported that the relatively low availability of most of these elements in Egyptian soil affect soil fertility to a great extent. The deficiency of these micro- elements in plant nutrition cause some changes in physiological and biochemical processes resulting in reduction of growth, delay of development and quantitative decrease of yield (Blanarik & Milan, 1975). Also, El-Gazzar (2000) concluded that nofatrin application significantly increased straw and fiber yield/fed. In addition, citric acid application also had the same effect on crop growth rate , relative growth rate and seed oil yield / fed.

Therefore , the aim of this investigation was to study the effect of nitrogen fertilization level and foliar application of some nutrient compounds on growth, yield and quality of some flax varieties .

## Material and Methods

Two field trials were conducted at El-Gemmeiza Res. Station, Gharbia Governorate, through the two successive seasons 2002/2003 and 2003/2004 . The present research was planned to study the influence of soil fertilizations with nitrogen and foliar application of some nutrient compounds, on some growth properties, yield and yield components for three flax varieties .

Each experiment included 27 treatments which were the combination of 3 varieties (Sakha 1, 2 and Blenka), 3 N levels (0, 30, 60 kg/fed) and 3 foliar application treatments [without spraying, mixture of ascorbic acid and citric acid, at the rate of 250 ppm for each one (500 ppm as a whol) and nofatrin (NPK , Fe , Mn , Zn, B and Mo) at the rate of 1 l/fed]. Manual sprayers were used and the size of the sprayer was 400 l of water per feddan. The design of the experiment was split split plot with four replications. Main plots consisted of verities, the nitrogen levels were allocated to sub- plots, while foliar applications were assigned to sub- sub plots.

Nitrogen levels were soil added before first and second irrigations in the form of urea (46.5 % N ) .Foliar spraying were tried after 45 and 75 days from sowing. The sub sub plot area was 2 x 3 m (1/700 fed). Flax seeds were broadcasted at the rate of 40 kg/fed for Blenka variety and 25 kg /fed for the other two varieties. The date of sowing was 5 November in the first season and 3 November in the second one. Phosphorus at a rate of 15 kg $P_2O_5$ in the form of ordinary superphosphate (15.5% $P_2O_5$) was applied to all plots and the other normal cultural practices were applied as used in flax fields. The experimental sites were preceded by cotton in the first season and maize in the second one.

The soil texture of the experimental field is clay loam, and the chemical and mechanical analyses are presented in Table 1 for the two seasons. The table also shows the nutrient contents of available N (Jackson, 1967), the available P (Olsen *et al.*, 1954) and the available K (Pipper, 1950).

**TABLE 1. Soil mechanical and chemical analyses of upper 50 cm of soil in 2002/2003 and 2003/ 2004 seasons.**

| Priority | 2002/03 season | 2003/04 season |
|---|---|---|
| Mechanical analysis | | |
| Sand (%) | 28.4 | 31.7 |
| Silt (%) | 26.1 | 30.8 |
| Clay (%) | 45.5 | 37.5 |
| Soil texture | Clay loam | Clay loam |
| Chemical analysis | | |
| pH (1: 2.5 soil water suspension) | 7.50 | 8.02 |
| EC. (ds/m)in soil : water ext (1:5) | 0.43 | 0.40 |
| $CaCO_3$ (%) | 1.88 | 1.59 |
| Organic matter (%) | 2.18 | 2.01 |
| SAR (%) | 1.78 | 2.04 |
| SSP (%) | 46.00 | 39.81 |
| Available macronutrients (ppm) | | |
| N | 24.5 | 31.50 |
| P | 16.60 | 18.24 |
| K | 379.0 | 342.0 |
| Soluble ions (ppm) | | |
| $Fe^{+2}$ | 8.30 | 8.10 |
| $Mn^{+2}$ | 4.93 | 5.13 |
| $Zn^{+2}$ | 1.41 | 1.35 |
| $Cu^{+2}$ | 1.28 | 1.84 |

Source: Soils and Water Research Institute, El- Gemmiza Province.

For determining some of growth characters, ten plants were taken randomly at harvest to measure, plant height(cm) and main stem diameter (mm). All plots were harvested to determine, straw yield /fed(ton), seed yield (ton /fed) and fiber yield (kg/fed). Oil yield was calculated by multiply seed yield by oil percentage . Flax fiber were separated from the stems by using retting process. Fiber length was determined in (cm). Fiber fineness in metrical number (Nm) was determined as described by Radwan & Momtaz (1966), as follows; Metrical number (Nm) expressing the fineness was obtained by the following formula:

$$Nm = \frac{N \times L}{G} \quad \text{where;}$$

Nm = Metrical number

N= Number of fibers
L= length of fibers in (mm)
G= weight of fibers in (mg).

Seed oil content , was determined as adopted by the methods of A.O.A.C. (2000) with Soxhelt apparatus using petroleum ether ( 40 – 60°C).

*Statistical analysis*

Data obtained were statistically analysed according to procedures outlined by Snedecor & Cochran (1967), the least significant difference (L.S.D.) test at 5% level of significance was used to compare treatment means.

## Results and Discussion

*Growth characters*

Tables 2 , 3 ,4 and 5 cleared that, there were significant differences among the studied varieties in plant height and main stem diameter in both seasons .In the first season Sakha 1 var. pronounced its superiority for the two tested characters, followed by Sakha 2 var., whereas, Blenka var. gave the lowest values. While in the second season, the arrangement of these studied varieties changed with regard to main stem diameter where Sakha 2 var. was the first one followed by Sakha 1 . El- Gazzar (2000) and Abou- Zaid (2001) explained these differences depending on the genetically factors and their responses to the environmental conditions.

In both seasons, increasing nitrogen fertilization level from 0 up to 60 kg N/fed enhanced significantly plant height and main stem diameter (cm) (Table 2). These results may be ought to the remarkable effect of nitrogen on stimulation of cell enlargement and hence internode elongation and further increase in cell number and size (Amna, 1987; Amna *et al.*, 1997 and El-Shimy *et al.*, 1993).

TABLE 2. Plant height (cm), stem diameter (mm), straw yield ( ton /fed), fiber yield ( kg/fed) and seed yield/fed as affected by N level and foliar application of organic compounds in the three flax varieties in the two seasons.

| Main effect | Plant height (cm) | | Stem diameter (mm) | | Straw yield (ton/fed) | | Fiber yield (kg/fed) | | Seed yield/fed (ton/fed) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 |
| Variety effect (v) | | | | | | | | | | |
| Sakha 1 | 107.36 | 107.23 | 1.94 | 1.42 | 4.26 | 4.32 | 744.90 | 762.95 | 0.68 | 0.70 |
| Sakha 2 | 104.78 | 105.03 | 1.95 | 1.76 | 4.02 | 3.85 | 724.20 | 644.45 | 0.71 | 0.71 |
| Blenka | 91.26 | 104.48 | 1.10 | 0.78 | 3.83 | 3.74 | 763.30 | 770.26 | 0.41 | 0.39 |
| LSD (0.05) | 2.29 | 1.08 | 0.06 | 0.14 | 0.16 | 0.14 | 13.10 | 19.43 | 0.01 | 0.007 |
| Nitrogen level effect (N) | | | | | | | | | | |
| 0 kg N/fed | 88.21 | 91.20 | 1.10 | 1.07 | 2.88 | 2.98 | 498.76 | 540.70 | 0.57 | 0.55 |
| 30 kg N/fed | 106.66 | 111.64 | 1.75 | 1.37 | 4.62 | 4.18 | 830.40 | 771.05 | 0.60 | 0.61 |
| 60 kg N/fed | 108.52 | 114.67 | 2.17 | 1.50 | 4.59 | 4.74 | 832.30 | 854.85 | 0.65 | 0.64 |
| LSD (0.05) | 1.57 | 0.63 | 0.09 | 0.05 | 0.16 | 0.14 | 18.58 | 19.40 | 0.01 | 0.006 |
| Organic compounds effect (0) | | | | | | | | | | |
| Control | 97.87 | 99.44 | 1.51 | 1.25 | 3.84 | 3.69 | 692.97 | 664.22 | 0.60 | 0.59 |
| Organic acid mixture | 105.23 | 110.14 | 1.66 | 1.26 | 4.29 | 4.21 | 771.35 | 770.31 | 0.60 | 0.60 |
| Nofatrin | 101.83 | 107.43 | 1.85 | 1.43 | 3.98 | 3.96 | 718.44 | 712.33 | 0.61 | 0.62 |
| LSD (0.05) | 1.42 | 0.19 | 0.10 | 0.07 | 0.18 | NS | 14.70 | 22.37 | 0.01 | 0.006 |
| Interaction (VNO) | NS | NS | NS | NS | NS | NS | NS | NS | * | * |

**TABLE 3. Plant height (cm), stem diameter (mm), straw yield (ton/fed), fiber yield (kg/fed) and seed yield (ton/fed) as affected by V x N interaction in the two season.**

| Varieties | Plant height (cm) | | | Stem diameter (mm) | | | Straw yield (ton/fed) | | | Fiber yield (kg/fed) | | | Seed yield (ton/fed) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N level (kg/fed) | | | N level (kg/fed) | | | N level (kg/fed) | | | N level (kg/fed) | | | N level (kg/fed) | | |
| | 0 | 30 | 60 | 0 | 30 | 60 | 0 | 30 | 60 | 0 | 30 | 60 | 0 | 30 | 60 |
| Variety effect (v) | 2002 Seasons | | | | | | | | | | | | | | |
| Sakha 1 | 94.72 | 112.66 | 114.70 | 1.39 | 2.06 | 2.39 | 3.06 | 4.83 | 4.87 | 538.30 | 842.20 | 855.20 | 0.64 | 0.70 | 0.74 |
| Sakha 2 | 92.51 | 110.02 | 111.80 | 1.15 | 2.13 | 2.55 | 2.89 | 4.62 | 4.56 | 477.30 | 760.50 | 764.20 | 0.65 | 0.72 | 0.72 |
| Blenka | 77.42 | 97.30 | 99.07 | 0.76 | 10.6 | 1.48 | 2.70 | 4.43 | 4.35 | 493.70 | 888.70 | 877.60 | 0.36 | 0.40 | 0.41 |
| LSD (0.05) | 2.37 | | | 0.07 | | | NS | | | NS | | | 0.01 | | |
| Variety effect (v) | 2003 Season | | | | | | | | | | | | | | |
| Sakha 1 | 92.63 | 114.79 | 116.05 | 1.23 | 1.58 | 1.46 | 3.15 | 4.78 | 5.05 | 545.40 | 839.5 | 909.70 | 0.65 | 0.68 | 0.73 |
| Sakha 2 | 90.45 | 108.08 | 114.92 | 1.35 | 1.84 | 1.37 | 3.12 | 3.89 | 4.55 | 509.40 | 626.50 | 750.90 | 0.67 | 0.70 | 0.78 |
| Blenka | 90.55 | 112.07 | 113.05 | 0.98 | 2.07 | 1.50 | 2.69 | 3.89 | 4.64 | 546.10 | 717.30 | 905.50 | 0.38 | 0.41 | 0.44 |
| LSD (0.05) | 1.09 | | | 0.11 | | | 0.11 | | | 33.16 | | | 0.02 | | |

**TABLE 4. Plant height (cm), stem diameter (mm), straw yield (ton/fed), fiber yield (kg/fed) and seed yield (ton/fed) as affected by V x O interaction in the two seasons.**

| Treatments | Plant height (cm) | | | Stem diameter (mm) | | | Straw yield (ton/fed) | | | Fiber yield (kg/fed) | | | Seed yield (ton/fed) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Organic compounds (O) | | | Organic compounds | | | Organic compounds | | | Organic compounds | | | Organic compounds | | |
| | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin |
| Variety effect (v) | 2002 Seasons | | | | | | | | | | | | | | |
| Sakha 1 | 101.39 | 111.76 | 108.93 | 1.70 | 1.96 | 2.18 | 4.03 | 4.50 | 4.24 | 708.73 | 794.16 | 733.24 | 0.67 | 0.69 | 0.72 |
| Sakha 2 | 100.24 | 108.63 | 105.46 | 1.83 | 1.88 | 2.12 | 3.84 | 4.28 | 3.95 | 630.50 | 703.70 | 607.30 | 0.69 | 0.71 | 0.73 |
| Blenka | 89.36 | 93.31 | 91.12 | 0.91 | 1.15 | 1.23 | 3.65 | 4.08 | 3.75 | 739.70 | 816.20 | 754.80 | 0.39 | 0.39 | 0.40 |
| LSD (0.05) | 2.46 | | | 0.18 | | | NS | | | 24.73 | | | 0.006 | | |
| Variety effect (v) | 2003 Season | | | | | | | | | | | | | | |
| Sakha 1 | 101.91 | 112.04 | 109.53 | 1.36 | 1.42 | 1.50 | 4.11 | 4.55 | 4.30 | 719.81 | 827.67 | 750.39 | 0.69 | 0.68 | 0.69 |
| Sakha 2 | 99.78 | 108.20 | 105.47 | 1.64 | 1.67 | 1.26 | 3.57 | 4.16 | 3.83 | 585.36 | 681.67 | 630.12 | 0.70 | 0.72 | 0.73 |
| Blenka | 98.15 | 110.21 | 107.30 | 0.77 | 0.70 | 0.85 | 3.53 | 3.94 | 3.75 | 687.56 | 806.61 | 756.49 | 0.41 | 0.42 | 0.43 |
| LSD (0.05) | 1.19 | | | 0.12 | | | 0.19 | | | 38.75 | | | NS | | |

**TABLE 5. Plant height (cm), stem diameter (mm), straw yield (ton/fed), fiber yield (kg/fed) and seed yield (ton/fed) as affected by N x O interaction in the two seasons.**

| Treatments | Pant height (cm) | | | Stem diameter (mm) | | | Straw yield (ton/fed) | | | Fiber yield (kg/fed) | | | Seed yield (ton/fed) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Organic compounds | | | Organic compounds | | | Organic compounds | | | Organic compounds | | | Organic compounds | | |
| | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin |
| Nitrogen level effect (N) | 2002 Season | | | | | | | | | | | | | | |
| 0 kg N/fed | 82.08 | 92.42 | 90.15 | 0.94 | 1.12 | 1.25 | 2.52 | 3.10 | 3.05 | 440.43 | 552.76 | 503.10 | 0.62 | 0.66 | 0.68 |
| 30 kg N/fed | 103.02 | 109.82 | 106.91 | 1.46 | 1.76 | 2.03 | 4.42 | 4.85 | 4.60 | 790.20 | 876.86 | 815.40 | 0.59 | 0.61 | 0.63 |
| 60 kg N/fed | 105.65 | 111.46 | 108.45 | 2.14 | 2.11 | 2.06 | 4.57 | 4.90 | 4.22 | 828.26 | 866.10 | 802.56 | 0.63 | 0.64 | 0.65 |
| LSD (0.05) | 2.63 | | | 0.12 | | | 0.08 | | | 20.43 | | | 0.008 | | |
| Nitrogen level effect (N) | 2003 Season | | | | | | | | | | | | | | |
| 0 kg N/fed | 84.45 | 96.18 | 92.99 | 1.00 | 1.03 | 1.20 | 2.69 | 3.30 | 2.97 | 473.71 | 591.44 | 529.97 | 0.56 | 0.57 | 0.58 |
| 30 kg N/fed | 104.33 | 116.51 | 114.10 | 1.30 | 1.36 | 1.46 | 3.81 | 4.54 | 4.21 | 680.50 | 836.33 | 760.33 | 0.60 | 0.61 | 0.60 |
| 60 kg N/fed | 111.06 | 117.75 | 115.21 | 1.47 | 1.49 | 165 | 4.71 | 4.81 | 4.70 | 838.45 | 879.39 | 846.71 | 0.64 | 0.65 | 0.67 |
| LSD (0.05) | 1.10 | | | 0.10 | | | NS | | | 28.45 | | | NS | | |

Foliar application of nutrient compounds had a significant effect on plant height and main stem diameter in both seasons. The mixture of organic acids gave the tallest plants whereas, Nofatrin recorded the maximum main stem diameter in both seasons. Foliar spraying with organic acids plays an important role in D-glucos production and electron transport system as published by Anton & Bassiem (1998). Moreover, the superiority of nofatrin may be due to its chemical structure, *i.e.*, Zn plays an interesting role in plant metabolism, such as it is considered as cofactor of enzyme. It lends a hand in auxin metabolism that reflects on growth characters.

All the first order interactions (var. x N. level), (var. x Organic compounds) and (N. level x Organic compounds) had substantially effects on plant height and main stem diameter in both seasons. The application of nitrogen at level of 60 kg / fed for Sakha 1 var. surpassed the other treatments and the other studied varieties, followed by Sakha 2 var. under the same fertilizer condition. The imported var. Blenka showed a slight response for nitrogen fertilizer, recording the lowest averages for plant height. As for main stem diameter , the greatest averages were obtained as fertilizing Sakha 2 var. with 60 kg N/fed, whereas Blenka var. awarded the lowest ones without any addition of nitrogen fertilizer. On the other hand, the second order interaction (var. x N. level x Organic compounds) had no significant effect on both studied characters.

*Yield characters*

Data in Tables 2, 3, 4 and 5 cleared that the differences among the three studied varieties for straw, fiber and seed yields /fed, were significant in both seasons. Sakha 1 and the imported var. Blenka pronounced their superiority for fiber yield/fed (kg), as experiencing with the other tested varieties. Whereas, Sakha 2 var. ranked first and awarded the highest averages for seed yield/fed , followed by Sakha 1 and Blenka variety which scored the lowest average. The highest straw yield/fed (ton) was produced by Sakha 1 var.

All the previous studied yield characters were significantly affected by nitrogen fertilizer levels. In both seasons, increasing nitrogen fertilizer levels from 0 up to 60 kg/fed increased significantly straw, fiber, and seed yields/fed. However, the increase of N level beyond 30 kg N /fed did not bring out further significant increase . This superiority may be due to the considerable increase in plant height and stem diameter that was reflected on yield properties, *i.e.*, straw and fiber yield.

Regarding nutrient compounds influence, foliar spraying with the mixture of ascorbic and citric acids was more significantly effective than nofatrin, regarding straw and fiber yield/ fed ,whereas nofatrin reflected its superiority of seed yield /fed in both seasons, as revealed in Tables 2, 3 , 4 and 5 .

The first and second order interactions affected on the previous studied characters between significant or insignificant levels, in both seasons, *i.e.* (var. x N level) in the first season had no significant impact on straw and fiber yield/fed. While, it revealed significant effect in the second one. Also, the second order interaction had no significant effect on both of them but seed yield/fed was significantly affected with (var. x N level x Organic compounds) interaction in both seasons . Spraying Sakha 1 var. with nofatrin under the application of 60 kg N/fed gave the greatest seed yield/fed. The lowest seed yield/fed was obtained from plots received zero nitrogen foliar where, spraying Blenka var. with organic acids without any addition of N fertilizer (control) awarded the smallest averages of seed yield/fed.

*Yield quality characters*

Date in Tables 6, 7, 8 and 9 showed that , the differences, among the three studied varieties for oil yield and fiber length and fineness were significant in both seasons.

Sakha 1 outyielded the other verities in fiber length, whereas, Blenka outyielded other varieties in fiber fineness, however Sakha 2 gave the highest values of oil yield/fed in both seasons.

Data revealed that nitrogen levels had a significant effect on oil yield, fiber fineness and fiber length. Fertilization with 60 kg N/fed gave the highest values of oil yield and fiber length/fed in both seasons, while plot received no nitrogen recorded the highest value of fiber fineness in both seasons.

Fiber fineness was decreased with increasing nitrogen level when, the untreated plants had finer fibers than those fertilized with 30 or 60 kg N/fed. These results clearly indicate that the increase in fiber length was on the expense of fiber fineness. As the fineness of bast fibers depends upon the diameter of the sclerenchyma cells , the increase obtained herein in plant height and stem diameter (Table 2) due to the increase of N level could accourd for the decrease observed hevein in fiber finenss. These findings agreement with those reported by Kineber & El-Kady (1998) , El-Gazzar (2000) and Abou Zaid (2001).

Results of the study recorded that the first order interaction among the studied treatments had significant effects on most characters in both seasons. The interaction between Sakha 2 and 60 kg N/fed recorded the highest oil yield, while the highest value of fiber fineness was taken from Blenka x control interaction. On the other hand, the highest value of fiber length was taken from the interaction between Sakha 1 and 60 kg N/fed in both seasons . Data also showed that the spraying Sakha 2 with nofatrin gave the highest oil yield, while spraying Blenka and Sakha 1 with organic acids recorded the highest fiber fineness and fiber length.

TABLE 6. Oil yield (kg/fed), fiber length (cm), fiber fineness (Nm) as affected by N level and foliar application of organic compounds in the three flax varieties in the two seasons.

| Main effects | Oil yield ( kg/fed) | | Fiber length (cm) | | Fiber fineness (Nm) | |
|---|---|---|---|---|---|---|
| | 2002 | 2003 | 2002 | 2003 | 2002 | 2003 |
| Variety effect (v) | | | | | | |
| Sakha 1 | 232.36 | 214.12 | 96.9 | 95.2 | 224.22 | 224.02 |
| Sakha 2 | 238.67 | 240.13 | 85.1 | 85.1 | 228.10 | 217.88 |
| Blenka | 125.75 | 127.27 | 85.1 | 89.1 | 179.11 | 278.85 |
| LSD (0.05) | 2.12 | 0.53 | 1.30 | 1.26 | 1.023 | 1.71 |
| Nitrogen level effect (N) | | | | | | |
| 0 kg N/fed | 184.99 | 184.45 | 78.9 | 75.3 | 244.69 | 242.87 |
| 30 kg N/fed | 201.09 | 194.63 | 97.5 | 95.3 | 243.95 | 239.91 |
| 60 kg N/fed | 210.69 | 202.43 | 99.6 | 99.1 | 242.78 | 237.93 |
| LSD (0.05) | 0.53 | 0.84 | 1.52 | 1.41 | 0.57 | 1.39 |
| Organic compounds effect (O) | | | | | | |
| Control | 194.63 | 191.59 | 82.0 | 85.8 | 243.50 | 240.04 |
| organic acid mixture | 198.43 | 193.38 | 94.2 | 93.7 | 244.16 | 243.03 |
| Nofatrin | 203.62 | 196.54 | 93.2 | 90.1 | 243.78 | 237.64 |
| LSD (0.05) | 6.63 | 0.95 | 1.20 | 2.45 | NS | 1.01 |
| Interaction (VNO) | ** | * | NS | ** | * | NS |

**TABLE 7. Oil yield (kg/fed), fiber length (mm) and fiber fineness (Nm) as affected by V x N interaction in the two seasons.**

| Treatments | Oil yield (kg/fed) | | | Fiber length (cm) | | | Fiber fineness (Nm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | N level (kg/fed) | | | N level (kg/fed) | | | N level (kg/fed) | | |
| | 0 | 30 | 60 | 0 | 30 | 60 | 0 | 30 | 60 |
| Variety effect (v) | 2002 Season | | | | | | | | |
| Sakha 1 | 214.56 | 231.75 | 250.76 | 83.8 | 99.60 | 104.0 | 227.1 | 224.9 | 222.3 |
| Sakha 2 | 218.91 | 244.76 | 252.34 | 81.5 | 91.7 | 101.3 | 227.6 | 227.4 | 242.7 |
| Blenka | 121.51 | 126.78 | 128.95 | 71.5 | 90.2 | 93.5 | 281.1 | 279.5 | 276.7 |
| LSD (0.05) | 2.62 | | | 2.63 | | | 1.00 | | |
| Variety effect (v) | 2003 Season | | | | | | | | |
| Sakha 1 | 209.51 | 211.78 | 221.06 | 83.9 | 97.7 | 108.3 | 225.8 | 224.1 | 278.5 |
| Sakha 2 | 118.59 | 124.78 | 133.44 | 69.4 | 91.5 | 94.3 | 224.0 | 216.4 | 213.1 |
| Blenka | 225.26 | 242.33 | 252.79 | 72.6 | 96.6 | 98.3 | 278.8 | 269.1 | 278.5 |
| LSD (0.05) | 1.46 | | | 2.45 | | | 2.42 | | |

**TABLE 8. Oil yield (kg/fed), fiber length (cm) and fiber fineness (Nm) as affected by V x O interaction in the two seasons.**

| Treatments | Oil yield (kg/fed) | | | Fiber length (cm) | | | Fiber fineness (Nm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Organic compounds | | | Organic compounds | | | Organic compounds | | |
| | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin |
| Variety effect (v) | 2002 Season | | | | | | | | |
| Sakha 1 | 227.35 | 230.60 | 238.75 | 91.8 | 100.5 | 98.6 | 224.8 | 225.2 | 224.2 |
| Sakha 2 | 234.55 | 238.60 | 242.86 | 98.6 | 97.2 | 95.4 | 228.3 | 227.4 | 228.5 |
| Blenka | 121.90 | 125.72 | 129.54 | 82.6 | 86.7 | 86.9 | 278.9 | 279.7 | 278.6 |
| LSD (0.05) | 3.83 | | | 2.08 | | | 0.84 | | |
| Variety effect (v) | 2003 Season | | | | | | | | |
| Sakha 1 | 211.20 | 213.68 | 217.47 | 99.7 | 98.1 | 96.4 | 223.8 | 225.6 | 222.6 |
| Sakha 2 | 238.95 | 239.60 | 241.84 | 82.2 | 89.3 | 83.9 | 216.9 | 221.6 | 215.6 |
| Blenka | 124.63 | 126.86 | 130.31 | 83.8 | 93.7 | 90.1 | 279.3 | 281.9 | 275.2 |
| LSD (0.05) | NS | | | 1.22 | | | 1.76 | | |

**TABLE 9. Oil yield (kg/fed), fiber length (cm) and fiber fineness (Nm) as affected by N x O interaction in the two seasons.**

| Treatments | Oil yield (kg/fed) | | | Fiber length (cm) | | | Fiber fineness (Nm) | | |
|---|---|---|---|---|---|---|---|---|---|
| | Organic compounds | | | Organic compounds | | | Organic compounds | | |
| | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin | 0 | Organic acid | Nofatrin |
| Nitrogen level effect (N) | 2002 Season | | | | | | | | |
| 0 kg N/fed | 178.63 | 184.29 | 192.07 | 72.5 | 83.2 | 81.1 | 244.31 | 245.69 | 245.11 |
| 30 kg N/fed | 197.02 | 200.91 | 205.35 | 90.9 | 100.1 | 98.0 | 243.65 | 244.31 | 243.90 |
| 60 kg N/fed | 208.25 | 210.09 | 213.73 | 97.3 | 101.1 | 100.5 | 243.55 | 242.49 | 242.32 |
| LSD (0.05) | 6.64 | | | 1.99 | | | 0.48 | | |
| Nitrogen level effect (N) | 2003 Season | | | | | | | | |
| 0 kg N/fed | 182.43 | 184.46 | 186.47 | 69.9 | 80.5 | 76.1 | 242.08 | 247.38 | 239.27 |
| 30 kg N/fed | 192.58 | 194.20 | 197.11 | 91.6 | 98.9 | 95.5 | 240.35 | 241.79 | 237.61 |
| 60 kg N/fed | 199.77 | 201.48 | 206.04 | 96.2 | 102.2 | 98.8 | 237.70 | 240.04 | 236.05 |
| LSD (0.05) | NS | | | 2.11 | | | 1.76 | | |

Eventually, it could be concluded that the studied growth and yield characters responded significantly to the investigated factors; nitrogen level and nutrient compounds, The local studied varieties showed their superiority for the most characters under study , whereas the imported Blenka var. surpassed them in few cases. The combination between local varieties (Sakha 1 or Sakha 2 ) with 30 or 60 kg/fed and ascorbic & citric acids mixture gave in most cases the best results for the studied characters. It seems evident that the fertilization with 30 kg N/fed attained some results that are similar to those obtained with 60 kg N/ fed with the foliar application .

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# تأثير مستوى التسميد النيتروجيني و الرش ببعض المركبات الغذائية على بعض أصناف الكتان

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تم إجراء تجربتان في محطة بحوث الجميزة خلال موسمي ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/٢٠٠٤ لدراسة ، تأثير مستويات التسميد النيتروجيني ( صفر ، ٣٠ و ٦٠ كجم ن / فدان) والرش ببعض المركبات الغذائية ( بدون رش وخليط من حمض الاسكوربيك وحمض الستريك ٢٥٠ جزء في المليون من كلا منهم ) وتغذية معدنية ( نوفاترين بمعدل لتر/ فدان) على صفات النمو والمحصول والجودة لثلاث أصناف من الكتان ( سخا ١ ، سخا ٢ وبلانكا ) وكانت أهم النتائج كما يأتي :

تفوق الصنف سخا (١) معنوياً علي الصنف سخا (٢) وبلانكا في طول النبات ومحصول القش للفدان وكذلك طول الألياف في كلا الموسمين . بينما تفوق الصنف سخا (٢) علي سخا (١) في سمك الساق الرئيسي ، ومحصول البذور ومحصول الزيت للفدان في كلا الموسمين . وتفوق الصنف بلانكا علي سخا (١) ،(٢) في محصول الألياف / فدان والنعومة.

أدى إضافة ٦٠ كجم ن/ فدان إلى تحقيق أعلى قيم لمعظم الصفات المدروسة (طول النبات ، قطر الساق و محصول القش ومحصول الألياف ومحصول البذور) فيما عدا النعومة للألياف والتي انخفضت بهذه الإضافة ولم تختلف هذه القيم معنوياً عن تلك المسجلة بإضافة ٣٠ كجم ن / فدان .

أدى الرش بالأحماض العضوية إلى التفوق على باقي معاملات الرش في ( طول النبات ، محصول القش ، محصول الألياف للفدان والطول والنعومة للألياف) . بينما تفوق النوفاترين في محصول البذور للفدان ومحصول الزيت للفدان وقطر الساق الرئيسي .

أدى تسميد الصنف سخا (١) بمعدل ٦٠ كجم ن / فدان والرش بالنوفاترين إلى الحصول على أعلى قيم في طول النبات ، محصول القش ومحصول الألياف وكذلك طول الألياف . وقد أدى تسميد الصنف سخا (٢) بمعدل ٦٠ كجم ن / فدان إلى إنتاج تسجيل أعلى قيم لقطر الساق ومحصول البذور والزيت . وقد تفوق الصنف بلانكا عن باقي الأصناف في نعومة الألياف مع معاملة الكنترول.