**Journal of Neonatal Surgery**
***ISSN(Online): 2226-0439***
***Vol. 13, (2024)***
*https://www.jneonatalsurg.com*

OPEN ACCESS

# Influence of planting dates and nitrogen fertilizer levels on grain quality and chemical properties on two Oat varieties (Aveva sativa L.).

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Cite this paper as Aya E. El-Sharawy, Maha M. Abdalla, Al-Sayed B Gaballah , Ameen H. Bassiouny (2024) Influence of planting dates and nitrogen fertilizer levels on grain quality and chemical properties on two Oat varieties (Aveva sativa L.). .Journal of Neonatal Surgery, 13 1834-1843

## ABSTRACT

The field trail was conducted at an extension in Research Farm of Faculty of Technology and Development, Zagazig University at Ghazalah village Zagazig District Sharkia Governorate, Egypt during 2022/2023 and 2023/2024 seasons to study the effect of planting dates (30th October, 15th November and 30th November) and nitrogen fertilizer rates (zero, 30, 60 and 90 kg. N/fed.) on quality and chemical properties of two Oat varieties (White and Rad Oat).

The results showed that planting dates had a significant difference in both seasons and combined in all properties, as well as the (30th October) early planting date produced highest germination %, good seedling %, stem length (cm.), root length (cm.), fresh weight of seedling (g.) and dry weight of seedling (g.). While (15th November) middle planting date gave the highest values of chemical properties.

Also, the results indicated that White Oat variety was superior and significantly increased than the Red Oat variety in all studied properties of quality and chemical properties.

Increasing nitrogen levels from zero,30 to 60 and 90 kg. N/ fed. significantly increased of the most studied characters. In general, 90 kg. N/fed. gave the highest values, followed by 60, 30 kg. N/ fed., while zero treatment was recorded a lowest in this respect.

The results indicated also that, grain yield (ton/ fed.) appeared a positive significant correlation with no. grains/panicle, 1000-grain weight (g.), grains protein %, grains carbohydrates %, straw protein% and straw carbohydrates %, germination % and stem length (cm.).

In addition, Path analysis revealed that number of spikelets / panicle, number of grains/panicle and 1000-grain weight (g.) were the main grain yield variation and the relative contributions were about 4.985, 5.795 and 126.330 % in respective order.

**Conclusively,** all studied quality characters; 30th October surpassed than 15th November and 30th November, respectively when 90kg. N/fed. gave the highest values viability, vigour and chemical characters. White Oat variety superior in all studied characters, i.e. germination%, good seedling %, stem length (cm.), root length (cm.), fresh and dry weight of seedling (g.), grains protein and carbohydrates %, straw protein and carbohydrates %. The grain yield (ton/fed.) appeared a positive significant correlation with most studied characters..

**Keywords:** *Germination –Nitrogen -Protein, Carbohydrates -Viability – Vigour- Oat.*

## 1. INTRODUCTION

Oat (Avena sativa L.) is a kind of cereal which is suitable for personal consumption amongst the cool climate cereal of the world. Besides being directly used in the human nutrition,

Oat is also used as an important raw material in industry. Moreover, its grain and straw is also frequently used for animal. According to year of 2018, 230 thousand tons of Oat is produced in the world FAO (2020).

Seed quality is one of the main factor that affect establishment and performance of crops, and it is related to the sum of the genetic, physical, physiological and health aspects that affect the capacity of seeds and gave high-yielding plants **(Marcos-Filho 2015).** Understanding the relationship between planting dates of the crop environments and the yield of varieties is essential for production seeds of superior quality. According to **Caron *et al.,* (2017)** the characterization of phonological modifications that occur in plants as a result of contrasting planting dates is important for defining the adoption of crop practices that assist in taking better advantage of environmental conditions and in maximizing the yield of better quality seeds from planting dates of growing period.

The evaluation of Oat varieties has been studied by several investigators, since the test varieties significantly differed in seed yield, quality and chemical properties **(Dumlupinar *et al.,* 2011; Chakraborty *et al.,* 2014; Mut *et al.,* 2015; Godara *et al.,* 2016; Ali *et al.,* 2017; Mut *et al.,* 2018; Ratan *et al.,* 2018; Al-Ajmi and AL-Refai 2020; Murali *et al.,* 2021; Kumar *et al.,* 2023** and **Samal *et al.,* 2023;** while, **Alhilfi, 2020** reported that two types of (Jauzania and Shefa Oats) had no significant differences in 1000-grain weight (g.) and protein ratio.

The effect of planting dates on Oat by **Jehangir *et al.,* 2013; Shaker *et al.,* 2016; Al-Ajmi and AL-Refai, 2020; Bazzo *et al.,* 2020; Murali *et al.,* 2021** and **TONG *et al.,* 2021.** They showed that significant increased yields, quality and chemical properties by planting dates data. On the other hand, planting dates had no significant influence on nutrient contents in grain and straw of Oat by **kadam *et al.,* (2022).**

It is well known that nitrogen fertilization plays an important role on the productivity of different field crops. The yield attributes, yield quality and chemical properties to be affected with nitrogen fertilization. The obtained results showed aa obvious and positive response on most of the studied characters as N level increased. This conclusion was obtained by **Iqbal *et al.,* 2013; Lafond *et al.,* 2013; Jat *et al.,* 2014; Brunava *et al.,* 2015; Midha *et al.,* 2015; Godara *et al.,* 2016; Ali *et al.,* 2017; Kumar *et al.,* 2017; Yan *et al.,* 2017; Jat *et al.,* 2018; Devi *et al.,* 2019; Obour *et al.,* 2019** and **Kumar *et al.,* 2023.**

Concerning the yield analysis, **Tessema and Getinet (2020)** and **Mahajan and Chauhan (2021)** illustrated that Oat seed yield positively correlated with most components characters. The objective of this study was the effect plating dates and N fertilizer on quality, chemical properties and yield analysis of two Oats cultivars.

## 2. MATERIALS AND METHODS

The field experiment was conducted at Research Farm of the Faculty of Technology and Development, Zagazig University at Ghazalah village, Zagazig District Sharkia Governorate, Egypt during the two successive winter seasons of 2022/2023 and 2023/2024 to study the effect of plating dates and nitrogen fertilization on yield, quality and chemical properties of tow Oat varieties (*Avena sativa* L.).

The experiment included 24 treatments which the combination of three planting dates (30$^{th}$ October, 15$^{th}$ November and 30$^{th}$ November), four levels of nitrogen, i.e. Zero, 30, 60 and 90 kg N/fed., with two varieties of Oats. The experimental field was laid in a randomized black design with three replications. The plot area was 6m$^2$ (3m x 2m) and seeds were drilled in rows 20 apart. Other normal cultural practices for Oat crop was followed all through the season. The four nitrogen fertilizer (ammonium nitrate 33.05%) for each plot was divided into two equal parts (after 25 and 60 days) respectively from sowing.

**Studied characters: -**

**I- Seed viability and vigour:**

Germination tests was performed according to International Seed Tasting Association **(ISTA 1999).** Sample of 300 seeds were randomly taken from each treatment and divided into three replicates and germinated under laboratory conditions at 25 ± 2 ℃ for ten days in sterilized paper to estimate the followings:

**Standard germination test**

**Germination percentage:** Germination percentage was defined as the total number of normal seedling at the end of the test after 10 days.

**Good seedling percentage:** Percentage of good seedling was accorded according to **(ISTA, 1999).**

**Stem length (cm.):** During the final count; ten normal seedlings from each replicate were taken randomly to measure the stem length (cm.).

**Rood length (cm.):** Same in measure for stem length (cm.).

**Seedling fresh weight (g.):** During the final count, ten normal seedlings which were used for measuring the seedling fresh weight (g.).

**Seedling dry weight (g.):** Seedling length were dried in a forced air oven at 105℃ for 24 hours and weights thereafter. Dry

weight recorded and expressed in milligrams **(Krishnasamy and Seshu, 1990).**

**II- Chemical properties: -**

**Grain:** Protein content % was determined using the standard methods by **Westerman (1990)** and crud protein % was calculated by multiplying N Content X 5.36 according to **Wrolstad *et al.*, (2005)** and **Evenhuis and Waard (1980).** Carbohydrates content% was determined by **DuBois *et al.* (1956)** and **A.O.A.C (1970).**

**Straw:** Protein content % and carbohydrates content%.

**Statistical analysis: -**

The proper statistical analysis of split-split plot design was combined analysis was performed for the characters recorded in both seasons and combined. The analysis of variance described by **Snedecor and Cochran (1981).** The collected data were statistically analyzed using the Analysis of Variance **(ANOVA)** to detect significance if any at treatment level. Differences among treatments were judged according to **Duncan (1955)**. Means followed by different letters were statistically significant. Farther, the correlation coefficients among all possible combinations of characters were calculated and Path analysis to nitrogen fertilization using the method of **Svab (1973).**

## 3. RESULTS AND DISCUSSION

**Viability and vigour:**

Laboratory experiments were carried out at Seed Laboratory of Faculty of Technology and Development, Zagazig University Egypt, during the winter seasons of 2022/2023 and 22023/2024 to study the effect of planting dates and nitrogen levels on seed viability and vigour of two Oat varieties (*Avena sativa* L.).

**Germination percentage and Good seedling %: -**

The results in Table (1) show that planting dates differed highly significantly in germination % and good seedling % in two seasons and the combined as well meanwhile, 30$^{th}$ October planting date appeared to produce the highest germination % (95.373%) and good seedlings% (65.30%) which was followed by 15$^{th}$ November and 30$^{th}$ November planting date. The results are in a good accordance with those reported. **Caron *et al.*, 2017; Ali *et al.*, 2017; Mut *et al.*, 2018; Al-Ajmi and Al-Refai, 2020; Murali *et al.*, 2021; Kumar *et al.*, 2023** and **Samal *et al.*, 2023.**

Also, the results in Table (1) show that the tested varieties (White and Red Oat) differed highly significantly in germination% and good seedling % in both seasons and the combined, whereas White Oat was superior than Red Oat. This is in harmony with results obtained by **Murali *et al.*, (2021) and Samal *et al.*, (2023).**

Regarding, the influence of nitrogen fertilization had high significant on germination % and good seedling % to in both seasons and the combined. Since, the relative increase in germination to due to increasing nitrogen levels from control Kg N/ fed. were about 0.853 %, 1.695 % and 2.435 % and the relative increase in good seedling % due to nitrogen applied in same forward from control Kg N/fed. were about 1.176%, 2.351% and 3.242%.

**2- Seedling measurements: -**

Seedling measurements include stem length (cm.), root length (cm.), fresh weight of seedling "g." and dry weight of seedling "g." are shown in Tables (1 and 2). The results indicated highly significant differences in both seasons and the combined in all cases. The effect of planting dates on all seedling measurements the results showed that early planting date 30$^{th}$ October tented to the longest and higher values in two seasons and the combined for stem length (11.90 cm.); root length (7.022 cm.); seedling fresh weight (2.768 g.) and seedling dry weight (0.8365 g.) and the densest planting data followed by the second and dates (15$^{th}$ November to 30$^{th}$ November).

Generally, most of seed viability and vigour of Oat verities to be reduced with delaying of planting dates lower values, respectively. So, it could be concluded that planting of Oat early under such conditions could be greatly improve grain viability and vigour properties and produce higher and longer grains **Rahuma, M. A. (2018); Călugăr *et al.*, (2024) and popa *et al.*, (2025)**.

It is clear from results in Tables (1 and 2) show that verities (White and Red Oat) differed highly significant in stem length (cm.) and root length (cm.) and significant in fresh and dry weight of seedling (g.) in seasons and the combined respectively. White Oat gave the taller length (cm.) and higher weight in all studied characters (seedling measurements) than Red Oat.

But, the differences did not reach the level of significance on stem length (cm.) and root length (cm.) with nitrogen applied. However, nitrogen fertilization had significant effect on fresh and dry weight of seedling (g.). General, 90 kg / N fed., gave the highest values of seedling measurements. These results are in agreement with those obtained by **Călugăr *et al.* (2024)** and **popa *et al.* (2025)**.

**Table (1): Germination percentage (%), Good seedling percentage (%), Stem length (cm.) and Root length (cm.) Oat as affect by planting dates, varieties and Nitrogen levels in two seasons and their combined**

| Main effects and Interactions | germination percentage (%) | | | good seedling percentage (%) | | | Stem length (cm.) | | | Root length (cm.) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data |
| Planting dates (D) | | | | | | | | | | | | |
| 30th October | 85.36 a | 95.13 a | 95.39 a | 65.30 a | 64.75 a | 65.03 a | 12.08 a | 11.72 a | 11.90 a | 7.302 a | 6.732 a | 7.022 a |
| 15th November | 90.40 b | 89.88 b | 90.14 b | 60.88 b | 60.33 b | 60.61 b | 10.73 b | 10.37 b | 10.55 b | 6.195 b | 5.625 b | 5.915 b |
| 30th November | 95.65 c | 84.84 c | 85.10 c | 56.28 c | 55.73 c | 56.01 c | 8.83 c | 8.47 c | 8.65 c | 5.062 c | 4.492 c | 4.782 c |
| F .test | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| Varieties (V) | | | | | | | | | | | | |
| White Oat | 91.95 a | 91.43 a | 91.69 a | 61.96 a | 61.41 a | 61.69 a | 11.08 a | 10.72 a | 10.90 a | 6.577 a | 6.007 a | 6.297 a |
| Red Oat | 88.99 b | 88.47 b | 88.73 b | 59.68 b | 59.13 b | 59.40 b | 10.02 b | 9.659 b | 9.84 b | 5.796 b | 5.226 b | 5.515 b |
| F .test | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| Nitrogen levels (N) | | | | | | | | | | | | |
| Control (N zero) | 89.36 c | 88.84 d | 89.10 c | 59.81 d | 59.26 d | 59.54 d | 10.20 | 9.837 | 10.02 | 5.927 | 5.357 | 5.647 |
| 30 kg/fed. | 90.12 b | 89.60 c | 89.86 c | 60.51 c | 59.96 c | 60.24 C | 10.45 | 10.09 | 10.27 | 6.082 | 5.512 | 5.802 |
| 60 kg/fed. | 90.87 b | 90.35 b | 90.61 b | 61.21 b | 60.66 b | 60.94 b | 10.68 | 10.32 | 10.50 | 6.256 | 5.686 | 5.976 |
| 90 kg/fed. | 91.53 a | 91.01 a | 91.27 a | 61.74 a | 61.19 a | 61.47 a | 10.87 | 10.51 | 10.69 | 6.481 | 5.911 | 6.201 |
| F .test | * | * | * | * | * | * | N.S | N.S | N.S | N.S | N.S | N.S |
| Interaction | | | | | | | | | | | | |
| D*V | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| D*N | ** | ** | ** | ** | ** | ** | N.S | N.S | N.S | N.S | N.S | N.S |
| V*N | ** | ** | ** | * | * | * | N.S | N.S | N.S | N.S | N.S | N.S |
| D*V*N | ** | ** | ** | * | * | * | * | * | * | * | * | * |

Treatment within a column followed by different letter are significantly with Duncan's multiple range test at 5 % level

**Table (2): Fresh weight of seedling (g.) and Dry weight of seedling (g.) of Oat as affect by planting dates, varieties and Nitrogen levels in two seasons and their combined**

| Main effects and Interactions | Fresh weight of seedling (g.) | | | Dry weight of seedling (g.) | | |
|---|---|---|---|---|---|---|
| | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data |
| Planting dates (D) | | | | | | |
| 30th October | 2.98 a | 2.55 a | 2.77 a | 0.954 a | 0.719 a | 0.837 a |
| 15th November | 1.99 b | 1.56 b | 1.77 b | 0.636 b | 0.400 b | 0.518 b |
| 30th November | 1.57 c | 1.22 c | 1.39 c | 0.500 c | 0.265 c | 0.383 c |
| F .test | ** | ** | ** | ** | ** | ** |
| Varieties (V) | | | | | | |
| White Oat | 2.40 a | 1.97 a | 2.18 a | 0.766 a | 0.531 a | 0.649 a |
| Red Oat | 1.96 b | 1.59 a | 1.77 b | 0.627 b | 0.392 b | 0.509 b |
| F .test | ** | N.S | * | * | * | * |
| Nitrogen levels ( N ) | | | | | | |
| Control (N zero) | 1.98 b | 1.58 b | 1.78 b | 0.634 b | 0.399 b | 0.516 b |
| 30 kg/fed. | 2.15 a | 1.74 a | 1.94 a | 0.686 b | 0.451 b | 0.568 b |
| 60 kg/fed. | 2.25 a | 1.84 a | 2.05 a | 0.718 a | 0.483 b | 0.600 a |
| 90 kg/fed. | 2.34 a | 1.94 a | 2.14 a | 0.749 a | 0.514 a | 0.632 a |

| | | | | | | |
|---|---|---|---|---|---|---|
| **F .test** | * | * | * | * | * | * |
| **Interaction** | | | | | | |
| **D*V** | * | * | * | * | * | * |
| **D*N** | * | * | * | * | * | * |
| **V*N** | * | * | * | * | * | * |
| **D*V*N** | * | * | * | * | * | * |

Treatment within a column followed by different letter are significantly with Duncan's multiple range test at 5 % level

**Table (3): Protein (%) and Total Carbohydrates of Grains and Straw of Oat as affect by planting date, varieties and Nitrogen levels in two seasons and their combined**

| Main effects and interactions | Grains | | | | | | Straw | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Protein % | | | Total Carbohydrates % | | | Protein % | | | Total Carbohydrates % | | |
| | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data | 1st season 2022/2023 | 2nd season 2023/2024 | Combined | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data | 1st season 2022/2023 | 2nd season 2023/2024 | Combined Data |
| **Planting dates (D)** | | | | | | | | | | | | |
| 30th October | 9.26 b | 9.14 b | 9.20 b | 50.54 b | 50.65 b | 50.60 b | 5.06 b | 4.97 b | 5.02 b | 43.23 b | 43.35 b | 43.29 b |
| 15th November | 9.59 a | 9.50 a | 9.54 a | 51.87 a | 51.96 a | 51.92 a | 5.87 a | 5.74 a | 5.81 a | 45.59 a | 45.84 a | 45.72 a |
| 30th November | 8.27 c | 8.18 c | 8.22 c | 46.39 c | 46.48 c | 46.44 c | 4.05 c | 3.97 c | 4.01 c | 38.31 c | 38.42 c | 38.37 c |
| F .test | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| Varieties (V) | | | | | | | | | | | | |
| White Oat | 9.19 a | 9.07 a | 9.13 a | 50.42 a | 50.52 a | 50.47 a | 5.22 a | 5.11 a | 5.17 a | 43.40 a | 43.60 a | 43.50 a |
| Red Oat | 8.89 b | 8.80 b | 8.85 b | 48.78 b | 48.88 b | 48.83 b | 4.76 b | 4.68 b | 4.72 b | 41.36 b | 41.48 b | 41.42 b |
| F .test | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |
| **Nitrogen levels (N)** | | | | | | | | | | | | |
| Control (N zero) | 8.65 d | 8.54 d | 8.60 d | 48.66 d | 48.75 d | 48.71 d | 4.55 d | 4.46 d | 4.50 d | 41.37 d | 41.49 d | 41.43 d |
| 30 kg/fed. | 8.88 c | 8.80 c | 8.84 c | 48.90 c | 49.01 c | 48.96 c | 4.81 c | 4.73 c | 4.77 c | 41.83 c | 41.95 c | 41.89 c |
| 60 kg/fed. | 9.18 b | 9.08 a | 9.13 b | 49.56 b | 49.66 b | 49.62 b | 5.17 b | 5.09 b | 5.13 b | 42.56 b | 42.85 b | 42.71 b |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 90 kg/fed. | 9.45 a | 9.33 a | 9.39 a | 51.27 a | 51.37 a | 51.32 a | 5.44 a | 5.31 a | 5.38 a | 43.75 a | 43.86 a | 43.81 a |
| F .test | ** | ** | ** | ** | * | * | ** | ** | ** | ** | ** | ** |
| Interaction | | | | | | | | | | | | |
| D*V | * | * | * | ** | ** | ** | ** | N.S | * | ** | ** | ** |
| D*N | N.S | N.S | N.S | ** | ** | ** | ** | * | ** | ** | * | ** |
| V*N | * | * | * | ** | ** | ** | ** | N.S | N.S | ** | ** | ** |
| D*V*N | N.S | N.S | N.S | ** | ** | ** | ** | N.S | * | ** | N.S | * |

Treatment within a column followed by different letter are significantly with Duncan's multiple range test at 5 % level

**Table (4): Correlation coefficient among some studied chemical and quality characters of Oat**

| Characters | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1-Grain yield (ton/ fed.) | .764 (*) | .903 (**) | .997 (**) | .882 (**) | .884 (**) | .809 (**) | .891 (**) | 0.428 (*) | 0.220 | .507 (*) | .061 | .222 |
| 2- No. spikelet's/ panicle | | .436 (*) | .713 (**) | .577 (*) | .564 (*) | .407 (*) | 0.519(*) | .396 (*) | .107 | .428 (*) | 336 (*) | .333(*) |
| 3-No. grains/panicle | | | .933 (**) | .849 (**) | .866 (**) | .878 (**) | .925 (**) | .379 (*) | .316 | .473 (*) | .157 | .101 |
| 4- 1000-grain weight (g.) | | | | .888 (**) | .892 (**) | .831 (**) | .909 (**) | .420 (*) | .234 | .503 (*) | .025 | .202 |
| 5- Grains Protein (%) | | | | | .979 (**) | .965 (**) | .968 (**) | .711 (**) | .503 (*) | .765 (*) | .367 (*) | .157 |
| 6- Grains Carbohydrates (%) | | | | | | .971 (**) | .985 (**) | .736 (**) | .572 (*) | .792 (*) | .394 (*) | .149 |
| 7- Straw Protein (%) | | | | | | | .979 (**) | .598 (*) | .419 (*) | .669 (*) | .262 | .153 |
| 8- Straw Carbohydrates (%) | | | | | | | | .690 (**) | .571 (*) | .758 (*) | .391 (*) | .131 |
| 9-Germination percentage (%) | | | | | | | | | .909 (**) | .994 (**) | .725 (**) | .115 |
| 10- Good seedling percentage (%) | | | | | | | | | | .908 (**) | .842 (**) | .015 |
| 11- Stem length (cm.) | | | | | | | | | | | .705 (**) | .120 |
| 12- Root length (cm.) | | | | | | | | | | | | .133 |
| 13-Dry weight of seedling (g.) | | | | | | | | | | | | |

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed)

2-Path analysis:

Path analysis was used to determine the relative importance of number of spikelet's/ panicle, number of grains/panicle and 1000 grain weight (g.) to grain yield variation in Oat. The effects of direct and indirect path coefficients of yield components on grain yield are shown in Table (5). 1000-grain weight (g.) showed a highly direct on grain yield of Oat.

The indirect effect through number spikelet's /panicle was a positive value (0.041449) while the indirect effect through number of grains/panicle was negative and low value (-0.099919). Similar trend was presented for number of spikelet's / panicle except, indirect effect through number of grains/ panicle was negative value (-0.046684). But, number of spikelet's/panicle showed negative direct effect of (-0.107094). While, the indirect effects through each of number of grains/panicle and 1000- grain weight (g.) were a positive value of (0.025341) and (0.984753), respectively.

The relative importance of the studied components to grain yield variation as percentage are presented in Table (6). It is clear that 1000- grain weight (g.) and number of grains / panicle as well as their interaction contributed as much in grain yield variation, since $R^2$ recorded herein was time 100% of total yield variation. However, the residual affect contributing grain yield was zero of the total variation. The data obtained showed that the most important sources of grain yield variation may be arranged according to their importance in following order: 1000- grains weight(g.) and number of spikelet's/panicle and its interaction (Number of grains / panicle X 1000-grain weight (g.) and number of spikelet's/panicle X Number of grains/panicle. Since their values. were 111.40%, 1.15, 21.09 and 0.54 % contributing to grain yield variation. Also, the total direct and indirect effect for 1000-grain weight (g.), number of grains/panicle and number of spikelet's/panicle (4.985, 5.795 and 126.320). From these results, it can be stated conveniently that improving the productivity of commercial varieties could be achieved when the studied treatments i.e. N fertilization and planting dates must be directed to be active in increasing number of spikelet's/panicle, number of grains/panicle and 1000-grain weight (g.).

Conclusion: all studied quality characters 30$^{th}$ October surpassed than 15$^{th}$ November and 30$^{th}$ November, when 90 kg. N /fed. gave the highest values viability, vigour and chemical characters. White Oat variety superior in all studied characters, i.e. germination%, good seedling %, stem length (cm.), root length (cm.), fresh and dry weight of seedling (g.), grains protein and carbohydrates %, straw protein and carbohydrates%. The grain yield (ton/fed.) appeared a positive significant correlation with most studied characters.

**Table (5): Partitioning of simple Correlation coefficients between grain yield/fed. and its components under the different treatments**

| Source | Value |
|---|---|
| 1- Number of spikelet's/ panicle. | |
| Direct effect | 0.058134 |
| In direct effect via Number of grains/panicle | -0.046684 |
| In direct effect via 1000-grain weight (g.) | 0.752550 |
| Total (r $y_1$) | 0.764000 |
| 2- Number of grains/panicle. | |
| Direct effect | -0.107094 |
| In direct effect via Number of spikelet's/ panicle | 0.025341 |
| In direct effect via 1000-grain weight (g.) | 0.984753 |
| Total (r $y_2$) | 0.903000 |
| 3- 1000-grain weight (g.). | |
| Direct effect | 1.055470 |
| In direct effect via Number of spikelet's/ panicle | 0.041449 |
| In direct effect via Number of grains/panicle | -0.099919 |
| Total (r $y_3$) | 0.997000 |

**Table (6): Direct and Joint effects of yield components to the variation of grain yield in Oat (*Avena sativa*)**

| Source of Variation | C.D | % |
|---|---|---|
| Number of spikelet's/ panicle | 0.003380 | 0.34 |
| Number of grains/panicle | 0.011469 | 1.15 |
| 1000-grain weight (g.) | 1.114016 | 111.40 |
| Number of spikelet's/ panicle x Number of grains/panicle | -0.005428 | -0.54 |
| Number of spikelet's/ panicle x 1000-grain weight (g.) | 0.087497 | 8.75 |
| Number of grains/panicle x 1000-grain weight (g.) | -0.210923 | -21.09 |
| $R^2$ | 1.000011 | 100.00 |
| Residual factors | -0.000011 | 0.00 |
| Total | 1.000000 | 100.00 |

C.D: Coefficient of determination % = Percentage contributed

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