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Utilization of Some Fertilizers to Improve Productivity of Naked Barley

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Abstract

In order to investigate the effects of four organic N (compost) + nano-N treatments (Control, Organic N, Nano-N, and Organic N+Nano-N) and four levels of mineral N fertilizer (0, fifteen, thirty, and forty five kg N/fed) on growth characteristics, yield and yield components, as well as nutritive value of naked barley, field experiments two were carried out in Moshtohor Tokh, Qalubia Governorate, Egypt, during the 2019/2020 and 2020/2021 seasons. With three replications, the experiment was designed utilizing a split plot layout RCBD. Four levels of mineral nitrogen fertilizer were apportioned at random throughout the sub plots, while the four nitrogen organic and nano treatments were assigned to the main plots. The subplot's area measured 3.5 × 3 m, or 10.5 m2 (1/400 fed). The following were the primary findings: With the exception of the harvest index in the first and second seasons, the organic N+nano-N treatment produced the highest values of all the features examined. In contrast to the other levels, forty five N/fed level produced the maximum values for all examined features and increased noticeably in both seasons. In terms of the interaction effect, there were significant differences in plant height in the second season, spike weight in both seasons, and No. spikelets/spike, No. grains/spike and grain yield/fed in the first season between the levels of organic N + Nano-N and mineral N fertilizer. We may conclude that, under the given conditions of this experiment, the height yield productivity was created by applied organic N+nano-N and fertilized with 50 or 75 kg N fed^{-1}.

Key Words: *Naked barley, Organic N, Nano-N, Mineral N, Yield and its components.*

Introduction

Around the world, barley crop (*Hordeum vulgare* L.) is a significant grain, not just of Egypt. After rice, wheat, and maize, it comes in fourth place among cereals in terms of total production and acreage (FAO, 2021). In Egypt, barley is a winter grain crop that is primarily utilized for animal feed and human consumption. Barley is produced across the temperate regions because to its excellent climatic adaptation. It reacts favorably to fertilizer that contains organic, nano, and mineral N, depending on the nation. Malt barley may be grown using different agronomic techniques than its feed crop. The majority of soils worldwide lack sufficient amounts of nitrogen, necessitating the addition of organic fertilizers or chemical fertilizers.

Results of several studies have reported that using organic N improved soil fertility as well as nano N increased yield and yield components of barley (**Shata *et al.*, 2007, Getachew *et al.*, 2014, Abay and Tesfaye, 2015, Abera *et al.*, 2018**).

In this concern, the increased applied of N was found to have positive impact on yield and components of barly as reported by **Singh *et al.* (2013), Kakraliya *et al.* (2017), Jemal and Aliyi (2021), Adhikari and Singh (2022) and Dahiya *et al.* (2022).**

In the Moshtohor district of the Kalubia Governorate, Egypt, naked barley is grown on clay soil. The goal of study was to determine appropriate agricultural management. approaches, such as organic N (compost), nano-N alone or mixed, and mineral nitrogen fertilizer levels.

Materials and Methods

In order to investigate the effect of four organic N (compost) + nano-N treatments (Control, Organic N (10 kg compost $plot^{-1}$), Nano-N (1 ml/L $plot^{-1}$, and Organic N (10 kg compost $plot^{-1}$)+Nano-N (1 ml/L plot-1) and four levels of mineral N fertilizer (0, fifteen, thirty, and 45 kg N fed) on yield and components of naked barley variety Giza123, two field. experiments were carried out in the Moshtohor.

region, Kalubia Governorate, Egypt, during the 2019/20 and 2020/21 seasons. The soil's texture was clay, and during the first and second seasons, its PH values were 7.91 and 7.90, it's organic. matter content was 17.1 and 17.0 mg/kg, and its total nitrogen concentration was 0.11 and 0.10%, respectively.

Each experiment comprised sixteen treatments, each consisting of four amounts of mineral N fertilizer and four combinations of organic N+nano N. A split plot with three replications was used in Randomized Complete Blok Design experiment. In the main plots, the four organic N+nano N levels were randomly arranged, while in the sub-plots, the four mineral N fertilizer levels were similarly randomly arranged. The sub-plot measure 3 × 3.5 m = 10.5 m^2. Through preparing experimental site, 25 kg P_2O_5 fed^{-1} of calcium superphosphate (12.5%) was used. Barley kernels were manually drilled into rows, with a 10.5 m^2 experimental unit made up of 15 rows spaced 20 cm apart and 3.5 m in length. The preceding crop was corn in two seasons. N fertilizer urea (46.5% N) and its rate was splitted into 2 equal doses application before 1st and 2nd irrigations in the two seasons. Other agricultural treatments were done as recommended in region.

At harvest time, random of samples ten plants was chosen from sub plots in order to measure the following characteristics: height of plant (cm), length of spike (cm), weight of spike (g) and number of spikelets/spike. Weight of sausaned grain (g) was calculated by taking a meter square sample from sub plot. Grain and straw kg/fed were calculated for sub plot as a whole. Grain yield fed/biological yield fed x 100 is the harvest index.

For each season's data, an analysis of variance was conducted independently, in accordance with Snedecor and Cochran (1980). Using the MSTAT-C Statistical Software package, treatment means were compared at the 0.05 level of significance using the least significant difference test (Mich. Sta. Univ., 1983).

Results & Discussion

- Organic and nano-N Effect:

Table 1 shows the barley production and component data for the 2019–20 and 2020–21 seasons as impacted by organic (compost) and nano N treatments. The findings unequivocally show that, in both seasons, the organic (compost) and nano N treatments had a substantial impact on the investigated characters. With the exception of harvest index, height plant, length spike, number of spikelets/spike, spike weight, number of grains/spike, grain index, grain and straw yields/fed was all markedly higher of the compost+Nano-N treatment compared to the other treatments in both seasons. Therefore, 1st and 2nd seasons, respectively, the compost+Nano-N treatment yielded the significantly highest values for plant height (134.41 and 134.41 cm), spike length (11.45 and 10.58 cm), number of spikelets/spike (23.33 and 22.00), weight spike (4.31 and 3.86), number of grains spike (70.00 and 66.00), 1000-grain weight (42.50 and 39.41), grain yield (2550 and 2527) and straw yield/fed (5783 and 5769). Based on current data, it is evident that applying compost and nano-N to barley increased its grain weight, highlighting the significant contribution of this essential nutrient. Increasing the application of compost and nano-N improves photosynthetic activity and metabolic efficiency, which helps barley's grain filling phases accumulate more generated metabolites. Results trend to agree with those obtained by **Shata *et al.* (2007), Getachew *et al.* (2014), Abay and Tesfaye (2015) and Abera *et al.* (2018).**

Table 1. Yield and attributes of barley affected by organic and Nano-N in 2019/20 and 2020/21 seasons

Characters	2019/20 season				LSD at 5%	2020/21 season				LSD at 5%
	Control	Organic	Nano-N	O+N		Control	Organic	Nano-N	O+N	
Plant height (cm)	128.08	131.91	132.16	134.41	**1.59**	125.16	130.75	130.33	134.41	**1.38**
Spike length (cm)	10.41	10.87	10.91	11.45	**0.47**	8.58	9.91	9.66	10.58	**NS**
No. spikelets $spike^{-1}$	21.66	22.66	22.50	23.33	**0.74**	20.00	20.75	20.58	22.00	**0.95**
Weight of $spike^{-1}$ (g)	3.85	4.04	3.98	4.31	**0.17**	3.41	3.56	3.60	3.86	**NS**
No. kernels $spike^{-1}$	65.00	68.00	67.50	70.00	**2.23**	60.00	62.25	61.75	66.00	**2.86**
1000-kernel weight (g)	39.25	41.33	41.08	42.50	**0.95**	36.75	39.16	38.41	39.41	**1.22**
Grain yield (kg fed^{-1})	2297	2457	2458	2550	**45**	2259	2430	2396	2527	**32**
Straw yield (kg fed^{-1})	5390	5612	5576	5783	**42**	5363	5699	5539	5769	**78**
Harvest index	29.75	30.24	30.87	30.57	**0.59**	29.18	30.83	30.71	30.47	**NS**

NS=No significance

- Effect of mineral N levels:

The effects of N mineral fertilizer levels on barley output and associated characteristics are displayed in Table (2). The data unequivocally show that N levels in both seasons had a major impact on the personalities under study. All of the variations in N levels were noteworthy, with the exception of the harvest index in 2nd season alone. applied of 45 kg N/fed over the control treatment in the 1st and 2nd seasons resulted in increases, height plant of 4.94 and 7.39%, spike length of 21.95 and 12.97%, number of spikelets spike-1 of 13.15 and 8.86%, spike weight of 20.83 and 15.95%, number of kernels spike-1 of 13.14 and 8.86%, 1000-kernel weight of 17.41 and 13.89%, grain yield fed-1 of 13.35 and 12.29%, and straw yield fed-1 of 9.26 and 8.69%. This outcome is mostly attributable to the notable responsiveness of barley plants to nitrogen (N) administration and the critical function of N in the development of barley grains and vegetative growth. Grain yield has increased primarily as a result of N's positive effects on all growth and yield component characteristics. Additionally, these bacteria might create certain compounds that enhance plant growth, which would increase grain yield. This result is consistent with what some researchers found, by Singh *et al.* (2013), Kakraliya *et al.* (2017), Jemal and Aliyi (2021), Adhikari and Singh (2022) and Dahiya *et al.* (2022).

Table 2. Yield and components of barley affected by mineral N levels of 2019/2020 and 2020/2021 seasons

Characters	2019/20 season				LSD at 5%	2020/21 season				LSD at 5%
	0	15	30	45		0	15	30	45	
Plant height (cm)	124.83	129.00	133.83	138.91	**2.57**	123.66	129.50	131.50	136.00	**1.63**
Spike length (cm)	9.70	10.58	11.54	11.83	**0.32**	9.25	9.29	9.75	10.45	**NS**
No. spikelets spike^{-1}	20.91	22.33	23.25	23.66	**0.50**	19.75	20.25	21.83	21.50	**0.85**
Weight of spike^{-1} (g)	3.60	3.98	4.25	4.35	**0.10**	3.26	3.65	3.75	3.78	**0.23**
No. kernels spike^{-1}	62.75	67.00	69.75	71.00	**1.51**	59.25	60.75	65.50	64.50	**2.57**
1000-kernel weight (g)	37.33	40.33	42.66	43.83	**1.10**	35.41	37.91	40.08	40.33	**1.28**
Grain yield (kg fed^{-1})	2253	2415	2539	2554	**81**	2244	2389	2458	2520	**53**
Straw yield (kg fed^{-1})	5277	5542	5776	5766	**157**	5290	5570	5760	5750	**162**
Harvest index	30.01	30.35	30.26	30.81	**NS**	29.75	29.87	29.49	32.09	**NS**

NS=No significance

- Effect of the interaction:

Table 3 displays the substantial interaction between the levels of mineral N fertilizer and organic N + Nano-N on the features under study. The findings show that the levels of organic N + Nano-N and mineral N fertilizer had a significant impact on spike weight in two seasons, whereas height plant in the second one and No. spikelets/spike, No. kernels/spike and grain yield/fed in 1st season were significant differences. The application of organic+nano N treatment under 45 kg N fed^{-1} application treatment resulted in the maximum values of height plant (141.33, 140.00), number of spikelets/spike (23.66, 22.66), weight spike (4.50, 4.00), number of kernels/spike (71.00, 68.00) and grain yield/fed (2609, 2585 kg) in the first, second seasons, respectively. While, under 0 N/fed application treatment, 0 organic+zero nan N treatment produced the minimum values of plant height (121.00 and 119.66), No. spikelets /spike (19.33, 19.00), weight spike (3.30, 3.03), No. kernels/spike (58.00, 57.00), and grain yield/fed (1997, 1995) in the first, second seasons, respectively.

Table 3. The interaction between organic+nano-N and mineral N levels on yield and components of naked barley in 2019/2020 and 2020/2021 seasons

Organic+ Nano-N	2018 season				2019 season			
	Mineral N levels kg fed^{-1}							
	0	15	30	45	0	15	30	45
Plant height (cm)								
Control	121.00	125.33	130.00	136.00	119.66	123.33	127.00	130.66
Organic	124.66	132.33	131.33	139.33	123.00	134.33	128.66	137.00
Nano-N	124.66	130.00	135.00	139.00	123.33	128.33	133.33	136.33
O+N	129.00	128.33	139.00	141.33	128.66	132.00	137.00	140.00
LSD at 5%		**NS**				**3.27**		
No. spikelets spike^{-1}								
Control	19.33	21.33	22.33	23.66	19.00	19.33	21.33	20.33
Organic	21.00	22.33	23.66	23.66	18.66	20.33	22.00	22.00
Nano-N	21.00	22.00	23.33	23.66	20.33	19.33	21.66	21.00
O+N	22.33	23.66	23.66	23.66	21.00	22.00	22.33	22.66
LSD at 5%		**1.00**				**NS**		
Spike weight (g)								
Control	3.30	3.66	3.96	4.50	3.03	3.16	3.90	3.56
Organic	3.56	3.93	4.36	4.30	3.20	3.70	3.36	4.00
Nano-N	3.50	3.96	4.23	4.23	3.13	3.80	4.00	3.50
O+N	4.06	4.36	4.46	4.36	3.70	3.96	3.86	3.93
LSD at 5%		**0.21**				**0.46**		
No. kernels spike^{-1}								
Control	58.00	64.00	67.00	71.00	57.00	58.00	64.00	61.00
Organic	63.00	67.00	71.00	71.00	56.00	61.00	66.00	66.00
Nano-N	63.00	66.00	70.00	71.00	61.00	58.00	65.00	63.00
O+N	67.00	71.00	71.00	71.00	63.00	66.00	67.00	68.00
LSD at 5%		**3.02**				**NS**		
Grain yield (kg fed^{-1})								
Control	1997	2263	2370	2560	1995	2193	2330	2520
Organic	2246	2400	2590	2593	2350	2400	2573	2396
Nano-N	2363	2413	2590	2467	2236	2391	2376	2581
O+N	2408	2586	2609	2596	2396	2573	2553	2585
LSD at 5%		**162**				**NS**		

NS=No significance

Applying 45 kg N fed^{-1} application treatment and organic+nano N treatment under the experiment's conditions is the conclusion that may be drawn.

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إستخدام بعض الأسمدة لتحسين إنتاجية وجودة الشعير العاري

أيه عماد الدين السيد حسين [1] ، ناصر خميس بركات الجيزاوي [1] ، محمد خيري السيد عبدالحافظ [2] وصديق عبد العزيز صديق محيسن [1]

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أجريت تجربتان حقليتان بمنطقة مشتهر – محافظة القليوبية – مصر خلال شتاء موسمي 2020/2019 و 2021/2020 م لدراسة تأثير أربع معاملات من سماد الكمبوست وسماد النانو النيتروجيني (كنترول بدون سماد ، تسميد عضوي كمبوست ، تسميد نانو نيتروجين وتسميد كمبوست + نانو نيتروجين) وأربع معدلات من التسميد النيتروجيني المعدني (صفر ، 15 ، 30 و45 كجم فدان) على النمو والمحصول ومكوناته والقيمة الغذائية لحبوب الشعير العاري صنف جيزة 123. وكان التصميم المستخدم قطاعات كامله العشوائية في أربع مكررات بتوزيع القطع المنشقة حيث وضعت معاملات سماد الكمبوست وسماد النانو النيتروجيني في القطع الرئيسية ووضعت معدلات التسميد النيتروجيني المعدني في القطع الشقية الأولى. وكانت مساحة القطعة التجريبية 10.5 م2 (3 م طولا x 3.5 م عرضا) ..

وتتلخص أهم النتائج بالآتي:.

- سجلت معاملة التسميد بالكومبوست مع الرش بالنيتروجين النانو أعلى القيم لكل الصفات المدروسة بفروق معنوية ما عدا صفة النسبة المئوية لدليل الحصاد في كلا موسمي الزراعة.
- أعطت معاملة التسميد النيتروجيني المعدني بمعدل 45 كجم/فدان أعلى المتوسطات وبزيادة معنوية لكل صفات المحصول ومكوناتة ما عدا النسبة المئوية لدليل الحصاد لكلا موسمي الزراعة.
- تأثر معنويا كل من عدد سنيبلات السنبلة ، عدد حبوب السنبلة ومحصول الحبوب للفدان في الموسم الأول و طول النبات في الموسم الثاني. بينما تأثر وزن السنبلة معنويا في الموسم الأول والثاني بالتفاعل بين سماد الكمبوست+النانو النيتروجيني ومعدلات التسميد النيتروجيني المعدني.

– توصي هذه الدراسة تحت ظروف تلك التجربة بإضافة سماد الكومبوست بمعدل 4 طن+الرش بسماد النانو نيتروجين بمعدل400 مل للفدان مع التسميد الأرضي بالنيتروجين المعدني بمعدل 45 كجم ن للفدان.