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Response of Some Barley Cultivars to Different Sowing Dates, N-Fertilizer and Seeding Rates

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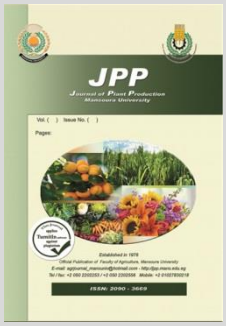

ABSTRACT

Two field experiments were conducted during 2019/2020 and 2020/2021 seasons to study the effect of sowing dates (10th December, 1st January and 20th January), N-fertilizer (45 and 70 kg N/fed) and seeding rates (50 and 70 kg seeds/fed) on earliness, growth, yield and its attributes of some barley cultivars (Giza 132, Giza 133, Giza 134 and Giza 135) under conditions of sandy soils. Each sowing date was accomplished in individual conduct experiment. Every experiment of sowing dates was passed in split-split plot layout with 3 replicates. December 10th plantation markedly exhibited most marked increases in earliness characters, growth characters and yields and its attributes. Giza 134 cultivar produced greatest amounts of plant elevation, No. of spikes/m^2, spike interval, No. of grains for each spike, grains weight for each spike, 1000 – grain wt., grain and straw yields for each fed. Fertilizing with 70 kg N/fed gave greatest amounts of earliness characters, growth characters, yields and its attributes. Sowing with50 kg seeds/fed led to obtain the greatest amounts of No. of days from sowing to 50 % heading and to full maturity, spike interval, No. of grains/spike, grains weight/spike and 1000 – grain wt. While, sowing with 70 kg seeds/fed gave greatest amounts of plant elevation, No. of spikes/m^2, grain and straw yields for each fed. Sowing barley Giza 134 or 133 cultivars on 10th December with 70 kg seeds/fed and fertilizing plants with 70 kg N/fed could be recommended to obtain highest productivity under conditions of sandy soils.

Keywords: Barley, cultivars, sowing dates, N-levels, seeding rates.

INTRODUCTION

Barley (*Hordeum vulgare* L.) is one of the extremely valuable cereal crops in arid and semi-arid areas *i.e.* Egypt and all over the world. Barley can replace wheat as the prevailing crop, due to its tolerance to drought and salinity. Barley is more productive under adverse environments than other cereal crops (Alazmani, 2014). In Egypt, the total cultivated area of barley in 2020 season reached about 69751 feddan and the total production exceeded 104092 tons with an average of 12.44 ardab/fed (FAO, 2022).

Climate change and water management are the most critical constraints to improve and sustain barley productivity. To combat these challenges, the choice of suitable date of sowing, N-fertilizer rate with varying seed rates are of vital significance (Hogy *et al.*, 2013).

Early sowing date of barley recorded higher yield in comparison to late sown crop (Chaudhary *et al.*, 2017). Delay in planting may results in low biomass production and poor grain development due to higher temperature conditions at the time of maturity (Abd El-Lattief *et al.*, 2021). Amarjeet *et al.* (2020) revealed that sowing barley in last week of October recorded higher yields in comparison to sowing in the 3rd week of November. Shivhare *et al.* (2020) found that sown barley on 15th November recorded significantly higher grains number and weight per the spike, length of spike and 1000-grain weight over 5th November and 25th October sown. Moustafa *et al.* (2021) reported that sowing in late October yielded higher than intermediate sowing in mid-November and late sowing in early December.

Agwa and Mohamad (2020) found that barley cultivars significantly affected growth parameters, yield and yield components. Giza134 cultivar had the greatest amounts of all mentioned traits, except for 1000-grain weight, which was increased by Giza 131cultivar. Shivhare *et al.* (2020) found that the variety NDB-3 recorded significantly higher No. of effective tillers, No. of grains per spike and 1000-grain weight comparing other studied varieties (NDB 2, NDB 1173 and Super laxmi). Jemal and Aliyi (2021) indicated that studied barely cultivars Adoshe, Robera and Abdene significantly affected day to heading, day to physiological maturity, plant elevation, spike interval, No. of grains per spike, thousand seed weight, grain and straw yields. The greatest amounts of these traits were recorded from sowing Adoshe barley cultivar. Moustafa *et al.* (2021) reported that genotypes impacted grain yield. Some of the tested genotypes performed better than others as indicated by about 39% grain yield, suggesting higher adaptation capacity.

Nitrogen application influences the amount formed chlorophyll, which influences cell size, leaf area and photosynthetic activity (Marschner, 1995). Tanaka and Nakano (2019) concluded that grain yield increased markedly with increasing N application rate. Abd El-Lattief *et al.* (2021) showed that there was a significant effect of fertilization treatments on plant elevation, spike interval, grains weight/spike, No. of spikes/m^2, 1000-grain weight, the grain and straw yields per feddan. The greatest

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amounts of previous traits were recorded when applied of 75% recommended NPK. Ali *et al.* (2021) found that the highest mean values of plant elevation, spike interval, No. of grains spike^{-1}, grains weight spike^{-1}, and grain yield plant^{-1} were obtained from high level of nitrogen (60 kg N fed^{-1}). Cozzolino *et al.* (2021) showed that barley yield and growth parameters increased with nitrogen application. Gezahegn *et al.* (2021) and Jemal and Aliyi (2021) revealed that the effect of N-fertilizer rates (0, 23, 46, 69, and 92 kg ha^{-1}) showed a significant increase in the No. of the productive tiller, grains number and weight/spike and thousand-grain weight with the increase in nitrogen levels. Also the results showed that the highest No. of grain/spike, thousand-grain weight and grain yield were obtained from application of 92 kg N/ha. Haasan *et al.* (2021) stated that nitrogen fertilization was very effective on all yield characteristics, so any increase in N levels was followed by a significant increase in each of No. of grains/spike, grains weight/spike and No. of spikes/m^2, also increased 1000-grain weight and grain yield per fed.

Seed rates differ by cultivar and sowing method (Agwa and Mohamad, 2020). Bekele *et al.* (2020) concluded that increment in barley seeding rate from 100-175 kg/ha decreased No. of grains/spike by 28.2%, 1000-grain weight by 23.51%. Haasan *et al.* (2021) stated that seeding rate of 80 kg/fed appeared to produce the highest value in each of No. of spikes/m^2 and grain yield/fed. Meanwhile, the seeding rate of 40 kg/fed recorded the highest value in each of No. of grains per spike, weight of grains/spike and 1000-grain. Rahi and Mihbis (2021) showed that the rate of seeds 80 kg ha^{-1} surpassed the characteristics of plant elevation, weight of grains/spike, while the lowest seed level 40 kg ha^{-1} gave an increase in the length of the spike.

Therefore, the objective of the present was to determine the effect of sowing dates, N-fertilizer and seeding rates along with their relations on earliness, growth, yield and its attributes of some barley cultivars under restrictions of sandy soils, Ismailia Governorate, Egypt.

MATERIALS AND METHODS

Dual field trials were organized at investigational Farm of Ismailia Agriculture Research Station, Agricultural Research Center (ARC), Egypt, throughout 2019/2020 and 2020/2021 seasons to study the effect of sowing dates, N-fertilizer and seeding rates as well as their interactions on earliness, growth, yield and its attributes of some barley cultivars under conditions of sandy soils.

Three sowing dates (10th December, 1st January and 20th January) as intermediate, late and too late sowing were studied. Each sowing date was representative as experiment. Every experimentation of sowing dates was brought out designed in split-split plot layout with triplet replicates.

The main plots were assigned to two mineral N-fertilizer rates (45 and 70 kg N for each fed) as ammonium nitrate (33.5 % N), which utilized at the abovementioned amounts as transmitting in two equivalent amounts preceding the 1st and the 2nd watering.

The sub plots (3 × 3.5 m *i.e.* 10.5 m^2) were allotted to two seeding rates (50 and 70 kg seeds/fed). Barley seeds of studied cultivars at the aforementioned rates were sown using broadcasting method.

The sub sub-plots were assigned to four barley cultivars (Giza 132, Giza 133, Giza 134 and Giza 135).

Allowing to Page (1982) physical and chemical soil properties were measured in soil samples that taken from the experimental field area as revealed in Table 1.

Table 1. Physical and chemical soil estates at the investigational sites throughout 2019/2020 and 2020/2021seasons.

Soil property	2019/2020 Season	2020/2021 Season
A: Particle size distribution (%):		
Coarse sand	49.40	48.90
Fine sand	41.40	41.90
Silt	4.00	3.95
Clay	5.20	5.25
Texture class	Sandy	
B: Soil physical properties:		
Bulk density (g/cm^3)	1.82	1.91
Hydraulic conductivity (cm h^{-1})	12.99	12.85
Wilting point (%)	5.00	4.95
Field capacity (%)	11.23	11.26
Available water (%)	6.23	6.25
C: Soil chemical properties:		
EC (dS m^{-1} soil paste extract)	0.83	0.85
pH (1 : 2.5 soil : water suspension)	7.78	7.81
Organic matter (%)	0.18	0.16
CEC (e-mol/kg)	8.15	8.18

The cultivation took place on the aforesaid dates in both seasons. The first irrigation was applied at 15 days after sowing and then plants were irrigated every 10 days till the dough stage. The common agricultural practices for growing barley under conditions of sandy soils corresponding to the suggestions of Ministry of Agriculture were observed not including the factors beneath study.

Studied characters:

- Earliness characters:

Earliness characters and No. of days from sowing to 50 % heading and to full maturity were determined as the No. of days from sowing to 50 % heading and to full maturity in each plot.

- Growth characters:

Once 100 days after planting, 1 m^2 was at random chosen from every plot to assess plant elevation (cm) as average of ten plants.

- Yields and its attributes:

On harvest time, 1 m^2 was at random chosen from every plot to assess No. of spikes for each m^2, spike interval (cm), No. of grains for each spike, grains weight for each spike (g) and 1000 – grain wt. (g), grain (in ardab for each fed) and straw yields (tons for each fed).

All data were statistically analyzed according to ANOVA for the split-split plot design to each experiment, then combined analysis was done between sowing dates experiments after doing homogeneity test error mean squares between sowing dates as published by Gomez and Gomez (1984). Least significant difference (LSD) method was used to examine the variations among means at 5 % level of possibility as explained by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1. Effect of sowing dates:

Regarding the effect of sowing dates *i.e.* 10th December, 1st January and 20th January as intermediate, late and too late sowing, respectively on earliness characters (No. of days from sowing to 50 % heading and to full maturity), growth characters (plant elevation) and yields and its attributes (No. of spikes/m^2, spike interval, No. of grains/spike, grains weight/spike, 1000 – grain weight wt., grain along with straw yields for each fed), it significant in the two time of years (Tables 2 and 3).

It is clearly seen that December 10th plantation markedly exhibited the most marked increases in earliness characters, growth characters and yields and its attributes of barley ~~if~~ compared with late or too late sowing in both seasons. Where, the greatest amounts of earliness characters, growth characters and yields and its attributes were resulted from sowing barley on 10th December in the first and second seasons. Late sowing date of barley on 1st January ranked after the former mentioned sowing date concerning its effect on earliness characters, growth characters and yields and its attributes of barley in both seasons. Whereas, the lowest values of earliness characters, growth characters and yields and its attributes were recorded due to too delay sowing date of barley up to 20th January in the first and second seasons of this study.

The desirable effect on earliness characters, growth characters and yields and its attributes of barley as a result of planting barley on 10th December might be imputed to the suitable environmental conditions during this period which play a vigorous protagonist in activating establishment and development of plants, hence increasing plant elevation. Confirming these findings, Amarjeet *et al.* (2020), Shivhare *et al.* (2020), Abd El-Lattief *et al.* (2021) and Moustafa *et al.* (2021).

2. Cultivars performance:

The obtained results of this study indicate that all studied earliness characters (No. of days from sowing to 50 % heading and to full maturity), growth characters (plant elevation) and , yields and its attributes (No. of spikes for each m^2, spike interval, No. of grains for each spike, grains weight for each spike, 1000 – grain wt., grain and straw yields for each fed) were significantly differed due to various studied barley cultivars i.e. Giza 132, Giza 133, Giza 134 and Giza 135 in both seasons (Tables 2 and 3).

It could be noticed that barley cultivar Giza 132 surpassed other studied cultivars (Giza 133, Giza 134 and Giza 135) and resulted in the highest No. of days from sowing to full maturity and the lowest values of No. of spikes/m^2, spike interval, No. of grains for each spike, grains weight for each spike, 1000 – grain wt., grain and straw yields for each fed in both seasons. Nevertheless, Giza 134 cultivar produced the greatest amounts of plant elevation, No. of spikes for each m^2, spike interval, No. of grains for each spike, grains weight for each spike, 1000 – grain wt., grain and straw yields for each fed and the lowest values of No. of days from sowing to full maturity in the first and second seasons. However, Giza 135 cultivar significantly exceeded another examined cultivars in No. of days to 50 % heading and plant elevation in both seasons. While, Giza 133 cultivar recorded the lowest values of No. of days to 50 % heading and plant elevation in both growing seasons.

Table 2. No. of days from sowing to 50 % heading and full maturity, plant elevation, No. of spikes/m^2 and spike interval as affected by sowing dates, N-fertilizer and seeding rates of some barley cultivars as well as their interactions during 2019/2020 and 2020/2021 seasons.

Characters / Treatments	No. of days to 50 % heading		No. of days to full maturity		Plant elevation (cm)		No. of spikes/m^2		Spike interval (cm)	
Seasons	2019/2020	2020/2021	2019/2020	2020/2021	2019/2020	2020/2021	2019/2020	2020/2021	2019/2020	2020/2021
A- Sowing dates:										
10th December	91.81	92.79	122.8	126.8	103.89	108.21	269.4	274.6	7.69	8.00
1st January	84.93	86.00	117.5	118.5	98.24	102.46	239.7	246.4	7.26	7.56
20th January	77.50	78.47	108.0	109.1	86.18	90.83	213.1	218.1	6.84	7.17
LSD (0.05)	0.44	0.50	0.8	0.5	1.30	1.38	4.3	4.0	0.13	0.14
B- Cultivars:										
Giza 132	85.38	86.36	119.0	120.5	95.89	101.06	224.1	230.8	7.08	7.39
Giza 133	82.58	83.66	116.0	117.4	86.83	91.80	247.0	252.0	7.29	7.58
Giza 134	85.22	86.19	113.1	117.1	100.75	103.83	266.8	271.5	7.54	7.87
Giza 135	85.80	86.80	116.4	117.5	100.94	105.30	225.0	231.1	7.15	7.46
LSD (0.05)	0.59	0.61	1.2	1.0	1.37	1.42	3.3	3.9	0.12	0.13
C- N-fertilizer rates:										
45 kg N/fed	83.80	84.86	115.2	117.7	91.79	96.79	230.1	236.9	7.05	7.36
70 kg N/fed	85.69	86.65	117.0	118.6	100.41	104.21	251.4	255.9	7.48	7.79
F. test	*	*	*	*	*	*	*	*	*	*
D- Seeding rates:										
50 kg seeds/fed	85.11	86.12	117.1	118.4	92.54	98.17	235.0	241.1	7.41	7.71
70 kg seeds/fed	84.38	85.38	115.1	117.8	99.67	102.83	246.4	251.6	7.12	7.44
F. test	*	*	*	*	*	*	*	*	*	*
E- Interactions (F. test):										
A × B	NS	NS	NS	NS	NS	NS	*	*	*	*
A × C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
A × D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
B × C	NS	NS	NS	NS	*	*	*	*	*	*
B × D	NS	NS	NS	NS	*	*	NS	NS	*	*
C × D	*	*	*	*	*	*	*	*	*	*
A × B × C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
A × B × D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
A × C × D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
B × C × D	NS	NS	NS	NS	*	*	*	*	NS	NS
A × B × C × D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 3. No. of grains/spike, grains weight/spike, 1000 – grain wt., grain and straw yields/fed as affected by sowing dates, N-fertilizer and seeding rates of some barley cultivars as well as their interactions during 2019/2020 and 2020/2021 seasons.

Characters Treatments	No. of grains/spike		Grains weight/ spike (g)		1000 – grain wt. (g)		Grain yield (ardab/fed)		Straw yield (t/fed)	
Seasons	2019/2020	2020/2021	2019/2020	2020/2021	2019/2020	2020/2021	2019/2020	2020/2021	2019/2020	2020/2021
A- Sowing dates:										
10th December	65.95	69.22	3.357	3.454	50.73	53.73	14.36	14.66	3.608	3.969
1st January	62.27	66.56	2.941	3.038	47.08	50.00	12.40	12.93	3.301	3.397
20th January	58.66	62.66	2.600	2.725	44.16	47.10	10.61	10.91	2.885	2.970
LSD (0.05)	1.15	1.20	0.050	0.052	0.93	0.87	0.31	0.35	0.117	0.115
B- Cultivars:										
Giza 132	60.69	64.25	2.622	2.726	43.11	46.20	11.36	11.83	3.044	3.126
Giza 133	62.50	66.02	2.950	3.069	47.42	50.09	12.57	12.85	3.325	3.426
Giza 134	64.66	69.08	3.320	3.400	51.06	54.01	13.93	14.21	3.586	4.011
Giza 135	61.33	65.25	2.972	3.094	47.72	50.82	11.98	12.44	3.104	3.218
LSD (0.05)	1.02	1.08	0.064	0.073	0.85	0.80	0.13	0.15	0.069	0.062
C- N-fertilizer rates:										
45 kg N/fed	60.48	64.55	2.741	2.874	45.09	48.05	11.29	11.74	2.972	3.055
70 kg N/fed	64.11	67.75	3.191	3.271	49.56	52.51	13.64	13.92	3.558	3.835
F. test	*	*	*	*	*	*	*	*	*	*
D- Seeding rates:										
50 kg seeds/fed	63.54	67.48	3.072	3.169	48.09	51.05	11.84	12.22	3.130	3.417
70 kg seeds/fed	61.05	64.81	2.860	2.976	46.56	49.51	13.08	13.45	3.400	3.474
F. test	*	*	*	*	*	*	*	*	*	*
E- Interactions (F. test):										
A × B	*	*	*	*	NS	NS	*	*	*	*
A × C	NS	NS	*	*	*	*	*	*	*	*
A × D	NS	NS	NS	NS	NS	NS	*	*	*	*
B × C	*	*	*	*	*	*	*	*	*	*
B × D	*	*	*	*	*	*	NS	NS	NS	NS
C × D	*	*	NS	NS	NS	NS	*	*	*	*
A × B × C	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
A × B × D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
A × C × D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
B × C × D	NS	NS	NS	NS	*	*	*	*	*	*
A × B × C × D	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

The variation among barley cultivars in earliness characters, growth characters and yields and its attributes may be due to the genetical variation between them. These results are in close harmony with those recorded by Agwa and Mohamad (2020), Shivhare *et al.* (2020), Jemal and Aliyi (2021) and Moustafa *et al.* (2021)

3. Impact of N-fertilizer rats:

N-fertilizer levels (45 and 70 kg N/fed) significantly affected barley earliness characters (No. of days from sowing to 50 % heading and to full maturity), growth characters (plant elevation) and yields and its attributes (No. of spikes/m^2, spike interval, No. of grains/spike, grains weight/spike, 1000 – grain wt., grain and straw yields/fed) in both seasons (Tables 2 and 3).

Fertilizing barley plants with 70 kg N for each fed gave the greatest amounts of earliness characters, growth characters and yields and its attributes in the 1st and 2nd seasons. Whereas, mineral fertilizing barley plants with 45 kg N for each fed produced the lowest values of earliness characters, growth characters and yields and its attributes in equally seasons. These results can be easily ascribed to the nitrogen which consider as one of the major elements for plant nutrition and it increases the vegetative cover for plant and forms strong plants with long spikes. Moreover, nitrogen encourages plant to uptake other elements activating, thereby growth of plants, consequently enhancing growth measurements and all yield components and grain yield per unit area. Comparable results were obtained by Ali *et al.* (2021), Cozzolino *et al.* (2021), Gezahegn *et al.* (2021), Haasan *et al.* (2021) and Jemal and Aliyi (2021).

4. Effect of seeding rates:

The obtained data of this research reveal that the effect of seeding rates (50 and 70 kg seeds/fed) of barley on all studied earliness characters (No. of days from sowing to 50 % heading and to full maturity), growth characters (plant elevation) and yields and its attributes (No. of spikes/m^2, spike interval, No. of grains for each spike, grains weight for each spike, 1000 – grain wt., grain along with straw yields for each fed) was significant in both seasons (Tables 2 and 3).

It was noticed that decreasing No. of plants per feddan by sowing the lowest seeding rate (50 kg seeds/fed) led to obtained the greatest amounts of earliness characters, growth characters and yields and its attributes in the 1st and 2nd time of years. While, sowing with the utmost seeding rate (70 kg seeds/fed) gave the greatest amounts of plant elevation, No. of spikes/m^2, grain and straw yields/fed and the lowest values of No. of days from sowing to 50 % heading and to full maturity, spike interval, No. of grains/spike, grains weight/spike and 1000 – grain wt. in the first and second seasons.

This increase in grain yield/fed due to the increase in seeding rate may be due to the increase in the No. of plants per unit area, although decrease grain yield of individual plants as a result of competition among the adjacent plants, which led to decrease the amount of solar radiations intercepted by plants, as well as less aeration and light distribution among plants, which led to decrease the photosynthetic activities and dry matter accumulation per plant. Similar ~~comparable~~ results were obtained by Bekele

et al. (2020), Haasan *et al.* (2021) and Rahi and Mihbis (2021).

5. Effect of interactions:

About the effect of interactions among studied factors (sowing dates, barley cultivars, N-fertilizer and seeding rates), there are a lot of significant effects on all studied characters as showed in Tables 2 and 3. We present only the effect of significant interaction on grain yield.

Data in Tables 4 appear that the greatest amounts of grain yield/fed (15.91 and 16.09 ardab/fed) were resulted from sowing barley Giza 134 on 10th December as intermediate sowing date in the first and second seasons, respectively. Sowing barley Giza 133 on 10th December ranked secondly after sowing barley Giza 134 on 10th December in together time of years. Conversely, the lowest possible rates of grain yield for each fed (9.52 and 9.83 ardab/fed) were resulted from sowing barley sowing barley Giza 132 on 20th January as too late sowing date in the first and second seasons, respectively.

Table 4. Grain yield (ardab/fed) as affected by the interaction between sowing dates and barley cultivars during 2019/2020 and 2020/2021 seasons.

Sowing dates	Cultivars			
	Giza 132	Giza 133	Giza 134	Giza 135
	2019/2020 season			
10th December	13.34	14.23	15.91	13.98
1st January	11.21	12.83	13.66	11.92
20th January	9.52	10.67	12.23	10.04
LSD (0.05)	0.22			
	2020/2021 season			
10th December	13.66	14.55	16.09	14.33
1st January	12.00	13.06	14.01	12.63
20th January	9.83	10.95	12.53	10.34
LSD (0.05)	0.26			

Data in Table 5 become manifest that the greatest amounts of grain yield/fed (15.73 and 15.99 ardab/fed) were produced from sowing barley on 10th December as intermediate sowing date and fertilizing with the highest N-fertilizer rate (70 kg N/fed) in the first and second seasons, respectively. Therefore, the best interaction treatment was sowing barley on 1st January as late sowing date and fertilizing with the highest N-fertilizer rate (70 kg N /fed) in together time of years. Alternatively, the smallest rates of grain yield for each / fed (9.67 and 9.97 ardab/fed) were resulted from sowing barley on 20th January as too late sowing date and fertilizing with the lowest N-fertilizer rate (45 kg N/fed) in the 1st and 2nd seasons, correspondingly.

Table 5. Grain yield (ardab/fed) as affected by the interaction between sowing dates and N-fertilizer rates during 2019/2020 and 2020/2021 seasons.

Sowing dates	N-fertilizer rates	
	45 kg N/fed	70 kg N/fed
	2019/2020 season	
10th December	13.00	15.73
1st January	11.19	13.62
20th January	9.67	11.56
LSD (0.05)	0.26	
	2020/2021 season	
10th December	13.32	15.99
1st January	11.94	13.91
20th January	9.97	11.85
LSD (0.05)	0.30	

Statistics Data in Table 6 show that greatest amounts of grain yield/fed (14.97 and 15.25 ardab/fed) were resulted from sowing barley on 10th December as intermediate sowing date with the highest seeding rate (70 kg seeds for each / fed) in the 1st and 2nd seasons, correspondingly. The next best interaction treatment was sowing barley on 10th December as intermediate sowing date with the lowest seeding rate (50 kg seeds/fed) in both seasons. In contrast, the bottom amounts lowest values of grain yield for each/fed (10.13 and 10.43 ardab for each/fed) were resulted from sowing barley on 20th January as too late sowing date with the lowest seeding rate (50 kg seeds/fed) in the 1st and 2nd seasons, correspondingly.

Table 6. Grain yield (ardab/fed) as affected by the interaction between sowing dates and seeding rates during 2019/2020 and 2020/2021 seasons.

Sowing dates	Seeding rates	
	50 kg seeds/fed	70 kg seeds/fed
	2019/2020 season	
10th December	13.76	14.97
1st January	11.65	13.16
20th January	10.13	11.10
LSD (0.05)	0.26	
	2020/2021 season	
10th December	14.07	15.25
1st January	12.16	13.70
20th January	10.43	11.40
LSD (0.05)	0.29	

Data in Table 7 become manifest that the greatest amounts of grain yield/fed of barley (15.05 and 15.30 ardab/fed) were produced from fertilizing Giza 134 cultivar with the highest N-fertilizer rate (70 kg N/fed) in the 1st and 2nd seasons, correspondingly. Therefore, the best interaction treatment was fertilizing Giza 133 cultivar with the highest N-fertilizer rate (70 kg N/fed) in time of years. Alternatively, While, the smallest amounts of grain yield/fed of barley (10.60 and 11.18 ardab/fed) were resulted from fertilizing Giza 132 cultivar with the lowest N-fertilizer rate (45 kg N/fed) in the 1st and 2nd seasons, correspondingly.

Table 7. Grain yield (ardab/fed) as affected by the interaction between barley cultivars and N-fertilizer rates during 2019/2020 and 2020/2021 seasons.

Cultivars	N-fertilizer rates	
	45 kg N/fed	70 kg N/fed
	2019/2020 season	
Giza 132	10.60	12.10
Giza 133	11.11	14.04
Giza 134	12.82	15.05
Giza 135	10.61	13.36
LSD (0.05)	0.30	
	2020/2021 season	
Giza 132	11.18	12.37
Giza 133	11.39	14.32
Giza 134	13.12	15.30
Giza 135	11.29	13.70
LSD (0.05)	0.32	

Data in Table 8 turn into apparent that the greatest amounts highest values of grain yield/fed of barley (14.37 and 14.64 ardab/fed) were produced from sowing with the highest seeding rate (70 kg seeds/fed) and fertilizing with the highest N-fertilizer rate (70 kg N/fed) in the 1st and 2nd seasons, correspondingly. The subsequently. So, the best

interaction treatment was sowing with the lowest seeding rate (50 kg seeds/fed) and fertilizing with the highest N-fertilizer rate (70 kg N/fed) in the two growing seasons. Also, the lowest values smallest amounts of grain yield/fed of barley (10.79 and 11.23 ardab/fed) were resulted from sowing with the lowest seeding rate (50 kg seeds/fed) and fertilizing with the lowest N-fertilizer rate (45 kg N/fed) in the 1st and 2nd seasons, correspondingly.

Table 8. Grain yield (ardab/fed) as affected by the interaction between N-fertilizer and seeding rates during 2019/2020 and 2020/2021 seasons.

N-fertilizer rates	Seeding rates	
	50 kg seeds/fed	70 kg seeds/fed
	2019/2020 season	
45 kg N/fed	10.79	11.78
70 kg N/fed	12.90	14.37
LSD (0.05)	0.22	
	2020/2021 season	
45 kg N/fed	11.23	12.25
70 kg N/fed	13.20	14.64
LSD (0.05)	0.23	

Data in Table 9 show that the greatest amounts of grain yield/fed of barley (16.10 and 16.39 ardab/fed) were resulted from sowing Giza 134 cultivar with the highest seeding rate (70 kg seeds/fed) and fertilizing with the highest N-fertilizer rate (70 kg N/fed) in the 1st and 2nd seasons, correspondingly. The next best interaction treatment was sowing Giza 133 cultivar with the highest seeding rate (70 kg seeds/fed) and fertilizing with the highest N-fertilizer rate (70 kg N/fed) in both seasons. On the other hand, the shortest values of ardab/fed of barley (10.01 and 10.51 ardab/fed) were resulted from sowing Giza 132 cultivar with the lowest seeding rate (50 kg seeds/fed) and fertilizing with the lowest N-fertilizer rate (45 kg N/fed) in the 1st and 2nd seasons, correspondingly.

Table 9. Grain yield (ardab/fed) as affected by the interaction among barley cultivars, N-fertilizer rates and seeding rates during 2019/2020 and 2020/2021 seasons.

N-fertilizer rates	Seeding rates	Cultivars			
		Giza 132	Giza 133	Giza 134	Giza 135
	2019/2020 season				
45 kg N/ fed	50 kg seeds/fed	10.01	10.58	12.37	10.20
	70 kg seeds/fed	11.20	11.64	13.27	11.02
70 kg N/ fed	50 kg seeds/fed	11.53	13.47	13.99	12.62
	70 kg seeds/fed	12.68	14.61	16.10	14.10
LSD (0.05)		0.43			
	2020/2021 season				
45 kg N/ fed	50 kg seeds/fed	10.51	10.91	12.67	10.85
	70 kg seeds/fed	11.50	11.87	13.57	12.07
70 kg N/ fed	50 kg seeds/fed	11.84	13.74	14.21	13.00
	70 kg seeds/fed	12.89	14.89	16.39	14.40
LSD (0.05)		0.52			

CONCLUSION

It can be concluded that sowing barley Giza 134 or 133 cultivars on 10th December with 70 kg seeds/fed and fertilizing plants with 70 kg N/fed to obtain highest efficiency under the environmental conditions of sandy soils at Ismailia Governorate, Egypt.

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استجابة بعض أصناف الشعير لمواعيد الزراعة ومعدلات مختلفة من السماد النيتروجينى والتقاوي

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أقيمت تجربتان حقليتان في المزرعة البحثية بمحطة البحوث الزراعية بالإسماعيلية، مركز البحوث الزراعية ، مصر، خلال موسمى 2020/2019 و 2020 / 2021 يهدف دراسة بعض العمليات الزراعية التى تساهم فى زيادة إنتاجية الشعير مثل مواعيد الزراعة المختلفة تعبيراً عن التغيرات المناخية التى يشهدها العالم ومصر فى الآونة الأخيرة وأنسب الأصناف للزراعة ومعدلات السماد النيتروجينى ومعدلات التقاوى. تم تنفيذ مواعيد الزراعة الثلاثة (10 ديسمبر "ميعاد متوسط" ، 1 يناير "ميعاد متأخر" و20 يناير "ميعاد متأخر جدا") فى تجارب مستقلة. ثم تم تنفيذ كل تجربة لمواعيد الزراعة فى تصميم القطع المنشقة مرتين فى ثلاث مكررات. حيث إشتملت القطع الرئيسية على الأربعة أصناف تحت الدراسة وهى؛ جيزة 132، جيزة 133.، جيزة 134 وجيزة 135. أما القطع الشقية الأولى فقد إحتوت على مستويين من السماد المعدنى النيتروجينى (45 و 70 كجم نيتروجين / فدان). فى حين احتوت القطع الشقية الثانية على معدلين للتقاوى هما؛ 50 و70 كجم تقاوى / فدان، ثم أجري التحليل التجميعى للتجارب مواعيد الزراعة الثلاثة. توضح النتائج المتحصل عليها أن الزراعة فى 10 ديسمبر أظهرت بشكل ملحوظ زيادات معنوية في صفات التبكير والنمو والمحصول ومكوناته إذا ما قورنت بالزراعة المتأخر أو المتأخرة جداً في كلا الموسمين، حيث نتجت أعلى القيم لصفات عدد الأيام من الزراعة حتى طرد 50٪ من السنابل وحتى تمام النضج ، ارتفاع النبات، عدد السنابل / م 2 ، طول السنبلة ، عدد الحبوب / سنبلة ، وزن الحبوب / سنبلة ، وزن 1000 حبة ، محصول الحبوب والقش / فدان من زراعة الشعير في 10 ديسمبر في كلا الموسمين. وجد أن صنف الشعير جيزة 134 تفوق على الأصناف المدروسة الأخرى (جيزة 132 ، جيزة 133 ، جيزة 135) وأعطى افضل القيم لصفات عدد الأيام من الزراعة حتى النضج الكامل وأدنى القيم لصفات عدد السنابل / م 2 ، طول السنبلة ، عدد الحبوب / السنبلة ، وزن الحبوب / السنبلة ، وزن 1000 حبة، محصول الحبوب والقش / فدان في كلا الموسمين. أعطت نباتات الشعير التى تم تسميدها معدنياً بأعلى مستوى من السماد النيتروجيني (70 كجم نيتروجين / فدان) أعلى قيم لصفات عدد الأيام من الزراعة حتى طرد 50٪ من السنابل وحتى تمام النضج ، ارتفاع النبات، عدد السنابل / م 2 ، طول السنبلة ، عدد الحبوب / سنبلة ، وزن الحبوب / سنبلة ، وزن 1000 حبة ، محصول الحبوب والقش / فدان في كلا الموسمين الأول والثاني. لوحظ أن تناقص عدد النباتات للفدان عن طريق الزراعة بأقل معدل تقاوى (50 كجم تقاوى / فدان) أدت إلى الحصول على أعلى القيم لصفات عدد الأيام من الزراعة حتى طرد 50٪ من السنابل وحتى النضج الكامل وطول السنبلة وعدد الحبوب / سنبلة ، وزن الحبوب / سنبلة ووزن 1000 حبة في كلا الموسمين الأول والثاني. بينما أعطت الزراعة بأعلى معدل تقاوى (70 كجم تقاوى / فدان) أعلى القيم لصفات ارتفاع النبات وعدد السنابل / م 2 ومحصول الحبوب والقش / فدان في كلا الموسمين الأول والثاني. من نتائج هذه الدراسة يمكن التوصية بزراعة الشعير صنف جيزة 134 أو 133 فى 10 ديسمبر بمعدل تقاوى 70 كجم / فدان معد التسميد المعدني للنباتات بمعدل 70 كجم نيتروجين / فدان وذلك للحصول على أقصى إنتاجية تحت الظروف البيئية للأراضي الرملية بمحافظة الإسماعيلية، مصر