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Response of Three Wheat Varieties to Nitrogen Levels, Seeding Rates and Their Combination: 1. Growth Analysis

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Abstract: Two field experiments were conducted to evaluate the effect of three nitrogen fertilizer levels, i.e. 60, 80 and 100 kg N/fed One feddan = 4200m^2 = 2.4h, three seeding rates, i.e. 40, 60 and kg grains/fed on growth analysis of three wheat varieties (Giza-171, Gemmiza-12 and Shandawil-1) where randomly kept in main plots, sub plots and sub-subplots, respectively at Agricultural and Experiments Research Station, Giza, Faculty of Agriculture, Cairo University, Egypt during 2018/2019 and 219/2020 seasons. The estimated studied growth characters were: Leaf area (LA) at 40, 60 and 80 days after sowing (DAS), leaf area index (LAI) at 40, 60 and 80 DAS, crop grow rate (CGR), Relative growth rate (RGR) and nit assimilation rate (NAR) at two periods (40-60 and 60-8 DAS) and flag leaf area (FLA) at 80 DAS. Results indicated that nitrogen fertilizer levels had significant effect on all studied characters in both season, except LA at 40 DAS, CGR at both periods in the first season and LA at 40 and 60 DAS, NAR at both periods in the second season. Application of either 100 or 80 kg N/fed recorded the highest values of the most of studied characters in first and second season, respectively. Seeding rates significantly affected all studied traits in both season, except LAI at 80 DAS, RGA at 60 DAS, NAR at the first period and FLA in the first season and LA at all dates, RGR at second period and NAR at both periods in the second season. The highest of the most studied traits wee obtained with planting wheat with either 60 or 80 kg grains/fed. Among verities, Giza-171 followed by Gemmiza-12 recorded the highest significant values from all studied characters in both seasons. Concerning the interaction between all studied factors, significant effect on LAI at 40 and 80 DAS, CGR at both periods, RGR at second period and FLA in the first season was found. On the other hand, this interaction significantly affected the most of studied characters in first season. It could be conclude that planting Giza-171 with 80 kg grains/fed and application of 100 kg N/fed could produced the highest values of the most of studied growth characters under the experimental site and the similar conditions.

Keywords: Wheat Varieties, Growth Analysis, N Levels and Seeding Rates

1. Introduction

Wheat (*Triticumaestivum* L.) is an important food crop in Egypt. During 2016-2020, it was grown on an area of 3.5 million feddan (one feddan=4200m^2) with an annual production of 9.3 million tons. Egypt imports more than 50% of its wheat requirement [6, 10]. Therefore, increasing wheat production is an important goal to reduce the gap between production and consumption through expanding the wheat cultivated area ond increasing productivity per unit area. Consequently, increasing wheat production is major concern of Agronomists [10, 21]. External factors including light, plant density and fertilizer application have significant effect on growth and yield of wheat. The wheat crop requires adequate supply of seeds and nutrients particularly nitrogen for good growth and higher yield. Moreover, seeding rate and

nitrogen fertilizer are very essential for good vegetative growth, plant development and grain development in wheat production. The growth attributed are directly influenced by different nitrogen levels, seeding rates and varieties 13, 20, 11, and 10.It is well established fact that plant structure is determined by growth parameters such as leaf area, leaf area index, crop growth rate, relative growth rate, nitassimilation rate and flag leaf area. The use of the above mentioned growth parameters to analysis quantity plant growth had become known as growth analysis [26].”Keeping in view the above factors, the present research was conducted to investigate the effect of different nitrogen levels, seeding rates and varieties on growth analysis of wheat.

2. Materials and Methods

Two field experiments were conducted to evaluate the effect of three nitrogen fertilizer levels, threeseeding rates on growth analysis of three wheat varieties at Agricultural and Experiments Research Station, Giza, Faculty of Agriculture, Cairo University, Egypt. During 2018/2019 and 2019/2020 seasons. The experiments were laid out in randomized complete block design having split-split plot arrangement with three replication. Nitrogen levels, i.e. 60 kg N/fed (25% lower than the recommended rate), 80 kg N/fed (recommended rate) and 100 kg N/fed (25% more than the recommended rate) (One feddan = 4200 m^2 = 2.4 h), three different seed rates, i.e. 40 kg grains/fed (25% lower than the recommended rate), 60 kg grains/fed (recommended rate) and 80 kg grains /fed (25% more than the recommended rate) and three wheat varieties (Giza-171, Gemmiza-12 and Shandawil-1) where randomly kept in main plots, sub plots and sub-subplots, respectively. The nit plot size 4 m^2 (2 x 2m)**.**Wheatgrains were handily drilled in rows spaced 20 cm apart on 22th and 18th November in both seasons, respectively. The preceding crop was corn in both seasons. Half of nitrogen fertilizer in the form of urea (46.5 N) was appliedin the two equal doses, half was applied at sowing, while the remaining half was applied at the first irrigation. Nutrients, otter than nitrogen, were applied uniformly to the experiments according to the requirements of the crop.All other agronomic practices were kept normal and uniform. The estimated studied growth characters were: Leaf area (LA) at 40, 60 and 80 days after sowing (DAS) according to [18], leaf area index (LAI) at 40, 60 and 80 DAS according to [26], crop grow rate (CGR), Relative growth rate (RGR) and nit assimilation rate (NAR) at two periods (40-60 and 60-8 DAS) according to [19] and flag leaf area (FLA) at 80 DAS according to [18] All the data collected during the both seasons were subjected to statistical analysis using Excel data sheet by using statistical software package MSTAT-C [15] Least Significant Differences test (L.S.D) at 0.05% probability was employed to test the significant differences among mean values of each treatment [24].

3. Results and Discussion

Effect of nitrogen fertilizer levels on leaf area (lA), leaf area index (LAI), area index (LAI), crop growth rate (CGR), relative growth rate (RGR), nit assimilation rate (NAR) and flag leaf area (FLA) in both seasons are presented in Table 1.

Table 1. *Leaf area (LA), leaf area index (LAI), crop growth rate (CGR), relative growthrate (RGR, nit assimilation rate (NAR) and flag leaf area (FLA) as affected bynitrogen fertilizer levels in both seasons.*

Characters	N levels (kg/fed[1])									
	60	80	100	F	LSD	60	80	100	F	LSD
	2018/2019					2019/2020				
LA at 40 DAS	21.90	21.20	23.60	ns	-	22.60	21.11	21.40	ns	-
LA at 60 DAS	24.3	25.00	24.50	*	0.20	41.90	40.50	43.4	ns	-
LA at 80 DAS	46.30	46.70	4.84	*	0.39	46.50	41.50	47.80	*	1.20
LAI at 40 DAS	3.30	3.20	3.50	*	0.21	3.00	3.50	3.20	*	0.20
LAI at 60 DAS	8.70	8.30	8.80	*	0.09	11.7	11.80	11.90	*	0.10
LAI at 80 DAS	7.80	7.60	7.90	*	0.10	20.60	19.80	9.40	*	0.39
CGR at 40-60 DAS	2.59	2.50	3.10	ns	-	1.34	1.48	1.36	*	0.11
CGR at 60-80 DAS	9.56	8.46	8.69	ns	-	1.97	2.59	2.13	*	0.45
RGR at 40-60 DAS	6.40	7.26	8.47	*	0.75	3.80	2.63	2.81	*	0.17
RGR at 60-80 DAS	15.22	18.85	19.69	*	0.83	7.12	6.72	6.81	*	0.07
NAR at 40-60 DAS	5.16	4058	45.90	*	0.10	1.11	1.24	0.85	ns	-
NAR at 60-80 DAS	11.14	9.00	9.81	*	1.32	1.61	1.68	1.69	ns	-
FLA at 80 DAS	62.4	61.30	65.00	*	1.10	45.80	46.00	44.60	*	1.20

*=Significant
ns- Not significant
1= One feddan=4200m^2

Results indicated that nitrogen fertilizer levels had a significant effect on LA at 60 and 80 DAS in the first season and at 80 DAS in the second one. The heights leaf area (25.0 and 48.4 dm^2) was obtained at 60 and 80 kg N/fed at both growth dates, respectively. In this way and in the second season, the highest value (47.80 d/m^2) was recorded under application of 80 kg N/fed. This effecting might be due to the effect of nitrogen on leaf expansion, cell division and enlargement. It is known that nitrogen fertilizer increase metabolism activates of plant cell which enhancing its photosynthetic products of assimilation. These results are in harmony with those obtained by [19, 1, 9] who found that

leaf area /plant increased significantly with increasing nitrogen levels. Result indicated that application of nitrogen at different levels had significant effect on LAI at all dates in both seasons. Application of 100 kg N/fed produced the highest LAI (3.50 and 8.80) at first and second dates in the first season as well as (11.9) at the second date in the second one.These results are in agreement with those obtained by [2, 23, 9]. Crop growth rate significantly affected with changing nitrogen fertilizer levels at the two studied periods in the second season. Fertilized wheat plants with 80 kg N/ fed showed the highest CGR (1.48 and 2.39 g /m^2/day) in both periods, respectively. These results are in agreement with those obtained by [22, 5 and 14]. Results indicated that higher level of nitrogen (80 kg N/fed) produced significantly higher RGR (8.47 and 19.69 g/g/day) at both periods in the first season, respectively while, application of 60 kg N/fed produced the highest values (3.80 and 7.12) at both periods, respectively in the second season. This might be referred to the lowest dry matter production results from the lower nitrogen level. These result are in harmony with those obtained by [16, 2, 13, 23, 14] These result indicated that NAR significantly affected among the changing in nitrogen fertilizer levels at both periodsin the first season where the highest NAR (5.16 and 11.14 mg /dm^2 /day) was recorded at 60 kg N /fed at both periodsin the firstseason, respectively. These result are in harmony with those obtained by [2, 7, 12, 23, 11] who found that NAR significantly affected with application of nitrogen fertilizer. These results revealed that nitrogen fertilizer levels significantly affected FLA at 80 days after sowing in both seasons. Mean comparison showed that the highest FLA (65.0 and 46.0 dm^2) were recorded at 100 kg N/fed in the first season and at 80 kg N /fed in the second one. It could be concluded that the application of nitrogen had positive effect on FLA of wheat which indicated the vital role of nitrogen in plant growth. The encouraging effect of nitrogen on the vegetative growth of wheat plants is clearly illustrated. The present findings are in agreement with those obtained by [2, 7, 25, 23, 1] who found that nitrogen application significantly increased LA and FLA.

3.1. Effect of Seeding Rates

Results presented in Table 2 show the effect of seeding rates on studied traits. It quite clear from the obtained results that seeding rates had significant effect on leaf area /m^2 at all dates in the first season but this effect was not true in the second one. The highest values (23.50, 25.00 and 48.00 dm^2) were recorded with sowing 80 kg grains /fed. The effect of seeding rates on LAI at all sampling dates, except at 80 DAS in the first season was significant in both seasons. Planting wheat with seeding rate of 60 kg / fed produced the highest LAI (3.50 and 3.55, 8.40 and 20.30) at first date in both season, respectively and at third one in the first season but application of 40 kg grain / fed recorded the highest value (9.6 and 20.3) at the second date in the first season and at the third date in the second season, respectively. These result are in harmony with theseobtainedby [4, 23] who found that LAI was not significantly affected by application of nitrogen fertilizer.

Table 2. *Leaf area (LA), leaf area index (LAI), crop growth rate (CGR), relative growthrate (RGR, nit assimilation rate (NAR) and flag leaf area (FLA) as affected byseeding rates in both seasons.*

Characters	Seeding rates (kg /fed[1])									
	40	60	80	F	LSD	40	60	80	F	LSD
	2018/2019					2019/2020				
LA at 40 DAS	22.90	21.50	23.50	*	1.30	22.60	21.3	20.80	ns	-
LA at 60 DAS	24.90	23.60	25.0	*	1.60	42.70	42.00	41.90	ns	-
LA at 80 DAS	46.70	46.60	48.00	*	1.30	45.10	45.60	48.20	ns	-
LAI at 40 DAS	3.30	3.50	3.20	*	0.21	3.00	3.50	3.30	*	0.19
LAI at 60 DAS	9.60	9.20	8.40	*	0.62	10.6	12.00	9.80	*	0.81
LAI at 80 DAS	7.20	8.40	7.30	ns	-	20.30	20.00	18.6	*	1.90
CGR at 40-60 DAS	2.72	2.63	2.81	*	0.03	1.42	1.39	1.37	*	0.04
CGR at 60-80 DAS	10.03	7.78	8.90	*	1.11	2.19	2.22	2.28	*	0.06
RGR at 40-60 DAS	8.29	7.11	6.19	*	1.01	2.83	2.80	2.70	*	0.02
RGR at 60-80 DAS	16.67	17.04	17.31	ns	-	7.41	6.67	6.61	ns	-
NAR at 40-60 DAS	5.31	4.96	4.70	ns	-	0.95	1.31	0.95	ns	-
NAR at 60-80 DAS	11.16	8.96	9.84	*	0.88	1.76	1.58	1.77	ns	-
FLA at 80 DAS	66.1	61.80	60.60	ns	-	45.60	45.30	44.80	*	0.49

*=Significant
ns- Not significant
1= One feddan=4200m^2

Seeding rates caused a significant effect on CGR at both periods in both seasons. At the first period planting wheat with 80 and 40 kg grains / fed produced the highest CGR (2.81 and 1.42 g/m^2/day) in both seasons, respectively. On the other hand and at the second period, seeding rate of 40 and 80 kg grain / fed recorded the highest CGR (10.03 and 2.28 g/m^2/day) in both seasons, respectively. The obtained results showed that the changing in seeding rates had significant effect on AGR at the first period in both season. The highest RGR (8.29 and 2.83 g/g/day) wasrecorded at 40 kg grains /fed. These results are in harmony with those obtained by [3, 23].Seeding rates had a significant effect on NAR at the second period (60 – 80 day) in the first season and the highest NAR (11.16mg/dm^2/day) was obtained with application of 40 kg grains/fed. This effect was not true at both periods in the second one. These results are agreement

with those obtained by [11]. It is clear from the obtained results that seeding rates significantly affected flag leaf area in the second season only. The highest value (45.6 dm^2) was recorded at 40 kg grains/fed. These results are not agreement with those reported by [23] who found that flag leaf area was not significantly affected by changing in wheat seeding rates.

3.2. Effect of Varieties

Table 3 show the effect of varieties on the studied traits.Varieties differed significantly among their effect on leaf area at second date (60 DAS) in both seasons and at third date (80 DAS) in first season. At 60 DAS, Giza-171 gave the highest LA (25.9 dm^2), while Gemmiza-12 produced the maximum LA (42.4 dm^2) in second season. These results may be due to the differences in the genetic makeup of the varieties. The obtained results are in harmony with those reported by Shemi [23, 10] who indicated that LA significantly affected with changing wheat genotypes. Result indicated that significant differences existed between the tested varieties on LAI at first and third dates in the first season and at second and third dates in the second one. Giza–171 had higher LAI (3.50) at the first date in the first season and (20.0) at the third date in the second one. Shandawil-1 recorded the highest LAI (11.30) at the second date in the second season and Gemmiza-12 gave the highest LAI (8.2) at the third date in the first one. These observations in the present study might be due to the differences among the tested varieties that could be attributed to their different genetic constitutions as well as their response to the prevailing environmental conditions. These result are in harmony with those obtained by [23] and not agreement with those found by [25] Varieties differed significantly among their response on CGR at both periods in both seasons. Gemmiza–12 surpassed the other two varieties and recorded the highest CGR (1.48 and 2.59) g//m^2/day) at the first and second period in second season, respectively, while Shadawil-1 and Giza-171 at both periods in the first season recorded the highest CGR (3.10 and 9.56 g/m^2/day), respectively. The differences between varieties in AGR were significant at each of studied periods in both seasons. It evident from the obtained results that Shandawil–1 had superiority (8.47 and 2.81 g/g/day) at the first period and (19.96 and 7.81 g/g/day) at the second period over the other two varieties in both seasons, respectively. Likewise, [23] reported that wheat genotypes significantly differed in RGR. Varieties significantly differed in NAR at both periods in the first season. This effect was not true in the second season. Giza-171 surpassed the other two varieties and produced the highest values (5.16 and 11.14 mg /dm^2 day), respectively. This difference between wheat varieties in nit assimilation rate might be attributed to the differences in their genetic makeup. [11] found that NAR was significantly affected with changing wheat varieties.

Table 3. *Leaf area (LA), leaf area index (LAI), crop growth rate (CGR), relative growthrate (RGR, nit assimilation rate (NAR) and flag leaf area (FLA) as affected byvarieties in both seasons.*

Characters	Varieties									
	1	2	3	F	LSD	1	2	3	F	LSD
	2018/2019					2019/2020				
LA at 40 DAS	22.30	21.90	21.40	ns	-	21.90	21.11	22.00	ns	-
LA at 60 DAS	25.90	22.30	25.2	*	1.21	41.60	42.40	41.70	*	0.10
LA at 80 DAS	47.80	47.20	47.80	*	0.59	49.00	40.00	43.90	ns	-
LAI at 40 DAS	3.50	3.20	3.30	*	0.10	3.20	3.20	3.30	ns	-
LAI at 60 DAS	9.20	8.00	8.50	ns	-	10.40	10.50	11.30	*	0.81
LAI at 80 DAS	7.80	8.20	7.60	*	0.19	20.00	19.30	19.40	*	0.58
CGR at 40-60 DAS	2.59	2.50	3.10	*	0.08	1.34	1.48	1.36	*	0.02
CGR at 60-80 DAS	9.56	8.46	8.69	*	0.32	1.97	2.59	2.13	*	0.65
RGR at 40-60 DAS	6.40	7.26	8.47	*	0.99	3.80	2.63	2.81	*	0.17
RGR at 60-80 DAS	15.22	18.85	19.69	*	0.83	7.12	6.72	7.81	*	0.59
NAR at 40-60 DAS	5.16	4.58	4.59	*	0.51	1.11	1.24	0.85	ns	-
NAR at 60-80 DAS	11.14	9.00	9.81	*	0.79	1.61	1.68	1.69	ns	-
FLA at 80 DAS	77.60	52.60	77.00	*	2.30	44.40	46.30	45.80	*	0.49

*=Significant
ns- Not significant
1= Giza-171
2= Gemmiza-12
3= Shandawil-1

These results show a significant effect for varieties on flag leaf area during the experimental seasons. In the first season, the highest flag leaf (7.60 dm^2) was obtained under Giza-171. On the other had and in second season, results indicated that Genniza-12 produced the highest value (46.3 dm^2. These results might be due to the differences in the genetic makeup of the varieties. The present results are in harmony with those obtained by [8] who pointed out that flag leaf area was significantly affected by different genotypes. On the contrary, [25] found that the differences in flag leaf area among wheat genotypes were not significant.

3.3. Effect of Interactions

Results in Table 4 show the effect of studied interactions on studied traits in both seasons. The interaction between

nitrogen levels and seeding rates had significant effect on all trait in both seasons except LAI at 60 DAS, CGR, RGR in the first period in the first season..Nitrogen levels x varieties significantly affected all studied traits in both seasons except LA at 40 DAS in the first season as well as LAI at 80 DAS and RGR in both periods in the second season and FLA in the first season.Among the interaction between seeding rates and varieties, their was significant effect on all studied traits in first season except LA at 40 and 80 DAS, NAR at the first period and FLA and on all studied traits in the second season except LA at all dates, LAI at 80 DAS, NAR at both periods in the second season. The interaction between all studied factors had significant effect on LAat 60 DAS in the second season, LAI at 40 and 80 DAS in the first season and at all dates in the second season, CGR at the second period in the first season and at both periods in the second one, RGR at both periods in both seasons and FLA in the first season On the other hand, any trait not mentioned previously did not reach the significant level at any date and in any season.

Table 4. *Studied characters as affected by different studied interactions in bothseasons.*

Characters	Interactions							
	AxB	AxC	BxC	AxBxC	AxB	Axc	BxC	AxBxC
	2018/2019				2019/2020			
LA at 40 DAS	*	ns	ns	ns	*	*	ns	ns
LA at 60 DAS	*	*	*	ns	*	*	ns	*
LA at 80 DAS	*	*	ns	ns	*	*	ns	ns
LAI at 40 DAS	*	*	*	*	*	*	*	*
LAI at 60 DAS	ns	*	*	ns	*	*	*	*
LAI at 80 DAS	*	ns	*	*	*	*	*	*
CGR at 40-60 DAS	ns	*	*	ns	*	*	*	*
CGR at 60-80 DAS	*	*	*	*	*	*	*	*
RGR at 40-60 DAS	ns	*	*	*	*	ns	*	*
RGR at 60-80 DAS	*	*	*	*	*	ns	*	*
NAR at 40-60 DAS	*	*	ns	ns	*	*	ns	ns
NAR at 60-80 DAS	*	*	*	ns	*	*	ns	ns
FLA at 80 DAS	*	ns	ns	*	*	*	*	*

N= Nitrogen levels
B= Seeding rates
C= Varities

4. Conclusion

Finally, It could be concluded from the present results that planting Giza-171 varitieswith 80 kg grains/fed and application of 100 kg N/fed could produced the highest values of the most of the studied growth traits under the experimental site and the similar conditions.

References

[1] Abdulkareem, B. M. (2018). Response of Maize (Zea mays l). To zinc Application under Different Levels of Nitrogen Fertilizer. M.Sc. Thesis, Faculty of Agriculture, Cairo University, pp. 99.

[2] Alam, M. S. (2013). Growth and yield potentials of wheat as affected by management practices. African Journal of Agricultural Research, 8 (47): 6068-6072.

[3] Ali, H. K. and Jofari, M. (2012). A study on various cultivars densities effects on wheat growth index. Intern. J. Agric. Crop Sci., 4 (18): 1337-1341.

[4] Dai, X.; Xiaohu, Z.; Dian, Y. J.; Li, L.; Haibo, K. andMingrong, H. (2013). Management the seeding rate to improve nitrogen use efficiency of winter wheat. Filed crop Res., 154.: 100–109.

[5] El-Metwally, I. M.; Abd El-Salam, M. S. and El-Fatoh, A. G. A. (2010). Nitrogen fertilizer levels and some weed control treatments effects on barley and associated weeds. Agric. Biol. J. Am., 1 (5): 992 1000.

[6] FOASAT (2019). Population Data. Food and Organization of united nation, Rama, On line at http://faostate,fao.org//download/OOAE.

[7] Gheith, E. M. S.; Ola Z. El-Badry and Wahid, S. A. (2013a). Response of growth and straw yield of some wheat genotypes to sowing dates and nitrogen levels. Zagazig J. Agric. Res., 40 (5): 809-815.

[8] Gheith, E. M. S.; Ola Z. El-Badry and Wahid, S. A. (2013b). Sowing dates and nitrogen fertilizer levels effect on grain yield and its component of different wheat genotypes. Res. J. Agric. and Biol. Sci., 9 (5): 176-181.

[9] Gheith, E. M. S.; Shafik, M. M.; Ola Z. El-Badry and Adulkareem, B. M. (2018). Growth and productivity of maize (Zea mays L.) as affected by nitrogen and zinc fertilizer levels: 1 Growth analysis. Bioscience Research 15 (1): 54-59.

[10] Gheith, E. M. S. and Ola El-Badry (2020). Response of wheat yield and its components to zinc and iron application under different levels of nitrogen. Inter. J. Agric. Appl. Sci., 1 (1): 14-17.

[11] Gheith, E.; El Metwally and Shemi, R. (2019). Response of wheat growth analysis and nitrogen use efficiency to nitrogen levels and seeding rates. J. Nutr. and Obesit 2: 101-105.

[12] Gul, S.; Khan, M.; Khanday, B. and Nabi, S. (2015). Effect of sowing methods and NPK Levels on growth and yield of rain fed maize (Zea mays L.) Scientific, PP. 198575.

[13] Iqbal, J.; Hayct, K. and Hussami, S. (2012). Effect of sowing dates and nitrogen levels on yield and yield component of what (Triticum easteviumL.). Pakistan J. Nutri., 11 (7) 531–536.

[14] Mansour, A. S. M. (2017). Effect of Organic Amendments, Nitrogen fertilization and spray of Micronutrients on Barley. PH. D. Thesis, Faculty of Agriculture (Saba Bashe), Alexandria University, pp. 133.

[15] Michigan State University (1990): MSTAT- C: Micro-computer Statistical Program, Version 2. Michigan State University, East Lansing, USA.

[16] Mohammed, A.; Rezvani, M.; Zakernezhad, S. and karamzadeh, H. (2012). Effect of nitrogen rate on yield and yield components of wheat (Triticum aestivum L. (Int. J. Biosci, 6 (5): 147 151.

[17] Olusegum (2015). Nitrogen (N) and phosphorus (P) fertilizer application on maize (Zea mays L.) growth and yield at Ado-Ekiti, South-West, Nigeria. American Journal of Experimental Agriculture, 6 (1): 22-28.

[18] Pearce, R. P.; Mock, J. J. and Paily, T. (1975). Rapid method for estimating leaf area per plant in maize. Crop Sci., 15: 691-694.

[19] Radford, P. J. (1967). Growth analysis formula, their use and abuse. Crop Sci., 7 (3): 171- 175.

[20] Rasmoussen, L. S.; Dorte, B. D. and Kristian, T. K. (2015). Winter wheat cultivars and nitrogen (N) fertilization effects on root growth, N uptake efficiency and N use efficiency. Euro. J. Agron., 68: 38-49.

[21] Rizkalla, A. A.; H., Nassien, B. A.; Al-Ansary, A. M. F.; Nassef, J. E. and Hussein, J. E. (2012). Combing ability and hertorsis relative to PAPD marker in cultivated and newly hexploid wheat varieties. Aust. J. Basic Applied Sci., 6: 215-224.

[22] Ryan, J.; Abdel Monem, M. and Amir, A. (2019). Nitrogen fertilizer response of some barley varieties in semi-arid conditions morocco. J. Agric. Sci. Technol., 11: 277-236.

[23] Shemi, R. M. J. (2017). Productivity andNitrogen Use Efficiency of Some Wheat Varieties under Different Seeding Rates and Nitrogen Fertilizer Levels. M.Sc. Thesis, Faculty of Agriculture, Cairo University, pp. 152.

[24] Steel, R. C. and Torrie, S. H. (1997). In principles and procedures of statistics". McGrauc Hill Book Company, Inc., New York, London.

[25] Wahid, S. A. (2013). Response of Some Wheat Genotypes to Environmental Conditions. M. Sc. Thesis, Fac. Agri., Cairo Univ., Egypt.

[26] Watson, D. J. (1952). The physiological basis of variation in yield. African Journal of Agricultural Research, 5 (9): 881-892.