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RESPONSE OF YIELD AND ITS COMPONENTS TRAITS FOR FOUR PROMISING GENOTYPES OF WHEAT TO DIFFERENT LEVELS OF NITROGEN FERTILIZATION

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ABSTRACT

A field experiment was carried out to evaluate the effects of different nitrogen levels on four promising bread wheat genotypes. The experiment was conducted at the farm of Field Crops Dept., College of Agricultural Engineering Sciences, University of Duhok in winter season 2020-2021. The experimental units laid out in factorial experiment with (R.C.B.D) with three replicates. Four genotypes were used (Bora, Jehan-99, AApast-36 and AApast-26) and four levels of nitrogen (0,75,150 and 200kg ha-1). The result revealed that the growth parameters respond significantly to nitrogen fertilizer. Application of nitrogen levels in combination increase yield, gave the highest grain yield 219.1 (g) at 200kg ha-1 nitrogen, also the highest grain (231 g) was recorded from AApast-36 genotypes. Among the interaction of nitrogen levels and wheat genotypes produced the highest grain yield (266.6g) per plant at 200kg N ha-1 and Apast-36 genotypes. The Apast-36 genotype was superior in flag leaf area 48.14 cm2, Number of seed per plant 42.8, weight of seed spike 1.88g and 1000-seed weight (43.73 g). So that this genotype can be considered an advanced line and can be placed in a breeding program. Most of the studied traits are highly correlated with yield such as 1000-seed weight (0.91), spike length 0.52 and number of seeds per spike 0.45 and it can be said that these traits are the important effective components in seed yield.

INTRODUCTION

Wheat (*Triticium aestivum* L.) has the highest importance among the cereal crops grown for grain purpose worldwide. In Iraq and Kurdistan region, the farmers are still unable to get potential yield of wheat and their average production of wheat is for below. There are several reasons that causes low wheat production in Iraq and Kurdistan region such as cultivation of local low yielding genotypes, in adequate rainfall, poor agronomic practices, disease and insect pest are among the principal limitation to wheat production. Whatever, there were different factors to overcome the low wheat production, one of these factors is the use of high-productivity genotypes and application of nitrogen fertilizer in suitable amount. (Mohammed *et al*.,2021).

Therefore, it is necessary to use the genotypes which have high genetic yield potential and require high amount of nitrogen to produce their maximum production

(Kuthram *et al*.,2011). Several researchers reported the role of nitrogen in wheat plant, nitrogen is one of the major nutrients which reduce the yield of wheat when it is not applied in proper amounts as it is needed for fast growth of the plant and to get high production per hectare. Nitrogen play important role in all the metabolic processes of the plants. Nitrogen the main componed and major constituent of plant especially in living tissues for formation of protein, enzymes, coenzymes nucleic acid, phytochromes and chlorophyll, it plays an important role in biochemical processes of the plant. Therefore, it is one of the most required nutrient by wheat crop. (Ali *et al.,* 2000; Behera *et al.,*2000; Mann and Musih, 2004; Heinemauh, *et al.,* 2006; Imdad *et al.,*2018; Kuthram *et al.,* 2011 and Mohammed *et al.,*2021). Other researches were done on the nitrogen deficiency effects on biomass production and solar radiation use efficiency by the plant, with a great impact of grain yield and its components, also the deficiency of nitrogen effect on number tiller m^2, spike length umber of seed $spike^{-1}$ and 1000 grain wheat. (Kuthram *et al.,*2011). The objective of this study is to select the wheat genotypes with high yield under four nitrogen levels.

MATERIALS AND METHODS

To evaluate the influence of different nitrogen levels on growth parameters and yield of bread wheat, field experiment was carried out at the farm of College Agricultural Engineering Sciences, Duhok University. The experiment was Laid out in a randomized complete block design (RCBD) with three replications having a plot size 3m length x 2.5m width, distance was 0.25m. The wheat variety (Jehan-99, Bora, Apast-36-185574 and Apast-26-185579)were sown at rate of 120kg ha^{-1} on 30/11/2020 before sowing seed was treated with Benlate and Topsin-14 solution following to recommendations to protect it from the soil born disease. The fertilizer including phosphorus P_2O_5 added at rate 84kg ha^{-1} during preparation before planting and urea fertilizer (N%46) at rate 0,75,150,200kg ha^{-1} added in two periods, the first in the tillering stage and the second before flowering. Weed control was carried out with the Topic pesticide for narrow leaved and Granstar for broad-leaved at 2-3 leaf stage for both types of weed. In winter season 2020-2021, the rainfall was little, so that supplemental irrigation was used (Table1).

Data were recorded on plant height (cm), spike length (cm), number of seed per spike, seed weight in spike(g), 1000 seed weight(g), flag leaf area (cm^2) grain yield per unit area (g $0.9m^2$) and grain yield (kg per. hectare). The data analyzed according to GLM procedure to estimate the significant effect of studied traits at probability 0.05 using Minitab software package, and Duncan's Multiple Range Test (DMRT) for test the means of treatments.

Table (1): Some soil properties and rainfall in season 2020-2021.

Soil properties	Unit	Depth (0-30)cm	Month	Rainfall mm
pH		7.97	11/ 2020	25.1
Ec	$ds.m^{-1}$	0.45	12/ 2020	40.5
A vaiable N	$mg.kg^{-1}$	105.95	1/ 2021	83.0
A vaiable P	$mg.kg^{-1}$	4.84	2/ 2021	19.20
O.M	$g.kg^{-1}$	17.4	3/ 2021	40.8
Sand	$g.kg^{-1}$	72.53	4/ 2021	2.0
Silt	$g.kg^{-1}$	430.17		
Clay	$g.kg^{-1}$	496.12		
Soil Texture		Silt . Clay	Mean	35.10

- All soil properties analysis was conducted at the central laboratory, and rainfall rate from meteorological station at the University of Duhok, College of Agricultural Engineering Sciences.
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RESULTS AND DISCUSSION

Table 2 showed the analysis of variance for four bread wheat and four nitrogen levels and interaction. The result revealed that the bread wheat genotypes had highly significant effect on plant height, number of days to 50% flowering, flag leaf area, spike length, no. of seeds spike^{-1}, wt. of seed spike, 1000-seed weight and total yield, also the nitrogen levels had highly significant effect for all character except days to 50% flowering, the interaction between nitrogen and wheat genotypes had highly significant effect on all studied characters except number of days to 50% flowering. These results are in accordance with report of (Wending and Lovato, 2007; Debre.,2017; Fersew *et al.*,2018 and Mohammed *et al.*,2021).

Table (2): Analysis of variance for bread wheat characters genotypes under four nitrogen levels.

S.O.V	df	Plant height (cm)	Days to 50% flowering	Flag leaf Area (cm^2)	Spike length (cm)	No. of seed spike^{-1}	Wt. of seed spike (g)	1000-seed weight (g)	Total seed yield 10.7m (g)
Block	2	3.65	39935	1.30	0.001	0.83	0.01	1.82	8.00
Nitrogen (N)	3	**1799.61	48029	**504.60	**60.68	**70.13	**1.03	**294.81	**6893.90
Varieties (V)	3	**245.28	40110	**1595.89	**10.68	**234.24	**1.74	**357.63	**19379.70
N x V	9	**32.30	39386	**109.96	**9.18	**8.37	**0.06	**8.15	**96.30
Error	30	1.13	39505	0.45	0.20	0.37	0.001	0.14	1.00
Total	47								

*significant at 0.05 probability level, **significant at 0.01 probability level

The data in Table 3 revealed the effect of bread wheat genotypes, nitrogen levels and their interaction on plant height and days to 50% flowering of AApast-26 genotypes which recorded maximum plant height (84.25 cm) and followed by Jehan 99 genotypes (82.91 cm), while the minimum plant height was obtained by Bora genotype (80.16 cm). Regarding on the effect of nitrogen levels, the rate 200 kg ha^{-1} recorded the maximum plant height (98.00 cm). Relying on the interaction effect between wheat genotypes and nitrogen levels on the plant height, AApast-26 had the maximum plant height (105.00 cm) at level 200 kg ha^{-1} while, the shortest plant height (64.66 cm) obtained by Bora genotypes. For days to 50% flowering, the Bora genotypes Bora, Jehan-99 and AApast-36 were recorded the earliest days to flowering (141.08, 146.08 and 142.91 days) respectively, while the AApast-26 recorded the later with 158.75 days.

Table (3): Effect of bread wheat genotypes, nitrogen levels and their interaction on plant height and days to 50% flowering.

Nitrogen level	Plant height cm					Days to 50% flowering				
	Bora	Jehan-99	AApast-36	AApast-26	Mean	Bora	Jehan-99	AApast-36	AApast-26	Mean
No	64.66 J	70.00 i	75.00 h	66.00 J	68.91 d	130.33 b	132.33 b	128.00 b	130.00 b	130.25 b
N_1 75	80.00 g	81.66 g	86.00 f	91.00 e	84.66 c	131.00 b	147.66 b	145.00 b	150.00	143.41 b
N_2 150	85.00 f	86.00 f	93.00 d	95.00 c	89.74 b	150.66 b	152.00 b	148.00 b	145.00 b	148.91 B
N_3 200	91.00 e	94.00 cd	102.00 b	105.00 a	98.00 a	152.33 b	152.33 b	150.33 b	210.66 a	166.41 a
Mean	80.16 c	82.91 b	89.00 a	89.25 a		141.08 b	146.08 b	142.91 b	158.75 a	

Means that not share a letters are significantly different.

Also for effect of nitrogen levels, the rate 200kg ha-1 give the later days to 50% flowering and produced by AApast-26 at 200kg ha- nitrogen level. For interaction between wheat genotypes and nitrogen level, the all genotypes did not differ significantly in days to 50% flowering and record 130.33, 132.33, 128.00 and 130.00 days for genotype at control treatment respectively, whilst, the later wheat genotypes (210.66 days) was recorded by AApast-26 at 200kg ha- nitrogen levels previous studied by (Zagonel *et al.,* 2002; Fresew *et al.,*2018 and Imdad *et al.,*2018; Al-Jaboury and Al abar, 2021) showed similar results.

The data in Table 4 represented the effect of wheat genotypes, nitrogen levels and their interaction on flag leaf area and spike length. For flag leaf area the maximum flag leaf area was observed in Apst-35 (48.14 cm^2) which differed significantly from other genotypes. Nitrogen application rate of 200kg N ha^{-1} resulted in increased flag leaf area (36.77 cm^2) This might be due to the role of nitrogen in proving wheat growth, internode elongation, photosynthesis and metabolism assimilate production. Regarding the interaction between wheat genotypes and nitrogen levels the flag leaf area showed the largest flag leaf area (57.03 cm^2) and (56.24 cm^2) at highest level of nitrogen application (rate 200 and 150 kg ha^{-}) with bread wheat genotypes Apst-35. From the results above the bread wheat genotypes differed significantly in their response to nitrogen levels. This might be due to source sink interaction, meaning maximum proportion of nitrogen source is used to produce maximum flag leaf area. For spike length, the data relating to spike length as influenced by different genotypes in presented in Table 4. Data regarding spike length at maturity showed significant difference among the different genotypes. Jehan-99 produced higher spike length of 12.25cm while Apst-35 gave spike lesser length 10.75cm. This variation in spike length is due to genetic variability among different genotypes. For the nitrogen effect in spike length, the spike length increase significantly with increased level of nitrogen application. Nitrogen application at rate 150kg ha^{-} recorded the higher spike length of 13.00cm while the lowest spike length (8.25cm) were obtained by zero nitrogen application. For interaction between bread wheat genotypes and nitrogen level application, the results exhibited that the maximum spike length (16cm) was obtained from the treatment combination (Jehan-99 * 200kg ha^{-}) and the lower spike length (7cm) was obtained from the treatment combination (AApast-26 with zero nitrogen application). A variability of sufficient nutrients resulted in higher spike length. The studies by Moushumi *et al*. (2018); Fresew *et al*.(2018) and Debre.(2017) also reported that increasing nitrogen level up to 150kg N ha^{-1} enhanced flag leaf area and spike length.

Table (4): Effect of bread wheat genotypes and nitrogen levels on flag leaf area and spike length.

Nitrogen level	Flag leaf area cm^2					Spike length cm				
	Bora	Jehan-99	AApast-36	AApast-26	Mean	Bora	Jehan-99	AApast-36	AApast-26	Mean
N_0	20.28 h	22.64 g	25.65 f	19.84 h	22.13 D	9.00 e	9.00 e	8.00 f	7.00 g	8.25 c
N_1 75	22.87 g	28.64 e	53.64 b	22.61 g	31.94 C	10.00 d	10.00 d	9.00 e	12.00 c	10.25 b
N_2 150	23.62 g	32.52 d	56.24 a	26.52 f	34.73 B	12.00 c	14.00 b	14.00 b	12.00 c	13.00 a
N_3 200	26.31 f	35.58 c	57.03 a	28.16 e	36.77 A	14.00 b	16.00 a	12.00 c	9.00 e	12.75 a
Mean	23.29 d	29.84 b	48.14 a	24.28 c		11.25 b	12.25 a	10.75 c	10.00d	

Mean that do not share a letter are significant difference.

The results in Table 5 revealed that the number of seed spike-1 was statistically significant over different nitrogen levels, the highest number of seeds per spike (40.55) from 200kg N ha-1 showed and the lowest (34.17) from zero nitrogen application. Also the data in the same table showed that the highest number of seed per spike (42.08) was recorded under Apst-35 genotypes while the lowest (34.58) was found in Bora genotypes. For effect of interaction between bread wheat genotypes and nitrogen levels, the results in Table 5 exhibited, the highest number of seed per spike (46.33) was produced by the interaction of Apst-35 and 200kg N rate and lowest number (31.67) was obtained by the treatment combination of Bora genotypes with zero nitrogen application. Regarding for wt. of seed per spike the results showed that the maximum value (1.72g) was produced under 200kg N ha^{-1} and also the lowest value (1.06g) was obtained with zero nitrogen application. Concerning the effect of bread wheat genotypes the maximum value (1.88g) was recorded by Apst-35, while the minimum value (1.15g) was produced in Bora bread wheat genotype. The effect of interaction between genotypes and nitrogen levels, the largest value (2.37g) was observed from the treatment combination of 200kg N ha^{-1} and Apst-35 genotypes, whilst the lower (0.86g) was obtained from treatment combination (zero nitrogen application and Bora bread wheat genotypes). The results in the Table indicate that the explanation of total variation on genotypes performance plus its interaction with different nitrogen levels application were similar to results of (Kuthran *et al.*, 2011;Ali and Juthey.,2017; Beyensh *et al.*,2017 and Tahir *et al.,* 2020 and Al-Gazal, 2021).

Table (5): Effect of bread wheat genotypes, nitrogen levels and their interaction on No. of seeds per spike and weight of seeds spike.

Nitrogen level	No. of seeds spike^{-1}					Wt. of seeds spike (g)				
	Bora	Jehan-99	AApast-36	AApast-26	Mean	Bora	Jehan-99	AApast-36	AApast-26	Mean
N_0	31.67 Ij	36.33 ef	37.67 d	31.00 j	34.17 d	0.86 j	1.26 g	1.34 f	0.79 k	1.06 d
N_1 75	34.67 g	37.33 de	40.00 c	33.00 h	36.25 c	1.04 i	1.40 e	1.67 d	1.15 h	1.32 c
N_2 150	35.67 fg	40.67 c	44.33 b	32.33 hi	38.25 b	1.34 f	1.72 d	2.14 b	1.16 h	1.59 b
N_3 200	36.33 ef	44.33 b	46.33 a	32.5 hi	40.55 a	1.36	1.96 c	2.37 a	1.18 h	1.72 a
Mean	34.58 c	39.67 b	42.08 a	32.18 d		1.15 c	1.58 b	1.88 a	1.07 d	

Mean that do not share a letters are significantly different.

For 1000-seed weight, the highest value of 1000-seed weight (42.19g) was achieved in case of N_3 (200kg N ha^{-1}) which was followed by N_2 (39.97g) where nitrogen was applied at the level of 150kg N ha^{-1} Table 6. The results relating to 1000-seed weight as affected by different genotypes, the AApast-36 bread wheat genotype gave the higher (43.73g) than the Bora genotype which recorded lower value (32.33g). regarding to effect of interaction between bread wheat genotypes and nitrogen levels on 1000-seeds weight it was varied from 27.30g to 49.97g numerically the highest 1000-grain weight 49.97g was obtained from the treatment combination of 200k N ha^{-1} and Apst-35 bread wheat genotype and the lowest 1000-seed weight (27.30g) was recorded from the treatment combination of zero nitrogen application and Bora bread wheat genotypes. For total grain yield, the genotypes effects were varied significantly for this trait, the highest seed yield 231.0g was produced in AApast-36 genotypes and lowest was (144.9g) per plant obtained from AApast-36. Concerning the effect of nitrogen levels in seed yield, the highest seed yield value (219.10g) was observed in 200kg N ha^{-1}. The lowest value (166.20) was observed in zero nitrogen application. The effect of interaction showed that the highest seed yield (266.60g) was recorded in 200kg N ha^{-1} and Apst-35 treatment and the lowest seed yield (117.40g) was observed in zero nitrogen application and AApast-26 genotype treatment. From the results above, the presence of a good genotype which the addition of the appropriate amount of nitrogen led to the improvement of some yield components of the crop that had a direct effect on the seed yield of the genotypes. These results are quite in line with (Fresew *et al.,*2018; Izzat *et al.*,2020; Mohammed *et al.*,2021 and Shuaib *et al.*,2019).

Table (6): Effect of bread wheat genotypes, nitrogen levels and their interaction on 1000-seed weight and total yield.

Nitrogen levels	1000-seed weight (g)					Total grain yield (g)				
	Bora	Jehan-99	AApast-36	AApast-26	Mean	Bora	Jehan-99	AApast-36	AApast-26	Mean
N_0	27.30 k	34.87 h	34.43 h	26.60 L	30.80 d	149.9 m	191.0 h	206.4 f	117.4 o	166.2 d
N_1 75	31.20 j	37.97 f	42.59 d	32.87 i	36.16 c	159.0 L	196.9 g	211.9 e	131.5 h	174.8 c
N_2 150	34.5 h	40.87 e	47.93 b	36.50 g	39.97 b	173.1 j	224.0 d	239.1 c	159.3 L	198.9 b
N_3 200	36.27 g	45.50 c	49.97 a	36.67 g	42.10 a	189.4 i	249.1 b	266.6 a	171.4 k	219.1 a
Mean	32.33 d	39.8 b	43.73 a	33.16 c		167.8 c	215.3 b	231.0 a	144.9 d	

Mean that not share a letters are significantly different.

The results in Table 7 represent the simple correlation coefficient between studied characters. Result shows that the seed yield have strong positive correlation with 1000-seed weight and spike length with value 0.913 and 0.520 respectively. Also the No. of seed spike were strong positively correlated with low seed yield, total seed yield, flag leaf area and Wt. of seeds per spike and the value ranged 0.921, 0.957, 0.824 and 0.967 respectively. Weak and low negative correlation between seed yield and days to 50% flowering. The most studied traits are highly correlated and can be said that these traits are the important effective components in seed yield. Similar results were revealed by (Birhanu *et al.*,2017 and Mohammed and Othman.,2020).

Table (7): Simple correlation coefficient between yield and some bread wheat characters.

	1000-seed weight (g)	Days to 50y flowering	Spike length (cm)	No. seeds spike	Total yield 10.7m^2 (g)	Flag leaf area cm^2	Wt of seeds spike(g)
Days to 50 flowering	0.022 N.s						
Spike length cm	**0.603	-0.114 N.s					
No. of seeds spike	*0.687	0.283 N.s	*0.571				
Total yield 10.7m^2	**0.913	-0.048 N.s	**0.520	**0.449			
Flag leaf area cm^2	**0.885	-0.030 N.s	0.331 N.s	**0.518	**0.776		
Wt. of seeds spike	**0.971	-0.056 N.s	*0.605	**0.580	**0.937	**0.872	
No. of seeds spike	**0.921	-0.111 N.s	*0.553	*0.470	**0.957	**0.824	*0.967

*significant at 0.05 probability level.
**significant at 0.01 probability level.

CONCLUSION

In conclusion, the study showed that all the wheat genotypes response well up to nitrogen levels in this experiment. Moreover, a greater response to nitrogen levels application was observed when the climatic conditions are suitable during the growing season. Finally, we have noted that the positive effect of nitrogen application on seed yield was related to better promising of bread wheat genotypes.

استجابة صفات الحاصل ومكوناته لأربعة تراكيب وراثية واعدة من الحنطة الناعمة لمستويات مختلفة من التسميد النيتروجيني

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الخلاصة

طبقت تجربة حقلية لتقييم اربعة تراكيب وراثية من الحنطة تحت اربعة مستويات من النيتروجين. أُجريت الدراسة في حقل قسم المحاصيل الحقلية في كلية علوم الهندسة الزراعة جامعة دهوك خلال الموسم الشتوي 2020–2021 وضعت الوحدات التجريبية في تجربة عاملية بتصميم القطاعات العشوائية الكاملة بثلاث مكررات. استعمل اربعة تراكيب وراثية في الحنطة (bora, Jehan-99, Apast-36, Apast-26) تحت تأثير اربعة مستويات من النيتروجين 0، 75، 150، 200 كغم هكتار يوريا. أشارت النتائج الى استجابة عالية للمعالم الخضرية وكان التأثير معنوياً تحت مستويات النيتروجين المختلفة. كما أظهرت النتائج أعلى حاصل للبذور تحت مستوى السمادي 200 كغم/هكتار (219.1 غرام) وسجل التركيب الوراثي Apast–36 اعلى انتاج (231 غرام) تحت نفس المستوى السمادي. تفوق التركيب الوراثي Apast-36 في المساحة الورقية (48.14 سم٢) وعدد البذور في السنبلة (42.8) ووزن بذور السنبلة 1.88غرام ووزن 1000 حبة (43.73 غرام) ولذلك يمكن اعتبار هذه السلالة من السلالات المتفوقة والتي يمكن وضعها في برنامج للتربية للحصول على أعلى انتاجية. أظهرت دراسة الارتباط بين الحاصل وبعض مكوناته ارتباطاً موجباً وعالياً فقد سجلت صفة وزن 1000 حبة ارتباطاً بلغ (0.91) وطول السنبلة 0.52 وعدد البذور في السنبلة 0.45 ولذلك يمكن القول ان هذه الصفات لها دور الفاعل في تميز الاصناف لبعضها عن البعض.

الكلمات الدالة: الحاصل، الحنطة الناعمة، نيتروجين.

REFERENCES

AL-Ghazal, S.A.(2021). Nitrogen fertilizer and effect of forage grass crops:Article Review. *Mesopotamia Journal of Agriculture*, *49*(4):48-58.

Ali, A., Choudhry.M.A., Malik.M. A., Ahmed . R & Saifullah.A. (2000). Effect of various dose of nitrogen on the growth and yield of two wheat cultivars. *Pakistan Journal of Biological Sciences*. *3*(6): 1004-1005.

Ali, N. S & Al-Juthey. H. A. (2017).The application of nano technology for micro-nutrient in Agriculture Production (review article) *The Iraqi Journal of Agriculture Sciences*. *9*(48):441-489.

Al-Jaboury, S.M,& Al abar.A.T,(2021). Physiological effect of nitrogenous fertilizer application times and polymers gel on the growth characteristics of bread wheat *Triticum aestivum* L. *Mesopotamia Journal of Agriculture*, *49* (1), 120-130

Behera, U.K., Chougule B. A., Thakur R. S., Ruwali. K. N., Bhawsar. R. C& Pandey.H. N. (2000). Influence of planting dates and nitrogen levels on yield and quality of durum wheat. *Indian Journal Agriculture Sciences*. *70*:434-436.

Beyenesh, Z., Nigussie. D & Fethien. A. (2017). Yield and nutrient use efficiency of bread wheat as influenced by time and rate of nitrogen application in Enderta. *Tigray Northern Ethiopia. Open Agriculture 2*(1):611-624.

Birhanu, M., Senyehu.A., Alemywhu.A., Ermias.A *&* Dargicho.D (2017). Correlation and path coefficient studies of yield and yield associated traits in bread wheat (*Triticum aestivium* L.) genotypes. *Advance in plants and Agriculture Research 6*(5): 127-136.

Debre, M. (2017). Response of bread wheat varieties to different seed rate for growth, yield and yield components in Kombolcha District. *North Eastern Ethiopia Journal of Biology, Agriculture, and Healthcare 7*(23) 79-91.

Fresew, B., Nigussie. D., Adamu. M & Tamado (2018). Effect of nutrogen fertilizer rate on grain yield and nitrogen uptake and use efficiency of bread wheat varieties on the vertisols if central high land of *Ethiopia Agriculture And food security*. *7*(78) 2-12.

Heinemauh, A. B. , Stone. L. F & Moreira. B. (2006). Eficienca de uso r. da radiacao solar na productividade de tri decorrene da adubacao nitrogenada. *Revista Brasileira de Engenharia Agricola Ambiental*. *10*(2): 352-356.

Imdad, U., Nasir. A., Saba. D & Muhammed.A. S. (2018). Effect of difference nitrogen levels on growth, yield and yield contributing Attributes of wheat. *International Journal Sciences and Engineering Resources. 9*(9):595-602.

Kuthram, U.B., Yildiz.B & Cakrram.I (2011). Effect of nitrogen on uptake, remobilization and partitioning of zinc and iron throughout the development of durum wheat. *plant and soil*. *342*, 1-2:149-164.

Mann, R. A., Jehangir, W. A., & Masih, I. (2004, September). Improving crop and water productivity of rice-wheat system in Punjab, Pakistan. In *Proceedings of the 4th international crop science congress, Brisbane* (*Vol. 25*).

Mohammed, A. A. & Othman M. M. (2020). Simple correlation and some genetic parameters of yield bread wheat genotypes and its components. *Journal of Research in Agriculture and Nimal science. 7* (5): 30-32.

Mohammed, A. H., Omer. A. O & Hogir. S. M (2021). Response yield and some growth parameters of bread wheat to nano and nitrogen fertilizers. *Journal of University of Duhok*. *24*(1): 73-81.

Moushumi, A., Mosleh. D.& Hossain. I. (2018). Study on growth and yield potential od promising wheat genotypes under Modified Agronmical practices. *World Journal of Research and Review*. *6(*1):41-49.

Shuaib, K., Kashif. N., Muhammad. N, Irfan. R &. Ali. M.A.(2019). Evaluation of growth and yield attributed of some wheat varieties under local conditions of south punjab, *Pakistan Journal Plant Breeding Genetic 7*(1):19-25.

Tahir, I. S. A., Elbashier, E. M. E., Ibrahim, M. A. S., Saad, A. S. I., & Abdalla, O. S. (2020). Genetic gain in wheat grain yield and nitrogen use efficiency at different nitrogen levels in an irrigated hot environment. *International Journal of Agronomy*, *2020*.

Wending, A, Eltz. F. L. F & Lovato.T. (2007). Recomendacao de adubacao nitrogenada para trigo em sucessalo ao milho esoja sob sistema plantio direto no paraguai. *Revista Brasileira de Ciencia do solo 31*(5): 985-994.

Zagonel, J., Vehancio.W.S., Kanz. R. P & Tanamati.H. (2002). Doses de nitrogenio e densidade de plantas com e-sem um regulador de crescimenti afetando o trigo cultivar *OR-1. Ciencia Rural. 3* (1):25-29.