# INFLUENCE OF NITROGEN RATES ON THE PERFORMANCE OF WHEAT (Triticum aestivum L.) VARIETIES IN NORTHERN GUINEA SAVANNA ECOLOGICAL ZONE OF TARABA STATE NIGERIA

**[*1]AKAANGEE Mercy Mwarga, [1]GUNGULA Daniel Terrumun [2]MEER Bernard Bunde and [1]JAKUSKO Bukar Baba**

[1]Department of Crop Production and Horticulture, Modibbo Adama University, P.M.B. 2076, Yola, Adamawa State, Nigeria.

[2]Department Forestry and Wildlife Management, Taraba State University P.M.B. 1167, Jalingo, Taraba State, Nigeria

https://doi.org/10.35410/IJAEB.2023.5838

## ABSTRACT

Influence of nitrogen rates on the performance of Wheat varieties were investigated to determine the effects of nitrogen rates on growth and yield of wheat (Triticum aestivum) in the study area. The experiments were laid out in split plot design with seven nitrogen rates. The treatments were replicated three times. The sub plot size was 3 m x 2 m. The crop was planted in the middle of November, at the beginning of the dry season. Half of each nitrogen rate was applied at sowing and the other half splited into two and top dressed at early tilling and flowering stage. Data were collected on number of tillers, Plant height, number of spikelets spike-1, number of grains spike-1, weight of 1000 grain, biomass yield, grain yield and harvest index. All the data collected were subjected to Analysis of Variance (ANOVA) and Least Significant Difference (LSD) using Genstat version 4.0. The results revealed that nitrogen fertilization had significant effect (P<0.05) on wheat yield and yield components. Number of tillers was highest at 180 kg N ha-1 and variety Linfen. Similarly, Plant height was best at 180 kg N ha-1 and variety Reyna-28 while number of spikelets spike-1 was highest at 150 kg N ha-1 and variety Reyna-28 which was at par with Linfen. All the yield characters and final grain yield performed best at 120 kg N ha-1 and Reyna-28. These results indicate that, Nitrogen rate of 120 kg N ha-1 and Reyna-28 proved to be the best rate and variety for higher grain yield. Thus it is recommended that 120 kg N ha-1 and Reyna-28 be used for irrigated wheat production in the study area.

**Keywords:** Nitrogen Rate, Wheat (Triticum Aestivum L.) Varieties, Tillers, Plant Height, Yield And Harvest Index.

## 1. INTRODUCTION

Wheat (*Triticum aestivum* L.) is an important staple crop around the world. Its importance has is being felt now more than ever due to its shortage in the world trade as a result of the conflict between Russia and Ukraine. Wheat ranks first among the cereal crops, accounting for 30% of all cereal food worldwide and major food for over one third of world population and provides about 20% of the total food calories directly or indirectly for the human race (Ali and Teymur, 2013). In Nigeria, wheat is mainly cultivated under irrigation conditions in the northern part of the country where suitable low temperature (<$25^0$ C) exist during the cold harmattan period from November to March (Uche, 2013 and LCRI, 2015). There is increase in domestic demand for baked and pasta products in the country with national requirement of about

4.0 million metric tonnes annually. However, local production is only 2.2% of its national requirement while the remaining is imported (LCRI, 2015; Falaki and Mohammed, 2011).

Nitrogen is the most important nutrient supplied to most non-legume crops, including wheat. It is the most important constituent of plant proteins and is required throughout the crop growth period from vegetative stage to harvesting. Nitrogen fertilizer is known to affect the number of tillers per $m^2$, number of grains $spike^{-1}$, spike length, 1000-grain weight and grain yield of wheat (Campuzano *et al.*, 2012; Liu and Shi, 2013). Application of nitrogen is known to mainly increase the grain yield, biological yield and other characters including plant height and 1000 seed weight (Yadav and Dhanai, 2017). Given the importance of nitrogen fertilization, Shirazi *et al.* (2014) stated that increased vegetative growth, spike length, spike bearing tillers and plant height efficiently can be attributed to nitrogen fertilization which greatly helps the plant to expose its potential to grow vigorously. The application of the appropriate rate of N fertilizer is considered to be a primary means of increasing wheat grain yield, improving nitrogen uptake and use efficiency and consequently nitrogen harvest index (Fageria, 2014) in (Belete *et al.*, 2018).

Therefore, availability of nitrogen to wheat during various phases of its growth and development is an important factor influencing the yield and quality of grain (Yousaf *et al.*, 2014). Asghar *et al.* (2000) reported that among the factors responsible for low yield of wheat, the deficiency of nitrogen in our soils is considered the most important and that wheat yield will be increased with the increasing rate of nitrogen application. With the high demand and low production of domestic wheat in Nigeria couple with the status of the soil on which wheat is grown in Nigeria, the present study was therefore designed to determine the effects of nitrogen rates on growth and yield of wheat (*Triticum aestivum*) in Jalingo.

## 2. MATERIALS AND METHOD

Field experiment was conducted in 2017 and 2018 dry seasons at the Nukkai Irrigation Research Farm of the Department of Crop Science, Taraba State College of Agriculture, Jalingo which is located within latitude $8^0$ 55′0″ N and longitude $11^0$ 19′25″ E at altitude 1600.23 m above sea level in Southern Guinea Savanna ecological zone (GPS, 2021). Jalingo has a wet and dry tropical climate, with the rainy season lasting from May to October and averaging 750 to 1000 mm of annual precipitation, and the dry season starting in November and lasting until March or April (TADP, 2012). The temperature ranged from 33 to $39^0$ C and the relative humidity ranged from 31 to 60% over the study periods (November 2017 to March 2018) (TSCOAJ, 2018).

The experiment was set up using a split plot design, with three different types of wheat assigned to the sub plot and seven nitrogen fertilizer rates (0, 30, 60, 90, 120, 150, and 180 kg Nha-1) assigned to the main plot. To get the necessary tilt for small grains, the field was leveled, cleared, and then plowed, harrowed, and ploughed again. Wheat seeds obtained from Lake Chad Research Institute were treated with Apron star at the rate of 10 g to10 kg of seeds and sown by dibbling at row spacing of 30 × 25 cm on 15 November. The sources of fertilizer were NPK 15:15:15 and Urea (46:0:0). When seeds were sown in each plot, half of each nitrogen rate was applied, and the remaining half was divided in half and top-dressed throughout the early tillage and flowering periods. Due to the soil's silt-clay structure and the time of year (dry season), irrigation was applied to the field at intervals of seven days starting at sowing and continued until

ISSN: 2456-8643

the grain filing reached the hard state. Post emergence application of Bentazone at 1.5 kg ai $ha^{-1}$ (2.5 L ai $ha^{-1}$) was applied at 4 weeks after sowing as recommended (Lake Chad Research Institute LCRI, 2015).

Data were collected on number of tillers $plant^{-1}$, plant height $plant^{-1}$ (cm), number of spikelet $spike^{-1}$, number of grains $spike^{-1}$, weight of 1000 grains, biomass and grain yields and harvest index. The crop was harvested at physiological maturity at an area of $1m^2$ of each plot, sundried to obtain the biomass yield and threshed to obtain the grains. All the data collected were subjected to Analysis of Variance (ANOVA) appropriate to split-plot design and means were separated using Least Significance Difference (LSD) at 5% level of significance as described by Gomez and Gomez (1984). The package used was GENSTAT Version 4.0

## 3. RESULTS AND DISCUSSION

Table 1 showed the findings of the study area's plant height, tiller count, spikelet count, and grain count measurements.

### 3.1 Plant Height

The influence of nitrogen rate and variety on plant height at 70 DAS for the dry seasons of 2017 and 2018 as well as the combined result (the two years) is given in Table 1. The effect of nitrogen rate and varieties on plant height at 70 DAS for 2017 and 2018 dry seasons as well as combined (the two years) shown in Table 1 revealed that different rates of nitrogen affected the plant height significantly in both seasons and combined result. Based on the combined results, plant heights of 67.01 and 49.49 cm at 180 kg N ha-1 and 0 kg N ha-1, respectively, were reported as the maximum and minimum plant heights. In general, the increased plant height and rising nitrogen rate are directly proportionate. This may be explained by the important function that nitrogen played in the elongation of internodes and the increased capacity for metabolite production as a result of increased plant leaf area during vegetative growth. The result of this finding agrees with the result obtained by Amjed *et al.* (2011) that maximum and minimum plant heights were produced from 180 kg N $ha^{-1}$ and 0 kg N $ha^{-1}$ respectively. Other authors also observed that increase in nitrogen fertilization increased plant height (Ullah *et al*., 2018; Asadie *et al*., 2013).

Reyna-28 provided the tallest plants, measuring 75.02 cm, followed by Linfen, which measured 63.41 cm, and Cettia, which recorded the shortest plants, measuring 45.23 cm (Table 1). These differences in plant height among the three types were highly significant in both seasons and the combined years (Table 1). The variation in plant height among the varieties may be attributed to genetic variability and their differences in the utilization ability of the different rates of nitrogen fertilizer applied. Similar results were reported by Muhammad *et al.*, (2014) who observed varietal significant plant height in which Punjab-2011 gave the tallest plants, followed by sehar-2006 which was significantly at par with Millat-2011. The result agreed with that of Adugna and Haile (2019).

### 3.2 Number of Tillers

The effect of nitrogen rate on number of tillers $plant^{-1}$ for 2017 and 2018 dry seasons and combined result were presented in Table 1. Maximum number of tillers $plant^{-1}$ (29.61) was recorded from 180 kg N $ha^{-1}$ while the control gave the minimum number of 12.11 tillers.

ISSN: 2456-8643

Increased rates of nitrogen resulted in reduction of mortality of tillers and produced more tillers from the main stem. This result is quite in line with Muhammad *et al*. (2014b) who affirmed that nitrogen fertilizer is found to affect the number of tillers plant$^{-1}$. They reported that the increase in number of tillers plant$^{-1}$ with an increase in nitrogen rates could be attributed to the well accepted role of nitrogen in accelerating the vegetative growth of plants. These results are confirmatory to those revealed by (Rahman *et al*., 2011andLiaqat *et al*., 2003).

Table 1 also recorded significant differences among varieties on number of tillers. The effect of varieties on number of tillers plant$^{-1}$ showed that Linfen recorded the highest number of 27.66 tillers plant$^{-1}$ followed by Reyna-28 with 20.96 tillers plant$^{-1}$ while Cettia gave the lowest number of 13.94 tillers plant$^{-1}$. The significant differences observed in the total number of tillers could be ascribed to differences in ability of cultivars to utilize nitrogen fertilizer as well as partition their photosynthates and accumulation of dry matter. LCRI (2015) also affirmed that Linfen has a profuse tillering ability. This result is in line with the findings of Mandic *et al*. (2015) who reported that the intensity of tillering is a varietal characteristic which is caused by environmental factors.

### 3.3 Number of Spiklets Spike$^{-1}$

There were significantly different effects of nitrogen rate and varieties on number of spikelets spike$^{-1}$in 2017, 2018 and combined results of the two years (Table 1). Maximum number of 19.47 spiklets spike$^{-1}$ were recorded from 150 kg N ha$^{-1}$ while 0 kg N ha$^{-1}$ produced the least number of 16.34 spikelets spike$^{-1}$. These findings are in consonance with the reports of Shahbazpanahi *et al*. (2012) who reported that with the increase of nitrogen rate, number of spikes m$^{-2}$ increased. When there is more absorption of nitrogen by the plants, it enhanced vegetative growth, more number of tillers per unit area and they produce more number of spikes per unit area, (Nourmohammadi *et al*., 2010).

Significant varietal differences were observed on number of spikelets spike$^{-1}$ in both seasons and in the combined results with Reyna-28 having the highest value of 18.79 spikelets spike$^{-1}$ which was statistically similar to that of Linfen (18.47) and the minimum value of 17.67 spikelets spike$^{-1}$ from Cettia. This is in line with Sultana *et al*. (2012) who reported significantly the highest number of spikelets per spike among the varieties they tested. Similarly, Bello and Singh (2013) also observed differences among the varieties they worked on in number of spikelets per spike.

### 3.4 Number of Grains Spike$^{-1}$

Number of grains spike$^{-1}$ was also significantly increased by the higher rates of nitrogen application in both seasons and the two years combined result (Table 1). From the combined result, maximum number of 52.30 grains spike$^{-1}$ was recorded from 120 kg N ha $^{-1}$ while minimum of number 27.60 grains spike$^{-1}$ was observed from the control. Nitrogen promoted the initiation of spiklets which resulted in more number of grains spike$^{-1}$ but more nitrogen rate from 150 kg N ha$^{-1}$ decreased the number of grains due to increased vegetative growth. This trend might be due to the role of nitrogen in flowering, seed formation and crop maturation. These findings are in conformity with the findings of (Maqsood *et al*., 2014) who reported that the application of 120 kg N ha$^{-1}$gave maximum grains spike$^{-1}$ than control and that application above

ISSN: 2456-8643

120 kg N $ha^{-1}$ lead to decline in number of grains $spike^{-1}$. Abedi *et al*. (2011) reported that number of grains $spike^{-1}$ significantly increased with increasing nitrogen fertilization rates.

Significant varietal influence on number of grains $spike^{-1}$ with the highest number (54.21) was observed in Reyna-28, followed by 46.95 in Cettia and the lowest number of 19.56 grains $spike^{-1}$ in Linfen (Table 1). The low number of grains $spike^{-1}$ in Linfen was due to unfavourable climatic condition (heat stress) during heading, flowering and pollination (end of January to early February) which resulted to a greater percentage of empty spikelets. These findings confirm the findings of Bavar *et al*. (2016) who observed that varieties with the highest number of spikes $m^{-2}$ rather had the least grain yield. These results agree with the findings of Ali *et al*. (2000) who also observed significant differences among cultivars in number of grains $spike^{-1}$.

**Table 1: Effects of Nitrogen Rate and Varieties on Plant Height, Number of Tillers Plant-1, Number of Spikelets Spike-1 and Number of grains Spike-1 During 2017and 2018 Dry Seasons and Combined Result of the Two Years**

| Nitrogen | Plant Height (cm) | | | Number of Tillers | | | Number of Spikelets | | | Number of Grains Spike$^{-1}$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Level (kgha$^{-1}$) | 2017 | 2018 | Combined | 2017 70 DAS | 2018 70 DAS | Combined | 2017 | 2018 | Combined | 2017 | 2018 | Combined |
| 0 | 50.86 | 48.52 | 49.69 | 14.14 | 9.97 | 12.08 | 16.66 | 16.06 | 16.34 | 28.19 | 27.00 | 27.60 |
| 30 | 52.5 | 49.88 | 51.02 | 17.38 | 11.98 | 14.68 | 17.64 | 16.73 | 17.19 | 32.88 | 29.36 | 31.12 |
| 60 | 53.93 | 51.76 | 52.84 | 20.55 | 14.02 | 17.30 | 18.40 | 17.47 | 17.93 | 38.62 | 35.51 | 37.07 |
| 90 | 58.33 | 54.74 | 56.54 | 23.27 | 17.00 | 20.14 | 19.08 | 17.93 | 18.51 | 44.33 | 42.04 | 43.19 |
| 120 | 62.33 | 59.33 | 60.83 | 27.32 | 20.53 | 23.93 | 20.07 | 18.67 | 19.37 | 53.91 | 50.69 | 52.30 |
| 150 | 65.30 | 63.14 | 64.22 | 31.19 | 25.04 | 28.18 | 20.05 | 18.89 | 19.47 | 47.58 | 45.18 | 46.38 |
| 180 | 67.97 | 66.06 | 67.01 | 33.29 | 26.00 | 29.61 | 20.02 | 18.73 | 19.38 | 45.15 | 42.89 | 44.02 |
| P of F | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <001 | <.001 | <.001 | <001 |
| LSD | 1.069 | 0.271 | 0.522 | 0.613 | 0.304 | 0.324 | 0.903 | 0.485 | 0.486 | 1.133 | 2.040 | 1.105 |
| **Variety** | | | | | | | | | | | | |
| Reyna-28 | 76.49 | 73.36 | 74.93 | 24.03 | 17.82 | 20.96 | 19.49 | 18.35 | 18.79 | 56.07 | 52.34 | 54.21 |
| Cettia | 46.37 | 44.09 | 45.21 | 15.43 | 12.43 | 13.94 | 18.46 | 16.89 | 17.67 | 48.74 | 45.16 | 46.95 |
| Linfen | 53.27 | 51.16 | 52.22 | 32.19 | 23.13 | 27.66 | 18.60 | 18.10 | 18.47 | 19.75 | 19.36 | 19.56 |
| P of F | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <001 | <.001 | <.001 | <001 |
| LSD | 0.559 | 0.125 | 0.280 | 0.468 | 0.182 | 0.246 | 0.266 | 0.278 | 0.188 | 0.581 | 0.880 | 0.516 |
| Interaction | ** | ** | ** | ** | ** | ** | NS | NS | NS | ** | ** | ** |

Key: DAS = Days after Sowing, ** = Highly Significant (P≤0.01), NS = No Significant.

### 3.5 Weight of 1000 Grains

Variation in nitrogen rates on 1000 grain weight was significantly different in both seasons and the combined result (Table 2). Maximum 1000 grain weight of 38.40 g was found in 120 kg N ha-1, followed by 35.57 in 150 kg N ha-1 which was at par with 90 kg N ha-1 (35.50), while 0 kg N ha-1 recorded the minimum weight of 30.21 g. The application of nitrogen increased the protein percentage, which in turn increased the grain weight. In line with this result, Rahman et al. (2011) reported of maximum 1000 grain weight for wheat in two consecutive years by application of 120 kg N ha-1. These findings disagree with those of Bavar et al. (2016) that with the increased of nitrogen, weight of 1000 grains reduced and had inverse relation with other yield components.

Highly significant response of weight of 1000 grains to varieties was observed in the two years and combined result with the highest (37.57 g) and lowest (32.12 g) weight of 1000 grain recorded in Reyna-28 and Cettia respectively. This observation is apparently due to their genetic make-up. These results agree with the results of Bello and Singh. (2013) and Abdelkhalek et al. (2015) who also reported differences in 1000 grain weight among the varieties they worked with.

### 3.6 Biomass Yield

There were differences among the nitrogen rates and varieties in both seasons and the combined results (Table 2). More application of nitrogen gave tall plants, more grain yield, and higher number of tillers per unit land area and total dry matter which collectively resulted in higher biomass yield. These results confirm the findings of Rahim et al. (2010) that, increasing nitrogen led to linear increase in biological yield. Assefa et al. (2015) reported that biomass yield of bread wheat increased with increasing application of N and P fertilizer in a consistent manner.

Varieties significantly influenced biomass yield in both seasons and the combined result of the two years with the highest (11349 kg ha-1) and the lowest of 9426 kg ha-1 of biomass from Reyna-28 and Cettia respectively. This concurs with the findings of Rahim et al. (2010) and Alemu and Tesfay (2016) who reported differences in biological yield of wheat cultivars.

### 3.7 Grain Yield

Wheat grain yield was also significantly increased by different rates of nitrogen in the two seasons and their combined result (Table 2). Maximum grain yield of 4081.9 ha$^{-1}$ was obtained from 120 kg N ha $^{-1}$ while minimum grain yield of 1699.3 kg ha $^{-1}$ was recoded from the control. This was attributed to the significant increase in the yield components most especially, number of grains spike$^{-1}$ and weight of 1000 grains. This result is concordance with the work of Shah *et al.* (2011) who reported of maximum grain yield from plots treated with 120 kg N ha$^{-1}$, while minimum grain yield was recorded from control plots. The research agrees with the report of Gionvani *et al*. (2012) that higher grain yield at higher nitrogen fertilization rates could be explained by better performance of grain yield components, especially number of fertile tillers, number of grains spike$^{-1}$ and flag leaf length. These results are in full agreement with the findings of Laghari *et al,* (2010) in Leghari and Hafeez. (2016) who recorded the maximum grain yield at 120: 60: 60 NPK kg ha$^{-1}$.

There was significant varietal effect on grain yield in both seasons and combined result where Reyna-28 differed from Cettia and Linfen with higher grain yield of 3722.7 kg $ha^{-1}$. This could be attributed to the higher number of fertile tillers, more number of grains $spike^{-1}$ and 1000-grain weight obtained by Reyna-28 as compared to the other two varieties. This result confirms the report of LCRI (2015) that out of the three varieties studied, Reyna-28 has higher grain yield. This affirmed the report of Degewione *et al.* (2013) and Belete *et al*. (2018) that the significant varietal effect obtained on grain yield and other traits reveals the existence of sufficient genetic variability among the wheat varieties.

The reduction in grain yield during 2018 dry season could be connected to the corresponding low production of the yield components in 2018 due to higher temperature as evidently reported in the meteorological data (TSCOAJ, 2018). According to Akhmad (2015), rapid development caused poor biomass production, restricted tilling, and low grain set at higher temperatures of 23 0C and 30 0C (minimum and maximum) which significantly decreased grain output. In Africa, because of adverse role of temperature in shortening the crop cycle duration and evapotranspiration demand, crop yield is reduced (Sultan, 2012). This is supported by FAO (2019) which reported lower world wheat production of 734 milliom metric tons in 2018/2019 as compared to 771 mmt in 2017/2018 due to diverging weather condition. This assertion is confirmed by the reports of (Sjerven, 2019 and Global Information and Early Warning System on food and agriculture (GIEWS, 2019).

### 3.8 Harvest Index

Under different rates of nitrogen, harvest index differ significantly. Maximum harvest index of 33.2 was obtained from 120 kg N $ha^{-1}$ while minimum Harvest 25.5 was obtained from 180 kg N $ha^{-1}$ which was statistically similar to 30 kg N $ha^{-1}$ and 60 kg N $ha^{-1}$. This might be attributed to excess vegetative growth accompanied by decreased number of grains and grains weight traits that contributed to total grain yield in higher nitrogen rates, while in the control and lower nitrogen rates, the nutrients might have been exhausted during vegetative growth. Asif *et al*. (2012) reported that harvest index significantly increased by increasing nitrogen fertilizer rates. The results of this study disagree with the findings of Mahjourimajd *et al*. (2016) who reported that harvest index showed no direct response to varying nitrogen application and Tamang *et al*. (2017) who reported that highest harvest index was recorded at low nitrogen application levels.

There were highly significant variations among the varieties on harvest index. Variety Reyna-28 exhibits superior performance (32.1) in harvest index over Cettia (27.9) and Linfen (24.9). This may be attributed to its genetic make-up which is expressed in its ability to better utilize the environmental condition for better growth, development and final grain yield even at low nitrogen application. This study is also in line with the earlier studies of Noureldin *et al*. (2013) and Belete *et al*. (2018) who reported significant difference in harvest index among varieties.

ISSN: 2456-8643

**Table 2: Effects of Nitrogen Rate and Varieties on Weight of 1000 Grains (g), Biomass Yield (kg ha-1), Grain Yield (kg ha-1) and Harvest Index in during the 2017and 2018 Dry Seasons and Combined Result of the Two Years.**

| Nitrogen | 1000 Grain Weight | | | Biomass Yield | | | Grain Yield | | | Harvest Index | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Level (kg ha$^{-1}$) | 2017 | 2018 | Combined | 2017 | 2018 | Combined | 2017 | 2018 | Combined | 2017 | 2018 | Combined |
| 0 | 31.81 | 28.61 | 30.21 | 7673 | 5413 | 6543 | 2162.6 | 1236.1 | 1699.3 | 28.18 | 23.04 | 25.61 |
| 30 | 33.26 | 29.09 | 31.17 | 8571 | 6195 | 7383 | 2341.3 | 1510.9 | 1926.1 | 27.31 | 24.05 | 25.68 |
| 60 | 36.04 | 30.62 | 33.33 | 10562 | 7180 | 8871 | 3001.6 | 1842.2 | 2421.9 | 28.54 | 25.59 | 27.06 |
| 90 | 39.60 | 31.39 | 35.50 | 11907 | 8118 | 10012 | 3672.2 | 2700.0 | 3186.1 | 30.58 | 33.08 | 31.83 |
| 120 | 43.01 | 33.80 | 38.40 | 13306 | 11152 | 12229 | 4349.3 | 3814.6 | 4081.9 | 32.57 | 33.83 | 33.20 |
| 150 | 38.25 | 32.90 | 35.57 | 14910 | 12012 | 13461 | 4246.5 | 3590.0 | 3918.2 | 28.34 | 29.64 | 28.99 |
| 180 | 35.56 | 33.52 | 34.54 | 15342 | 13043 | 14192 | 3827.6 | 3427.9 | 3627.7 | 24.91 | 26.10 | 25.51 |
| P of F | <.001 | <.001 | <001 | <.001 | <.001 | <.001 | <.001 | <.001 | <001 | <.001 | <.001 | <001 |
| LSD | 0.638 | 0.224 | 0.320 | 5.587 | 35.28 | 17.20 | 42.78 | 40.10 | 27.77 | 0.328 | 0.448 | 0.263 |
| **Variety** | | | | | | | | | | | | |
| Reyna-28 | 42.09 | 32.95 | 37.52 | 12589 | 10110 | 11349 | 4173.10 | 3272.3 | 3722.7 | 32.90 | 31.38 | 32.09 |
| Cettia | 35.68 | 29.67 | 32.68 | 10900 | 7951 | 9426 | 3122.20 | 2132.1 | 2627,2 | 29.02 | 26.72 | 27.87 |
| Linfen | 32.60 | 31.64 | 32.12 | 11770 | 8987 | 10379 | 2819.40 | 2361.9 | 2590.7 | 23.98 | 25.71 | 24.85 |
| P of F | <.001 | <.001 | <001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <.001 | <001 |
| LSD | 0.218 | 0.145 | 0.128 | 4.895 | 21.99 | 11.02 | 27.60 | 40.19 | 23.84 | 0.194 | 0.367 | 0.203 |
| Interaction | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** | ** |

## 4.CONCLUSION AND RECOMMENDATIONS

Height, tillers, spikelets, and grain spikes of the plant were all strongly influenced by variable nitrogen rates. In terms of grain production, Reyna-28 was the top-performing wheat variety, while nitrogen application at 120 kg N ha-1 was shown to be the optimal rate for crop components and yield in the study area. Based on the results of the study, it is recommended for irrigated wheat agriculture in the northern guinea savanna ecological zone to apply 120 kg N ha-1 and use the wheat variety Reyna-28.

## REFERENCES

Abdelkhalek, A. A., Darwesh, R. K., Mona, H. and El-Mansoury, A. M. (2015). Response of Some Wheat Varieties to Irrigation and Nitrogen Fertilization Using Ammonia Gas in North Nile, Delta region. Annals of Agricultural Science 60(2). 245-256.

Abedi, I., Alamzadeh, A. and Kazemeini, I. (2011). Wheat Yield and Grain Protein Re¬sponse to Nitrogen Amount and Timing Australian Journal of Crop Science,5(3):330– 336.

Adugna, G and Haile, W. (2019). Yield and Nitrogen Uptake of Wheat as Affected by Nitrogen Fertilizer and Compost in the Central Rift Valley of Ethiopia. Ethiop Journal of Agricultural Science 29(1): 85-97

Ahmed, S. S. and Tarence, T. (2016). Effects of Different Levels of NPK on Yield of Wheat (Triticum aestivum L.). International Journal of Multidisplinary Research and Development. 3 (5):224-227.

Akhmad, Z. (2015). Adaptation of Wheat to a Tropical Environment. Unpublished PhD Thesis Submitted to School of Agriculture, Food and Wine, University of Adataide.

Alemu, A. and Tesfay, B. (2016): Response of Some Resistant Barley Varieties to Russian Wheat Aphid (Diuraphis noxia) Damage under Different Nitrogen Fertilizer Rates in Tigray, Northern Ethiopia. Journal of the Drylands, 6(1): 469 - 477

Ali, A., Choudry, M. A., Malik, M. A., Ahmad, R. and Saifullah, S. (2000). Effect of Various Doses of Nitrogen on the Growth and Yield of Two Wheat Cultivars. Pakistan Journal of Biological Sciences, 3(6): 1004-1005.

Ali, N. and Teymur, K. (2013). Response of Wheat to Mineral Nitrogen Fertilizer and Biofertilizer (Azotobacter sp. and Azospirillum sp.) Inoculation under Different Levels of Weed Interference. EKOLOGIJA. 59 (2): 85–94

Amjed, A., Syed, W.H; Khaliq, T., Asif, M., Aziz, M. and Mubeen, M. (2011). Effects of Nitrogen on Growth and Yield Components of Wheat. (REPORT). Science International (Lahore), 23 (4), 331-332,2011.

Asadie, G., Ghorbani, R., Khorramdel, S. and Azizi, G. (2013) Effects of Wheat Straw and Nitrogen Fertilizer on Yield and Yield Components of Garlic (Allium sativum L.). Agricultural Science and Sustainable Production Journal, No. 4, 157-168

Asghar Ali, M. A., Choudhry, M., Asghar, M., Rashid, A and Saifullah (2000). Effect of Various Doses of Nitrogen on the Growth and Yield of Two Wheat (Triticum aestivum L.) Cultivars. Pakistan Journal of Biological Sciences 3 (6): 1004-1005.

Asif, M., Ali, A., Safdar, M., Maqsood, S. H and Hussain, A (2012). Growth, yield Components and Harvest Index of Wheat (Triticum aestivum L.) as Affected by Different Irrigation Regines and Nitrogen Management Strategy. Science International (Lahore) 24: 215 – 218.

Assefa M., Johnson, M. R. S., Nyambilila, A. and Tekalign, M. (2015). Wheat Response to Applied Nitrogen, Sulfur and Phosphorous in three Representative Areas of the Central Highlands of Ethiopia. International Journal of Plant and Soil science 8(5):1-11.

Association in Bread Wheat (Triticum aestivum L.) Genotypes. International Research Journal of Agricultural Sciences 1(2):19-29.

Bavar, M., Heidari S. A. H. and Noormohamadi, G. H. (2016). The Effects of Different Levels of Nitrogen on Yield and Yield Components of Rainfed Wheat in Two Regions of North Khorasan. Open Journal of Ecology. 6. 443-451

Vol. 08, No. 04; 2023

ISSN: 2456-8643

Belete, F., Dechassa, N., Molla, A and Tana, T (2018). Effect of Nitrogen Fertilizer Rates on Grain Yield and Nitrogen Uptake and Use Efficiency of Bread Wheat (Triticum estivum L.) Varieties on the Ve. rtisols of Central Highlands of Ethiopia. Agriculture and Food Security 7 (78): 1-41

Bello, M. S. and Singh, A. (2013). Yield and Yield Components of Bread Wheat as Influenced by Water Stress, Sowing Date and Cultivar in Sokoto, Sudan Savannah, Nigeria. American Journal of Plant Sciences, 4, 122-130.

Campuzano, G. E., Slafer G. A. and Miralles, D. J. (2012). Differences in Yield, Biomass and their Compo¬nents between Triticale and Wheat Grown under Contrasting Water and Nitrogen Environments. Field Crops Research.128: 167–179.

Degewione, A., Dejene, T. and Sharif, M. (2013). Genetic Variability and Traits

Fageria, N. K. (2014) Nitrogen Harvest Index and its Association with Crop Yields. Journal of Plant Nutrittion. 37:795–810.

Falaki1, A. M. and Mohammed, I. B. (2011). Performance of Some Durum Wheat Varieties at Kadawa, Kano State of Nigeria. Bayero Journal of Pure and Applied Sciences, 4(1): 48 – 51.

FAO, Food and Agriculture Organization (2019). Food and Agriculture Organization of the United Nations.Crop Prospect and Food Situation. Quarterly Global Report, 1st March, 2019

GIEWS, Global Information and Early Warning System, (2019). Global Information and Early Warning System on Food and Agriculture.

Giovania, B., Bomhofen, E., Eduarado, R., Eduarado, S. P., Lamesda da Silva, Cand Pinnow, C. (2012). Agronomic Performance of Wheat Cultivars in Response to Nitrogen Fertilization Levels. Acta Scientinum maringa, 34 (3): 275-283

Gomez, K. A. and Gomez, A. D. (1984). Statistical Procedures for Agricultural Research 2nd Ed. John Wiley and Sons Singapore. 680.

GPS (2021) Global Position System Data of the Experimental Site.

Laghari, G. M., Oad, F. C., Tunio, S. D., Gandahi, A. W., Siddiqui, M. H., Jagirani, A. W. and Oad, S. M. (2010). Growth, Yield and Nutrient Uptake of Various Wheat Cultivars under Different Fertilizers Regimes. Sarhad Journal of Agriculture 26(4): 489-497.

Lake Chad Research Institute. (2015). Federal Ministry of Agriculture and Rural Development. Extension Guide on the Production of Wheat. Pp 1- 4.

Leghari, A. H. (2016). Effect of NPK and Boron on Growth and Yield of Wheat Variety Tj-83. Unpublished Master Thesis Submitted to the Department of Agronomy Sind Agriculture University Tandojam.

Liaqat, A., Q. Din, M. U. and Ali, M. (2003). Effect of Different Doses of Nitrogen Fertilizer

Liu D and Shi Y. (2013). Effects of Different Nitrogen Fertilizer on Quality and Yield in Winter Wheat. Advanced Journal of Food Science and Technology. 5(5): 646–649.

Mahjourimajd, S., Kuchel, H., Langridge, P. and Okamoto, M. (2016). Evaluation of Australian Wheat Genotypes for Response to Variable Nitrogen Application. Plant Soil 399:247–255.

Mandic, V., Krnjaja, V., Tomil, Z., Bejelic, Z., Simic, A., Muslic, D.R and Gogic, M. (2015). Nitrogen fertilizer Influence on Wheat Yield and Use Efficiency under Different Environmental Conditions. Chilean Journal of Agricultural Research 75(1):92-97.

Maqsood, M., Shehzad, M. A., Ramzan, Y and Sattar, A (2014). Effect of Nitrogen Nutrition on Growth, Yield and Radiation Use Efficiency of Different Wheat (Triticum aestivum L.) Cultivars. Paistan. Journal of Agricultural Science 51(2), 441-448.

Muhammad, M, Muhammad, A. S, Yasir, R and Abdul, S (2014). Effect of Nitrogen Nutrition on Growth, Yield and Radiation Use Efficiency of Different Wheat (Triticum aestivum L.) Cultivars. Pakistan Journal of Agricultural Science. 51(2).

Muhammad, Y. Suleiman, A.I. A. Khalid, A.O. and Salih, A.I. S (2014). The Effect of Nitrogen Application Rates and Timings of First Irrigation on Wheat Growth and Yield. International Journal of Agriculture Innovations and Research.2 (4): 2319-1473.

Noureldin, N. A., Saudy, H. S., Ashmawy, F. and Saed, H. M. (2013). Grain Yield Response Index of Bread Wheat Cultivars as Influenced by nitrogen levels. Annals of Agricultural Science. 58:147–52.

Nourmohammadi, G. H., Siadat, A. and Kashani, A. (2010). Cereal Crops, Ninth Printing. Chamran University Press, Ahvaz, Iran, p. 48.

on the the Yield of Wheat. Int. J. Agri. and Bio. 5 (4):438–439.

Rahim, N., Amir, M., Reza, S. and Ehsan N. (2010). Response of Bread Wheat to Nitrogen Application in Calcareous Soils of Western Iran American-Eurasian Journal of Agriculture & Environmental Science.9 (1): 79-85.

Rahman, M. A., Sarker, M. A. Z., Amin, M. F., Jahan, A. H. S. and Akhter, M. M. (2011). Yield Response and Nitrogen Use Efficiency of Wheat under Different Doses and Split Application of Nitrogen Fertilizer. Bangladesh Journal of Agricultural Research 36(2):231-240.

Shah, W. A., Khan, H. U., Anwar, S. and Nawab, K. (2011). Yield and Yield Components of Wheat as Affected by Different Seed Rates and Nitrogen Levels. Sarhad Journal of Agriculture 27(1):17-25.

Shahbazpanahi, B., Paknejad, F., Habibi, D., Sadeghi Shoaa, M., Nasri, M. and Pazoki, A. (2012). Evaluation of Irrigation Regimes on Yield and Yield Componente in Different Cultivars of Wheat (Triticum aestivum L.). Iranian Journal of Agronomy and Plant Breeding, 8, 185-197.

Shirazi, S.M., Yusop, Z., Zardan, N.H and Ismail, Z. (2014). Effect of Irrigation Regimes and Nitrogen Levels on Growth, and Yield of Wheat. Hindaw, Publishing Corporation Advances in Agriculture. Available at http://dx.oloi.org.11o.1155/2014/250874. Accessed on April 22nd 2023.

Sjerven, J (2019, 1, 25). International Grain Council Forecasts Lower World Wheat Output in 2018-2019 URL. Available at https://www.world-grain.com/articles/11543-igc forecasts-lower-world-wheat-output-in-2018-2019. Accessed on February 10th 2023

Sultan, B. (2012). Grobal Warming Threatens Agricultural Productivity in Africa and South Assia. Environmental Research Letters. 7:041001 Pp3.

Sultana, M. R., Alim, M. A., Hossain, M. B., Karmaker, S. and Islam, M. S. (2012). Effect of Variety and Weed Management Practices on Yield and Yield Attributes of Wheat. Journal of Environmental Science and natural Resources, 5(2); 91-96,

TADP, Taraba Agricultural Development Programme, (2012). Annual Report, Taraba Agricultural Development Programme Jalingo, Nigeria.

Tamang, G. B., Brasier, K. G., Thomason, W. E., Griffey, A. C. and Fukao, T. (2017). Differential Responses of Grain yield, Grain Protein, and their Associated Traits to Nitrogen Supply in Soft Red Winter Wheat. Journal of Plant Nutrition and Soil Science.180; 316–325.

Vol. 08, No. 04; 2023

ISSN: 2456-8643

TSCOAJ, Taraba State College of Agriculture Jalingo (2018). The meteorological data of Taraba State College of Agriculture Jalingo, Taraba State, Nigeria. Dept. of General studies, TSCOAJ.

Uche, M. N (2013). Global Agricultural Informatio Network Report on Nigeria Grain and Feed Annual Report by United State Department for Agriculture [USDA] Foreign Agriculture Service.

Ullah, I., Ali, N., Durrani, S., Shabaz, M. A., Hafeez, A., Ameer, H., Ishfaq, M., Fayyaz, M. R., Reham, A. and Waheed, A. (2018). Effect of Different Nitrogen Levels on Gruwth, Yield and yield Contributing Attributes of Wheat. International Journal of Scientific and Engineering Research 9 (9): 595-602.

Yadav, M. S. and Dhanai, C. S. (2017). Effect of Different Doses of Nitrogen and Seed Rate on Various Characters and Seed Yield of w#heat (Triticum aestivum L.). Journal of Pharmacognosy and Phytochemistry; 6 (2): 01-05.

Yousaf, M., Shaaban, M., Ali, S. A, I., Fahad, S and Khan, M. J. (2014). Effect of Nitrogen Application Rates and Timings of First Irrigation on Wheat Growth and Yield. International Journal of Agriculture Innovations and Research, 2(4):645-653.