Journal of Medicinal and Industrial Plant Sciences (2025) 3 (1): 16- 28
ISSN: 2959 – 121X
DOI: https://doi.org/10.32894/MEDIP.25.3.2

Impact of different levels of nitrogen fertilization on physiological traits, forage yield and yield components of some maize (*Zea mays* L.) hybrids.

Tara Abubakr Mohammed[1], Rekawt Rahman Ismaiel[2]
[1,2] *Hort. Dept., College of Agricultural Engineering Sciences/ Dohuk Univ*

[*] *Corresponding author: E-mail:* *tara.muhammad@su.edu.krd*

ABSTRACT

The experiment was conducted during the fall of 2024 in Darato, southeast of Erbil, at a location with a latitude of 36°7'9.402"N, longitude of 44°4'2.922"E, and an altitude of 449 meters above sea level. The study aimed to evaluate the impact of three nitrogen fertilizer levels (150, 200, and 250 kg ha^{-1}) on forage yield and yield components of two maize hybrids (*Zea mays* L.): hybrid H1 (Jimson) and hybrid H2 (Safa). A factorial experiment was carried out using a randomized complete block design (RCBD) with three replications. The results presented that at N 150 kg ha^{-1}, H2F1 produced the maximum total fresh yield (144.30 t ha^{-1}) and number of rows per ear (13.8), whereas H2F3 produced the highest total dry yield (51.61 t ha^{-1}) at nitrogen 250kg ha^{-1}. Additionally, the maximum plant height and ear weight per plant were recorded by H1 at (167.68 cm and 61.01g) respectively. Nitrogen fertilizers vary greatly in terms of ear weight per plant; 150 kg ha^{-1} produced the maximum ear weight (63.64 g), whereas 200 kg ha^{-1} produced the highest ear length and 1000 kernel weight (24.66 cm and 391.33 g), respectively. More research may be done to find out how nitrogen treatments affect maize development, yield, and yield component at varying rates.

KEY WORDS: Maize; Nitrogen; Physiological; Hybrids; Yield.

Received: 01/01/2025 ; **Accepted**: 30/01/2025 ; **Available online:** 31/03/2025
© 2023.This is an open access article under the CC by licenses http://creativecommons.org/licenses/by/4.0

تأثير مستويات من السماد النيتروجيني في حاصل علف وحبوب هجينين من الذرة الصفراء (*Zea mays* L.)

تارا ابوبكر محمد[1]، ريّكەوت رحمن إسماعيل[2]
[2،1]قسم المحاصيل الحقلية والنباتات الطبية كلية علوم الهندسة الزراعية / جامعة صلاح الدين-اربيل

الملخص

أجريت التجربة في موسم الزراعة الصيفي 2024 في دارتوو جنوب شرق أربيل والتي تقع على خط عرض 9.402′7″ شمالا وخط طول 2.922′4″ 44 شرقا وعلى ارتفاع 449 مترا فوق سطح البحر لدراسة تأثير ثلاث مستويات من السماد النيتروجيني هي: (150، 200، و250 كغم هكتار[-1]) في حاصل علف وحبوب هجينين من الذرة الصفراء **(Zea mays L)** وهما : الهجين **(H1)** (جيمسون)، والهجين **H2** صفا **((**باستخدام تصميم القطاعات العشوائية الكاملة **(RCBD)** بثلاثة مكررات بتجربة عاملية. وأظهرت النتائج أنه عند 150 كغم هكتار[-1] من النيتروجين، أنتج **H2F1** أقصى إنتاج طازج إجمالي 144.30 طن هكتار[-1] وعدد الصفوف في العرنوص (13.8)، في حين أنتج **H2F3** أعلى إنتاج جاف إجمالي (51.61 طن هكتار[-1]) عند نيتروجين 250 كغم هكتار[-1]، بالإضافة إلى ذلك، تم تسجيل الحد الأقصى لارتفاع النبات ووزن العرنوص لكل نبات بواسطة **H1**عند (167.68 سم و 61.01 غم) على التوالي، وتختلف الأسمدة النيتروجينية بشكل كبير من حيث وزن العرنوص لكل نبات؛ حيث بلغ الحد الأقصى لوزن العرنوص 150 كغم هكتار[-1]- (63.64 غم)، في حين أن 200 كغم هكتار[-1] تنتج أعلى طول لعرنوص ووزن 1000 حبة (24.66 سم و391.33 غم)، على التوالي، ويمكن إجراء المزيد من الأبحاث لمعرفة كيفية تأثير اضافات النيتروجين على تطور الذرة وإنتاجيتها ومكوناتها بمعدلات متفاوتة
الكلمات المفتاحية: الذرة الصفراء؛ النيتروجين؛ الفسيولوجية؛ الهجائن؛ الحاصل

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops of the world after wheat and rice, growing everywhere in the irrigated as well as in rain-fed areas. In botany, it is referred to as

(*Zea mays* L.) and is belong of the Poaceae family. Ali et al. (2012) Be observed that maize is multipurpose crop that can be used for human consumption, animal feed. The main purpose of producing maize is for human consumption, either as a processed or fresh food. Furthermore, is grown for animal feed and industrial applications such crisping, ethanol, starch, and flour (Salemi et al., 2011). Malvar et al. (2008) reported that mostly used for animal feed, industrial products like glucose and starch, and specialty foods, maize is farmed in developed nations. It is a good source of essential vitamins and minerals, fat, protein, and carbohydrates (Jeet et al., 2012). Jasemi et al. (2013) display that one of the simplest and fastest ways to rise yield per unit area is to apply fertilizer. El-Bana et al. (2000) showed that various factors, such as cultivars and nitrogen fertilizer, influenced the highest production of maize yield. Assefa and Mekonnen (2019) demonstrated that one crucial component and significant factor in the growth and development of plants is nitrogen. Nitrogen is a element of protein and nucleic acids and when N is sub-optimal, growth. For optimal maize growth, it must be available in adequate quantities throughout the growing season. Anjorin (2013) illustrated that in order to produce maize, nitrogen is a crucial plant nutrient and a key role in determining yield. Fageria and Baligar (2005) demonstrated that in order for a crop to grow and develop, nitrogen is crucial. Several nitrogen applications amount dramatically enhanced grain production in maize plants Manzoor et al. (2006). Sorkhi and Fateh (2014) reported that it increases the crop's yield lack of nitrogen results in underdeveloped growth, pale yellow color, small grain size and reduced yield. It is a crucial component of protein and amino acids. The application of NPK Nano fertilizer at varying rates had a noteworthy impact on the overall grain yield. The NPK Nano fertilizer's ability to directly stimulate cell division and expansion processes. Plant growth rates were accelerated by this by raising Higher chlorophyll content, more green area, and specific plant chemicals that promote cell division and expansion processes all contributed to higher plant growth rates. As a result, the yield components rose as well as the photosynthetic process's ability to produce dry matter and transmit it from sources to receptors more quickly. Saeed and Khalil (2023). The availability of nitrogen in soil solutions and crop plants' uptake of it are the main factors influencing plant growth. Sharifi and Taghizadeh (2009); Khan et al. (2014) illustrated that nitrogen (N) is a vital plant nutrient and a significant yield component that affects the total yield by facilitating plant growth and development. It is an essential component of many different enzymes, nucleic acids, and proteins and has a significant impact on numerous physiological processes, including the synthesis of chlorophyll. Hence, an excess or deficit of N lowers the yield. A research by Khan et al. (2012) found that N application met the necessary nutritional needs for the maize crop to grow quickly, which encouraged the production of grains. The enhancement in traits linked to elevated nitrogen levels can be attributed to nitrogen's crucial role in forming amino acids, proteins, and enzymes, as well as its involvement in chlorophyll production. This supports increased growth rates, branching, and leaf production, which collectively improve the

efficiency and activity of photosynthesis, ultimately boosting carbohydrate production (Al-Zyadi, 2024). Mohammed and Ismael (2022) illustrated that the effect of different rates of nitrogen fertilizer and cutting frequency on some green forage. Jalali et al. (2010) reported the results of two years of research on the impact of N fertilizer on the yield component of corn showed that the 250 kg ha^{-1} fertilizer produced the maximum weight of 100 grains. There are numerous reasons for the low productivity of maize, including weeds, disease, insects, pests, and a reduction in soil fertility. Agronomic practices also play a significant role. The aim of this research was carried out to investigate the response of some maize to different levels of nitrogen fertilization.

MATERIALS AND METHODS

Two (hybrids) of maize (Zea mays L.) as the plant material were used. Three levels of nitrogen were used as N1 with 150 kg ha^{-1}, N2 with 200 kg ha^{-1} and N3 with 250 kg ha^{-1} nitrogen .

The experiments were carried out during summer season 2024, at South east of Erbil located at (Latitude 36℃7′9.402″N Longitude 44℃4′2.922″E) and evaluation of 449 meters above sea level. To study the response of some maize (Zea mays L.) hybrids to different levels of nitrogen fertilization. Hybrids (H1(Jameson), and H2 (Safa) of maize .

Randomized Completely Block Design (RCBD) with three replications was used in factorial experiment. Implemented in three Nitrogen fertilizer rate of (150,200 and 250 kg ha^{-1}) were distributed and used at two different time first time at planting date and second at (50) days after planting date, (There are 50 cm between rows each plot consists of 4 rows, 25cm between plants, resulting in a plant population of 53333 plants ha^{-1}. Plots were hand-weeded as necessary during the cropping season, and diseases and insects were closely monitored. The plants were thinned after six leaf stage.

The data were subjected to standard analysis of variance and means were compared at significant 5% level by Duncan test using SPSS version 25 computer analysis according to (Weinberg and Abramowitz, 2008). As well as (t-test) was done to detect the effect of locations combination.

The chemical analysis of the study media

soil properties	Unit	
pH		8.10
Electrical Conductivity	$Ds.m^{-1}$	0.60
Organic matter	Mg kg^{-1}	8.70
Total CaCo3	Mg kg^{-1}	340
Particle size distribution	Clay%	30.20
	Silt%	57.60
	Sand%	2.20
	Textural name	Silty clay loam
Ca+2	$Mmol.L^{-1}$	2.75
Mg+2		1.92
Na+		1.39
K+		0.12
Cl-		1.20
HCO3-		208
N	µg g^{-1}soil	0.16
P	µg g^{-1}soil	4.15

RESULTS AND DISCUSSION

a- Effect of nitrogen fertilizer and hybrids on plant height(cm):

The results of Table2 showed interaction of between hybrids and fertilizer HF significantly difference on plant height the results showed that H1F2 recorded highest plant height (173.46cm) and H1F3(171.13cm) and the lowest value was obtained in H2F2 (141.33cm) and H2F3(159 cm) plant height. On the other hand, the results display the, nitrogen fertilizer, alone showed non significantly difference on plant height existing inTable3 as while Table 4 presented variation in plant height between hybrids showed significant the result showed that H1 recorded highest plant height (167.68cm) and the lowest value was obtained H2(154.35cm) .

The outcomes agreed with those of Sharifi and Namvar (2016) he proved that adding more nitrogen to plants enhanced their height, improved vegetative development, and internodal extension. According to Gross et al. (2006) N need only be administered once or twice during the season to have a beneficial impact on plant height. Mukherjee et al. (2000) also noted that plants grew taller as the N rate increased. Woldesenbet and Haileyesus (2016) demonstrates that a rise in nitrogen levels is accompanied by an increase in plant height. With a 92 kg ha^{-1} application, the tallest plant measured 360.66 cm, while the smallest plant measured 347.33 cm when no N was applied. In a similar, Kandil (2013) found that when nitrogen levels rose from 214 to 429 kg N ha^{-1}, maize plant height increased. Onasanya et al. (2009) illustrated that the use of nitrogen fertilizer is responsible for the maize plant's rise in height. The study's findings showed that the maize varieties utilized in it responded differently to soils with 100 N kg ha^{-1} and low N levels (Anjorin, 2013). The findings are consistent with those of (Ali et al., 2012). who discovered larger plants at harvest after applying a higher dose of nitrogen .

b- Effect of nitrogen fertilizer and hybrids on number of leaves per plants:

According to the results of Table 2 presented interaction of HF significantly difference on number of leaves per plants the results showed that H2F2 recorded highest (15.46) and H2F1(15.4) and the lowest value was obtained in H1F2(12.73) and H1F1 (12.86) number of leaves per plants. By increase nitrogen 200kg ha^{-1} for H2 enhanced the quantity of leaves number of leaves could be due to an increase in nodes. Although Table2 presented results nitrogen fertilizer alone showed non significantly difference on number of leaves per plants but hybrids alone showed significantly difference on number of leaves per plants. The results showed that H2 (15.20) recorded highest and the lowest value was obtained in H1(13.05) as showed in Table 3. Increase the number of leaves per plant of maize when the nitrogen fertilizer rate was increased 250kg ha^{-1}. Jones et al. (1995) discovered that N fertilizer greatly enhanced the quantity of leaves and proposed that this increase in leaves could be due to an increase in nodes. Woldesenbet and Haileyesus (2016) illustrated increase

in the number of leaves was noted in conjunction with a rise in the N level. The data showed that the highest number of leaves per plant (17.2) was created by applying 69 and 92 kg ha^{-1}, while the lowest number of leaves per plant (15.8) was produced by applying no N. According to Badr and Othman (2006) there was a considerable increase in the number of leaves per plant of maize when the nitrogen fertilizer rate was increased from zero to 250 kg N ha^{-1}.

c- Effect of nitrogen fertilizer and hybrids on fresh leaf weight (g):

The results represented that interaction of HF significantly difference on fresh leaf weight(g) highest value recorded by H2F2 64.52g and H2F1 60.88g and the lowest value was recorded by H1F2 46.34g and H2F3 53.31 g as showed in Table 2. By adding nitrogen 200kg ha^{-1} fresh leaf increasing in different hybrids. Additionally, Table 2 Illustrated nitrogen fertilizer alone showed non significantly difference on fresh leaf weight whereas hybrids alone were significantly affected H2 recorded highest 59.57g fresh leaf weight while lowest value was recorded H1 52.84g as presented in Table 3.

d- Effect of nitrogen fertilizer and hybrids on fresh steam weight (g):

Table 2 display that interaction HF significantly difference on fresh stem weight. The results showed that, H2F2 recorded highest value 85.04g H1F2 recorded lowest value 59.48 g fresh stem weight. As well as Table 2 display nitrogen fertilizer alone showed non significantly difference on fresh stem weight. By adding nitrogen fresh steam increasing in different hybrids. Furthermore, hybrids alone were significantly affected fresh stem weight expose in Table 3 as well H2 recorded height 76.58 g fresh stem weight H1 recorded lowest 65.51 g fresh stem weight.

e- Effect of nitrogen fertilizer and hybrids on dry leaf weight(g):

According to analysis of variance interaction HF significantly difference on dry leaf weight as showed in Table 2 H2F2 18.30 g recorded height H1F2 12.35 g H1F3 13.14 g recorded lowest dry leaf weight. The findings of NATH et al. (2009), who noted that dry leaves in maize gradually decreased with increasing nitrogen, are consistent with these observations. Although Table 3 illustrated nitrogen fertilizer alone showed non significantly affected dry leaf weight. while Table 4 display hybrids alone showed significantly affected dry leaf weight H1recorded lowest H2 recorded highest value 13.25 g, 17.40 g dry leaf weight respectively. Increased dry matter production was the result of increased vegetative growth enhanced by increased nitrogen application. According to Kumar (2008), the dry weight of plants grew significantly when the nitrogen rate was gradually increased from 0 to 120 kg ha^{-1}. The vegetative growth stage of the maize crop is the most effective period to apply nitrogen.

f- Effect of nitrogen fertilizer and hybrids on dry stem weight(g):

Table1demonstrated that results of interaction treatments HF were significantly affected dry stem weight highest value recorded by H2F2 35.68 g and the lowest value was obtained in H1F2 24.22g. Adding nitrogen 200kg ha^{-1} dry leaf increasing in different hybrids on another hand the results indicated hybrids alone were significantly affected dry stem weight showed in Table 4. H2 33.71 g recorded highest H1 recorded lowest value 27.13 g. Although, Table 3 showed nitrogen fertilizer showed non significantly differences on dry stem weight.

g- Effect of nitrogen fertilizer and hybrids on leaf/ stem ratio:

The results of interactions nitrogen and hybrids showed significantly difference on leaves/ stem ratio H1F3 86.27 recorded highest value leaves/ stem ratio while H1F1 70.2 recorded lowest value leaves/ stem ratio as showed in Table 2. While Table 3,4 nitrogen and hybrids alone non significantly difference on leaves/ stem ratio .

h- Effect of nitrogen fertilizer and hybrids on total fresh yield(t ha^{-1}):

The results of ANOVA showed that interaction of HF treatments significantly difference total fresh yield. Highest total fresh yield value recorded by H2F1 144.30t ha^{-1} while lowest total fresh yield value recorded by H1F2 101.16t ha^{-1} Table 2 illustrated that. Adding 150kg ha^{-1} increasing total fresh yield for H2 when compared to other levels. As well as nitrogen fertilizer alone showed non significantly difference on total fresh yield as showed in Table 3. While, in hybrids alone showed significantly difference on total fresh yield H2 recorded highest total fresh yield (133.37 t/ha) and the lowest value was obtained in H1 116.80 t ha^{-1} total fresh yield Table 3 presented that. Additionally, it was noted that the yield began to decline when the nitrogen content reached its maximum 200 kg ha^{-1}. El-Shahed et al. (2017) showed the impact of N on vegetative growth, which in turn supported metabolic processes and enhanced growth and yield aspects of maize. Also, Muirhead et al. (1985) discovered that applying nitrogen enhanced the yield of maize. The favorable effect of N on all the growth indices examined in this study can be attributed to the out yielded in fresh yield of forage following nitrogen application.

i- Effect of nitrogen fertilizer and hybrids on total dry yield (t ha^{-1}):

The results as showed in Table 2 indicated that interaction of HF treatments significantly difference on total dry yield. H2F3 51.61 t ha^{-1} recorded highest value H1F2 28.91t ha^{-1} recorded lowest value total dry yield when compared to other levels. Table 3 illustrated that nitrogen fertilizer alone showed non significantly difference on total dry yield. While Table 4 exposed hybrids alone

showed significantly difference on total dry yield. H1 38.16t ha^{-1} recorded lowest value also H2 47.43t ha^{-1} recorded lowest value total dry yield.

.Table 1 Impact of interactions on Physiological traits and forage yield

Hybrids * Fertilizer		Plant height	No. leaves	Fresh Leave weight g	Fresh steam weight g	Dry leave weight g	Dry steam weight g	Total fresh forage yield t ha^{-1}	Total dry forage yield t ha^{-1}	Leaf stem ratio
H1	F1	158.467^{a} b	12.867 d	57.333^{a} b	71.093^{b} c	14.253^{b} c	29.34b^{c}	128.427^{a} b	45.26b^{c}	70.2^{b}
	F2	173.467^{a}	12.733 d	46.347^{c}	59.487^{c}	12.353^{c}	24.227^{d}	101.167^{c}	28.913^{d}	78.067^{a} b
	F3	171.133^{a}	13.567 c	54.867^{b} c	65.967^{b} c	13.147^{c}	27.833^{cd}	120.833^{b} c	40.313^{c}	86.27^{a}
H2	F1	162.733^{a}	15.4^{a}	60.88^{ab}	75.76^{ab}	15.72^{b}	32.027^{ab} c	144.307^{a}	44.747^{b} c	77.533^{a} b
	F2	141.333^{b}	15.467 a	64.527^{a}	85.04^{a}	18.307^{a}	35.68^{a}	133.567^{a} b	45.94^{b}	81.65^{a}
	F3	159^{ab}	14.733 b	53.313^{b} c	68.94^{bc}	18.173^{a}	33.44^{ab}	122.253^{b} c	51.613^{a}	80.967^{a}

At 5% of DMRT, means with the same litters for each factor and interaction do not differ significantly

Table 2. Impact of fertilizer on Physiological traits and forage yield.

Fertilizer	Plant height	No. leaves	Fresh leave weight g	fresh steam weight g	Dry leave weight g	Dry steam weight g	Total fresh forage yield t ha^{-1}	Total dry forage yield t ha^{-1}	Leaf stem ratio
F1	160.600	14.133	59.107	73.427	14.987	30.683	136.367	45.003	73.867
F2	157.400	14.100	55.437	72.263	15.330	29.953	117.367	37.427	79.858
F3	165.067	14.150	54.090	67.453	15.660	30.637	121.543	45.963	83.618

At 5% of DMRT, means with the same litters for each factor and interaction do not differ significantly

Table 3. Impact of hybrids on Physiological traits and forage yield.

Hybrids	Plant height cm	No. leaves	Fresh leave weight g	Fresh steam weight g	Dry leave weight g	Dry team weight g	Total fresh forage yield t ha^{-1}	Total dry forage yield t ha^{-1}	Stem leaf ratio
H1	167.689^{a}	13.056^{b}	52.849^{b}	65.516^{b}	13.251^{b}	27.13 ^{b}	116.809^{b}	38.162^{b}	78.179
H2	154.356^{b}	15.200^{a}	59.573^{a}	76.580^{a}	17.400^{a}	33.716^{a}	133.376^{a}	47.433^{a}	80.050

At 5% of DMRT ,means with the same litters for each factor and interaction do not differ significantly

j- Effect of nitrogen fertilizer and hybrids on ear weight per plant (g)

According to ANOVA the results illustrated that nitrogen fertilizer and hybrids alone and interactions significantly difference on ear weight per plant H1 61.01g and F1 63.64 g recorded highest value while H2 50.42 g and F2 49.84 g recorded lowest value ear weight per plant as showed

in Table 6,7. The results as showed in Table 5 illustrated that interaction of VF treatments significantly difference on ear weight per plant H1F1 72.95 g H2F3 44.38 g recorded highest and lowest value ear weight per plant respectively. Increasing number of kernels per row increase ear weight as well as by increasing nitrogen150kg ha^{-1} ear weight increase for H1while for H2 by increasing nitrogen 250kg ha^{-1} ear weight decrease.

k- Effect of nitrogen fertilizer and hybrids on number of rows per ear

As presented in Table 5 interaction of HF treatments significantly difference on number of rows per ear. The results explained that H2F1 highest value 13.8 H1F2 11.13 lowest value number of rows per ear. Adding nitrogen 150kg ha^{-1} for H2 increase row per ear. As well as hybrids showed significantly difference on number of rows per ear H2 13.31 H1 11.86 showed highest and lowest value number of rows per ear, whereas nitrogen fertilizer alone showed non significantly difference on number of rows per ear Table 6,7 display that respectively. Comparing N 150kg ha^{-1} to another rate of N, there were more rows per ear. The increased number of rows per ear resulting from the N dose may have been caused by the abundant supply of N needed for plant growth and development.

l- Effect of nitrogen fertilizer and hybrids on number of kernels per row

The results of analysis of variances illustrated that interaction of HF treatments significantly difference on number of kernels per row the result showed that H2F1 14.06 recorded highest value number of kernels per row while H1F1 11.66 recorded lowest value number of kernels per row Table 4 showed that. However, Table 5 display that nitrogen fertilizer alone showed non significantly difference on number of kernels per row. Additionally, Table 6 illustrated that hybrids showed significantly difference on number of kernels per row H2 15.82 recorded highest value H1 12.46 recorded lowest value number of kernels per row. Similar result showed by (Jasemi et al., 2013) found that the maximum number of grains per ear row was 150 kg ha^{-1}.

In a different study, Costa et al. (2002) found that the number of kernels per row rose with nitrogen consumption. Additionally, according to reports by Al-Rudha and Al-Younis (1981), the number of kernels per row increased in proportion to the nitrogen consumption. Additionally, Seadh et al. (2015) and Matusso and Materusse (2016) found that the number of grain per row increased when N was added. Akmal et al. (2010) state that the positive rise in yield components shows that N increased the supply of assimilates for component growth and yield set. These results could be explained by the way nitrogen influences the meristematic activity of the maize plant and an increase in yield quality, as well as the vigor of vegetative development and the accumulation of photosynthetic assimilates, which lead to a high number of grains per row. The results of Bahr et al. (2006) and Shapiro and Wortmann (2006) are in agreement with these findings.

m- Effect of nitrogen fertilizer and hybrids on ear length (cm)

Hybrids, nitrogen alone and interactions showed significantly difference on ear length(cm) as showed in Table 7,6, respectively H2 24.28cm and F2 24.66 cm recorded highest value while H1 21.48cm and F3 21.73cm recorded lowest value ear length(cm) respectively. The results as showed in Table 4 illustrated that interaction of HF treatments significantly difference on ear length(cm) H2F2 26.26 cm H1F1 19.93cm recorded highest and lowest value ear length(cm) respectively. The results showed a significant variation in ear length(cm) between nitrogen, hybrids. The amount of nitrogen fertilizer applied has a major impact on ear length. As the nitrogen content rise from 0 to 115 kg N kg ha^{-1}, ear length also increased (Assefa and Mekonnen, 2019) .

n- Effect of nitrogen fertilizer and hybrids on 1000 kernel weight (g)

According to results hybrids and nitrogen alone showed significantly difference on 1000 kernel weight while Table 5 showed that interactions non significantly difference on1000 kernel weight. Highest value recorded by H2 379.77 g and the lowest value was recorded by H1 359.11 1000-kernel weight. The 1000-grain weight was affected significantly by the hybrids Table 6 display that. Also, Table 6 illustrated that 1000-grain weight was significantly impacted by the nitrogen fertilizer. F2 391.33 g and F1 328.33 g recorded highest and lowest value respectively according to results maximum seed weight was recorded at 200kg ha^{-1}. Additionally, the maximum seed weight of 250 kg N ha^{-1} was reported by (Sorkhi and Fateh, 2014). Similar findings were also reported by GÖKMEN et al. (2001), who found that cultivars and nitrogen content had an impact on the 1000 grain weight. The findings of this study supported those of Mahmood et al. (2001), who discovered that nitrogen had a major effect on the weight of 1000 grains. According to certain reports, maize grains weigh significantly more when nitrogen is added (Blumenthal et al., 2003). According to reports by Izadi and Emam (2010), when nitrogen was raised from 90 to 180 kg per hectare, maize seed weight increased dramatically. Sharar et al. (2003) also reported similar results.

Table 4. Impact of interactions on yield components.

Hybrids * Fertilizer		Ear weight per plant g	No. row per ear	No. kernels per row	1000 kernel weight g	Ear length cm
H1	F1	72.953^{a}	11.533^{b}	11.667^{c}	308.000	19.933^{d}
	F2	47.14^{c}	11.133^{b}	13.133^{bc}	386.667	23.067^{bc}
	F3	62.947^{ab}	12.933^{a}	12.6^{bc}	382.667	21.467^{cd}
H2	F1	54.34^{bc}	13.8^{a}	17.2^{a}	348.667	24.6^{ab}
	F2	52.553^{bc}	13^{a}	16.2^{a}	396.000	26.267^{a}
	F3	44.38^{c}	13.133^{a}	14.067^{b}	394.667	22^{bcd}

At 5% of DMRT ,means with the same litters for each factor and interaction do not differ significantly

Table 5. Impact of fertilizer on yield components.

Fertilizer	Ear weight per plant g	No. row per ear	No. kernels per row	1000 kernel weight g	Ear length cm
F1	63.647[a]	12.667	14.433	328.333[c]	22.267[ab]
F2	49.847[b]	12.067	14.667	391.333[a]	24.667[a]
F3	53.663[ab]	13.033	13.333	388.667[b]	21.733[b]

At 5% of DMRT ,means with the same litters for each factor and interaction do not differ significantly

Table 6. Impact of hybrids on yield components.

Hybrids	Ear weight per plant g	No. row per ear	No. kernels per row	1000 kernel weight g	Ear length cm
H1	61.013 [a]	11.867 [b]	12.467 [b]	359.111[b]	21.489 [b]
H2	50.424 [b]	13.311 [a]	15.822 [a]	379.778 [a]	24.289 [a]

At 5% of DMRT ,means with the same litters for each factor and interaction do not differ significantly

CONCLUSIONS

According to the results generally the physiological traits yield and yield component parameters significantly influenced by interactions nitrogen and hybrids. However, physiological traits also number row per ear, number kernels per row alone were non significantly influenced by nitrogen fertilizer. Furthermore, F1 recorded height ear weight per plant As well as F2 recorded height 1000 kernel weight g, ear length cm respectively. On another hand significantly influenced by an exception for hybrids alone was significant in all parameters except leaf stem ratio. H2 recorded highest in all parameters except plant height, ear weight per plant recorded highest in H1. Interaction H2F2 recorded highest number of leaves, leave fresh weight g, steam fresh weight g, leave dry weight g, steam dry weight g, ear length cm and lowest plant height. While interaction H1F2, recorded highest plant height, and lowest leave fresh weight g, leave dry weight g, steam fresh weight g steam dry weight g, total fresh yield, total dry yield, number of rows per ear and number of leaves. H1F1 recorded highest ear weight per plant g and lowest number kernels per row, ear length cm. respectively while H1F3 recorded highest leaf stem ratio also H2F3 recorded lowest ear weight per plant g. These findings underscore the importance of selecting the right nitrogen levels and hybrids to optimize Physiological traits and yield outcomes effectively.

REFERENCES

AKMAL, M., REHMAN, H., FARHATULLAH, M. A. & AKBAR, H. (2010) Response of maize varieties to nitrogen application for leaf area profile, crop growth, yield and yield components. Pakistan Journal of Botany, 42, 1941^{-1}947.

Al- Zyadi, Q. A. (2024). Effect of nitrogen fertilizer and boron spray on growth and yield of black mustard (Brassica nigra L.). Journal of Medicinal and industrial plants 2023 1(1): 16- 21.

ALI, S., UDDIN, S., ULLAH, O., SHAH, S., ALI, S. & UD DIN, I. (2012) Yield and yield components of maize response tocompost and fertilizer-nitrogen. Food Sci. Qual. Manag, 38, 39-44.

AL-RUDHA, M. & AL-YOUNIS, A. (1981) The effect of row-spacings and nitrogen levels on yield, yield components and quality of maize (Zea mays L.).

ANJORIN, F. (2013) Comparative growth and grain yield response of five maize varieties to nitrogen fertilizer application. Greener Journal of Agricultural Sciences, 3, 801-808.

ASSEFA, K. & MEKONNEN, Z. (2019) Effect of level and time of nitrogen fertilizer application on growth, yield and yield components of maize (Zea mays L.) at Arba Minch, Southern Ethiopia. African Journal of Agricultural Research, 14, 1785-1794.

BADR, M. & OTHMAN, S. A. (2006) Effect of plant density, organic manure, bio and mineral nitrogen fertilizers on maize growth and yield and soil fertility.

BAHR, A. A., ZEIDAN, M. & HOZAYN, M. (2006) Yield and quality of maize (Zea mays L.) as affected by slow-release nitrogen in newly reclaimed sandy soil.

BLUMENTHAL, J. M., LYON, D. J. & STROUP, W. W. (2003) Optimal plant population and nitrogen fertility for dryland corn in western Nebraska. Agronomy Journal, 95, 878-883.

COSTA, C., DWYER, L. M., STEWART, D. W. & SMITH, D. L. (2002) Nitrogen effects on grain yield and yield components of leafy and nonleafy maize genotypes. Crop Science, 42, 1556-1563.

EL-BANA, A., GOMAA, M. & GOMAA, M. (2000) Effect of N and K fertilization on maize grown in different populations under newly reclaimed sandy soil. Zagazig J. Agric. Res, 27, 1179-1190.

EL-SHAHED, H. M., MOWAFY, S., OSMAN, M. & EL-NAGGAR, N. Z. (2017) Physiological response of maize hybrids to nitrogen and phosphorus fertilization. Zagazig Journal of Agricultural Research, 44, 41-69.

FAGERIA, N. K. & BALIGAR, V. C. (2005) Enhancing nitrogen use efficiency in crop plants. Advances in agronomy, 88, 97-185.

GÖKMEN, S., SENCAR, Ö. & SAKIN, M. A. (2001) Response of popcorn (Zea mays everta) to nitrogen rates and plant densities. Turkish Journal of Agriculture and Forestry, 25, 15-23.

GROSS, M. R., VON PINHO, R. G. & BRITO, A. H. D. (2006) Nitrogen fertilization, sowing rate and interrow spacing in corn crop in no-tillage system. Ciência e Agrotecnologia, 30, 387-393.

IZADI, M. & EMAM, Y. (2010) Effect of planting pattern, plant density and nitrogen levels on grain yield and yield components of maize cv. SC704.

JALALI, A., BAHRANI, M. & SALEHI, F.(2010) Yield of corn (Zea mays L.), organic carbon changes and nitrate nitrogen of soil under effect of compost application, residues and nitrogen fertilizer management. Proceeding 11th Iranian Crop Sci. Congress, 2010. 2591-2594.

JASEMI, M., DARABI, F., NASERI, R., NASERIRAD, H. & BAZDAR, S. (2013) Effect of planting date and nitrogen fertilizer application on grain yield and yield components in maize (SC 704). American-Eurasian Journal of Agriculture and Environmental Science, 13, 914-919.

JEET, S., SINGH, J., KUMAR, R., PRASAD, R. K., KUMAR, P., KUMARI, A. & PRAKASH, P. (2012) Effect of nitrogen and sulphur levels on yield, economics and quality of QPM hybrids under dryland condition of eastern Uttar Pradesh, India. Journal of Agricultural Science, 4, 31.

JONES, R., SANDERSON, M., READ, J. & LOVELL, A. (1995) Management of corn for silage production in south central USA. Journal of production agriculture, 8, 175-180.

KANDIL, E. (2013) Response of some maize hybrids (Zea mays L.) to different levels of nitrogenous fertilization. Journal of Applied Sciences Research, 9, 1902-1908.

KHAN, F., KHAN, S., FAHAD, S., FAISAL, S., HUSSAIN, S., ALI, S. & ALI, A. (2014) Effect of different levels of nitrogen and phosphorus on the phenology and yield of maize varieties. American Journal of Plant Sciences, 2014.

KHAN, N. W., NAEEM KHAN, N. K. & KHAN, I. A. (2012) Integration of nitrogen fertilizer and herbicides for efficient weed management in maize crop.

KUMAR, A. (2008) Productivity, economics and nitrogen-use efficiency of specialty corn (Zea mays L.) as influenced by planting density and nitrogen fertilization. Indian Journal of Agronomy, 53, 306-309.

MAHMOOD, M. T., MAQSOOD, M., AWAN, T. H. & RASHID, S. (2001) Effect of different levels of nitrogen and intra-row plant spacing on yield and yield components of maize. Pakistan Journal of Agricultural Sciences, 38, 1-2.

MALVAR, R., REVILLA, P., MORENO-GONZÁLEZ, J., BUTRÓN, A., SOTELO, J. & ORDÁS, A. (2008) White maize: genetics of quality and agronomic performance. Crop science, 48, 1373-1381.

MANZOOR, Z., AWAN, T. H., SAFDAR, M. E., ALI, R. I., ASHRAF, M. M. & AHMAD, M. (2006) Effect of nitrogen levels on yield and yield components of Basmati 2000. J. Agric. Res, 44, 115-120.

MATUSSO, J. & MATERUSSE, M. (2016) Growth and yield response of maize (Zea mays L.) to different nitrogen levels in acid soils. Academic research journal of agricultural science and research, 4, 35-44.

MOHAMMED, T. A. & ISMAEL, N. B. (2022) The Effect of Different Nitrogen Concentration and Cutting Frequency on Some Quality Characters of Two Sorghum (Sorghum bicolor L. Moench) Varieties. Zanco Journal of Pure and Applied Sciences, 34, 92-102.

MUIRHEAD, W., MELHUISH, F. M. & WHITE, R. (1985) Comparison of several nitrogen fertilisers applied in surface irrigation systems. I. Crop response. Fertilizer research, 6, 97-109.

MUKHERJEE, A., MANDAL, S. & PATRA, B. (2000) Effect of dates of sowing, cutting management and levels of phosphate application on seed yield of shaftal.

NATH, K., NEPALIA, V. & SINGH, D. (2009) Effect of integrated nutrient management on growth and yield of sweet corn (Zea mays L. ssp. Saccharata). Annals of Agricultural Research, 30.

ONASANYA, R., AIYELARI, O., ONASANYA, A., OIKEH, S., NWILENE, F. & OYELAKIN, O. (2009) Growth and yield response of maize (Zea mays L.) to different rates of nitrogen and phosphorus fertilizers in southern Nigeria. World Journal of Agricultural Sciences, 5, 400-407.

Saeed, I. H. and Khaled K. A. (2023). Effect of nano-NPK fertilizer on some growth characteristics and yield of Maize (Zea mays L.). Journal of Medicinal and industrial plants 2023 1(1): 52-59.

SALEMI, H., MOHD. AMIN, M., LEE, T. S., MOHD KAMIL YUSOFF, M. K. Y. & AHMAD, D. (2011) Effects of deficit irrigation on water productivity and maize yields in arid regions of Iran.

SEADH, S., ABIDO, W. & ABDULRAHMAN, D. (2015) The role of foliar application in reducing maize nitrogen requirements. Journal of Plant Production, 6, 1169-1181.

SHAPIRO, C. A. & WORTMANN, C. S. (2006) Corn response to nitrogen rate, row spacing, and plant density in eastern Nebraska. Agronomy journal, 98, 529-535.

SHARAR, M., AYUB, M., NADEEM, M. & AHMAD, N. (2003) Effect of different rates of nitrogen and phosphorus on growth and grain yield of maize (Zea mays L.). Asian Journal of Plant Sciences, 2, 347-349.

SHARIFI, R. S. & NAMVAR, A. (2016) Effects of time and rate of nitrogen application on phenology and some agronomical traits of maize (Zea mays L.). Biologija, 62.

SHARIFI, R. S. & TAGHIZADEH, R. 2009. Response of maize (Zea mays L.) cultivars to different levels of nitrogen fertilizer.

SORKHI, F. & FATEH, M. (2014) Effect of nitrogen fertilizer on yield component of maize.

WEINBERG, S. L. & ABRAMOWITZ, S. K. (2008) Statistics using SPSS: An integrative approach, Cambridge University Press.

WOLDESENBET, M. & HAILEYESUS, A. 2016. Effect of nitrogen fertilizer on growth, yield and yield components of maize (Zea mays L.) in Decha district, Southwestern Ethiopia. International Journal of Research-Granthaalayah, 4, 95^{-1}00.