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EFFECT OF SUPPLIED NITROGEN FERTILIZERS ON SELECTED GENOTYPES OF SUNFLOWER

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ABSTRACT

A field experiment was carried out in the fields of the College of Agricultural Engineering Sciences- University of Baghdad. This study was conducted to investigate the efficiency of selection to improve some field traits associated with sunflower seed yield and select genotypes that will achieve the best balance between high yield components under conditions of nitrogen deficiency. The experiment included eight sunflower genotypes and three levels of N-supplied (50, 100, and 200) N kg ha^{-1}. RCBD was used design with split-plot arrangement the sunflower genotypes were allotted as main plots and sub-plots were allotted nitrogen fertilizer rates with three replicates for the autumn season of 2022.The results showed that the selected LD genotype had the lowest plant height of 145.50 cm and the highest yield of 7.92 tons ha^{-1}. The selected SHS genotype gave a plant height of 146.53 cm, which did not differ significantly from the LD genotype. Selection at adequacy and lack of N-Supplied improved the performance of selected genotypes for the most genetic and phenotypic traits. The LD genotype has been superior, so it is important to include it in genetic and environmental interaction trials in many locations and years.

Keywords: sunflower, selection, nitrogen fertilizer.

تأثير اضافة الاسمدة النايتروجينية على تراكيب وراثية منتخبة لزهرة الشمس

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الخلاصة

نفذت تجربة حقلية في حقول كلية علوم الهندسة الزراعية جامعة بغداد. اجريت الدراسة لتقييم كفاءة الانتخاب لتراكيب وراثية من زهرة الشمس تحت مستويات مختلفة من النايتروجين. تضمنت التجربة ثمانية تراكيب وراثية لزهرة الشمس وثلاث مستويات من النايتروجين (50، 100، 200) N كغم.ه$^{-1}$. استخدم تصميم القطاعات العشوائية الكاملة بترتيب الالواح المنشقة اذ مثلت مستويات التسميد النايتروجيني للالواح الرئيسية والتراكيب الوراثية الالواح الثانوية وبثلاث مكررات للموسم الخريفي 2022. اظهرت النتائج ان التركيب الوراثي المنتخب LD حقق اقل ارتفاع للنبات 145.50سم واعلى انتاجية 7.92 طن.ه$^{-1}$ اعطى التركيب الوراثي SHS اقل ارتفاع للنبات 146.53 سم، والذي لم يختلف

[*] **This article is taken from the doctoral dissertation of the first researcher.**

بشكل كبير عن التركيب الوراثي LD. ادى الانتخاب الى عند كفاية ونقص النايتروجين الى تحسين التراكيب الوراثية لمعظم الصفات الوراثية والمظهرية. تفوق المنتخب LD لذا من المهم ادراجه في تجارب التفاعل الجيني والبيئي وفي العديد من المواقع والسنوات.

الكلمات المفتاحية: زهرة الشمس، الانتخاب، التسميد النايتروجيني.

INTRODUCTION

The optimal quantity level of N-supplemented lead to a regulation of PH at (5–5.5) in the vacuole and applets in the cell. Therefore, enzymes such as ATPase and pyro phosphatase will activate the photosynthesis apparatus **(Okab & Abed, 2022)**. Nitrogen is a crucial nutrient for the growth and development of crops that, if not consumed in sufficient quantities, will limit plant growth **(Abed & Abed, 2010)**. The plant uptakes NO3 and tries to regulate cytosolic PH hemostasis, causing balance in K and Cl **(Kumari, 2017; Shaker & Rosool, 2023)**. Plant breeders are trying to get an acceptable yield under different fertilizing conditions **(Elsahookie & Abed, 2008)**. The selection method is one of the best breeding methods for improving degraded varieties and helps in increasing the number of preferred genes for different plant traits, as well as increasing free radicals in plant cells exposed to biotic or abiotic stress **(Al-Assafi & Abed, 2014)**. Through the oxidation of lipids in cell membranes, the degradation of nucleic acids and proteins, and the lack of effectiveness of chloroplasts and mitochondria, which leads to a decrease in yield **(Elsahookie *et al*., 2011; Al-Temimi & Abed, 2016)**. Plant yield was a complex trait affected by environmental factors, so the selection of traits with high inheritance is important in breeding and improvement programs **(Jessup *et al*., 2020)**. The genetic progress of the trait to the studied trait, as plants with a height of 150 cm are important criteria for selection, which in turn increases the yield of sunflower as well as increasing the plant's resistance to environmental stresses **(Abed, 2017)**. The diameter of the head is also a characteristic that is closely related to seed yield and can be considered a reliable criterion for increasing production **(Alkhawlani, 2002)**. The characteristic of the yield is not governed by specific genes but the genes wich contorted ether plant characteristics such as plant height, leaf area, number of grains per disk, and grain weight, which are responsible for increasing or decreasing the yield **(Ghazi & Abed, 2021)**. The presence of nitrogen in the soil is an important factor in influencing gene expression, and the gene can alter itself in its gene expression when processing nitrogen, as gene expression can mutate, accelerate, or inhabit regulatory mechanisms in the cell under the influence of external and internal factors **(Abed & Abed,2010; Ziyad et al., 2018)**. Genetic and environmental variations and the interaction between them lead to the emergence of heterogeneities in society, and the amount of each depends on the number of genes governing the trait and the impact of its action on the environment **(Al-Mehemdi & Abed, 2016)**. The research aims to study the efficiency of selection in improving some field traits associated with the yield of sunflower seeds to determine the genotype varieties of sunflower that combine the high yield with the extent of their response to withstand the increase or lack of nitrogen.

MATERIALS AND METHODS

In the first season, eight genotypes of sunflower, including parent varieties, were planted in autumn season 2022 the Research Station of the Field Crops Department, College of Agricultural Engineering Sciences, University of Baghdad Aljaderea. Which was selected from a previous study of two varieties (Shamus and the local variety) for the first selection cycle, with selection criteria (early flowering, plant shortening, disk diameter) for varieties of the sunflower. The population of sunflowers was selected individually by the mass selection method using selection at (10%). Fertilizers are added at a rate of 200 kg N ha^{-1}, (80 kg P_2O_5 ha^{-1} and 80 kg K2O ha^{-1}). In addition, N-fertilizer was applied twice-once during planting and another at disk-formation stage. While phosphate and potash fertilizer were supplied at the planting stage, plant disks were wrapped at flowering with cloth bags to ensure self-pollination, pollen mixing, and distributing them to all disks for each selection criterion. At the end of the season, the disks are harvested for each criterion individually under the serve selection criteria. A comparison experiment was conducted for the genotypes obtained according to the design of the RBCD in the order of split plot design, where the levels of nitrogen fertilization were 50, 100, and 200 kg N ha^{-1} respectively. The main plots were N-supplied, and sub-plots were genotypes with three replicates. At harvest date, a random sample was taken from each experimental unit of five plants and studied for the number of days up to 50% flowering, plant height, disk diameter (cm) for five plants, and yield (tons ha^{-1}).

RESULTS AND DISCUSSION

Number of days up to 50% flowering

Flowering is a complex genetic mechanism that controls the overall yield of a plant. The results of Table 1 showed that there were significant differences between the genotypes in the least period of cultivation for flowering, as the genotypes (LC) and (SHC) gave the least flowering duration, which amounted to 48.57 and 49.71 days, respectively, compared to the (LF) genotype, which gave the highest period of cultivation for flowering, which amounted to 58.73 days. It is noted that there are significant effects of N-supplied at the period from planting to 50% flowering, as the nitrogen level of 200 kg N ha^{-1} gave the lowest flowering duration 50.08 days compared to the level of fertilization of 50 kg N ha^{-1}, which gave the highest period of 56.93 days. This is because the increase in nitrogen fertilization led to an increase in the flowering hormone associated with the structure of PEBP proteins, which is increased by increasing amino acids **(AL-Behadili & Abed, 2019)**. There was a significant relationship between the genotypes and the levels of nitrogen fertilization, as the flowering duration of LC genotype at 200 kg N ha^{-1} and 100 kg N ha^{-1} were 44.40 and 45.63 days from planting up to 50% flowering **(Okab & Abed, 2022)**. The results show that all genetic variations were greater than the environmental variations for the number of days of planting up to 50% flowering, which led to an increase in the inheritance rate (85.73), (86.52), and (55.01) for 50, 100 and 200 kg N ha^{-1} respectively, and this result is consistent with previous studies **(Okab & Abed, 2023)**.

Table (1): The effect of selected genotypes and N- levels and their infraction on the number of days to 50% flowering for the autumn season 2022.

Genotypes	N-levels kg N ha^{-1}			Mean
	50	100	200	
SHC- variety	51.03	49.87	48.23	49.71
SHS-selected	54.93	52.50	51.70	53.04
SHD-selected	54.30	59.83	53.53	55.89
SHF-selected	54.83	52.53	51.30	52.89
LC –Variety	55.67	45.63	44.40	48.57
LS-selected	70.57	51.67	47.87	56.70
LD-selected	54.93	54.03	47.77	52.24
LF-selected	59.17	60.13	55.80	58.37
LSD 0..005	4.01**			2.31**
Mean	56.93	53.27	50.08	
LSD 0.005	2.83**			

Plant height (cm)

Plant height is an important selection criterion for increasing yield and resistance to environmental stresses in sunflower plants. The results of Table 2. showed significant differences between the genotypes, the genotype (LD), (SHS) and (SHF) gave the lowest plant height of 145.50 cm, 146.53 cm and 148.76 cm respectively. While the original (LC) gave the highest height of the plant about to 165.63 cm and did not differ significantly from (SHD) genotype, the difference between genotypes in plant height is due to genetic and environmental interaction, as well as the selection of short stem led to gene frequency to favorable trait **(Al-Athari, ,1992; Ghazi & Abed ,2021)**. The results showed that there were no significant differences between N levels in the plant height, as N-supplied in 50 kg N ha^{-1} gave the lowest height of the plant, while the level of 200 kg N ha^{-1} gave the plant height of 153.6 and 158.05 cm respectively. There are no significant variations between genotypes due to nitrogen fertilizer levels, indicating that genotypes have behaved similarly under N levels **(Ahmad et al., 2018; Zhao *et al*., 2021)**.

Table (2): The effect of selected genotypes and N-levels and their infraction on the plant height (cm) for the autumn season 2022.

Genotypes	N-levels kg N ha $^{-1}$			Mean
	50	100	200	
SHC- variety	156.33	160.79	161.78	159.63
SHS-selected	140.46	148.64	150.49	146.53
SHD-selected	162.22	164.07	168.39	164.89
SHF-selected	147.33	148.19	150.75	148.76
LC –Variety	165.44	164.66	166.78	165.63
LS-selected	152.93	153.00	154.00	153.31
LD-selected	143.72	142.67	150.10	145.50
LF-selected	160.59	161.00	162.11	161.23
LSD 0..005	Ns			4.50**
Mean	153.63	155.38	158.05	
LSD 0.005	Ns			

Disk diameter

Disk diameter is an important criterion to select the genotypes because it is correlated with the yield. The results of Table 3 indicate that there are significant differences between the genotypes in the characteristic of the diameter of the disk; the (SHC genotypes) exceeded the highest value of 20.00 cm, while the genotype (LF) gave the lowest value of the disk diameter, about 17.62 cm. The results showed significant differences between the levels of nitrogen fertilization, as the level of 200 kg N ha $^{-1}$ gave the highest value of 19.81 cm, while the fertilizer level of 50 kg N ha $^{-1}$ gave the lowest value of 18.21 cm for the characteristic of the diameter of the disks. This result is consistent with **(Wen, *et al.*, 2018 & Alhaideri, 2021)**. Significant differences were found in the interaction between the genotypes and nitrogen fertilizer levels. The genotype (SHS) in the fertilizer level of 200 kg N ha $^{-1}$ gave the highest value of the disk diameter of 22.20 cm, while the genotype (LD) in the fertilizer level of 50 kg N ha $^{-1}$ gave the lowest value of the trait of 16.72 cm. The reason for the increase in the diameter of the disk in the selected genotypes is due to their ability to optimize the use of nitrogen fertilizer and increase net photosynthesis **(Al-Assafi & Abed, 2014; Pourmohemmad, 2016)**.

Table (3): The effect of selected genotypes and N- levels and their infraction on disc Diameter (cm) for the autumn season 2022.

Genotypes	N-levels kg N ha $^{-1}$			Mean
	50	100	200	
SHC- variety	18.08	20.75	21.17	20.00
SHS-selected	18.33	19.25	22.20	19.93
SHD-selected	17.75	19.68	20.18	19.21
SHF-selected	18.83	19.00	19.61	19.15
LC –Variety	19.77	19.82	19.83	19.81
LS-selected	17.60	17.42	18.19	17.74
LD-selected	18.30	16.72	19.03	18.02
LF-selected	17.02	17.58	18.25	17.62
LSD 0..005	0.96**			0.55**
Mean	18.21	18.78	19.81	
LSD 0.005	0.72**			

Plant yield (tons ha $^{-1}$)

The efficiency of the genotype can be determined by the relationship between the yield and its components, which are affected by external factors. The results of Table 4 indicate that there are significant differences between the genotypes. The (LD genotype) gave the highest yield of 7.92 tons ha $^{-1}$, which did not differ significantly from the two genotypes (SHC and SHF), which amounted to 7.17 tons ha $^{-1}$ and 7.12 tons ha $^{-1}$ respectively, while the genotype (LC) gave the lowest yield of 5.71 tons ha $^{-1}$. The superiority of LD genotype is due to the difference in genotypes among them, which is due to the difference in the components of the yield that contribute to its formation, as the selection led to shortening the height of the plant, which is reflected positively on the yield. It was noted that there were significant differences between N-levels: where 200 kg N ha^{-1} gave the highest yield of 7.93 tons' ha $^{-1}$, while the fertilization level of 50 kg N ha $^{-1}$ gave the lowest yield of 6.06 tons ha $^{-1}$ which agreed with **(Ali, 2021; Golla & Chalchsa, 2019)**.

Table (4): The effect of selected genotypes and fertilizer levels and their infraction on yield ton/h) for the autumn season 2022.

Cultivars	**Nitrogen levels**			**Mean**
	50	100	200	
SHC- variety	6.51	7.11	7.90	7.17
SHS-selected	6.85	6.82	7.16	6.94
SHD-selected	4.87	5.41	7.39	5.89
SHF-selected	6.20	7.04	8.12	7.12
LC –Variety	5.43	5.45	6.24	5.71
LS-selected	5.66	5.98	6.90	6.18
LD-selected	7.21	7.53	9.02	7.92
LF-selected	5.76	6.05	6.44	6.08
LSD 0..005	Ns			0.56**
Mean	18.21	18.78	19.81	
LSD 0.005	0.83*			

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