Kirkuk University Journal for Agricultural Sciences
ISSN:2958-6585
https://kujas.uokirkuk.edu.iq

RESEARCH ARTICLE
https://doi.org. 10.58928/ku25.16204

Effects of sowing date and Cultivar on growth, yield and quality of Niger *(Guizatia abyssinica Cass.)* Grown Under Sulaimani Condition.

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Received:15/04/2025 **Revised: 19/05/2025** **Accepted: 27/05/2025** **Published: 01/06/2025**

ABSTRACT

The present study was conducted at the experimental field site Qlyasan Research Station, situated within the Sulaimani region. This facility serves as the research hub for the Department of Biotechnology and Crop Science, affiliated with the College of Agricultural Engineering Sciences at the University of Sulaimani. A field experiment was conducted in spring during the growing season of (2023) to evaluate the impact of planting date on growth, yield and quality of niger (*Guizatia abyssinica* Cass.) cultivars The experiment include two factors first was planting dates: (April 1st, April 15th, May 1st and May 15th), while second factor include cultivars (Benglanuglue, Karal and Animax). Results revealed that the longest days to 50% flowering and days to maturity and the highest values plant height, branch number/ plant, capitulum number/ plant, seed number/ capitulum, 1000-seed weight, and seed yield (kg ha^{-1}), seed oil content obtained from crop sown on 1st April as compared to other planting dates. The lowest values of all the mentioned parameters were obtained from the crop sown on 15th May. However, the highest amount of seed protein content was obtained from crops sown on 15th May. Among the cultivars, Benglanuglue performed significantly better than other cultivars and produced the highest seed yield and seed oil content at the 1st April sowing time.

***Keywords*:** Niger, planting date, cultivars, seed yield, oil and protein content.

INTRODUCTION

Niger, scientifically known as *Guizotia abyssinica*, is an oleaginous crop with a history of cultivation spanning approximately 5 millennia. Predominantly cultivated in South India and Ethiopia, these nations serve as the primary global producers of this oilseed. Indeed, Niger seed oil holds significant nutritional and health benefits, attributed to its unique fatty acid profile and substantial content of fat-soluble bioactive compounds. Furthermore, Niger seed oil exhibits an appealing pale-yellow hue and possesses a distinct nutty flavor profile. Notably, as supported by research [1], characterized by a high concentration of linoleic acid, its fatty acid composition closely resembles that of sunflower and safflower oils. Niger serves primarily as a source for oil extraction. Its oil finds widespread application in various sectors, including culinary applications, the formulation of cosmetics and soaps, the production of paints, illumination, and lubrication. Additionally, Niger seed oil is utilized as a key ingredient in the preparation of chutneys. In the pharmaceutical industry, Niger seed oil possesses the potential to serve as a viable alternative to olive oil and a suitable substitute for sesame oil in various applications. The extracted oil is used in foods, and the cake is used as feed [2]. Niger, an exotic species within the context of avian seed mixtures imported into the Kurdistan Region, constitutes a substantial proportion, representing 22.73% of the overall seed composition, as documented by [3] In the previously cited source mentioned that Niger seeds with the bird seed mixtures which imported to Kurdistan previously, indicated that potential product of Niger can be fully exploited with suitable agronomic and genotypes. Niger seeds find culinary applications primarily as a flavoring agent in vegetable stir-fries [4]. Timely sowing is a critical agronomic practice that maximizes the expression of a cultivar's genetic potential by ensuring access to optimal environmental conditions, including light intensity, temperature, precipitation, and humidity [5]. This crop exhibits a broad genetic foundation, manifested by substantial phenotypic variability across a spectrum of agronomically valuable traits. These traits encompass seed yield potential, seed oil content, seed oil quality, and sensitivity to photoperiod, as documented by [6].

A comprehensive review of the scientific literature revealed a paucity of data regarding the cultivation of Guizotia abyssinica (Niger seed) as an oilseed crop under the specific agro-ecological conditions of the Sulaimani region. Consequently, the introduction of this novel crop holds potential for providing a valuable raw material resource for both agro-industrial

applications and the animal feed sector. This study, therefore, aimed to evaluate the agronomic performance of three Niger seed cultivars across four distinct sowing dates, serving as an initial step towards the integration of this oilseed crop into the agricultural systems of the Sulaimani region, Iraq.

Material and Methods

The current study was done in the Qlyasan, which was located at the Governorate of Sulaimani in the Kurdistan, northeast of Iraq, on the border with Iran, during the Spring of 2023 to evaluate the impact of four different sowing dates on growth, yield and quality of Niger cultivars. The experimental design conducted under Randomized Complete Block Design (RCBD) with three replications to ensure experimental accuracy. (April 1st, April 15th, May 1st and May 15th), while the three cultivars (Benglanuglue, Karal, Animax) were used. Primary tillage was achieved through moldboard plowing, followed by secondary tillage for soil refinement. Drip irrigation was implemented as the irrigation method. Each planting bed received an initial seeding rate of 2-3 seeds, followed by a single plant per stand after two weeks of germination. Five plants were randomly selected from each experimental plot for data collection. Studied characters were period from planting to flowering stage (50% of the plants with bloom), period from planting to mature stage, Data collection included a range of agronomic traits, including plant height (cm), branches/plant, capitulum/ plant, seeds/ capitulum, 1000-grain weight (g), seed yield (kg ha^{-1}), and grain oil and protein contents. Plant maturity provided as the criterion for manual harvest. oil and protein content were determined using a Digital Soxhlet apparatus with hexane as the extraction solvent [7]. Protein content was quantified using the standard Kjeldahl method, employing a BUCHI K-424 nitrogen analyzer [8].

Table 1: Characterization of Soil Physic-chemical Properties at the Study Site:

Physicochemical Properties			
Physical properties	Sand	87	($g\ kg^{-1}$)
	Silt	435	
	Clay	458	
	Texture	Silty Clay (SiC)	
Chemical properties	pH	7.59	
	ECe	490	($\mu S\ cm^{-1}$)
	O.M.	22.4	($g\ kg^{-1}$)
	$CaCO_3$	304.3	

Table 2: Climatological Data for Qlyasan Location in 2023:

2023	Average Temperature (C^O)		Rainfall (mm)	
Month	Max	Min	Max	Min
January	14.5	-0.4	1147.8	17.2
February	21.7	-2	323.6	290.6
March	24.4	2.4	565.8	324.2
April	27.1	4.6	670.2	565.8
May	33.6	11.6	718.8	679.2
June	41	18.9	0.4	0
July	44.2	25	0	0
August	45.3	23.9	0.2	0
September	42.4	20.3	0	0
October	33.5	13.8	10.6	1

Results and Discussion

Effect of planting dates and cultivars on yield and its components:

As shown in Table 3, all yield components (day to 50% flowering, day to maturity, plant height, branches/plant, capitula/plant, Seed/capitula, 1000 grain weight and seed yield kg/ha) were significantly influenced by planting date. The 1st of April is the best sowing time for all above studied parameters, and all traits significantly reduced on the 15th of May compared to another planting date. The variation in growth parameters among the planting dates resultant from the impact of key meteorological parameters, including rainfall, temperature and relative humidity. As the early sowing time, the days to 50% flowering and days to maturity become longer because of the suitable climate conditions for vegetative growth before the onset of flowering, which is highly affected by photoperiod [9]. As shown in Table 2, the well rainfall from January to

April and the optimum temperature from sowing to maturity give the plants a favourable environmental condition to complete the growth cycle. As shown in Table 3. The phenological stages of 50% flowering and maturity were attained, respectively (62.16 and 115.200 days), when niger sown on 1st April. They were longer than the late sowing date, which allowed the plants to benefit more from soil water and nutrient led to increased photosynthesis rate with a consequent increase in plant height, No. of branches, capitula/ plant capsule, No. of seed/ capsule and the 1000 seed weight led to an increase in seed yield with a mean value of (341.77 kg ha^{-1}) compared to other planting dates. These results support the hypothesis that a combination of photoperiod, temperature, and rainfall, when synchronized with optimal planting, promotes an extended vegetative growth period and photosynthesis rate led to increase in the seed yield [10]. More supports to the current results, the positive correlation between day to maturity and seed yield in niger was reported by [9].

In the current study, when the date of sowing was delayed, the days to 50% flowering and day to maturity became shorter, and all yield attribute traits decreased gradually, as shown in Table 3. Because late planting date causing unfavourable environment condition for the niger growth and development, consequently led to reduction in seed yield. Similar results were reported by [11].

Among the cultivars, the longest days to 50% flowering and days to maturity, with a mean of (55.500 and 98.908 days) respectively, were recorded for Benglanuglue as shown in Table 4. As a result, all mentioned yield attributed traits are significantly highest with a consequence increase in seed yield, with a mean value of (270.63 kg. ha-1) in the Benglanuglue cultivar compared to other cultivars, as shown in Figure 3. These results agree with those reported by [12,13] in safflower.

Planting dates and cultivars caused significant differences in all studied above parameters figure (1 and 2), among the cultivars sown in this experiment, the cultivar of Benglanuglue suppressed over the other cultivars (Karal and Animax) in all mentioned parameters as shown in table (4) and figure (3) at the 1st April sowing date and produced the highest amount of seed yield with a mean value of (420kg.ha^{-1}). Following the cultivar of Karal at the 1st April sowing time. The optimum planting date plays a fundamental role in turning the full genetic potential of varieties, as it provides the optimum weather conditions for optimum crop growth and development [9]. The variation in different cultivars' responses to planting dates may be due to genetic variability [14].

Effect of planting dates and cultivars on seed oil and protein content:

As presented in table (3) planting dates shows significant effect on niger seed oil and protein content. Plants sown on 1st April gave the greatest amount of seed oil (29.13%) compared to other planting dates and gradually decreased with delayed planting dates to 15th May, which gave the lowest amount of seed oil content (25.78%). This might be due to the optimum weather condition existed during the grain filling stage in niger sown in early date compared to delayed planting. These results are in harmony with the findings of [15] in peanut.

Conversely recorded for seed protein content in niger as the highest amount was obtained from the delayed planting date 15th May with a mean value of (23.96%) compared with earlier planting date as shown in table 3. In general, seed protein content is adversely related to seed oil content, and both are controlled by genetic and environmental factors [16]. Similar results were reported in rapeseed [17]. Delayed planting exposes plants to elevated temperatures during the critical seed-filling stage, which positively affects seed protein content while negatively affecting the seed oil content [18].

Among the cultivars as shown in Table 4, Benglanuglue produced seeds with the highest oil content (28.97%) and the lowest protein content (22.92 %). Animax produced seeds with the lowest oil (26.69 %) content and the highest protein content (23.73%). In general, different cultivars have different responses to environmental conditions [19,20]. The interaction of planting dates and cultivars presented in Figure 4 significantly influenced seed oil and protein content. Benglanuglue recorded the highest amount of seed oil content on 1st April (31.17%) and the lowest amount of protein content (22.15%). Animax recorded the lowest amount of seed oil content (25.47%) and the highest amount of protein content (24.84%) at the 15th May planting date.

Conclusion

From the results obtained from this study, it can be concluded that the best cultivars to sow under rainfed conditions in the Sulaimani region, Iraq. Benglanuglue and planting on 1st April produced economic seed yield and oil content. However, other planting dates and other cultivars should be investigated to confirm the best planting date and the best cultivar for the exact location.

Table 3: Effect of planting dates on Niger yield and its components:

Cultivars	Days to 50% flowering	Day to maturity	Plant height (cm)	No. of branch /plant	No. of capsule/plant	No. of seed/capsule	1000 seed weight(g)	Seed yield (kg-ha)	Oil content%	Protein content%
Benglanuglue	55.500	98.908	119.74	17.48	31.23	23.83	3.46	270.63	28.97	22.92
Karal	56.667	100.767	116.00	16.31	28.93	20.68	3.21	199.51	27.50	22.74
Animax	55.117	98.083	114.61	16.77	29.96	22.03	3.30	225.51	26.6	23.73
LSD($p \leq 0.05$)	0.187	0.303	0.730	0.314	0.603	0.333	0.039	5.834	0.351	0.039

Table 3: Effect of planting dates on Niger yield and its components:

Planting dates	Days to 50% flowering	Day to maturity	Plant height (cm)	No. of branch /plant	No. of capitula /plant	No. of seed/capitula	1000 seed weight(g)	Seed yield (kg-ha-1)	Oil content%	Protein content%
1-April	62.16	115.200	135.84	18.93	33.50	27.08	3.74	341.77	29.13	22.50
15-April	57.67	103.111	123.57	17.91	31.71	24.14	3.56	273.81	28.17	23.25
1-May	53.80	95.689	116.24	16.07	28.62	20.59	3.10	183.24	27.68	22.81
15-May	49.40	83.011	91.48	14.49	26.32	16.90	2.88	128.70	25.78	23.96
LSD(p≤0.05)	0.26	0.372	1.473	0.780	0.883	2.236	0.042	22.446	0.507	0.075

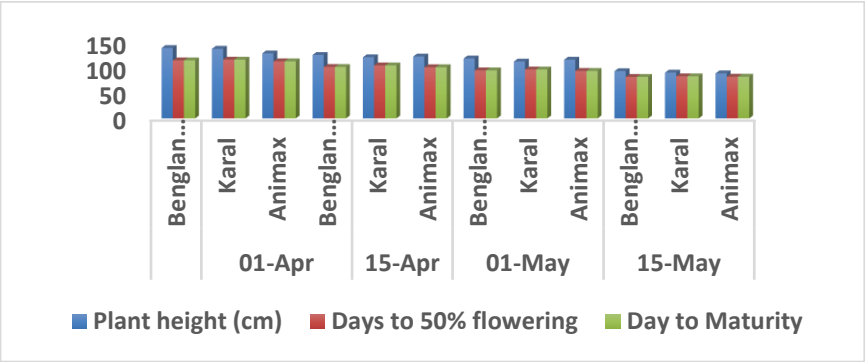

Figure 1: Effect of combination between cultivars and planting dates on plant height (cm), days to 50% flowering and days to maturity. Means with different letters differ significantly at (p ≤0.05**)**

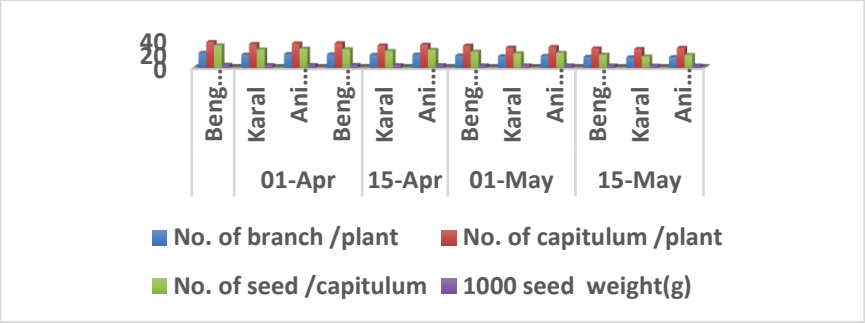

Figure 2: Effect of combination between cultivars and planting dates on No. of branches, No. of capitulum/plant, No. of seed/ capitulum and 1000 seed weight (g). Means with different letters differ significantly at (p ≤0.05).

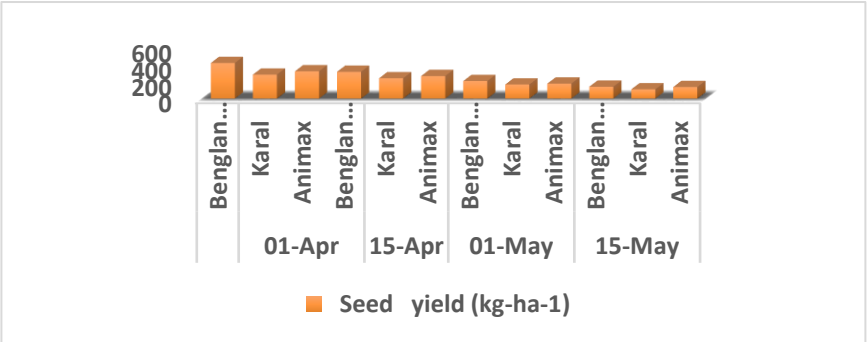

Figure 3: Effect of combination between cultivars and planting dates on seed yield (kg. ha^{-1}). Means with different letters differ significantly at (p ≤0.05).

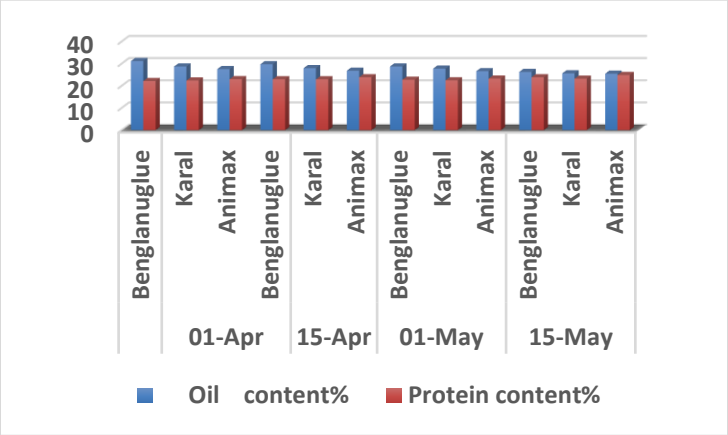

Figure 4: Effect of combination between cultivars and planting dates on oil content and protein content%. Means with different letters differ significantly at ($p \leq 0.05$)y.

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تأثير موعد الزراعة والصنف على نمو وإنتاجية ونوعية النيجر *(Guizatia abyssinica Cass.)* المزروع تحت ظروف السليمانية .

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الخلاصة
أجري البحث الحالي في محطة قليسان للأبحاث، الواقعة في مدينة السليمانية. تعمل هذه المنشأة كمركز بحثي لقسم التكنولوجيا الحيوية وعلوم المحاصيل، التابع لكلية علوم الهندسة الزراعية بجامعة السليمانية. أجريت تجربة ميدانية خلال ربيع عام ٢٠٢٣ لتقييم تأثير أربعة مواعيد زراعة مميزة على خصائص النمو، وخصائص الغلة، ومحتوى الزيت عبر مجموعة من أصناف النيجر كان الهدف الأساسي من هذا البحث هو تقييم تأثير أربعة مواعيد زراعة مميزة (١ نيسان، ١٥ نيسان، ١ أيار و١٥ أيار) على نمو ثلاثة أصناف من نبات النيجر *(Benglanuglue, Karal, Animax)* وإنتاجية البذور وتركيب البذور. أظهرت النتائج أن أطول أيام الإزهار حتى ٥٠٪ وعدد الأيام حتى النضج وأعلى قيم ارتفاع النبات وعدد الفروع / نبات وعدد الرؤوس / نبات وعدد البذور / رأس ووزن ١٠٠٠ بذرة ومحصول البذور (كجم هكتار $^{-1}$) ومحتوى الزيت في البذور تم الحصول عليها من المحصول المزروع في 1 أبريل مقارنة بتواريخ الزراعة الأخرى. تم الحصول على أقل قيم لجميع المعلمات المذكورة من المحصول المزروع في 15 نيسان. ومع ذلك ، تم الحصول على أعلى كمية من محتوى البروتين في البذور من المحصول المزروع في ١٥ أيار. ومن بين الأصناف، أظهر صنف بنجلانوجلو أداءً أفضل بشكل ملحوظ من الأصناف الأخرى وأنتج أعلى محصول للبذور وأعلى محتوى من زيت البذور على التوالي، في موعد البذر في الأول من نيسان.

الكلمات المفتاحية: نيجر، مواعيد زراعية، أصناف، حاصل البذور, محتوى الزيت والبروتين.