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Comparison of Introduced Mung Bean (*Vigna radiata* L.) Varieties with the Local Variety Cultivated at Different Planting Distances in Southern Iraq

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ABSTRACT

A field experiment was conducted at the fields of a farmer in west of Maysan Governorate (latitude 30.51° N and longitude 47.06° E) during the fall season of 2023. The study aimed to investigate the effect of four mung bean (*Vigna radiata* L.) varieties (Local, Omrani, Parto, and Ghohar) cultivated at three different planting distances (20, 25, and 30 cm) on some growth traits and yield. The experiment was conducted using split plots in a randomized complete block design (RCBD) with three replicates, occupying the planting distances for the main plots, and the varieties for the sub-plots. The statistical analysis revealed significant differences among the varieties for most studied traits. The Ghohar variety (V4) outperformed the other varieties in most parameters, producing the highest seed yield of 2.346 tons ha^{-1}. Additionally, the Omrani variety (V2) recorded the highest number of seeds per pod, while the Local (V1) and Parto (V3) varieties showed the lowest values for the studied traits.The planting distance of 25 cm significantly improved leaf number, leaf area, and leaf area index, resulting in the highest seed yield of 2.304 tons ha^{-1}. Meanwhile, the 20 cm planting distance significantly increased plant height, reaching 52.21 cm.The interaction between the Ghohar variety (V4) and the 25 cm planting distance showed superiority in growth traits, such as leaf number, leaf area, and leaf area index, which translated into the highest seed yield of 3.017 tons ha^{-1}.
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مقارنة أصناف مدخلة حديثا من محصول الماش (*Vigina radiate L*) مع الصنف المحلي المزروعة على مسافات زراعة مختلفة في المنطقة الجنوبية من العراق

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الخلاصة

نفذت تجربة حقلية في حقول احد المزارعين غرب محافظة ميسان (خط عرض 30.51 شمالا وخط طول 47.06 شرقا) خلال الموسم الخريفي 2023 بهدف معرفة تأثير اربعة اصناف من محصول الماش (محلي , عمراني, بارتو, كوهر) المزروعة بثلاث مسافات زراعة بين الجور(20، 25، 30) في بعض صفات النمو والحاصل , طبقت التجربة العاملية وفقا لترتيب الالواح المنشقة (Split plot design) باستخدام تصميم القطاعات العشوائية الكاملة(R.C.B.D) بثلاثة مكررات حيث شغلت مسافات الزراعة الألواح الرئيسية (main- plot) والاصناف الالواح الثانوية(sub-plot). اظهرت نتائج التحليل الاحصائي اختلاف الاصناف معنويا في معظم الصفات المدروسة اذ تفوق الصنف كوهرV4 في اغلب الصفات واعطى اعلى معدل لحاصل البذور بلغ (2.346) طن هــ$^{-1}$, وتفوق الصنف V2 في صفة عدد البذور في القرنة, في حين اعطى الصنفان V1 و V3 ادنى المعدلات للصفات المدروسة .كما اظهرت النتائج تفوق المسافة بين الجور 25 سم معنويا في صفات(عدد الاوراق، المساحة الورقية ودليل المساحة الورقية) مما انعكس على حاصل البذور بإعطائها اعلى معدل بلغ (2.304) طن هـ$^{-1}$, وتفوقت مسافة الزراعة 20 سم معنويا في صفة ارتفاع النبات واعطت 52.21 سم. اتضح من النتائج تفوق التداخل بين الصنف كوهرV4 ومسافة الزراعة 25 سم في صفات النمو(عدد الاوراق، المساحة الورقية ودليل المساحة الورقية) وبالتالي تفوقه في حاصل البذور بإعطائه اعلى معدل بلغ(3.017) طن هــ$^{-1}$.

INTROUCTION

Mung bean (*Vigna radiata* L.) is an annual legume crop characterized by its short growth cycle, high tolerance to elevated temperatures, and drought resistance, making it suitable for cultivation under marginal conditions with limited moisture and low soil fertility (Muchow *et al*., 1993). Mung bean is grown for both its nutritional and fodder value and serves as a staple crop in many producing countries, particularly in developing nations. Its seeds contain a high protein content of up to 24%, along with fats, carbohydrates, minerals, and vitamins. Additionally, it is rich in essential amino acids, particularly lysine, which is deficient in most cereal grains (Hussain *et al*., 2011; Afzal *et al*., 2008).

Mung bean is cultivated twice annually, during both the spring and fall seasons, and it is also used as green manure to improve the physical properties of soil. It is incorporated into crop rotations with cereals due to its ability to fix atmospheric nitrogen, enhancing soil fertility and improving some of its physical characteristics. Despite the crop's importance, the average yield of mung bean in Iraq remains below the global standard. Several factors contribute to this low productivity, primarily the lack of adoption of modern agricultural technologies for crop cultivation and management.

To improve the production quantity and quality of mung bean in Iraq, continuous research is required to develop or import new varieties and subject them to rigorous testing to assess their adaptability to local conditions. For many years, Iraqi farmers have relied on a local variety that is characterized by low purity, susceptibility to diseases, and vulnerability to lodging (Al-Fahdawi *et al*, 2007). Therefore, it is crucial to explore the optimal management practices for these varieties, including planting distances, which represent a fundamental aspect of successful crop production.

Planting distance significantly influences the number and distribution of plants per unit area, which affects competition among plants for essential growth factors and, consequently, influences physiological processes, growth, yield, and crop quality. Several studies have demonstrated significant differences in growth traits and yield among different mung bean varieties. For example, Tanya *et al*. (2015) reported significant differences among varieties in plant height, branch number, leaf number, dry weight, and seed yield. In contrast, Pamei *et al*. (2020) found no significant differences among varieties in the time required to reach 50% flowering, although varieties differed significantly in seed yield and its components.

Similarly, Mota *et al*. (2021) observed significant differences between two mung bean varieties in terms of the number of days to 50% flowering, time to physiological maturity, plant height, number of branches, leaf area, and leaf area index. Ahmed and Hussein (2020) reported no significant differences between a local and a French mung bean variety in plant height and seed yield. Khatun (2021) also identified significant differences in growth traits and yield among three mung bean varieties. Pulok *et al*. (2015) highlighted the significant impact of planting distance on plant height, leaf number, and dry matter weight. Furthermore, Wubetu (2018) demonstrated significant effects of planting distances (5, 10, and 15 cm) on growth traits and yield. Tehulie and Fikadu (2021) also reported that different planting distances (5, 10, and 15 cm) significantly affected the growth and yield of mung bean.

Given the scarcity of studies addressing these factors in southern Iraq, this study aims to compare the newly introduced varieties with the local variety in terms of growth and yield performance. The goal is to identify the most suitable variety and optimal planting distance to maximize mung bean productivity in the region.

MATERIAL AND METHODS

A field experiment was conducted during the fall season of 2023 in the west of Maysan Governorate, near the city center of Amarah (latitude 30.51° N and longitude 47.06° E) on silty loam soil (Table 1). The objective was to compare four mung bean (*Vigna radiata* L.) varieties, three of which were recently introduced to Iraq, with the local variety, using different planting distances to assess their growth and productivity. The factorial experiment was conducted using a split-plot design within a randomized complete block design (RCBD) with three replicates.

The experiment involved two factors:

1-Planting distances: 20 cm (D1), 25 cm (D2), and 30 cm (D3) between hills.

2-Mung bean varieties: Local (V1), Omrani (V2), Parto (V3), and Ghohar (V4).

All varieties were brought from the Ahvaz region in southwestern Iran, their original homeland is India, and they were cultivated and propagated by selection.

The planting distances were assigned to the main plots, while the varieties were allocated to the sub-plots. Each block contained 12 experimental units (4 varieties × 3 planting distances). The experimental unit measured 9 m² (3 × 3 m) and consisted of five rows, each 3 m long, with 60 cm spacing between rows. The spacing between plants within each row varied according to the experimental design (20, 25, or 30 cm). A 50 cm gap was left between experimental units.

Seeds were sown on **August 8, 2023**, with three seeds per hill, which were thinned to one plant per hill after two weeks. Any failed hills were replanted during the thinning process. Triple superphosphate fertilizer (45% P2O5) was applied at a rate of 100 kg P ha^{-1} (Al-Juheishy, 2019) during land preparation. Nitrogen fertilizer, in the form of urea (46% nitrogen), was applied at 120 kg N ha^{-1} (Al-Juheishy and Al-Layla, 2019) in two splits: the first 21 days after germination, and the second two weeks after the first application.

Weed control was carried out manually whenever needed. Plants were harvested upon reaching physiological maturity, which was determined by the yellowing of leaves and pods, pod dryness, and seed hardening. Harvesting was performed at different times depending on the variety's maturity stage.

Table 1: Some physical and chemical properties of the experimental field soil before planting.

Property	Value	Unit
pH	7.64	-
E.C.e	3.4	dS m^{-1}
Organic Matter	10.50	g kg^{-1}
Soil Texture		
Clay	251.00	g kg^{-1}
Silt	452.00	g kg^{-1}
Sand	211.00	g kg^{-1}
Available Nutrients		
Nitrogen	27.00	mg kg^{-1}
Phosphorus	14.2	mg kg^{-1}
Potassium	19.30	mg kg^{-1}
Soluble Ions		
Ca^{2+}	1.96	mmol L^{-1}
Mg^{2+}	0.13	mmol L^{-1}
Na^{+}	9.70	mmol L^{-1}
Cl^{-}	5.94	mmol L^{-1}
SO_4^{2-}	2.56	mmol L^{-1}
HCO_3^{-}	0.2	mmol L^{-1}

Soil samples taken from the agricultural field were analyzed in the laboratory of the Department of Soil and Water Management, Agriculture College, University of Basra.

Studied Traits

1-Days from Planting to 50% Flowering: This trait was recorded based on the number of days from planting until 50% flowering, determined through field observations for each experimental unit.

2-Plant Height (cm): Plant height was measured as the average height of ten randomly selected plants from the middle rows of each experimental unit.

3-Total Number of Branches per Plant (branches $plant^{-1}$): This trait was calculated as the average number of branches from ten randomly selected plants from the middle rows at the 50% flowering stage.

4-Percentage of Effective Branches (%): The percentage of effective branches was determined by calculating the total number of branches per plant and the number of pod-bearing branches. The following formula was used:

Percentage of effective branches = (pod-bearing branches / total number of branches per plant) × 100

5-Leaf Area (cm^2) : Leaf area was calculated for each experimental unit by measuring the dimensions (maximum length and width) of leaves from five plants. The leaf area for each plant was estimated using the following formula:

Leaf Area=(Maximum Length×Maximum Width)×0.68

6-Leaf Area Index (LAI) : The leaf area index was computed using the following equation: LAI=Total Leaf Area per Plant \Area Occupied by the Plant

7-Number of Pods per Plant (pods $plant^{-1}$) : The number of pods was recorded for ten randomly selected plants from the middle rows of each experimental unit at maturity. The average number of pods per plant was then calculated.

8-Number of Seeds per Pod (seeds pod^{-1}) : Twenty pods were randomly selected from the plants used for pod counting. These pods were manually threshed, and the total number of seeds was divided by the number of pods to determine the average number of seeds per pod.

9-Total Seed Yield (tons ha^{-1})

Seed yield was measured by harvesting the two middle rows of experimental unit The yield was adjusted to 12% moisture content and converted to tons per hectare on a unit area basis.

Statistical analysis:

The data were statistically analyzed for all the studied characteristics using the analysis of variance method for factorial experiments designed using the split-plot method with a complete randomized block design and using the statistical program Genstat. The means of the single factors and interactions were compared using the Least Significant Difference (LSD) test at a probability level of 0.05 (Al-Rawi and Khalaf Allah, 2000).

RESULTS AND DISCUSSION

The results in Table (2) show a significant effect of the varieties on the number of days from planting to 50% flowering. The V1 variety recorded the lowest average number of days (38.22 days), with no significant difference from V3 (38.44 days). In contrast, the V4 variety required the most days (42.06 days) to reach 50% flowering, though it did not significantly differ from V2, which took 42.50 days. These differences may be attributed to genetic variations among the varieties, which aligns with the findings of Shiferaw and Abewoy (2023) and Mota *et al*. (2021), who also reported significant differences in flowering time among varieties. The results indicate that neither planting distance nor the interaction between varieties and planting distances had a significant effect on the number of days to 50% flowering.

Table 2 : Effect of varieties, planting distances, and their interaction on days from planting to 50% flowering in mung bean

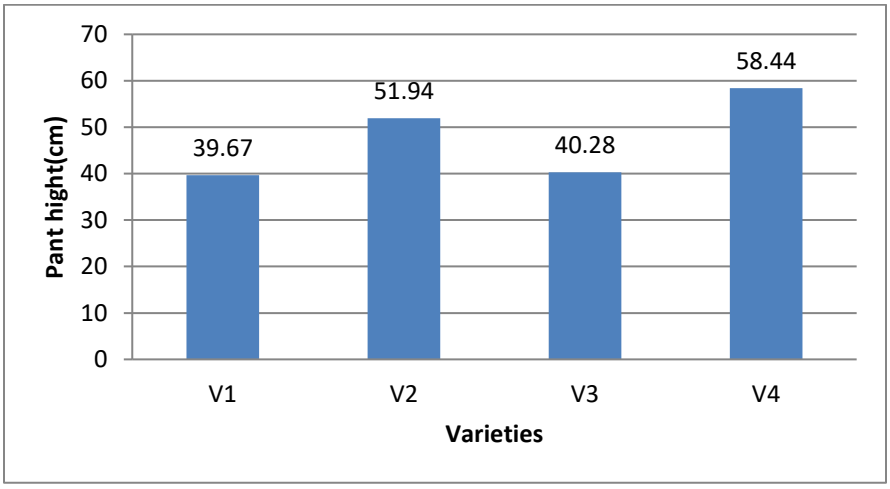
Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	38.33	41.83	38.50	42.00	40.17a
D2	37.83	43.17	38.17	41.67	40.21a
D3	38.50	42.50	38.67	42.50	40.54a
Variety Mean	38.22a	42.50b	38.44a	42.06b	
LSD	For varieties = 1.124	For distances = N.S.	For interaction=N.S		

As shown in Table(3) the varieties significantly affected plant height. The V4 variety exhibited the tallest plants, with an average height of 58.44 cm, representing a 47.32% increase compared to the V1 variety, which had the shortest height (39.67 cm). This difference may be attributed to the genetic makeup of the V4 variety, consistent with the findings of Singh *et al*. (2022) and Mondal and Sengupta (2019), who also reported significant differences in plant height among mung bean varieties. The results also show that planting distances significantly affected plant height. The 20 cm planting distance (D1) resulted in the tallest plants, with an average height of 52.21 cm, representing a 20.24% increase compared to the 30 cm distance (D3), which produced the shortest plants (43.42 cm). This increase in height under closer spacing may be due to limited lateral space, which forces plants to compete for light, stimulating upward growth. These findings align with the results of Bohara *et al*. (2022) and Kumari *et al*. (2020), who found that closer planting distances result in taller mung bean plants.

The interaction between varieties and planting distances also had a significant effect on plant height. The combination of V4 and D1 (20 cm) produced the tallest plants, with an average height of 64.17 cm, while the combination of V1 and D3 (30 cm) resulted in the shortest plants (30.50 cm). This interaction reflects the influence of environmental conditions and genetic traits on plant growth and competition for light under different spacing conditions, consistent with the findings of Singh *et al*. (2022) and Thavaprakash (2017).

Table 3 : Effect of varieties, planting distances, and their interaction on plant height (cm) in mung bean

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	50.00	55.00	39.67	64.17	52.21a
D2	38.50	52.67	40.83	56.50	47.12b
D3	30.50	48.17	40.33	54.67	43.42c
Variety Mean	39.67c	51.94b	40.28c	58.44a	
LSD	For varieties = 4.138	For distances =2.940	For interaction=6.683		

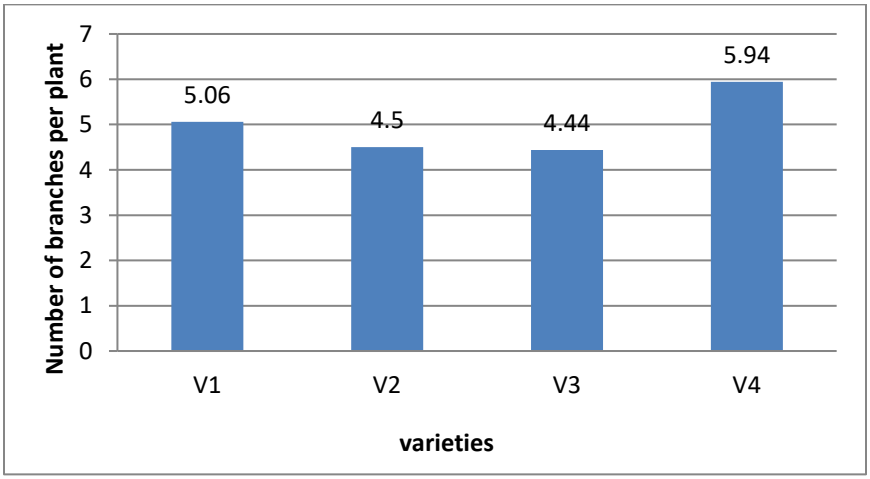


The effected of varieties in plant height (cm)

The results in Table(4) indicate significant differences among the varieties regarding the total number of branches per plant. The V4 variety produced the highest average number of branches (5.94 branches plant^{-1}), representing a 33.78% increase compared to the V3 variety, which had the lowest average (4.44 branches plant^{-1}). The V3 variety showed no significant difference from V2 (4.50 branches plant^{-1}). The reason for the superiority of variety 4 in the number of branches may be attributed to its superiority in the number of days from planting to 50% flowering (Table 2) with an increase in the height of the plant (Table 3), which led to an increase in its branches. The planting distances did not have a statistically significant effect on the total number of branches, though an increasing trend was observed with wider spacing. The 30 cm distance (D3) resulted in the highest average number of branches (5.19 branches plant^{-1}), followed by D2 (25 cm) with 5 branches plant^{-1} and D1 (20 cm) with 4.77 branches plant^{-1}.

Table 4 : Effect of varieties, planting distances, and their interaction on the total number of branches per plant

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	4.67	4.50	4.25	5.67	4.77a
D2	5.08	4.67	4.42	5.83	5.00a
D3	5.42	4.33	4.67	6.33	5.19a
Variety Mean	5.06b	4.50c	4.44c	5.94a	
LSD	For varieties = 0.584	For distances =N.S	For interaction=N.S		



The effected of varieties on number of branches per plant

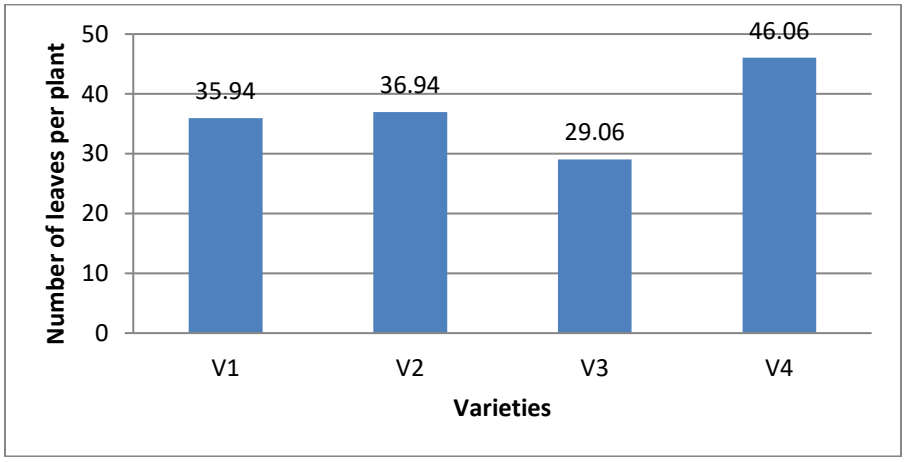
Table (5) shows that the varieties, planting distances, and their interaction did not have a statistically significant effect on the percentage of effective branches. The results in Table(6)indicate significant differences among the varieties in the number of leaves per plant. The V4 variety had the highest average (46.06 leaves plant^{-1}), showing a 58.50% increase compared to V3, which recorded the lowest average (29.06 leaves plant^{-1}). This superiority of V4 can be linked to its taller plant height (Table 3) and higher number of branches (Table 4), indicating a genetic advantage. These findings are consistent with Gavali *et al*. (2023) and Verma *et al*. (2011), who reported varietal differences in leaf number.The D2 distance (25 cm) resulted in the highest number of leaves (43.12 leaves plant^{-1}), representing a 41.38% increase compared to the D1 distance (20 cm), which had the lowest number (30.50 leaves plant^{-1}). The reduced competition at D2 spacing allowed for better vegetative growth, consistent with the findings of Gavali *et al*. (2023) and Satodiya *et al*. (2015). Table 6 showed there is no significant for interaction between verities and distances in leaves number of mung.

Table 5 : Effect of varieties, planting distances, and their interaction on the percentage of effective branches.

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	76.9	79.4	80.0	77.2	78.4a
D2	71.1	86.9	79.2	86.3	80.9a
D3	77.2	89.2	80.8	84.7	83.0a
Variety Mean	75.1a	85.2a	80.0a	82.7a	
LSD	For varieties = N.S	For distances = N.S	For interaction=N.S		

Table 6: Effect of varieties, planting distances, and their interaction on the number of leaves per plant.

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	31.17	31.17	23.67	36.00	30.50c
D2	43.00	43.17	33.50	52.83	43.12a
D3	33.67	36.50	30.00	49.33	37.38b
Variety Mean	35.94b	36.94b	29.06c	46.06a	
LSD	For varieties = 3.625	For distances = 4.202	For interaction= N.S		



The effected of varieties on number of leaves per plant

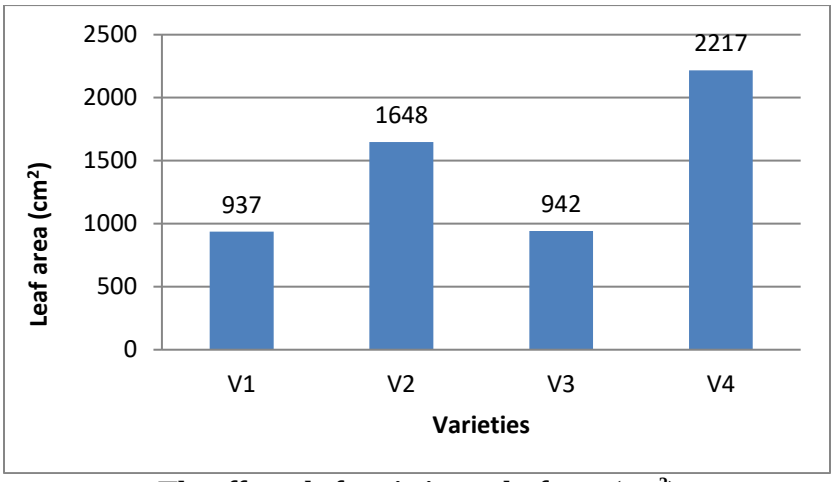
Table (7) shows significant differences in leaf area among the varieties and planting distances. The V4 variety achieved the highest leaf area (2217 cm²), representing a 136.61% increase compared to V1, which had the smallest leaf area (937 cm²). This is attributed to the higher number of branches and leaves in V4 (Tables 4 and 6). These results align with Mondal *et al*. (2013) and Abdalgafor. and Al-Jumaily (2016), who reported significant differences in leaf area among mung bean varieties. The D2 planting distance (25 cm) produced the highest leaf area (1880 cm²), a 73.27% increase compared to D1 (20 cm), which recorded the lowest value (1085 cm²). The wider spacing reduced competition for light and nutrients, promoting

better leaf expansion. These findings are consistent with Ahamed *et al*. (2011), who found that planting distances affect the leaf area of mung bean plants.

The interaction between varieties and planting distances significantly influenced leaf area. The combination of V4 and D2 (25 cm) yielded the highest leaf area (2701 cm²), while the combination of V1 and D3 (30 cm) resulted in the smallest leaf area (730 cm²). This interaction reflects the combined effects of genetic traits and environmental conditions.

Table 7 : Effect of varieties, planting distances, and their interaction on leaf area (cm²) in mung bean.

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	741	1060	848	1691	1085c
D2	1342	2256	1221	2701	1880a
D3	730	1627	757	2259	1343b
Variety Mean	937c	1648b	942c	2217a	
LSD	For varieties=121.3	For distances =127.7	For interaction= 212.8		



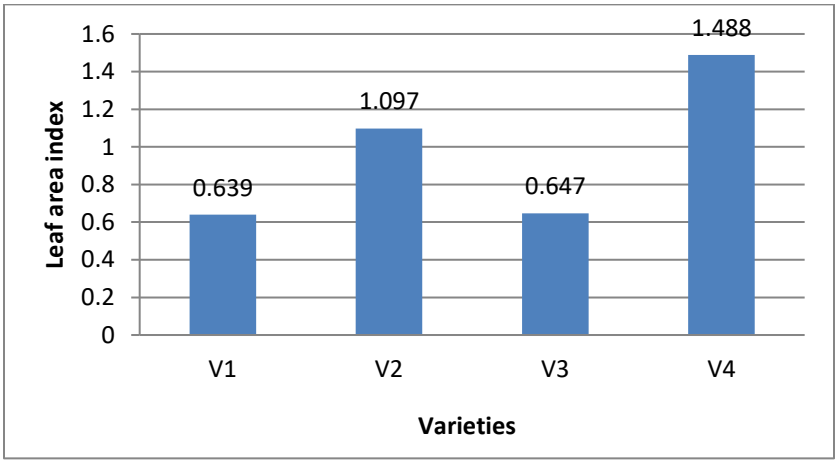
The effected of varieties on leaf area(cm²)

Leaf Area Index (LAI)

Table(8) shows that both varieties and planting distances significantly affected the leaf area index (LAI). The V4 variety achieved the highest LAI (1.488), compared to V1, which recorded the lowest LAI (0.639). The superior performance of V4 can be attributed to genetic differences and its higher number of branches, leaves, and larger leaf area (Tables 4, 6, and 7). These findings are consistent with Ali *et al*. (2021), who reported significant differences in LAI among mung bean varieties. The D2 planting distance (25 cm) resulted in the highest LAI (1.253), compared to D3 (30 cm), which had the lowest value (0.746). This may be due to better vegetative growth at the D2 spacing, leading to more effective photosynthesis. These results align with Sathyamoorthi *et al*. (2008). The interaction between varieties and planting distances was also significant, with the combination of V4 and D2 producing the highest LAI (1.801), while the combination of V1 and D3 resulted in the lowest LAI (0.405).

Table (8): Effect of varieties, planting distances, and their interaction on leaf area index (LAI) in mung bean

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	0.617	0.883	0.706	1.409	0.904b
D2	0.894	1.504	0.814	1.801	1.253a
D3	0.405	0.904	0.421	1.255	0.746c
Variety Mean	0.639d	1.097b	0.647c	1.488a	
LSD	For varieties=0.0780	For distances = 0.0888	For interaction= 0.1402		

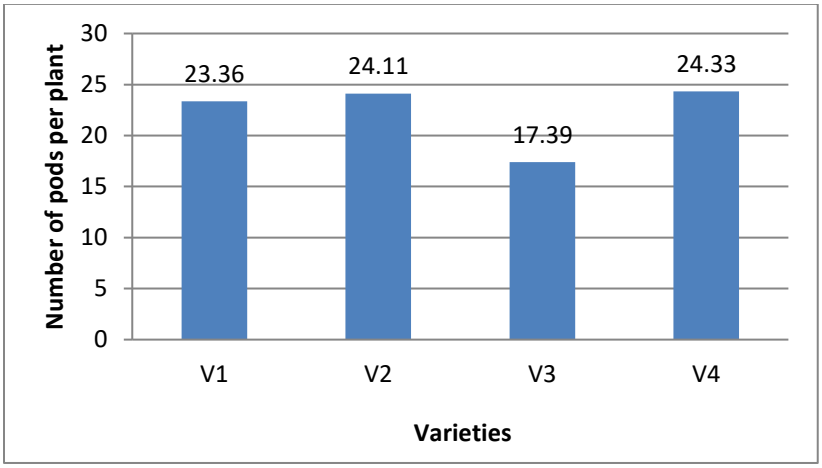


The effected of varieties on leaf area index

Table (9) shows significant differences among varieties in the number of pods per plant. The V4 variety produced the highest number of pods (24.33 pods plant^{-1}), a 39.91% increase compared to V3 (17.39 pods plant^{-1}). There was no significant difference between V4, V1 (23.36 pods plant^{-1}), and V2 (24.11 pods plant^{-1}). The superior performance of V4 can be attributed to its genetic traits, which resulted in taller plants and more branches (Tables 3 and 4). These findings align with Shiferaw and Abewoy (2023) and Chattha *et al*. (2017b). Planting distances also significantly affected the number of pods per plant, with the D2 distance (25 cm) yielding the highest number (27.00 pods plant^{-1}), a 50.67% increase compared to D1 (17.92 pods plant^{-1}). This may be due to better light capture and nutrient availability, leading to improved photosynthesis. These results align with Sonani *et al*. (2016). The results of the table 9 showed that there is no significant effect of the interaction between varieties and planting distances on this trait.

Table9: Effect of varieties, planting distances, and their interaction on the number of pods per plant.

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	20.17	18.50	12.00	21.00	17.92c
D2	28.50	29.50	21.67	28.33	27.00a
D3	21.42	24.33	18.50	23.67	21.98b
Variety Mean	23.36a	24.11a	17.39b	24.33a	
LSD	For varieties=1.629	For distances = 1.515	For interaction= N.S		

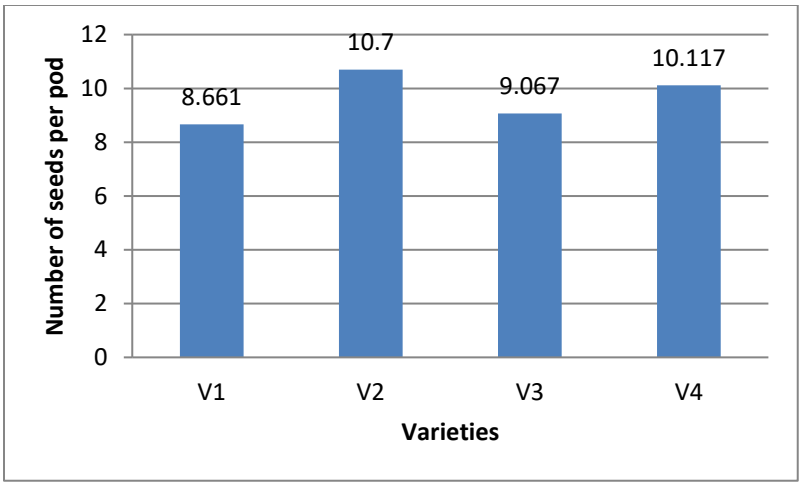


The effected of varieties on number of pods per plant

The results in Table (10) indicate significant differences in the number of seeds per pod among varieties. The V2 variety recorded the highest number of seeds (10.700 seeds pod^{-1}), a 23.54% increase compared to V1, which had the lowest number (8.661 seeds pod^{-1}). This may be due to genetic differences between the species. There was no significant difference between V2 and V4 (10.117 seeds pod^{-1}). These findings align with Shiferaw and Abewoy (2023) and Ahmad *et al*. (2015). Planting distances also significantly affected the number of seeds per pod, with D2 yielding the highest number (10.371 seeds pod^{-1}), a 15.34% increase compared to D1 (8.992 seeds pod^{-1}). These results align with Gavali *et al*. (2023) and Bhatt (2020).

Table10: Effect of varieties, planting distances, and their interaction on the number of seeds per pod.

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	7.933	10.167	8.483	9.383	8.992c
D2	9.633	11.250	9.550	11.050	10.371a
D3	8.417	10.683	9.167	9.917	9.546b
Variety Mean	8.661d	10.700a	9.067c	10.117b	
LSD	For varieties=0.3523	For distances = 0.3035	For interaction= N.S		



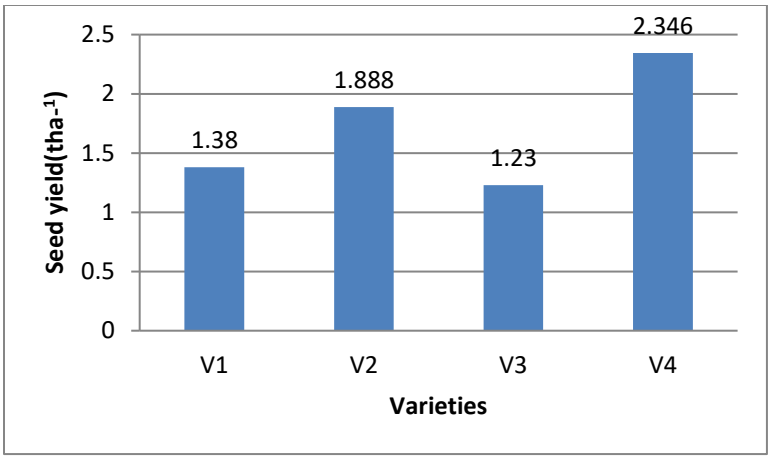
The effected of varieties on number of seeds per pods

Table(11) indicates significant differences in seed yield among the varieties and planting distances. The V4 variety recorded the highest yield (2.346 tons ha^{-1}), a 90.73% increase compared to V3, which had the lowest yield (1.230 tons ha^{-1}). The superior performance of V4 is attributed to its better growth traits, increasing the number of seeds in the pod (table 10) as well as the genetic composition of the variety, consistent with Kumar *et al*. (2009) and Hossain *et al*. (2016). The D2 planting distance (25 cm) resulted in the highest seed yield (2.304 tons ha^{-1}), a 68.18% increase compared to D3 (1.370 tons ha^{-1}). This result highlights the importance of optimal spacing for efficient resource use, consistent with [Jasper and Singh (2022) , Bhatt (2020).

The interaction between varieties and planting distances was also significant, with the V4 × D2 combination yielding the highest seed yield (3.017 tons ha^{-1}), while the V3 × D1 combination had the lowest yield (0.906 tons ha^{-1}).

Table 11: Effect of varieties, planting distances, and their interaction on seed yield (tons ha^{-1})

Distance	Varieties				Distance Mean
	V1	V2	V3	V4	
D1	1.224	1.490	0.906	2.219	1.460b
D2	1.849	2.641	1.709	3.017	2.304a
D3	1.068	1.533	1.076	1.802	1.370b
Variety Mean	1.380c	1.888b	1.230d	2.346a	
LSD	For varieties=0.1862	For distances =0.1522	For interaction= 0.3078		



The effected of varieties on seed yield (t ha^{-1})

CONCLUSION

The results of this study suggest that the highest productivity of mung bean (*Vigna radiata* L.) can be achieved by cultivating the Ghohar variety (V4) at a planting distance of 25 cm under the environmental conditions of the experimental area. The newly introduced varieties can be recommended for cultivation during the fall season in southern Iraq, especially the V4 and V2 varieties, which demonstrated significant superiority and recorded the highest yields compared to the local variety.

CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding this manuscript.

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