FUDMA Journal of Agriculture and Agricultural Technology
ISSN: 2504-9496
Vol. 11 No. 1, March 2025: Pp.73-85

https://doi.org/10.33003/jaat.2025.1101.09

INFLUENCE OF SOWING METHOD ON WEED SUPPRESSION AND YIELD RESPONSE OF SOYBEAN VARIETIES IN SUDAN SAVANNA AGRO ECOLOGICAL ZONE OF NIGERIA

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ABSTRACT
Weed pressure and suboptimal agronomic practices reduce soybean productivity in Nigeria's Sudan Savannah. A 2023 rainy-season field trial was conducted at Bayero University Kano and a community farm in Dutsin-Ma, Katsina State, using a randomized complete block design with three replications. Five soybean varieties (TGX 1955-4F, TGX 1987-10F, TGX 1987-6F, TGX 1951-3F, TGX 1835-10E) were tested under drilling, single-row dibbling, and double-row dibbling for weed suppression, growth, and yield. Across sites, drilling recorded the lowest weed density (12.0 m^{-2}) and dry matter (148.2 g m^{-2}), and the highest grain yields (1872.3 kg ha^{-1} at Kano, 1672.2 kg ha^{-1} at Dutsin-Ma). TGX 1955-4F produced the most pods (24.73 pods/plant), the highest pod weight (30.51 g), and the top yield (2200 kg ha^{-1}) under drilling. TGX 1987-10F had the heaviest seeds (58.56 g/100 seeds) but the lowest yield (1130.1 kg ha^{-1}). TGX 1955-4F with drilling is recommended for optimal weed suppression and yield in the Sudan Savannah.

Keywords: crop-weed competition, soybean varieties, sowing methods, weed suppression, yield

INTRODUCTION
Soybean (*Glycine max* [L.] Merril.) plays a vital role in food security, soil fertility restoration, and income generation in Sub-Saharan Africa, particularly in Nigeria's Sudan Savannah. Its high protein and oil content, coupled with its ability to fix atmospheric nitrogen, make it an excellent crop for nutritional improvement and sustainable agricultural intensification (Amante *et al.,* 2024). In recent years, expansion in poultry feed demand has further increased soybean's economic relevance in Nigeria.
However, the average national yield of soybean (about 1.2 t/ha) remains significantly below the global average, largely due to weed pressure, poor varietal selection, and suboptimal agronomic practices (Bebeley *et al.,* 2022; Arshad *et al.*, 2025). Weed infestation alone accounts for up to 90% yield loss depending on species composition and timing of competition in Nigeria's agro-ecological zones (Abdullahi *et al.*, 2025). In the Sudan Savannah, most farmers use the traditional dibbling sowing method, which provides more space for weeds to thrive, resulting in reduced soybean performance (Nath *et al*., 2024). Improved methods such as drilling are believed to increase canopy cover, enhance moisture retention, and suppress weed growth, but these remain underutilized due to lack of localized, research-based recommendations (Nandan *et al*., 2018; Bebeley *et al.*, 2022).

Additionally, studies have revealed significant differences in the growth and yield attributes among soybean varieties in this region, which can influence their competitive ability against weeds (Magashi *et al*., 2018; Nath *et al*., 2024; Sodangi, 2024). Despite this, there is still limited research evaluating how the interaction between sowing methods and varietal traits can be leveraged to suppress weed growth and optimize yields sustainably. Addressing this knowledge gap is essential for resource-poor farmers who face constraints in accessing herbicides and labor for frequent manual weeding.
By combining varietal competitiveness with effective sowing strategies, farmers can adopt low-input, high-efficiency weed management practices suited to the Sudan Savannah context (Barberi, 2019; Shittu *et al.,* 2023). Therefore, this study aims to evaluate the weed suppression ability of selected soybean varieties as influenced by different sowing methods in the Sudan Savannah agro-ecological zone of Nigeria.

MATERIALS AND METHODS

Experimental Site

The trial was conducted during the 2021 rainy season at two locations within the Sudan Savannah agro-ecological zone of Nigeria: The Teaching and Research Farm of the Faculty of Agriculture, Bayero University Kano (11°55′N, 8°26′E; 460 m above sea level) and Dutsin-Ma in Katsina State (12°25′21″N, 7°27′35″E). The Sudan Savannah zone is characterized by a unimodal rainfall pattern ranging from 600 to 1000 mm annually, with a rainy season typically lasting from May to October. Average daily temperatures range from 26°C to 34°C. The soils in both locations are classified as sandy loam to loam, moderately well-drained, and low in organic matter and nitrogen, which makes them typical representatives of the savannah soils used for rain-fed crop production in northern Nigeria.

Treatments and Experimental Design

The experiment was arranged as a 3 × 5 factorial combination in a Randomized Complete Block Design (RCBD) with three replications. It comprised three sowing methods (drilling, single-row dibbling, and double-row dibbling) and five soybean varieties (TGX1987-62F, TGX1987-10E, TGX1935-10E, TGX1951-3F, and TGX1955-4F). All seed varieties were sourced from the International Institute of Tropical Agriculture (IITA), Kano station.

Varietal Description

TGX1935-10E is an early maturing variety well adapted to the Sudan Savannah, with high nodulation and resistance to rust disease, leaf spot, and bacterial pustule, yielding 1.5–2.0 t/ha.
TGX1987-62F is also early maturing, highly nodulating, adapted to the Savannah zones, resistant to rust, leaf spot, and bacterial pustule, with yield potential up to 2.1 t/ha.
TGX1987-10F shares similar early maturity and resistance traits, with yield potential of 1.5–2.0 t/ha.
TGX1951-3F is medium maturing, high-yielding, low-shattering, with high oil content, excellent grain color, and thrives in both southern and northern Guinea Savannah.
TGX1955-4F is medium maturing (105–110 days), highly nodulating, resistant to rust, leaf spot, and bacterial pustule, and can yield up to 2.4 t/ha.

Cultural Practices

Soil Sampling and Analysis

Prior to land preparation, composite soil samples were randomly collected using an auger at a depth of 0-30 cm from each experimental site. The samples were analyzed for key physical and chemical properties, including soil pH, organic carbon, total nitrogen, available phosphorus, and particle size distribution.

Land Preparation and Sowing

The land was manually cleared, then harrowed and ridged with a spacing of 75 cm between ridges. Sowing was carried out according to the respective sowing method treatments, using a recommended seed rate of 100 kg ha^{-1}.

Sowing Configuration

For single- and double-row dibbling, seeds were sown at 75 cm inter-row and 10 cm intra-row spacing. In the drilling method, seeds were continuously drilled along the center of each ridge.

Weeding

Weeds were controlled manually using a hoe at 3 and 6 weeks after sowing (WAS).

Fertilizer Application

Fertilizer was applied at a rate of 20:40:20 using NPK (15:15:15) and Single Super Phosphate (SSP, 18%). All nitrogen and potassium, along with half of the phosphorus, were applied at 2 WAS, while the remaining phosphorus was applied at 4 WAS.

Harvesting

Soybean plants were harvested at physiological maturity, defined as when approximately 95% of the pods had turned brown. Harvesting was done manually by cutting the plants at the base of the stem. The harvested plants were sun-dried, threshed, and the grains were air-dried and weighed.

Data Collection and Data Analysis

Data were collected on both weed-related parameters, crop growth and yield traits following standard agronomic procedures. All data were subjected to analysis of variance

(ANOVA) using GENSTAT statistical software (17th edition). Treatment means were separated using the Student-Newman-Keuls (SNK) test at a 5% level of significance.

RESULTS AND DISCUSSION

Weed Studies

Weed Species Composition A diverse weed flora was observed across the soybean plots at both Bayero University Kano (BUK) and Dutsin-Ma during the 2023 rainy season, comprising broadleaved species, grasses, and sedges (Table 1). In total, 18 weed species were identified, with varying life spans (annual and perennial) and levels of infestation between the two locations. Among the broadleaved weeds, *Ageratum conyzoides* L., *Hyptis suaveolens* Poit., and *Hyptis spicigera* Lam. were the most dominant species, showing moderate to high infestation levels in both BUK and Dutsin-Ma. *Leucas martinicensis* (Jacq.) R.Br. and *Daniellia oliveri* (Rolfe) Hutch. & Dalziel also appeared consistently at moderate levels across both sites, while *Aspilia africana* (Pers.) C.D. Adams and *Trianthema portulacastrum* L. were more specific to Dutsin-Ma. In contrast, species like *Tridax procumbens* L. and *Amaranthus spinosus* L. were present only at BUK.The grasses were characterized by high adaptability, with *Eleusine indica* (L.) Gaertn. and *Axonopus compressus* (Sw.) P.Beauv. consistently showing high infestation in both locations. *Rottboellia cochinchinensis* (Lour.) Clayton and *Cynodon dactylon* (L.) Pers. were also notably dominant, especially in Dutsin-Ma, with *Cynodon dactylon* (L.) Pers. showing very high infestation there. The presence of multiple aggressive grass species suggests intense interspecific competition, particularly in Dutsin-Ma where grass weed pressure was generally higher.The sedge population was dominated by *Cyperus rotundus* L. and *Cyperus esculentus* L.. *Cyperus rotundus* L. showed high infestation at BUK and moderate at Dutsin-Ma, whereas *Cyperus esculentus* L. was more dominant at Dutsin-Ma. These perennial sedges are known for their persistence and difficulty in control due to underground tubers and rhizomes.

Overall, infestation levels varied by location and species, with some weeds showing site-specific dominance. Notably, *Aspilia africana* (Pers.) C.D. Adams and *Trianthema portulacastrum* L. were prevalent only at Dutsin-Ma, while *Tridax procumbens* L. and *Amaranthus spinosus* L. were exclusive to BUK. The repeated presence of certain dominant weed species such as *Ageratum conyzoides* L., *Hyptis suaveolens* Poit., *Eleusine indica* (L.) Gaertn., and *Cyperus rotundus* L. across both sites aligns with recent findings in legume-based cropping systems in Nigeria (Lawal *et al*., 2023; Shittu *et al*., 2024; Kabir *et al.,* 2025a), and further supports the notion that low early-season canopy coverage promotes rapid weed establishment and persistence. This composition highlights the importance of integrated weed management practices, especially those combining competitive soybean varieties and sowing methods that promote early canopy closure, to suppress these dominant weed species effectively.

Table 1: Effects of sowing method and variety on weed species composition of Soybean at BUK and Dutsin-Ma during the 2023 wet season

Weed Biotype	Life span	Level of infestation	
		BUK	Dutsin-Ma
Broadleaved			
Tridax procumbens L	A	**	-
Hyptis sauveolens Poit	A	***	***
Amaranthus spinosus L	A	**	-
Ageratum conyzoides L	A	***	**
Aspilia africana (L.) Pers	P	-	***
Leucas martinicensis Jacq	P	**	**
Hyptis spicigera (Lam)	A	***	**
Trianthema portulacastrum (L.)	A	-	**
Daniellia oliveri Rolfe	P	***	**
Cleome visiosa (L.)	A	*	**
Grasses			
Eleusine indica (L.)	A	***	**
Axonopus compresus Beaur	P	***	**
Cynodon dactylon (L.) Pers	P	**	***
Rottboellia cochinchinensis (L.) Roob A		***	***
Eleusine indica (L.)	A	***	**
Axonopus compresus Beaur	P	***	**
Sedges			
Cyperus rotundus L.	P	***	**
Cyperus esculentus L.	P	**	***

-= absent, *= <30% (low occurrence), ** = 31-60% (moderate occurrence), *** = >60% (high occurrence). A= Annual, P=Perennial.

Weed covers score, Weed biomass, and Weed density

The results presented in Tables 2 shows that sowing methods and soybean varieties significantly influenced weed-related parameters, particularly weed dry weight and weed density at Dutsin-Ma.

While it was not significant (P > 0.05) at BUK, among sowing methods, drilling consistently exhibited the weed dry weight, and weed density at Dutsin-Ma, where weed biomass was significantly ($P < 0.05$) reduced compared to single and double row dibbling. Drilling plots recorded only 148.2 g/m² of weed dry matter and 12.0 plants/m² weed density, compared to 248.4 g/m² and 16.4 plants/m² in single row dibbling plots. This finding confirms that drilling promotes early canopy closure, enhancing the crop's competitive advantage and limiting space and light for weed growth (Singh *et al.*, 2023).

The performance of single and double-row dibbling was inferior, with significantly higher weed biomass and density. This is likely due to wider intra-row spacing and slower canopy closure, which allowed weeds to establish more freely. These results are in line with findings from Kabir *et al*. (2025a & b), who reported that closely spaced sowing configurations reduce weed proliferation by minimizing bare soil exposure during early growth stages.

Regarding varietal influence, TGX 1955-4F recorded the lowest weed dry weight (101.3 g/m²) and weed density (13.6 plants/m²) at Dutsin-Ma, indicating superior weed suppression ability. In contrast, TGX 1987-10F showed the highest weed biomass (120.7 g/m²) and weed density (19.5 plants/m²), suggesting weaker competitive traits such as slower canopy expansion or lower ground cover. This variation among varieties is consistent with earlier reports showing that genotypic traits like early vigor, leaf area development, and growth habit play key roles in weed suppression (Crusiol *et al*., 2024; Rabiu *et al.*, 2025).

A significant sowing method × variety interaction was observed for weed density at Dutsin-Ma (Table 3), where TGX 1987-10F under single dibbling recorded the highest weed density (23.67 plants/m²), while TGX 1955-4F under drilling showed the lowest (9.00 plants/m²). These results demonstrate that the weed suppression potential of soybean varieties is enhanced or diminished depending on the planting method used. Similar trends were noted by Rubailes (2023) and Topa *et al.* (2025), who emphasized that integrating genotype selection with optimized agronomic practices improves weed control efficiency in legume systems. Furthermore, while some interactions did not reach statistical significance across all parameters, the combined effect of drilling and competitive varieties like TGX 1955-4F led to the most effective weed suppression. This supports the concept of integrated weed management (IWM), wherein cultural methods (such as drilling) and biological traits (like canopy closure) work synergistically to reduce reliance on herbicides and labor-intensive weeding (Balihar and Dahiya, 2024).

Table 2: Effects of sowing methods and variety on weed covers score, weed dry weight and weed density of soybean at BUK and Dutsinma during 2023 rainy season

Treatment	BUK			Dutsin-Ma		
	Weed covers score	Weed dry weight ($g\ m^{-2}$)	Weed density ($n\ m^{-2}$)	Weed covers score	Weed dry weight ($g\ m^{-2}$)	Weed density ($n\ m^{-2}$)
Sowing method (SM)						
Drilling	1.30	478.9	9.333	1.953	148.2b	12.0b
Single row Dibbling	1.33	482.1	8.933	2.207	248.4a	16.4a
Double row Dibbling	1.35	556.4	9.000	2.233	227.5a	16.4a
Prob	0.721	0.593	0.763	0.752	0.045	0.001
SE±	0.041	85.0	0.410	0.061	0.652	0.33
Variety (V)						
TGX 1955-4F	1.356	514.1	9.000	1.58	101.3a	13.6e
TGX 1987-10F	1.367	540.5	10.000	2.40	120.7b	19.5a
TGX 1987-6F	1.256	521.1	8.778	2.34	123.3b	16.5c
TGX 1951-3F	1.311	473.7	8.889	2.16	115.7b	14.7d
TGX 1835-10E	1.344	479.3	8.778	2.15	103.4a	18.0b
Prob	0.605	0.968	0.447	0.051	0.005	0.001
SE±	0.054	109.8	0.579	0.079	0.788	0.43
Interaction						
SM x V	0.605	0.699	0.641	0.104	0.637	0.001

Means within the same column with unlike letters are statistically different at 5% level of probability using the SNK test.

Table 3: Interaction between sowing method and variety on weed density at Dutsin-Ma

	Variety				
Treatment	TG X1955-4F	TGX 1987-10F	TGX 1987-6F	TGX 1951-3F	TGX 1835-10E
Sowing method					
Drilling	9.00g	16.0c	12.00efg	10.00fg	13.00def
Single row Dibbling	9.00g	23.67a	15.33cd	14.33cde	22.33a
Double row Dibbling	11.00fg	19.00b	22.33a	11.00fg	18.67b
SE±			0.755		

Means within the same column with the same letter (s) are not significantly different at the 5% level of probability using the SNK test.

Plant height and Leaf area index (LAI)

The result from Table 4 demonstrate that sowing method significantly influenced leaf area index (LAI) at both locations. Single dibbling consistently produced a higher LAI compared to drilling and double-row methods, particularly at Dutsin-Ma (1.97 vs. 0.165 and 1.178 respectively). This suggests that wider interplant spacing in single dibbling may have enhanced canopy development and leaf expansion, resulting in a greater LAI, which aligns with recent findings showing that line sowing promotes better canopy structure and vegetative growth in soybean (Feng *et al.*, 2019; Xu *et al.*, 2024).

Regarding plant height, the data show non-significant differences among sowing methods at both sites. However, varietal effects were more pronounced at Dutsin-Ma, where TGX 1955-4F and TGX 1951-3F achieved the tallest heights, while TGX 1987-10F was shortest. This variation could be linked to genotypic differences in growth vigor and environmental responsiveness, consistent with findings that variety selection significantly contributes to soybean growth parameters under different climatic zones (Omari *et al*., 2025).

For LAI variation by variety, TGX 1987-6F exhibited the highest values in both locations, highlighting its superior canopy expansion potential, which is linked to greater photosynthetic capacity and biomass accumulation (Santanoo *et al***.**, 2020; Yan *et al.,* 2024).

Table 5 reveals a significant interaction effect on plant height at Dutsin-Ma. TGX 1955-4F under drilling had the tallest plants (73.00 cm), suggesting this variety thrives best under drilling, possibly due to improved root anchorage and better soil moisture retention. Conversely, double-row planting tended to reduce plant height, likely due to inter-row competition for resources, aligning with insights that higher planting densities or suboptimal configurations can suppress plant elongation (Tang *et al*., 2025).

Table 4: Effect of sowing methods and variety on plant height and leaf area index of soybean at BUK and Dutsinma during 2023 rainy season

Treatment	BUK		Dutsin-Ma	
	Plant height (cm)	Leaf area index	Plant height (cm)	Leaf area index
Sowing method (SW)				
Drilling	69.80	0.94b	66.66a	0.165b
Single row Dibbling	68.73	1.82a	65.67b	1.97a
Double row Dibbling	69.00	1.13b	65.92b	1.178b
Prob	0.810	0.055	<0.001	0.065
SE±	1.206	0.182	0.321	0.009
Variety (V)				
TGX 1955-4F	69.11	1.27	68.78a	0.97
TGX 1987-10F	67.00	1.18	64.32b	1.08
TGX 1987-6F	71.33	1.81	67.53ab	1.94
TGX 1951-3F	68.33	1.40	68.67a	0.89
TGX 1835-10E	70.11	1.02	64.44b	0.94
Prob	0.362	0.112	<0.001	0.201
SE±	1.557	0.235	0.414	0.118
Interaction				
S x V	0.254	0.491	0.001	0.487

Means within the same column with the same letter are not significantly different at the 5% level of probability using the SNK test.

Table 5: Interaction between sowing methods and variety on Plant height (cm) at Dutsin-Ma

	Variety				
Treatment	TG X1955-4F	TGX 1987-10F	TGX 1987-6F	TGX 1951-3F	TGX 1835-10E
Sowing method					
Drilling	73.00a	64.33bc	65.67bc	67.33b	61.00bc
Single row Dibbling	64.33bc	62.67bc	63.73bc	65.33bc	60.00bc
Double row Dibbling	60.00bc	57.00c	62.00bc	62.00bc	63.00bc
SE±			1.729		

Means within the same column with the same letter (s) are not significantly different at the 5% level of probability using the SNK test.

Yield Components and Grain Yield Response

Table 6 shows that both sowing method and soybean variety significantly influenced yield components including pod weight per plant, number of pods, 100-seed weight, and grain yield, particularly at the Dutsin-Ma site. At BUK, drilling slightly outperformed other sowing methods in grain yield (1872.3 kg/ha), while it was not significant with other yield related components. Similarly, at Dutsin-Ma, drilling significantly improved number of pods per plant (18.63) and grain yield (1672.2 kg/ha), outperforming single dibbling (16.53 & 1290.8 kg/ha) and double row (14.69 &1425.4 kg/ha). These results suggest that drilling optimizes plant population uniformity, resource uptake, and canopy structure, enhancing productivity similar to the findings by Thiyagarajan *et al.* (2020), who reported increased pod formation and grain yield under drilled sowing compared to dibbling. Drilling also contributed to higher seed weight consistency, possibly due to more efficient water use and reduced intra-plant competition. This pattern is consistent with findings from (Kamara *et al.,* 2023), who highlighted improved seed filling and higher test weights under drilling in dryland soybean trials.

Varietal differences were highly significant, particularly at Dutsin-Ma, where TGX 1955-4F recorded the highest number of pods per plant (23.73) and grain yield (1910.4 kg/ha), reflecting its superior reproductive capacity and adaptability under field conditions. A similar trend was observed at BUK, with TGX 1955-4F achieving the highest pod number (103.6) and grain yield (1995.1 kg/ha), closely followed by TGX 1951-3F. In contrast, TGX 1987-10F and TGX 1835-10E produced significantly fewer pods (11.82 and 12.32, respectively) and lower yields (1130.1 and 1284.4 kg/ha), indicating reduced reproductive efficiency and limited yield potential under the prevailing conditions.

Notably, TGX 1987-10F exhibited the highest 100-seed weight across both locations (54.38 &58.56 g), suggesting a varietal tendency to allocate more assimilates to seed size than pod number. However, its low pod production and grain yield imply that large seed size alone is insufficient for yield maximization in suboptimal environments. These findings align with those of (Faligowska *et al*., 2025), who noted that while large-seeded soybean varieties may offer nutritional or market advantages, they require well-matched agronomic practices and favorable environments to realize their full yield potential.

The interaction between sowing methods and variety on number of pods per plant and grain yield at Dutsin-Ma was significant and is displayed in Table 7. Results indicates that TGX 1955-4F under single dibbling and drilling produced the highest pod numbers (26.33 and 24.73, respectively) compared with rest of the interaction combination, while for grain yield, TGX 1955-4F under drilling reached a peak of 2200 kg/ha, outperforming all other combinations. In contrast, TGX 1987-10F under double row sowing recorded the lowest yield (814 kg/ha), illustrating how poor pairing of genotype and sowing method can drastically reduce output. These findings affirm that genotype-specific sowing configurations can significantly enhance yield potential, as previously highlighted in (Eseigbe *et al.,* 2024), where the most productive soybean outcomes were achieved when sowing geometry was tailored to variety architecture and resource requirements.

Table 6: Effect of sowing method and variety on Pod weight per plant (g), Number of pods, 100 seed weight (g) and Grain yield (kg/ha^{-1}) of soybean at BUK and Dutsin-Ma during 2023 rainy season

Treatment	BUK				Dutsin-Ma			
	Number of pods plant^{-1}	Pod weight plant^{-1} (g)	100 seed weight (g)	Grain yield (kg ha^{-1})	Number of pods plant^{-1}	Pod weight plant^{-1} (g)	100 seed weight (g)	Grain yield (kg ha^{-1})
Sowing methods (SM)								
Drilling	86.1	40.07	48.45	1872.3a	18.63a	33.99	46.61	1672.2a
Single row Dibbling	82.8	39.94	47.47	1706.3b	16.53b	26.24	47.32	1290.8c
Double row Dibbling	77.8	37.35	47.53	1744.9b	14.69c	27.10	46.31	1425.4b
Prob	0.558	0.080	0.43	0.006	<0.001	0.075	0.13	<0.001
SE±	5.39	1.248	0.58	113.4	0.408	2.67	0.26	19.9
Variety (V)								
TGX 1955-4F	103.6a	40.12	45.91b	1995.1a	23.73a	30.51	45.30b	1910.4a
TGX 1987-10F	51.3c	38.46	54.38a	1620.3b	11.82d	29.51	58.56a	1130.1d
TGX 1987-6F	79.7bc	38.87	45.82b	1770.4ab	15.88c	29.47	45.72b	1374.1c
TGX 1951-3F	102.7ab	37.53	45.96b	1799.3ab	19.33b	31.44	45.35b	1613.5b
TGX 1835-10E	73.9c	37.94	45.54b	1620.3c	12.32d	28.74	46.11b	1284.4d
Prob	0.007	0.068	0.027	0.006	<0.001	0.75	0.071	<0.001
SE±	0.056	0.051	0.79	146.4	0.527	0.062	0.35	25.7
Interaction								
S x V	0.731	0.811	0.710	0.886	<0.001	0.950	0.620	<0.001

Means with the same letter (s) in a column are not significantly different at the 5% level of probability using the SNK test.

Table 7: Interaction between sowing method and variety on Number of pods and grain yield per hectare at Dutsin-Ma

Treatment	Variety				
	TGX 19555-4F	TGX 1987-10F	TGX 1987-6F	TGX 1951-3F	TGX 1835-10E
Sowing method			**Number of pods per plant**		
Drilling	24.73ab	13.27de	19.80c	22.27bc	13.10de
Single Dibbling	26.33a	11.87de	15.63d	15.80d	13.00de
Double row Dibbling	20.13c	10.33e	12.20de	19.93c	10.87e
SE±			0.912		
			Grain yield (kg/ha)		
Drilling	2200a	1411c	1515c	1761b	1471c
Single Dibbling	1717b	1165d	1160d	1267d	1138d
Double row Dibbling	1612b	814o	1447c	1810b	1244d
SE±			36.3		

Means within the same column with the same letter (s) are not significantly different at the 5% level of probability using the SNK test.

CONCLUSION

This study clearly demonstrates that both sowing method and soybean variety significantly affect weed suppression, growth parameters, and grain yield under Sudan Savannah conditions. Drilling emerged as the most effective sowing method, reducing weed infestation while maximizing plant height, leaf area index, and grain yield across both locations. Among the varieties tested, TGX 1955-4F consistently outperformed others, producing the highest number of pods, pod weight and grain yield at Dutsin-Ma, especially when paired with drilling. These results affirm TGX 1955-4F's strong adaptability, competitive growth habit, and yield potential. The significant varietal × sowing method interaction highlights the importance of integrated decision-making for optimal agronomic outcomes.

Therefore, the combination of drilling and the variety TGX 1955-4F is recommended for large-scale soybean cultivation in the Sudan Savannah, as it consistently demonstrated superior weed suppression and higher grain yield.

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