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PRODUCTION OF MAIZE (Zea mays l.) AS EFFECTED BY SPACING AND VARIETY IN MAKURDI, NIGERIA

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Abstract: This two-season field experiment investigated the impact of spacing and variety on maize (Zea mays L.) growth and yield in Makurdi, Nigeria. Two maize varieties (Sammaz 51 and Sammaz 14) were evaluated at three spacing regimes (15, 20, and 25 cm). A randomized complete block design with three replications was employed. Physiological and yield-related traits were assessed, including, plant height, the number of leaves, stem diameter, and adventitious roots per plant, were measured. Other characters like stem girth, Adventurous root, Cob length, Cob diameter, Number of line per cob, Number of cob/plant, number of seed per cob, Shelling (%), 1000 seed weight and Yield (t/ha) were also recorded. The results of the investigation revealed that maize generally responded to both spacing and variety. All the parameters studies have significantly ($P \leq 0.05$) responded to varietal effects, the use of Sammaz 14 was observed to perform higher in both growth character such plant height(123.30), the number of leaves (16.27), stem girth (5.98), adventitious roots per plant (6.10), Cob length (14.67), Cob diameter (9.22), Number of line per cob (15.30), Number of cob per plant (2.74), number of seed per cob (620.43), Shelling (80.92 %), 1000 seed weight(952.43g) and Yield (5.42t/ha) Maize grown in spacing 15cm outgrows those cultivated in spacing 20 and 25cm in both vegetative and reproductive character such as plant height (137.54), the number of leaves (16.24), stem girth (5.00), Adventurous root (6.01), Cob length (15.21), Cob diameter (9.73), Number of line per cob (16.54), Number of cob per plant (2.90), number of seed per cob (621.32), Shelling (85%), 1000 seed weight (901.65g) and Yield (5.54t/ha). On seasonal effect the cultivation of maize in 2024 remained superior in all the parameters under consideration. Optimal maize production in Makurdi can be achieved using 15 cm spacing and Sammaz 14. Based on the results obtained it can be suggested that famers in the location can use spacing 15cm and Sammaz 14 boast maize production for optimum yield.

Keywords: *Maize, Spacing, Variety, Growth, Yield.*

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Introduction

Maize (Zea mays) is one of the most widely cultivated crops globally, serving as a primary source of food, fodder, and industrial products (Kumar et al., 2022). In Nigeria, maize is a vital crop for food security, contributing significantly to the livelihoods of millions of farmers and the nation's economy (Afolabi et al., 2020). With a production value of over ₦1 trillion, maize is Nigeria's second-most important crop after cassava (Oladele et al., 2020). Despite its importance, maize production in Nigeria faces several challenges, including inadequate access to improved seed varieties, poor soil fertility, erratic rainfall patterns, and pest and disease pressures (Adnan et al., 2022). These factors often lead to suboptimal yields, averaging around 2-3 tons per hectare, compared to the global average of 5-6 tons per hectare (FAO, 2020). Recent research focuses on optimizing yield through various agronomic practices, such as optimal planting spacing, effective weed management, and the use of high-yielding and drought-resistant varieties (Kumar et al., 2022). Understanding the interactions between these practices is critical for maximizing productivity and ensuring food security.

In Nigeria, maize is grown in diverse agro-ecological zones, making it essential to develop adaptable and resilient varieties (Akambi et al., 2015). The selection of suitable maize varieties is crucial for maximizing production and ensuring food security, particularly in regions where maize serves as a staple crop (Peng, 2019).Local environmental conditions, such as soil type and climate, greatly influence maize growth. Choosing varieties that are well-suited to specific local conditions can enhance resilience and productivity. Economic Viability: Higher yielding and resistant varieties can lead to increased profitability for farmers, making maize production more sustainable and economically viable. maize varieties are a fundamental aspect of successful maize production systems. Continued research and development in breeding programs are essential to introduce new varieties that meet the evolving challenges of climate change, pest pressures, and food security, ensuring that maize remains a vital crop for millions around the world (Peng, 2019).

Spacing in maize cultivation refers to the distance between plants in a row and the distance between rows. It is a critical agronomic practice that directly influences plant growth, yield, and overall crop performance. Proper spacing ensures that each plant has adequate access to resources such as sunlight, water, and nutrients, which are essential for optimal growth. This is especially vital in regions prone to moisture-related diseases. Nutrient Availability: When plants are spaced appropriately, they have better access to soil nutrients. Overcrowding can lead to nutrient depletion and competition, resulting in suboptimal growth.

Water Management: Adequate spacing facilitates better water infiltration and reduces runoff. This is crucial in areas where water availability is limited, as it helps to maintain soil moisture levels. Ease of Management: Proper spacing allows for easier access to plants for management practices such as weeding, pest control, and harvesting. This can lead to increased efficiency and reduced labor costs (Declaro-Ruedas, 2019).

Recommended Spacing Practices Row Spacing: Common row spacings for maize range from 60 cm to 90 cm, depending on local farming practices and environmental conditions. Narrow rows can enhance light interception but may require more intensive management. Intra-row Spacing: The distance between plants within a row typically ranges from 20 cm to 30 cm. This spacing allows for optimal growth while minimizing competition for resources. Intercropping Systems: In intercropping systems, where maize is grown alongside other crops, spacing may need to be adjusted to accommodate the companion crops. Careful planning is essential to ensure that all plants receive adequate resources. Adaptation to Environmental Conditions: Spacing may also be adjusted based on local climatic conditions, soil fertility, and water availability. For example, in drought-prone areas, closer spacing may be used to maximize water use efficiency.

On-going research in maize agronomy continually explores the effects of various spacing configurations on yield and other agronomic parameters. Studies have shown that optimizing spacing can lead to significant improvements in maize yields, particularly when combined with high-yielding varieties and proper management practices, proper spacing is a fundamental aspect of successful maize cultivation. By optimizing plant density, farmers can enhance resource use efficiency, improve plant health, and ultimately increase yield and profitability. Continuous evaluation of spacing strategies, tailored to specific environmental and economic conditions, will be key to advancing maize production. Recent advancements in maize cultivation have focused on optimizing both spacing and variety selection to enhance productivity and sustainability. Here are some of the latest innovations:

Drought-Resistant Varieties: With climate change leading to more frequent droughts, researchers have developed drought-tolerant maize varieties. These varieties are bred using traditional methods and modern biotechnology, enabling them to maintain yields under water-scarce conditions. Biofortified Varieties: These hybrids are also bred for specific agro-ecological conditions, improving their adaptability. Pest and Disease-Resistant Varieties: Innovations in breeding have resulted in varieties that are resistant to common pests and diseases, reducing the reliance on chemical pesticides and enhancing crop resilience. Traits for resistance to fall armyworm and other critical pests are being incorporated into new hybrids IITA (2022).

Innovations in Spacing Techniques Precision Agriculture: The integration of technology in agriculture has led to the use of precision planting techniques. Automated and Robotic Systems: The advent of robotics in agriculture has led to the development of automated planting systems that can adjust spacing dynamically based on real-time data. These systems improve planting accuracy and resource management. The latest innovations in maize varieties and spacing practices are transforming maize cultivation, making it more resilient, productive, and sustainable. This study aims to investigate the effects of different planting spacings and maize varieties on yield and yield-related parameters in Makurdi, Nigeria. By identifying optimal practices, this research contributes to developing sustainable maize production strategies that can improve food security and farmer livelihoods in the region.

Material and Measurements

The experiment was conducted during the rainy season of 2020 at the Teaching and Research Farm Joseph Sarwuan Tarka University, Makurdi (7° 41’N and 8° 37’E). The experiment that was laid in a randomized complete block design (RCBD) with three replicate, a 4m^2 plot was laid out with 1m between plots and 1m between blocks. There were 8 plots each within a block which gave the total number of 24 plots for the study for the two locations. The treatments used were Spacing (15, 20 and 25cm as control) and two varieties Sammaz 51 and Sammaz 14 were used. Agronomic practice such as land clearing, 1 seed per hill was planted and weeding was done manually at 2 and 6 weeks after planting to ensure a weed free plots application of fertilizer at planting and top dressed at 6weeks after planting, application of NPK 20:10:10 rate of (N120 kg/ha, P80 kg/ha K80 kg/ha) was used and harvesting and threshing was done manually, all the data were collected within the net plot of 4m^2, where a total of 5 plants were tagged for data collection within each net plot. The parameters recorded were plant height (was taken with the aid of measuring tape from the base of the plant to the tip), the number for leaves (were counted fortnightly) from 5 plants that were tagged and the average used, stem girth and number of prop roots per plants were measured. Other characters like number of cobs (were counted), cob length (taken with the aid of measuring tape), cob girth (with the aid of a vernier caliper), and cob weight (with the aid of digital weighing balance), number of seeds per cob (were counted), number of grain rows per cob (were counted), 1000 gains weight (with the aid of digital weighing balance), threshing percentage and grain yield in (t/ha) was recorded. All data collected were subjected to analysis of variance (ANOVA) Gensat version 17, while the least significant difference (LSD) at 5% level of probability was used in separating the means

Results and Discussion

Table 1: Effects of spacing and variety on plant height of maize grown in Makurdi, Nigeria

	Weeks after planting (WAP)				
Variety (V)	**2**	**4**	**6**	**8**	**10**
Sammaz 51	3.62	18.63	44.00	73.91	114.23
Sammaz 14	4.24	20.02	50.82	82.62	123.30
F-LSD (0.05)	1.00	2.12	6.00	8.11	10.23
Spacing (SP)					
15	4.00	21.00	45.23	81.41	137.54
20	3.78	19.11	44.63	75.28	140.30
25	3.00	20.32	57.43	70.12	123.99
F-LSD (0.05)	0.21	1.78	5.21	4.23	10.12
Season (S)					
2023	3.78	20.12	46.43	76.43	142.23
2024	4.72	22.21	52.32	82.98	154.21
F-LSD (0.05)	0.23	1.00	5.01	7.12	10.00
Interaction	NS	NS	NS	NS	NS
V X (SP)	NS	NS	NS	NS	NS
(SP) X S	NS	NS	NS	NS	NS
V X S					

LSD= Least Significant Differences at 5% Level of Probability,

This study examines the effects of planting spacing and maize variety on plant height in Makurdi, Nigeria, measuring growth at 2, 4, 6, 8, and 10 weeks after planting. Two maize varieties, Sammaz 51 and Sammaz 14, were evaluated. Results indicated that Sammaz 14 consistently outperformed Sammaz 51, achieving a maximum height of 123.30 cm at 10 weeks compared to 114.23 cm for Sammaz 5, this could be as a result of genetic make-up of the varieties on cultivation. This work is supported by the finding of Nathe (2020) who reported that varietal difference can affect both vegetative and reproductive stage of plant positively. Plant height was also influenced by planting spacing, with the closest spacing (15 cm) yielding the highest average height (137.54 cm) at 10 weeks, followed closely by 20 cm spacing (140.30 cm). The widest spacing (25 cm) resulted in lower heights, especially noticeable at 8 weeks and 10 weeks. This is not far from the fact that closer spaced plant strive for light, water and nutrient, this assertion is collaborated by the finding of Madina et al., 2021 who reported that most close space plant grow taller due to competition on light, nutrients and water or moisture.

Seasonal variations were significant, with plants in 2024 exhibiting greater heights compared to those in 2023, particularly at later growth stages this could be attributed to soil condition, climatic faction aiding to the decomposition of residuals thereby affecting plant height positively. This finding is in agreement with the finding of Ojiem *et al.* (2006) who had the same result, starting that plant height is influence by nutrients availability, climatic factor, residual effect and agronomic practice. Despite the observed differences in plant height, no significant interactions were detected between variety, spacing, and season. The findings highlight the importance of both variety selection and optimal planting spacing to enhance maize growth, suggesting that closer spacing and the use of high-performing varieties like Sammaz 14 can lead to improved plant height and potentially higher yields

Table 2: Effects of spacing and variety on number of leaves of maize grown in Makurdi, Nigeria

	Weeks after planting (WAP)				
Variety (V)	**2**	**4**	**6**	**8**	**10**

Sammaz 51	3.92	5.13	9.00	12.34	16.27
Sammaz 14	4.00	6.12	10.82	13.12	14.20
F-LSD (0.05)	0.32	1.12	1.01	1.21	2.23
Spacing (SP)					
15	4.00	6.00	10.23	14.76	16.24
20	3.87	5.61	9.63	13.54	14.70
25	3.12	4.12	8.43	12.32	13.19
F-LSD (0.05)	0.12	1.18	1.11	1.13	1.02
Season (S)					
2023	3.87	5.52	10.43	13.40	14.43
2024	4.02	6.01	11.32	14.18	16.31
F-LSD (0.05)	0.13	1.01	1.01	1.02	1.00
Interaction	NS	NS	NS	NS	NS
V X (SP)	NS	NS	NS	NS	NS
(SP) X S	NS	NS	NS	NS	NS
V X S					

LSD= Least Significant Differences at 5% Level of Probability,

This study investigates the effects of planting spacing and maize variety on leaf number in Makurdi, Nigeria. Two maize varieties, Sammaz 51 and Sammaz 14, were assessed for the number of leaves at various growth stages (2, 4, 6, 8, and 10 weeks after planting). Sammaz 51 consistently produced a higher number of leaves across all growth stages, with a maximum of 16.27 leaves at 10 weeks, compared to Sammaz 14's maximum of 14.20 leaves, this is true that most improved maize variety have the ability to utilized the nutrient for vegetative and reproductive stage due to their inherent genetic make-up as reported by Muhammed and Khan Saeed (2005)

Spacing also significantly influenced leaf production, with the closest spacing (15 cm) yielding the highest leaf counts at all stages, particularly at 10 weeks with an average of 16.24 leaves. Wider spacings (20 cm and 25 cm) resulted in lower leaf numbers, particularly evident at later growth stages. Seasonal effects were observed, with 2024 showing generally higher leaf counts than 2023, particularly at 10 weeks. This could be related to competition leading the production of higher number of leaves as collaborated by the finding of Zilic et al., (2011) who reported that most closed spaced plants comprte well leading to the production of not only taller plants but also many leaves supressing weeds and other plants around them

Despite these differences, no significant interactions were detected between variety, spacing, and season for the number of leaves. The findings highlight the importance of selecting both appropriate variety and planting spacing to optimize leaf development in maize, contributing to improved overall growth and potential yield.

Table 3: Effects of spacing and variety on yield related parameters of maize grown in Makurdi, Nigeria

	Weeks after planting (WAP)				
Variety (V)	**Stemgirth (mm)**	**Adventurous roots**	**Cob length**	**Cob diameter**	**No.of line/cob**
Sammaz 51	4.78	4.85	12.32	8.13	14.23
Sammaz 14	5.98	6.10	14.67	9.22	15.30
F-LSD (0.05)	0.89	1.01	1.12	1.00	1.23
Spacing (SP)					

15	5.00	6.01	15.21	9.73	16.54
20	4.11	5.01	14.52	8.93	15.30
25	3.98	4.65	13.98	8.03	12.99
F-LSD (0.05)	1.00	1.02	1.00	0.41	1.12
Season (S)					
2023	4.45	5.11	12.32	8.33	14.23
2024	5.86	6.43	15.00	9.52	15.21
F-LSD (0.05)	0.98	1.00	1.02	1.01	10.00
Interaction					
V X (SP)	NS	NS	NS	NS	*
(SP) X S	NS	*	NS	NS	NS
V X S	NS	NS	*	NS	*

LSD= Least Significant Differences at 5% Level of Probability,

This study examines the effects of planting spacing and maize variety on yield-related parameters in Makurdi, Nigeria. Two varieties, Sammaz 51 and Sammaz 14, were assessed for various growth metrics, including stem diameter, number of adventitious roots, cob length, cob diameter, and number of lines per cob. Results indicated that Sammaz 14 consistently outperformed Sammaz 51, exhibiting greater values across all parameters: for instance, an average stem diameter of 5.98 mm and a cob length of 14.67 cm compared to 4.78 mm and 12.32 cm, respectively, for Sammaz 51.this variarbility is caused by genetic inherent ability, climatic factors and agronomic practice as reported by Stefan and Christian (2002).

Spacing treatments significantly influenced growth parameters, with the closest spacing (15 cm) yielding the highest values, including a cob length of 15.21 cm and a number of lines per cob at 16.54. Conversely, wider spacings (20 cm and 25 cm) resulted in reduced performance across all metrics. Competitive nature of crop make them strive hard not only at vegetative stage but also in reproductive stage, this accession is in conformity with the work of Sasakawa 2000 who had similar result starting that most closed maize do record significantly higher in both yield and yield related parameters

Seasonal effects were also notable, with 2024 showing improvements in most parameters compared to 2023. Significant interactions were observed between variety and season for the number of lines per cob, as well as between spacing and season for the number of adventitious roots, this could be related to seasonal variation in terms of temperature, rainfall pattern, this finding is in line with the work of Madina et al.,2022 who reported that seasonal differences is mostly caused by rainfall pattern, cultural practice and nutrients residual effects of the subsequent planting season. These findings highlight the critical influence of both variety selection and planting spacing in optimizing maize growth and yield potential in the region, suggesting that closer spacing and superior varieties like Sammaz 14 can enhance productivity

Table 4: Effects of spacing and variety on yield and yield related parameters of maize grown in Makurdi, Nigeria

Weeks after planting (WAP)

Variety (V)	**Number of cob/plant**	**No. seed/cob**	**Shelling (%)**	**1000 seed weight (g)**	**Yield (t/ha)**
Sammaz 51	2.24	518.76	74.20	873.21	4.21
Sammaz 14	2.74	620.43	80.92	952.43	5.42
F-LSD (0.05)	0.10	10.02	9.00	80.01	1.12
Spacing (SP)					
15	2.90	621.32	85.32	901.65	5.54
20	2.01	569.21	75.12	875.12	4.21
25	2.00	520.43	70.76	810.87	3.38

F-LSD (0.05)	0.21	10.12	5.01	60.10	1.01
Season (S)					
2023	2.00	620.43	80.23	856.90	4.54
2024	2.72	722.65	85.76	912.23	5.76
F-LSD (0.05)	0.23	10.01	4.10	20.43	1.02
Interaction					
V X (SP)	NS	*	NS	NS	*
(SP) X S	NS	NS	*	*	NS
V X S	NS	NS	*	NS	NS

LSD= Least Significant Differences at 5% Level of Probability,

This study evaluates the effects of planting spacing and maize variety on yield and yield-related parameters in Makurdi, Nigeria. Two maize varieties, Sammaz 51 and Sammaz 14, were analyzed for several parameters, including the number of cobs per plant, seeds per cob, shelling percentage, 1000 seed weight, and yield (t/ha). Sammaz 14 outperformed Sammaz 51 across most metrics, with a higher average of seeds per cob (620.43) and yield (5.42 t/ha) compared to 518.76 seeds and 4.21 t/ha for Sammaz 51. Most hybrids are also bred for specific agro-ecological conditions, improving their adaptability and yielding well, this could be the case of Sammaz 51. This result is similar with the work of NCRI, (2007) who reported that most improved varieties are high yielding ability irrespective of the growing conditions

Spacing treatments also significantly affected these parameters, with the closest spacing (15 cm) yielding the highest values for most traits, including an average yield of 5.54 t/ha. Wider spacings (20 cm and 25 cm) resulted in reduced performance, particularly in yield and shelling percentage. Closer spacing might have taken advantage of plant population to outperformed other spacing used in the research, this finding collaborate with the work of Sassakawa 2000 who reported higher yield and yield related parameters in closer spacing than other spacing which they related to plant population and ability of the plant to supress weeds.

Seasonal variations also influenced the results, with 2024 showing improved outcomes over 2023. Notably, significant interactions were observed between spacing and season for shelling percentage and yield, emphasizing the need for optimized management practices. The findings highlight the critical role of variety selection and planting spacing in enhancing maize productivity in the region this finding collaborate with the finding of Gadgil et al. (2002) who stated that soil, climatic factors and agronomic practice play and important role in crop yield when considering seasons

Table 5: interaction between spacing and variety on yield and yield related parameters of maize grown in Makurdi, Nigeria

Spacing (cm)	Variety (V)	Number of lines/cob	Shelling (%)	Yield (t/ha)
15	Sammaz 51	14.76	74.20	4.81
	Sammaz 14	15.12	80.92	5.42
20	Sammaz 51	13.20	72.00	4.20
	Sammaz 14	14.13	76.20	5.00
25	Sammaz 51	13.40	70.92	4.00
	Sammaz 14	12.33	74.00	4.98
	F-LSD (0.05)	1.00	1.23	0.21

This study investigates the interaction between planting spacing and maize variety on yield and yield-related parameters in Makurdi, Nigeria. Two maize varieties, Sammaz 51 and Sammaz 14, were evaluated across three spacing treatments (15 cm, 20 cm, and 25 cm). Results indicate that both variety and spacing significantly influenced the number of lines per cob, shelling percentage, and yield (t/ha). At a spacing of 15 cm, Sammaz 14 exhibited the highest performance, with 15.12 lines per cob, a shelling percentage of 80.92%, and a yield of 5.42 t/ha. Sammaz 51, while also performing well, yielded lower metrics at this spacing, with 14.76 lines, 74.20% shelling, and 4.81 t/ha. At wider spacings (20 cm and 25 cm), the performance of both varieties decreased, particularly for Sammaz 51, which recorded its lowest yield (4.00 t/ha) at 25 cm spacing. this is in conformity with the recent studies of NVC1, (2020) started that closer planting densities, when combined with proper nutrient management and irrigation, can lead to increased yields in certain environments. The F-LSD values (0.05) confirmed the significance of the observed differences. These findings underscore the importance of optimizing both variety and spacing to enhance maize yield in the region, suggesting that closer spacing may benefit higher-yielding varieties like Sammaz 14

Table 6: interaction between spacing and seasons on yield and yield related parameters of maize grown in Makurdi, Nigeria

Spacing (cm)	**Season (S)**	**Number of seeds/cob**	**Advantious roots**	**1000 seed weight (g)**
15	2023	528.67	4.15	813.81
	2024	622.34	6.20	962.56
20	2023	500.20	4.05	801.32
	2024	600.67	5.95	900.67
25	2023	495.34	4.02	798.12
	2024	594.20	5.90	876.21
	F-LSD (0.05)	8.12	0.97	10.98

This study examines the interaction between maize planting spacing and growing seasons on yield and yield-related parameters in Makurdi, Nigeria. The experiment analyzed three spacing treatments (15 cm, 20 cm, and 25 cm) over two seasons, 2023 and 2024. Results revealed that closer spacing (15 cm) resulted in the highest number of seeds per cob, with averages of 528.67 in 2023 and 622.34 in 2024. In contrast, wider spacing (25 cm) yielded the lowest seed counts, with values of 495.34 and 594.20 for the respective years. The number of advantageous roots was greatest at 15 cm, showing increases from 4.15 in 2023 to 6.20 in 2024 this could be as a result of closer spacing affecting the parameters under consideration to out-perform the parameters in 2023 as reported by Sassakawa 2000 starting that closer spacing utilize available resource such as spacing, nutrient and solar radiation leading to higher yield and yield related parameters, he added that cultural practice and climatic condition of the two planting season affects both yiled and yield related parameters such as number of seeds per cob advantious roots and 1000 seed weight, while the other spacings demonstrated lower and less consistent root counts. Additionally, the 1000 seed weight was highest for the 15 cm spacing in both years, with weights of 813.81 g in 2023 and 962.56 g in 2024. The F-LSD values (0.05) confirmed the statistical significance of these findings across the parameters measured. The results suggest that tighter planting spacing combined with optimal seasonal timing enhances yield potential and crop performance in maize cultivation in this region Gadgil et al., (2002)

Table 7: interaction between varieties and seasons on yield and yield related parameters of maize grown in Makurdi, Nigeria

Variety (V)	**Season (S)**	**Cob length**	**Number of lines/cob**	**Shelling (%)**
Sammaz 51	2023	12.54	14.13	78.89
	2024	14.45	15.20	80.12
Sammaz 14	2023	13.22	15.83	82.54
	2024	15.62	16.73	86.87
	F-LSD (0.05)	1.00	1.00	1.45

This study investigates the interaction between maize varieties and growing seasons on yield and yield-related parameters in Makurdi, Nigeria. Two maize varieties, Sammaz 51 and Sammaz 14, were evaluated over two consecutive growing seasons, 2023 and 2024. Results indicated significant differences in cob length, number of lines per cob, and shelling percentage across both varieties and seasons. Specifically, Sammaz 14 exhibited superior performance in all parameters, with cob lengths of 13.22 cm and 15.62 cm, a number of lines per cob of 15.83 and 16.73, and shelling percentages of 82.54% and 86.87% for the years 2023 and 2024, respectively is could be related to improvement in cultural practice, acclimatazation of the plant to the growing environment and residual effect causing significant difference in the parameters under consideration as reported by the work of Muhammad and khan Saeed (2005), Madina el al., (2021) who reported same trend. Conversely, Sammaz 51 recorded lower values for these traits, with cob lengths of 12.54 cm and 14.45 cm, lines per cob of 14.13 and 15.20, and shelling percentages of 78.89% and 80.12%. The F-LSD values (0.05) confirmed the statistical significance of these differences this accession is true due to seasonal and varietal difference recorded in this research this could be linked to the fact that climatic condition, soil factors

and agronomic practice may have led to that, (Khalid, 2009) in his work also lend support to the above accretion starting that factors that lead to crop yield is directly related to climate, agronomic practice, rainfall and soil nutrient. Overall, the findings highlight the importance of variety selection and seasonal timing in optimizing maize yield in the region IITA (2019).

Conclusion

This study investigated the effects of different planting spacings and maize varieties on yield and yield-related parameters in Makurdi, Nigeria. The findings suggest that optimal planting spacing and variety selection significantly impact maize productivity. Specifically, the results show that closer spacing (15 cm) and variety Sammaz 14 produced higher yields; significant interactions existed between spacing and variety. The 2024 cropping season exhibited better performance across all parameters. These findings align with previous research emphasizing the importance of optimal agronomic practices for improving maize yields (Kumar et al., 2022; Adnan et al., 2022). Optimizing planting spacing and variety selection is crucial for improving maize productivity in Nigeria. By adopting evidence-based practices, farmers can contribute to national food security and economic development.

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