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EFFECT OF DIFFERENT LAND CONFIGURATION AND CROP GEOMETRY ON BABY CORN (*Zea mays* L.) AS THE GROWTH PERFORMANCE, SOIL AND PLANT NUTRIENT LEVELS

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ABSTRACT

Baby corn (*Zea mays* L.) is an emerging high-value vegetable crop with increasing demand in both domestic and export markets. A field experiment titled "Effect of Different Land Configuration and Crop Geometry on baby corn (*Zea mays* L.)" was conducted at the Instructional Farm, Integral University, Lucknow, Uttar Pradesh during *Kharif* season 2025–26 to study the effect of different land configurations (Flatbed – M_1, Ridge and Furrow – M_2, Broad Bed and Furrow – M_3) and five crop spacing levels (S_1 – 45 cm × 15 cm, S_2 – 45 cm × 20 cm, S_3 – 45 cm × 25 cm, S_4 – 45 cm × 30 cm, and S_5 – 60 cm × 20 cm) on growth, yield attributes, yield and soil properties of baby corn. The experiment was laid out in a Split Plot Design (SPD) with three replications. Results revealed that Ridge and Furrow (M_2) significantly outperformed other land configurations in most growth parameters, yield attributes and final yield. The crop spacing of 45 cm × 25 cm (S_3) proved optimal for maximizing yield and growth performance. Baby corn yield was highest under M_2 (Ridge and Furrow) was recorded superior over M_1 (Flatbed) and M_3 (Broad Bed and Furrow) with spacing S_3 (45 cm × 25 cm) for most of the growth, yield related attributes. M_2 (ridge and furrow) and S_3 (45cm×25cm) recorded the maximum baby corn yield of 7,113.91 kg ha^{-1} (49.27% increase over Flatbed) and 7,215.02 kg ha^{-1} (29.25% increase over 45 × 20 cm) respectively. Green fodder yield also followed a similar trend. Post-harvest soil properties (pH, EC, organic carbon) remained unaffected by treatments. Hence the study concludes that Ridge and Furrow land configuration with 45 cm × 25 cm spacing is the most suitable combination for profitable baby corn cultivation in the Indo-Gangetic plains.
Keywords: Baby corn, Land configuration, Crop Geometry, Ridge and Furrow, Broadbed and Furrow, *Zea mays*, *Kharif*, Yield attributes.

Introduction

Baby corn (*Zea mays* L.) is the immature and unfertilized cob of maize that is harvested at an early stage, usually before pollination takes place. It is a highly nutritious vegetable crop that is rich in vitamins, minerals, and dietary fiber and it widely used in salads, soups and processed foods. In recent years, baby corn has gained significant importance in agriculture due to its short duration, high market demand and better economic returns compared to many traditional crops (Yadav *et al.*, 2019).

It can be harvested within 50 to 60 days after sowing which makes it suitable for intensive cropping systems and allows farmers to grow multiple crops in a year. This characteristic makes baby corn particularly useful for small and marginal farmers who aim to maximize income from limited land resources (Ram *et al.*, 2022). Baby corn ears 10 to 12 cm long and 1.0 to 1.5 cm diameter in light yellow color with regular row arrangement are mostly preferred in the market. Baby corn is used either of two ways, fresh or processed consumption (Dutta *et al.*, 2022).

Baby corn production and markets are growing worldwide, especially in Asia, Africa and South America. Asian countries are the major consumers of baby corn. Baby corn contains 15-18 % crude protein, 2-3% potassium, 3-5% fiber, 0.3-0.5% calcium and 75-80 mg ascorbic acid per 100 g, playing a significant role as a nutritious crop (Islam *et al.*, 2022).

Land configuration refers to the method of shaping and arranging the field for crop cultivation. Common land configurations include flatbed planting, ridge and furrow, raised bed and broad bed and furrow systems. Each of these methods creates a different soil environment that affects water movement, aeration, temperature and nutrient availability. Proper land configuration helps in efficient water management, reduces soil erosion and improves crop growth conditions. Among different land configurations, ridge and furrow and broad bed and furrow systems have shown better performance compared to flatbed planting. In these systems, the crop is grown on raised portions of soil, which helps in better drainage and prevents waterlogging (Babu *et al.*, 2020).

Crop Geometry is another critical factor affecting baby corn production. It occurs when plants are closed together, reducing space between plant and increasing crop density. This condition restricts water infiltration, root growth and air movement in the soil. Plant Geometry is mainly caused by repeated use of heavy machinery, continuous cropping and improper tillage practices. Natural factors such as rainfall impact and drying-wetting cycles can also contribute to geometry (Nawaz *et al.*, 2023). Research on the combined effects of land configuration and crop geometry in baby corn is limited, particularly for the Indo-Gangetic plains of Uttar Pradesh. Most existing studies have examined these factors separately or under different agro-climatic conditions. Therefore, the present investigation was conducted to assess the performance of baby corn under different land configurations and spacing, also to assess the soil and plant nutrient levels under different land configuration and crop geometry in baby corn under agro climatic conditions of Lucknow, Uttar Pradesh during the *Kharif* season 2025–26.

Materials and Methods

The field experiment was conducted at the Instructional Farm Unit, Integral University (IIAST), Lucknow, Uttar Pradesh during the *Kharif* season of 2025–26. The experimental site is situated in the Indo-Gangetic plains, one of the most fertile agricultural zones of India. It is geographically located at approximately 26°47' North latitude and 82°12' East longitude, at an average altitude of 123 meters above mean sea level. The region receives an average annual rainfall of about 1200 mm, of which approximately 80% is concentrated between mid-June and end of September.

The experimental site experienced a sub-tropical climate during the *Kharif* season. Maximum temperature ranged from 27.1°C to 37.3°C, while the minimum temperature ranged from 23.6°C to 29.4°C. The relative humidity varied between 60% and 100%, remaining high during the monsoon period. The total rainfall during the crop period was approximately 450–500 mm, sufficient to meet the water requirement of the crop. Meteorological data were recorded at the meteorological observatory of Integral University.

The crop used for the experiment was baby corn (*Zea mays* L.) and the variety selected was 'IBCH 402', a widely cultivated hybrid suitable for baby corn production, developed by ICAR-Indian Institute of Maize Research, Ludhiana, Punjab. It is a short-duration variety (50–60 days), ideal for intensive cropping systems with high potential for crop diversification, yielding approximately 1.5–2 tonnes of dehusked baby corn per hectare.

Before commencement of the experiment, soil samples were collected from 0–15 cm depth and analyzed for physical and chemical properties. The soil was found to be sandy loam in texture with a slightly alkaline pH of 7.4, electrical conductivity of 0.32 dS m^{-1}, and organic carbon content of 0.48%. Available nitrogen was 230 kg ha^{-1}, available phosphorus 21.4 kg ha^{-1}, and available potassium 168 kg ha^{-1} representing medium fertility status.

The experiment was laid out in a split plot design (SPD) with three replications. The treatments consisted of three land configurations (like M_1 – Flatbed, M_2 – Ridge and Furrow, M_3 – Broad Bed and Furrow) and five crops spacing levels (like S_1 – 45 cm × 15 cm, S_2 – 45 cm × 20 cm, S_3 – 45 cm × 25 cm, S_4 – 45 cm × 30 cm, and S_5 – 60 cm × 20 cm.), giving a total of 15 treatment combinations. A recommended dose of fertilizer was applied uniformly across all plots. Seeds were sown at the commencement of the *Kharif* season with proper irrigation and crop protection measures. Harvesting was done at the immature cob stage (2-3 after days of silk emergence), as per standard baby corn cultivation practices.

Results and Discussion

Growth Parameters

At 30 DAS, differences among land configurations and crop spacing were non-significant, indicating that early crop establishment is primarily governed by seed quality and initial soil moisture rather than land configuration. By 45 DAS, significant differences emerged. M_2 (Ridge and Furrow) recorded the maximum height of 126.17 cm, significantly superior to M_1 (Flatbed, 118.57 cm), while M_3 (Broad Bed and Furrow) was intermediate (123.13 cm). At harvest, M_2 recorded the tallest plants (164.03 cm), followed by M_3 (154.47 cm) and M_1 (145.17 cm).

Among crop spacing, S_3 (45 cm × 25 cm) produced the tallest plants at all stages (69.90 cm at 30 DAS, 128.74 cm at 45 DAS, 162.63 cm at harvest), while the closest spacing S_1 (45 cm × 15 cm) recorded the shortest plants (143.39 cm at harvest).

Table 1: Effect of Land Configuration and Crop Spacing on Plant Height of Baby Corn

Treatment	Plant Height at 30 DAS (cm)	Plant Height at 45 DAS (cm)	Plant Height at Harvest (cm)
Land Configuration			
M_1 (Flatbed)	66.35	118.57	145.17
M_2 (Ridge and Furrow)	67.42	126.17	164.03
M_3 (Broad Bed and Furrow)	66.71	123.13	154.47
SEm±	1.33	1.39	2.44
CD (0.05%)	NS	5.60	9.82
Crop Spacing			
S_1 (45 cm × 15 cm)	63.26	116.50	143.39
S_2 (45 cm × 20 cm)	65.41	120.31	150.42
S_3 (45 cm × 25 cm)	69.90	128.74	162.63
S_4 (45 cm × 30 cm)	67.19	122.09	155.76
S_5 (60 cm × 20 cm)	68.38	125.47	160.58
SEm±	1.61	2.11	3.29
CD (0.05%)	NS	6.19	9.65

Dry Matter Accumulation at Harvest (g plant^{-1})

Dry matter accumulation was significantly influenced by land configuration. M_2 (Ridge and Furrow) recorded the highest dry matter (357.22 g plant^{-1}), followed by M_3 (332.58 g plant^{-1}) and M_1 (307.54 g plant^{-1}). Among crop spacing, S_3 (45 cm × 25 cm) produced the maximum dry matter (344.19 g plant^{-1}), followed by S_5 (335.67 g plant^{-1}) and S_1 recorded the lowest (323.23 g plant^{-1}).

Number of Leaves Plant^{-1}

Number of leaves per plant was not significantly influenced by either land configuration or crop spacing. The values ranged from 13.31 (M_1) to 13.73 (M_2) for land configuration and from 13.16 (S_1) to 14.03 (S_3) for crop spacing. This parameter is largely governed by the genetic makeup of the variety.

Phenological Parameters

Days to tasseling and days to silking were non-significantly affected by both land configuration and crop spacing. Days to tasseling ranged from 50.40 (M_2) to 50.93 (M_1) and days to silking from 54.00 (M_2) to 54.87 (M_1). This confirms that phenological development in baby corn is primarily controlled by temperature accumulation and varietal characteristics rather than planting geometry.

Yield Attributes

Number of Cobs Plant^{-1}

Number of cobs plant^{-1} was significantly affected by land configuration. M_2 recorded the highest (2.81 cobs plant^{-1}), followed by M_3 (2.69) and M_1 (2.18). Among crop spacing, S_3 produced the maximum (3.01 cobs plant^{-1}), while S_1 recorded the lowest (1.71 cobs plant^{-1}).

Cob Length and Cob Weight

Cob length with husk was highest under M_2 (14.17 cm) and S_3 (15.02 cm). Cob length without husk was also maximum under M_2 (9.75 cm) and S_3 (10.61 cm). Cob weight was highest under M_2 (26.37 g) and S_3 (26.78 g). Cob girth with husk and without husk were non-significant across treatments, suggesting these parameters are more strongly determined by varietal characteristics.

Table 2: Effect of Land Configuration and Crop Spacing on Yield Attributes of Baby Corn

Treatment	No. of Cobs plant^{-1}	Cob Length with Husk (cm)	Cob Length without Husk (cm)	Cob Weight (g)
Land Configuration				
M_1 (Flatbed)	2.18	13.61	9.21	22.82
M_2 (Ridge and Furrow)	2.81	14.17	9.75	26.37
M_3 (Broad Bed and Furrow)	2.69	13.89	9.46	25.57
SEm±	0.02	0.06	0.08	0.17
CD (0.05%)	0.09	0.25	0.32	0.69
Crop Spacing				
S_1 (45 cm × 15 cm)	1.71	12.97	8.54	21.97
S_2 (45 cm × 20 cm)	2.17	13.57	9.19	23.08
S_3 (45 cm × 25 cm)	3.01	15.02	10.61	26.78
S_4 (45 cm × 30 cm)	2.94	13.66	9.24	26.19
S_5 (60 cm × 20 cm)	2.98	14.23	9.79	26.58
SEm±	0.05	0.08	0.07	0.29
CD (0.05%)	0.14	0.24	0.21	0.84

Yield of Baby Corn

Baby Corn Yield (kg ha^{-1})

Baby corn yield was significantly influenced by land configuration. Ridge and Furrow (M_2) recorded the highest yield of 7,113.91 kg ha^{-1}, followed by Broad Bed and Furrow (M_3: 6,599.25 kg ha^{-1}) and Flatbed (M_1: 4,765.20 kg ha^{-1}). M_2 was significantly superior to both M_1 and M_3. The crop spacing S_3 (45 cm × 25 cm) produced maximum yield of 7,215.02 kg ha^{-1}, followed by S_5 (6,645.81 kg ha^{-1}). The closest spacing S_1 (45 cm × 15 cm) recorded the lowest yield (5,601.97 kg ha^{-1}).

Green Fodder Yield (kg ha^{-1})

Green fodder yield was also significantly influenced by land configuration. M_2 recorded the highest fodder yield (16,732.92 kg ha^{-1}), followed by M_3 (14,469.81 kg ha^{-1}) and M_1 (13,805.14 kg ha^{-1}). The spacing S_3 produced the maximum green fodder yield (16,495.33 kg ha^{-1}), followed by S_5 (15,559.64 kg ha^{-1}) and S_1 recorded the lowest (13,413.03 kg ha^{-1}).

Table 3: Effect of land configuration and crop spacing on baby corn yield and green fodder yield

Treatment	Baby corn yield (kg ha^{-1})	Green fodder yield (kg ha^{-1})
Land configuration		
M_1 (Flatbed)	4,765.20	13,805.14
M_2 (Ridge and Furrow)	7,113.91	16,732.92
M_3 (Broad Bed and Furrow)	6,599.25	14,469.81
SEm±	50.26	224.78
CD (0.05%)	202.65	906.25
Crop spacing		
S_1 (45 cm × 15 cm)	5,601.97	13,413.03
S_2 (45 cm × 20 cm)	5,582.22	14,600.35
S_3 (45 cm × 25 cm)	7,215.02	16,495.33
S_4 (45 cm × 30 cm)	5,752.26	14,944.75
S_5 (60 cm × 20 cm)	6,645.81	15,559.64
SEm±	127.15	362.83
CD (0.05%)	373.32	1,065.33

Post-Harvest Soil Properties

Post-harvest soil properties including pH, electrical conductivity (EC), and organic carbon were non-significantly affected by land configuration and crop spacing. Soil pH ranged from 7.24 to 7.25 across land configurations and 7.24 to 7.26 across crop spacings. EC ranged from 0.33 to 0.34 dS m^{-1} and organic carbon from 0.47 to 0.48% all within non-significant limits.

able 4: Effect of Land Configuration and Crop Spacing on Post-Harvest Soil Properties

Treatment	Soil pH	EC (dS m^{-1})	Organic Carbon (%)
Land Configuration			
M_1 (Flatbed)	7.24	0.33	0.47
M_2 (Ridge and Furrow)	7.25	0.33	0.48
M_3 (Broad Bed and Furrow)	7.25	0.34	0.48
SEm±	0.05	0.02	0.01
CD (0.05%)	NS	NS	NS
Crop Spacing			
S_1 (45 cm × 15 cm)	7.24	0.33	0.47
S_2 (45 cm × 20 cm)	7.25	0.34	0.47
S_3 (45 cm × 25 cm)	7.25	0.34	0.48
S_4 (45 cm × 30 cm)	7.24	0.33	0.47
S_5 (60 cm × 20 cm)	7.26	0.34	0.47
SEm±	0.06	0.02	0.03
CD (0.05%)	NS	NS	NS

Summary and Conclusions

The present field investigation entitled “Effect of Different Land Configuration and Crop Geometry on baby corn (*Zea mays* L.)” was conducted at the Instructional Farm, Integral University, Lucknow during *Kharif* season 2025–26. The experiment comprised three land configurations (Flatbed – M_1, Ridge and Furrow – M_2, Broad Bed and Furrow – M_3) and five crop spacing levels (S_1 to S_5), laid out in Factorial Randomized Block Design with three replications. Based on the results and discussion of the study, the following conclusions are drawn:

Land Configuration: Ridge and Furrow (M_2) was significantly superior in plant height (164.03 cm at harvest), dry matter accumulation (357.22 g plant^{-1}), number of cobs per plant (2.81), cob length with husk (14.17 cm), cob weight (26.37 g), baby corn yield (7,113.91 kg ha^{-1}) and green fodder yield (16,732.92 kg ha^{-1}) over Flatbed and Broad Bed and Furrow systems.

Crop Spacing: The spacing of 45 cm × 25 cm (S_3) was found to be the most productive spacing, recording maximum plant height, dry matter accumulation, number of cobs per plant (2.81), cob attributes, baby corn yield (7,215.02 kg ha^{-1}) and green fodder yield (16,495.33 kg ha^{-1}).

Phenological Parameters: Days to tasseling and days to silking were non-significantly affected by either land configuration or crop spacing, confirming that these parameters are primarily governed by varietal characteristics and thermal environment.

Post-Harvest Soil Properties: Soil pH, EC and organic carbon remained statistically unaffected by any of the land configurations or crop spacing treatments, indicating that baby corn short duration (50–60 days) was insufficient to cause measurable changes in soil chemical properties within a single season.

On the basis of the results obtained in the present study the following conclusions are being made:

1. Based on the performance of baby corn under different land configuration and spacing treatments, M_2 (Ridge and Furrow) was recorded superior over M_1 (Flatbed) and M_3 (Broad Bed and Furrow) with spacing S_3 (45 cm × 25 cm) for most of the growth, yield related attributes. M_2 (ridge and furrow) and S_3 (45cm×25cm) recorded the maximum baby corn yield of 7,113.91 kg ha^{-1} (49.27% increase over Flatbed) and 7,215.02 kg ha^{-1} (29.25% increase over 45 × 20 cm) respectively, showing its suitability for improving productivity under the agro-climatic conditions of Lucknow.
2. Among the soil and plant nutrient parameters under different land configuration and crop geometry, there is no major differences observed as all the parameters were shown non-significant. However, an increased available Potassium was recorded in M_2 (Ridge and Furrow) and spacing 45 × 25 cm (S_3).

Hence, on the basis of the present investigation, it can be concluded that Ridge and Furrow land configuration combined with a crop spacing of 45 cm × 25 cm is the most suitable agronomic practice for baby corn production in the Indo-Gangetic plains of Uttar Pradesh. This combination provides optimal soil physical conditions through improved drainage, aeration and root proliferation, while the moderate intra-row spacing balances plant population with per-plant resource availability, maximizing both individual plant performance and total crop productivity.

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