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Effect of land configuration on yield and yield attributes on different *kharif* crops under rainfed situations

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Abstract
The experiment was carried out at S.G. College of Agriculture and Research Station, Jagdalpur, Bastar, IGKV, Raipur (C.G.) during the *Kharif* season of 2022 with a split plot design as the experimental setup. The plant height was significantly affected, with M3 resulting in the tallest plants, followed by M1 and M2 producing the shortest plants. Maize crop consistently showed taller plants throughout growth stages compared to other crops. C1 (Rice) had the highest tiller count, while cowpea exhibited the most branches. M3 outperformed other treatments significantly in number of grains per panicle, cobs per plant, and pods per plant. Finger millet (C3) showed notably high results for grains per panicle. M3 also had significantly higher test weight, while cowpea had higher test weight than other crops, and sesame had the lowest. Broad bed furrow with rice and cowpea displayed significantly higher test weight, similar to M1. M3 excelled in grain yield per hectare, whereas M2 had the lowest. Cowpea had notably higher green pod yield. M3 recorded the highest harvest index, similar to M1 and M2. Maize had significantly higher harvest index, while sesame had the lowest.

Keywords: Land configuration, broad bed furrow, crops

Introduction
Rainfed agriculture is a type of farming that relies on rainfall for water. Nearly 70% of the world's poor reside in rural regions and rely on production systems supported by rainfall for their income. India is the largest rainfed agricultural nation in the world in terms of both area (86 Mha) and produce value. In India, about 51.20 per cent of India's net cultivated area (140 Mha) is taken up by rainfed agriculture, which also provides roughly 40% of the country's population with a living wage and contributes 44% to the nation's total food supply, Anonymous (2021) [1].

One of the main issues influencing agricultural production under rainfed farming is the uncertainty and fluctuation of rainfall both in space and time. Due to the monsoon's anomalous behaviour throughout the same season, the crop is frequently affected which reduces productivity by both water logging and a soil moisture deficiency. Land surface management techniques improves soil moisture, which stabilizes crop production in a rainfed ecosystem at a certain level.

Land configuration is the technique by which the rainwater has to be trapped on the soil surface when rainfall exceeds the infiltration rate. This method aims to increase the capacity of the soil profile to store water throughout the growing season for crops (Ramesh and Rathika, 2009) [10]. The BBF (Broad Bed Furrow) strategy is one of the in-situ moisture conservation techniques and is renowned for its water conservation, automated weeding, fertiliser placement, available moisture conservation, decreased lodging, and improved crop stand (Swapna *et al*., 2020) [11].

Materials and Methods
The current experiment was held at the Research cum Instructional Farm, S.G. College of Agriculture and Research Station, Jagdalpur, IGKV, Raipur during *Kharif* 2022. The field experiment was carried out in split plot design where plot was replicated thrice with three main plots *viz*., opening furrow after two rows (M1), opening furrow after four rows (M2) and BBF (Broad Bed Furrow; M3) and five sub plots having five different crops *viz*., rice (C1), maize (C2), finger millet (C3), cowpea (C4) and sesamum (C5).

The experimental data collected at various phases of growth was compiled and statistically analysed using Fischer's method of analysis of variance as described by Gomez and Gomez (1984) [3]. The level of significance employed in the 'F' test was 5%.

Results and Discussion

The plant height of the crops was significantly influenced by the land configuration, with M3 (Broad bed furrow) resulting in the tallest plants, followed by M1 (Opening furrow after two rows), and M2 (Opening furrow after four rows) producing the shortest plants. Maize consistently exhibited taller plants at all growth stages compared to sesame and cowpea, which showed shorter plants at different stages. Similar findings were also found by the Jnanesha *et al*. (2016) [5] reported that broad bed and furrow had considerably greater plant heights than flat bed. Rice (C1) had the highest number of tillers both at 30 days after sowing and at harvest, while cowpea showed the most branches at 60 days after sowing. It could be owing to the availability of greater soil moisture for improved overall plant development when using the broad bed approach Archana, *et al*. (2021) [2]. The flowering and maturity times varied significantly among different land configurations and crops. M3 and C4 (cowpea) exhibited early flowering, while M2 and C1 (rice) showed late flowering. Similarly, M3 showed early maturity, whereas M2, C4, and C1 showed late maturity. Regarding yield attributes, M3 (Broad bed furrow) outperformed other treatments significantly in terms of grains per panicle, cobs per plant, and pods per plant. M1 and M2 had similar and significant results for these attributes. For the different field crops, finger millet (C3) showed highly significant results for grains per panicle. The results were in line with the Kantwa *et al.* (2005) [6], Venkatakrishnan, (1998) [12], and Lomte (2006) [9]. M3 also achieved significantly higher test weight compared to other treatments, while C4 (cowpea) had significantly higher test weight compared to all other crops, and C5 (sesame) had the lowest test weight. Broad bed furrow with rice and cowpea displayed significantly higher test weight, similar to treatment M1. Similar results were also found by Halli and Angadi (2019) [4], who reported that higher seed index was recorded with broad bed furrow method of planting as compared to ridges and furrow method. In terms of grain yield per hectare, M3 (Broad bed furrow) outperformed other land configurations, while M2 (Opening furrows after two rows) had the lowest grain yield per hectare. Among different crops, cowpea (C4) had noticeably higher green pod yield. M3 recorded the highest harvest index among land configuration treatments. Maize (C2) crop had significantly higher harvest index, while sesame (C5) had the lowest harvest index.

Table 1: Effect of different land configuration and crops on plant height

Treatment	Plant height (cm)		
	30 DAS	60DAS	At harvest
Land configuration			
M1: Opening of furrow after 2 rows	24.79	67.29	91.03
M2: Opening of furrow after 4 rows	22.61	63.50	85.41
M3: Broad bed furrow	29.36	72.76	98.77
SEm±	0.35	1.71	1.35
CD at 5%	1.39	6.70	5.31
CV%	5.37	9.74	5.71
Crops			
C1: Rice	24.03	63.78	86.82
C2: Maize	31.11	81.73	114.30
C3: Finger millet	22.47	75.37	97.51
C4: Cowpea	29.35	50.43	70.64
C5: Sesame	20.98	67.95	89.40
SEm±	0.96	1.60	2.22
CD at 5%	2.79	4.66	6.49
CV%	11.20	7.07	7.27

Table 2: Effect of different land configuration and crops on number of branches and tillers

Treatment	Number of branches and tillers		
	30 DAS	60 DAS	At harvest
Land configuration			
M1: Opening of furrow after 2 rows	0.53	2.49	2.89
M2: Opening of furrow after 4 rows	0.51	2.05	2.81
M3: Broad bed furrow	0.73	2.80	3.27
SEm±	0.02	0.05	0.07
CD at 5%	0.07	0.19	0.28
CV%	11.83	7.70	9.36
Crops			
C1: Rice	2.60	3.91	5.43
C2: Maize	0.00	0.00	0.00
C3: Finger millet	0.02	1.44	1.87
C4: Cowpea	0.20	4.11	3.84
C5: Sesame	0.13	2.78	3.80
SEm±	0.02	0.09	0.14
CD at 5%	0.05	0.26	0.40
CV%	9.44	11.11	13.67

Table 3: Interaction between land configuration × crops on number of branches and tillers at 30 DAS

Treatment	Rice	Maize	Finger millet	Cowpea	Sesame
Opening of furrow after 2 rows	2.67	0.00	0.00	0.00	0.00
Opening of furrow after 4 rows	2.47	0.00	0.07	0.00	0.00
Broad bed furrow	2.67	0.00	0.00	0.60	0.40
Interaction(M×C)	CD at 5%		SEm±		CV%
	0.11		0.40		9.44

Table 4: Interaction between land configuration × crops on number of branches and tillers at 60 DAS

Treatment	Rice	Maize	Finger millet	Cowpea	Sesame
Opening of furrow after 2 rows	4.07	0.00	1.40	4.13	2.87
Opening of furrow after 4 rows	3.33	0.00	1.27	3.27	2.40
Broad bed furrow	4.33	0.00	1.67	4.93	3.07
Interaction(M×C)	CD at 5%		SEm ±		CV%
	0.48		0.11		11.11

Table 5: Effect of different land configuration and crops on days to flowering and maturity

Treatment	Days to 50% flowering	Days to maturity
Land configuration		
M1: Opening of furrow after 2 rows	65.37	96.60
M2: Opening of furrow after 4 rows	67.65	99.20
M3: Broad bed furrow	63.50	94.60
SEm±	0.28	0.45
CD at 5%	1.08	1.77
CV%	1.63	1.80
Crops		
C1: Rice	79.18	106.33
C2: Maize	57.97	91.00
C3: Finger millet	68.17	103.33
C4: Cowpea	53.34	89.00
C5: Sesame	68.87	94.33
SEm±	0.30	0.66
CD at 5%	0.88	1.91
CV%	1.39	2.02

Table 6: Effect of different land configuration and crops on yield attributes

Treatment	Yield attributes	
	No. of grains panicle^{-1}, cob^{-1}, pod^{-1}	Test weight (g)
Land configuration		
M1: Opening of furrow after 2 rows	540.53	14.52
M2: Opening of furrow after 4 rows	531.65	14.12
M3: Broad bed furrow	546.10	14.77
SEm±	7.13	0.05
CD at 5%	28.00	0.20
CV%	5.12	1.40
Crops		
C1: Rice	91.80	23.93
C2: Maize	482.85	17.66
C3: Finger millet	2055.86	3.45
C4: Cowpea	13.53	24.15
C5: Sesame	53.11	3.16
SEm±	9.87	0.15
CD at 5%	28.81	0.45
CV%	5.49	3.19

Table 7: Interaction between land configuration × crops on test weight (g)

Treatment	Rice	Maize	Finger millet	Cowpea	Sesame
Opening of furrow after 2 rows	24.11	17.61	3.47	24.25	3.15
Opening of furrow after 4 rows	22.77	17.52	3.42	23.78	3.11
Broad bed furrow	24.91	17.86	3.45	24.40	3.24
Interaction(M×C)	CD at 5%		SEm ±		CV%
	0.80		0.12		3.19

Table 8: Effect of different land configuration and crops on yield and its attributes

Treatment	Grain yield (q ha^{-1})	Stover yield (q ha^{-1})	HI (%)
Land configuration			
M1: Opening of furrow after 2 rows	35.90	71.19	33.19
M2: Opening of furrow after 4 rows	33.60	68.90	32.67
M3: Broad bed furrow	41.17	78.12	33.32
SEm±	0.57	1.43	0.24
CD at 5%	2.24	5.60	0.93
CV%	5.98	7.60	2.75
Crops			
C1: Rice	31.49	41.33	43.08
C2: Maize	44.81	56.34	44.29
C3: Finger millet	23.57	53.08	30.72
C4: Cowpea	78.22	185.41	29.67
C5: Sesame	6.37	27.52	18.82
SEm±	0.93	2.08	0.29
CD at 5%	2.72	6.07	0.85
CV%	7.59	8.57	2.62

Table 9: Interaction between land configuration × crops on grain yield (q ha^{-1})

	Rice	Maize	Finger millet	Cowpea	Sesame
Opening of furrow after 2 rows	29.91	44.04	23.37	76.04	6.16
Opening of furrow after 4 rows	25.84	40.71	21.16	74.19	6.11
Broad bed furrow	38.70	49.68	26.20	84.45	6.84
	CD at 5%		SEm ±		CV%
Interaction (M×C)	4.99		1.27		7.59

Conclusions

At a glance, the study demonstrated that the Broad bed furrow (M3) land configuration was the most effective in improving crop performance, resource utilization, and it produces higher growth parameters and yield when compared to other treatments in rainfed *Kharif* crops in the upland conditions of the Bastar Plateau Zone, Chhattisgarh.

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