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Growth Response of Maize (*Zea mays*) Varieties to Different Land Configuration under Organic Production System in Acid Soils of Meghalaya

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Abstract: Maize is second most important crop after rice in Meghalaya with significant and very high potential for exploring its diversity for varied agro-climatic situation in organic farming system. The intervention to address different soil and climatic constraints is second most important area of investigation which is followed by research theme of exploring the genotypic diversity of maize in Meghalaya. A field experiment was planned at Instructional Farm of College of Agriculture (CAU-I), Kyrdemkulai to test the performance of four maize cultivars ((RCM-75, RCM-76, DA-61-A and RCM 1-2) with treatment variables of land configuration (ridges and furrow, furrow irrigated raised bed and flat bed) and conditions of late planting and organic production system. Maize variety DA-61-found statistically superior over RCM-1-2 in terms of stand establishment and recorded highest number of plants with cobs and tassel at harvest. Among the land configuration, ridges and furrow planting had highest dry matter accumulation and found significantly superior over flat bed planting of maize. The increase in dry matter accumulation in ridges and furrow method was 3.42 and 6.9 g/plant over furrow irrigated raised bed and flat bed, respectively; while root dry matter in ridges and furrow was higher by 1.24 to 1.66 g/plant than other land configuration. The investigation showed the significant contribution of land configuration for crop survival and growth under late planting condition along with varietal selection.

INTRODUCTION

Maize (*Zea mays*) is promising cereal in India and rank third after rice and wheat in production and showed increased in area by 1.4 time, production 2.7 times and productivity by 1.6 times from 2000-01 to 2018-19; while Meghalaya it is a second largest grown crop followed by rice and showed promising growth by increasing area by 0.7 %, production by 5 % and productivity by 1.8 % within fiveyear (form 2013-14 to 2017-18) (Anonymous, 2019). Being newly introduced species diversity (for e.g. baby corn, sweet corn, etc.) and varieties/ hybrids for commercial production, the cultivation practices are mixture of traditional practices and practices introduced institutionally through different maize promotion programmes (Ansari et al., 2015). The major intervention introduced in state for shaping the crop cultivation includes, new varieties, spraying of neem formulation, use of different biodynamic formulation for growth enhancement, intercropping with pulses such as soybean, relay cropping with French bean, intercropping with different vegetables and different land configuration. The land configuration play important role inNorth East Hill (NEH) regionwhere the soil physical constraints such as soil erosion, shallow soil depth, low fertility and washing of soil and manures due to runoff affect the crop productivity to a great extend.The rate of erosion in North East Hill region is 5.0 to 68.20

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t/ha (Saha et al., 2012); which indicates severity of soil physical constraints. The changing the soil depth and drainage property due to land configuration affects crop establishment, root formation, crop survival and mortality and all these showed the effect on reproductive growth of plant.Considering the potential of different land configuration in reducing the impact of soil physical constraints, its evaluation in maize with different production factors such as organic production system, late planting condition and varietal evaluation in combined manner will be worthy and therefore the present study was planned.

MATERIAL AND METHODS

The field experiment was conducted at Instructional Farm of College of Agriculture (CAU-I), Kyrdemkulai, Meghalaya located at 25^0 74′ N latitude, 91^0 81′ E longitude and 700 meter above mean sea level) in *kharif* season of 2021-22. The climate of selected area is subtropical with average seasonal (June to September) and annual rainfall of 1424.1 mm and 2119.3 mm, respectively. The experiment was planned in split plot design with three main plot and four sub-plots with three replications. The main plots were land configuration viz., ridges and furrow, furrow irrigated raised bed and flat bed; while sub-plots treatments were four maize varieties (RCM-75, RCM-76, DA-61-A and RCM 1-2). The land cleared off from forest vegetation in 2019 and sown with oat (*Avena sativa*) in *rabi* season of 2019; while in 2020-21 field was planted with Maize–Pea–Linseed cropping system.The field was prepared by giving two pass of power tillers followed by collection of stubbles. After field preparation, ridges and furrow were prepared by keeping 50 cm spacing between centers of ridges; while raised bed were prepared to occupy two rows of maize followed by furrow of 30 cm width and 15 cm deep. For flat bed no any arrangement were made except bund on all side of the plots to separate plots. Sowing of crop was done on 29^{th} and 30^{th} June, 2021 by dibbling seed at spacing of 50 ×20 cm in all three land configurations followed by gap filling at 10 and 15 DAS. The rate of manure application was decided by considering nitrogen requirement of 120 kg/ha as 100 % recommended rate of nitrogen application. The Pongamia cake is used as a source of manure and nitrogen content in it was 2.5 % N. The entire quantity of manure was applied below the seed manually by making a shallow depressing using row maker one day before the sowing. For weed management two weeding at 25 and 45 days after sowing (DAS) was done and crop was grown as rainfed crop. For management of insect pests and fall army worm, cultural practices such as hand picking, application of mud/soil inside whorls in early growth stage and spraying of neem seed kernel extract was done. Plant population count was taken at 60 DAS and at harvest for entire plot; while plants with cob and tassel were counted at harvest. Plant height measured by taking height of topmost leaf at 60 DAS and height of tassel at harvest.At harvest, dry matter portioning was recorded by measuring the weight of stem, leaf, rot, tassel and cob after oven drying at 60 ± 2^0C temperature. The statistical significance among applied treatments were studied using the F-test and least significant difference (LSD) values ($P = 0.05$).

RESULTS AND DISCUSSION

Among the varieties, DA-61-A found better in survival with highest number of total plants per plot at harvesting as well as highest number of plants with tassel and cobs at harvesting (Table 1). This variety was remained on par with RCM-76 and RCM-75 and found significantly superior over RCM-1-2 in terms of survival. The plant population decrease was 13.5 to 31.3 % at harvest over 60 DAS; while 66.7 – 90.9 % and 59.3 – 70.8 % of the total plant populationsurvived bear tassel and cob, respectively. All varieties perform superior in ridges and furrow method of planting. The ridges and furrow found significantlysuperior over flat bed in at all observations of plant population, plant with cob and plant with tassel; while remained on par with furrow irrigated raised bed for plant population at 60 DAS and plants with cobs. All three methods remain on par with respect to plant with tassel. The variation in survival and reproductive growth among land configuration showed their role in reducing the stress arose due

Table 1: Influence of different land configurationson growth behaviour of maize varieties

Treatments	*Plant population (No.)*		*Plant with tassel (No.) at harvest*	*Plant with cobs (No.) at harvest*	*Plant height (cm)*		*Dry matter accumulation (g/plant)*					
	60 DAS	*At Harvest*			*60 DAS*	*At harvest*	*Shoot*	*Root*	*Leaf*	*Tassel*	*Cob*	*Total*
Flat bed												
RCM-76	30	22	19	15	58.2	103.3	10.16	5.55	6.35	2.70	21.58	46.3
RCM-75	29	22	20	15	58.0	102.2	10.06	5.47	6.30	2.68	21.17	45.7
DA-61-A	32	24	22	17	62.1	104.8	10.38	5.80	6.56	2.81	21.77	47.3
RCM 1-2	29	20	18	14	55.0	95.4	9.90	5.22	6.17	2.64	21.08	45.0
Mean	30	22	20	15	58.33	101.4	10.1	5.51	6.35	2.71	21.40	46.1
Furrow irrigated raised bed												
RCM-76	34	25	21	16	60.3	106.2	10.75	5.86	6.72	2.85	22.83	49.0
RCM-75	34	25	22	16	60.2	107.1	11.01	5.99	6.90	2.93	23.18	50.0
DA-61-A	34	26	23	17	61.8	112.3	11.41	6.37	7.21	3.08	23.92	52.0
RCM 1-2	32	22	19	15	58.0	99.1	10.41	5.51	6.47	2.78	22.16	47.3
Mean	34	25	21	16	60.1	106.2	10.90	5.93	6.83	2.91	23.02	49.58
Ridges and furrow												
RCM-76	36	30	24	18	63.1	109.8	11.15	6.13	7.04	2.99	23.69	51.0
RCM-75	36	30	24	18	63.9	111.8	11.38	6.26	7.17	3.06	24.13	52.0
DA-61-A	37	32	26	19	64.9	112.8	12.20	6.62	7.64	3.28	25.77	55.5
RCM 1-2	35	27	18	16	62.0	102.1	10.98	9.68	6.93	2.96	22.92	53.5
Mean	36	30	23	18	63.48	109.1	11.43	7.17	7.20	3.07	24.13	53.0
LSD (*P*= 0.05)												
Land Configuration	4.88	1.31	3.54	2.72	2.92	4.08	0.96	0.98	0.65	0.25	2.10	4.32
Varieties	6.54	3.52	3.68	3.67	4.93	4.49	0.79	0.83	0.48	0.21	1.70	3.48
Land Configuration × Varieties	8.39	9.42	5.32	6.58	7.44	6.68	1.34	1.53	0.85	0.36	2.77	6.07

(DAS: days after sowing)

to soil physical displacement due to runoff. Plant height washighest in DA-61-A grown in ridges and furrow and remained on par with same variety grown in other land configuration at 60 DAS; while at harvest, height was significantly higher in ridges and furrow compared to flat bed planting. The increase in plant height in ridges and furrow at harvest was2.9 cm and 7.7 cm over furrow irrigated raised bed and flat bed, respectively.

The dry matter accumulation at harvest in furrow irrigated raised bed and ridges and furrow remain on par for all plant part except root. Increase in root dry matter in ridges and furrow was 1.24 to 1.66 g/ha over other land configuration indicating indirect role of land configuration in nutrient acquisition. The variation in nutrient acquisition due to land configuration was reported by Babu et al. (2020). The highest total dry matter accumulation at harvest was recorded in DA-61-A (55.5 g/plant) in ridges and furrow and remain on par with RCM 1-2 in ridges and furrow; while in case other land configurations, DA-61-A had significantly highest plant dry matter accumulation than other varieties. The performance of RCM-1-2 was inferior to all other varieties in flat bed and furrow irrigated raised bed for total dry matter production at harvest; while in ridges and furrow it has higher dry matter accumulation. This indicates variation in varietal performance across land configuration. Out of total dry matter accumulation cob and shoot had 42.8–46.8% and 20.5–22.0 % dry matter accumulation. Our study concludes that, land configuration and varietal selection play role in important alleviating the stresses arises due to late planting. Performance of ridges and furrow was found superior than all other land configuration and among variety DA-61-A was found superior in all three land configuration studied.

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