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Performance of various farming practices on growth, yield and soil nutrient status of *kharif* rice under lateritic soil

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Abstract
A field experiment was conducted during the *kharif* season of 2020-21 and 2021-22 at the Agronomy farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.). The experimental soil was sandy clay loam texture, slightly acidic (pH) reaction, high in organic carbon, and low in available N, low in available P_2O_5 and medium in available K_2O. The experiment was laid out in RBD comprising of 4 treatments replicated five times. The treatments comprised of different farming practices *viz*., low budget, organic, conservation and conventional farming practices. During the course of investigation, growth observations of rice was recorded periodically from 30 DAT till at the harvest at an interval of 30 days and yield contributing characters and yields were recorded at harvest to evaluate the treatment effects. The uptake of major nutrients by the *kharif* rice was analyzed and interpreted. Similarly, economics of different treatments was worked out. The growth parameters like plant height, number of tillers, number of leaves and dry matter accumulation were significantly higher under conservation farming practice followed by conventional, organic and low budget farming practices in that descending order of significance in the pooled data. The grain and straw yield of rice was significantly higher under conservation farming practice as compared to rest of the treatments, whereas soil pH, organic carbon, available N, available P and available K performed better result under organic farming practice than other treatments which was followed by conservation, conventional and low budget farming practice. Thus, the study suggested that conservation and organic farming practice could be the best farming practices for sustainable growth and production as well as nutrient status of the soil in *kharif* rice under lateritic soil.

Keywords: Conservation, organic, farming practice, low budget

Introduction
Rice (*Oryza sativa* L.) is the main staple food crop for over fifty per cent population worldwide. Rice based cropping system is the hugest source of livelihood of larger part of rural community in Konkan, which be placed along the Arabian seacoast at the extreme western part of the Indian peninsular region. The rice crop is adopted to an extensive range of climatic conditions, as such, cultivated lands ranges from coastal lowlands, floodplains and deltas to forested hills and mountains. It is predicted that in India is expected to reach 1.6 billion people by 2050 when it will beyond the China as the hugest populous country of the earth (Anonymous, 2022) [1]. In India, food will have to be produced from contracting land resources because there is no further land for cultivation. Number of scientists and researchers developed sustainable production technology which has been restricted to individual crop, but there is need to work with cropping system that farmers enhanced the crop production and such every crop is grown under such certain system. (Ray, Mueller, West, & Foley, 2013) [5]. Indian soil is suffering from many nutrient deficiencies due to application of unbalanced fertilizer doses and lack of organic material in cultivated filed (Meena *et al*. 2017, Amit Kumar *et al*. 2018) [13, 2]. Important of low budget, organic, conservation and conventional farming practices in situation, specific resource based, changing climate and technology-based condition along with suitable cropping system needs to be identified for sustainable production of rice based cropping system under lateritic soils of Konkan region.

Material and Methods
The field experiment was initiated in year 2020-21 and 2021-22 at the Agronomy farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.) The climatic condition are hot humid to

sub humid with will expressed three season *viz*., rainy, winter and summer. The mean rainfall is 3500 mm, of which about 90 per cent received during the month of June to October with about 95 to 100 rainy days in most of the year. The experimental soil was sandy clay loam texture, slightly acidic (pH) reaction, high in organic carbon, and low in available N, low in available P_2O_5 and medium in available K_2O. The experiment was laid out in RBD which comprising of 4 treatments replicated five times as a Pseudo-replication. The treatments comprised of different farming practices *viz*., low budget, organic, conservation and conventional farming practices. During the course of investigation, growth observations of rice was recorded periodically from 30 DAT till at the harvest at an interval of 30 days and yield contributing characters and yields were recorded at harvest to evaluate the treatment effects. The uptake of major nutrients by the *kharif* rice crop were analyzed and interpreted.

Results and Discussion

Effect on growth attributes

The data on the Growth attributes like mean plant height (cm), mean number of tillers hill^{-1}, mean number of leaves hill^{-1} and dry matter accumulation hill^{-1} (g) of *kharif* rice are presented in Table 1. Result revealed that the conservation (C_3) farming practice recorded significantly higher values of growth attributing characters *viz*., mean plant height (68.20 cm), mean number of tillers hill^{-1} (10.98), mean number of leaves hill^{-1} (10.52) and dry matter accumulation hill^{-1} (76.90 g)under study followed by conventional (C_4), organic (C_2) and low budget (C_1) farming practices in that descending order of significance during both the years of experimentation and in the pooled data. This might be because of more favourable weather condition, efficient fertilizer use and increasing soil temperature due to application of mulching. These results are accordance with findings of Yadav *et al.* (2016) [10], Singh *et al*. (2018) [15] and Srinivas *et al*. (2019) [9].

Effect on yield attributes

The data pertaining to yield attributes of rice crop like mean number of panicles hill^{-1}, length of panicle (cm), weight of panicle hill^{-1}, number of filled grains panicle^{-1} and test weight (g) are presented in Table 2. The data reveled that, yield attributes *viz*., mean number of panicles hill^{-1} (11.62), length of panicle (21.81 cm), weight of panicle hill^{-1} (41.47), number of filled grains panicle^{-1} (140.00) and test weight (25.33 g) were recorded significantly higher in conservation farming practices under study than rest of the treatments which was followed by conventional, organic and low budget farming practices during investigation in the pooled data of two years. The beneficial effect of conservation farming practice in enhancing the growth through increased plant height, leaves, tillers and dry matter accumulation ultimately reflected in higher yield attributing characters. Similar results were also found by Seema *et al.* (2016) [12] and Nahar *et al*. (2017) [4].

Effect on grain and straw yield

The data regarding grain and straw yield of *kharif* rice is presented in Table 2 discovered that the conservation farming practice reported significantly the highest grain (43.30 q ha^{-1}) and straw (66.15 q ha^{-1}) yield of *kharif* rice than rest of the treatments followed by conventional, organic and low budget in that descending order of significance during the study in the pooled data of two years. The grain yield of rice is a function of all these yield contributing characters of individual plants and ultimately higher grain and straw yield was received from the *kharif* rice. Similar results were observed in the research conducted by Singh *et al*. (2017) [14].

Effect on soil properties

The data presented in Table 3 revealed that, the mean soil pH (6.05) and available P_2O_5 (13.90) recorded significantly higher when rice crop cultivated under organic farming practice followed by conservation, conventional and low budget farming practices, whereas organic carbon, available N and available K_2O failed to show significant result during the investigation and pooled data of two years. It might be due to application of high organic fertilizers to same farming practice results the highest available nutrients. The results are also conformity with the results reported by Yadav *et al*. (2018) [11].

Conclusion

Major objective of the study to identify suitable farming practice for sustainable production of *kharif* rice under lateritic soils of Konkan region. It can be concluded that for achieving higher sustainable production of crops, the adoption of conservation farming practice holds to be better management practice option.

Table 1: Effect of different farming practices on various growth parameters at harvest during 2020 and 2021 (Pooled data) of *kharif* rice

Farming practices	Plant height (cm)	Number of tillers hill^{-1}	Number of leaves hill^{-1}	Dry matter accumulation hill^{-1} (g)
C_1: Low budget	61.44	7.38	3.18	44.24
C_2: Organic	62.96	9.86	4.92	51.43
C_3: Conservation	68.20	10.98	10.52	76.90
C_4: Conventional	66.48	10.30	7.00	60.04
SE (m) ±	0.52	0.17	0.26	0.61
C.D. at 5 %	1.30	0.43	0.65	1.51
G.M.	64.77	9.63	6.41	58.15

Table 2: Effect of different farming practices on yield and yield attributes at harvest during 2020 and 2021 (Pooled data) of *kharif* rice

Farming practices	Number of panicles hill^{-1}	Length of panicle (cm)	Weight of panicle hill^{-1} (g)	Number of filled grains panicle^{-1}	Test weight (g)	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})
C_1 : Low budget	7.60	20.60	18.07	86.80	24.27	34.37	52.84
C_2 : Organic	10.20	20.76	27.86	96.90	24.42	40.31	62.69
C_3 : Conservation	11.62	21.81	41.47	140.00	25.33	43.30	66.15
C_4 : Conventional	10.50	20.93	32.32	113.80	24.70	41.93	63.56
SE (m) ±	0.22	0.17	0.66	0.73	0.09	0.26	0.34
C.D. at 5 %	0.56	0.43	1.64	1.81	0.22	0.63	0.84
G.M.	9.98	21.02	29.93	109.38	24.68	39.98	61.31

Table 3: Effect of different farming practices on soil properties after harvest of *kharif* rice during 2020 and 2021 (Pooled data)

Farming practices	pH	Organic carbon (%)	Available N (Kg ha^{-1})	Available P_2O_5 (Kg ha^{-1})	Available K_2O (Kg ha^{-1})
C_1 : Low budget	5.99	1.12	250.15	10.45	107.74
C_2 : Organic	6.05	1.15	249.10	13.90	108.59
C_3 : Conservation	5.97	1.13	250.80	11.80	108.01
C_4 : Conventional	6.00	1.10	247.32	11.53	107.99
SE (m) ±	0.02	0.02	1.63	0.35	0.22
C.D. at 5 %	0.04	NS	NS	0.86	NS
G.M.	6.00	1.12	249.34	11.92	108.08

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