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ORIGINAL ARTICLE **OPEN ACCESS**

Response of tillage methods, land configurations and sources of Nutrients on the yield performance of direct seeded rice (*Oryza Sativa* L.)

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ABSTRACT

Two years research experiment was conducted during Kharif season of 2014 and 2015 to investigate the, "Effect of methods of tillage, land configuration and sources of nutrients on the performance of direct seeded rice. (Oryza sativa L.)" at Agronomy Farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.). The soil of the experimental plot was medium in available nitrogen, low in available phosphorus and fairly high in available potassium. The field experiment was laid out in split-split plot design comprising 30 treatment combinations replicated thrice. Main plot treatment consisted of three tillage methods, Zero tillage (crop harvest at ground level), Conservation tillage (stubble mulch) and Conventional tillage. The sub plot treatment consisted of Land configuration i.e flat bed and raised bed while, sub-sub plot treatment comprised of five sources of nutrients, Absolute control (no fertilizers), recommended dose of fertilizer (100:50:50 NPK kg ha^{-1}), Konkan Annapoorna Briquettes (56:24:10 NPK Kg ha^{-1}), Konkan Annapoorna Briquettes (56:24:10 NPK Kg ha^{-1}) with soil application of Zinc sulphate @ 25 kg ha^{-1} and Copper sulphate @ 5 kg ha^{-1} and Modified Konkan Annapoorna Briquettes (46:20:8:8:1.5 N:P:K :Zn: Cu Kg ha^{-1}). In the pooled analysis treatment conventional tillage recorded significantly the highest grain yield than the rest of treatments except conservation tillage which was on par with conventional tillage. Significantly the lowest grain yield was registered under the treatment zero tillage. Treatment flat bed (recorded significantly more grain and straw yield over the treatment raised beds of grain and straw yield in both the years. From the pooled data analysis it was observed that, treatment KAB + soil application of micronutrients recorded significantly the highest grain yield while treatment of absolute control- no fertilizers obtained significantly the lowest grain yield over the rest of sources of nutrients.

Keywords: *tillage, land configuration, sources of nutrients, rice*

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INTRODUCTION

Rice (*Oryza sativa* L.) is life for most people living in country. Rice in Konkan is being grown mostly as puddled transplanted crop. This method of cultivation involves labour intensive practices like traditional 'Rab', raising seedlings, uprooting and transplanting them in puddle fields. The main reasons for low productivity in Konkan are untimely/delayed transplanting, low plant population per unit area, broadcast application of fertilizers in imbalanced proportion, poor water and weed management practices etc. In recent years, conventional rice production technologies have been leading to deterioration of soil health and declining farm profitability due to high inputs of water and labor. Conservation agriculture (CA) based resource-conserving technologies i.e. zero-tillage (ZT), raised-bed planting and direct-seeded rice (DSR) has shown promise as alternatives to conventional production technologies to overcome these problems [2].

Conservation tillage is a practice used in conventional agriculture to reduce the effects of tillage on soil erosion. Crop residues result when a previous crop is left anchored or loose after harvest or when a cover crop (legume or non-legume) is grown and killed or cut to provide mulch. Surface mulch helps reduce water losses from the soil by evaporation and also helps moderate soil temperature. Bed planting refers to a cropping system where the crop is grown on beds and the irrigation water is applied in furrows between the beds. This is common practice for row crops, but not for small grain crops such as wheat and

rice. The technique offers a number of advantages, such as improved fertilizer efficiency, better weed control and reduced seed rate. Adequate and balanced fertilizer management in association with manures is very much essential to exploit the full potential yield of rice.

MATERIAL AND METHODS

The present investigation was conducted at Agronomy farm, College of Agriculture, Dapoli, Dist. Ratnagiri (M.S.) during *Kharif* season of the years 2014 and 2015. The field experiment was conducted in plot no. 11 of 'A' block. The selection of site was considered on the basis of suitability of the land for cultivation of crop and resources available for rice crop in *Kharif* season. The field experiment was laid out in split-split plot design comprising of 30 treatment combinations replicated thrice. Main plot treatment consisted of three tillage methods, Zero tillage (crop harvest at ground level), Conservation tillage (stubble mulch) and Conventional tillage. The sub plot treatment consisted of Land configuration i-e flat bed and raised bed while, sub-sub plot treatment comprised of five sources of nutrients, Absolute control (no fertilizers), recommended dose of fertilizer (100:50:50 NPK kg ha^{-1}), Konkan Annapoorna Briquettes (56:24:10 NPK Kg ha^{-1}), Konkan Annapoorna Briquettes (56:24:10 NPK Kg ha^{-1}) with soil application of Zinc sulphate @ 25 kg ha^{-1} and Copper sulphate @ 5 kg ha^{-1} and Modified Konkan Annapoorna Briquettes (46:20:8:8:1.5 N:P:K :Zn:Cu Kg ha^{-1}).

Rice crop was directly sown at 22.5 cm spacing. While, flat bed consists of 16 Lines and raised bed consists of 12 lines, which was directly sown by drilling with the help of drum seeder. The crop was fertilized as per the treatments. In case of briquettes application fertilizer briquettes *viz.,* Urea- Godavari briquette was applied through deep placement method. Briquettes were manually placed at about 7 to10 cm @ 1 Briquettes in 22.5 cm line sowing rice crop after 14 days direct seeding of rice. For ascertaining the effect of different treatments on growth and development of rice, periodical observations were recorded. The observations were recorded at every 20 days interval from the date of sowing and at harvest. Treatment conventional tillage recorded higher plant height, number of tillers per 0.5 m length and dry matter accumulation per 0.25 m length of rice crop followed by conservation tillage which were at par with each other but recorded significantly superior over treatment zero tillage during both years of study. The yield contributing characters *viz*., number of panicle per 0.5 m length, length of panicle, number of filled grains/panicle and test weight were significantly influenced due to methods of tillage, during both the years of experimentation. However, treatment conventional tillage recorded higher number of tillers per 0.5 m length of panicle, number of panicles per tiller, number of filled grains/panicle and test weight followed by treatment conservation tillage which were at par with each other but significantly superior over treatment zero tillage (T_0). The rice crop grown by conventional method registered significantly the highest grain yield in 2014 and 2015 and straw yield which was followed by treatment conservation tillage which was at par with each other but found significantly superior over treatment zero tillage grain yield and straw yield during both the years.

However, in the pooled analysis treatment conventional tillage recorded significantly the highest grain yield than the rest of treatments except conservation tillage which was on par with conventional tillage. Significantly the lowest grain yield was registered under the treatment zero tillage. Significantly higher plant height, number of tillers per 0.5 m length and dry matter accumulation per 0.25 m length of rice was recorded in treatment flat bed (L_1) than raised bed (L_2) at all growth stages of crop growth except at 20 DAS during both the years of investigation. In respect of yield attributes, significantly more number of panicle (per 0.5 m length), length of panicle (cm), number of filled grains per panicle and test weight (g) noticed under treatment flat bed than raised bed during the both year of investigation.

RESULTS AND DISCUSSION

Effect of methods of tillage:

Data presented in Table 1 revealed that, significantly the highest grain yield was recorded by treatment conventional tillage (T_2), which was followed by treatment conservation tillage (T_1) which was at par, with each other but found significantly superior over treatment zero tillage (T_0). Treatment T0 recorded significantly the lowest grain yield as compared to different methods of tillage, during both the years. However, in the pooled analysis treatment conventional tillage (T_2) recorded significantly the highest grain yield than the rest of treatments except conservation tillage which was on par with conventional tillage. Significantly the lowest grain yield was registered under the treatment zero tillage (T_0). From the pooled data it was observed that, the increase in grain yield over zero tillage (T_0) due to treatments conventional tillage (T_2) and conservation tillage (T_1) was to the tune of 26.96 and 19.89 per cent, respectively. It may be due to more availability of nutrients and soil moisture for the longer period reduces percolation losses of irrigation water in rice production. The increased yield attributes might be

due to increased growth and development parameters which ultimately resulted in increased grain. These results corroborated the findings of Bhatt *et al*. [1] and Hussain *et al*. [4].

Effect of land configuration

Perusal of the data presented in Table 1 revealed that, different land configuration methods significantly influenced the mean grain yield (q ha^{-1}) of rice during both the years and in pooled mean. Treatment flat bed (L_1) recorded significantly more grain yield over the treatment raised beds (L_2) in both the years. The pooled analysis of two years also recorded similar results. Increased in grain yield due to treatment flat bed was to the tune of 4.95 per cent over raised bed (L_2). The results are in confirmation with the results reported by Brar *et al*. (2011).

Effect of sources of nutrient

Mean grain yield (q ha^{-1}) was significantly influenced due to different sources of nutrient during both the years of experimentation and in pooled mean. Significantly the highest grain yield was found in treatment of KAB + soil application of micronutrients (N_3) followed by treatment of application of modified KAB in combination with micronutrients

Table 1: Mean grain, straw yield of rice as influenced by different treatments during the years 2014, 2015 and in pooled data.

Treatment	Grain yield (q/ha^{-1})			Straw yield (q/ha^{-1})		
	2014	2015	Pooled mean	2014	2015	Pooled mean
A. Tillage methods (T)						
T_0-Zero tillage	36.25	33.41	34.83	43.30	37.03	40.16
T_1-Conservation tillage	41.85	41.68	41.76	49.35	45.15	47.25
T_2-Conventional tillage	44.41	41.78	43.09	52.07	45.88	48.98
S.Em. ±	1.13	1.11	0.79	1.44	1.56	1.06
C.D. at 5%	4.44	4.35	2.58	5.66	6.12	3.46
B. Land configuration (L) :						
L_1- Flat Bed	43.60	41.74	40.84	51.51	45.88	48.24
L_2- Raised Bed	38.08	36.16	38.95	44.97	39.50	42.69
S.Em. ±	0.76	0.77	0.54	1.10	1.16	0. 83
C.D. at 5%	2.63	2.65	1.50	4.12	4.03	2.31
C. Source of nutrient (N) :						
N_0- Absolute control	28.34	28.10	28.22	33.86	30.61	32.23
N_1-RDF	39.20	37.44	38.32	45.70	40.85	43.28
N_2- RDF with applying Zinc sulphate @ 25 kg + Copper sulphate @ 5 kg ha^{-1})	48.48	45.85	47.17	57.47	50.21	53.84
N_3 : KAB with Zinc sulphate @ 25 kg + Copper sulphate @ 5 kg ha^{-1})	41.60	39.65	40.62	48.71	43.33	46.02
N_4: Modified KAB in combi. with Zinc sulphate @ 25 kg + Copper sulphate @ 5 kg ha^{-1} (46 :20 : 8 : 8:1.5 N:P:K:Zn:Cu)	46.57	43.73	45.15	55.44	48.44	51.94
S.Em. ±	0.95	0.93	0.66	1.12	1.06	0.77
C.D. at 5%	2.69	2.65	1.86	3.19	3.00	2.16
General mean	40.84	38.95	39.90	48.24	42.69	45.46

(N_4) which were at par with each other but was observed to be significantly superior than the treatment of recommended dose of fertilizer (N_1) and recommended dose of fertilizer + soil application of micronutrients (N_2). However, treatment of absolute control- no fertilizers (N_0) showed lowest grain yield (q ha^{-1}) of rice over rest of sources of treatments during both years of experimentation. However, from the pooled data analysis it was observed that, treatment KAB + soil application of micronutrients (N_3) recorded significantly the highest grain yield while treatment of absolute control- no fertilizers (N_0) obtained significantly the lowest grain yield over the rest of sources of nutrients. The increase in grain yield over treatment of absolute control due to N_3, N_4, N_2 and N_1 was to the tune of 67.15, 59.99, 43.94 and 35.79 per cent, respectively. The increase in grain yield of rice may be accounted for significant improvement in yield attributes which finally converted into grain yield. Similar results were reported by Talashilkar *et al*. [5], Dhane *et al*. [3].

CONCLUSION

For obtaining higher yield from direct seeded rice it should be grown by conventional tillage method on flat bed system with use of Konkan Annapurna Briquettes @175 kg ha^{-1} in combination with soil application of zinc sulphate @ 25 kg ha^{-1} and copper sulphate @ 5 kg ha^{-1}.

However, from the pooled data analysis it was observed that, treatment KAB + soil application of micronutrients recorded significantly the highest grain yield while treatment of absolute control- no fertilizers obtained significantly the lowest grain yield over the rest of sources of nutrients.

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