SHORT COMMUNICATION

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Studies on tillage, weed and nutrient management practices on growth and yield in rice

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ABSTRACT

A field experiment was conducted at Marathwada Krishi Vidyapeeth, Parbhani, during wet season 2011. The experiment was laid out with eight treatment combinations involving tillage operation, weed and nutrient management. Rice grain and straw yield were significantly more under conventional tillage practice than conservation tillage owing to higher values of growth and yield attributes of rice under conventional tillage. However, conservation tillage showed significantly higher values of available N, P_2O_5, K_2O, Fe and BD than conventional tillage. Amongst management practices recommended dose of fertilizer (RDF @ 80:50:50 M{L Lg ha^{-1})+ $FeSO_4$ 10 kg + hoeing at 30 days after sowing (DAS)+ hand weeding (HW) at 30 DAS and 45 DAS recorded significantly more values of growth attributes, yield attributing characters, grain yield (2.48 t ha^{-1}), lowest mean weed dry matter (42.53 g) at harvest and no. of weeds (26.81) at harvest over rest of management practices, however, it was at par with 80% RDF + $FeSO_4$ 8 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS . Amongst management practices significantly higher available N, P_2O_5, K_2O, Fe and BD were recorded at harvest under RDF + $FeSO_4$ 10 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS.

Key words: *conservation tillage, green manures, intercropping, weed, upland rice*

Rice plays a pivotal role with reference to food security of Indian sub continent. Uncertainties of rainfall, limitation for increasing irrigation facilities towards traditional rice cultivation method, fertilizer and pesticide availability are major challenges for attaining desired rice production at regional and national level. Hence use of resource conservation technology is inevitable in rice based cropping system. Resource conservation technology deliberately intend to use source of nutrient, pest and weed control method from the production system unit to minimize the use of external inputs in the system to minimize cost of cultivation and to maintain biological, physical and chemical health of soil. The yield losses due to weed are 36 per cent in transplanted rice but as high as 84 percent in direct sown rice/ aerobic rice (Ravichandran, 1991). The extent of yield reduction due to weed infestation is also very high under upland situation. With above consideration it was felt necessary to plan a field trial to study the different conservation technologies with nutrient levels and weed management practices in drilled upland paddy.

The field experiment was conducted at Marathwada Krishi Vidyapeeth, Parbhani during wet season 2011-2012. The total annual precipitation of Parbhani was 599 mm distributed from the beginning of 27 meteorological week to 41 meteorological week. Soil of the experimental site was clayey in texture. The initial available soil nutrient status showed medium in nitrogen (230.17 kg ha^{-1}), medium in available phosphorus (16.22 kg ha^{-1}) and high in available potassium (412 kg ha^{-1}). The experiment was laid out in split plot design with eight treatment combinations and three replications, with two treatments *i.e.* conventional tillage and conservation tillage in the main plot and four treatments *i.e.* recommended dose of fertilizer (RDF) @ 80:50:50 NPK kg ha^{-1} + $FeSO_4$ 10 kg + green manuring and incorporation at 35 days after sowing (DAS) + 1 HW at 45 DAS, 80% RDF (64:40:40 NPK kg ha^{-1}) + $FeSO_4$ 8 kg + green manuring and

incorporation at 35 DAS + 1 hand weeding (HW) at 45 DAS, RDF (80:50:50 NPK kg ha^{-1}) + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS + 1 HW at 45 DAS and RDF (80:50:50 NPK kg ha^{-1}) + $FeSO_4$ 10 kg + green manuring incorporation at 35 DAS + pendimethalin @ 0.75 kg ha^{-1} (Pre-emergence) in sub plot. A medium duration upland rice cv. Avishkar was used for the study. *Sesbania aculeata* was used as green manure crop. For concurrent growing of green manure crops, one row of *Dhaincha* was sown in between two rows of rice in finely prepared soil. Paddy seeds @ 50 kg ha^{-1} and green manure crops @ 30 kg ha^{-1} was used for sowing. The sowing was completed by drilling method at a spacing of 30x10 cm. NPK was applied as per the treatment. Two irrigations were given to crop as per the necessity during the total period of investigation. Pre emergence herbicide was applied and hand weeding was done as per treatment. The weeds were uprooted at 30, 60, 90 and at harvest from each plot from one m^2 area for necessary observations on weed. Weeds were dried and dry weight was recorded. Competition offered by weeds as measured by per cent reduction in yield *i.e.* weed index (WI) owing to their presence in the field and weed control efficiency (WCE) were analyzed. At the time of harvesting, the selected five plants $plot^{-1}$ were harvested separately and used for recording the post harvest observation *viz.* panicle length, grains $panicle^{-1}$, panicle weight, test weight.

It is revealed from the present investigation that conventional tillage showed significantly better values of various growth attributes *i.e.* plant height, mean leaf area and mean number of tillers as compared to conservation tillage these result are in confirmation with Kumar and Yadav (2005). This might be due to better availability of nutrient, water and better growth of root in conventional tillage as compared to conservation tillage.

Panicle weight, numbers of panicle m^{-2} and test weight (1000 grain weight) at harvest were significantly higher in conventional tillage than conservation tillage. Similar results were reported by Sharma (2000) and Alum and Matin (2002). This might be attributed to better vegetative growth *i.e.* number of leaves, leaf area, plant height which might have contributed towards translocation of nutrients to the sink region *i.e.* panicle and ultimately resulted into more number of panicle, panicle weight and test weight than conservation tillage.

Grain yield and straw yield were significantly more under conventional tillage practice than conservation tillage. Sharma (2005) also observed the higher yield *i.e.* grain yield (2.31 t ha^{1}) and straw yield (5.52 t ha^{-1}) in conventional tillage compared to conservation tillage. Higher grain and straw yield observed in conventional tillage might be due to better growth and yield attributes in conventional tillage than conservation tillage. Significantly higher NMR and B:C ratio was found in conventional tillage as compared to conservation tillage this might be attributed to more grain and straw yield in conventional tillage than conservation tillage. Similar findings were recorded by Mishra and Singh (2007).

Conservation tillage showed significantly higher values of available N, P, K, Fe and BD than conventional tillage these results are in confirmation with Surekh and Pavanchandra Reddy (2005). This might be due to less exposure of soil which might have reduced soil loss through runoff in rainy season and incorporation of dhaincha (*Sesbania aculeata*) during the study period in conservation tillage. However, electrical conductivity was non significantly influenced due to tillage practices.

Significantly more number of weeds m^{-2} and weed dry matter m^{-2} was noted in conservation tillage than conventional tillage at harvest. Singh *et al*. (2008) and Walia *et al*. (2009) also indicated more number of weeds and weed dry matter under conservation tillage than conventional tillage this might be due to higher weed seed bank in conservation tillage as compared to conventional tillage (11.62 %). More weeds were controlled in conventional tillage than conservation tillage and 16.70 per cent yield loss was observed in conservation tillage in comparison to conventional tillage.

Significantly, more plant height, leaf area m^{-2} and number of tillers were observed in RDF + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS & 45 DAS over rest of the management practices. However, it was at par with 80% RDF + $FeSO_4$ 8 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS at harvest. This might be attributed to 100% application of RDF(80:50:50 NPK kg ha^{-1}), 10 kg $FeSO_4$ and better weed management practices *i.e.* Two hand weeding + one hoeing which proved significantly better over other nutrient and weed management practices *i.e.* alone pendimethalin + green manuring or

Table 1. Effect of different management practices on growth and yield attributes of rice

Treatment	Growth attribute			Yield attribute			No. of weeds m^{-2}	Weed dry matter gm^{-2}
	Plant height (cm)	No.of tillers (m^{-2})	Leaf area (cm^2)	No. of panicle (m^{-2})	Panicle weight (gm)	Test weight (gm)		
Tillage Practice								
Conventional tillage	78.13	108.02	386.13	112.58	3.13	20.78	26.86	61.65
Conservation tillage	67.88	95.36	297.97	104.83	2.3	20.5	37.9	69.79
CD (P<0.05)	4.07	2.05	27.36	4	0.24	NS	1.91	4.08
Management Practices								
RDF+$FeSO_4$ 10 kg+green manuring and incorporation at 35 DAS+1 HW at 45 DAS	68.12	98.66	328.49	105.33	2.58	20.15	31.18	51.16
80% RDF+$FeSO_4$ 8 kg+green manuring and incorporation at 35 DAS+1 HW at 45 DAS	75.33	104.25	354.29	111.5	2.67	21.16	31.06	49.54
RDF+$FeSo_4$ 10 kg+hoeing at 30 DAS+ 1 HW at 30 DAS & 45 DAS	79.21	106.47	380.49	112.83	3.58	21.68	26.81	42.53
RDF (80:50:50 NPK kg ha^{-1})+$FeSO_4$ 10 kg+green manuring incorporation at 35 DAS + pendimethalin @ 0.75 kg ha^{-1}	66.36	97.39	304.49	105.17	2.04	19.56	40.47	119.6
General mean	73	101.69	342.05	108.71	2.72	20.64	32.38	65.7
CD (P<0.05)	4.79	6.43	44.35	5.09	0.44	NS	4.67	4.45

pendimethalin + one hand weeding. Similar results were reported by Yadav and Singh (2009) and Saha (2005).

Panicle weight, number of panicle m^{-2} at harvest and test weight were significantly higher in RDF + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS and 45 DAS over rest of the management practices. However, it was at par with 80% RDF + $FeSO_4$ 8 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS for number of panicle at harvest. This might be due to better availability of Nitrogen, Phosphorous, Potassium and Ferrous sulfate and better weed management practices fallowed in the treatment of RDF + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS and 45 DAS which resulted in to better growth and translocation of nutrients from source to sink giving better values of yield attributes as compared to other management practices. Test weight was found non significant. Similar results were obtained by Turkhede *et al*. (1996) and Ehsan Ullah *et al*. (2009).

Significantly higher grain yield (2.48 t ha^{-1}) and straw yield (6.19 t ha^{-1}) were observed under RDF + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS and 45 DAS over the rest of management practices however, it was at par with 80% RDF + $FeSO_4$ 8 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS for grain yield. This might be attributed to better availability of nutrient, weed management practices; growth and yield attributing character *i.e.* panicle weight, number of panicle. Similar results were also reported by Krishnakumar *et al*. (2005) and Janardhan *et al*. (1999)**.** Significantly higher NMR and B:C ratio was observed in RDF + FeSO4 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS and 45 DAS over rest of all management practices. However, it was at par with 80% RDF + $FeSO_4$ 8 kg + green manuring and subsequent incorporation at 35 DAS + 1 HW at 45 DAS this might be attributed to maximum grain yield recorded in RDF + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS and 45 DAS.

Amongst management practices the significantly higher available NPK, Fe and BD were recorded at harvest under RDF + $FeSO_4$ 10 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS. However, it was at par with 80% RDF + $FeSO_4$ 8 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS for available P, Fe and BD. This might be due to incorporation of green manure and recommended dose of fertilizer. Similar results were also reported by Soni *et al*. (1988), Krishnakumar *et al*. (2005), Anitha and Muthew (2010). Electrical

Table 2. Rice yield, net monitary returns and soil properties as influenced by different tillage, nutrient and weed management practices

Treatment	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	NMR (₹)	B:C ratio	N (kg ha^{-1})	P (kg ha^{-1})	K (kg ha^{-1})	Fe (ppm ha^{-1})	BD (g cc^{-1})	EC (mmhos Cm^{-1} at 25^0 C)
Tillage Practice										
Conventional tillage	2.31	5.52	19660	2.21	275.6	18.35	357.9	1.42	1.28	0.158
Conservation tillage	1.93	5.24	15070	2.09	278.2	19.39	363.0	1.50	1.32	0.160
CD (P<0.05)	0.19	0.03	2957.12	-	6.17	2.52	5.82	0.06	0.04	NS
Management Practices										
RDF+$FeSO_4$ 10 kg+green manuring and incorporation at 35 DAS+1 HW at 45 DAS	2.11	5.56	14733	1.82	280.5	19.68	363.0	1.47	1.35	0.158
80% RDF+$FeSO_4$ 8 kg+green manuring and incorporation at 35 DAS+1HW at 45 DAS	2.11	5.45	15245	1.86	277.8	19.36	360.6	1.46	1.32	0.159
RDF+$FeSo_4$ 10 kg+hoeing at 30 DAS+ 1 HW at 30 DAS & 45 DAS	2.48	6.19	20218	2.10	272.8	17.98	358.5	1.44	1.27	0.157
RDF (80:50:50 NPK kg ha^{-1})+$FeSO_4$ 10 kg+ green manuring incorporation at 35 DAS + pendimethalin @ 0.75 kg ha^{-1}	1.78	4.33	11186	1.68	276.6	18.46	359.8	1.46	1.31	0.157
General mean	2123	5386	16018	1.96	276.9	18.87	360.50	1.46	1.30	0.158
Initial values					230.17	16.22	351.12	1.05	1.31	0.159
CD (P<0.05)	0.31	0.40	5115.2	-	1.97	1.27	1.78	0.015	0.011	NS

conductivity was not significantly influenced due to management practices.

Significantly higher number of weeds and weed dry matter were observed in RDF + $FeSO_4$ 10 kg + green manuring incorporation at 35 DAS + pendimethalin @ 0.75 kg ha^{-1} (Pre-emergence) as compared to rest of all management practices. This might be due to absence of hand weeding or mechanical weed management practices in along with green manuring and/or pendimethalin. Similar trends were obtained by Singh *et al*. (2008) and Saha (2005).

64.53% weeds were controlled in RDF + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS & 45 DAS in comparison to RDF + $FeSO_4$ 10 kg + green manuring incorporation at 35 DAS + pendimethalin @ 0.75 kg ha^{-1} (Pre-emergence) and 28.09% grain yield loss was observed in RDF + $FeSO_4$ 10 kg + green manuring incorporation at 35 DAS + pendimethalin @ 0.75 kg ha^{-1} (Pre-emergence) as compared to (RDF + $FeSO_4$ 10 kg + hoeing at 30 DAS + 1 HW at 30 DAS & 45 DAS).Weed control efficiency to the tune of 56.72 and 58.75 was observed in RDF + $FeSO_4$ 10 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS and 80% RDF + $FeSO_4$ 8 kg + green manuring and incorporation at 35 DAS + 1 HW at 45 DAS, respectively.

REFERENCES

Alam SMK and Matin MA 2002. Impact of tillage on root growth and yield of rice in silt loam soil, Journal of Biological Science 2(8):548-550.

Anitha S and Mathew J 2010. Direct and indirect effect if concurrent growing of dhaincha (*Sesbania oculeta*) in wet-seeded rice (*Oryza sativa*) on the productivity of rice-rice cropping system Indian J. of Agri. Sci, 80(6): 487-492.

Ehsan Ullah, Atique-UR Rehaman, Qaisar Arshad and Shamshad Hussan Shah S 2009. Yield response of fine rice to NP fertilizer and weed management practices, Pak.Jr.Botany., 41(3):1351-1357.

Krishanakumar S, Nagarjan R, Natrajan SK, Jawahar D and Pandian BJ 2005. Effect of NPK fertilizer for hybrid rice (*Oryza sativa*) productivity in alfisol soil in Tamilnadu. Asian .J. of plant sci. 4 (6):574-576.

Janardhan G, Muniyappu TV, Reddy VC, Ramchandra C and Bhaskar S 1999. Studies on weed control and

crop toxicity rating of pre-emergenic herbicides in transplanted rice Mysore J. Agric. Sci. (33): 333-337.

Kumar R and DS Yadav 2005. Effect of zero and minimum tillage in conjunction with nitrogen management in wheat after rice. Indian Journal of Agronomy, 50(1): 54-57.

Mishra JS and Singh VP 2007. Integrated weed management in zero-till direct seeded rice (*Oryza sativa*) - wheat (*Triticum astivum*) cropping system. Indian J. of Agronomy, 52(3): 198-203.

Pillai GK and Rao MV 1974. Integrated weed management in rice. Indian fmg.26 (12):17-23.

Ravichandran VK 1991. Integrated management in necessary to check weeds in direct sown rice. Indian farming. 41 (1): 5-6.

Sanjay Saha 2005. Efficacy of certain new herbicides formulation in transplanted rice under rainfed shallow lowland. Indian J. Weed Sci. 37:109-110.

Sharma 2000. Relative effect of zero and conventional tillage on growth and yield of wheat and soil fertility under rice- wheat cropping system. Indian Journal of Agricultural Sciences, 43(2): 673-675.

Singh Parmeet, Singh P and Singh SS 2008. Production potential and economic analysis of direct wet eeded aromatic rice (*Oryza sativa*) Cv. Pusa basmati 1 as influenced by fertility level and weed management practiced. Oryza, 45 (1) : 23-26.

Soni PN, Sikarwar HS and Mehta DK 1988. Long term effects of fertilizer application on productivity in rice-wheat sequence. Ind. J. Agron., 33 (2): 167-172.

Surekha KK and Pavanchandra Reddy 2005. Contribution of crop residue to yield and nutrient uptake of irrigated rice (*Oryza sativa*) in rice-rice cropping system. Ind. J. of Agril. Sci. 75 (7): 342-394.

Walia US, Bhullar MS, Shelly Nayyar and Amandeep singh siddu 2009. Role of seed rate and herbicides on the growth and development of direct dry-seeded rice. Indian J. Weed Sci. 41 :33-36

Yadav and Singh 2009. Effect of hand weeding on growth and yield of rice. Indian J. of weed science., 12 (5):45-48.