E-ISSN: 2618-0618
P-ISSN: 2618-060X

www.agronomyjournals.com
2024; SP-7(9): 620-623
Received: 11-06-2024
Accepted: 18-07-2024

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Influence of natural farming vs conventional farming practices on growth and dry matter production of paddy

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DOI: https://doi.org/10.33545/2618060X.2024.v7.i9Si.1557

Abstract
An experiment entitled, "Response of paddy (*Oryza sativa* L.) under natural farming practices" was conducted during *kharif* season of 2023-24 at farm of Krishi Vigyan Kendra, Sakoli Dist. Bhandara (M.S.) under Dr. Panjabrao Deshmukh Krishi Vidyapeeth Akola. The study on paddy revealed that conventional method of RDF 100:50:50 NPK kg ha^{-1} significantly highest growth parameters of paddy. However, among all the natural farming practices, an application of Ghanajivamrut @ 500 kg ha^{-1} before transplanting + application of Jivamrut @ 500 L ha^{-1} (15 days interval) + foliar spray of jivamrut (at panicle initiation, flowering and grains filling stage) + incorporation of paddy straw @ 2 t ha^{-1} + Glyricidia cuttings @ 2 t ha^{-1} at puddling has recorded maximum values of growth parameter of rice among all the natural farming practices.

Keywords: Matter production, conventional farming, natural farming

Introduction
Rice (*Oryza sativa* L.) is the world's most important crop and primary source of food for more than half of the world's population. More than 90 per cent of world's rice is grown and consumed in Asia, where 60 per cent of the earth's people liveWorldwide, rice is grown on 161.7 million hectares, with the production of about 749.1 million tons with an average productivity of 4.63 tons ha^{-1} (Agricultural Statistics at a glance-2021) [1]. It belongs to grass family Poaceae and sub-family Oryzoideae.

Rice is the main nutritional source of Indian people. Rice provides 23 per cent more calories of energy than that, provides by wheat and maize crop. It contains 78 g carbohydrates, 7.3 g protein, 3.5 g fat, 0.4 g crude fiber, 0.41 mg thiamine, 0.02 mg riboflavin, 5.80 mg niacin equivalent 4 mg sodium, 0.5 mg iron, 32 mg magnesium, 1.8 mg zinc, 51 mg calcium and 150 mg phosphorous per 100 g (Anonymous, 2002) [4].

Rice is one of the most important food crops of India in terms of area, production and consumer preference. India is the second largest producer and consumer of rice in the world. In India rice is cultivated over an area of 437.80 lakh ha with annual production of about 177.6 million tons with an average productivity of 4.05 tons ha^{-1} (Agricultural Statistics at a glance 2021) [1]. Its production has to be raised to 160 million tons by 2030 with minimum annual growth rate of 2.35% to meet the future rice requirements.

Natural farming saw enormous rise with several state adoption as state policy or grass root movement in southern states. With adoption as state policies of several state government to move towards organic farming or natural farming. It needs scientific validation in terms of its impacts on productivity in different agroclimatic conditions, different cropping systems and different soil types. Conjoint use of cereal-legume intercropping and natural farming systems can be ideal to reduce greenhouse gas emission and increase yield stability while maintaining soil fertility. Keeping these in mind that the present study was conducted to examine natural farming in terms of soil health research.

Natural farming is naturistic way of farming for the marginal and small farmers using desi cow's products. There are basically four wheels of natural farming named- 1) Beejamrit (Nectar for

seeds), 2) Jeevamrit (Nectar of microbes), 3) Acchadana (mulching) and 4) Whapasa (Proper maintenance of aeration and moisture during crop growth).

Materials and Methods

A field experiment was laid out in randomized block designed with four replication and six treatments. The soil of experimental plot was clay loam in texture, slightly acidic in reaction with medium organic carbon content. It was low in available nitrogen (225.79 kg ha^{-1}), low in available phosphorus (22.89 kg ha^{-1}) and high in available potassium (315.12 kg ha^{-1}) during the years of experimentation. The gross plot size was 3.4 m x 3.0 m and net plot size was 3.0 m x2.7 m. The seedlings of paddy were transplanted 21 DAS with spacing 20 cm x 15 cm and maintained optimum population.

Result and Discussion

Plant height (cm)

The periodical data on mean plant height as influenced by different treatments in the table no.1. The data on mean plant height (cm) was recorded at 30, 60, 90 days after transplanting (DAT) and at harvest. The data showed that the mean plant height pf paddy was progressively increased with increasing age of the cop and found maximum at harvest. The rate of increase in the height of the paddy up to 60 DAT and then constant at 90 DAT and at harvest. The application of Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T_6 recorded significantly the highest plant height at all the stages. However, among all the natural farming treatments, the application of T_4 + paddy straw incorporation @ 2 t ha^{-1} + Glyricidia @ 2 t ha^{-1} i.e. T_5 showed the highest plant height and at par with Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T_6 and T_3 + Jivamrut foliar spray (at panicle initiation, flowering and grains filling stage) i.e. T_4 is at par with T_4 + paddy straw incorporation @ 2 t ha^{-1} + Glyricidia @ 2 t ha^{-1} i.e. T_5. Similar findings were recorded b Kokularthy *et al*. (2016) and Geretheran *et al*. (2016).

Table 1: Plant height of rice (cm) as influenced by different treatments

Treatments		Plant height (cm)			
		30 DAT	60 DAT	90 DAT	At Harvest
T_1	Control	20.75	67.00	83.75	88.00
T_2	Ghanajivamrut @ 500 $kgha^{-1}$	24.00	73.50	90.25	94.75
T_3	T_2 + Jivamrut @500 L^{-1}ha (15 days interval)	26.00	74.75	92.50	97.75
T_4	T_3 + Jivamrut foliar spray (at panicle initiation, flowering and grains filling stage)	28.00	75.00	93.50	98.00
T_5	T_4 + paddy straw incorporation 2 tha^{-1} + glyricidia 2 tha^{-1}	31.00	75.50	93.50	99.00
T_6	Conventional (100:50:50 Kg NPK ha^{-1})	34.75	79.00	98.25	103.50
S.E (m) ±		2.34	2.00	2.17	2.36
C.D at 5%		7.05	6.03	6.56	7.13
General mean		27.46	74.13	92.17	96.83

Number of functional leaves

The periodical data on mean number of leaves as influenced by different treatments in the table no.2. The observations were recorded at 30, 60, 90 DAT and at harvest. The average number of functional leaves per pant was increased up to 60 DAT and then decreased with yellowing due to portioning of dry matter towards reproductive parts. The number of leaves was significantly highest in application of Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T6. However, among all the natural farming practices, the application of T_4 + paddy straw incorporation @ 2 t ha^{-1} + Glyricidia @ 2 t ha^{-1} i.e. T_5 showed the highest number of leaves significantly and is at par with Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T_6. T_3 + Jivamrut foliar spray (at panicle initiation, flowering and grains filling stage) i.e. T_4 is at par with T_4 + paddy straw incorporation @ 2 t ha^{-1} + Glyricidia @ 2 t ha^{-1} i.e. T_5. Similar findings were recorded b Kokularthy *et al*. (2016) and Geretheran *et al*. (2016).

Table 2: Number of functional leaves $plant^{-1}$ of rice at various growth stages as influenced by different treatments

Treatments		Number of functional leaves $plant^{-1}$			
		30 DAT	60 DAT	90 DAT	At Harvest
T_1	Control	11.75	13.95	21.38	24.10
T_2	Ghanajivamrut @ 500 $kgha^{-1}$	13.50	17.70	22.53	25.65
T_3	T_2 + Jivamrut @500 Lha^{-1} (15 days interval)	14.95	18.71	23.90	27.55
T_4	T_3 + Jivamrut foliar spray (at panicle initiation, flowering and grains filling stage)	15.18	19.30	24.30	28.48
T_5	T_4 + paddy straw incorporation 2 tha^{-1} + glyricidia 2 tha^{-1}	15.65	19.85	25.23	29.35
T_6	Conventional (100:50:50 Kg NPK ha^{-1})	19.55	23.43	28.55	34.45
S.E (m) ±		1.20	1.76	1.38	1.65
C.D at 5%		3.62	5.32	4.16	5.00
General mean		15.09	18.82	24.31	28.26

Number of tillers sq m^{-1}

The periodical data on mean number of tillers sq m^{-1} as influenced by different treatments in the table no.3.The average number of tillers differed significantly at all growth stages. The number of tillers gradually increased from 30 DAT to 90 DAT and thereafter decreased up to harvest. The application of Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T_6 showed significantly highest number of tillers per plant. However, among all the natural farming practices, the application of T_4 + paddy straw incorporation @ 2 t ha^{-1} + Glyricidia @ 2 t ha^{-1} i.e. T_5 showed the highest number of tillers per plant and is at par with Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T_6. The

increased number of tillers with organic nutrients was mainly due its influence on vegetative crop growth resulting in higher number of tillers. Similar results were reported by Kokularthy *et al*. (2016) and Geretheran *et al*. (2016).

Table 3: Number of tillers sq m-1 of rice at various growth stages as influenced by different treatments

Treatments		Number of tillers sq m^{-1}			
		30 DAT	60 DAT	90 DAT	At Harvest
T_1	Control	162.50	230.00	237.50	228.75
T_2	Ghanajivamrut @ 500 $kgha^{-1}$	195.25	245.50	247.50	236.00
T_3	T_2 + Jivamrut @500 Lha^{-1} (15 daysinterval)	211.75	275.00	265.00	263.50
T_4	T_3 + Jivamrut foliar spray (at panicle initiation, flowering and grains filling stage)	250.25	291.25	291.25	310.00
T_5	T_4 + paddy straw incorporation 2 tha^{-1} + glyricidia 2 tha^{-1}	256.75	322.75	331.75	313.50
T_6	Conventional (100:50:50 Kg NPK ha^{-1})	275.00	437.25	447.50	427.50
S.E (m) ±		13.28	32.68	106.86	21.77
C.D at 5%		40.01	98.47	303.42	65.61
General mean		225.25	300.01	24.31	296.54

Dry matter accumulation

The periodical data on mean dry matter accumulation as influenced by different treatments in the table no.4 and depicted in fig no.1. It resulted that the rate of dry matter accumulation showed at the beginning of crop growth and increased with the age of the crop. The maximum dry matter accumulation per accumulation per plant was recorded at harvest in Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T6. However, among all the natural farming practices, the application of T4 + paddy straw incorporation @ 2 t ha^{-1} + Glyricidia @ 2 t ha^{-1} i.e. T_5 showed the highest dry matter accumulation per plant and is at par with Conventional method (100:50:50 kg NPK ha^{-1}) i.e. T_6. This is because of increased plant height, functional leaves and leaf area containing maximum nutrient availability. Similar results were reported by Kokularthy *et al*. (2016) and Geretheran *et al*. (2016). Least reduction of dry matter production was observed with T_5 (natural farming practices).

Table 4: Periodical changes in dry matter accumulation (g) $plant^{-1}$ of rice as influenced by different treatments

Treatments		Dry Matter Accumulation (g) $plant^{-1}$				
		30 DAT	60 DAT	90 DAT	At Harvest	Reduction of dry matter (g) over conventional method at harvest (%)
T_1	Control	3.38	11.38	15.20	20.18	28.43
T_2	Ghanajivamrut @ 500 $kgha^{-1}$	6.93	13.20	18.13	23.48	16.70
T_3	T_2 + Jivamrut @500 Lha^{-1} (15 days interval)	7.70	14.85	19.83	24.13	14.43
T_4	T_3 + Jivamrut foliar spray (at panicle initiation, flowering and grains filling stage)	8.50	15.43	20.35	25.25	10.46
T_5	T_4 + paddy straw incorporation 2 tha^{-1} + glyricidia 2 tha^{-1}	10.75	16.03	20.98	25.78	8.58
T_6	Conventional (100:50:50 Kg NPK ha^{-1})	12.00	18.15	23.08	28.20	0
S.E (m) ±		1.17	1.23	1.28	1.09	
C.D at 5%		3.54	3.73	3.73	3.29	
General mean		8.29	14.84	19.59	24.61	

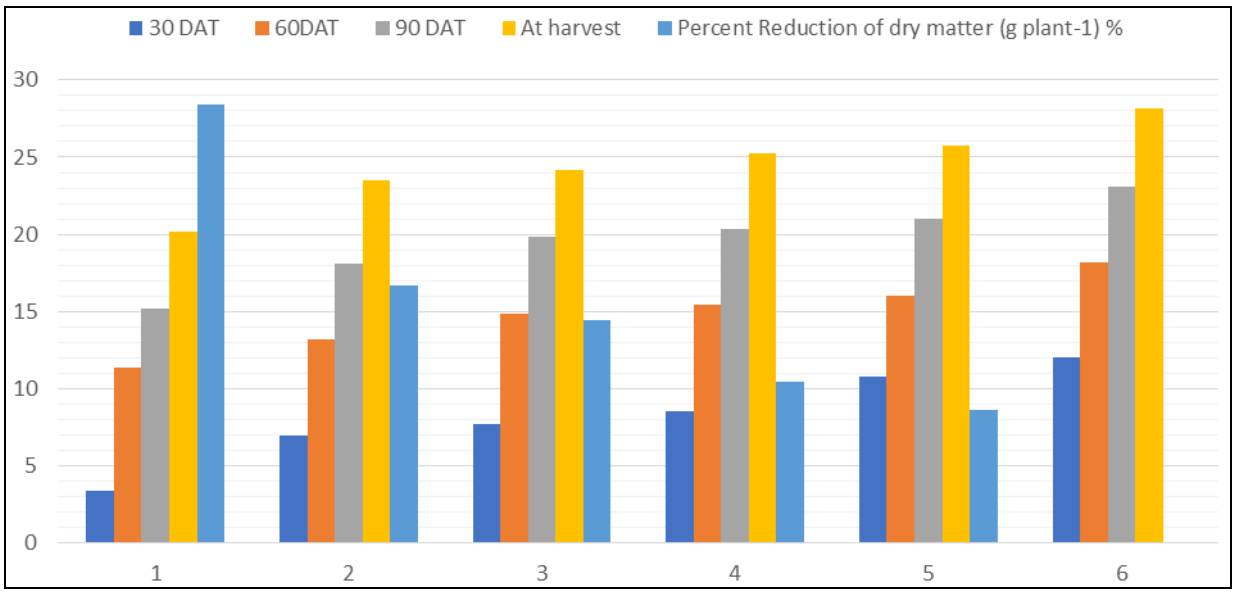

Fig 1: Periodical changes in dry matter accumulation (g) $plant^{-1}$ of rice as influenced by different treatments

Conclusion

1. Based on one year study, it was indicated that the growth contributing parameters i.e. height, number of functional leaves, number of tillers sq m^{-1} and dry matter production of paddy crop showed significantly highest values. However, among all the natural farming practices, the treatment includingan application of Ghanajivamrut @ 500 kg ha^{-1} before transplanting + application of Jivamrut @ 500 L ha^{-1} (15 daysinterval) + foliar spray of jivamrut (at panicle initiation, flowering and grains filling stage) + incorporation of paddy straw @ 2 t ha^{-1} + Gliricidia cuttings @ 2 t ha^{-1}showed the highest values of growth parameters and getting at par with conventional method.
2. The long-term study of 5 to 7 years on natural farming is needed for getting final conclusion.
3. If a link of 5 to 7 years can be made between natural farming practices along with theirsustainable and ecological residual effects, then growth and dry matter production of paddy will get extreme beneficiary responses.

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