International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(3): 2241-2244

Received: 16-03-2020
Accepted: 18-04-2020

B Geetha
Department of Soil Science & Agril. Chemistry, University of Agricultural Sciences, Raichur, Karnataka, India

SR Balanagoudar
Department of Soil Science & Agril. Chemistry, University of Agricultural Sciences, Raichur, Karnataka, India

Ashok Kumar Gaddi
Department of Soil Science & Agril. Chemistry, University of Agricultural Sciences, Raichur, Karnataka, India

B Manjunatha
Department of Soil Science & Agril. Chemistry, University of Agricultural Sciences, Raichur, Karnataka, India

YM Ramesh
Department of Agronomy University of Agricultural Sciences, Raichur, Karnataka, India

Corresponding Author:
B Geetha
Department of Soil Science & Agril. Chemistry, University of Agricultural Sciences, Raichur, Karnataka, India

Effect of integrated plant nutrient supply system on growth, yield and economics of dry-direct seeded rice

B Geetha, SR Balanagoudar, Ashok Kumar Gaddi, B Manjunatha and YM Ramesh

DOI: https://doi.org/10.22271/chemi.2020.v8.i3af.9544

Abstract
Integrated use of plant nutrients aim at combined application of inorganic and organic sources to improve efficiency of applied nutrients, reduce environmental hazards and improve crop productivity. The present experiment was conducted during *kharif*-2018 at ARS, Dhadesugur, Karnataka, India to evaluate the integrated plant nutrient supply system on growth, yield and economics of dry-DSR with nine treatments and three replications. Among the IPNS imposed treatments, the treatment T_9 (125% RDF + FYM @ 6 t ha^{-1} + biofertilizers @ 12.5 kg ha^{-1} + foliar spray of 19:19:19 (1%) at 45, 60 and 75 DAS) exerted significant higher grain and straw yield (7,461 and 8,808 kg ha^{-1}, respectively) as compared to other treatments. The economic analysis revealed that integrated use of inorganic, organic and biofertilizers along with foliar spray of 19:19:19 (1%) at 45, 60 and 75 DAS gave higher gross return, net return and BC ratio (` 151215 $ha^{-1}$, ` 98756 ha^{-1} and 2.88, respectively).

Keywords: Plant nutrients, IPNS, FYM, biofertilizers, integrated

Introduction

Rice is a vital food for more than half of the world's population. Rice accounts for 55 per cent of total cereal production in the country. The per capita food intake in India is 2,234 calories per day of which 30 per cent comes from rice. Worldwide rice is grown over an area of 161 million hectare with an annual production and productivity of about 678.7 million tonnes and 2.91 tonnes per hectare, respectively. In India paddy is cultivated in an area of 42.9 million hectare, with a production of 111.1 million tonnes at a productivity level of 2.58 tonnes per hectare. In Karnataka it is mainly grown as an irrigated crop in Tunga Bhadra Project (TBP), Cauvery and Upper Krishna Project (UKP) command areas, which spread over a total of 1.36 million hectare with a production of 3.99 million tonnes and productivity of 3.10 tonnes per hectare (Anon., 2018) [1].

The nutrient requirement of direct seeded rice is probably lower than that of transplanted rice during early growth stages. TBP areas are known for using imbalance dose of nutrients with higher tendency for N application. This also causes environmental damage and increase the total cost of production as heavy N use makes the rice crop more susceptible to pest and disease and thus increases cost of protection. Unbalanced fertilizer use also causes soil degradation and particularly when N fertilizer use drives the removal of P and K that are not replenished by the addition of fertilizer nutrients. Therefore, it is envisaged that for sustainable agricultural production in the country, integrated plant nutrient supply system (IPNS) appears to be more promising. Such system would also reduce the cost of farming in addition to maintaining the soil productivity, improving the eco-system and ultimately resulting in improved soil-plant-health in a sustainable agricultural eco-system. So, it has been considered worthwhile to study the growth, yield and economics of dry-DSR as influenced by integrated plant nutrient supply system.

Materials and Methods

The experiment was conducted during *kharif* - 2018, at Agricultural Research Station, Dhadesugur. It is located in Northern Dry zone (Zone 3) of Karnataka at 16º 12" N latitude and 77º 20" E longitude with an altitude of 389 m above mean sea level. The soil was deep black with clayey in texture having slight alkaline pH (8.42), low salinity (0.55 dS m^{-1}) and medium in soil organic carbon content (5.4 g kg^{-1}). The soil was low in available nitrogen (257 kg ha^{-1}), medium in available phosphorous (39.4 kg ha^{-1}) and available potassium (310 kg ha^{-1}). The available sulphur (12.7 mg kg^{-1}) was medium in the soil. The concentrations of DTPA extractable micronutrients (mg kg^{-1}) in soil were zinc, iron, copper, manganese and boron (0.88, 4.36, 0.99, 2.67 and 3.01 mg kg^{-1}, respectively).

In soil test laboratory method (Package of Practice, UAS, Raichur and Dharwad, 2014) [8] the amount of fertilizer dose was calculated on the basis of fertility ratings (Low, medium and high for N, P and K). As per the soil test rating in the experimental field, available nitrogen was low (257 kg ha^{-1}) and the RDF for rice crop is 150:75:75 N, P_2O_5 and K_2O kg ha^{-1}, therefore, additional 25 N kg ha^{-1} along with recommended dose of fertilizer is applied. For available phosphorus and potassium, the soil test rating is medium. Hence, no change is made in recommended dose of fertilizer. Thus, the calculated fertilizer dose was 175:75:75, N, P_2O_5 and K_2O kg ha^{-1}, respectively. This experiment comprised of nine treatments *viz*., T_1- Absolute Control, T_2- RDF (175:75:75 NPK kg ha^{-1}) fertilizers only, T_3- RDF (175:75:75 NPK kg ha^{-1}) + FYM @ 6 t ha^{-1}, T_4- 75% RDF (131:56:56 NPK kg ha^{-1}) + FYM @ 6 t ha^{-1} + biofertilizers* @ 12.5 kg ha^{-1}, T_5- 100% RDF (175:75:75 NPK kg ha^{-1}) + FYM @ 6 t ha^{-1} + biofertilizers* @ 12.5 kg ha^{-1}, T_6- 125% RDF (219:94:94 NPK kg ha^{-1}) + FYM @ 6 t ha^{-1} + biofertilizers* @ 12.5 kg ha^{-1}, T_7- T_4 + foliar spray of 19:19:19 (1%) at 45, 60 & 75 DAS, T_8 - T_5 + foliar spray of 19:19:19 (1%) at 45, 60 & 75 DAS and T_9- T_6 + foliar spray of 19:19:19 (1%) at 45, 60 & 75 DAS. The experiment was laid out in randomized block design with three replications and statistically analysed to find out the best performing treatments.

Note: RDF was changed according to Soil Fertility Ratings.

***** *Azospirullum* and PSB @ 12.5 kg ha^{-1} each.

Results and Discussion

Growth attributes

Among the treatments tested, treatment T_9 (125% RDF + FYM @ 6 t ha^{-1} + biofertilizers @ 12.5 kg ha^{-1} + foliar spray of 19:19:19 (1%) at 45, 60 & 75 DAS) recorded the maximum values for plant height, number of tillers per meter square and dry matter production at harvest stage, which is on par with T_8 and T_6 treatment (Table 1) compared to absolute control.

Treatments that received higher N applications along with spray of 19:19:19 at critical growth stages have responded positively with higher plant height, number of tillers and dry matter production. Nitrogen is associated with the increase in protoplasm, cell division and cell enlargement, might also enhance vegetative growth resulting from cell size and meristematic activity which in turn increases the plant height (Tisdale *et al*., 1985) [16]. Maiti *et al*. (2006) [5] reported that the maximum plant height was recorded when the crop received 125 per cent RDF along with 5 tonnes of FYM ha^{-1}. Mohanty *et al.* (2013) [6] also found that application of chemical fertilizer, FYM and biofertilizer produced significantly higher number of tillers as compared to 100 per cent RDF and control. The application of chemical fertilizers in conjunction with organic fertilizer increased the use efficiency of added chemical fertilizer which in turn increased the nutrient availability at later growth period ultimately resulted in increased dry matter production (Shinde *et al*., 2017) [10].

Table 1: Growth attributes of dry-DSR at harvest as influenced by different sources of nutrients

Treatment	Plant height (cm)	No. of tillers per meter square	Total dry matter Production (g $plant^{-1}$)
T_1	92.7	616	26.10
T_2	94.2	747	32.34
T_3	98.5	798	35.08
T_4	97.0	783	34.27
T_5	98.6	810	38.18
T_6	99.9	830	46.77
T_7	99.3	819	41.01
T_8	101.4	888	51.23
T_9	102.9	933	55.35
S. Em. ±	1.17	41.19	2.88
CD @ 5%	3.52	123.49	8.64

Yield attributes

The yield potential of rice is determined by the yield attributes and the values of the yield attributes were in accordance with that of growth parameters. Among the treatments, combined application of 125% RDF + FYM @ 6 t ha^{-1} + biofertilizers @ 12.5 kg ha^{-1} + foliar spray of 19:19:19 (1%) at 45, 60 & 75 DAS (T_9) resulted in significantly superior effect on all the yield attributes *viz*., number of grains per panicles, grain yield and straw yield, except the panicle length and test weight and is at par with T_8 and T_6 treatment (Table 2), since the weight of individual grain is mainly influenced by the genetic makeup of the plant as compared to other environmental factor. These results are in accordance with the findings of Singh *et al*. (2015) [11]. The better performance of integrated application might also be due to the counteraction of the effect of inorganic fertilizer by the FYM and the steady and liberal supply of adequate nutrients during the later stages of crop growth, thus helping in fixing more photosynthates and translocation of them from source to sink and thereby enhanced the number of filled grains per panicle. This is in line with the findings of Stalin and Vaiyapuri (2009) [13]; Suseendran (2011) [15]. The grain yield was increased up to 10-12 per cent by the foliar spray of 19:19:19. This might be due to easy solubility and uniform distribution of nutrients leading to availability of sufficient nutrients for uptake by the crops. Similar observations were made by Chandrakanth (2015) [2].

The application of biofertilizers *viz*., *Azospirillum* and PSB produce phytohormones that induce root growth, improved nutrient and water absorption by plants, which augmented increase in production of shoot biomass which ultimately favored for higher growth parameters, yield attributes and yield of rice. The above findings are in collaboration with the report of Sunil and Shankara (2014) [14]. Stalin and Darthiya (2018) [12] observed that 75 per cent recommended dose of N + recommended dose of P and K + 25 per cent N on equivalent basis of vermicompost + biofertilizers exerted significant influence on growth, yield attributes and yield of rice.

Table 2: Yield attributes of dry-DSR as influenced by different sources of nutrients

Treatment	Panicle length (cm)	No. of grains per panicle	Test weight (g)	Grain Yield (kg ha^{-1})	Straw Yield (kg ha^{-1})
T_1	21.0	237	12.3	3071	3595
T_2	22.3	243	12.8	5276	6191
T_3	24.2	266	13.6	5740	6735
T_4	23.7	244	13.5	5621	6595
T_5	24.0	268	14.0	6068	7114
T_6	25.0	281	14.9	6714	7874
T_7	23.8	275	14.2	6269	7372
T_8	25.2	337	16.2	6956	8179
T_9	26.7	361	17.5	7461	8808
S. Em. ±	1.07	22.91	1.06	276.41	324.60
CD @ 5%	NS	68.69	NS	828.67	973.15

Economics of dry-Direct Seeded Rice as imposed by different treatment

Economics of any treatment is the deciding factor in many situations, to judge its applicability in the field condition to recommend farming community to obtain better return with minimum investment in cultivation. It is the final criteria to evaluate the best treatment which is economically sound and can be accepted as viable one. The effect of integrated plant nutrient supply system was significant with respect to gross returns, net returns and BC ratio (Table 3). The cost of cultivation of dry DSR was higher (` 52458 ha^{-1}) with application 125% RDF + FYM @ 6 t ha^{-1} + biofertilizers @ 12.5 kg ha^{-1} + foliar spray of 19:19:19 (1%) at 45, 60 and 75 DAS due to higher quantity of fertilizer application rates as compared to other treatments. Among the different treatments, the higher gross returns, net returns and BC ratio (`151215 ha$^{-1}$, ` 98756 ha^{-1} and 2.88, respectively) were recorded with T_9 treatment compared to control (` 62222 ha$^{-1}$, ` 28758 ha^{-1} and 1.86, respectively). This is mainly due to higher grain and straw yield obtained with least investment in fertilizer lead to more gross returns, net returns and finally BC ratio. These results are in collaboration with the findings of Rani *et al*. (2014), Jayabal *et al*. (1999), Ghosh *et al*. (2014) and Mondal *et al*. (2015) [9, 4, 3, 7].

Table 3: Cost of cultivation, gross returns, net returns and B:C as influenced by different sources of nutrients in dry-DSR

Treatment	Cost of cultivation (ha^{-1})	Gross returns (ha^{-1})	Net returns (ha^{-1})	B:C
T_1	33464	62222	28758	1.86
T_2	40654	106913	66255	2.63
T_3	48154	116321	68167	2.42
T_4	49626	113896	64270	2.30
T_5	50454	122951	72497	2.44
T_6	51288	136048	84760	2.65
T_7	50796	127037	76241	2.50
T_8	51624	140972	89347	2.73
T_9	52458	151215	98756	2.88
S. Em. ±	-	-	5819	0.11
CD @ 5%	-	-	17444	0.34

Conclusion

The combined application of organic manures, chemical fertilizers and foliar spray of nutrients generally produces higher crop productivity when compared to chemical fertilizer alone. This increase in crop productivity may be attributed to the balanced supply of nutrients, efficient utilization of applied fertilizer nutrients in the presence of organic sources and the synergistic effect of the conjoint addition of various sources of nutrients. From the results of the current experiment, it could be concluded that application of 125 per cent RDF + FYM @ 6 t ha^{-1} + biofertilizers @ 12.5 kg ha^{-1} + foliar spray of 19:19:19 (1%) at 45, 60 and 75 DAS resulted in increased growth, yield and economics of dry-DSR.

References

1. Anonymous. Agricultural statistics at a glance, Department of agriculture and cooperation, directorate of economics and statistics, Ministry of Agriculture, Govt. of India, New Delhi, 2018, 85.
2. Chandrakanth. STCR approach for soil and foliar application of soluble fertilizer and their effect on soil properties, growth and yield of maize. M. Sc. Thesis, University of Agricultural Sciences, GKVK, Bangalore, 2015.
3. Ghosh K, Chowdhury MAH, Rahman MH, Bhattacherjee S. Effect of integrated nutrient management on nutrient uptake and economics of fertilizer use in rice cv. Nerica 10. J Bangladesh Agril. Univ. 2014; 12(2):273-277.
4. Jayabal A, Palaniappam SP, Chelliah S. Evaluation of integrated nutrient management techniques in rice. Oryza. 1999; 36(3):263-265.
5. Maiti S, Saha M, Banerjee H, Pal S. Integrated nutrient management under hybrid rice (*Oryza sativa* L.) hybrid rice cropping sequence. Indian J Agron. 2006; 51(3):157-159.
6. Mohanty M, Nanda SS, Barik AK. Effect of integrated nutrient management on growth, yield, nutrient uptake and economics of wet season rice (*Oryza sativa*) in Odisha. Indian. J Agric. Sci. 2013; 83(6):599-604.
7. Mondal S, Mallikarjun M, Ghosh M, Ghosh DC, Timsina J. Effect of integrated nutrient management on growth and productivity of hybrid rice. J Agric. Sci. Tech. 2015; 5:297-308.
8. Package of Practice. UAS, Raichur and Dharwad, 2014.
9. Rani BS, Krishna TG, Munirathnam P. Studies on the effect of foliar fertilization in combination with conventional fertilizers on yield, economics and nutrient uptake of rice (*Oryza sativa* L.) under KC Canal Ayacut area of Andhra Pradesh, India. Agril. Sci. Digest. 2014; 34(1):15-20.
10. Shinde NK, Seema MN, Ghorade RB, Mohod NB. Effect of integrated nutrient management on yield and quality of parching sorghum varieties. Int. J Curr. Microbiol. App. Sci. 2017; 6(12):4268-4272.
11. Singh KYP, Joshi H, Chandra DK, Singh R, Kumar M. Effect of integrated nutrient management on growth, productivity and quality of sweet sorghum (*Sorghum bicolour*). Indian J Agron. 2015; 60(2):291-296.
12. Stalin P, Darthiya M. Studies on integrated plant nutrient supply system on maximization of rice for Cauvery delta region. Plant Arch. 2018; 18(2):2466-2468.

13. Stalin P, Vaiyapuri V. Studies on integrated plant nutrient supply system on yield maximization and economic analysis in rice for Cauvery delta region. Plant Arch. 2009; 9(1):47-49.
14. Sunil RL, Shankara L. Effect of manurial schedules on growth and yield of different cropping systems under rainfed alley system. Indian J Agron. 2014; 45(4):687-92.
15. Suseendran. Studies on integrated nutrient and weed management in low land transplanted rice. Ph.D. Thesis. Annamalai Univ., Annamalainagar, India, 2011.
16. Tisdale SL, Werner NL, James DB. Soil fertility and fertilizers, Mac Millan publishing company, New York, 1985, 754.