Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2019; 8(6): 2530-2532
Received: 28-09-2019
Accepted: 30-10-2019

Hanamant SH
Department of Agronomy, College of Agriculture University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Narayana S Mavarkar
Department of Agronomy, College of Agriculture University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Basavraj M
Department of Agronomy, College of Agriculture University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Corresponding Author:
Hanamant SH
Department of Agronomy, College of Agriculture University of Agricultural and Horticultural Sciences, Shivamogga, Karnataka, India

Effect of integrated nutrient management in direct seeded rice (*Oryza sativa* L.) in southern transitional zone of Karnataka

Hanamant SH, Narayana S Mavarkar and Basavraj M

Abstract
The Field experiment was carried out during *Kharif* 2018 at AHRS, Bhavikere to study the effect of integrated nutrient management in direct seeded rice (*Oryza sativa* L.) in Southern Transitional Zone of Karnataka. The experiment was laid out in Randomized block design with 9 treatments with 3 replications. The results revealed that application of 100% recommended NPK + FYM + plant growth promoting rhizobacteria (PGPR) + 20:20:20 water soluble fertilizers (T5) recorded significantly higher grain yield (49.16 q ha-1) and yield parameters like number of panicles per plant (17.18) and panicle weight (3.20 g). Similar trend was noticed in growth parameters like plant height (73.94) and number of tillers (22.56) which contributed to the yield. The lowest yield was recorded with the control plot (16.47q ha-1).

Keywords: Direct seeded rice, integrated nutrient management and PGPR

Introduction

Rice (*Oryza sativa* L.) is the staple food crop of more than half of the world's population. It is grown in six continents and in more than hundred countries. In Asia, more than two billion people are getting 60 to 70 per cent of their energy requirement from rice alone and its derived products. Human consumption accounts 85 per cent of total production and hence rice deserves a special status among cereals as world's most important wetland crop. Area under rice in the world is 160.9 m ha with a production of 719.7mt and average productivity of 4472 kg/ha, out of which 90 per cent of world's rice is produced in Asian continent including six countries such as China, India, Indonesia, Bangladesh, Vietnam and Japan (Anon., 2017) [1]. In India, rice is grown in an area of m ha with an annual production of 106.57mt and productivity of 2424 kg/ha, (Anon., 2017a) [2]. In Karnataka, it is grown in 1.33 m ha with total production of 3.52 m t and the average productivity of 2649 kg/ha (Anon., 2017b) [3]. Demand for rice in India is increasing every year and it is estimated that by 2025 AD the increasing requirement would be 140mt. To sustain present self-sufficiency in food production and to meet future food requirements, India has to increase its rice productivity by 3 per cent per annum against the backdrop of diminishing natural resource bases like land, labour and water that pose a real challenge for scientific community. Rice is a moisture hungry crop and a prolific user of water which requires 3000-5000 litres of water to produce one kg of grain which is almost 2 to 3 times higher than any other cereal crops such as wheat and maize. Rice is cultivated under four major ecosystems namely irrigated (57%), rainfed low land (31%), rainfed upland (9%) and deep water (3%). Out of total water available in India, 60 per cent is utilized for rice cultivation. The water supply-demand gap in India is projected to be 25 per cent by the year 2020.Thus lack of water rather than land may become the principal constraint to increase food output and to keep the world in peace.

Direct seeding of rice is not a new idea; a number of farmers throughout Asia have cultivated the crop this way for decades. Perhaps most famously, beginning in the 1950s Masanobu Fukuoka, the Japanese farmer-philosopher and author of *The One Straw Revolution*, flouted both traditional Japanese rice cultivation and industrial production models by seeding rice directly and keeping fields dry for most of the season. In Direct seeded rice system, wherein the crop is established in non-puddled, non-flooded fields and rice is grown like an upland crop (unsaturated condition) with adequate inputs and supplementary irrigation when rainfall is insufficient. DSR refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery. Rice can be directly seeded either through dry or wet (pre germinated) seeding. Dry seeding of rice can be done by drilling the seed into a fine seedbed at a depth of 2 to 3 centimeters.

Wet seeding requires levelled fields to be harrowed and then flooded (puddling). The field is left for 12 to 24 hours after puddling, then germinated seeds (48-72 hours) are sown using a drum seeders. Seed can be broadcast for either dry or wet seeding, but manual weeding is more difficult. Indeed, weed management is a critical factor in direct seeding. Timely application of herbicides (timing is dependent on the method of seeding) and one or two hand weeding provide effective control.

Use of fertilizers in conventional rice cultivation has been reported to have poor nutrient use efficiency due to excessive use of water and readily available nature of nutrients in fertilizers. But total replacement of fertilizer by manures to avoid such losses may not be an easy alternative as manures contain less nutrients. Hence, it is desirable to adopt integrated approach in meeting the nutrient demand of the crop. This approach involves application of chemical fertilizers, organic manures or crop residues to bridge the gap between nutrient demand and supply to improve the grain yield.

Integrated Nutrient Management (INM) is the adoption of technically appropriate and managerially efficient in achieving the objectives of judiciously utilizing all the major sources of plant nutrients in an integrated manner so as to attain optimum economic yield from a specific cropping system (Sarkar, 2000) [11]. Using organic sources such as FYM, Vermicompost, biofertilizers and enriched compost deserves priority for sustained production and better resource utilization in integrated nutrient management *i.e.*, use of organic manures within organic fertilizers. INM technology is sustainable as compared to modern chemical farming as it relies more on organic inputs (Muneshwar Singh *et al*., 2001) [9].

Nitrogen has important role in realization of rice yield. In India about 67 per cent of soils are estimated to be deficit in adequate nitrogen and consequently rice crop has become a major consumer of nitrogen fertilizer (Hooper, 1982) [7]. The addition of organic manures for direct seeded rice crop improves the organic matter status of soil. It helps the soil to supply the nutrients and also improves the physical properties of soil. Further, organic matter acts as a food for microorganisms and boosts the multiplication of their population, which in turn improves the mineralization of nitrogen in soil and thus, fertility and productivity of the soil is improved. Another important source of maintaining soil fertility is use of biofertilizers. The role of biofertilizers, an alternate low cost input has a prime importance in recent decades and they play a vital role in maintaining long-term soil fertility. Biological nitrogen fixing microorganisms significantly contributed for nitrogen addition to soil while phosphate and potassium helps in solubilizing bound form of phosphorous and potassium in soil. These beneficial microorganisms are known to secrete plant growth promoting substances for improved plant growth and crop yield (Venkateshwaralu and Prasad 2012) [14]. The role and importance of biofertilizers in sustainable crop production has been reported by several research workers (Wani Lee, 1995 and Katyal *et al.* 1994) [15, 8]. Soil harbours a huge population of microorganisms and their abundance play a key role in making plant nutrients available to plants and keep the soil productive for crop production. Among the varied form of biological nitrogen fixing biofertilizers in rice cultivation *Azospirillum* has a prime role and has been recognized as a potential nitrogen fixing diazotroph colonizing root environment of paddy and other cereal crops. It fixes atmospheric N2, enhances uptake of nutrients and also produces plant growth promoting substances. Water soluble fertilizers are fast-acting fertilizers that are good to use when plants are under stressful period, such as transplanting the plant or during times of extreme drought. The benefits can be seen within a few minutes of applying a foliar fertilizer, as it bypasses any soil conditions that may hinder the availability of the nutrients to the plant. Granular fertilizers are much slower to break down and benefit the plant. It also facilitates effective supply of macro and micro nutrients in one solution through foliar spray. Standardization, quantification and scheduling of water soluble fertilizer as foliar spray for cereal crops of the region will help in promoting plant growth and lower the corrosive effects on the plants. Application of water soluble fertilizers to the crops through irrigation or direct spray in small quantity will saves labour, cost of production, and reduce compaction of soil.

The combination of all these nutrient sources not only play a role in increasing the crop yield levels but also improves the soil physical, chemical and biological properties in order to maintain soil fertility status as well as achieving sustainable yield in direct seeded rice. Keeping all these points in view, the present investigation entitled "Effect of integrated nutrient management in direct seeded rice (*Oryza sativa* L.) in southern transitional zone of Karnataka." was carried out during *kharif* 2018 in AHRS, Bhavikere.

Material and Methods

Field experiment was conducted during *kharif* 2018 at zonal agriculture and horticultural research station, Bhavikere which is situated at an altitude of 695 meters above mean sea level and comes under southern transitional zone (Zone VII). The soil type was red sandy loam, acidic in nature (pH 5.34), low in organic carbon (0.48%), low in nitrogen (227.71 kg ha-1), medium in available phosphorus (34.04 kg ha-1) and medium in potassium (167.58 kg ha-1). The experiment was laid out on a randomized block design with nine treatments and three replications. The treatment comprised of combinations of inorganic fertilizers like urea, single super phosphate (SSP) and muriate of potash (MOP) and organic sources like FYM and Vermicompost along with PGPR at different rates *viz.*, T1- control, T2-100% RDF, T3-100% RDF+FYM, T4-100% RDF+FYM + PGPR, T5-100% RDF+FYM+PGPR +20:20:20 water soluble fertilizers, T6-75% RDF, T7-75% RDF+FYM, T8-75% RDF+FYM+PGPR and T9-75% RDF+FYM+ PGPR+20:20:20 water soluble fertilizers.

The field was thoroughly prepared by tractor, cultivator and leveler to make fine tilth. Plots were prepared with a dimension of 4.8m x 3.4m. Seed rate at 30 kg ha-1 was used in aerobic rice. Lines were opened at 30cm x 10cm spacing and seeds were sown as per treatment. Recommended package of practices were followed for growing the crop. A common fertilizer dose of 100:50:50 kg N, P2O5 and K2O ha^{-1} was adopted. Half of the fertilizer was applied as basal and the remaining quantity was applied in two equal splits at 30 and 50 days after sowing. The weeds were managed by passing wheel hoe two times at 30 and 50 days and hand weeding at 20 and 40 days after sowing. The crop was grown purely on rainfed situation and irrigation was given during dry spells. Periodical observation on growth and yield were recorded.

Result and Discussion

In the present investigation, significantly taller plant was recorded in T5 (73.94 cm) over the control T1 (48.78 cm) and found to be on par with T9. Number of tillers per plant was found to be significantly higher in T5 (22.56) which was on par with T9. Higher plant height and more number of tillers in T5 was due to better utilization of available nutrients and slow release of nutrients from organic sources at later stages of crop growth. Similar findings were documented by Babu and Reddy (2000) [5]. Significantly more number of tillers might be due to better availability of nutrients and reduced mortality of tillers which in turn resulted in higher uptake of nutrients. Significantly increase in plant height with these treatments might be due to greater availability and steady release of nutrients from organic sources will helps to increase the plant height. These findings are in line with Shaikh *et al*. (2017) [12]. The yield parameters such as number of panicles per plant and panicle weight were found to be significantly highest in T5 (17.18, 3.20g) respectively which is on par with T9. These important growth and yield parameters are responsible for highest grain yield in T5 (49.16 q ha^{-1}) which is on par with T9 (47.50 q ha^{-1}). This is due to inorganic fertilizers in combination with organic manures caused the greater translocation of photosynthesis from source to sink that resulted in higher yield contributing characters in rice (Barik *et al*., 2008) [6]. These results are in line findings of Venkatesha *et al*. (2015) [13]. Arun Kumar *et al*. (2014) [4] also reported that application of 125% RDF +5 t ha-1 vermi compost significantly recorded higher yield attributes and yield parameters of aerobic rice.

Table 1: Effect of integrated nutrient management practices on growth parameters, yield attributes and yield of direct seeded rice

Treatments	Plant height (cm)	Number of tillers plant-1	Number of panicles plant-1	Panicle weight (g)	Grain yield (kg ha-1)
T1	48.78	10.21	9.21	1.05	1647.86
T2	57.76	14.38	13.45	2.02	3850.00
T3	62.94	19.86	14.21	2.48	4360.00
T4	65.02	20.35	15.18	2.85	4620.00
T5	73.94	22.56	17.18	3.20	4916.67
T6	53.96	12.09	12.10	1.85	3166.67
T7	60.77	15.75	13.81	2.25	3933.33
T8	62.32	19.52	14.65	2.51	4433.33
T9	70.85	21.63	16.32	3.05	4750.00
SE. m ±	2.77	0.70	0.74	0.13	131.25
CD @ 5%	8.29	2.10	2.21	0.74	377.20

Note: RDF-100:50:50 Kg NPK ha-1, FYM- 10 t ha-1, Vermi compost- 7.5 t ha-1, PGPR- 250 ml acre-1

Legends: T1100% Control, T2-100% RDF, T3-100% RDF+FYM, T4-100% RDF+FYM+PGPR, T5-100% RDF+FYM+PGPR+20:20:20 water soluble fertilizers, T6-75% RDF, T7-75% RDF+FYM, T8-75% RDF+FYM+PGPR and T9-75% RDF+FYM+PGPR +20:20:20 water soluble fertilizers.

Conclusion

Application of 100% RDF+FYM+PGPR +20:20:20 water soluble fertilizers (T5) has resulted in significantly higher grain yield of direct seeded rice which is on par with 75% RDF+FYM+PGPR +20:20:20 water soluble fertilizers (T9).

References

1. Anonymous. Rice-Statistics and facts, 2017. http://www.Statista.Com/tropics/1443/rice/.
2. Anonymous. Agricultural statistics at a glance, 2017a. http:// eands.dacnet.nic.in Agricultural-Statistics-At-Glance2014.pdf.
3. Anonymous. Karnataka agricultural statistics at a glance, 2017b. Http; /raitamitra. kar.nic.in/ENG/statistics.asp
4. Arun Kumar RN, Meena LY, Gilotia YK. Effect of organic and inorganic sources of nutrient on yield, yield attributes and nutrient uptake of rice cv. PRH-10. The Bioscan. 2014; 9:595-597.
5. Babu RBT, Reddy VC. Effect of nutrient sources on growth and yield of direct seeded rice (*Oryza sativa* L.). Crop Res. 2000; 25:189-193.
6. Barik AK, Raj A, Saha RK. Yield performance, economics and soil fertility through organic sources (Vermi compost) of nitrogen as substitute to chemical fertilizers in wet season rice. Crop Res. 2008; 36:4-7.
7. Hooper SR. Cropping System Research in Asia, Report on workshop IRRI, Los Banos, Philippines, 1982, 123-148.
8. Katyal JC, Venkatashwarlu B, Das SK. Biofertilizers for Nutrient Supplementation in Dryland Agriculture. Ferti. News. 1994; 39(4):27-32.
9. Muneshwar Singh, Singh VP, Sammi Reddy K. Effect of integrated use of fertilizer nitrogen and FYM or GM on transformation of NKS and productivity of rice-wheat system on a Vertisol. J Indian Soc. Soil Sci. 2001; 49(3):430-435.
10. Paramesh V, Sridhara CJ, Shashidhar KS, Bhuvaneswari S. Effect of integrated nutrient management and planting geometry on growth and yield of aerobic rice. Intl. J Agril. Sci. 2014; 10:49-52.
11. Sarkar AK. Integrated nutrient management for better livelihood of farmer's in rainfed areas. J Indian Soc. Soil Sci. 2000; 48(4):690-696.
12. Shaikh AA, Kulkarnik V, Pandi Alekya. Effect of different organic manures on growth contributing characters in paddy. Contemporary Res. in India. 2017; 7(3):28-32.
13. Venkatesha MM, Krishnamurthy N, Tuppad GB, Venkatesh KT. Yield, economics and nutrient uptake of aerobic rice cultivars as influenced by INM practices. Res. Environ. Life Sci. 2015; 8(1):113-118.
14. Venkateshwaralu B, Prasad JVNS. Carrying capacity of Indian agriculture: issues related to rainfed agriculture. Curr. Sci. 2012; 102(6):882-888.
15. Wani SP, Lee KK. Microorganisms as biological inputs for sustainable agriculture in Organic Agriculture. (Thampan PK Ed.) Peekay Tree Crops Development Foundation, Cochin, India, 1995, 39-76.