



E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; 7(1): 2642-2643
Received: 01-11-2017
Accepted: 02-12-2017

Meena N
PhD Scholar, Department of
Agronomy, TNAU, Coimbatore,
Tamil Nadu, India

PS Fathima
Professor and Head, Department
of Agronomy, College of
Agriculture, V.C. Farm, Mandya,
University of Agricultural
Sciences, Bengaluru, Karnataka,
India

GR Denesh
Assistant Professor, Department
of Agronomy, College of
Agriculture, V.C. Farm, Mandya,
University of Agricultural
Sciences, Bengaluru, Karnataka,
India

HS Shivaraj Kumar
PhD Scholar, Department of
Agronomy, UAHNS, Shimoga,
Karnataka, India

Correspondence

Meena N
PhD Scholar, Department of
Agronomy, TNAU, Coimbatore,
Tamil Nadu, India

Economics of agronomic biofortification of hybrid rice with zinc and iron on methods of rice cultivation

Meena N, PS Fathima, GR Denesh and HS Shivaraj Kumar

Abstract

A field experiment was conducted in College of Agriculture, V.C. Farm, Mandya during Kharif 2014. The experiment was laid out in split plot design with main plot as three methods of rice cultivation and subplot as four micronutrient management practices replicated thrice. Among the method of rice cultivation due to increased yield in System of Rice Intensification recorded the higher gross returns (90568 Rs/ha), net returns (50559Rs/ha) and Benefit: Cost ratio (2.26) compared to the Conventional method and Aerobic methods of rice cultivation. Soil application of zinc sulphate and iron sulphate showed higher gross returns (87309 Rs/ha) and net returns (47387 Rs/ha) due to high yield. Benefit: Cost ratio was higher with Seed treatment with the zinc sulphate at 0.2 % and iron sulphate at 0.1% (2.21) due to the less cost of cultivation than the other micronutrient management practices like soil application of zinc sulphate and iron sulphate and seed treatment combined with foliar spray.

Keywords: micronutrient management, rice cultivation, hybrid rice, seed treatment, foliar spray

Introduction

Rice is the major staple food for more than 60% of world's population and it plays a pivotal role in Indian agriculture, as it is the principal food crop for more than 70 per cent of the world population. Among the cereal crops, it serves as the principal source of nourishment for over half of the global population. Over 2 billion people in Asia alone derive 80% of their energy needs from, rice which contains 80% carbohydrates, 7-8% protein, 3% fat and 3% fiber. Until recently, rice was considered only a starch food and a source of carbohydrates and some amount of protein (Sanjay Kumar *et al.* 2018) [1]. It provides 23 % of the calories consumed by the world's population and provides 50–80 % of the energy intake of the people in the developing countries which is more than that of wheat or corn. However, rice is a poor source of many essential minerals and organic substances, especially iron (Fe), zinc (Zn) and lysine (Lys) and other essential amino acids for human nutrition. Currently, malnutrition of Fe and Zn afflicts more than 50 % of the world's population (Welch, 2005) [2]. This weakens immune function and impairs growth and development and continuous heavy consumption of rice with low concentration of Fe and Zn has been considered a major contributor (Welch and Graham, 1999) [3] and Zn deficiency is currently listed as a major risk factor for human health and causes of death globally. Biofortification, the delivery of micronutrients via staple food crops, has been proposed to complement existing efforts for the alleviation of micronutrient deficiency (Bouis *et al.* 2011) [4].

Rice production and food security largely depend on the irrigated lowland rice system, whose sustainability is threatened by fresh water scarcity, water pollution and competition for water use.

For producing 1kg of rice about 3000 -5000 litres of water is required owing to increasing water scarcity, a shifting trend towards less water demanding crops against rice is noticed in most part of India and this warrants alternate methods of rice cultivation that aims at higher water and crop productivity. There are evidences that cultivation of rice through system of rice intensification (SRI) can increase rice yields by two to three fold compared to current yield levels (Uphoff, 2005) [5]. Aerobic rice cultivation where fields remain unsaturated throughout the season like an upland crop offers an opportunity to produce rice with less water (Bouman *et al.* 2002) [6].

Materials and Methods

The field experiment was conducted in the kharif, 2014 at the college of Agriculture, V.C. Farm, Mandya, Karnataka on red sandy loam soil. Hybrid rice variety used is KRH-4. The

experiment was laid out in split plot design consisting of three replications with three main plots as methods of rice cultivation viz., System of Rice Intensification method, Conventional method and Aerobic method and four subplots with micronutrient management practices viz., Control without Zn and Fe, Soil application of ZnSO₄ at 20kg/ha and FeSO₄ at 10kg/ha, Seed treatment with ZnSO₄ at 0.2% and FeSO₄ at 0.1% and Seed treatment combined with the Foliar spray of ZnSO₄ and FeSO₄ at 0.5% each at boot leaf stage and panicle initiation stage. Nutrients were applied as per the treatment

Results and Discussion

Economics of rice cultivation varied due to methods of rice cultivation and micronutrient management practices. Higher gross returns (Rs.90568 ha⁻¹), net returns (Rs.50551 ha⁻¹) and benefit cost ratio (Rs 2.26) were obtained with SRI method followed by conventional method compared to aerobic method. The increased net return and B:C ratio was attributed to higher grain and straw yield obtained in SRI method compared to conventional and aerobic methods respectively.

Cost of cultivation was more in conventional method due to more number of management practices. The similar results have been also obtained by Jayadeva *et al.* 2009^[7] and Hugar *et al.* 2009^[8].

Among the micronutrient management practices, soil application of ZnSO₄ at 20 kg ha⁻¹ and FeSO₄ at 10 kg ha⁻¹ recorded higher gross returns (Rs.87309 ha⁻¹) and net returns (Rs.46606.99 ha⁻¹), followed by seed treatment alone compared to seed treatment combined with foliar spray of ZnSO₄ and FeSO₄ at 0.5 % over control. Higher gross returns and net returns with the treatment soil application of zinc sulphate and iron sulphate due to increased in yield these results of the study are in agreement with the findings of Mehta (1999)^[9], Tripathi and Tripathi (2004)^[10]. Higher Benefit : Cost ratio (2.21) recorded with treatment consisting of ZnSO₄ at 0.2 % and FeSO₄ at 0.1 % as Seed treatment compared to the other micronutrient management practices due to the use of small amounts of zinc sulphate and iron sulphate per hectare and hence the cost of cultivation was low (Harris *et al.*, 2008)^[11].

Table 1: Economics of Agronomic biofortification of hybrid rice with Zn and Fe in methods of rice cultivation

Treatment	Cost of cultivation (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
Main plot: Methods of cultivation				
M ₁ = SRI method of cultivation	40009	90568	50559	2.26
M ₂ = Conventional method of cultivation	41967	86289	44323	2.05
M ₃ = Aerobic method of cultivation	38217	75690	37474	1.98
Subplot: Micronutrient management practices				
S ₁ = Control without Zn and Fe,	38633	77800	39168	2.01
S ₂ = ZnSO ₄ at 20 kg/ha + FeSO ₄ at 10 kg/ha through Soil application	39923	87309	47387	2.18
S ₃ = ZnSO ₄ at 0.2 % and FeSO ₄ at 0.1 % as Seed treatment	38633	85747	47114	2.21
S ₄ = ZnSO ₄ at 0.2 % and FeSO ₄ at 0.1 % as Seed treatment + Foliar spray of ZnSO ₄ at 0.5 % and FeSO ₄ at 0.5 % at panicle initiation and boot leaf stage.	38727	85504	46777	2.20

References

- Sanjay Kumar, Ashok Kumar Singh, G Singh, Nareshmani Pandey, Ajit Kumar, Dinesh Kumar. Effect of establishment methods and weed management practices on the growth and yield of direct seeded rice (*Oryza sativa* L.) Journal of Pharmacognosy and Phytochemistry. 2018; 7(1):164-168.
- Welch RM, Biotechnology, biofortification, and global health. Food and Nutri. Bull., 2005; 26:419-421.
- Welch RM, Graham RD. A new paradigm for world agriculture: meeting human needs. Productive, sustainable, nutritious. Field Crops Res. 1999; 60:1-10.
- Bouis HE, Hotz C, McClafferty B, Meenakshi JV, Pfeiffer WH. Biofortification: a new tool to reduce micronutrient malnutrition. Food Nutr. Bull. 2011; 32:S31-40.
- Uphoff N. The development of the system of rice intensification in J Gonsalves *et al.* eds, Participatory Research and development for sustainable Agriculture and Rural Development. 2005; 3:119-125.
- Bouman BAM, Wang Hua QI, Yang Xiao Guang, Zhao Jun Fang, Wang Chang Gui. Aerobic rice (Han Dao): a new way of growing rice in water-short areas. In: Proc of the 12th Inter. Soil Conser. Organ. Conf., 26-31 May 2002, Beijing, China. Tsinghua University Press. 2002, 175-181.
- Jayadeva HM, Prabhakara settee TK, Sanjay MT. Effect of crop establishment techniques and sources of nitrogen on productivity, energetic and economics of rice. Mysore J Agric. Sci. 2009; 43(1):45-50.
- Hugar AY, Chandrappa H, Jayadeva HM, Sathish A, Mallikarjun GB. Influence of different establishment methods on yield and economics of rice. Agric. Sci. Digest. 2009; 29(3):202-205.
- Mehta DS. Effect of frequency of zinc application on yield of rice. Indian J Agron. 1999; 49(3):463-466.
- Tripathi AK, Tripathi HN. Studies on zinc requirement of rice. Haryana J Agron. 2004; 20(1):77-79.
- Harris D, Rashid A, Miraj G, Arif M, Yunas M. On-farm seed priming with zinc in chickpea and wheat in Pakistan. Pl. Soil. 2008; 306:3-10.