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Organic Farming, Nutritional Security and Environment Sustainability

Singh DK, Santosh Kumar Yadav, Supriya Tripathi, Kirti Sharma and Yogesh Sharma

Govind Ballabh Pant University of Agriculture & Technology, Pantnagar-263145
Udham Singhnagar, Uttarakhanad
Email:- dhananjayrahul@rediffmail.com Mobile No. 9411320066

Introduction

Organic farming has expanded rapidly in recent years and is seen as a sustainable alternative to chemical-based agricultural systems (Avery, 2007). Nutrient management in organic farming systems is often based on soil fertility building via nitrogen (N) fixation and nutrient recycling of organic materials, such as farmyard manure and crop residues, with limited inputs from permitted fertilizers (Gosling and Shepherd, 2005). Although organic farming has been criticized for relying on the build-up of soil phosphorus (P) and potassium (K) by past fertilization before converting to organic, its acceptance and popularity are growing mostly due to environmental and health related concerns (Galantini and Rosell, 2006). The fact that the use of organic fertilizers improves soil structure, nutrient exchange, and maintains soil health has raised interests in organic farming. The increasing scarcity of water is a major threat to rice production in many countries (Bouman *et al.,* 2009). Several approaches like alternate wetting and drying, raised beds, ground cover production system, aerobic rice systems (Prasad 2011) and System of Rice Intensification (SRI) are advocated to save water (Bruderie *et al.,* 2009). Therefore, with such background, field experiments were conducted to explore possible outcomes of sustainable production of organic basmati rice in rice-based cropping system in terms of productivity, water use-efficiency and methane emission reduction.

Methodology

Researches on organic farming under different aspect of management practices are being going on at G.B. Pant University of Agriculture and Technology, Pantnagar, India etc. under the Network Project on Organic Farming funded by ICAR. Since 2004-05 to explore possible outcomes of sustainable production of organic basmati rice in terms of productivity and water use efficiency the experimental soil was silty loam, medium in organic carbon (0.65%), available N (238 kg/ha), P (16.7 kg/ha), K (156 kg/ha) and high in available sulphur (29.3 kg/ha). Five management practices *viz.,* Green manure + FYM, FYM + Vermicompost, SRI with FYM, DSR+Soybean and Chemical in strip plot design. *Sesbania* was incorporated as green manure prior to basmati rice only. A similar experiment treatment also showed that the FYM+VC and GM+FYM were best to increase the antioxidant activity such as SOD, CAT, APX, GPOX, GR, TPC and TFC in the leaves.

Results

Among nutrient sources, use of DSR + Soybean recorded higher dry matter production, crop growth rate as well as grain yield and system productivity of basmati rice as compared to other sources and chemical fertilizers. Among the different basmati rice crop establishment, system productivity in terms of basmati rice grain equivalent was observed higher in System of Rice Intensification (SRI) as compared to conventional planting with continuous flooding. Irrigation water applied efficiency can also be increased by adopting system of rice intensification and direct seeded rice establishment systems. Highest irrigation water use efficiency in direct seeded rice (DSR) was due to decreased number of irrigations as compared to conventional transplanting and SRI. Organic control and chemical control recorded least irrigation water use efficiency due to continuous flooding which are being adopted by the farmers. FYM+VC and GM+FYM were best to increase the antioxidant activity such as SOD, CAT, APX, GPOX, GR, TPC and TFC in the leaves. Improvement in WHC of soil from initial in organic treatments receiving green manure and vermicompost was observed after one decade of continuous organic farming which was almost 76 % higher as compared to conventional farming. Bulk density of soil is decreasing under organic basmati rice based cropping system over ten years of continued crop cycles thereby decreasing the energy requirement. There has been a build-up of soil organic matter under organic farming system which is almost doubled after one decade of continuous organic farming as compared to chemical farming.

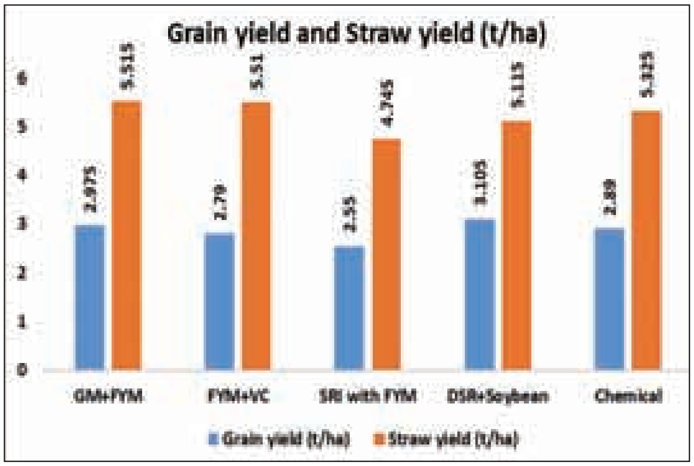

Fig.1: Effect of different Organic, Inorganic and integrated nutrient sources on grain yield and straw yield(t/ha) in Basmati rice.

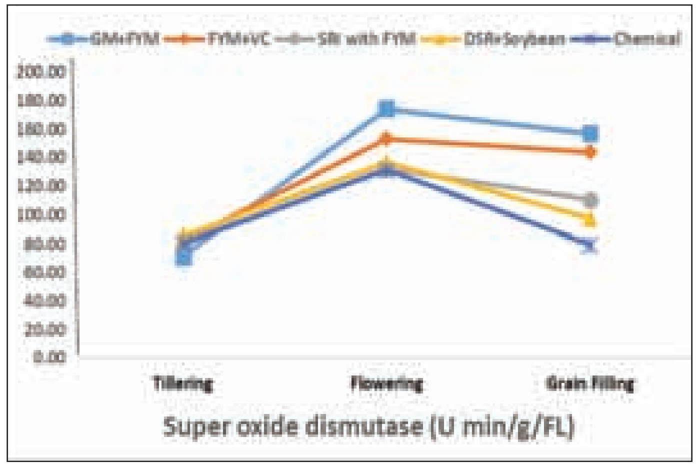

Fig.2: Effect of different Organic, Inorganic and integrated nutrient sources on Super oxide dismutase (U min/g/FL) in Hulled and Milled Basmati rice.

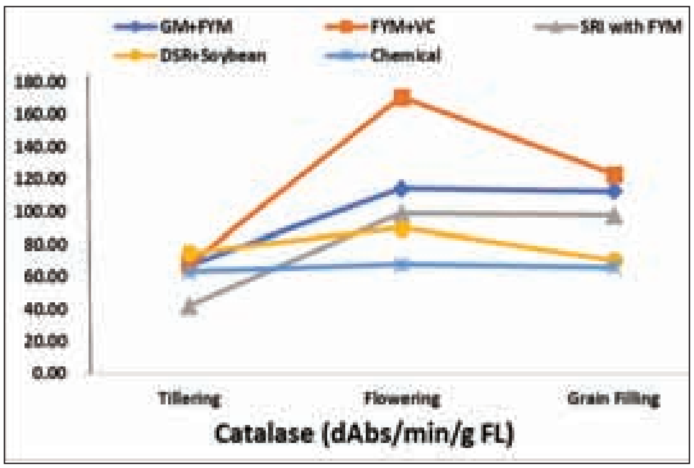

Fig.3 Effect of different Organic, Inorganic and integrated nutrient sources on Catalase (dAbs min/g FL) in Hulled and Milled Basmati rice.

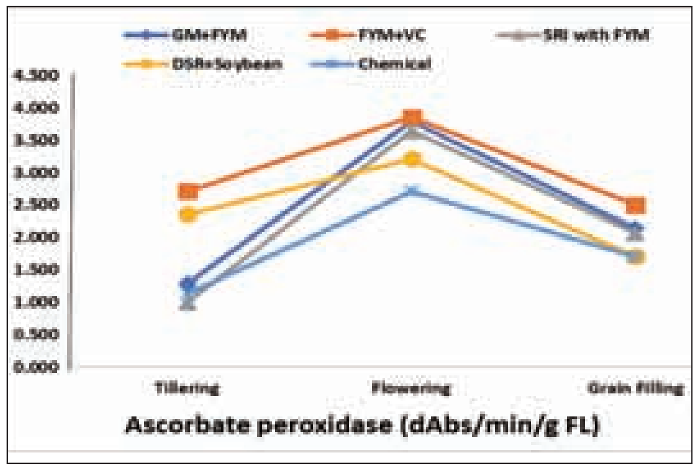

Fig.4 Effect of different Organic, Inorganic and integrated nutrient sources on Ascorbate peroxidase (dAbs min/g FL) in Hulled and Milled Basmati rice.

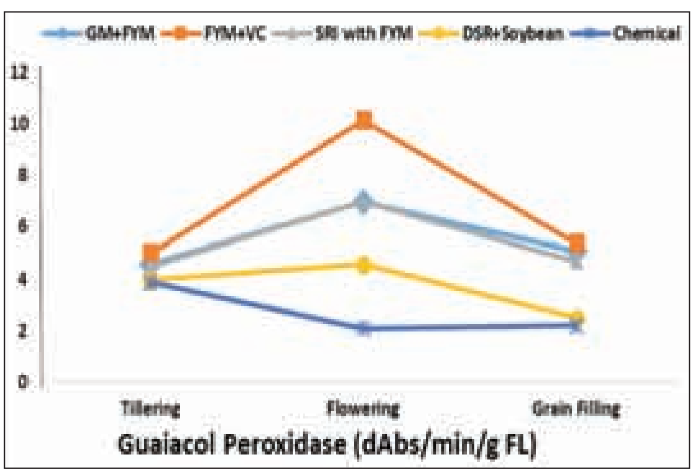

Fig.5 Effect of different Organic, Inorganic and integrated nutrient sources on Guaiacol Peroxidase (dAbs min/g FL) in Hulled and Milled Basmati rice.

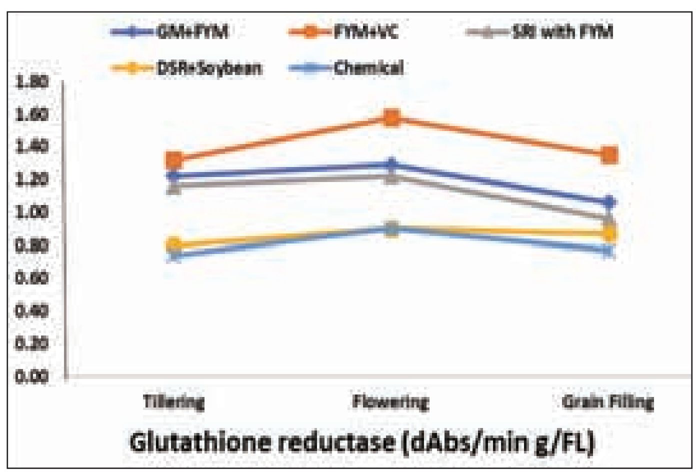

Fig.6 Effect of different Organic, Inorganic and integrated nutrient sources on Glutathione reductase (dAbs min/g FL) in Hulled and Milled Basmati rice.

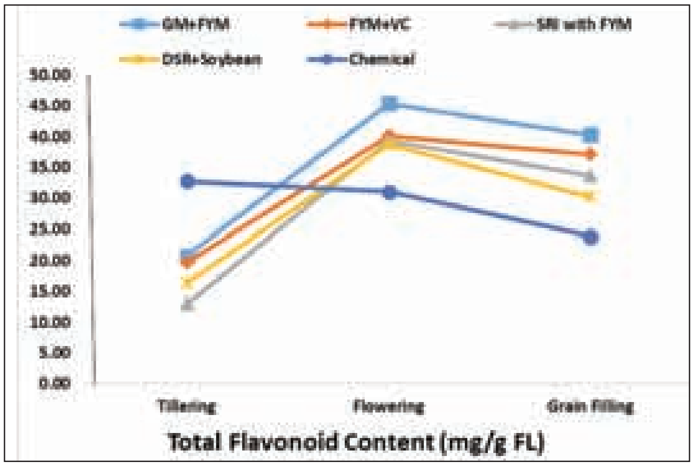

Fig.7 Effect of different Organic, Inorganic and integrated nutrient sources on Total Flavonoid Content (mg/g FL) in Hulled and Milled Basmati rice

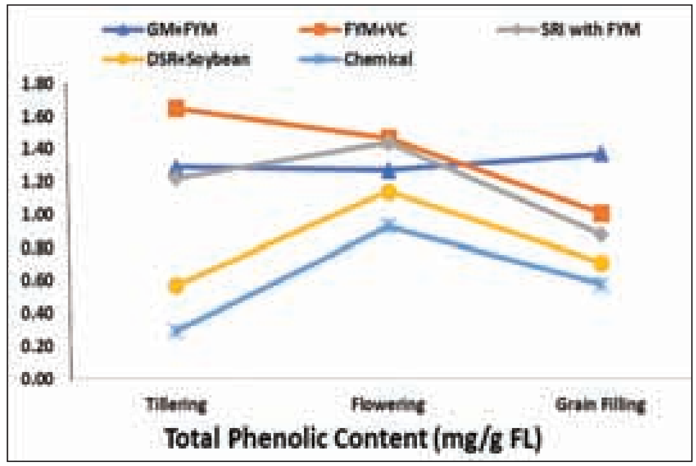

Fig.8 Effect of different Organic, Inorganic and integrated nutrient sources on Total Phenolic Content (mg/g FL) in Hulled and Milled Basmati rice

Conclusion

Build-up of soil organic matter is a key to adaptation in changing climatic scenario through increase in water holding capacity, improve soil ability to store the nutrients, proper aeration, to provide media for soil microorganism & buffering capacity or reduction of soil temperature. Availability of both macro and micro-nutrients enhanced under organic farming system as compared to chemical system. Therefore, crops in organic modes of cultivation can be sustained even under moisture stress situations i.e. rainfed conditions.

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