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Studies on organic farming of rice (*Oryza sativa*)–wheat (*Triticum aestivum*) cropping system

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Rice–wheat cropping system is the key for country's food security and self-sufficiency. Modern production system has emphasized the widespread use of chemicals like fertilizers and pesticides at higher levels over a prolonged period, which has not only polluted our water and air but also deteriorated physical, chemical and biological properties of soil, which are now showing the sign of fatigue and decline in yields. Therefore, the use of organic sources for nutrients needs and bio-pesticides and bio-insecticides for controlling the pest and disease under organic farming is an alternative approach to potentially sustain the productivity of the cropping system. An experiment was laid out in a randomized design with 3 replications to find out nutritional requirement of rice-wheat cropping system through organic manures and biofertilizers.

METHODOLOGY

Treatments consisted of 3 sets of treatments. One set of treatment was applied to rice, second to wheat and third to both rice and wheat. A set of treatments consisted of farmyard manure @ 10 t/ha (FYM), green manure + biofertilizer, green manure + FYM and green manure + FYM + biofertilizer. In addition, there was an absolute control for both rice and wheat. For green manuring *Sesbania aculeata* was used in rice and *Leucaena* green leaf manuring (LGLM) in wheat. For biofertilizers blue green algae (BGA) was used in rice and *Azotobacter* in wheat.

RESULTS

Results indicated that application of 10 t/ha of FYM

to rice increased grain yield over control by 34% in rice and 9% in wheat, whereas *Sesbania* green manuring (SGM) increased grain yield over control by 35% in rice and 25% in wheat. The combinations of SGM + BGA and SGM + FYM were more effective than FYM and SGM alone and increased grain yield over control by 39 and 49%, respective in rice and 27 and 34%, respectively in wheat. The combination of SGM + FYM + BGA was still better and increased grain yield over control by 57% in rice and 39% in wheat. Similarly, application of 10 t/ha FYM, *Leucaena* green leaf manuring (LGLM), LGLM + *Azotobacter*, LGLM + FYM and LGLM + FYM + *Azotobacter* increased grain yield over control by 18, 31, 35, 40 and 47%, respectively in rice and by 34, 44, 50, 57, and 62%, respectively in wheat. While considering total productivity of rice-wheat cropping system, application of FYM, SGM, SGM + BGA, SGM + FYM, SGM + FYM + BGA to rice increased total productivity of the system by 70, 75, 76, 81 and 85%, respectively, while application of LGLM, LGLM + *Azotobacter*, LGLM + FYM and LGLM + FYM + *Azotobacter* increased total productivity of the system by 73, 80, 83, 86 and 96, respectively. The different combinations of organic manures and biofertilizers were more effective when applied to both rice and wheat. Application of FYM, green manuring (GM), GM + biofertilizers, GM + FYM and GM + FYM + biofertilizers to both rice and wheat increased total productivity of the system by 89, 95, 98, 104 and 108% respectively.

Application of different combinations of organic manures and biofertilizers also significantly increased organic C, total N, available P and available K in soil.