International Journal of Farm Sciences **8(1):** 17-20, 2018; doi: 10.5958/2250-0499.2018.00005.8

Yield and soil health studies in wheat in pearl millet-wheat cropping system as influenced by various nutrient sources

BABLI and PRITI MALIK

Department of Agronomy, CCS Haryana Agricultural University
Hisar 125004 Haryana, India
Email for correspondence: priti.malikhau@gmail.com

 Received: 12.3.2017/Accepted: 24.5.2017

ABSTRACT

A field experiment was laid out at agronomy research farm of CCS Haryana Agricultural University, Hisar, Haryana during 2013-14 to evaluate the effect of various nutrient sources on yield and soil health in wheat under pearl millet-wheat cropping system. Maximum grain, straw and biological yield were recorded in T_6 (50% RD-NP + 50% N through FYM in pearl millet and 100% RD-NP in wheat) which was significantly higher over all the treatments except T_5. Organic carbon content was slightly increased from that of onset of the experiment to the end of the experiment at a depth of 0-15 cm. Significantly highest organic carbon (50% RD-NP +50% N through FYM in pearl millet and 100% RD-NP in wheat) was also observed in T_6 that improved the soil health in terms of positive nutrient balance. The organic carbon at the end of the experiment ranged from 0.34 to 0.51 per cent. At the end of the experiment pH ranged from from 7.86 to 8.10 and it was highest in T_6 among all the treatments.

Keywords: Pearl millet; wheat; soil health; nutrient sources

INTRODUCTION

Pearl millet is grown for both food and fodder. It is used as a feed in poultry and dairy and is an important drought-tolerant cereal crop. Pearl millet (*Pennisetum glaucum*)-wheat (*Triticum aestivum*) cropping sequence is the most popular under arid and semi-arid areas of India. This cropping sequence is very exhaustive that results in decrease in the productivity of soil, deterioration of soil health and potentially impairing the soil microbial activity. The productivity of soil and sustainability of crops in an intensive cropping system is improved by integrated use of organic and inorganic sources of nutrients of plants. The nutrient turnover in soil-plant system is considerably large under intensive cropping system. Therefore neither organic sources nor the chemical fertilizers alone can achieve production sustainability. Keeping this in view present study was undertaken to assess the effect of integrated nutrient management system on yield and soil health in pearl millet-wheat cropping sequence.

MATERIAL and METHODS

A field experiment was carried out to study the effect of various nutrient sources on yield and soil health studies in wheat under pearl millet-wheat cropping system in sandy loam soil of Hisar during 2013-14 at the agronomy research area at CCS Haryana Agricultural University, Hisar, Haryana. The experimental site had 7.87 pH, 191.53 kg/ha available nitrogen, 17.25 kg/ha available phosphorus and 288 kg/ha available potassium in the soil. The experiment was replicated thrice with twelve treatments and carried out in randomized block design. The treatments used were T_1 (Control with no fertilizer), T_2 (50% recommended NP to pearl millet and wheat through fertilizers), T_3 (50% recommended NP to pearl millet and 100% recommended NP to wheat through fertilizers), T_4 (75% recommended NP to pearl millet and wheat through fertilizers), T_5 (100% recommended NP to pearl millet and wheat through fertilizers). T_6 (50% NP through fertilizers + 50% N through FYM to pearl millet and 100% NP to wheat through fertilizers),

T_7 (75% NP through fertilizers + 25% N through FYM to pearl millet and 75% NP to wheat through fertilizers), T_8 (50% NP + 50% N through wheat straw to pearl millet and 100% NP to wheat through fertilizers), T_9 (75% NP + 25% N through wheat straw to pearl millet and 75% NP to wheat through fertilizers), T_{10} (50% NP + 50% N through *Sesbania* spp to pearl millet and 100% NP to wheat through fertilizers), T_{11} (75% NP + 25% N through *Sesbania* spp to pearl millet and 75% NP to wheat through fertilizers) and T_{12} (Farmers' practice). The recommended levels of nitrogen and phosphorus were 125 and 62.5 kg/ha for pearl millet and 150 and 60 kg/ha for wheat. The pearl millet variety used was HHB 197 with 5 kg seed/ha keeping row spacing of 45 cm. In wheat variety WH 711 was sown with 125 kg seed/ha keeping row spacing of 20 cm. The nitrogen content in different organic materials was determined each year and the amount of these materials required for substituting a specified amount of nitrogen as per the treatment was calculated. The organic sources of nutrients viz FYM, green manure of *Sesbania* and wheat straw were incorporated in soil at 30, 36 and 30 days respectively before sowing of pearl millet crop. The recommended nitrogen and phosphorus were applied through urea and DAP respectively. One post-sowing irrigation was applied during both the years to pearl millet. Similarly in wheat five irrigations were applied each year. Recommended package of practices were followed in both the crops for other agronomic operations. Yield, EC, pH and organic carbon obtained under wheat crop in pearl millet-wheat sequence were statistically analyzed using the f-test for treatment comparisons.

RESULTS and DISCUSSION

The data given in Table 1 show that T_6 (50% RD-NP + 50% N through FYM in pearl millet and 100% RD-NP in wheat) resulted in highest grain yield (5582 kg/ha) and was significantly higher over all the treatments except T_5 (5490 kg/ha) and T_{10} (5421 kg/ha). T_6 also recorded highest straw yield (6687 kg/ha) that was closely followed by T_5 (6560 kg/ha) and T_{10} (6450 kg/ha). Minimum straw yield was obtained in T_1 (Control). The minimum biological yield was obtained in T_1. T_6 (12269 kg/ha) produced significantly highest biological yield over all other treatments. Biological yield was statistically at par but higher in the treatments where 50 per cent N was supplied through FYM applied in pearl millet. Phosphorus application might have shown significant effect on the yield of wheat and the organic manures might have supplied the adequate and continuous amount of nutrients at different stages due to release of significant amount of nutrients

Table 1. Effect of different treatments on grain, straw and biological yield of wheat

Treatment	Biological yield (kg/ha)	Grain yield (kg/ha)	Straw yield (kg/ha)
T_1	2499	1190	1309
T_2	7798	3610	4188
T_3	9902	4649	5253
T_4	9836	4640	5196
T_5	12050	5490	6560
T_6	12269	5582	6687
T_7	10877	5036	5841
T_8	11176	5127	6049
T_9	10147	4742	5405
T_{10}	11871	5421	6450
T_{11}	10210	4749	5461
T_{12}	11034	5085	5949
SEm±	43.4	16.0	27.5
$CD_{0.05}$	128.2	47.3	81.1

T_1 (Control with no fertilizer), T_2 (50% recommended NP to pearl millet and wheat through fertilizers), T_3 (50% recommended NP to pearl millet and 100% recommended NP to wheat through fertilizers), T_4 (75% recommended NP to pearl millet and wheat through fertilizers), T_5 (100% recommended NP to pearl millet and wheat through fertilizers). T_6 (50% NP through fertilizers + 50% N through FYM to pearl millet and 100% NP to wheat through fertilizers), T_7 (75% NP through fertilizers + 25% N through FYM to pearl millet and 75% NP to wheat through fertilizers), T_8 (50% NP + 50% N through wheat straw to pearl millet and 100% NP to wheat through fertilizers), T_9 (75% NP + 25% N through wheat straw to pearl millet and 75% NP to wheat through fertilizers), T_{10} (50% NP + 50% N through *Sesbania* spp to pearl millet and 100% NP to wheat through fertilizers), T_{11} (75% NP + 25% N through *Sesbania* spp to pearl millet and 75% NP to wheat through fertilizers), T_{12} (Farmers' practice)

by mineralization at a constant level that resulted in highest grain yield. This might be attributed to its beneficial effect on yield attributes and higher availability of P that promoted growth and development ultimately resulting in higher yield. These findings are in accordance of those of Bhagchand and Gautam (2000).

EC

The data given in Table 2 show that at the start of the experiment the EC ranged between 0.17 to 0.22 dS/m at 0-15 cm soil depth and at the end of the experiment from 0.17 to 0.24 dS/m and was highest in T_6 (0.24 dS/m). A significant increase in EC of the soil was observed with the combined application of organic manures plus NP fertilizers over application of NP fertilizers alone (Kumara et al 2014).

pH

Higher pH value within chemical treatments was recorded in T_5. Among all the treatments pH value was highest in T_6 which was significantly higher over other treatments but at par with T_5 (Table 2). At the end of experiment pH ranged from 7.86 to 8.10 with highest in T_6. This could be due to continuous application of organic manures and phosphorus.

Organic carbon

Organic carbon (OC) content was slightly increased from start of the experiment to the end of the experiment at 0-15 cm depth. At the start of the experiment OC value ranged from 0.34 to 0.50 per cent (Table 2) which at the end of the experiment ranged from 0.34 to 0.51 per cent. T_6 (50% RD-NP + 50% N through FYM in pearl millet and 100% RD-NP in wheat) recorded highest (0.50%) organic carbon at the start and it was again highest (0.51%) at the end of the experiment. High organic matter in the soil improves the soil physical conditions and nutrient availability to crop plants. The increase in organic carbon content may be attributed to direct addition of organic manure in the soil which stimulates the growth and activity of favorable microorganisms, aids in better root growth and results in higher production of biomass, crop stubbles and residues (Singh et al 2011, Moharana et al 2012).

Table 2. EC, pH and organic carbon of soil at the start and at the end of the experiment

Treatment	EC (dS/m)		pH		OC (%)	
	Before sowing	At the end of experiment	Before sowing	At the end of experiment	Before sowing	At the end of experiment
T_1	0.17	0.17	7.72	7.86	0.34	0.34
T_2	0.18	0.18	7.72	7.92	0.36	0.37
T_3	0.18	0.19	7.88	8.02	0.41	0.41
T_4	0.18	0.19	7.79	8.00	0.40	0.41
T_5	0.20	0.21	7.93	8.08	0.48	0.49
T_6	0.22	0.24	8.00	8.10	0.50	0.51
T_7	0.20	0.20	7.91	7.98	0.44	0.44
T_8	0.20	0.20	7.93	7.98	0.46	0.46
T_9	0.19	0.19	7.88	8.07	0.42	0.42
T_{10}	0.20	0.21	7.93	8.04	0.47	0.48
T_{11}	0.19	0.19	7.90	8.07	0.43	0.43
T_{12}	0.20	0.21	7.91	8.08	0.45	0.45
SEm±	0.01	0.01	0.1	0.01	0.01	0.10
$CD_{0.05}$	0.02	0.02	0.2	0.04	0.02	0.20

T_1 (Control with no fertilizer), T_2 (50% recommended NP to pearl millet and wheat through fertilizers), T_3 (50% recommended NP to pearl millet and 100% recommended NP to wheat through fertilizers), T_4 (75% recommended NP to pearl millet and wheat through fertilizers), T_5 (100% recommended NP to pearl millet and wheat through fertilizers). T_6 (50% NP through fertilizers + 50% N through FYM to pearl millet and 100% NP to wheat through fertilizers), T_7 (75% NP through fertilizers + 25% N through FYM to pearl millet and 75% NP to wheat through fertilizers), T_8 (50% NP + 50% N through wheat straw to pearl millet and 100% NP to wheat through fertilizers), T_9 (75% NP + 25% N through wheat straw to pearl millet and 75% NP to wheat through fertilizers), T_{10} (50% NP + 50% N through *Sesbania* spp to pearl millet and 100% NP to wheat through fertilizers), T_{11} (75% NP + 25% N through *Sesbania* spp to pearl millet and 75% NP to wheat through fertilizers), T_{12} (Farmers' practice)

REFERENCES

Bhagchand and Gautam RC 2000. Effect of organic manure, biofertilizer and inorganic fertilizers on growth, yield and quality of rainfed pearl millet. Annals of Agricultural Research **21(4):** 459-464.

Kumara BH, Antil RS and Raj D 2014. Impact of long term manures and fertilizers application on carbon sequestration and its efficiency under pearl millet-wheat cropping sequence. International Journal of Farm Sciences **4(1):** 21-26.

Moharana PC, Sharma BM, Biswas DR, Dwivedi BS and Singh RV 2012. Long-term effect of nutrient management on soil fertility and soil organic carbon pools under a 6 year-old pearl millet-wheat cropping system in an Inceptisol of subtropical India. Field Crops Research **136:** 32-41.

Singh RN, Singh S, Prasad SS, Singh VK and Kumar P 2011. Effect of integrated nutrient management on soil fertility, nutrient uptake and yield of rice-pea cropping system on an upland acid soil of Jharkhand. Journal of the Indian Society of Soil Science **59(2):** 158-163.