RESEARCH ARTICLE

IMPACT OF TILLAGE PRACTICES ON PHYSICO-CHEMICAL AND FUNCTIONAL DIVERSITY IN PEARL MILLET-WHEAT CROPPING SYSTEM

Dhinu Yadav*, Leela Wati[1], Dharam Bir Yadav[2] and Ashok Kumar[3]

Department of Microbiology, CCS Haryana Agricultural University, Hisar
[1]Department of Microbiology, CCS Haryana Agricultural University, Hisar
[2]Department of Agronomy, CCS Haryana Agricultural University, Hisar
[3]Department of Agronomy, CCS Haryana Agricultural University, Hisar
Email: dhinuyadav737@gmail.com

Received-20.01.2020, Revised-17.02.2020

Abstract: Conservation agriculture based tillage practices mainly zero-tillage (ZT) considered as major component of sustainable agriculture that involves reducing the tillage operations retaining at coast 30% of plant parts/crop-residues at the soil surface and including crop-rotation in the existing cropping system. More research is needed for better understanding of tillage effects on soil physico-chemical and microbiological properties. Thus, the impact of two tillage systems: no-tillage (NT) and conventional tillage (CT) with different crop-rotations *i.e.* Conventional Tillage Wheat-Conventional Tillage Pearlmillet (CTW-CTPM), Conventional Tillage Wheat-Zero Tillage Pearlmillet (CTW-ZTPM), Zero Tillage Wheat-Conventional Tillage Pearlmillet (ZTW-CTPM) and Zero Tillage Wheat-Zero Tillage Pearlmillet (ZTW-ZTPM) on physico-chemical and functional diversity of soil was evaluated in the present investigation at CCSHAU, Regional Research Station (RRS) at Bawal during 2014 year. After harvesting of wheat in 2017, triplicate soil samples from undisturbed and disturbed soil were obtained from two different depths (0-15 cm and 15-30 cm), for determination of $CaCO_3$, Total N, P and K content and Functional diversity of microbes. Physico-chemical properties and functional diversity were recorded relatively higher under ZTW-ZTPM system at surface (0-15 cm) layer. SOC was recorded higher at surface layer under ZTW-ZTPM (0.29 %) as compared to CTW-CTPM (0.26 %) and the respective values at subsurface layer were 0.25 and 0.23%. In nutshell, NT treatments promoted better physico-chemical and functional diversity of the soil relative to the CT treatment.

Keywords: Functional diversity, Nutrient release pattern, Tillage systems

REFERENCES

Allen, D. E., Singh, B. P. and Dalal, R. C. (2011). Soil health indicators under climate change: a review of current knowledge. In: *Soil Health and Climate Change* (eds: Singh B P, Cowie A L and Chan K Y). Heidelberg: Springer; pp. 25–45.

Asenso, E., Li, J., Hu, L., Issaka, F., Tian, K., Zhang, L., Zhang, L. and Chen, H. (2018). Tillage effects on soil biochemical properties and maize grown in latosolic red soil of southern China. Hindawi. *App. Env. Soil Sci.* **2018,** 1-10.

Bremner, J. M. and Mulvaney, C. S. (1982). Nitrogen total. In: *Methods of Soil Analysis*, (eds: A L, Miller, R H and Keeny D R), Part 2, Chemical and Microbiological properties. *Am. Society Agr. Madison,* pp. 643-698.

Çelik, I., Acir, N., Günal, H., Acar, M. and Barut, Z. B. (2017). Effects of long-term soil tillage practices on soil chemical characteristics. *International conference on agriculture, forest, Food sciences and technologies*, 15-17 May, 2017 at Turkey.

Congreves, K. A., Hayes, A., Verhallen, L. L. and Van Eerd, L. L. (2015). Long term impact of tillage and crop rotation on soil health at four temperate agroecosystems. *Soil Till. Res.* **152,** 17–28.

Dorr de Quadros, P., Zhalnina, K., Davis-Richardson, A., Fagen, J. R., Drew, J., Bayer, C., Camargo, F. A. O. and Triplett, E. W. (2012). The effect of tillage system and crop rotation on soil microbial diversity and composition in a subtropical acrisol. *Div.* **4(4),** 375-395.

Gałązka, A., Gawryjołek, K., Perzyński, A., Gałązka, R. and Księżak, J. (2017). Changes in enzymatic activities and microbial communities in soil under long-term maize monoculture and crop rotation. *Polish J. Env. Stud.* **26,** 39–46.

Habig, J. and Swanepoel, C. (2015). Effects of conservation agriculture and fertilization on soil microbial diversity and activity. *Env*. **2(3),** 358-384.

Hobbs, P. R., Sayre, K. and Gupta, R. (2008). The role of conservation agriculture in sustainable agriculture. *Philosophical Transactions of the Royal Society B: Biol. Sci*. **363,** 543–555.

Islam, A. K. M. S., Saleque, M. A., Hossain, M. M. and Islam, A. K. M. A. (2015). Effect of conservation tillage on soil chemical properties in rice-maize cropping system. *The Agriculturists*, **13(2),** 62-73.

Janušauskaite , D., Kadžienė, G. and Auškalnienė, O. (2013). The Effect of tillage system on soil microbiota in relation to soil structure. *Polish J. Env. Stud.* **22(5),** 1387-1391.

Jat, R. A., Wani, S. P. and Sahrawat, K. L. (2012). Conservation agriculture in the semi-arid tropics: Prospects and problems. *Adv. Agro*. **117,** 191–273.

Jat, H. S., Datta, A., Sharma, P. C., Kumar, V., Yadav, A. K., Choudhary, M., Choudhary, V., Gathala, M. K., Sharma, D. K., Jat, M. L.,

*Corresponding Author

Yaduvanshi, N. P. S., Singh, G. and McDonald, A. (2018). Assessing soil properties and nutrient availability under conservation agriculture practices in a reclaimed sodic soil in cereal-based systems of North-West India. *Arch. Agro. Soil Sci.* **64(4),** 531-545.

John, M. K. (1970). Colorimetric determination of phosphorus in soil and plant materials with ascorbic acid. *Soil Sci*. **109,** 214-220.

Kalembassa, S. J. and Jenkinson, D. S. (1973). A comparative study of titrimetric and gravimetric methods for the determination of organic carbon in soil. *J. Sci. Food Agr.* **24,** 1089-1090.

Kaushik, U., Raj, D., Rani, P. and Antil, R. S. (2018). Impact of zero tillage on available nutrients status on pearlmillet wheat cropping system. *Int. J. Chem. Stud.* **6(3),** 2997-3000.

Knudsen, D., Peterson, G. A. and Pratt, P. F. (1982). Lithium, sodium, and potassium. *In: Methods of Soil Analysis.* Chemical and Microbiological properties. *Soil Sci. Society Am.* **2(2),** 225–246.

Krishna, V. V. and Veettil, P. C. (2014). Productivity and efficiency impacts of conservation tillage in northwest Indo-Gangetic Plains. *Agr. Sys.* **127,** 126–138.

Kumar, A., Panda, A., Mishra, V. N. and Srivastavaint, L. K. (2018). Short-term effect of conservation tillage on carbon pools under rainfed cropping systems of central India. *Int. J. Curr. Micro. App. Sci*. **7(1),** 2040-2053.

Neugschwandtner, R. W., Liebhard, P., Kaul, H. P. and Wagentrist, H. (2014). Soil chemical properties as affected by tillage and crop rotation in a long-term field experiment. *Plant Soil Env.* **60(2),** 57-62.

Nivelle, E., Verzeaux, J., Habbib, H., Kuzyakov, Y., Decocq, G., Roger, D., Lacoux, J., Duclercq, J., Spicher, F., Nava-Saucedo, J. E., Catterou, M., Dubois, F. and Tetu, T. (2016). Functional response of soil microbial communities to tillage, cover crops and nitrogen fertilization. *App. Soil Eco.* **108,** 147–155.

Nta, S. A., Lucas, E. B. and Ogunjimi, L. A. O. (2017). Effect of tillage on soil physico-chemical properties in South-Western Nigeria. *Int. J. Res. Agr. Forestry* **4(7),** 20-24.

Puri, A. N. (1949). Soils: Their Physics and Chemistry. Reinbold Publ. Corp. New York.

Zuber, S. M., Behnke, G. D., Nafziger, E. D. and Villamil, M. B. (2015). Crop rotation and tillage effects on soil physical and chemical properties in Illinois. *Agro. J.* **107(3),** 971-978.

Zuber, S. M., Behnke, G. D., Nafziger, E. D. and Villamil, M. B. (2018). Carbon and nitrogen content of soil organic matter and microbial biomass under long-term crop rotation and tillage in Illinois, USA. *Agr,* **8(3),** 1-12.