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Effects of long-term fertilization on soil labile carbon and aggregates in an oasis cropland

Yugang Wang, Ran Liu, Jinrong Rong, and Yan Liu

Xinjiang Institute of Ecology and Geography, Chinese Academy of Sciences,Urumqi, Xinjiang 830011, China (wangyg@ms.xjb.ac.cn)

Abstract

Soil labile carbon and aggregates are the important index of soil quality, particularly in the dryland which is vulnerable to land use change and management. This study examined the effects of twenty-year fertilization on soil labile organic carbon (C) and water stable aggregates in an oasis cropland in Xinjiang, Northwest China. The experiments were conducted in the vicinity of the Fukang station of Desert Ecology, Chinese Academy of Sciences, which is located in the hinterland of the Eurasia continent (44°17°N, 87°56′°E, altitude 461 m). The station is located at the southern edge of the Junggar Basin and is only 8 km from the southern edge of the Gurbantonggut Desert (the second largest desert in China). The climate is an arid continental climate with annual precipitation of 163 mm, and range in annual pan evaporation of 1780–2460 mm. The long-term experiment on soil fertility and nutrition balance started in 1990. The crop was winter wheat, planted in September each year, and harvested at the end of June or July of the next year. We compared particulate organic C, dissolved organic C, dissolved inorganic C, and water stable macro- aggregates (>0. 25 mm) in the desert from which the oasis was created and four fertilization treatments, which are no fertilization (CK), chemical fertilization (NPK), and chemical plus organic fertilization (NPK+M, M stands for pig manure; NPK+S, S stands for straw residue). The results showed that the fertilization led to the accumulation of particulate organic C, dissolved organic C, dissolved inorganic C, and the proportion of water stable macro- aggregates in surface soil (0-20 cm), compared to the desert from which the oasis was created. Compared with no fertilization (CK), chemical plus organic fertilization (NPK+M and NPKS) prompted the accumulation of soil labile C and the formation and stability of water stable macro-aggregates. In these treatments, the particulate organic C and water stable macro-aggregates in the surface soil played a major role in soil C accumulation of the soil profile. Soil labile C was positively correlated with soil aggregate stability.

Key words: Fertilization; Long-term; Oasis; Soil organic carbon; Water stable aggregates