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J Earth Sci Clim Change 2017, 8:10(Suppl)
DOI: 10.4172/2157-7617-C1-037

4th World Conference on

CLIMATE CHANGE

October 19-21, 2017 | Rome, Italy

Effects of rainwater harvesting on sunflower growth and optimization of the ridge-furrow ratio with different precipitation in the semi-arid region, Northern China

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The ridge-furrow rainwater-harvesting system (RFRHS) has been an important agricultural practice for improving dependable production and adapting to the warming and drying climate in semi-arid regions.However, the optimum RFRHS is not universal for different crop and precipitation conditions. To determine the optimal sunflower RFRHS under different precipitation conditions in semi-arid regions in Northern China, a 3-year field experiment with 7 treatments was conducted from 2013~2015 in Wuchuan county. This study included 3 ridge-furrow ratio (Rrf) (1.0 m: 1.0 m (R1), 1.0 m: 0.5 m (R2) and 0.5 m: 1.0 m (R0.5)) treatments with film-mulching ridge (M1) and no-mulching ridge (M0), and a flat plot without mulching as the control treatment (CK). The results showed that the film-mulching treatments (M1R1, M1R2 and M1R0.5) effectively promote sunflower growth, soil water storage (SWS) and the actual grain yield (Ya). They increased the available precipitation and improved the SWS, hundred-grain weight and Ya by 0.4%~13.8%, 4.5%~70.2%, and 15.6%~107.5% compared to the CK in 2013~2015, respectively. The results also showed that the optimal Rrf was reduced with increasing precipitation, and there was no need to apply the sunflower RFRHS when the precipitation was more than 588.7mm. The optimum Rrf interval for rainy, normal and dry years was 0.16~0.71, 0.71~1.34 and 1.34~2.77 respectively in Wuchuan County. Considering the actual production condition and the precipitation conditions in Wuchuan, we suggest that M1R0.5 can be promoted in this region. All in all, the study proved that the RFRHS could improve the crop production than the traditional cultivation, especially in arid years, but did not consume more water. So the RFRHS would make positive contribution to sunflower production in the semi-arid regions in Norther China under the warming and drying climate.

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