

Plastic film cover during the fallow season preceding sowing increases yield and water use efficiency of rain-fed spring maize in a semi-arid climate

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Summary

Plastic film mulch increases crop yields in rain-fed agriculture in cool semi-arid climates by warming the soil and reducing evaporative water losses. The semi-arid Khorchin area in Northeast China is an important production area for rain-fed maize. Drought stress occurs frequently, even if plastic film mulch is applied at sowing. We hypothesized that the yield and water capture of maize could be increased by reducing evaporative loss of water by use of plastic film cover during the autumn and winter preceding sowing. In this study, we compared maize growth, water uptake and yield in three film cover treatments: (1) film cover from the autumn before maize sowing until maize harvest (autumn mulching: AM), (2) film cover from maize sowing till harvest (conventional practice) (spring mulching: SM), (3) no film cover (no mulch: NM). Field experiments were conducted in Fuxin city, Khorchin region, Liaoning province, China in 2013/2014 and 2014/2015. Autumn mulching increased grain yield on average by 18% when compared to spring mulching and by 36% when compared to no mulching. The 1000-kernel weight in AM was 7% higher than in SM, and 12% higher than in NM. Soil water content in the root zone before sowing was 35 mm greater in AM than in SM and NM. Water uptake during the growing season was 34 mm greater in AM than in SM and NM. Water use efficiency for grain yield (yield per unit water uptake) in AM was on average 2.5% higher than in conventional mulching (SM) and 27% higher than in NM. Autumn mulching advanced development, with an advance of 5 days in tasseling time as compared to SM and 10 days when compared to NM. These results show that film cover during the

fallow period before maize sowing can increase crop yield and water use efficiency, and reduce climate risks in rain-fed agriculture under semi-arid conditions.

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