Optimizing Plastic Mulching Improves the Growth and Increases Grain Yield and Water Use Efficiency of Spring Maize in Dryland of the Loess Plateau in China

Shibo Zhang [1, 2], Guixin Zhang [1, 2], Zhenqing Xia [1, 2], Mengke Wu [1, 2], Jingxuan Bai [1, 2], Haidong Lu [1, 2, *]

([19]College of Agronomy, Northwest A &F University, Yangling 712100, China; [20]Key Laboratory of Biology and Genetic Improvement of Maize in Arid Area of Northwest Region, Ministry of Agriculture, Yangling 712100, China)

Abstract: 【**Objective**】Transparent plastic film mulching (PFM) with flat cropping cultivation has been widely applied to grow maize (*Zea mays* L.) in dryland agricultural production areas of the Loess Plateau in China. However, with global warming-induced gradual increase in soil temperature, film-mulched spring maize experiences premature senescence and yield loss. 【**Method**】In this study, a new form of mulching strategy involving dual mulching of transparent plastic film with whole maize stalks in a flat plot was established to improve growth and increase water use efficiency (WUE), precipitation use efficiency (PUE), and spring maize yield. The field experiment was conducted in 2018, 2019, and 2020 on a conventional flat plot without mulching (CK), a flat plot with single transparent PFM, and a flat plot of transparent film mulching with whole maize stalks (PFM+ST) in the dryland of the Loess Plateau in China, to quantify the effects of different treatments on soil hydrothermal conditions, maize phenology, plant growth dynamics, WUE, PUE, and maize yield. 【**Result**】Results demonstrated that soil water storage (SWS) at 0–100 cm soil layer in PFM and PFM+ST were significantly superior to those in CK, but SWS did not significantly differ between PFM and PFM+ST. Soil temperature under PFM+ST at 0–25 cm soil layer decreased by 1.2°C compared with that under PFM during growth, especially in early growing seasons (20–60 days after sowing [DAS]). PFM+ST extended vegetative and reproductive growth periods by 1–2 and 6–7 days compared with those in PFM, respectively. In later growth period (80–120 DAS), PFM+ST increased the root dry matter weight, SPAD, and LAI and significantly increased the aboveground dry matter accumulation. PFM+ST significantly increased the 100-kernel dry weight, grain yield, WUE, and PUE. PFM+ST had 3-year average grain yields of 10.82% and 36.48% greater than PFM and CK, respectively. The corresponding WUE and in 0–200 cm soil layer improved by 12.55% and 39.84%, and PUE improved by 10.82% and 36.48%, respectively. 【**Conclusion**】With global warming, applying PFM+ST cultivation practice effectively extended growth period and increased mulching spring maize yield and WUE in the study site.

Acknowledgements：National Natural Science Foundation of China (No. 31771724)
Shibo Zhang, E-mail：shibozhang@nwafu.edu.cn
Acknowledgements：Key Research and Development Project of Shaanxi Province (No. 2022NY-197)
Shibo Zhang, E-mail：shibozhang@nwafu.edu.cn