

黄土旱塬区不同覆盖措施对冬小麦农田土壤呼吸的影响

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Effects of different mulching measures on winter wheat field soil respiration in Loess Plateau dry land region.

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摘要 采用田间试验研究了黄土旱塬区不同覆盖措施下的冬小麦农田土壤呼吸日变化和季节变化特征. 试验包括4个处理: 作物生育期秸秆覆盖 $600 \text{ kg} \cdot \text{hm}^{-2}$ (M_{600})、秸秆覆盖 $300 \text{ kg} \cdot \text{hm}^{-2}$ (M_{300})、地膜覆盖 (PM) 和无覆盖处理 (CK). 结果表明: 冬小麦农田土壤呼吸速率从播种至返青之前呈下降趋势, 处理间没有显著差异; 越冬后土壤呼吸速率迅速提高, 至拔节期最高. 与CK相比, 3个覆盖处理在越冬至成熟期间均显著促进了土壤 CO_2 的释放, 其中PM与其他处理间的差异达到极显著水平. 全生育期 M_{600} 和 M_{300} 处理土壤呼吸速率平均分别为 1.47 和 $1.52 \mu\text{mol CO}_2 \cdot \text{m}^{-2} \cdot \text{s}^{-1}$, 较CK ($1.38 \mu\text{mol CO}_2 \cdot \text{m}^{-2} \cdot \text{s}^{-1}$) 分别提高了 6.6% 和 10.2% ; PM处理土壤呼吸速率平均为 $3.63 \mu\text{mol CO}_2 \cdot \text{m}^{-2} \cdot \text{s}^{-1}$, 较CK提高了 163% . CK处理土壤呼吸日变化呈单峰曲线, 峰值出现在 $12:00$ 左右, 秸秆覆盖后峰值时间推迟到 $14:00$ 左右; PM处理土壤呼吸日变化特征在拔节期与对照相似, 在成熟期则呈双峰曲线, 峰值分别出现在 $12:00$ 和 $16:00$ 左右. 土壤呼吸速率与土壤温度和土壤水分分别呈指数和抛物线式相关.

关键词: 土壤呼吸 覆盖 冬小麦 黄土旱塬区

Abstract: A field experiment was conducted to study the effects of different mulching measures on the diurnal and seasonal variations of winter wheat field soil respiration in dry land region of Loess Plateau. Four treatments were installed, *i.e.*, $300 \text{ kg} \cdot \text{hm}^{-2}$ straw mulching (M_{300}), $600 \text{ kg} \cdot \text{hm}^{-2}$ straw mulching (M_{600}), plastic film mulching (PM), and no mulching (CK). In all treatments, the soil respiration rate had a decreasing trend from autumn to winter, but increased rapidly after winter and peaked at jointing stage. Comparing with CK, treatments mulching promoted the soil respiration obviously from wintering to maturing stage, with significant differences between treatment PM and the others. The average soil respiration rate in treatments M_{300} and M_{600} in whole growth period was $1.52 \mu\text{mol CO}_2 \cdot \text{m}^{-2} \cdot \text{s}^{-1}$ and $1.47 \mu\text{mol CO}_2 \cdot \text{m}^{-2} \cdot \text{s}^{-1}$, being 10.2% and 6.6% higher than the CK ($1.38 \mu\text{mol CO}_2 \cdot \text{m}^{-2} \cdot \text{s}^{-1}$), respectively, and that in treatment PM was $3.63 \mu\text{mol CO}_2 \cdot \text{m}^{-2} \cdot \text{s}^{-1}$, 163% higher than CK. The diurnal variation of soil respiration rate in CK and in M_{300} and M_{600} presented a single peak curve and peaked at $12:00$ and $14:00$, respectively, but for PM treatment, the diurnal variation of soil respiration rate was similar with that in CK at jointing stage while presented a bimodal curve at maturing stage, with the peaks at $12:00$ and $16:00$, respectively. Soil respiration rate had an exponential correlation with soil temperature, and a parabolic correlation with soil moisture.

Key words: soil respiration mulching winter wheat Loess Plateau dry land region

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