

利用冬小麦作物生长模型对产量气候风险的评估

Assessing the climatic risk to crop yield of winter wheat using crop growth models

投稿时间: 2004-2-25 最后修改时间: 2004-12-25

稿件编号: 20050223

中文关键词: 冬小麦; 作物生长模型; 气候风险评估; 北京地区

英文关键词: winter wheat; crop growth model; climatic risk; Beijing

基金项目: 国家自然科学基金项目“华北平原小麦玉米两熟生产气候风险评估与决策支持研究”(39970418)

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中文摘要:

以北京地区冬小麦生产为例,介绍了两种作物生长模型——小麦生长模拟模型WheatSM和农业生产模拟系统(小麦模型)APSIM-Wheat在作物生产气候风险评估中的应用研究。在对WheatSM和APSIM-Wheat进行参数调试和验证的基础上,用北京地区1955~2000年的历史时期气候资料,以日为时间步长,进行多年冬小麦生产的模拟,分析不同气候年型下冬小麦产量的风险。其中,利用WheatSM的模拟结果评估了北京地区热害对冬小麦产量造成的风险,结果表明,5月平均气温 $\geq 21^{\circ}\text{C}$ 时为灌浆期高温年型,热害造成的减产至少在13.1%以上;利用APSIM-Wheat的模拟结果评估了北京地区干旱造成的冬小麦产量风险,结果表明,当全生育期降水量 $< 100\text{ mm}$,缺水 $> 169.40\text{ mm}$ 时,北京冬小麦全生育期严重干旱,冬小麦产量在 $4\text{ t}\cdot\text{hm}^{-2}$ 以下。以上研究结果符合生产实际,可为北京地区不同气候年型下冬小麦生产的动态决策和减轻灾害损失提供科学依据和技术支持。

英文摘要:

Based on validation of two crop growth models (WheatSM and APSIM-Wheat) for the winter wheat yield simulation of Beijing, winter wheat yields of multi-years were simulated by day step. According to the relationship among temperature, rainfall and simulated yields, different year types were defined and climatic risk to winter wheat production in different types of year was analyzed. Using WheatSM simulated yields, the high temperature risk to winter wheat production was assessed: when average temperature in May is over or equal to 21°C , the year of this phenological season is attributed to high temperature type and the yield will be reduced at least by 13.1% by high temperature disaster. Drought risk to wheat production was assessed using APSIM-Wheat simulated yield: when rainfall for a whole growing period is less than 100 mm and water shortage for a whole growing period is over 169.40 mm , the year is attributed to severe drought type and the yield is lower than $3.5\text{ t}\cdot\text{hm}^{-2}$. This study shows that the advantage of applying crop growth models to assessing climatic risk to crop production. The information obtained by climatic risk assessment provides valuable scientific basis and technological support for dynamic decision-making, and relieving the losses of winter wheat yield caused by high temperature and drought disasters, which ensures sustainable production of winter wheat in Beijing.

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