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大豆茎秆、叶片及豆荚生长的动态模拟

Dynamic simulation of stem, leaf and pod development on soybean

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中文摘要：

　　以疆莫豆1号、蒙豆30、北豆5号为试材，在系统观测的基础上，构建了大豆茎秆、叶片和豆荚等器官的形态建成模型。模型以生理发育时间为时间步长，以生理发育日来衡量茎秆、叶片和豆荚的生长进程与生长次序，以品种遗传参数为基础来确定其他的模型参数，引入了最小含氮量、最大含氮量和临界含氮量来订正氮素的影响。不同品种不同播期的检验结果表明，节间长度的模拟误差在0.08～0.59 cm，RMSE在0.25～0.28 cm；节间粗度的模拟误差在0～0.10 cm，RMSE在0.04～0.05 cm；叶片长度的模拟误差在0.28～0.58 cm，RMSE为0.47 cm；叶片宽度的模拟误差在0.31～0.39 cm，RMSE在0.35～0.36 cm；豆荚长度的模拟误差在0.14～0.39 cm，RMSE在0.24～0.39 cm；豆荚宽度的模拟误差在0.09～0.21 cm，RMSE在0.14～0.17 cm；豆荚厚度的模拟误差在0.04～0.09 cm，RMSE在0.06～0.07 cm。模型表现出较好的预测性和可靠性。该研究可为大豆器官形态的虚拟显示提供参考。

英文摘要：

　　Abstract: Based on systematic observation, the organ morphogenesis model was established on soybeans. In the model, the time step was physiological development time, the growth process and the growth of the order of the stem, leaves and pods were measured by physiological development day, the model parameters were determined by genetic parameters, and the minimum nitrogen content, maximum nitrogen content, and critical nitrogen content were used to express the impact of nitrogen. In the model, internode potential length and potential thickness increased gradually with the increase of the number of soybeans internode, and reached a maximum at the ninth and seventh internode, and then decreased gradually. Therefore, the potential length of the ninth internode and potential thickness of the seventh internode were determined as potential genetic parameters that can calculate the other internodes' potential length and potential thickness. Because of similar leaf morphology on each internode on soybeans, this study only modeled the dynamic of the third fronds. Based on soybean morphological characteristics, this study simulated the pods which first appeared on the third internode. The results showed that the absolute prediction errors ranges of internode length, internode thickness, leaf length, leaf width, pod length, pod width, and pod thickness were 0.08-0.59, 0-0.10, 0.28-0.58, 0.31-0.39, 0.14-0.39, 0.09-0.21, 0.04-0.09 cm respectively with the root mean square errors (RMSE) being 0.25-0.28, 0.04-0.05, 0.47, 0.35-0.36, 0.24-0.39, 0.14-0.17, 0.06-0.07 cm, respectively. The model reflected a satisfactory prediction. Moisture had a greater impact on soybean organ morphogenesis. Because of the test conditions, this study did not establish a moisture influence factor model. The model establishment of water and nitrogen coupling soybean organ morphogenesis is the next research program. The models also need to be tested at a greater variety and a wider geographical scope.

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