深施型液态施肥机扎穴机构优化设计 Optimization Design on Pricking Hole Mechanism of Deep-fertilization Liquid Fertilizer Applicator

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关键词： 液态施肥机 扎穴 椭圆齿轮 仿真 优化 设计

摘 要： 为实现液态施肥机高速作业，设计了一种结构简单、运动平稳的椭圆齿轮行星系作为液态施肥机的扎穴机构。对该机构进行运动学分析，建立了数学模型，以穴距200mm和入土深度120～150mm为寻优目标，应用Visual Basic 6.0软件编程得出满足机构运动要求的最优参数范围为：喷肥针尖和行星轮轴连线与行星架的初始夹角-45°～-40°、行星架初始角位移40°～50°、喷肥针尖与行星轮轴心距离280～300mm，此时椭圆齿轮长半轴29.364mm、齿数23、短半轴与长半轴比0.958，正圆齿轮半径25mm。从优化工作参数中选择一组参数设计扎穴机构，应用Pro/E软件进行仿真。结果表明，根据优化参数设计的扎穴机构能够满足穴距和入土深度的设计要求。 In order to realize the high-speed work of liquid fertilizer applicator, the elliptic gear planetary galaxy as the pricking hole mechanism was designed, which presented the simple structure and steady movement. Then, the mathematical model for this mechanism was established. By Visual Basic 6.0 program, taken the distance between hole 200mm and buried depth 120～150mm as the optimization goal, the most optimum parameters range of the mechanism was obtained as follows: the initial angle between planet frame and the line formed from spraying-fertilizer needle-tip and planet wheel axle was -45°～-40°, the initial angular displacement of planet frame was 40°～50°, the distance between spraying-fertilizer needle-tip and the planetary gear axle center was 280～300mm, simultaneously, the semi-major axis of elliptic gear was 29.364mm, the teeth quantity was 23, the ratio of semi-minor axes and semi-major axis was 0.958, the radius of circular gear was 25mm. Among the optimization operational parameters, a group of parameters were selected to design the pricking hole mechanism by using Pro/E simulation. The simulation result shows that the designed pricking hole mechanism can satisfy the design requirements of the distance between holes and the buried depth.

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