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论文

基于时空约束的大规模农产品时间柔性生产计划网络优化研究

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Application and Optimization for Network Flow Programming in Large-scale Agricultural Production Plan with Time Flexibility Based on Spatial-Temporal Restriction

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- 摘要
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摘要 随着农村土地有偿流转, 农民专业合作社、农业企业等各农村经济实体拥有大规模的土地, 为实现农产品规模化生产和集约化经营, 各农村经济实体需要根据土地资源、农业信息、生产技术制定农产品生产计划。鉴于此, 本文主要针对农产品生产计划决策问题先后建立网络、线性和非线性模型。首先根据农产品生产的时空特性和农产品生产时间柔性引入网络流规划构建网络模型;通过网络流量平衡分析, 推导网络模型应满足的约束条件, 结合各农产品的定量化控制, 对大规模农产品生产网络模型进行线性优化;再进一步考虑农产品生产率的影响因素, 构建非线性约束和目标函数对线性模型进行扩展;最后通过具体实例诠释大规模农产品生产计划拟订过程。结果表明, 土地满负荷生产农产品将打破市场的供需平衡, 容易造成"丰产不丰收"现象;利用本文模型制定农产品生产计划, 虽土地有闲置, 但在土地闲置期间, 土地肥力能得到恢复, 各种有机质能得到再生, 有利于为农产品持续生产提供良好的生产条件和环境, 有利于提高农产品的质量和产量, 增加经济效益。

关键词: 大规模 农产品 生产计划 时间柔性

Abstract: The farmland transfer generates various rural economic entities, such as farmers' professional cooperatives, agricultural enterprises and so on, and they take possession of large-scale farmland. In order to achieve large-scale production and intensive management of the agricultural products, it is important to make production plan on the base of the land resources, agricultural information, and production technology. In this context, the network model, the linear model and nonlinear model are successively built for the agricultural production plan. Firstly, based on the spatial-temporal and time flexible characteristics of the agricultural production, the network model of agricultural production plan is built. Secondly, through analyzing the network flow balance problems, the constraint conditions are derived, and combining with the quantitative control of agricultural products, the network model is optimized to get the linear model. Thirdly, considering the influence factors of agricultural productivity, the linear model is extended by establishing nonlinear constraints and objective function. Finally, the numerical example is provided to illustrate the process about making the large-scale agricultural production plan. Results of the numerical example show that the balance between supply and demand of market of agricultural products will be broken if the farmland is fully engaged for the agricultural production, which will cause harvest paradox, however. If the model presented in this paper is applied to formulate scientific and reasonable production plan by the various rural economic entities, although part of the farmland is unused, it will be also help to restore soil fertility and regenerate a variety of organic matter, and to improve good conditions and environment for subsequent production of agriculture products, which is beneficial to improve the quality and output of agricultural products, and increase economic benefit.

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