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Optimisation of logistics processes of energy grass collection

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The collection of energy grass is a logistics-intensive process [1]. The optimal design and control of transportation and collection subprocesses is a critical point of the supply chain. To avoid irresponsible decisions by right of experience and intuition, the optimisation and analysis of collection processes based on mathematical models and methods is the scientific suggestible way. Within the frame of this work, the author focuses on the optimisation possibilities of the collection processes, especially from the point of view transportation and related warehousing operations. However the developed optimisation methods in the literature [2] take into account the harvesting processes, county-specific yields, transportation distances, erosion constraints, machinery specifications, and other key variables, but the possibility of more collection points and the multi-level collection were not taken into consideration. The possible areas of using energy grass is very wide (energetically use, biogas and bio alcohol production, paper and textile industry, industrial fibre material, foddering purposes, biological soil protection [3], etc.), so not only a single level but also a multi-level collection system with more collection and production facilities has to be taken into consideration.

The input parameters of the optimisation problem are the followings: total amount of energy grass to be harvested in each region; specific facility costs of collection, warehousing and production units; specific costs of transportation resources; pre-scheduling of harvesting process; specific transportation and warehousing costs; pre-scheduling of processing of energy grass at each facility (exclusive warehousing). The model take into consideration the following assumptions: (1) cooperative relation among processing and production facilties, (2) capacity constraints are not ignored, (3) the cost function of transportation is non-linear, (4) the drivers conditions are ignored.

The objective function of the optimisation is the maximisation of the profit which means the maximization of the difference between revenue and cost. The objective function trades off the income of the assigned transportation demands against the logistic costs. The constraints are the followings: (1) the free capacity of the assigned transportation resource is more than the re-quested capacity of the transportation demand; the calculated arrival time of the transportation resource to the harvesting place is not later than the requested arrival time of them; (3) the calculated arrival time of the transportation demand to the processing and production facility is not later than the requested arrival time; (4) one transportation demand is assigned to one transportation resource and one resource is assigned to one transportation resource. The decision variable of the optimisation problem is the set of scheduling variables and the assignment of resources to transportation demands. The evaluation parameters of the optimised system are the followings: total costs of the collection process; utilisation of transportation resources and warehouses; efficiency of production and/or processing facilities. However the multidimensional heuristic optimisation method is based on genetic algorithm, but the routing sequence of the optimisation works on the base of an ant colony algorithm. The optimal routes are calculated by the aid of the ant colony algorithm as a subroutine of the global optimisation method and the optimal assignment is given by the genetic algorithm. One important part of the mathematical method is the sensibility analysis of the objective function, which shows the influence rate of the different input parameters.

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