Title The vehicle routing problem in field logistics: Part II

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Abstract

Most agricultural field operations involve a number of highly interconnected tasks executed by co-operating heterogeneous agricultural machines. Multiple machinery systems involved in "output material flow" operations, such as harvesting, as well as in "input material flow" operations, such as spraying and fertilising, include a number of primary units (PUs) supported by a number of service (mainly transport) units (SUs). Such operations require considerable efforts in terms of the managerial tasks of scheduling and planning. Here, a theoretical approach is presented to represent the planning and scheduling tasks for the SUs as examples of the well-known combinatorial optimisation problem "vehicle routing problem with time windows" (VRPTW). The approach builds on the concept that in the case of field operations involving co-operating machines, an SU, or a team of SUs, is required fulfil a request for on-site services from PUs, where the requests are generated by a spatial–temporal process which may be deterministic (*e.g.*, seeding), stochastic (*e.g.*, harvesting) or dynamic (*e.g.*, sensor-based site-specific spraying). According to this concept, the PU can be considered as the "customers" in the vehicle routing problem methodology. It has been shown that scheduling and planning problems for SUs in conventional machinery systems, as well as in emerging field robot systems, can be cast as examples of the VRPTW and, consequently, can be solved using advanced methods that have developed for the solution of these examples