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Abstract

We study the practical decision problem of fresh food production with a long production lead time to decide every period (e.g. week) how many items to produce. When a batch is ready for use, its items have a fixed shelf life, after which the items become waste in the sense that they cannot be sold anymore. The demand for (fresh) food products is uncertain and highly fluctuating, mainly caused by price promotions of retail organisations. We focus on cases where a so-called cycle fill rate service level requirement applies. We investigate the generation of a production plan that fixes the timing and quantity of the production for a finite time horizon. To minimise waste, one issues the oldest items first, i.e. a FIFO issuing policy. In case of out-of-stock, sales are lost.

We model this decision problem as a Stochastic Programming (SP) model. The objective of our study is to find order quantities for the SP model, that approximately meet cycle fill rate service level requirements while keeping outdating low. To find approximate solutions for the SP model, an MILP model is developed. The MILP model is a deterministic approximation that generates feasible replenishment quantities in less than a second. With a scenario-based MINLP approach, optimal solutions are generated for a large sample of demand paths as a benchmark for the MILP solutions. We show that the MILP model is suitable for practical use if the setup cost is such that the replenishment cycles in the production plan are close to or of the same length as the maximum shelf life. In those cases, the expected total costs are close to the costs of the optimal solution and the average fill rate is close to the required one.

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