A two-stage stochastic optimization model for delineating rectangular management zones

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In agriculture, the spatial and temporal variability of soil properties is one of the most important aspects that determine productivity and crop quality. In this work we propose a two-stage stochastic optimization model with recourse for getting a partition of an agricultural field into a site-specific rectangular management zones according to a given soil property. This model is an extension of an integer programming model proposed in [1] that minimizes the resulting number of management zones considering a required homogeneity level, by using the relative variance concept, with the purposes of achieving an homogeneous partition for a medium term horizon. However, some of the soil properties also change in time so that we introduce a finite set of scenarios with data of the selected property from previous seasons, given rise to a stochastic program. Moreover, the problem formulation needs the complete enumeration of all the possible management zones, but this is feasible for small and medium size instances so that we solve large instances applying a column generation algorithm proposed in [2]. The mathematical model and the computational strategy used make our methodology optimal and practical for its application. Experimental results, conclusions and extensions of the proposed approach are presented.

References

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