

Optimization applied to work assignment in flower crops

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About the Company

- ▶ Flores El Trigal
- ▶ Flower production business
- ▶ All processes involved in the production of the flowers
- ▶ Mainly focused on flowers of the chrysanthemum family
- ▶ Propagation and Production units



¹From Wikipedia

Power
Optimization

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Introduction

Problem statement

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References

Crop Distribution

- ▶ Blocks
 - ▶ Area covered by a greenhouse structure for the protection of the plants inside them
 - ▶ Divided internally into two rows of beds separated from each other
- ▶ bed
 - ▶ Area with soil adequated for planting
 - ▶ Actual location of plants
- ▶ Structure needed for the workers to move

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Propagation Unit

- ▶ Production of plant cuttings
 - ▶ Piece of a plant taken from the root or stem with the intention of creating a new plant
 - ▶ Taken from specialized plants
 - ▶ Used for both flower and specialized plants
- ▶ Dynamics
 - ▶ Orders
 - ▶ Harvest
 - ▶ Done daily by workers
 - ▶ Priority by days not harvested
 - ▶ Treatment of plants
 - ▶ Storage

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Problem statement

Waste

The waste comes primarily from the loss of cuttings due to quality standards

- ▶ Waste from harvest
- ▶ Waste from storage
- ▶ Waste from idle time

Fulfillment

Fulfillment of the orders is a priority for the company. Orders not met must be completed the week after.

Problem

Assigning workers the route through the beds and blocks each one needs to harvest every day minimizing waste of all kinds and the amount of cuttings not fulfilled in every order.

Objectives

Main Objective

Create and implement a mathematical program modeling most of the dynamics involved in the problem that serves as a guide and that can be expanded to model fully the dynamics involved in the problem.

Specific objectives

- ▶ Design and evaluate mathematical models
- ▶ Design the data structures involved
- ▶ Implement an application to use the model

Previous Research

Optimization techniques have been widely used in the field of agriculture to solve several kind of problems coming from logistic processes, worker assignments, financial decisions, maintenance, etc.

- ▶ Routing Problems
 - ▶ Particle swarm optimization for machines in sugarcane fields (Sethanan & Neungmatcha, 2016)
 - ▶ Simulated annealing and genetic algorithms applied to motion of vehicles (Ferentinos *et al.* , 2002)
- ▶ General production planning
 - ▶ Robust optimization in Citrus Company (Munhoz & Morabito, 2014)
 - ▶ Linear programming in crop rotation (Alfandari *et al.* , 2015)
 - ▶ Programming accounting for ripeness in apples (Gonzalez-Araya *et al.* , 2015)

Justification

- ▶ Use of manual labor
- ▶ Planning accounting for order dispatch and waste

Scope

Relaxation of some of the relationships

- ▶ Modeling of the storage and its waste
- ▶ Modeling of constraints regarding plant treatment

Methodology

- ▶ Development divided into three phases according to the specific objectives
- ▶ Regular meetings will be held to solve doubts and check progress
- ▶ Additional constraints will be modeled if time allows

Schedule

week 3	proposal redaction
week 4	state of the art revision
weeks 5-10	model formulation
weeks 11-14	data input coding
weeks 15-16	testing and experiments
weeks 17-18	final report redaction

Budget

This project does not count from any funding from Universidad EAFIT. The parts involved have agreed to invest some of their time. The application will be developed in C# with a model coded in AMPL format run through a free server.

Intellectual Property

Due to the relationship of some of the authors to Universidad EAFIT, the developments made during the project are subject to to the university's intellectual property rules Universidad EAFIT (2009).

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