OPTIMIZATION OF THE PRODUCTION PLANNING AND TRADE OF LILY FLOWERS AT JAN DE WIT CO.
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Jan de Wit Co., BRAZIL
General Manager and Owner

Marcelo Moraes
Jan de Wit Co., BRAZIL
Production and Sales Manager
OUTLINE OF THIS PRESENTATION

- introducing Jan de Wit Co.
- understanding the lily business chain
- the main results obtained
- the DSS and the transferability issue
- testimonies: producer and competitors
- concluding remarks
LILY BUSINESS CHAIN

FLOWER RETAILER

FLOWER WHOLESALER

WHOLESALE MARKETPLACE

FLOWER PRODUCER

BULB WHOLESALER

BULB PRODUCER

FINAL CUSTOMER
VEILING HOLAMBRA
- auction room -
PRODUCTION PROCESS
- from bulbs to flowers -

- RECEIVING BULBS
- PREPARARING BULBS
- SPACING
- PLANTING
- HARVESTING
- ROOTING
- PACKING
- DELIVERING FLOWERS
THE PROBLEM

• exploite market opportunities, respecting operational and technical restrictions;
• manage trade and production cycles: how to plan, do, check and respond;
• purchase the right bulbs: varieties, bulb sizes and quantities per size.
## INCREASED FINANCIAL RESULTS

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
<th>Δ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income from operations (R$)</td>
<td>309,546</td>
<td>495,243</td>
<td>60%</td>
</tr>
<tr>
<td>Income from operat. (% of sales)</td>
<td>12.3%</td>
<td>15.5%</td>
<td>26%</td>
</tr>
<tr>
<td>Return on owners equity</td>
<td>15.1%</td>
<td>22.5%</td>
<td>50%</td>
</tr>
</tbody>
</table>
## INCREASED FINANCIAL RESULTS

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<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
<th>Δ (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pots</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantities (units)</td>
<td>422,208</td>
<td>484,722</td>
<td>14.8%</td>
</tr>
<tr>
<td>Revenue (R$)</td>
<td>1,432,875</td>
<td>1,643,558</td>
<td>14.7%</td>
</tr>
<tr>
<td>Unit average price (R$)</td>
<td>3.39</td>
<td>3.39</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Bundles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantities (units)</td>
<td>220,469</td>
<td>285,088</td>
<td>29.3%</td>
</tr>
<tr>
<td>Revenue (R$)</td>
<td>1,133,925</td>
<td>1,585,984</td>
<td>39.9%</td>
</tr>
<tr>
<td>Unit average price (R$)</td>
<td>5.14</td>
<td>5.56</td>
<td>8.2%</td>
</tr>
<tr>
<td><strong>Total Revenue (R$)</strong></td>
<td>2,566,800</td>
<td>3,229,542</td>
<td>25.8%</td>
</tr>
</tbody>
</table>
INCREASED FINANCIAL RESULTS

<table>
<thead>
<tr>
<th></th>
<th>Δ (2000 / 1999)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenue</td>
<td>26%</td>
</tr>
<tr>
<td>Variable costs</td>
<td>23%</td>
</tr>
<tr>
<td>Contribution margin</td>
<td>32%</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>18%</td>
</tr>
<tr>
<td>Income from operations</td>
<td>60%</td>
</tr>
</tbody>
</table>
OBJECTIVE:
• maximization of the farm’s “total contribution margin”

CONSTRAINTS TO BE CONSIDERED:
• bulb inventory
• characteristics of the production cycle’s duration
• technical requirements (number of bulbs per pot or box, spacing to be followed)
• usage limitations for each type of greenhouse
• market requirements (selling unit, minimum number of buds and minimum number of stems per bundle or pot)
• upper and lower market-defined sales’ limits
MAIN DECISION VARIABLE TO BE CALCULATED

\[ NUMCANT_{jvgil} = \text{total of flowerbeds, in a specific greenhouse, originated from a specific bulb batch } j, \]
\[ \text{from a specific lily variety } v, \text{ for a specific use } g \text{ (e.g., potting flower or cutting flower), taking into consideration the pertinent planting week } i \text{ and the expected harvesting week } l. \]
GENERAL STRUCTURE OF THE DECISION SUPPORT SYSTEM

STOCK OF BULBS → PRODUCTION CYCLE → BULB AND PRODUCTION COSTS → CURRENT PLANTINGS → AVAILABILITY OF FLOWERBEDS → ESTIMATED SALES → GENERATION OF “TXT” FILES

OPTIMIZATION MODEL (GAMS) → OPTIMAL SOLUTION

FLOWERBED OCCUPATION ESTIMATES

FINANCIAL RESULT ESTIMATES

STOCK LEVEL ESTIMATES

PRODUCTION PLAN SUGGESTED
Production cycle

Bulb and production costs

Weeks

35  36  37  38  39  40  41  42  43  44  45  46  47  48  49  50
Stock of bulbs

Estimated sales

Current plantings and availability of flowerbeds
Planning horizon

SINGLE EQUATIONS 114,767
SINGLE VARIABLES 416,554

General Algebraic Modeling System
04/10/01 15:46:00 PAGE 2
Model Statistics SOLVE FLORES USING LP FROM LINE 40902
GAMS 2.50A Windows NT/95/98
MODEL STATISTICS
BLOCKS OF EQUATIONS 31
BLOCKS OF VARIABLES 19
NON ZERO ELEMENTS 1352820
GENERATION TIME = 90.190 SECONDS 70.1 Mb WIN-18-097
EXECUTION TIME = 90.190 SECONDS 70.1 Mb WIN-18-097
SOLVE SUMMARY
MODEL FLORES OBJECTIVE MC
TYPE LP DIRECTION MAXIMIZE
SOLVER OSL FROM LINE 40902
**** SOLVER STATUS 1 NORMAL COMPLETION
**** MODEL STATUS 1 OPTIMAL
**** OBJECTIVE VALUE 2059,733.0996
RESOURCE USAGE, LIMIT 2409.578 1000000.000
ITERATION COUNT, LIMIT 6172 1000000
OSL Version 1 Jul 4, 1999 WIN.OS.18.1.055.035.036.WAT OSL Version 1
Production plan

Stock levels

Flowerbed occupations
Financial re-evaluation

Salere-evaluation
Linear Programming applied to the flower sector: a gladiolus bulb production case study

José Vicente Caixeta Filho
Jan Maarten van Swaay Neto
Ricardo Luis Lopes
OPTIMIZATION OF THE PRODUCTION PLANNING AND TRADE OF CHRYSANTHEMUM FLOWERS AT SCHOENMAKER CO.

José Vicente Caixeta-Filho
Jan Maarten van Swaay-Neto
Antonio Wagemaker
CONCLUDING REMARKS

- the still not very traditional environment (= Agriculture) for an O.R. application
- the still not very traditional country (= BRAZIL) for a well succeeded O.R. application
- the size and specific type of business
- the use (and success) of an LP model
- the friendly interfaces of the DSS
- the quantifiable benefits
- the transferability potential
- the complete knowledge cycle (classroom → business → Edelman → classroom)