Agricultural Biological Engineering

CAPSTONE EXPERIENCE 2015

Balanced Bar: Programming and Process Development

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Introduction
Problem Statement & Background
The overall goal of The Salad Bar project is to use all-natural ingredients to produce a healthy, meal-supplement bar that is manufactured on a local farm by a student-run plant.

Market Research
The market is moving towards bars with higher nutritional standards in the form of hearty, healthy, organic bars [2]. In fact, the “nutritional” bar segment of the bar industry is growing while the more traditional “snack” bar segment is steadily declining [1]. According to Mintel, the typical snack bar consumer ages 18-37, making Purdue’s campus an ideal consumer market for our product [1].

Linear Programming Approach
A user-interface, Starting Point, which utilizes linear programming, was developed to maximize the nutritional value of products. We wanted the bar to contain as close to 20% of the daily value for all macronutrients. Thus we chose to minimize the sum of squared errors between the calculated percent daily value for fiber, lipid, carbohydrate and protein and 20%.

\[0B1 = |F - 0.2| + |L - 0.2| + |C - 0.2| + |P - 0.2|\]

Where \(F\), \(L\), \(C\), and \(P\) are the calculated percent daily value of fiber, lipid, carbohydrate, and protein for the P combination of ingredients.

Bar Formulation
Figure 1 reflects the balanced nutritional value of the Salad Bar. Table 1 summarizes the balanced recipe for an 80gram, of solids, bar.

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Composition (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Almond</td>
<td>20</td>
</tr>
<tr>
<td>Bell pepper</td>
<td>0.8</td>
</tr>
<tr>
<td>Black bean</td>
<td>20</td>
</tr>
<tr>
<td>Brown rice</td>
<td>20</td>
</tr>
<tr>
<td>Carrot</td>
<td>19.3</td>
</tr>
<tr>
<td>Corn</td>
<td>20</td>
</tr>
</tbody>
</table>

Economic Evaluation
The capital investment of this project is $346,500 in working capital and $2,310,000 in equipment, land, and building. Once production begins, $713,000 of annual profit will be made for a bar price of $1, return on investment of 45% and a production rate of 183,000kg/year will meet anticipated demand.

References