

stat teaser

ABOUT STAT-EASE SOFTWARE, TRAINING, AND CONSULTING FOR DOE
Phone 612.378.9449 Fax 612.378.2152 E-mail info@statease.com Web Site www.statease.com

Workshop Schedule

Crash Course on DOE for Sales and Marketing

September 29: Minneapolis, MN

See description on page 3. \$995* (\$795 each, 3 or more)

Statistics for Technical Professionals

June 29–30: Minneapolis, MN

October 5–6: Minneapolis, MN

Revitalize the statistical skills you need to stay competitive. \$995* (\$795 each, 3 or more)

Experiment Design Made Easy

May 3–5: Minneapolis, MN

June 7–9: San Jose, CA

July 12–14: Minneapolis, MN

August 16–18: Philadelphia, PA

September 20–22: Minneapolis, MN

Study the practical aspects of DOE. Learn about simple, but powerful, two-level factorial designs. \$1495* (\$1195 each, 3 or more)

Response Surface Methods for Process Optimization

June 14–16: Minneapolis, MN

October 18–20: Minneapolis, MN

Maximize profitability by discovering optimal process settings. \$1495* (\$1195 each, 3 or more)

Mixture Design for Optimal Formulations

May 24–26: Minneapolis, MN

August 2–4: Minneapolis, MN

Nov 8–10: San Jose, CA **New Location!**

Find the ideal recipes for your mixtures with high-powered statistical tools. \$1495* (\$1195 each, 3 or more)

Robust Design: DOE Tools for Reducing Variability

August 23–24: Minneapolis, MN

Use DOE to create products and processes robust to varying conditions. A must for Six Sigma. *Factorial and RSM proficiency are required.* \$1195* (\$995 each, 3 or more)

DOE Simplified

April 26, 2005: Minneapolis, MN

An overview of Design of Experiments (DOE) from A to Z, based on the popular book. \$295* (\$195 each, 3 or more)

Attendance is limited to 20. Contact Sherry at 800.801.7191 x18 or sherry@statease.com.

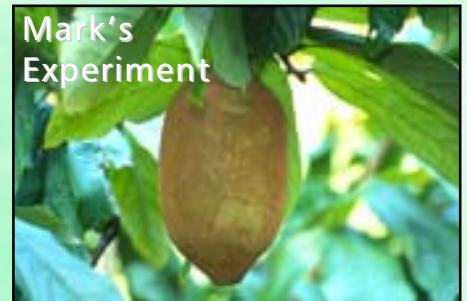
*Includes a \$95 student materials charge which is subject to state and local taxes.



Mixture Design Enhances the Nectar from an Exotic Amazonian Fruit

This past winter a Portuguese user of Design-Expert® software, Margarida Vieira, sent me a publication¹ she authored on a mixture design to optimize the nectar of Cupuacu (pronounced "koo-poo-a-soo") from the Amazon jungle. Considering the cold and snow this time of year here in Minnesota, this warmed me up considerably and inspired me to pass along this story to you. Although I have not yet had the opportunity to taste this Amazonian nectar, from what I see in the multiple response optimization results it must be very desirable.

According to my research via the Internet, Cupuacu is a relatively small Rainforest tree which belongs to the Cocoa family. Its fruit provides a



Mark's Experiment

The hard-shelled fruit of the Cupuacu (*theobroma grandiflorum*)
[Source: <http://isuzuimagens.com.br>]

creamy exotic-tasting pulp used throughout Brazil and Peru to make fresh juice, ice cream, jam, and tarts.

Vieira and her co-author, Cristina L. M. Silva, kept things simple by adding only sugar and water to the Cupuacu fruit pulp. They established the following ranges (coded on a 0 to 1 scale) for their mixture components:

- A. Sugar, 10-25% (0.1-0.25)
- B. Cupuacu, 15-30% (0.15-0.3)
- C. Water, 60-75% (0.6-0.75)

With the aid of Design-Expert, the formulators set up a completely replicated second-degree simplex-lattice design augmented with axial check blends (unreplicated) and the overall centroid replicated three times. If you've taken the Stat-Ease workshop "Mixture Design for Optimal Formulations" this all makes sense, but

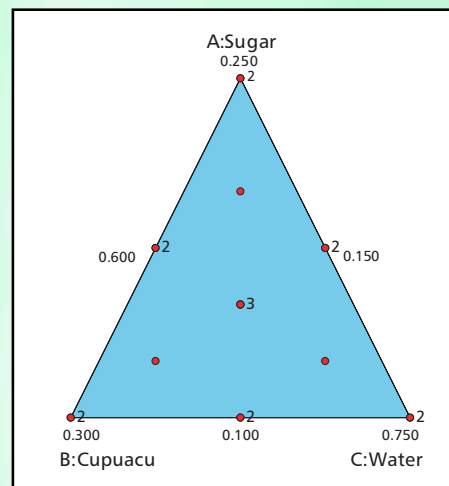


Figure 1: Three-component mixture design

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for those who have not studied these designs, it's easy to see the 18-blend layout on the ternary diagram shown in Figure 1.

The nectars were evaluated by a panel of 16 potential Cupuacu consumers in Portugal who rated the following sensory measures on a five-point hedonic scale (1=bad to 5=best):

- y1. Mouthfeel
- y2. Acidity
- y3. Taste
- y4. Sweetness
- y5. Overall opinion
- y6. Viscosity

To make the tasting more palatable, only six Cupuacu nectar blends were presented (coded to disguise the composition) at each of three weekly sessions, so the design was blocked as shown in Table 1.

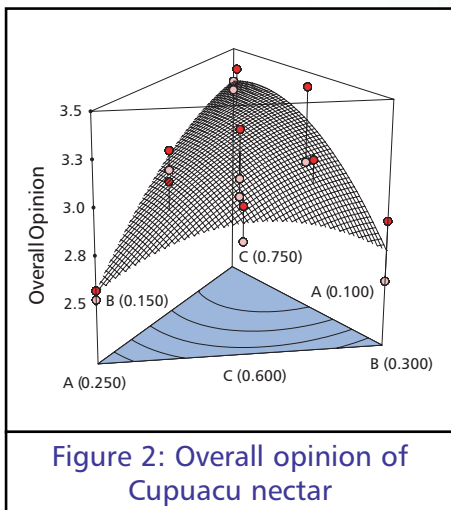


Figure 2: Overall opinion of Cupuacu nectar

The 3D response surface plot for overall opinion is shown in Figure 2. It shows the best results at lower ends of the tested ranges for Cupuacu fruit pulp (B) and sugar (A) diluted by near the maximum experimental concentration of water.

Again aided by Design-Expert, the formulators performed a multiple response

Run	Blk	Point Type	A: Sugar	B: Cupuacu	C: Water	y1: Mouth	y2: Acidity	y3: Taste	y4: Sweet	y5: Overall	y6: Viscosity
1	1	Check	0.125	0.250	0.625	3.240	3.100	3.360	3.230	3.140	2.030
2	1	Edge	0.175	0.225	0.600	3.010	2.780	3.070	3.740	2.980	2.520
3	1	Centroid	0.150	0.200	0.650	3.220	2.430	2.930	3.410	2.890	2.860
4	1	Vertex	0.100	0.300	0.600	2.690	3.290	2.860	2.420	2.860	2.000
5	1	Edge	0.175	0.225	0.600	3.080	2.610	2.990	4.120	2.790	2.240
6	1	Vertex	0.250	0.150	0.600	3.010	2.020	2.600	4.280	2.570	3.320
7	2	Centroid	0.150	0.200	0.650	3.360	2.510	3.460	3.420	3.260	2.830
8	2	Vertex	0.100	0.300	0.600	2.600	3.460	2.970	2.180	2.530	1.660
9	2	Edge	0.175	0.150	0.675	3.320	2.200	3.170	3.830	3.100	3.410
10	2	Check	0.200	0.175	0.625	3.290	2.220	2.980	4.460	3.060	3.760
11	2	Vertex	0.100	0.150	0.750	3.320	2.390	3.330	2.770	3.260	3.970
12	2	Edge	0.175	0.150	0.675	3.460	2.410	2.920	3.990	2.990	3.440
13	3	Edge	0.100	0.225	0.675		2.930		2.660	3.000	2.750
14	3	Centroid	0.150	0.200	0.650	3.470	2.740	3.170	3.640	2.990	2.720
15	3	Vertex	0.250	0.150	0.600	3.170	2.080	2.700	4.460	2.520	3.300
16	3	Check	0.125	0.175	0.700	3.390	2.830	3.250	2.980	3.480	3.410
17	3	Edge	0.100	0.225	0.675	3.540	3.010	3.430	3.120	3.420	3.290
18	3	Vertex	0.100	0.150	0.750	3.410	2.530	3.220	2.630	3.310	3.660

Table 1: Experimental layout and results from a mixture design

optimization to maximize overall desirability for all six sensory attributes. The screen-shot in Figure 3 shows my reproduction of the outcome which, due to minor deviations in how I modeled each response, differs immaterially from that published. The resulting graphical optimization with a flag planted at the optimum formulation is displayed in Figure 4.

The authors recommended a formula-

tion with 11% sugar, and 18.5% Cupuacu fruit pulp, diluted by 70.5% water (note again that this is insignificantly different from the results on these graphs.) Since this nectar was new to the European consumer, the optimized formulation was served to taste panelists three times a week over a two-week period to test their tolerance. According to the authors "the level of acceptance...did not influence the

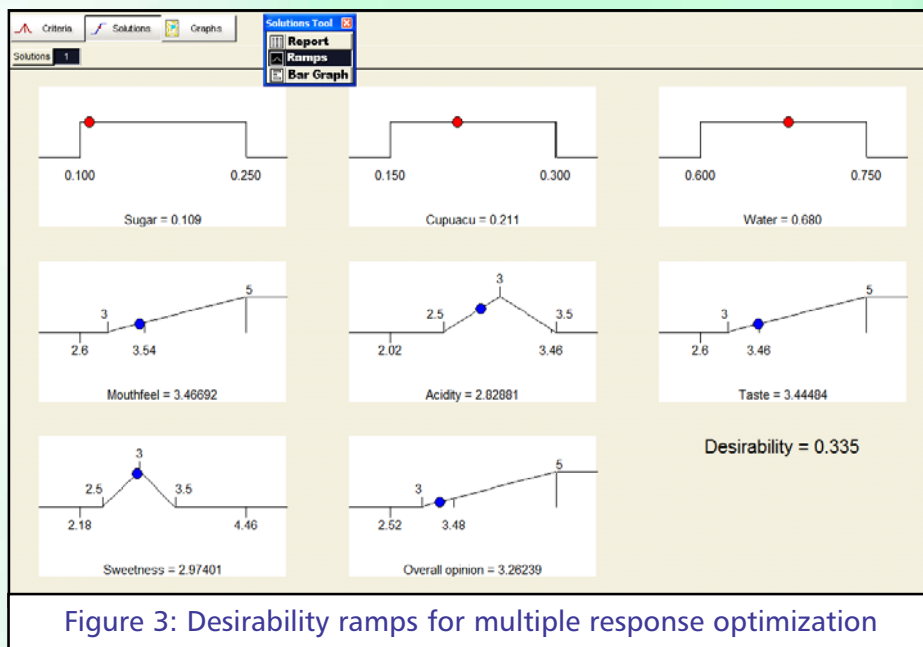


Figure 3: Desirability ramps for multiple response optimization

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New DOE Class for Sales & Marketing!

Stat-Ease, Inc. announces a new workshop specifically designed for Sales & Marketing professionals. This "Crash Course on DOE for Sales & Marketing" provides a fast and practical introduction to the use of experimental design in a non-industrial setting. The workshop has three main goals:

1. To make DOE more approachable for sales and marketing teams.
2. To present simple and workable ways to deal with historical data.
3. To show how to practically apply contemporary screening and full-factorial designs to identify the factors that control sales & marketing results—even when dealing with a large number of factors. (See Figure 1 for an illustration of a breakthrough interaction in sales & marketing.)

Perhaps because of its roots in agriculture and manufacturing, DOE is typically presented in a manner that is difficult to apply to sales, marketing, and general business environments. Examples are few and far between and instructors often have a hard time translating the concepts into useful applications. After eight years of intensive research on applying DOE to

sales and marketing, the presenter, Dr. Paul Selden, has uncovered dozens of examples proving that this powerful tool can yield tens of millions of dollars by identifying what appeals most to customers and by eliminating expensive traditional practices that prove ineffective.

The "Crash Course on DOE for Sales & Marketing" workshop has been developed from the ground up to demystify statistical design of experiments. It's recommended for anyone seeking a systematic approach to testing what works and what doesn't for improving sales and marketing practices.

Using sales & marketing case studies, practical DOE tools are taught as well as a step-by-step approach to planning experiments. The emphasis is on bridging the gap between theory and practice. The approach is as hands-on as possible, with many illustrations and exercises, minimizing time spent on statistics and lengthy, difficult calculations. This workshop is recommended for anyone seeking a systematic approach to testing what works and what doesn't in regards to sales, marketing, and

other critical business data.

Date: Thursday, September 29, 2005

Location: Stat-Ease, Inc., Minneapolis, Minnesota

Fee: \$995 (\$795 each, 3 or more)

Instructor: Dr. Paul Selden

For more information, see:

http://www.statease.com/class_mdcoe.html

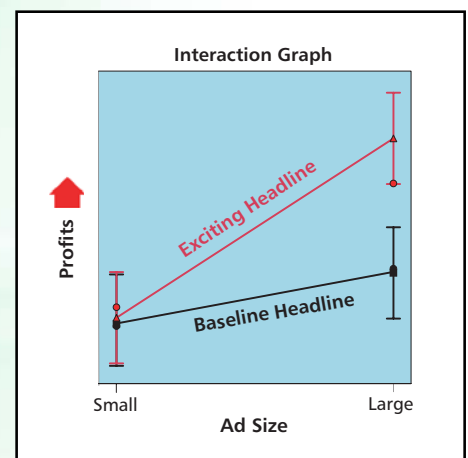


Figure 1: Illustration of a breakthrough interaction in sales & marketing—explosive growth occurs when an increase in ad size is combined with a change in headline!

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results."

The Cupuacu experimenters paid homage to John Cornell and his famous experiment on fish patties.² My question is whether Cupuacu nectar would make Cornell's patties palatable. However, I am very skeptical of this. More likely one would want to slam down several of John's legendary Harvey Wallbangers first and hope the high alcohol content would dull the sensory buds.

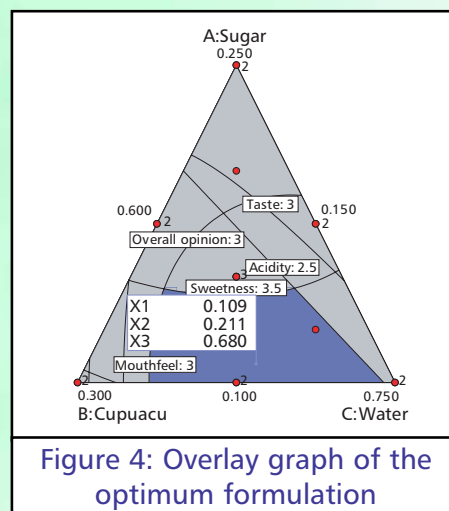


Figure 4: Overlay graph of the optimum formulation

¹ "Optimization of a Cupuacu (Theobroma Grandiflorum) Nectar Formulation," by Margarida C. Vieira and Cristina L. M. Silva, Journal of Food Process Engineering, 27 (2004) 181-196.

² "Experiments with Mixtures: Designs, Models, and the Analysis of Mixture Data, 3rd Edition," by John A. Cornell, John Wiley & Sons, Inc., Copyright 2002

Mark Anderson
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Where can you find us?

03/05

Stat-Ease will be appearing at many events this year. If we are in your neighborhood, please stop by and say hello!

April 13—AIChE Upper Midwest Annual Symposium, Bloomington, MN

Mark Anderson, Keynote Speaker: *"Response Surface Methods (RSM)—Statistical Tools for Accelerating Process Optimization"*

April 28—NY Chapter of the Society of Cosmetic Chemists, Spring Educational Seminar—"New Horizons: Exploring New Trends, Markets and Technologies," Summit, NJ

Talk by John Guerin: *"Optimizing Formulations Using Statistical Experimental Design"*

May 4-6—Pressure Sensitive Tape Council (PSTC) Technical Conference, Baltimore, MD, Booth #203

Talk by Shari Kraber: *"A Sticky Optimization"*

May 16-18—ASQ World Conference on Quality and Improvement, Seattle, WA, Booth #414

Talk by Pat Whitcomb: *"PCR Process Optimized via Split-Plot Design"*

May 18-20—Research Methods in the 21st Century: A Toolkit for Competitive Advantages (Advancement in Coatings Series), New Orleans, LA

Talk by Mark Anderson: *"How to Design and Analyze Mixture Designs that Include Process Factors and/or Categorical Variables"*

August 7-11—Joint Statistical Meetings, Minneapolis, MN, Booth #402

Roundtable Discussion by Shari Kraber: *"Successful Strategies for Screening Designs"*

October 10-11—MN ASQ Conference, Minneapolis, MN

October 20-21—49th Annual Fall Technical Conference, St Louis, MO

Talk by Pat Whitcomb: *"Using a Pareto Chart to Select Effects for a Two-Level Factorial DOE"*

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