Appendix B

Statistical Analysis Results

U N I V E R S I T Y O F

CONNECTICUT

COLLEGE OF AGRICULTURE AND NATURAL RESOURCES
Department of Plant Science

February 3, 1997

To: George Hamilton, Hillsbourgh County, Extension Educator
From: Tom Morris, University of Connecticut, Extension Agronomist T.M.
Subject: Statistical analysis of plant population data in sweet corn trial

It is correct that the American Society of Agronomy (ASA) does not allow use of the Duncan's multiple range test to separate means of experimental results. The ASA recommends use of the LSD test for means separation, but this only allows the comparison of two adjacent means. The reason the ASA doesn't allow use of the Duncan's Test is that when comparing more than two means the Duncan Test will sometimes led a researcher to conclude that there is a true difference among the means when in fact there is no difference.

There is a new Duncan's multiple range test that allows calculation of a proper critical value to separate many different means. I analyzed your plant population data using the new Duncan's Test in the Windows version of the Statistical Analysis System (SAS) version 6.11TSO40. The population groups would change slightly from the groups you obtained from the old Duncan's Test, BUT the interpretation would be the same: the 24,000 to 28,000 plant population would be the most appropriate population if the grower believed that the 32,000 population produced too small of an ear for his market.

The above statistical analysis was performed using an alpha level of 0.05. I prefer to use an alpha level of 0.10 for field experiments. Many field experiments are published in the Journal of Production Agriculture using an alpha of 0.10. Analysis of your plant population data using the new Duncan's and an alpha of 0.10 would result in the identical groupings as used in your report to SARE.

I hope this has helped to clear up a minor statistical problem. Keep up the good work George. We need more data of this type for the long-term sustainability of agriculture in the Northeast.

Tom

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Analysis of Variance Procedure
Class Level Information

Class	Levels	Values
REP	4	1 2 3 4
TRT	6	12000 16000 20000 24000 28000 32000

Number of observations in data set = 24

Analysis of Variance Procedure

Dependent Variable: MARKET

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	993666666.66666700	124208333.33333300	14.54	0.0001
Error	15	128166666.66666600	8544444.44444440		
Corrected Total	23	1121833333.33333000			

R-Square	C.V.	Root MSE	MARKET Mean
0.885752	13.86445	2923.08816912	21083.33333333

Source	DF	Anova SS	Mean Square	F Value	Pr > F
REP	3	9833333.33333397	3277777.77777799	0.38	0.7663
TRT	5	983833333.33333400	196766666.66666600	23.03	0.0001

Analysis of Variance Procedure

T tests (LSD) for variable: MARKET

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 15 MSE= 8544444
Critical Value of T= 2.13
Least Significant Difference= 4405.6

Means with the same letter are not significantly different.

T Grouping		Mean	N	TRT
A	D	32250	4	32000
B	C	25250	4	28000
C	B	20750	4	24000
C				
C		19500	4	20000
C				
C	B	16750	4	16000
D	A	12000	4	12000

Analysis of Variance Procedure

Duncan's Multiple Range Test for variable: MARKET

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 15 MSE= 8544444

Number of Means	2	3	4	5	6
Critical Range	4406	4618	4750	4840	4905

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	TRT
A	32250	4	32000
B	25250	4	28000
C	20750	4	24000
C			
C	19500	4	20000
C			
C	16750	4	16000
D	12000	4	12000

NH FARMER POPULATION MARKETABLE EARS - ANOVA - 1996 1

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Analysis of Variance Procedure

Level of TRT	N	MARKET Mean	LSD	MARKET SD
12000	4	12000.0000	A	816.49658
16000	4	16750.0000	B	2217.35578
20000	4	19500.0000	B	1290.99445
24000	4	20750.0000	B	2629.95564
28000	4	25250.0000	C	4112.98756
32000	4	32250.0000	D	3862.21008

Level of REP	N	MARKET Mean	MARKET SD
1	6	21666.6667	8914.40781
2	6	21333.3333	7257.18035
3	6	20000.0000	6260.99034
4	6	21333.3333	7146.09450

NH FARMER POPULATION LENGTH OF EARS - ANOVA - 1996 19

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Analysis of Variance Procedure

Class Level Information

Class	Levels	Values
REP	4	1 2 3 4
TRT	6	12000 16000 20000 24000 28000 32000

Number of observations in data set = 24

Analysis of Variance Procedure

Dependent Variable: LENGTH

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	8	1.58500000	0.19812500	3.16	0.0261
Error	15	0.94000000	0.06266667		
Corrected Total	23	2.52500000			

R-Square	C.V.	Root MSE	LENGTH Mean
0.627723	3.371490	0.25033311	7.42500000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
REP	3	0.21500000	0.07166667	1.14	0.3635
TRT	5	1.37000000	0.27400000	4.37	0.0118

Analysis of Variance Procedure

T tests (LSD) for variable: LENGTH

NOTE: This test controls the type I comparisonwise error rate not the experimentwise error rate.

Alpha= 0.05 df= 15 MSE= 0.062667
Critical Value of T= 2.13
Least Significant Difference= 0.3773

Means with the same letter are not significantly different.

T Grouping	Mean	N	TRT
A	7.6500	4	12000
A			
A	7.5750	4	16000
A			
A	7.5750	4	20000
A			
A	7.5000	4	28000
A			
B A	7.3000	4	24000
B			
B	6.9500	4	32000

Analysis of Variance Procedure

Duncan's Multiple Range Test for variable: LENGTH

NOTE: This test controls the type I comparisonwise error rate, not the experimentwise error rate

Alpha= 0.05 df= 15 MSE= 0.062667

Number of Means	2	3	4	5	6
Critical Range	.3773	.3955	.4068	.4145	.4201

Means with the same letter are not significantly different.

Duncan Grouping	Mean	N	TRT
A	7.6500	4	12000
A			
A	7.5750	4	16000
A			
A	7.5750	4	20000
A			
A	7.5000	4	28000
A			
B A	7.3000	4	24000
B			
B	6.9500	4	32000

Analysis of Variance Procedure

Level of TRT	N	LENGTH Mean	LENGTH SD
12000	4	7.65000000	0.05773503
16000	4	7.57500000	0.26299556
20000	4	7.57500000	0.27537853
24000	4	7.30000000	0.35590261
28000	4	7.50000000	0.21602469
32000	4	6.95000000	0.25166115

Level of REP	N	LENGTH Mean	LENGTH SD
1	6	7.30000000	0.35777088
2	6	7.41666667	0.39707262
3	6	7.56666667	0.21602469
4	6	7.41666667	0.36009258