Supplemental Report to the Oregon Processed Vegetable Commission 1999-2000

Processing and Quality Evaluation of Experimental Green Beans

Title Green Bean Breeding and Evaluation

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Project Dates July 1, 1999 - June 30, 2000

Project Funding $ 7993

Processing funds were used for labor and supplies for processing of experimental beans, laboratory and data analysis, and industry evaluation.

Objectives

The general objective of the processing component of this research is to support the green bean breeding program being carried out by Dr. Jim Myers in the Horticulture Department. The specific objectives are:

A. To provide Dr. Myers and the Oregon vegetable processing industry with frozen and canned samples of experimental green bean lines for comparison to varieties currently grown in Oregon,
B. To organize and conduct the industry cutting for evaluation of experimental beans, including data analysis, and
C. To analyze processed selections and varieties for objective quality characteristics.

Report of Progress

During the 1999 season, a total of thirty-eight green bean selections and varieties were canned and frozen in the Food Science Pilot Plant from five field trials planted at the OSU Department of Horticulture Vegetable Farm. Eleven experimental OSU standard sieve beans were processed along with Oregon 91G and Oregon 54 as standards. Nine OSU experimental small sieve beans with Minuette and Medinah as commercial standards were harvested and processed. Four commercial standard sieve selections and four small sieve selections were evaluated in the commercial trial. Three commercial wax bean selections and three romano flat pod selections were processed for observation.

Green Bean Varieties and Selections Processed in 1999

TYPE	VARIETY OR SELECTION	SOURCE
Standard Sieve	Oregon 91G	OR / OSU
	Oregon 54	OR / OSU
	5416	OSU
	5630	OSU
	5635	OSU
	5641	OSU
	5643	OSU
	5651	OSU
	5669	OSU
	5698	OSU
	5709	OSU
	5723	OSU
	5819	OSU
Small Sieve	Minuette	Harris Moran
	Medinah	Novartis
	5446	OSU
	5613	OSU
	5747	OSU
	5803	OSU
	5804	OSU
	5825	OSU
	5842	OSU
	5844	OSU
	5860	OSU
Commercial Standard Sieve	Green Arrow	Crites-Moscow
	SB4218	Novartis
	SB4248	Novartis
	Scuba	Crites-Moscow
Commercial Small Sieve	WB34	Pure Line
	51-98	Pure Line
	EX390	Seminis
	Proton	Pure Line
Commercial	Klondyke	Seminis
Wax	Indy Gold	Novartis
	EX8104639	Seminis
Commercial	Oja	Seminis
Romano	Roma II	Novartis
	Tapia	Seminis

Industry Evaluation

The industry evaluation was held in February, 2000. Frozen samples were rated for color, straightness, smoothness, pod length, and overall quality. Canned samples were rated for color, straightness, smoothness, flavor, and overall quality. The rating scale ranged from 1 (totally unacceptable) to 9 (superior). Results were analyzed using the Friedman Analysis of Rank method to determine mean rankings and the Wilcoxin Signed Rank method to identify statistically significant differences between pairs of selections. Both of these statistical tests yield values for the probability that there is no difference in the sets of data being compared. A "p" value of 1 indicates that it is a statistical certainty that there is no difference. A "p" value below .05 denotes a statistically significant difference at the 95% confidence limit.

Industry participation in the evaluation was extremely low this year. Thirteen people evaluated the frozen samples and six people evaluated the canned samples.

Results - Standard Sieve Advanced Selections

Color: The Friedman analysis shows that there were significant differences for frozen samples and for canned samples. For frozen samples, 91G was rated best of the advanced selections and 5669 was rated second, though not statistically different. For canned samples, 5669 was rated highest followed by 91G. In both cases there was a large drop in scores after these two. Lowest rated for color for both frozen and canned samples was 5635.

Straightness: The Friedman analysis shows no significance for frozen or canned samples. 5669 was rated highest for both processes.

Smoothness: The Friedman analysis shows significance for frozen samples only. 5669 was rated highest for both frozen and canned samples. 5635 and 54 were scored lowest for both frozen and canned.

Pod Length (frozen only): The Friedman analysis shows significance for frozen samples. 91G was ranked highest but only slightly higher than 5669 (mean rank = 5.042 vs. 5.0). 5635 was ranked lowest with 5651 slightly higher.

Flavor (canned only): The p value from the Friedman analysis indicates no statistical significance for canned flavor. 91G was rated highest, followed by 5669.

Overall Quality: The Friedman test shows significance for both frozen and canned samples. 5669 was rated highest in both cases, though by a wider margin for canned samples

Results - Standard Sieve New Selections (single harvest)

Color: The Friedman analysis indicates no significant differences for frozen or canned samples. 5643 was rated highest of the canned samples and 5709 was rated lowest. Scores for frozen samples were closer together

Straightness: The Friedman analysis shows significance for frozen samples where 5723 was rated highest and 5698 was rated lowest. The Wilcoxin analysis for the canned samples did show a significant difference between the highest rated, 5641, and lowest rated, 5698.

Smoothness: The Friedman analysis shows no significance for frozen or canned samples. Though there was a wide range in mean rankings for canned samples (5.5 to 1.0) distribution of scores (and number of participants) were such that differences were not significant.

Pod Length (frozen only): The Friedman analysis shows significance for frozen samples. 5819 was ranked highest followed closely by 5723 and 5641. 5698 was rated lowest.

Flavor (canned only): The p value from the Friedman analysis indicates no statistical differences for canned flavor.

Overall Quality: The Friedman test shows no significance for frozen or canned samples. 5643 was rated highest for canned samples and the Wilcoxin analysis did show that it was significantly higher than 5819.

Results - Standard Sieve Commercial Selections

Color: The Friedman analysis indicates significant differences for both frozen and canned samples. In both cases, SB4218 was rated highest, followed closely by SB4248.

Straightness: The Friedman analysis shows significance for frozen samples only. SB4218 was rated highest for frozen. Green Arrow was rated highest for canned.

Smoothness: The Friedman analysis shows significance for frozen samples. SB4218 was rated significantly higher than all other frozen samples. For canned samples, Scuba was rated highest and SB4248 lowest, though there were no statistically significant differences.

Pod Length (frozen only): The Friedman analysis shows significance for frozen samples. SB4218 was ranked significantly higher than any other bean.

Flavor (canned only): The p value from the Friedman analysis indicates statistically significant differences for canned flavor, though the

Wilcoxin analysis shows none. SB4218 was rated highest. Green Arrow and Scuba were rated lowest.

Overall Quality: The Friedman test shows significance for frozen but not for canned samples. In both cases SB4218 was rated highest and SB4248 second highest.

Results - Small Sieve Advanced Selections

Color: Significant differences were detected only among the frozen samples. For frozen samples Medinah was ranked statistically higher than 5613 or Minuette. For the canned samples, 5613 and Minuette were ranked higher than Medinah, though the difference was not statistically significant.

Straightness: The Friedman analysis shows significant differences among frozen samples but not the canned. For the frozen samples, Medinah was ranked significantly higher than the other two. Though no significance was shown by the Wilcoxin analysis, Medinah was also rated most straight of the canned samples.

Smoothness: The Friedman analysis shows significant differences only among the frozen samples. For frozen samples Medinah was rated statistically highest.

Pod Length (frozen only): The Friedman analysis shows significant differences among the frozen samples. Medinah was rated significantly higher than 5613 or Minuette.

Flavor (canned only): The Friedman analysis shows no significant differences among the canned samples. Minuette was rated highest and Medinah was rated lowest though there was no statistical significance.

Overall Quality: The Friedman analysis shows significance for frozen but not for canned samples. For frozen samples Medinah was rated significantly higher than all other samples. For canned samples, Medinah was also rated highest, though there was no statistical significance.

Results - Small Sieve New Selections (single harvest)

Color: Significant differences were detected only among the frozen samples. For frozen samples 5446 was ranked highest, followed by a closely ranked group of 5803, 5825, and 5747. For the canned samples, the most highly ranked samples were 5446, 5803, and 5842, though they were not statistically different from the lowest rated sample, 5844.

Straightness: The Friedman analysis shows significant differences among frozen samples but not the canned. For the frozen samples, 5844 and 5747 were ranked significantly higher than all other beans except 5446. No significance was shown for canned samples by the Wilcoxin analysis.

Smoothness: The Friedman analysis shows significant differences only among the frozen samples, though the p value for the canned samples (.0577) was very close to the significance limit (.05). For frozen samples, 5844 was rated highest, followed by 5747.

Pod Length (frozen only): The Friedman analysis shows no significant differences among the frozen samples, though the Wilcoxin analysis shows 5747, the highest rated sample, significantly higher than 5860, 5446, 5803, 5842, and 5804, the lowest rated sample.

Flavor (canned only): The Friedman analysis shows no significant differences among the canned samples. 5804 and 5860 rated most highly and 5842 was rated lowest though there was no statistical significance.

Overall Quality: The Friedman analysis shows significance for frozen but not for canned samples. For frozen samples, 5747 was rated significantly higher than all other samples except two. The second most highly rated sample was 5844. 5804, 5842, and 5860 were the lower rated samples. For canned samples, 5747 was also rated highest, followed by 5804 and 5825, though there was no statistical significance to any comparison.

Results - Small Sieve Commercial Selections

Color: Significant differences were detected only among the frozen samples. For frozen samples, 51-98 was ranked highest, significantly higher than Proton or WB34 (lowest ranked) but not significantly higher than EX390. For the canned samples, selections were rated Proton (highest), EX390, 51-98, and WB34 (lowest) though there were no significant comparisons.

Straightness: The Friedman analysis shows significant differences among frozen samples but not canned. For the frozen samples, 51-98 was ranked highest, significantly higher than EX390 and WB34 (lowest). 51-98 was also ranked highest of the canned samples though no statistical significance was shown by the Wilcoxin analysis.

Smoothness: The Friedman analysis shows significant differences only among the frozen samples. For frozen samples, 51-98 was rated highest, followed closely by Proton. Both were rated significantly higher than the other two beans. WB34 was ranked highest of the canned samples and EX390 was rated lowest though no statistical significance was shown by the Wilcoxin analysis.

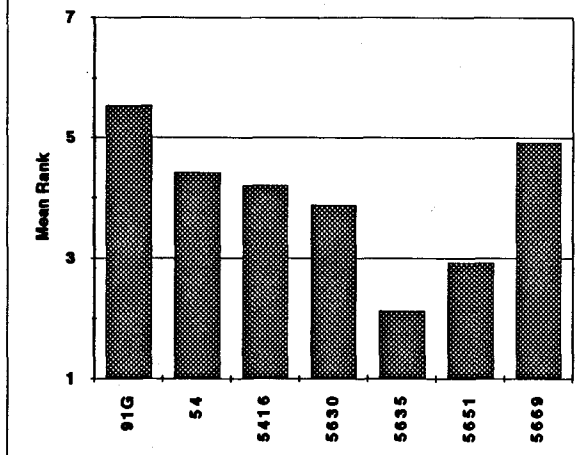
Pod Length (frozen only): The Friedman analysis shows statistically significant differences among the frozen samples. 51-98 was rated significantly higher than any of the other samples. Proton was rated second highest, significantly higher than WB34 or EX390.

Flavor (canned only): The Friedman and Wilcoxin analyses show no significant differences among all or between any of the canned samples. Rank order was WB34 (highest), 51-98, EX390, Proton (lowest).

Overall Quality: The Friedman analysis shows significance for frozen but not for canned samples. For frozen samples, 51-98 was rated highest, followed by Proton. Both of these were rated significantly higher than the other samples. The canned samples were ranked WB34 (highest), 51-98, EX390, Proton (lowest)., though there was no statistical significance to any of the comparisons.

1999 Standard Sieve Green Beans, Advanced Lines - Frozen Industry Evaluation

COLOR

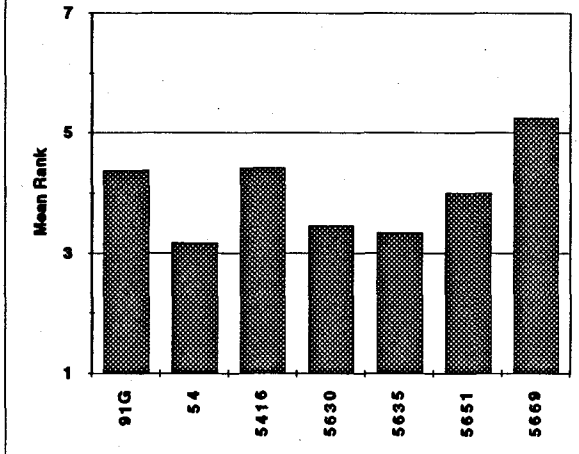


Friedman Analysis of Rank

Probability of no difference among samples, p = .0002

	Mean Rank
91G	5.5
5669	4.9
54	4.4
5416	4.2
5630	3.9
5651	2.9
5635	2.1

STRAIGHTNESS

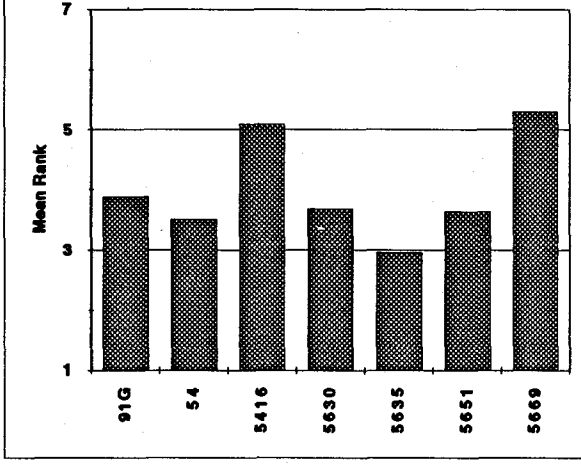


Friedman Analysis of Rank

Probability of no difference among samples, p = .084

	Mean Rank
5669	5.3
5416	4.4
91G	4.4
5651	4.0
5630	3.5
5635	3.3
54	3.2

SMOOTHNESS



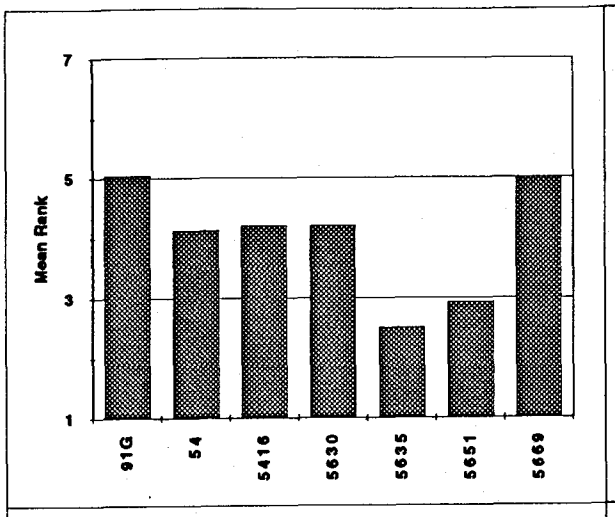
Friedman Analysis of Rank

Probability of NO difference among samples, p = .0241

	Mean Rank
5669	5.3
5416	5.1
91G	3.9
5630	3.7
5651	3.6
54	3.5
5635	3.0

1999 Standard Sieve Green Beans, Advanced Lines - Frozen
Industry Evaluation

POD LENGTH

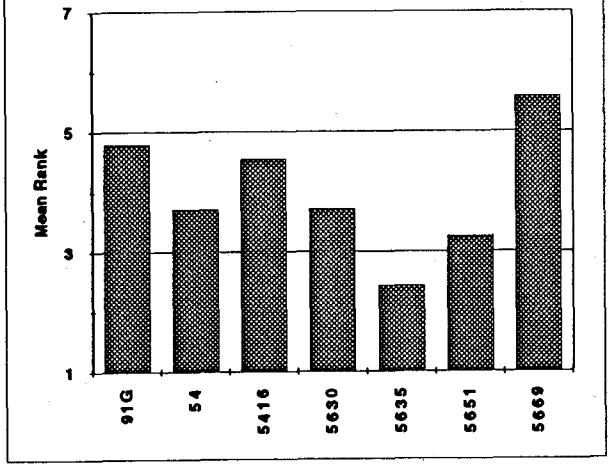


Friedman Analysis of Rank

Probability of NO difference among samples, p = .002

	Mean Rank
91G	5.0
5669	5.0
5416	4.2
5630	4.2
54	4.1
5651	2.9
5635	2.5

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0029

	Mean Rank
5669	5.6
91G	4.8
5416	4.5
54	3.7
5630	3.7
5651	3.3
5635	2.4

1999 Standard Sieve Green Beans, Advanced Lines - Frozen
Industry Evaluation

WILCOXIN SIGNED RANK
probability of NO difference

COLOR

	91G	5669	54	5416	5630	5651	5635
91G	-	.285	.011	.022	.046	.035	.003
5669	.285	-	.341	.085	.222	.056	.011
54	.011	.341	-	.206	.340	.104	.012
5416	.022	.085	.206	-	1.000	.266	.068
5630	.046	.222	.340	1.000	-	.227	.045
5651	.035	.056	.104	.266	.227	-	.248
5635	.003	.011	.012	.068	.045	.248	-

STRAIGHTNESS

	5669	5416	91G	5651	5630	5635	54
5669	-	.317	.454	.025	.021	.050	.061
5416	.317	-	1.000	.527	.160	.145	.189
91G	.454	1.000	-	.581	.166	.222	.034
5651	.025	.527	.581	-	.480	.408	.319
5630	.021	.160	.166	.480	-	.773	.521
5635	.050	.145	.222	.408	.773	-	.774
54	.061	.189	.034	.319	.521	.774	-

SMOOTHNESS

	5669	5416	91G	5630	5651	54	5635
5669	-	.739	.201	.070	.034	.085	.004
5416	.739	-	.357	.285	.185	.256	.032
91G	.201	.357	-	.785	.892	.480	.328
5630	.070	.285	.785	-	.739	.552	.084
5651	.034	.185	.892	.739	-	.722	.317
54	.085	.256	.480	.552	.722	-	.558
5635	.004	.032	.328	.084	.317	.558	-

POD LENGTH

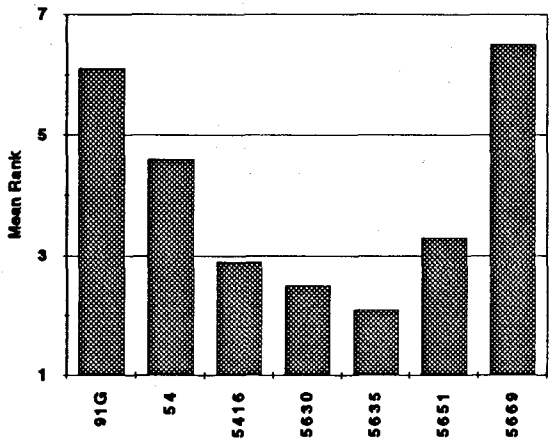
	91G	5669	5416	5630	54	5651	5635
91G	-	.527	.206	.160	.034	.020	.009
5669	.527	-	.589	.429	.340	.031	.006
5416	.206	.589	-	.655	.603	.165	.008
5630	.160	.429	.655	-	.792	.177	.008
54	.034	.340	.603	.792	-	.222	.078
5651	.020	.031	.165	.177	.222	-	.680
5635	.009	.006	.008	.008	.078	.680	-

OVERALL QUALITY

	5669	91G	5416	54	5630	5651	5635
5669	-	.553	.074	.071	.028	.032	.003
91G	.553	-	.308	.067	.169	.200	.031
5416	.074	.308	-	.389	.131	.209	.013
54	.071	.067	.389	-	.832	.389	.058
5630	.028	.169	.131	.832	-	.352	.070
5651	.032	.200	.209	.389	.352	-	.587
5635	.003	.031	.013	.058	.070	.587	-

1999 Standard Sieve Green Beans, Advanced Lines - Canned Industry Evaluation

COLOR

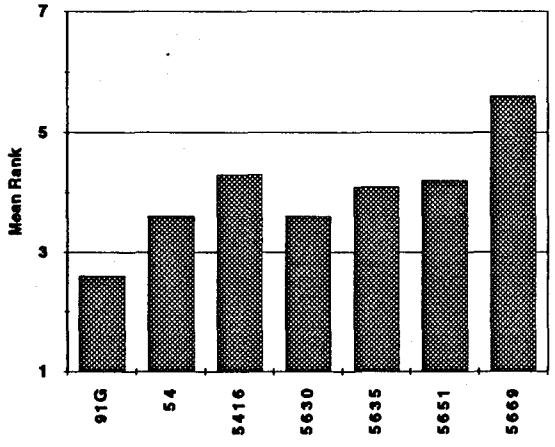


Friedman Analysis of Rank

Probability of no difference among samples, p = .0009

	Mean Rank
5669	6.5
91G	6.1
54	4.6
5651	3.3
5416	2.9
5630	2.5
5635	2.1

STRAIGHTNESS

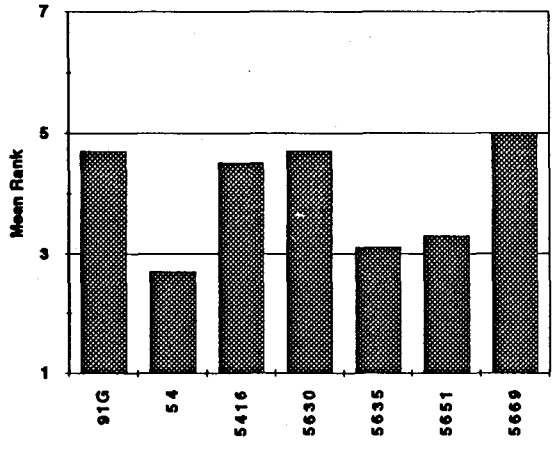


Friedman Analysis of Rank

Probability of no difference among samples, p = .2452

	Mean Rank
5669	5.6
5416	4.3
5651	4.2
5635	4.1
54	3.6
5630	3.6
91G	2.6

SMOOTHNESS



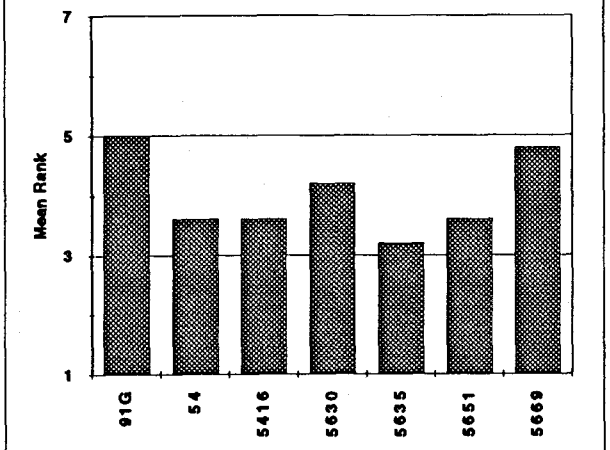
Friedman Analysis of Rank

Probability of NO difference among samples, p = .2777

	Mean Rank
5669	5.0
91G	4.7
5630	4.7
5416	4.5
5651	3.3
5635	3.1
54	2.7

1999 Standard Sieve Green Beans, Advanced Lines - Canned Industry Evaluation

FLAVOR

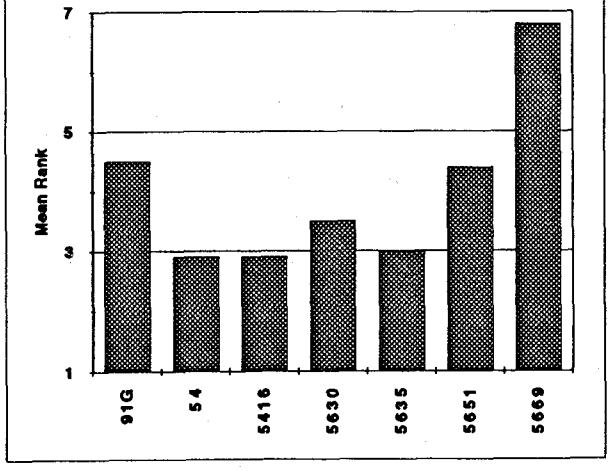


Friedman Analysis of Rank

Probability of NO difference among samples, p = .4135

	Mean Rank
91G	5.0
5669	4.8
5630	4.2
54	3.6
5416	3.6
5651	3.6
5635	3.2

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0104

	Mean Rank
5669	6.8
91G	4.5
5651	4.4
5630	3.5
5635	3.0
54	2.9
5416	2.9

1999 Standard Sieve Green Beans, Advanced Lines - Canned
Industry Evaluation

WILCOXIN SIGNED RANK

probability of NO difference

COLOR

	5669	91G	54	5651	5416	5630	5635
5669	-	1.000	.063	.034	.039	.039	.041
91G	1.000	-	.103	.041	.066	.042	.041
54	.063	.103	-	.103	.098	.103	.066
5651	.034	.041	.103	-	.564	.180	.103
5416	.039	.066	.098	.564	-	.414	.276
5630	.039	.042	.103	.180	.414	-	.317
5635	.041	.041	.066	.103	.276	.317	-

STRAIGHTNESS

	5669	5416	5651	5635	54	5630	91G
5669	-	.257	.462	.180	.103	.103	.042
5416	.257	-	.655	1.000	.317	.564	.336
5651	.462	.655	-	.655	.317	.414	.462
5635	.180	1.000	.655	-	.317	.655	.357
54	.103	.317	.317	.317	-	1.000	.462
5630	.103	.564	.414	.655	1.000	-	.414
91G	.042	.336	.462	.357	.462	.414	-

SMOOTHNESS

	5669	91G	5630	5416	5651	5635	54
5669	-	.257	.786	.706	.103	.578	.109
91G	.257	-	1.000	.655	.083	.450	.103
5630	.786	1.000	-	.564	.180	.257	.103
5416	.706	.655	.564	-	.414	.578	.103
5651	.103	.083	.180	.414	-	.891	.414
5635	.578	.450	.257	.578	.891	-	.655
54	.109	.103	.103	.103	.414	.655	-

FLAVOR

	91G	5669	5630	54	5416	5651	5635
91G	-	.157	.285	.180	.180	.180	.269
5669	.157	-	.276	.157	.157	.157	.357
5630	.285	.276	-	.317	.317	.317	.786
54	.180	.157	.317	-	1.000	1.000	1.000
5416	.180	.157	.317	1.000	-	1.000	1.000
5651	.180	.157	.317	1.000	1.000	-	1.000
5635	.269	.357	.786	1.000	1.000	1.000	-

OVERALL QUALITY

	5669	91G	5651	5630	5635	54	5416
5669	-	.085	.039	.039	.042	.042	.042
91G	.085	-	.786	.180	.285	.194	.194
5651	.039	.786	-	.317	.083	.083	.083
5630	.039	.180	.317	-	.564	.564	.564
5635	.042	.285	.083	.564	-	1.000	1.000
54	.042	.194	.083	.564	1.000	-	1.000
5416	.042	.194	.083	.564	1.000	1.000	-

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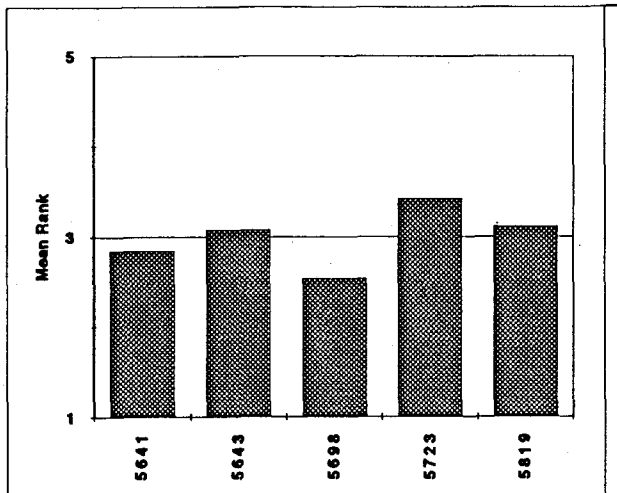
Industry Evaluation

COLOR

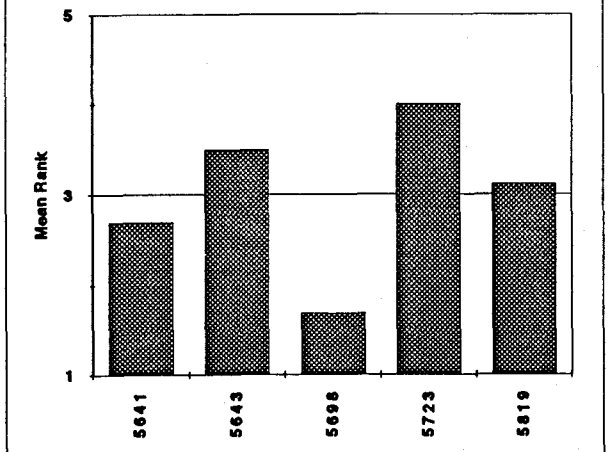


Friedman Analysis of Rank

Probability of no difference among samples, p = .5474

	Mean Rank
5723	3.4
5819	3.1
5643	3.1
5641	2.8
5698	2.5

STRAIGHTNESS

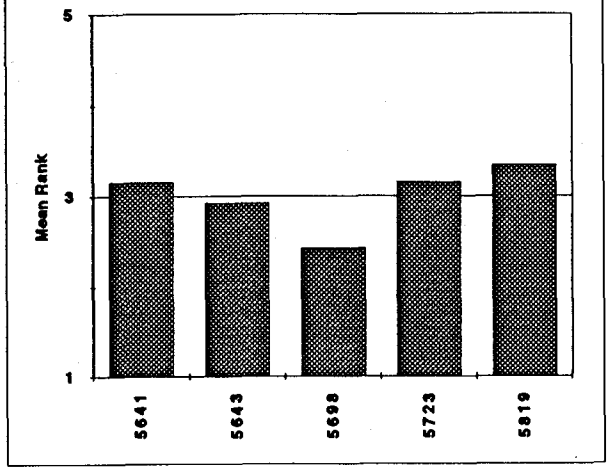


Friedman Analysis of Rank

Probability of no difference among samples, p =.0002

	Mean Rank
5723	4.0
5643	3.5
5819	3.1
5641	2.7
5698	1.7

SMOOTHNESS



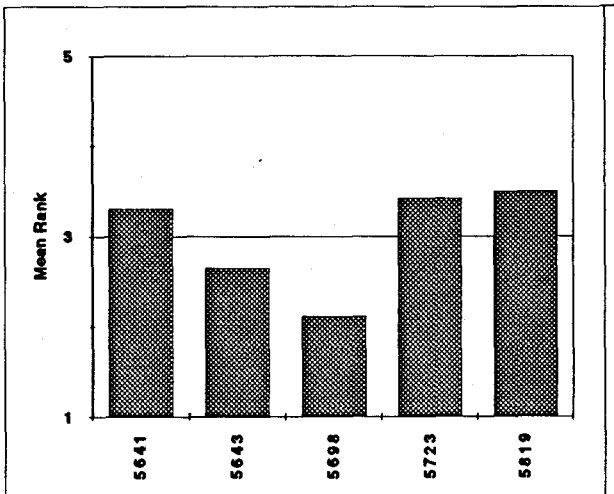
Friedman Analysis of Rank

Probability of NO difference among samples, p = .4397

	Mean Rank
5819	3.3
5641	3.2
5723	3.2
5643	2.9
5698	2.4

1999 Standard Sieve Green Beans, New Lines - Frozen
Industry Evaluation

POD LENGTH

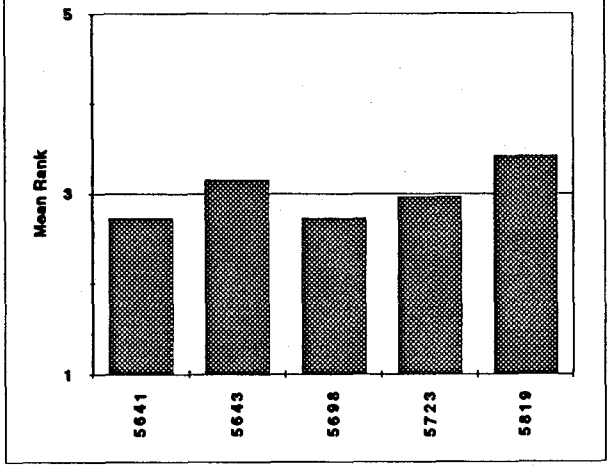


Friedman Analysis of Rank

Probability of NO difference among samples, p = .0271

	Mean Rank
5819	3.5
5723	3.4
5641	3.3
5643	2.7
5698	2.1

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .5959

	Mean Rank
5819	3.4
5643	3.2
5723	3.0
5641	2.7
5698	2.7

1999 Standard Sieve Green Beans, New Lines - Frozen
Industry Evaluation

WILCOXIN SIGNED RANK

probability of NO difference

COLOR

	5723	5819	5643	5641	5698
5723	-	.549	.569	.402	.254
5819	.549	-	.791	.490	.157
5643	.569	.791	-	.414	.454
5641	.402	.490	.414	-	.739
5698	.254	.157	.454	.739	-

STRAIGHTNESS

	5723	5643	5819	5641	5698
5723	-	.260	.218	.031	.002
5643	.260	-	.608	.034	.007
5819	.218	.608	-	.206	.014
5641	.031	.034	.206	-	.023
5698	.002	.007	.014	.023	-

SMOOTHNESS

	5819	5641	5723	5643	5698
5819	-	.527	.608	.317	.166
5641	.527	-	1.000	.706	.248
5723	.608	1.000	-	.739	.357
5643	.317	.706	.739	-	.257
5698	.166	.248	.357	.257	-

POD LENGTH

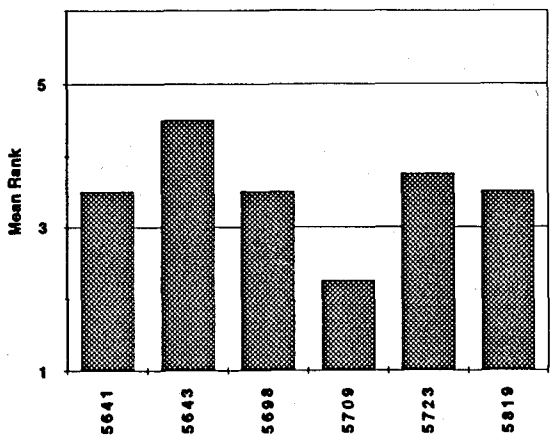
	5819	5723	5641	5643	5698
5819	-	.655	1.000	.085	.014
5723	.655	-	.725	.107	.021
5641	1.000	.725	-	.160	.021
5643	.085	.107	.160	-	.942
5698	.014	.021	.021	.942	-

OVERALL QUALITY

	5819	5643	5723	5641	5698
5819	-	.381	.258	.220	.052
5643	.381	-	.541	.746	.458
5723	.258	.541	-	.473	.714
5641	.220	.746	.473	-	.833
5698	.052	.458	.714	.833	-

1999 Standard Sieve Green Beans, New Lines - Canned Industry Evaluation

COLOR

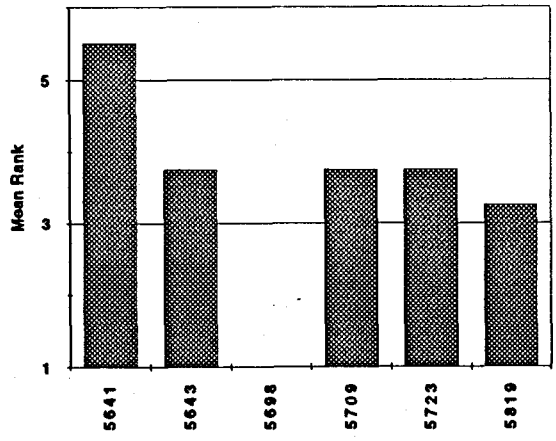


Friedman Analysis of Rank

Probability of no difference among samples, p = .8862

	Mean Rank
5643	4.5
5723	3.8
5641	3.5
5698	3.5
5819	3.5
5709	2.3

STRAIGHTNESS

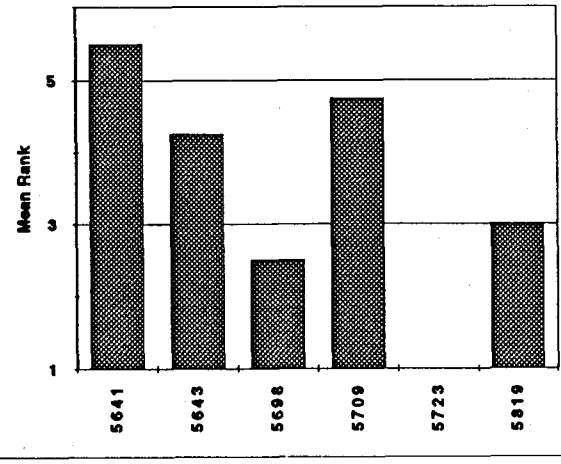


Friedman Analysis of Rank

Probability of no difference among samples, p = .2553

	Mean Rank
5641	5.5
5643	3.8
5723	3.8
5709	3.8
5819	3.3
5698	1.0

SMOOTHNESS



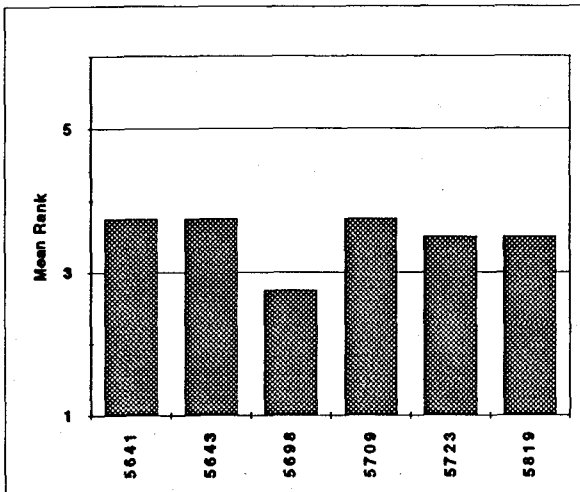
Friedman Analysis of Rank

Probability of NO difference among samples, p = .13

	Mean Rank
5641	5.5
5709	4.8
5643	4.3
5819	3.0
5698	2.5
5723	1.0

1999 Standard Sieve Green Beans, New Lines - Canned
Industry Evaluation

FLAVOR

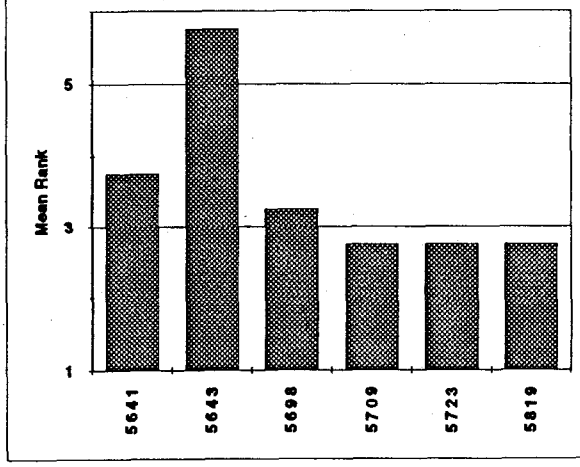


Friedman Analysis of Rank

Probability of NO difference among samples, p = .9927

	Mean Rank
5641	3.8
5643	3.8
5709	3.8
5723	3.5
5819	3.5
5698	2.8

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .4981

	Mean Rank
5643	5.8
5641	3.8
5698	3.3
5723	2.8
5819	2.8
5709	2.8

1999 Standard Sieve Green Beans, New Lines - Canned
Industry Evaluation

WILCOXIN SIGNED RANK

probability of NO difference

COLOR

	5643	5723	5641	5698	5819	5709
5643	-	.276	.083	.103	.334	.180
5723	.276	-	.706	.706	.458	.317
5641	.083	.706	-	.317	.888	.317
5698	.103	.706	.317	-	.890	.317
5819	.334	.458	.888	.890	-	.655
5709	.180	.317	.317	.317	.655	-

STRAIGHTNESS

	5641	5643	5723	5709	5819	5698
5641	-	.103	.157	.157	.066	.039
5643	.103	-	.317	1.000	.257	.039
5723	.157	.317	-	1.000	.655	.109
5709	.157	1.000	1.000	-	.317	.157
5819	.066	.257	.655	.317	-	.109
5698	.039	.039	.109	.157	.109	-

SMOOTHNESS

	5641	5709	5643	5819	5698	5723
5641	-	.317	.103	.334	.066	.103
5709	.317	-	1.000	.157	.180	.180
5643	.103	1.000	-	1.000	.414	.180
5819	.334	.157	1.000	-	.157	.066
5698	.066	.180	.414	.157	-	.083
5723	.103	.180	.180	.066	.083	-

FLAVOR

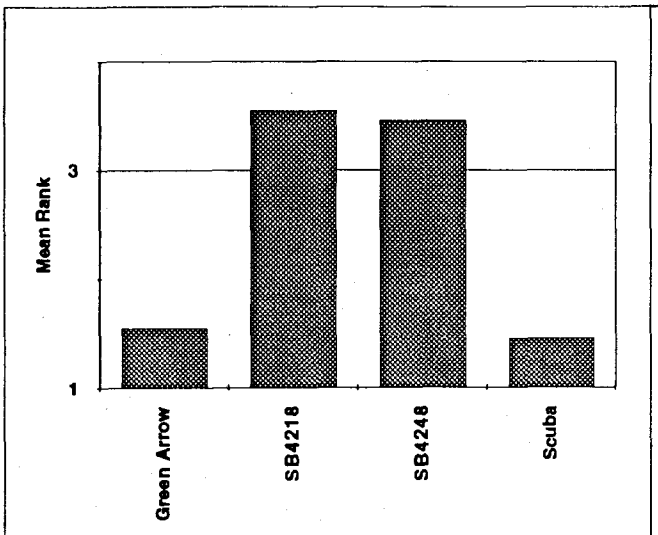
	5641	5643	5709	5723	5819	5698
5641	-	.414	1.000	.194	.336	.706
5643	.414	-	1.000	.317	.216	.706
5709	1.000	1.000	-	1.000	1.000	.317
5723	.194	.317	1.000	-	.317	.462
5819	.336	.216	1.000	.317	-	.273
5698	.706	.706	.317	.462	.273	-

OVERALL QUALITY

	5643	5641	5698	5723	5819	5709
5643	-	.564	.180	.109	.041	.180
5641	.564	-	.257	.103	.066	.317
5698	.180	.257	-	.564	.216	1.000
5723	.109	.103	.564	-	.317	1.000
5819	.041	.066	.216	.317	-	1.000
5709	.180	.317	1.000	1.000	1.000	-

1999 Standard Sieve Green Beans, Commercial Lines - Frozen Industry Evaluation

COLOR



Friedman Analysis of Rank

Probability of no difference among samples, p = .0001

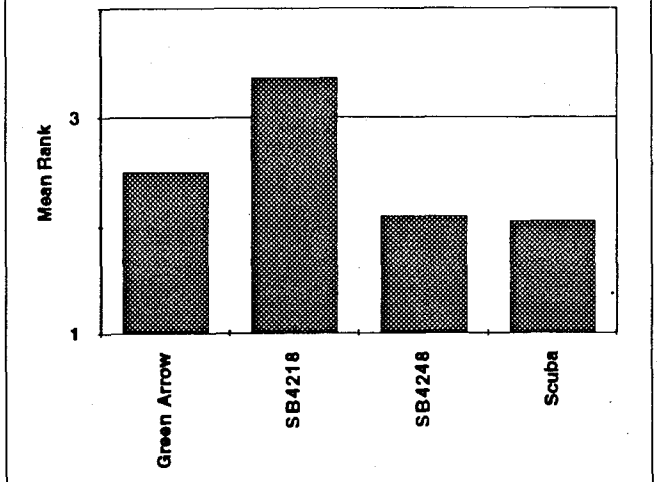
	Mean Rank
SB4218	3.55
SB4248	3.46
Green Arrow	1.55
Scuba	1.46

Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	SB4248	Green Arrow	Scuba
SB4218	-	.366	.002	.001
SB4248	.366	-	.003	.002
Green Arrow	.002	.003	-	.317
Scuba	.001	.002	.317	-

STRAIGHTNESS



Friedman Analysis of Rank

Probability of no difference among samples, p = .0193

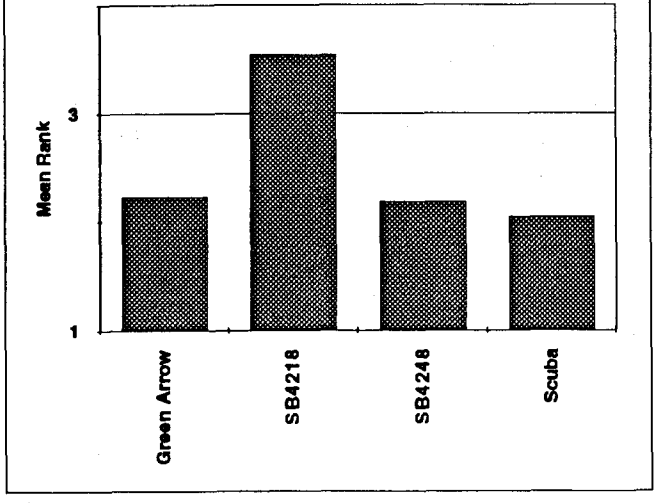
	Mean Rank
SB4218	3.36
Green Arrow	2.50
SB4248	2.09
Scuba	2.05

Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	Green Arrow	SB4248	Scuba
SB4218	-	.025	.047	.044
Green Arrow	.025	-	.603	.589
SB4248	.047	.603	-	.666
Scuba	.044	.589	.666	-

SMOOTHNESS



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0052

	Mean Rank
SB4218	3.55
Green Arrow	2.23
SB4248	2.18
Scuba	2.05

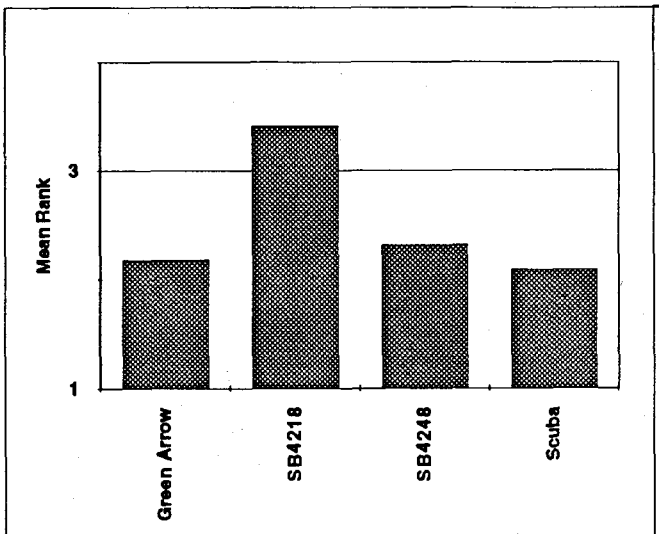
Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	Green Arrow	SB4248	Scuba
SB4218	-	.009	.011	.004
Green Arrow	.009	-	.623	.589
SB4248	.011	.623	-	.666
Scuba	.004	.589	.666	-

1999 Standard Sieve Green Beans, Commercial Lines - Frozen Industry Evaluation

POD LENGTH



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0167

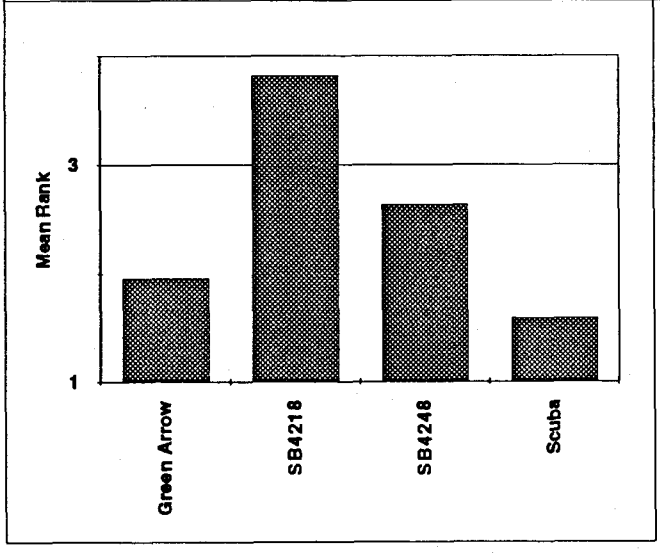
	Mean Rank
SB4218	3.41
SB4248	2.32
Green Arrow	2.18
Scuba	2.09

Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	SB4248	Green Arrow	Scuba
SB4218	-	.020	.011	.014
SB4248	.020	-	.890	.791
Green Arrow	.011	.890	-	.655
Scuba	.014	.791	.655	-

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0001

	Mean Rank
SB4218	3.82
SB4248	2.64
Green Arrow	1.96
Scuba	1.59

Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	SB4248	Green Arrow	Scuba
SB4218	-	.012	.003	.001
SB4248	.012	-	.179	.016
Green Arrow	.003	.179	-	.216
Scuba	.001	.016	.216	-

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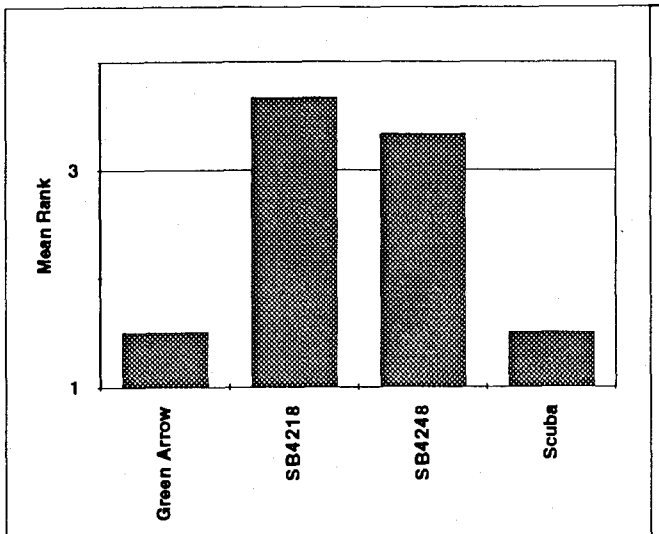
COLOR



Friedman Analysis of Rank

Probability of no difference among samples, p = .0438

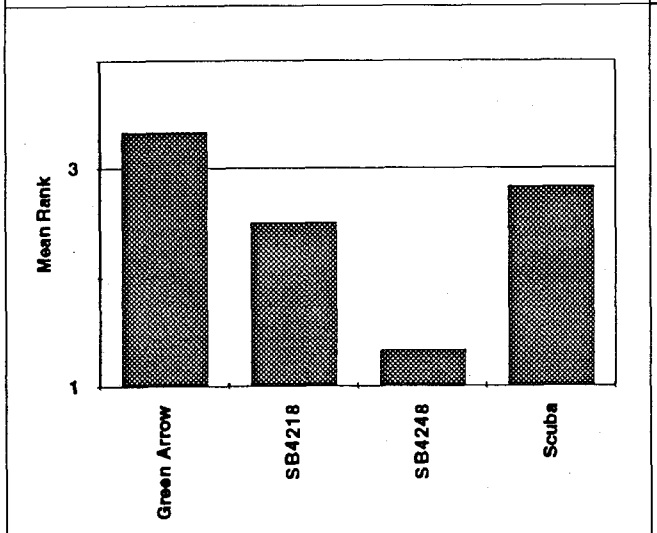
	Mean Rank
SB4218	3.67
SB4248	3.33
Green Arrow	1.50
Scuba	1.50

Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	SB4248	Green Arrow	Scuba
SB4218	-	.317	.109	.109
SB4248	.317	-	.109	.103
Green Arrow	.109	.109	-	.655
Scuba	.109	.103	.655	-

STRAIGHTNESS



Friedman Analysis of Rank

Probability of no difference among samples, p = .1812

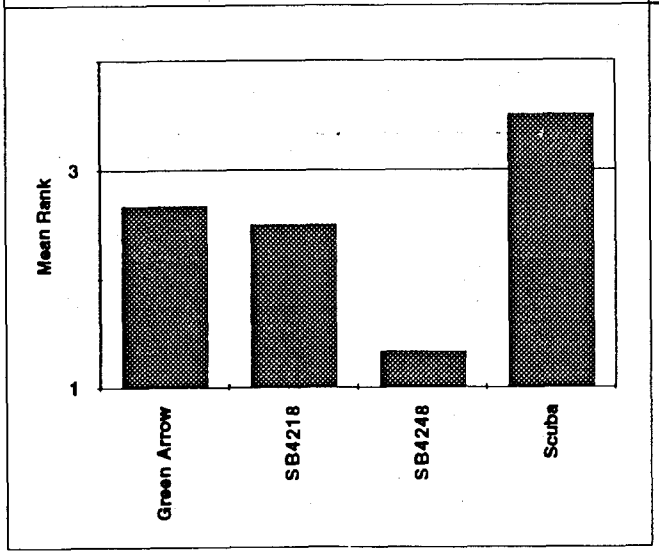
	Mean Rank
Green Arrow	3.33
Scuba	2.83
SB4218	2.50
SB4248	1.33

Wilcoxin Signed Rank

probability of no difference among samples

	Green Arrow	Scuba	SB4218	SB4248
Green Arrow	-	.317	.317	.109
Scuba	.317	-	1.000	.109
SB4218	.317	1.000	-	.144
SB4248	.109	.109	.144	-

SMOOTHNESS



Friedman Analysis of Rank

Probability of NO difference among samples, p = .1604

	Mean Rank
Scuba	3.50
Green Arrow	2.67
SB4218	2.50
SB4248	1.33

Wilcoxin Signed Rank

probability of no difference among samples

	Scuba	Green Arrow	SB4218	SB4248
Scuba	-	.157	.317	.103
Green Arrow	.157	-	.655	.103
SB4218	.317	.655	-	.144
SB4248	.103	.103	.144	-

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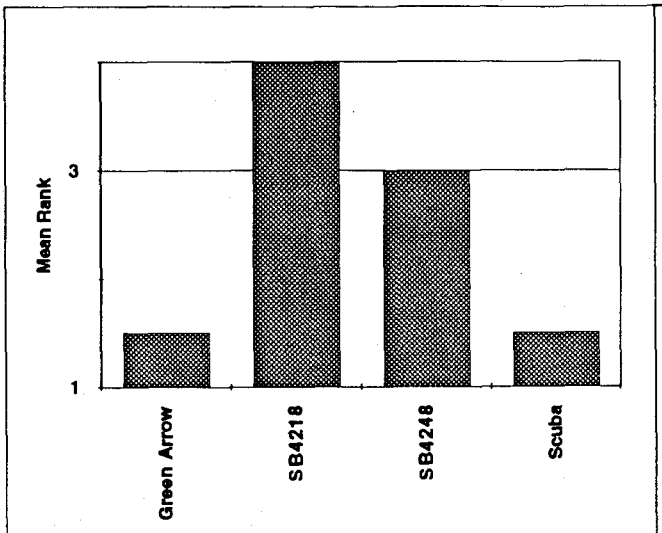
FLAVOR



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0293

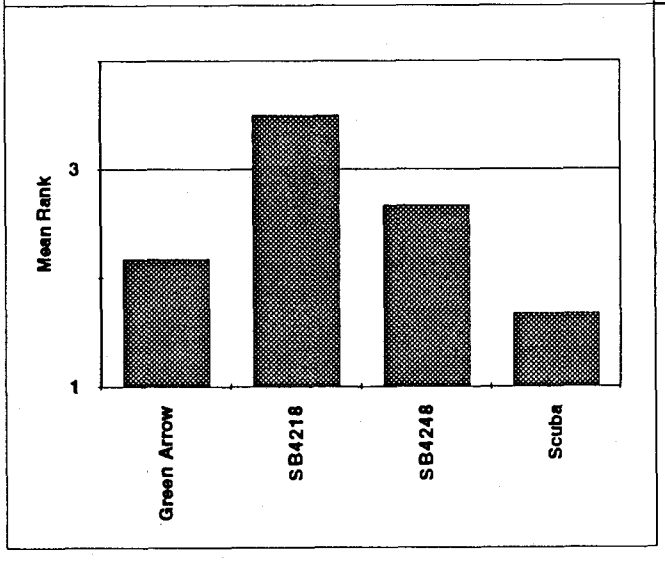
	Mean Rank
SB4218	4.00
SB4248	3.00
Green Arrow	1.50
Scuba	1.50

Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	SB4248	Green Arrow	Scuba
SB4218	-	.103	.103	.103
SB4248	.103	-	.103	.103
Green Arrow	.103	.103	-	1.000
Scuba	.103	.103	1.000	-

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .2998

	Mean Rank
SB4218	3.50
SB4248	2.67
Green Arrow	2.17
Scuba	1.67

Wilcoxin Signed Rank

probability of no difference among samples

	SB4218	SB4248	Green Arrow	Scuba
SB4218	-	.144	.180	.109
SB4248	.144	-	.414	.276
Green Arrow	.180	.414	-	.317
Scuba	.109	.276	.317	-

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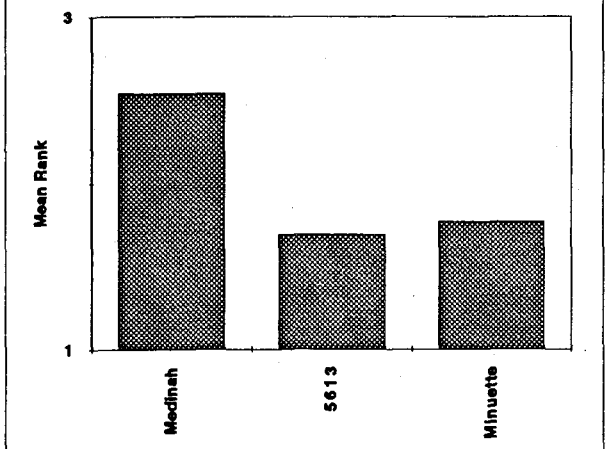
COLOR



Friedman Analysis of Rank

Probability of no difference among samples, p = .0129

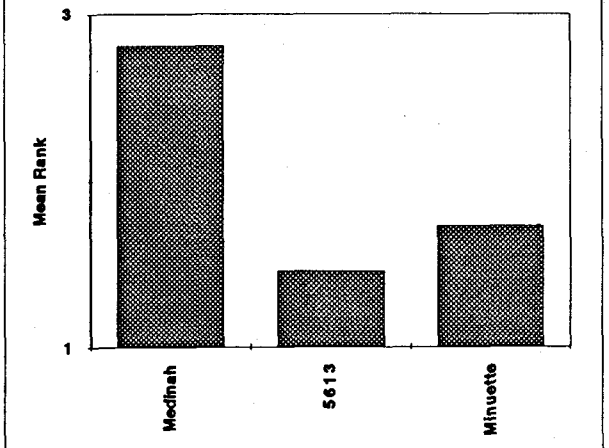
	Mean Rank
Medinah	2.5
Minuette	1.8
5613	1.7

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	Minuette	5613
Medinah	-	.048	.013
Minuette	.048	-	.739
5613	.013	.739	-

STRAIGHTNESS



Friedman Analysis of Rank

Probability of no difference among samples, p = .0001

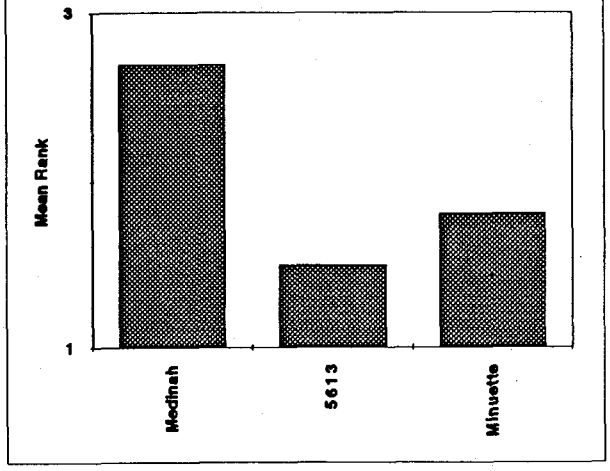
	Mean Rank
Medinah	2.8
Minuette	1.7
5613	1.5

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	Minuette	5613
Medinah	-	.004	.003
Minuette	.004	-	.334
5613	.003	.334	-

SMOOTHNESS



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0009

	Mean Rank
Medinah	2.7
Minuette	1.8
5613	1.5

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	Minuette	5613
Medinah	-	.016	.003
Minuette	.016	-	.272
5613	.003	.272	-

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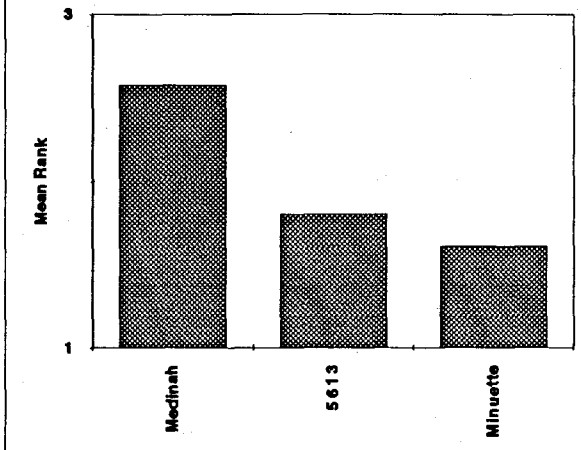
Industry Evaluation

POD LENGTH



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0126

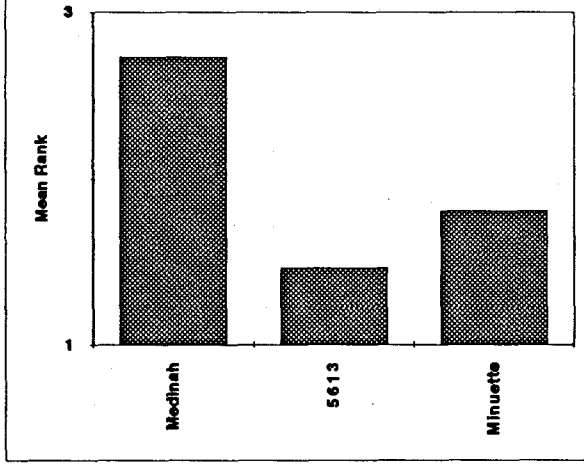
	Mean Rank
Medinah	2.6
5613	1.8
Minuette	1.6

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	5613	Minuette
Medinah	-	.021	.010
5613	.021	-	.194
Minuette	.010	.194	-

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .001

	Mean Rank
Medinah	2.7
Minuette	1.8
5613	1.5

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	Minuette	5613
Medinah	-	.010	.002
Minuette	.010	-	.705
5613	.002	.705	-

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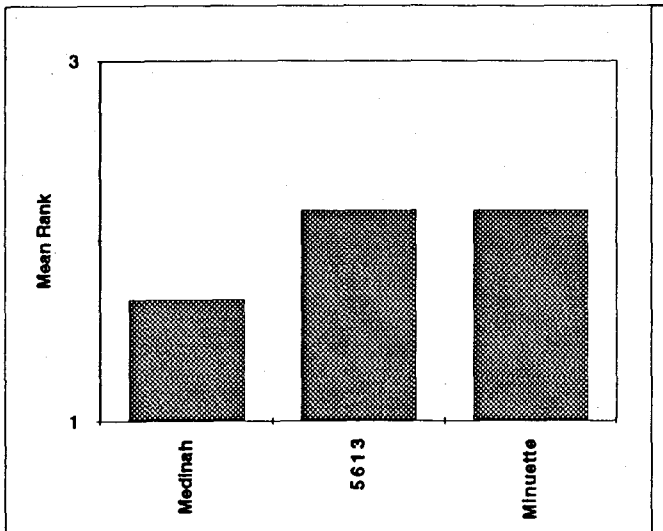
Industry Evaluation

COLOR



Friedman Analysis of Rank

Probability of no difference among samples, p = .3679

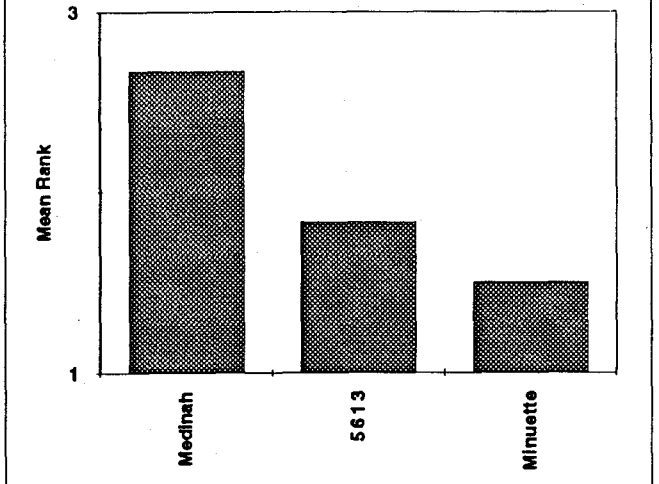
	Mean Rank
5613	2.2
Minuette	2.2
Medinah	1.7

Wilcoxin Signed Rank

probability of no difference among samples

	5613	Minuette	Medinah
5613	-	1.000	.317
Minuette	1.000	-	.317
Medinah	.317	.317	-

STRAIGHTNESS



Friedman Analysis of Rank

Probability of no difference among samples, p = .1561

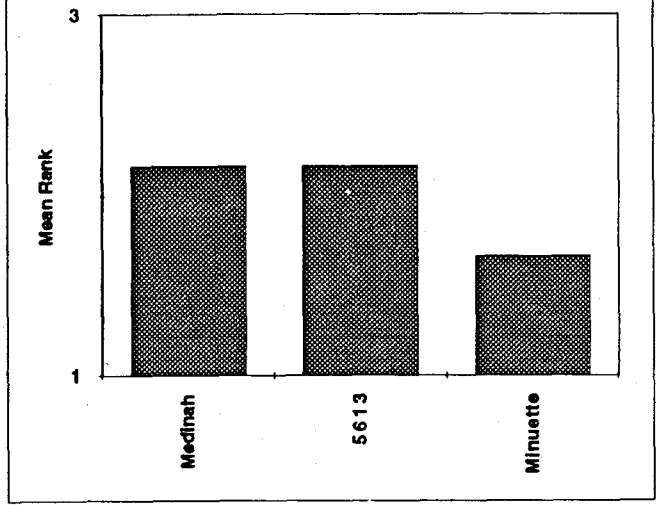
	Mean Rank
Medinah	2.7
5613	1.8
Minuette	1.5

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	5613	Minuette
Medinah	-	.157	.180
5613	.157	-	.317
Minuette	.180	.317	-

SMOOTHNESS



Friedman Analysis of Rank

Probability of NO difference among samples, p = .7165

	Mean Rank
Medinah	2.2
5613	2.2
Minuette	1.7

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	5613	Minuette
Medinah	-	1.000	.786
5613	1.000	-	.786
Minuette	.786	.786	-

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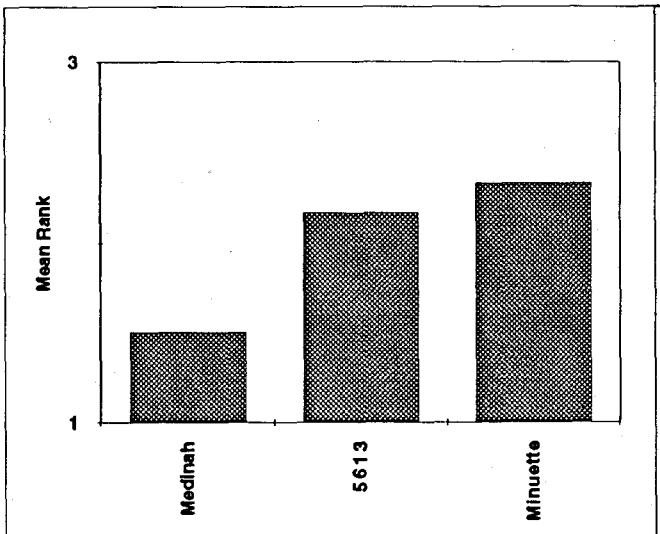
FLAVOR



Friedman Analysis of Rank

Probability of NO difference among samples, p = .4966

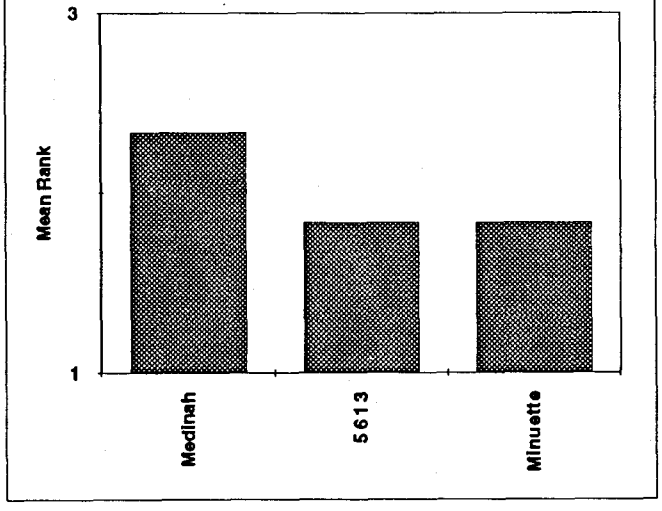
	Mean Rank
Minuette	2.3
5613	2.2
Medinah	1.5

Wilcoxin Signed Rank

probability of no difference among samples

	Minuette	5613	Medinah
Minuette	-	.655	.157
5613	.655	-	.786
Medinah	.157	.786	-

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .6065

	Mean Rank
Medinah	2.3
5613	1.8
Minuette	1.8

Wilcoxin Signed Rank

probability of no difference among samples

	Medinah	5613	Minuette
Medinah	-	.317	.317
5613	.317	-	1.000
Minuette	.317	1.000	-

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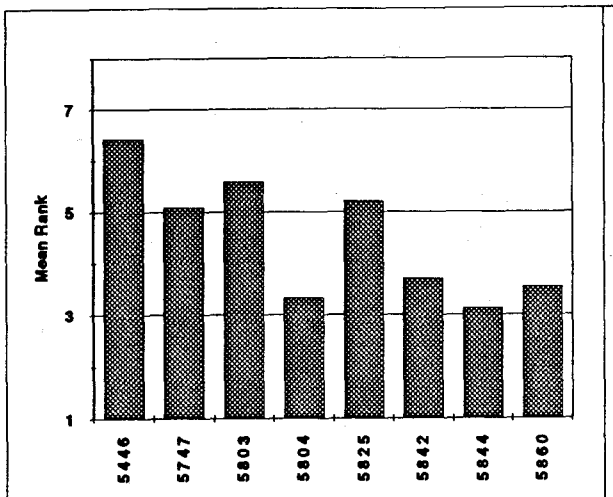
Industry Evaluation

COLOR

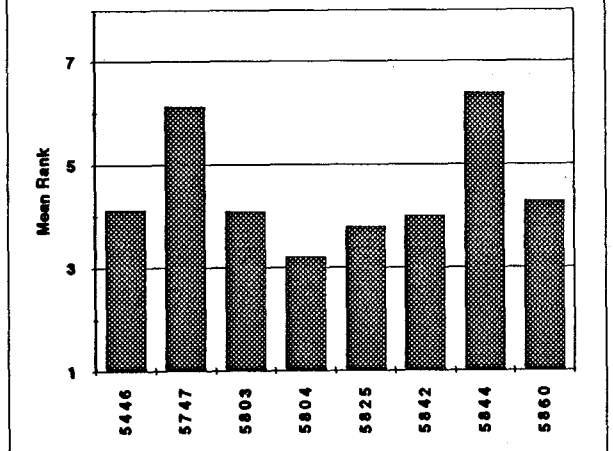


Friedman Analysis of Rank

Probability of no difference among samples, p = .0004

	Mean Rank
5446	6.4
5803	5.6
5825	5.2
5747	5.1
5842	3.7
5860	3.5
5804	3.3
5844	3.1

STRAIGHTNESS

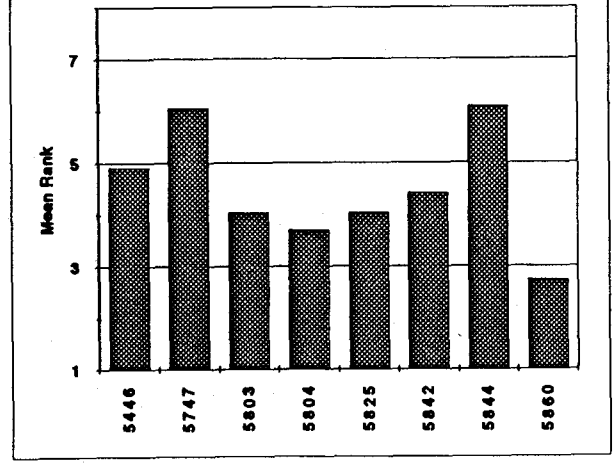


Friedman Analysis of Rank

Probability of no difference among samples, p =.0009

	Mean Rank
5844	6.4
5747	6.1
5860	4.3
5446	4.1
5803	4.1
5842	4.0
5825	3.8
5804	3.2

SMOOTHNESS



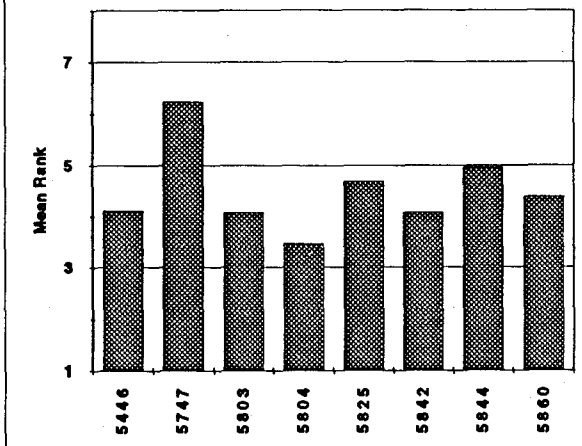
Friedman Analysis of Rank

Probability of NO difference among samples, p = .0009

	Mean Rank
5844	6.1
5747	6.0
5446	4.9
5842	4.4
5803	4.0
5825	4.0
5804	3.7
5860	2.8

1999 Small Sieve Green Beans, New Lines - Frozen
Industry Evaluation

POD LENGTH

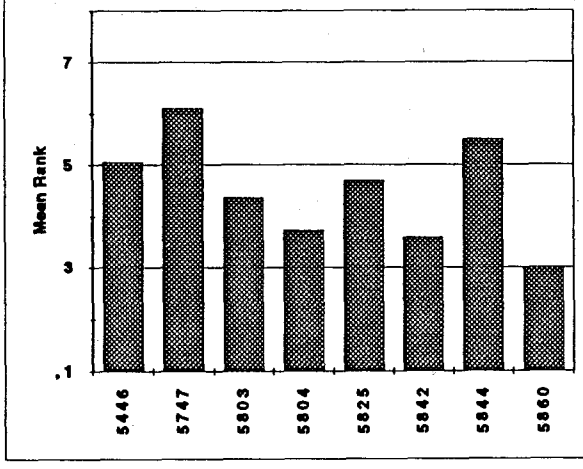


Friedman Analysis of Rank

Probability of NO difference among samples, p = .0636

	Mean Rank
5747	6.2
5844	5.0
5825	4.7
5860	4.4
5446	4.1
5803	4.1
5842	4.1
5804	3.5

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0192

	Mean Rank
5747	6.1
5844	5.5
5446	5.0
5825	4.7
5803	4.4
5804	3.7
5842	3.6
5860	3.0

1999 Small Sieve Green Beans, New Lines - Frozen
Industry Evaluation

WILCOXIN SIGNED RANK

probability of NO difference

COLOR

	5446	5803	5825	5747	5842	5860	5804	5844
5446	-	.129	.085	.080	.010	.007	.020	.012
5803	.129	-	.414	.527	.021	.028	.026	.016
5825	.085	.414	-	1.000	.034	.034	.057	.018
5747	.080	.527	1.000	-	.177	.034	.034	.046
5842	.010	.021	.034	.177	-	.527	.589	.160
5860	.007	.028	.034	.034	.527	-	1.000	.408
5804	.020	.026	.057	.034	.589	1.000	-	.334
5844	.012	.016	.018	.046	.160	.408	.334	-

STRAIGHTNESS

	5844	5747	5860	5446	5803	5842	5825	5804
5844	-	.786	.040	.093	.016	.003	.012	.007
5747	.786	-	.039	.013	.016	.014	.031	.013
5860	.040	.039	-	.598	.558	.527	.480	.157
5446	.093	.013	.598	-	1.000	.942	.852	.566
5803	.016	.016	.558	1.000	-	.739	1.000	.527
5842	.003	.014	.527	.942	.739	-	.706	.317
5825	.012	.031	.480	.852	1.000	.706	-	.157
5804	.007	.013	.157	.566	.527	.317	.157	-

SMOOTHNESS

	5844	5747	5446	5842	5803	5825	5804	5860
5844	-	.888	.220	.185	.014	.087	.066	.004
5747	.888	-	.473	.149	.014	.023	.026	.007
5446	.220	.473	-	.317	.305	.119	.124	.027
5842	.185	.149	.317	-	.719	.366	.340	.066
5803	.014	.014	.305	.719	-	1.000	.748	.046
5825	.087	.023	.119	.366	1.000	-	.655	.058
5804	.066	.026	.124	.340	.748	.655	-	.161
5860	.004	.007	.027	.066	.046	.058	.161	-

POD LENGTH

	5747	5844	5825	5860	5446	5803	5842	5804
5747	-	.142	.055	.032	.013	.016	.012	.011
5844	.142	-	.564	.194	.381	.206	.458	.062
5825	.055	.564	-	.564	.608	.366	.527	.058
5860	.032	.194	.564	-	1.000	.706	1.000	.334
5446	.013	.381	.608	1.000	-	.564	.951	.271
5803	.016	.206	.366	.706	.564	-	.776	.317
5842	.012	.458	.527	1.000	.951	.776	-	.377
5804	.011	.062	.058	.334	.271	.317	.377	-

OVERALL QUALITY

	5747	5844	5446	5825	5803	5804	5842	5860
5747	-	.159	.047	.056	.048	.016	.012	.009
5844	.159	-	.958	.566	.305	.132	.446	.067
5446	.047	.958	-	.605	.388	.169	.143	.024
5825	.056	.566	.605	-	.833	.085	.288	.098
5803	.048	.305	.388	.833	-	.491	.550	.034
5804	.016	.132	.169	.085	.491	-	.587	.606
5842	.012	.446	.143	.288	.550	.587	-	.398
5860	.009	.067	.024	.098	.034	.606	.398	-

1999 Small Sieve Green Beans, New Lines - Canned
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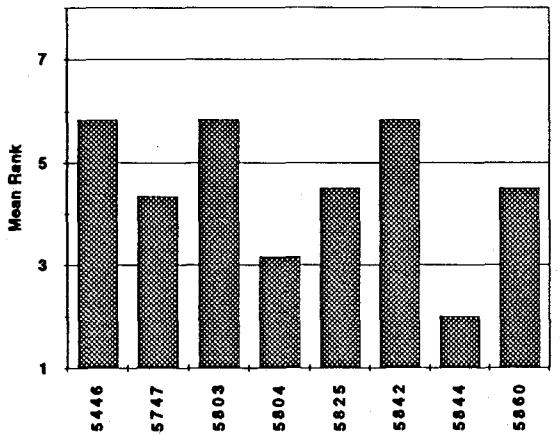
COLOR

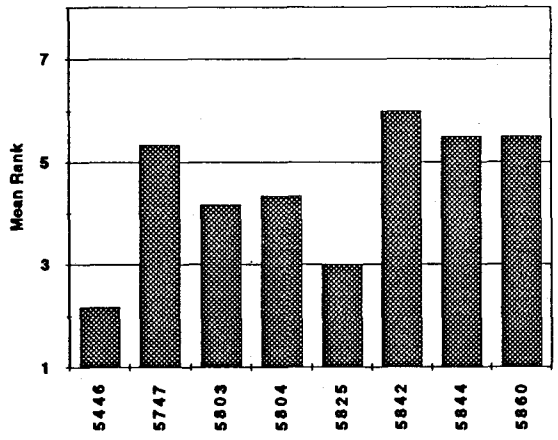


Friedman Analysis of Rank

Probability of no difference among samples, p = .1896

	Mean Rank
5446	5.8
5803	5.8
5842	5.8
5825	4.5
5860	4.5
5747	4.3
5804	3.2
5844	2.0

STRAIGHTNESS

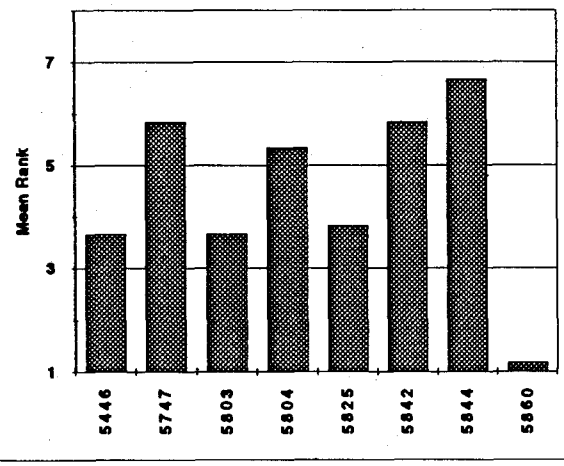


Friedman Analysis of Rank

Probability of no difference among samples, p =.3282

	Mean Rank
5842	6.0
5844	5.5
5860	5.5
5747	5.3
5804	4.3
5803	4.2
5825	3.0
5446	2.2

SMOOTHNESS



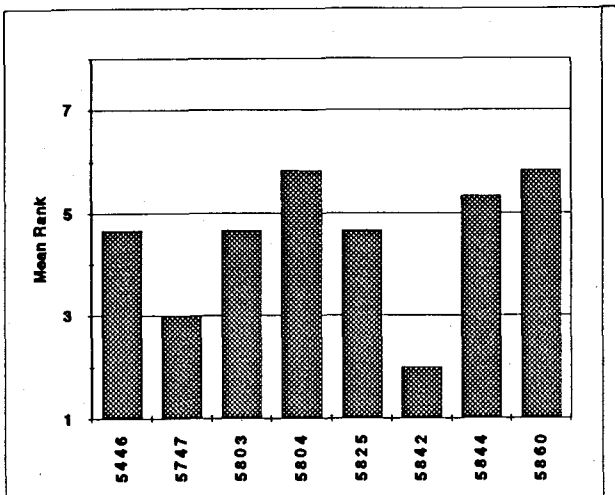
Friedman Analysis of Rank

Probability of NO difference among samples, p = .0577

	Mean Rank
5844	6.7
5747	5.8
5842	5.8
5804	5.3
5825	3.8
5446	3.7
5803	3.7
5860	1.2

1999 Small Sieve Green Beans, New Lines - Canned
Industry Evaluation

FLAVOR

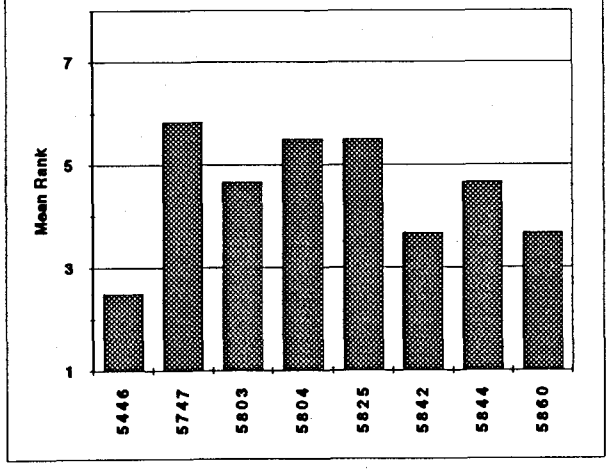


Friedman Analysis of Rank

Probability of NO difference among samples, p = .261

	Mean Rank
5804	5.8
5860	5.8
5844	5.3
5446	4.7
5803	4.7
5825	4.7
5747	3.0
5842	2.0

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .2271

	Mean Rank
5747	5.8
5804	5.5
5825	5.5
5803	4.7
5844	4.7
5842	3.7
5860	3.7
5446	2.5

1999 Small Sieve Green Beans, New Lines - Canned
Industry Evaluation

WILCOXIN SIGNED RANK

probability of NO difference

COLOR

	5446	5803	5842	5825	5860	5747	5804	5844
5446	-	1.000	1.000	.317	.317	.414	.180	.103
5803	1.000	-	1.000	.317	.317	.414	.180	.103
5842	1.000	1.000	-	.317	.317	.414	.180	.103
5825	.317	.317	.317	-	1.000	.655	.317	.180
5860	.317	.317	.317	1.000	-	.655	.317	.180
5747	.414	.414	.414	.655	.655	-	.317	.317
5804	.180	.180	.180	.317	.317	.317	-	.317
5844	.103	.103	.103	.180	.180	.317	.317	-

STRAIGHTNESS

	5842	5844	5860	5747	5804	5803	5825	5446
5842	-	1.000	1.000	.317	.786	.157	.180	.157
5844	1.000	-	1.000	.655	.317	.414	.180	.157
5860	1.000	1.000	-	.655	.317	.317	.180	.103
5747	.317	.655	.655	-	1.000	.317	.157	.180
5804	.786	.317	.317	1.000	-	.655	.317	.180
5803	.157	.414	.317	.317	.655	-	.317	.157
5825	.180	.180	.180	.157	.317	.317	-	.317
5446	.157	.157	.103	.180	.180	.157	.317	-

SMOOTHNESS

	5844	5747	5842	5804	5825	5446	5803	5860
5844	-	.317	.317	.317	.103	.180	.180	.109
5747	.317	-	1.000	1.000	.157	.157	.157	.109
5842	.317	1.000	-	1.000	.157	.157	.157	.109
5804	.317	1.000	1.000	-	.414	.317	.317	.103
5825	.103	.157	.157	.414	-	.414	.414	.180
5446	.180	.157	.157	.317	.414	-	1.000	.103
5803	.180	.157	.157	.317	.414	1.000	-	.103
5860	.109	.109	.109	.103	.180	.103	.103	-

FLAVOR

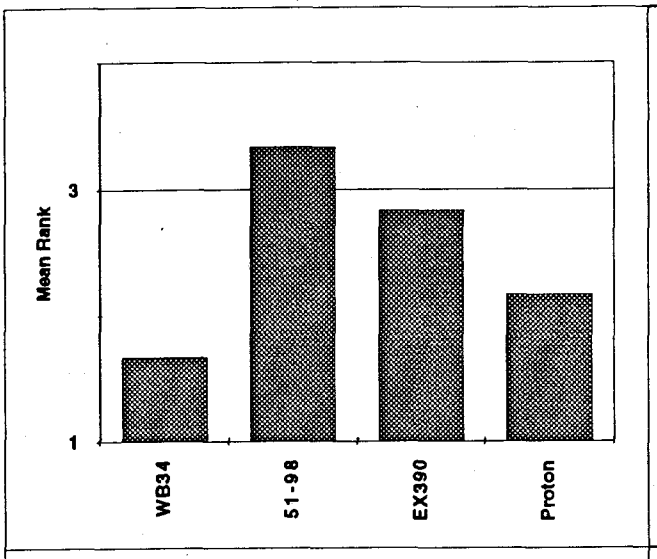
	5804	5860	5844	5446	5803	5825	5747	5842
5804	-	1.000	.655	.317	.317	.317	.180	.103
5860	1.000	-	.655	.317	.317	.317	.180	.103
5844	.655	.655	-	1.000	1.000	1.000	.157	.157
5446	.317	.317	1.000	-	1.000	1.000	.414	.103
5803	.317	.317	1.000	1.000	-	1.000	.317	.157
5825	.317	.317	1.000	1.000	1.000	-	.317	.157
5747	.180	.180	.157	.414	.317	.317	-	1.000
5842	.103	.103	.157	.103	.157	.157	1.000	-

OVERALL QUALITY

	5747	5804	5825	5803	5844	5842	5860	5446
5747	-	1.000	1.000	.317	.317	.180	.180	.157
5804	1.000	-	1.000	.317	.317	.317	.317	.180
5825	1.000	1.000	-	.317	.317	.317	.317	.180
5803	.317	.317	.317	-	1.000	.317	.317	.180
5844	.317	.317	.317	1.000	-	.317	.317	.180
5842	.180	.317	.317	.317	.317	-	1.000	.317
5860	.180	.317	.317	.317	.317	1.000	-	.317
5446	.157	.180	.180	.180	.180	.317	.317	-

1999 Small Sieve Green Beans, Commercial Lines - Frozen Industry Evaluation

COLOR



Friedman Analysis of Rank

Probability of no difference among samples, p = .0015

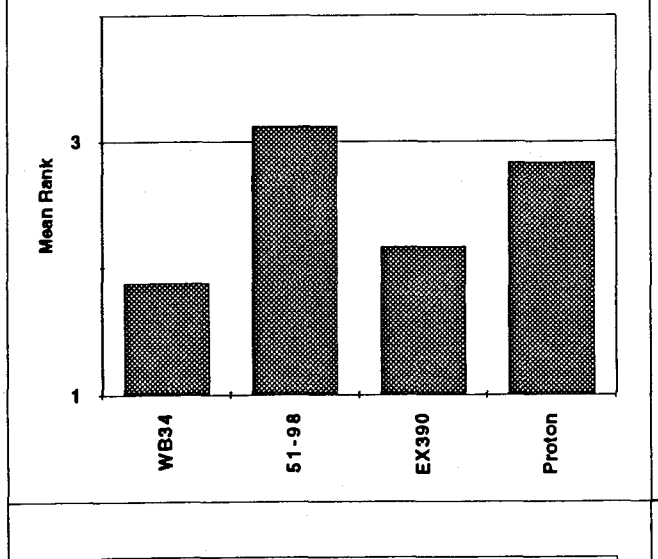
	Mean Rank
51-98	3.33
EX390	2.83
Proton	2.17
WB34	1.67

Wilcoxin Signed Rank

probability of no difference among samples

	51-98	EX390	Proton	WB34
51-98	-	.085	.013	.007
EX390	.085	-	.084	.013
Proton	.013	.084	-	.317
WB34	.007	.013	.317	-

STRAIGHTNESS



Friedman Analysis of Rank

Probability of no difference among samples, p = .0209

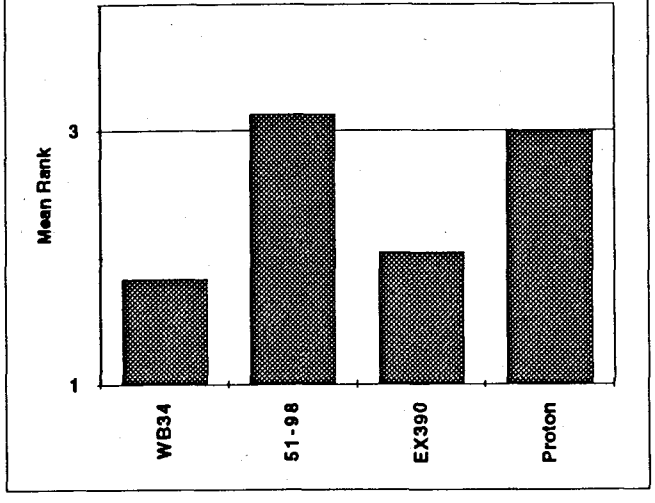
	Mean Rank
51-98	3.13
Proton	2.83
EX390	2.17
WB34	1.88

Wilcoxin Signed Rank

probability of no difference among samples

	51-98	Proton	EX390	WB34
51-98	-	.581	.039	.011
Proton	.581	-	.091	.032
EX390	.039	.091	-	.257
WB34	.011	.032	.257	-

SMOOTHNESS



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0107

	Mean Rank
51-98	3.13
Proton	3.00
EX390	2.04
WB34	1.83

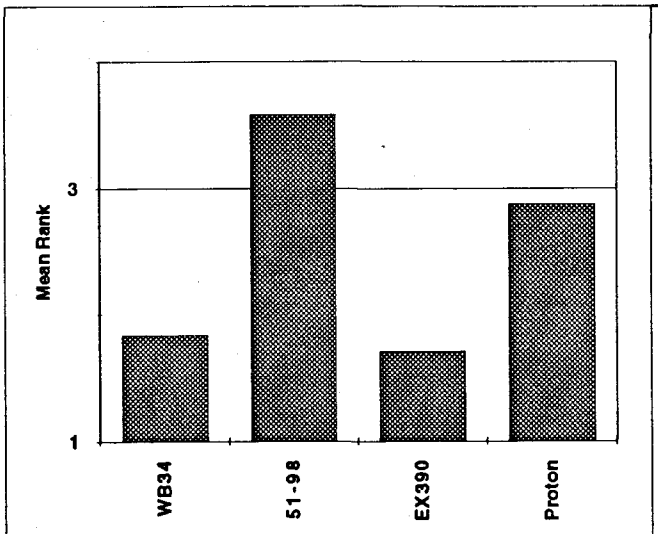
Wilcoxin Signed Rank

probability of no difference among samples

	51-98	Proton	EX390	WB34
51-98	-	.852	.026	.009
Proton	.852	-	.010	.012
EX390	.026	.010	-	.206
WB34	.009	.012	.206	-

1999 Small Sieve Green Beans, Commercial Lines - Frozen Industry Evaluation

POD LENGTH



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0001

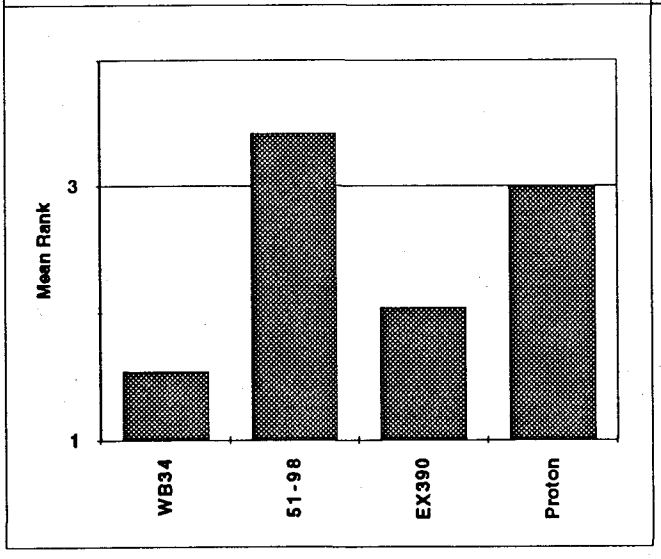
	Mean Rank
51-98	3.58
Proton	2.88
WB34	1.83
EX390	1.71

Wilcoxin Signed Rank

probability of no difference among samples

	51-98	Proton	WB34	EX390
51-98	-	.018	.005	.003
Proton	.018	-	.046	.007
WB34	.005	.046	-	.680
EX390	.003	.007	.680	-

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0003

	Mean Rank
51-98	3.42
Proton	3.00
EX390	2.04
WB34	1.54

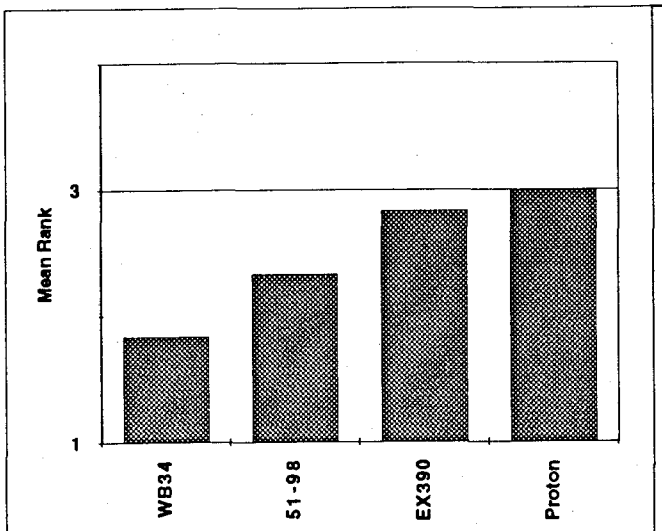
Wilcoxin Signed Rank

probability of no difference among samples

	51-98	Proton	EX390	WB34
51-98	-	.125	.011	.003
Proton	.125	-	.009	.009
EX390	.011	.009	-	.067
WB34	.003	.009	.067	-

1999 Small Sieve Green Beans, Commercial Lines - Canned Industry Evaluation

COLOR



Friedman Analysis of Rank

Probability of no difference among samples, p = .5815

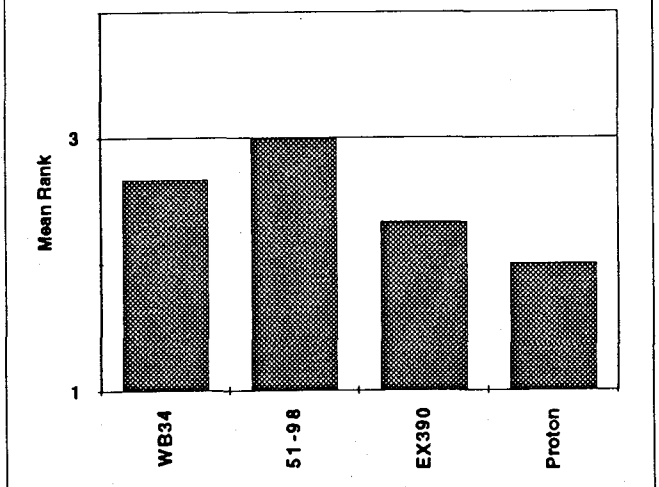
	Mean Rank
Proton	3.00
EX390	2.83
51-98	2.33
WB34	1.83

Wilcoxin Signed Rank

probability of no difference among samples

	Proton	EX390	51-98	WB34
Proton	-	.655	.317	.180
EX390	.655	-	.317	.564
51-98	.317	.317	-	.786
WB34	.180	.564	.786	-

STRAIGHTNESS



Friedman Analysis of Rank

Probability of no difference among samples, p = .6444

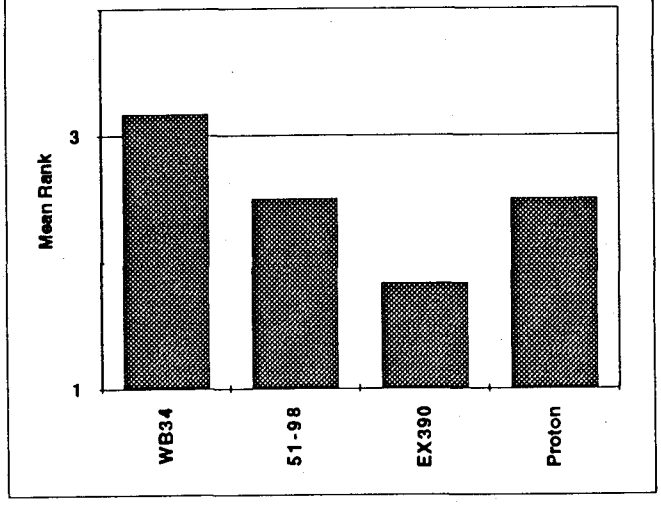
	Mean Rank
51-98	3.00
WB34	2.67
EX390	2.33
Proton	2.00

Wilcoxin Signed Rank

probability of no difference among samples

	51-98	WB34	EX390	Proton
51-98	-	.655	.317	.180
WB34	.655	-	.655	.317
EX390	.317	.655	-	.655
Proton	.180	.317	.655	-

SMOOTHNESS



Friedman Analysis of Rank

Probability of NO difference among samples, p = .2615

	Mean Rank
WB34	3.17
51-98	2.50
Proton	2.50
EX390	1.83

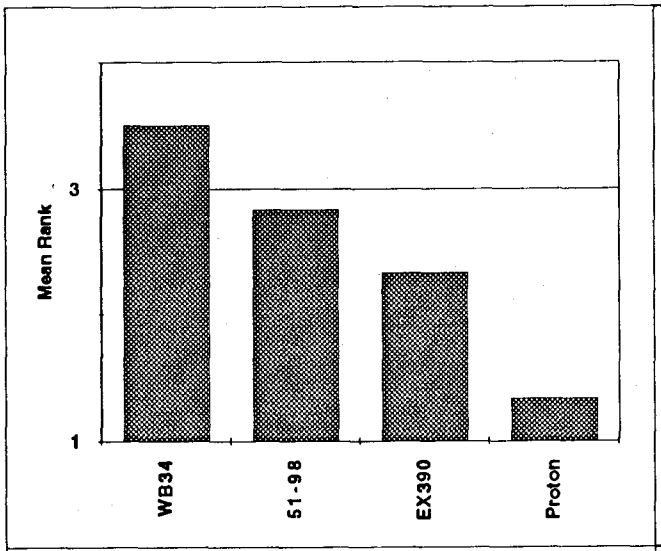
Wilcoxin Signed Rank

probability of no difference among samples

	WB34	51-98	Proton	EX390
WB34	-	.317	.317	.157
51-98	.317	-	1.000	.317
Proton	.317	1.000	-	.317
EX390	.157	.317	.317	-

1999 Small Sieve Green Beans, Commercial Lines - Canned
Industry Evaluation

FLAVOR



Friedman Analysis of Rank

Probability of NO difference among samples, p = .0925

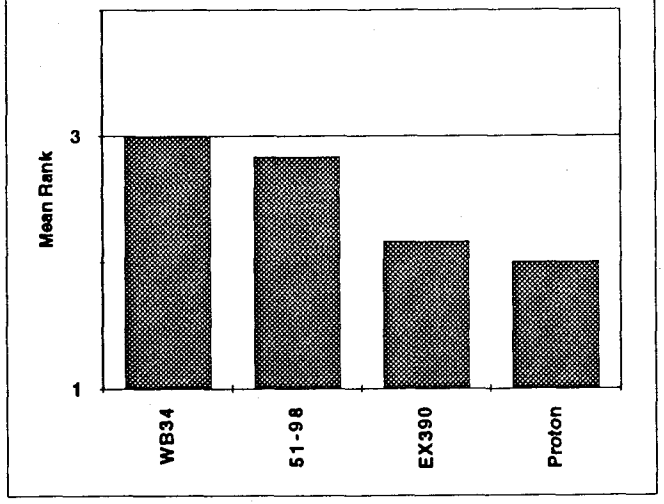
	Mean Rank
WB34	3.50
51-98	2.83
EX390	2.33
Proton	1.33

Wilcoxin Signed Rank

probability of no difference among samples

	WB34	51-98	EX390	Proton
WB34	-	.317	.180	.109
51-98	.317	-	.317	.180
EX390	.180	.317	-	.180
Proton	.109	.180	.180	-

OVERALL QUALITY



Friedman Analysis of Rank

Probability of NO difference among samples, p = .6026

	Mean Rank
WB34	3.00
51-98	2.83
EX390	2.17
Proton	2.00

Wilcoxin Signed Rank

probability of no difference among samples

	WB34	51-98	EX390	Proton
WB34	-	1.000	.564	.157
51-98	1.000	-	.317	.317
EX390	.564	.317	-	.655
Proton	.157	.317	.655	-