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FIELD BEHAVIOR AND PROCESSING CHARACTERISTICS
OF BLUE LAKE BEANS

By

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The processing of green beans is one of the major activities of the food processors of Oregon. In Oregon some 3,192,000 cases of 24 No. 2 cans of canned green beans were packed during the 1952 season. During this same period, some 23,000,000 pounds were processed as a frozen product in Washington and Oregon. The continued research in developing new varieties particularly adapted to environmental conditions in the Northwest make it mandatory that the quality evaluation of the new processing varieties be made before release of the planting stock to growers. New varieties are also produced by commercial seedsmen and these must likewise be subjected to quality evaluation. This report gives the results of the quality evaluation of six varieties of green beans packed as a canned and frozen product during the 1953 season.

EXPERIMENTAL

A. Raw Product

The varieties of beans included in the test were: (1) Associated 92, (2) Associated 231, (3) F. M.-1, (4) Germain 21, (5) U.S.D.A. 2006 and (6) U.S.D.A. 2053. The source of these varieties were respectively: (1) and (2), Associated Seed Co., (3) Ferry-Morse Seed Co., (4) Germain Seed Co., (5) and (6) B. F. Dana, Oregon State College.

These varieties were planted May 13, 1953 at the Beech Farm of the Department of Horticulture. The plots were 24 feet long and arranged in a 6x6 Latin Square design. Thus each variety was replicated six times. The plants were thinned to 3.5 plants per foot of row except F.M.-1, which was thinned to 2.3 plants per foot of row. At the time of planting, the plots were fertilized at the rate of 550 lbs./acre with 10-16-8 applied in a band 1½ inches to the side of and 2½ inches deeper than the seed. The plots were side dressed with 200 lbs. per acre of ammonium nitrate on July 22, 1953. They were irrigated at approximately 7-day intervals.

The plots were harvested at the intervals outlined in Table 1. After harvest the beans were brought into the laboratories of the Department of Food Technology and graded into sieve sizes 1 and 2's, 3's, 4's, 5's and 6's and over.

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For the processing evaluation sieve size 3's and the combined group of size 4's and 5's were selected and kept separate throughout the remainder of the study.

B. Processing Technique

After the lots were snipped and cut into 1" lengths, they were placed on stainless steel wire trays and steam blanched 3 minutes. After blanching, the beans were water spray cooled and the lot equally divided for canning and freezing tests.

For the canning tests, the cut and blanched beans were filled into plain 301 x 411 cans to 9 oz. net weight. One 30-grain salt tablet was added, the container filled with water and exhausted 8 minutes at 190°F. After sealing, the cans were processed 20 minutes at 240°F., water cooled and stored until later examination.

For the freezing evaluation, the blanched and cooled beans were filled into cellophane inner-liners, the liner sealed and inserted into a Marathon No. 5 carton and the product frozen at -20° F. over night and then transferred to 0° F. storage until examined.

C. Processing Characteristics Evaluated

1. Color

The color of each lot of beans was measured after blanching by the use of the Hunter Color Difference Meter. In the use of the instrument, a clear plastic sample box was used which permitted one to make 5 readings. The 5 readings were averaged and recorded. The beans were placed in the box, at random, the interstices filled with water and the Hunter Rd, a and b readings obtained after prior standardization of the instrument to the values for the SKC-15 "Kitchen Green" color plaque supplied by the National Bureau of Standards.

The color of each lot of canned or frozen beans was measured in a like manner except that, in the case of canned beans, the interstices were filled with the liquid contents of the container. Water was used to fill the interstices of the frozen beans. The color readings were determined after thawing of the frozen beans. Thawing techniques are described in the section under Shear Press determinations.

2. Crude Fiber

Crude fiber determinations were made on the canned product only. The determination was made approximately 2 months after processing and consisted of crushing 100 gms. of deseeded pods in a mortar. To the crushed pods were added 200 mls. of hot water and the contents transferred to a malted milk cup. After heating to boiling, 25 mls. of 50% NaOH were added and boiling continued 5 minutes. The cup was then transferred to the malted milk mixer and mixed 5 minutes. The contents of the mixer were then poured onto a tared 30-mesh Monel screen and washed with water at a standard pressure until free of alkali. The screen was dried at 212° F. for 2 hours and re-weighed. The gain in weight was recorded as per cent crude fiber.

3. Per cent Seed

The seed percentage data are based upon the weight, as per cent, of the seed extracted from 100 gms. of pods.

4. Shear Press Determinations

Shear press determinations were made on both the canned and frozen product. The Maryland Shear Press was utilized yielding shear press values in Kgs. per square inch. The determination was made by pouring 150 gms. of beans into the cup and lightly pressing them down in such a manner as to assure that the ends of the beans did not stick out of the cup. The shear press was operated in the usual manner. Shear press determinations were made on the canned beans soon after opening. The frozen beans were thawed in 250 mls. of boiling water. When the water had come to a boil, the frozen beans were inserted and cooked 8 minutes after the water had returned to a boil. The beans were then cooled at 34° F. before shear press readings were obtained.

5. PMA Grading

Approximately 2 months after processing the canned and frozen samples were graded by PMA officials at Salem. The samples were given random numbers to conceal their identity. The canned samples were graded for clearness of liquor, color and maturity. Frozen beans were graded for color and "texture and maturity".

DISCUSSION OF RESULTS

A. Field Behavior

Yield, sieve size, and maturity data for the Blue Lake type beans grown at the O.S.C. vegetable farm are shown in Tables 1 and 2. The six varieties listed in Tables 1 and 2 were grown in a well replicated test, so that careful comparisons of data on yielding ability are possible.

1. Yield

The varieties 2006 and 2053 developed by Mr. B. F. Dana, of the U.S.D.A. in cooperation with the Oregon Agricultural Experiment Station, gave the heaviest total yields, as they have done in previous tests at this location. As shown in Table 1, there was no significant difference in total yield of FM-1, Asgrow 92, and Asgrow 231. Since the stand of FM-1 was 2.3 plants per foot, compared to 3.5 plants for other varieties, it would be purely speculative as to whether a thicker stand of the variety would have resulted in distinctly heavier yields. The stand count for FM-1 was made at the end of harvest, since plants continued to come up throughout the summer. Many of these came up so late that they obviously contributed little to the yields.

2. Earliness

The yield data for various harvest dates in Table I indicate that Asgrow 92 is as early or earlier than FM-1. Actually, this is not the case and is due to the erratic, prolonged, germination of FM-1 seed. For plants germinating on the same date, maturity of FM-1 appears to be slightly earlier. Both are a few days earlier than Germain 21, and roughly 10 days earlier than Asgrow 231. The two U.S.D.A. varieties were slightly earlier than 231.

3. Vine Characteristics

Both Asgrow 92 and FM-1 are relatively "open" at the base and light in foliage production compared to Asgrow 231 and U.S.D.A. 2006 and 2053. Germain 21 is intermediate in this characteristic.

4. Continued Production

Asgrow 231 and U.S.D.A 2006 and 2053 tended to "concentrate" their pod set, with the crop maturing over a relatively short period. Asgrow 92 may mature the crop over a longer period, under favorable conditions, while FM-1, during 1953, produced pods over a longer period than any other variety. Here again, however, it is felt that the prolonged germination period and wider spacing of plants within the row influenced this characteristic. With more uniform germination and closer spacing in the row, one should expect to see some change in this characteristic, although the variety appears to hold up over a relatively long period.

5. Germination

Germination of all varieties was satisfactory, with the exception of FM-1. Low germination was not due to non-viable or "dead" seed, but to their inability to take up moisture. This "hard" seed develops within this particular variety under distinctly low humidity storage conditions, but can be overcome by storage at relatively high humidity. There is thus reason to expect that with more favorable storage of seed the variety will show better germination in 1954.

6. Pod Characteristics

The grade-out data in Table II show that Germain 21 produced a relatively low percentage of large sieve size beans. This is due at least partly to its slightly oval shape. All of the other varieties are round. The U.S.D.A. varieties 2006 and 2053 graded out moderately heavy in 5 and 6 sieve sizes, as they have done in past tests.

Asgrow 92 has a distinctly dark green pod, while FM-1 is darker than the U.S.D.A. varieties. Germain 21 raw pod color appeared to be slightly lighter than FM-1.

B. Evaluation of Processing Characteristics

The results of the processing quality evaluation are presented in Table III.

1. Color

In the concept of color, the dominant factor with respect to lightness or darkness is R_d . The location of the sample with respect to color is concerned with the ordinates $-a$ and $+b$ in the case of beans. Thus, a particular locus, as determined by $-a$ and $+b$ values, may appear light or dark as influenced by the R_d . Increasing values of R_d represent a shift toward lightness. Increasing of $-a$ values, a shift toward less yellow, more green and increasing concentration; while increasing values of $+b$ denote a shift toward

more yellow, less green while tending to hold the concentration or saturation level of the color rather constant. Thus the hue and chroma of the product is rather closely defined by the Hunter a and b value while the lightness or darkness of the color is defined by the Hunter Rd value.

2. Hunter Rd, for Freshly Blanched Beans

In size 3's, Associated 92 was the darkest variety. F.M.-1 and Associated 231 were in the second position while Germain 21, USDA 2006 and 2053 were the lightest colored. The difference between the varieties levels out with increasing maturity as evidenced by the breakdown of color groups in size 4-5's. In this size classification there are two broad groups with respect to Hunter Rd. In the darker group, Associated 231, Associated 92, and F.M.-1 are observed Germain 21 and the two USDA varieties are considerably lighter, not different from one another but are significantly lighter than the balance of the varieties at the 5% level.

3. Hunter -a, for Freshly Blanched Beans

Increasing values in Hunter -a indicate a slight shift away from yellow toward green. This is not to be construed as a radical shift in apparent color as the dominant factor in the concept of color is the Rd value. These data (Table III) indicate that there are three groups with respect to increasing Hunter -a values irrespective of size classification. The low value group includes F.M.-1 and Associated 92. In the medium value group are to be found Associated 231 and Germain 21. The higher value group included the two USDA selections. These classifications are significant at the 5% level.

4. Hunter +b, for Freshly Blanched Beans

Hunter +b indicate a slight shift toward yellow. Observe that this is diametrically opposed to the shift in Hunter -a values. These shifts tend to neutralize one another yielding to the dominant factor Hunter Rd. In this factor, irrespective of classification there are 4 groups each significantly different from one another. In order of increasing Hunter +b values, the varieties may be grouped as follows: group 1, Associated 92; group 2, F.M.-1; group 3, Associated 231 and Germain 21, and group 4, USDA 2006 and 2053.

5. Hunter Rd, Canned Samples

As observed in Table III, size 3 classification, there are three major groups in order of increasing Rd or lightness. In the darker group Associated 231 and 92 are observed. Significantly lighter was F.M.-1 while Germain 21 and the two USDA selections were the lightest of all. In the size 4-5's the arrangement of the varieties with respect to lightness or darkness is somewhat revised, indicating a shift of the apparent color due to increased maturity. In this size group are observed 4 color classifications all significantly different: group 1, Associated 92, the darkest; group 2, Associated 231 and F.M.-1; group 3, USDA 2006; and group 4, the lightest, Germain 21 and USDA 2053.

6. Hunter -a, Canned Samples

In size 3's, there were two general groups which were significantly different. In the first group, those with a lower Hunter -a value, were

Associated 231 and 92, while in the second group the remainder of the varieties in the test are to be found. The grouping is slightly more distinctive with increasing maturity as evidenced by the data for the larger sizes. In size 4-5's, Associated 92 and 231 had the lowest value, F.M.-1 was the next highest, Germain 21 and USDA 2006 in the third position, while USDA 2053 had the highest value.

7. Hunter +b, Canned Samples

In size 3's, Associated 231 and 92 had the lowest value and were not significantly different. F.M.-1 was significantly different from Associated 92 but not from Associated 231. Germain 21, USDA 2006 and 2053 were not significantly different but as a group were significantly different in that they had higher values from the balance of the varieties in the test. These same relationships hold true in the larger sizes.

8. Per cent Seeds

In size 3's, Associated 92 and F.M.-1 had the lowest percentage of seed and were not significantly different. F.M.-1, Associated 231, USDA 2006 and 2053 were not significantly different but did have a significantly lower seed percentage than Germain 21. F.M.-1, Associated 92 and the two USDA numbers were not significantly different in the larger size. Associated 92 was significantly different from Associated 231 but the latter variety was not significantly different from F.M.-1 or the two USDA varieties. Germain 21 was in a class of its own with the highest seed percentage 5.32%. Evidently this variety matures its seed at a much faster rate than the other varieties in the test and in the large size classification segmentation was evident. Note the large increase in seed percentage between size 3's and the 4-5's for this variety in contrast with the small increase for Associated 92.

9. Per cent Fiber

There was no significant difference between varieties in either of the size classifications with respect to fiber. All of the varieties had a low fiber content and it may be concluded on the basis of this test that the newer Blue Lake varieties have low fiber content.

10. Shear Press, Canned Samples

At the 5% significance level, there was significant difference between two groups of the varieties on the basis of the shear press values. In the lower reading group, Associated 231, USDA 2006 and 2053 were found. A second group comprised the balance of the varieties and these in addition to Associated 231 were significantly different from the two USDA selections at the 5% level. In the larger sizes the difference in shear press values leveled out and there was no significant difference between any of the varieties with the exception of Germain 21 which had a significantly higher shear press value in these larger sizes.

11. PMA Color Score, Canned Samples

F.M.-1 and Associated 92 had the highest PMA color score in the smaller size and together with Associated 231 were significantly higher than the balance of the varieties. USDA 2006, Germain 21 and Associated 231 had

higher scores, significant at the 5% level, as compared with USDA 2053. In the larger sizes, Associated 92, 231 and F.M.-1 received significantly higher scores than the balance of the varieties. USDA 2053 received the lowest score, 12.67, which was not significantly different from that score received by USDA 2006 but was different from that score received by the other light colored bean, Germain 21.

12. PMA Maturity Score, Canned Samples

In size 3's, there was no significant difference between any of the varieties in the test. In the larger size, USDA 2006 and 2053 had significantly lower scores than the other varieties.

13. Hunter Rd, Frozen Samples

There was no significant difference between the two USDA selections which had the highest Hunter Rd reading in size 3's. These two varieties were significantly lighter than the other light colored bean, Germain 21. Associated 92 was significantly darker than any of the other varieties in the test. There was no significant difference between F.M.-1 and Associated 231. In size 4-5's combined, the two USDA selections were lighter than any of the other varieties in the test. Germain 21 was significantly darker than the USDA selections but lighter than Associated 231. There was no significant difference between Associated 92 and F.M.-1. These varieties were the darkest frozen beans.

14. Hunter -a, Frozen Samples

In size 3's, Associated 92 and F.M.-1 had a significantly lower reading than Germain 21 or Associated 231. The two USDA selections were not significantly different from each other but had the highest value in the test. In size 4-5's, there was no significant difference between F.M.-1 and Associated 92 but each of the other varieties were significantly different from each other. The two USDA selections had the highest Hunter -a value.

15. Hunter +b , Frozen Samples

Associated 92 had a significantly lower reading than any of the other varieties in size 3's. Associated 231, Germain 21 and F. M.-1 were not significantly different and as a group had significantly lower readings for this color ordinate than the two USDA selections.

16. Shear Press, Frozen Samples

There was no significant difference between the varieties in size 3's. In size 4-5's, two large groups were observed. Those varieties with lower readings included Associated 231, USDA 2006 and 2053. The varieties with the higher readings included Associated 92, Germain 21 and F.M.-1. Associated 231 had a significantly lower reading than any of the varieties in the high reading group, but it was not different from those in the lower group.

17. PMA Color Score, Frozen Samples

There was no significant difference between the samples in size 3's. In the larger sizes, Germain 21, F.M.-1, USDA 2006 and 2053 received

significantly lower scores than Associated 231. Associated 92 was not significantly different from any of the varieties except Associated 231 which received a higher score and F. M.-1 which received a lower score.

18. PMA Texture and Maturity Score, Frozen Samples

There was no significant difference between the varieties in size 3's. In size 4-5's, USDA 2053 was not significantly different from F.M.-1 but it did receive a significantly lower grade than any of the other varieties in the test. F. M.-1 was not significantly different from the other varieties which received high scores with the exception of Associated 92 which received the highest score in the series.

C. Change in Hunter Color Reading as a Result of Inter-Relationships of Varieties and Processing.

During heat processing or freezing processing of beans a change in color occurs. The extent of such changes is indicated in the following section.

1. Hunter Rd values

The average canned Hunter Rd values for each of the six varieties in the test were compared against the value for freshly blanched beans. An increase in Hunter Rd (blanched to either process) represents an increase in the lightness of the product. Inspection of the data in Table IV, Hunter Rd readings, shows that the varieties Associated 231 and 92, in size 3's, were not significantly different with respect to the extent of increased Rd due to canning. There was no significant difference in the change of Rd due to canning among the other varieties in the test but it must again be emphasized that the Associated varieties had a significantly smaller change when compared to the balance of the varieties.

In the change in Rd from freshly blanched to frozen, size 3's, Germain 21 darkened more than any of the other varieties in the test, however the extent of decrease in Rd was not significantly different from the Associated varieties. F. M.-1 and the two USDA varieties were not significantly different from each other.

In size 4-5's, there was no significant difference in the way the varieties reacted during processing to the change in Rd.

2. Hunter -a values

The change in Hunter -a values as a result of canning was significantly larger in USDA 2006 than in F. M.-1 and Associated 92 in the size 3, and 4-5 classification. When one observes the loci of these Hunter values on the color ordinates for the Hunter Rd in question, it is to be noted that as a result of the canning operation there is a shift toward yellow in the hue of the product. The shift is much greater from freshly blanched to canned than that which occurs in the freezing preservation of the product.

No significant differences could be shown in the way the varieties reacted to the freezing preservation.

3. Hunter +b values

There was no significant difference in the way the varieties reacted with respect to the shift in Hunter +b values.

SUMMARY AND CONCLUSION

In the replicated tests, Associated 92 was superior to the other varieties in the canned pack. F. M.-1 and Associated 231 were also good but the former variety was troubled by poor germination while the latter had a flat yellow mutant which caused excessive pick-out on the belt.

There were two classifications of beans based upon the color of the canned product. In the first or light varieties, Germain 21 and the two USDA varieties were considered to be inferior to the balance of the varieties. Germain 21 also had a low yield, however, it scored well in PMA grading despite the high percentage of seed in the product. The two USDA selections, despite their high yield, were too light in color and were rated lower in PMA color and maturity score.

When frozen, Associated 92 and 231 received high PMA color scores, but the former variety was considerably darker. It is believed that the variety may be too dark and its lack of luster resulted in grading to the same level as Associated 231 even though 231 was considerably lighter in color. F. M.-1 was graded down in color due to lack of uniformity. As far as PMA color was concerned the only real difference was between USDA 2053 and F. M.-1 as compared with the balance of the varieties. With respect to PMA maturity USDA 2053 graded significantly lower than the other varieties.

The concept of the change in color as result of canning or freezing disclosed that the change in Hunter color classifications is not only the result of processing, but that the varieties react somewhat differently. The calculation of the reaction of varieties to processing with respect to color show that:

1. The general lightening due to canning was modified by variety.
2. The general darkening due to freezing was modified by variety only in size 3 classification.
3. The decrease in Hunter -a value due to both canning and freezing was very great. There were some significant differences in changes in Hunter -a readings of the varieties, but these differences were minor in comparison with the change brought about by processing.
4. The general increase in Hunter +b readings brought about by canning was modified slightly by varieties in either size groups.
5. The change in Hunter +b due to freezing was minor and not significantly modified by variety.

Table I

Blue Lake Variety Behavior
 Corvallis, 1953
 Yields at Various Harvest Dates

Variety

	Yield in Tons Per Acre at Each Harvest Date							Per Acre Yield
	Aug. 5	Aug. 10	Aug. 13	Aug. 19	Aug. 24	Aug. 31	Sept. 3	Total
FM-1	1.24	1.10	0.70	2.85	1.42	1.89	1.25	10.45
Asgrow 92	1.31	2.26	1.06	3.58	1.23	0.89	----	10.33
Germain 21	----	1.97	0.78	2.47	1.67	1.98	----	8.87
Asgrow 231	----	----	1.27	4.65	2.21	2.08	----	10.21
U.S.D.A. 2006	----	----	3.27	3.62	3.30	2.03	----	12.22
U.S.D.A. 2053	----	----	3.63	3.31	3.29	1.55	----	11.78

Significant Difference, odds 19:1

1.03

Significant Difference, odds 99:1

1.41

Table II

Blue Lake Variety Behavior
Seasonal Averages for Various Sieve Sizes
Corvallis, 1953

Variety	Per Cent of Beans in Various Sieve Sizes					Total Yield
	1 & 2	3	4	5	6 & over	Tons per Acre
FM-1	14.24	21.04	24.65	22.50	17.57	10.45
Asgrow 92	8.93	19.08	27.23	27.70	17.06	10.33
Germain 21	13.21	26.18	29.46	21.59	9.56	8.87
Asgrow 231	9.55	17.12	25.89	26.52	20.92	10.21
U.S.D.A. 2006	8.34	15.88	24.86	29.25	21.67	12.22
U.S.D.A. 2053	8.04	14.97	24.50	29.21	23.28	11.78

Least significant difference, odds 19:1

1.03

Least significant difference, odds 99:1

1.41

Table III. Quality of Pole Bean Varieties in Replicated Plots--1953

Variety and Season	S I E V E S I Z E 3'S																
	FRESH			CANNED						FROZEN							
	Hunter Blanched			Rd	Hunter		Seed %	Crude Fiber %	S.P. ¹ Kgs.	PMA Scoring		Rd	Hunter		S.P. ¹ Kgs.	PMA Scoring	
	Rd	-a	+b		-a	+b				C ²	M ³		-a	+b		C ²	T&M ⁴
Asso. 231 Med.late	7.01	13.59	10.92	7.72	4.56	12.96	2.91	0.0131	25.25	14.33	38.67	6.27	8.45	10.89	50.54	19.08	38.50
Germain 21 Med.early	7.95	13.68	11.31	9.16	5.18	14.36	3.47	0.0133	27.17	14.00	38.75	6.83	8.06	11.06	52.46	18.08	38.42
F. M.-1 Early	6.89	12.71	10.43	8.33	5.10	13.41	2.65	0.0106	27.25	14.58	38.92	6.45	7.52	10.84	54.66	18.08	38.92
Assoc. 92 Early	6.38	12.43	9.58	7.32	4.67	12.38	2.33	0.0112	27.40	14.58	38.92	5.65	7.31	9.55	51.66	18.33	38.92
USDA 2006 Med.late	7.66	14.65	11.90	9.03	5.33	14.24	2.91	0.0103	23.17	13.83	38.42	7.37	9.60	12.40	46.87	18.75	38.50
USDA 2053 Med.late	7.68	14.20	11.86	9.09	5.26	14.29	2.81	0.0108	23.17	13.58	37.75	7.37	9.19	12.14	48.16	18.66	38.33
L.S.D. (.05)	0.44	0.75	0.48	0.54	0.40	0.78	0.45	N.S.	2.68	0.50	N.S.	0.49	0.54	0.33	N.S.	N.S.	N.S.
	S I E V E S I Z E 4-5'S																
Asso. 231 Med.late	7.38	13.75	11.53	8.42	4.86	13.58	3.94	0.0130	26.58	14.00	37.50	7.21	8.77	11.91	44.71	18.83	37.83
Germain 21 Med. early	8.33	14.13	11.88	10.28	5.66	15.36	5.32	0.0180	29.17	13.42	37.42	7.82	8.26	12.20	48.58	18.08	37.67
F.M.-1 Early	7.13	12.73	10.70	8.68	5.17	13.93	3.55	0.0120	26.79	13.92	37.36	6.32	7.54	10.67	51.29	17.58	37.33
Assoc. 92 Early	6.92	12.41	10.00	7.83	4.81	13.15	3.01	0.0152	25.79	14.33	37.50	5.94	7.53	10.21	52.00	18.33	38.08
USDA 2006 Med.late	8.63	15.26	13.24	9.60	5.53	14.89	3.51	0.0177	26.20	13.00	36.58	8.46	9.90	13.37	46.12	18.17	37.75
USDA 2053 Med.late	8.26	14.99	13.16	10.30	6.03	15.50	3.40	0.0142	24.38	12.67	36.75	8.38	9.59	13.39	42.96	17.92	36.92
L.S.D. (.05)	0.41	0.74	0.58	0.40	0.38	0.44	0.67	N.S.	2.74	0.46	0.62	0.44	0.14	0.56	4.90	0.67	0.71

1. Shear press Kgs.

2. Color

3. Maturity

4. Texture and maturity

Replications consisted of two harvest dates from single plots.

Table IV. Changes in Hunter Rd, -a, +b Values
of Beans as a Result of Processing

HUNTER Rd

Variety	Hunter Rd, Size 3's		Hunter Rd, Size 4-5's	
	Fresh to Canned	Fresh to Frozen	Fresh to Canned	Fresh to Frozen
Assoc. 231	+0.71	-0.74	+1.04	-0.17
Germain 21	+1.21	-1.12	+1.95	-0.51
F. M.-1	+1.44	-0.44	+1.55	-0.81
Assoc. 92	+0.94	-0.73	+0.91	-0.98
USDA 2006	+1.37	-0.29	+1.07	-0.17
USDA 2053	+1.41	-0.31	+2.04	-0.12
L.S.D. (.05) = .69		L.S.D. (.05) = 1.29		

HUNTER a

Variety	Hunter -a, Size 3's		Hunter -a, Size 4-5's	
	Fresh to Canned	Fresh to Frozen	Fresh to Canned	Fresh to Frozen
Assoc. 231	-9.03	-5.13	-8.89	-4.98
Germain 21	-8.50	-5.62	-8.47	-5.87
F. M.-1	-7.61	-5.19	-7.56	-5.19
Assoc. 92	-7.76	-5.12	-7.60	-5.88
USDA 2006	-9.32	-5.05	-9.73	-5.38
USDA 2053	-8.94	-5.01	-8.96	-5.40
L.S.D. (.05) = 1.50		L.S.D. (.05) = 2.11		

HUNTER b

Variety	Hunter +b, Size 3's		Hunter +b, Size 4-5's	
	Fresh to Canned	Fresh to Frozen	Fresh to Canned	Fresh to Frozen
Assoc. 231	+2.04	-0.03	+2.05	+0.38
Germain 21	+3.05	-0.25	+3.48	+0.32
F. M.-1	+2.98	+0.41	+3.23	-0.03
Assoc. 92	+2.80	-0.03	+3.15	+0.21
USDA 2006	+2.34	+0.50	+1.65	+0.13
USDA 2053	+2.43	+0.28	+2.34	+0.23
L.S.D. (.05) = 1.43		L.S.D. (.05) = 1.83		