No. 7900075

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Michigan State University

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED NOVEL VARIETY OF SEXUALLY REPRODUCED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF seventeen YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, IMPORTING IT, OR EXPORTING IT, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS DESIGNATED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

NAVY BEAN

'Tuscola'

In Testimony Whereof, *I have hereunto set my hand and caused the seal of the* Plant Variety Protection Office *to be affixed at the City of* Washington *this* 1st *day of* May *in the year of our Lord one thousand nine hundred and* eighty.

Attest:

Commissioner
Plant Variety Protection Office
Grain Division
Agricultural Marketing Service

Secretary of Agriculture

FORM GR-470 (1-76)

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
GRAIN DIVISION
PLANT VARIETY PROTECTION OFFICE
NATIONAL AGRICULTURAL LIBRARY
BELTSVILLE, MARYLAND 20705

FORM APPROVED
OMB NO. 40-R3712

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

INSTRUCTIONS: *See Reverse.*

1a. TEMPORARY DESIGNATION OF VARIETY	1b. VARIETY NAME	FOR OFFICIAL USE ONLY
MSU Strain #8467	TUSCOLA	PV NUMBER 7900075

2. KIND NAME	3. GENUS AND SPECIES NAME	FILING DATE	TIME
Navy (Pea) Beans	Phaseolus vulgaris	4-19-79	4:30 A.M. P.M.

4. FAMILY NAME (BOTANICAL)	5. DATE OF DETERMINATION	FEE RECEIVED	DATE
Leguminosae	February 3, 1977	$ 250.00	4-19-79
		$ 250.00 EXEMPT	4-19-79
		$ 250.00	2726780

6. NAME OF APPLICANT(S)	7. ADDRESS (*Street and No. or R.F.D. No., City, State, and ZIP Code*)	8. TELEPHONE AREA CODE AND NUMBER
Michigan Agricultural Experiment Station	Michigan State University East Lansing, MI 48824	517- 353-9545

9. IF THE NAMED APPLICANT IS NOT A PERSON, FORM OF ORGANIZATION: (*Corporation, partnership, association, etc.*)	10. IF INCORPORATED, GIVE STATE AND DATE OF INCORPORATION	11. DATE OF INCORPORATION
State-Federal Institution		

12. Name and mailing address of applicant representative(s), if any, to serve in this application and receive all papers:

Dr. L. O. Copeland
Associate Professor
Department of Crop and Soil Sciences
Michigan State University
East Lansing, MI 48824

13. CHECK BOX BELOW FOR EACH ATTACHMENT SUBMITTED:

- [X] 13A. Exhibit A, Origin and Breeding History of the Variety *(See Section 52 of the Plant Variety Protection Act.)*
- [X] 13B. Exhibit B, Novelty Statement.
- [X] 13C. Exhibit C, Objective Description of the Variety *(Request form from Plant Variety Protection Office.)*
- [X] 13D. Exhibit D, Additional Description of the Variety.

14A. Does the applicant(s) specify that seed of this variety be sold by variety name only as a class of certified seed? *(See Section 83(a). If "Yes," answer 14B and 14C below.)* [X] YES [ ] NO

14B. Does the applicant(s) specify that this variety be limited as to number of generations?	14C. If "Yes," to 14B, how many generations of production beyond breeder seed?
[X] YES [ ] NO	[X] FOUNDATION [ ] REGISTERED [X] CERTIFIED

15. Does the applicant(s) agree to the publication of his/her (their) name(s) and address in the Official Journal? [X] YES [ ] NO

16. The applicant(s) declare(s) that a viable sample of basic seed of this variety will be deposited upon request before issuance of a certificate and will be replenished periodically in accordance with such regulations as may be applicable.

The undersigned applicant(s) is (are) the owner(s) of this sexually reproduced novel plant variety, and believe(s) that the variety is distinct, uniform, and stable as required in Section 41, and is entitled to protection under the provisions of Section 42 of the Plant Variety Act.

Applicant(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

March 15, 1979
(DATE)

(SIGNATURE OF APPLICANT)

March 15, 1979

FORM GR-470 (Reverse)

INSTRUCTIONS

GENERAL: Send an original copy of the application, exhibits and $250.00 fee to U.S. Dept. of Agriculture, Agricultural Marketing Service, Grain Division, National Agricultural Library, Beltsville, Maryland 20705. (See Section 180.175 of the regulations and rules of practice.) Retain one copy for your files. All items on the face of the form are self-explanatory unless noted below.

ITEM	YES	NO
5	Give the date the applicant determined that he had a new variety based on (1) the definition in Section 41(a) of the Act and (2) the date a decision was made to increase the seed.	
13a	Give (1), the genealogy, including public and commerical varieties, lines, or clones used, and the breeding method, (2), the details of subsequent stages of selection and multiplication, (3), the type and frequency of variants during reproduction and multiplication and state how these variants may be identified and (4), evidence of stability.	
13b	Give a summary statement of the variety's novelty. Clearly state how this novel variety may be distinguished from all other varieties in the same crop. If the new variety most closely resembles one or a group of related varieties; (1) identify these varieties and state all differences objectively; (2) Attach statistical data for characters expressed numerically and demonstrate that these differences are significant; and (3) submit, if helpful, seed and plant specimens or photographs of seed and plant comparisons clearly indicating novelty.	
13c	Fill in the Exhibit C, Objective Description form for all characteristics, for which you have adequate data.	
13d	Describe any additional characteristics that are not described, or whose description cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the description of characteristics that are difficult to describe; such as; plant habit, plant color, disease resistance, etc.	
14A	If "YES" is specified (seed of this variety be sold by variety name only as a class of certified seed) the applicant may NOT reverse his affirmative decision after the variety has either been sold and so labeled or published or the certificate has been issued. However, if the applicant specifies "NO", he may change his choice. (See Section 180.15 of the Regulations and Rules of Practice.)	

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Exhibit A

Origin and Breeding History of the Variety, Tuscola

Tuscola navy bean was isolated as a single plant selection in the first selfed generation of the fourth successive intercross generation of a diallel cross involving 10 true-breeding strains of navy beans. The 10 parents consisted of 5 determinate and 5 indeterminate strains, including Sanilac, Seaway, and Michelite varieties, varying for maturity and, in a minor way, for seed size and overall plant vigor, and descending from various genetic backgrounds. The diallel cross was made in 1959 at Michigan State University, producing 45 single crosses. These F_1's, in turn, were combined to produce 4-way crosses, and samples of this generation recombined to produce progeny of 8-way crosses. In the last (4th) generation, random intercrosses were made, since with only 10 initial parents, it was no longer possible to cross unrelated plants. The 4th generation hybrids were allowed to self-pollinate to produce the S_1 generation (1964). Tuscola was one of many progenies started from single plant selections in 1964. The line was advanced by selfing until the year 1968, at which time it was tested as MSU #8467, and given wider testing under that number until it was named Tuscola in May, 1977.

COOPERATIVE EXTENSION SERVICE
MICHIGAN STATE UNIVERSITY and
U.S. DEPARTMENT OF AGRICULTURE COOPERATING

DEPARTMENT OF CROP AND SOIL SCIENCES

EAST LANSING • MICHIGAN • 48824

December 3, 1979

Mr. Thaddeus E. Frey, Examiner
Plant Variety Protection Office, USDA
National Agricultural Library Building
Beltsville, MD 20705

Dear Mr. Frey:

To the best of our knowledge, Tuscola is uniform and stable in its genetic and morphological characteristics.

Sincerely yours,

L. O. Copeland

L. O. Copeland
Extension Specialist

cmw

SUMMARY STATEMENT

FOR NOVELTY OF TUSCOLA

The Michigan navy beans do not constitute a homogeneous group. Consequently, Tuscola, the latest addition to the group, differs from each of the other cultivars in one or more respects.

Sanilac is the most similar variety to Tuscola in agronomic performance. It differs from Tuscola in two respects: 1) seed coat toughness, and 2) in producing a short "vine" at the terminus of the primary shoot axis whereas Tuscola does not.

Seaway and Seafarer are both some seven to ten days earlier in maturity than Tuscola and both of them are more sensitive to seed coat injury than Tuscola. Seaway, because of susceptibility to V_{15} mosaic, is no longer grown commercially in Michigan. Gratiot, of comparable maturity and plant type to Tuscola, is also no longer grown commercially. Gratiot, too, is more sensitive to impact injury than Tuscola.

Exhibit B

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Novelty Statement

Tuscola is a navy bean with plant and seed appearance not appreciably different from other navy beans of MSU breeding, namely, Sanilac, Gratiot, Seaway, and Seafarer varieties. Its chief distinguishing characteristic, and the main reason why Tuscola has been released, is its "resistance" to mechanical damage (impact injury).

Documentation is as follows:

(1) Data presented in the original release announcement of May 3, 1977 from the Michigan Agriculture Experiment Station.

	Percent whole beans after impacting		
Impact velocity in feet/min	Tuscola	Sanilac (standard check)	Strain 0661 (hyper-sensitive)
1100	95	92	60
1450	90	76	42
1800	80	48	9
2200	57	22	7

(2) Canning results from Stokely-VanCamp Company, Indianapolis, Indiana.

Variety	% Cracked Skins in cans	Color	Uniformity	Disposition
Tuscola	0.48	good	good	accept
Sanilac	8.60	good	good	accept

(3) Shear-press results from laboratory tests at Michigan State University, Department of Food Science and Human Nutrition.

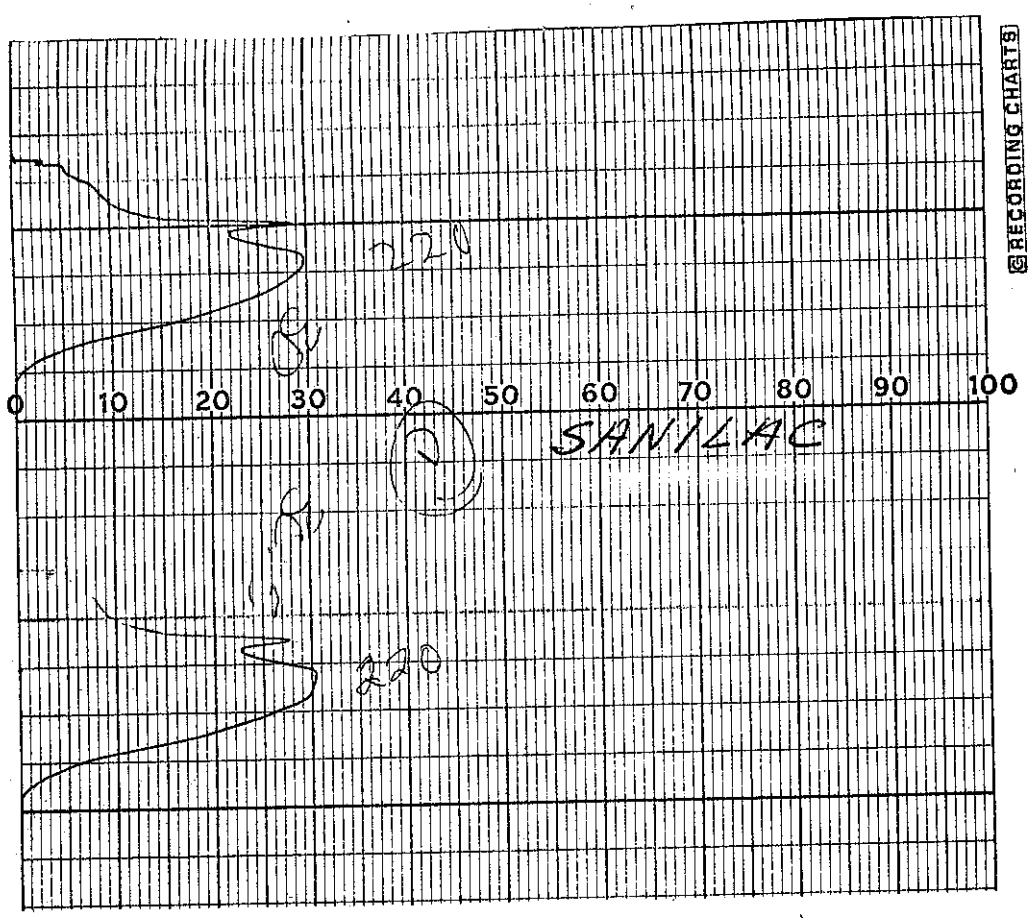
Page 1 shows the compression and shear curves obtained on Tuscola and Sanilac canned bean samples (duplicate curves for each variety were run) as determined in the Kramer Shear Press for runs made in February, 1979.

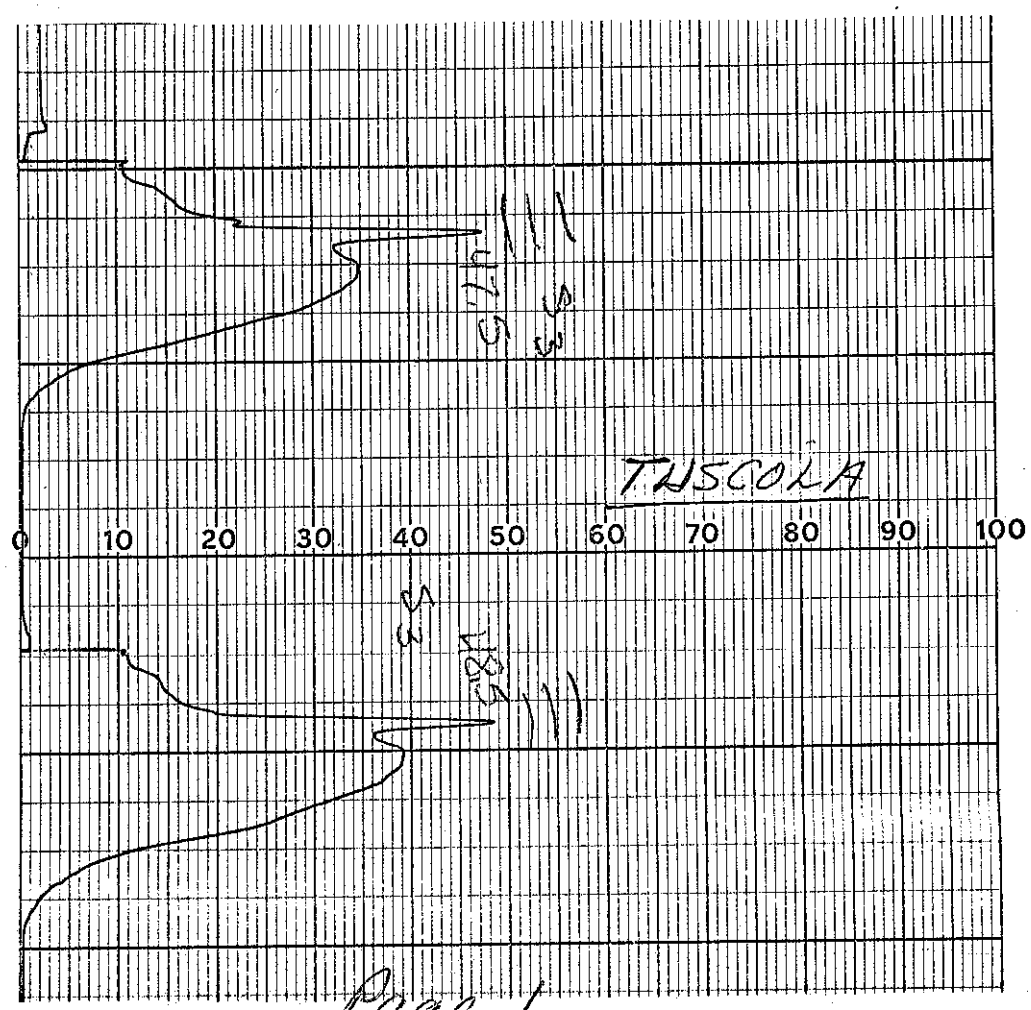
Interpretation is as follows: Reading from the bottom of the page, the first portion of the curve for Tuscola, up to the smooth peak at 39 in the scale represents compression and is equated to firmness or texture of the cotyledonary matrix. Following the compression peak, there is a dip and then a second peak which is, in the Tuscola variety, a very sharp and significantly higher peak than the compression peak. This is the shear peak and is equated to seed coat toughness.

For the Sanilac variety, the compression peak is somewhat lower and the shear peak markedly lower than in Tuscola, evidence of the resistance to impact injury in Tuscola, and that this resistance carries over to the canned product.

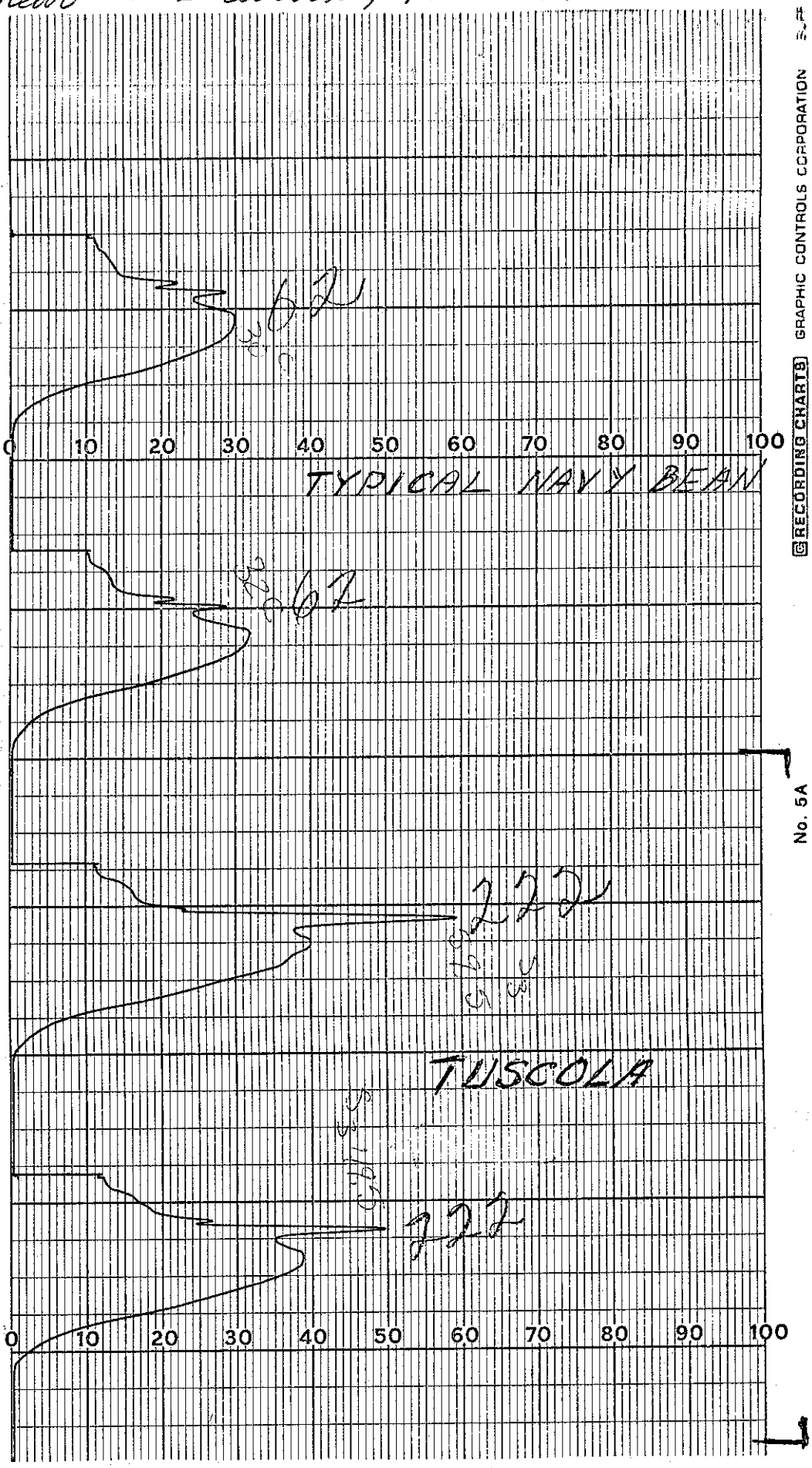
Page 2 shows a second replication, again with duplicate samples being run, of Tuscola, along with a typical navy bean pattern for comparison.

Kramer Shear-Press Curves, Feb 1979 7900075





Kramer Shear-Press curves, Feb 1979 7900075



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FORM APPROVED. OMB NO. 40-R3712

EXHIBIT C
(Bean)

FORM GR-470-12
(1/77)

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
GRAIN AND SEED DIVISION
HYATTSVILLE, MARYLAND 20782

OBJECTIVE DESCRIPTION OF VARIETY
BEAN (PHASEOLUS VULGARIS)

INSTRUCTIONS: See Reverse.

FOR OFFICIAL USE ONLY

PVPO NUMBER 7900075

NAME OF APPLICANT(S)
Michigan Agricultural Experiment Station

ADDRESS (Street and No. or R.F.D. No., City, State, and ZIP Code)
Michigan State University
East Lansing, Michigan 48824

VARIETY NAME OR TEMPORARY DESIGNATION
TUSCOLA

Place the appropriate number that describes the varietal character of this variety in the boxes below.
Place a zero in first box (e.g. [0][8][9] or [0][9]) when number is either 99 or less or 9 or less.

1. TYPE:

[3] 1 = SNAPBEAN 2 = GREEN SHELL 3 = DRY EDIBLE 4 = MULTIPURPOSE

2. SEASON AND REGION OF ADAPTABILITY IN THE U.S.:

[2] Grows best during: 1 = SPRING 2 = SUMMER 3 = FALL 4 = WINTER

[2] Best adapted in: 1 = NORTHWEST 2 = NORTHCENTRAL 3 = NORTHEAST 4 = SOUTHEAST 5 = SOUTHWEST 6 = MOST REGIONS

3. MATURITY (*Days from seeding to first harvest*):

[ ][ ] GREEN PODS [ ][ ] GREEN SHELLS [9][2] DRY SEEDS

[0][5] NO. DAYS EARLIER THAN ---------- [5]

[ ][ ] NO. DAYS LATER THAN ---------- [ ]

1 = TENDERCROP 2 = KENTUCKY WONDER 3 = KINGHORN WAX
4 = WHITE KIDNEY 5 = MICHELITE 62 6 = DWARF HORTICULTURAL
7 = BUSH BLUE LAKE 8 = OTHER (*Specify*)

4. PLANT:

[1] 1 = DETERMINATE, ERECT BUSH 2 = DETERMINATE, SPRAWLING BUSH 3 = DETERMINATE, SEMIPOLE 4 = INDETERMINATE, POLE

[0][4][5] CM. HEIGHT OR LENGTH OF VINE FROM PRIMARY LEAF NODE

[4][2] CM. SPREAD

[0][0][8] NUMBER PRIMARY BRANCHES PER MAIN STALK

[0][6] NUMBER INTERNODES ON MAIN STALK BETWEEN PRIMARY LEAF AND BASE OF TERMINAL INFLORESCENCE

[1] Branching habit: 1 = COMPACT 2 = OPEN

[0][6] MM. STALK DIAMETER ABOVE FIRST TRIFOLIATE LEAF

[0][2] CM. LENGTH OF FIRST INTERNODE ABOVE PRIMARY LEAF

[1] Main stalk: 1 = BRITTLE 2 = WIREY [1] 1. STOUT 2. THIN

[3] Flower position:
[2] Pod Position:
1 = LOW, CONCENTRATED 2 = HIGH, CONCENTRATED 3 = SCATTERED

5. LEAVES:

[1] 1 = SMOOTH 2 = WRINKLED [1] 1 = DULL 2 = GLOSSY [2] Thickness: 1 = THIN 2 = MEDIUM 3 = THICK

[2] Size: 1 = SMALL (*Earliwax*) 2 = MEDIUM 3 = LARGE (*Tendercrop*) [7] CM. PETIOLE LENGTH (*To basal leaflets of first trifoliate leaf*)

[2] Tip shape of center leaflet: 1 = ROUNDED 2 = TAPER POINTED 3 = SHARP POINTED

[3] PUBESCENCE - Dorsal:
[1] PUBESCENCE - Ventral:
1 = NONE 2 = SLIGHT 3 = CONSIDERABLE

[3] Color: 1 = LIGHT GREEN (*Bountiful*) 2 = MEDIUM GREEN 3 = DARK GREEN (*Bush Blue Lake*)

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FORM GR-470-12 (PAGE 2 OF 3 PAGES)

6. FLOWERS:

[1] Color: 1 = WHITE 2 = CREAM 3 = PINK 4 = LILAC 5 = PURPLE 6 = OTHER (Specify)_____

[2] Racemes: 1 = LONG 2 = MEDIUM 3 = SHORT [6] NUMBER FLOWERS PER RACEME

7. FRESH PODS: *(Edible maturity, averages for 10 pods)*

[ ] Color: 1 = LIGHT GREEN *(Bountiful)* 2 = MEDIUM GREEN *(Tendergreen)* 3 = DARK GREEN *(Wade)* 4 = LIGHT YELLOW *(Brittlewax)* 5 = GOLDEN YELLOW *(Cherokee Wax)* 6 = GREEN-RED VARIAGATED *(Horticultural)* 7 = OTHER (Specify) _____

[ ][ ] CM. LENGTH [ ][ ] MM. WIDTH *(Between sutures)* [ ][ ] MM. THICKNESS [ ][ ] WIDTH / THICKNESS X 10

[ ] Cross section pod shape: 1 = FLAT 2 = OVAL 3 = CREASEBACK 4 = ROUND

[ ] Curvature: 1 = STRAIGHT 2 = SLIGHTLY CURVED 3 = CURVED

[ ] Constrictions: 1 = NONE 2 = SLIGHT 3 = DEEP

[ ] Surface: 1 = SHINY 2 = DULL

[ ] Pod flesh: 1 = LIGHT 2 = DARK

[ ] MM. SPUR LENGTH

[ ] Fiber: 1 = NONE 2 = SPARSE 3 = CONSIDERABLE

[ ] NUMBER OF SEEDS PER POD

[ ] NUMBER MARKETABLE PODS PER PLANT *(Once over harvest)*

[ ] Pubescence: 1 = NONE 2 = SPARSE 3 = CONSIDERABLE

[ ] Spur: 1 = STRAIGHT 2 = SLIGHTLY CURVED 3 = CURVED

[ ] Surface: 1 = SMOOTH 2 = BLISTERED

[/] Pod flesh: 1 = FIRM 2 = WATERY

[ ] Suture string: 1 = PRESENT 2 = ABSENT

[ ] Seed development: 1 = SLOW 2 = MEDIUM 3 = FAST

[ ] NUMBER PODS PER PLANT *(Once over harvest)*

[ ] Machine harvest: 1 = ADAPTED 2 = NOT ADAPTED

8. SEED COAT COLOR:

[1] 1 = MONOCHROME 2 = POLYCHROME

[ ] 1 = SHINY 2 = DULL

[1] Primary color: 1 = WHITE 2 = YELLOW 3 = BUFF 4 = TAN 5 = BROWN 6 = PINK 7 = RED 8 = PURPLE 9 = BLUE 10 = BLACK 11 = OTHER (Specify)_____

[ ] Secondary color:

[ ] Color pattern: 1 = SPLASHED 2 = MOTTLED 3 = STRIPED 4 = FLECKED 5 = DOTTED

[ ] Secondary color location: 1 = HILAR RING 2 = HILAR SURFACE 3 = STROPHIOLE 4 = MICROPYLE 5 = SIDES 6 = DORSAL SURFACE 7 = NOT RESTRICTED TO ANY AREA 8 = COMBINATION OF LOCATIONS (Specify)_____

[1] Hilar ring: 1 = NOT PRESENT 2 = NARROW 3 = BUTTERFLY SHAPED

[1] Vein-like under coat pattern: 1 = ABSENT 2 = PRESENT

9. SEED SHAPE AND SIZE:

[1] Hilum view: 1 = ELLIPTICAL 2 = OVAL 3 = ROUND

[1] Side view: 1 = OVAL 2 = ROUND 3 = KIDNEY 4 = TRUNCATE ENDS

[4] Cross section: 1 = ELLIPTICAL 2 = OVAL 3 = CORDATE 4 = ROUND

[17.2] GM. WEIGHT PER 100 SEEDS

[1] Classification: 1 = PEA 2 = MEDIUM 3 = MARROW 4 = KIDNEY 5 = PINTO

[6.1] MM. WIDTH *(Dorsal to ventral)*

[5.2] MM. THICKNESS *(Side to side)*

[8.3] MM. LENGTH

[1.1.7] WIDTH / THICKNESS X 10

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FORM GR-470-12 (PAGE 3 OF 3 PAGES)

10. ANTHOCYANIN: (1 = Absent 2 = Present):

[1] FLOWERS [1] STEMS [1] PODS [1] SEEDS [1] LEAVES

11. DISEASE RESISTANCE (0 = Not tested; 1 = Susceptible; 2 = Resistant):

[1] RUST (Specify race) indigenous races
[1] BACTERIAL WILT
[2] ANTHRACNOSE Races α, β
[0] SOUTHERN BEAN MOSAIC
[1] CURLY TOP
[1] POWDERY MILDEW
2=[A] HALO BLIGHT
[0] ALFALFA MOSAIC VIRUS
[0] POD MOTTLE VIRUS
[1] ROOT KNOT NEMATODE

[0] ANGULAR LEAF SPOT
[2] COMMON BEAN MOSAIC
[1] YELLOW BEAN MOSAIC
[1] FUSARIUM ROOT ROT
[2] N.Y. 15 BEAN MOSAIC
[0] BEAN MOSAIC VIRUS 4
[1] FUSCOUS BLIGHT
[0] ALFALFA MOSAIC VIRUS 2
[0] RED NODE VIRUS
[ ] OTHER (Specify)

12. INSECT RESISTANCE: (0 = Not tested; 1 = Susceptible; 2 = Resistant)

[1] APHIDS
[1] POD BORER
[1] THRIPS
[1] SEED CORN MAGGOT

[1] LEAF HOPPERS
[1] LYGUS
[1] WEAVILS
[ ] OTHER (Specify)

13. PHYSIOLOGICAL RESISTANCE: (0 = Not tested; 1 = Susceptible; 2 = Resistant)

[0] HEAT [0] COLD [0] DROUGHT [ ] OTHER (Specify)

REFERENCES: The following publications may be used as a reference in completing this form:

1. Beans of New York. Vol. 1 Part II of Vegetables of New York. U.P. Hedrick et al. J. B. Lyon Company, Albany, N.Y. 1931.
2. Yarnell, S. H., Cytogenetics of the Vegetable Crops IV. Legumes. Bot. Rev. 31:247 - 330. 1965.
3. USDA Yearbook of Agriculture. 1937.

COLOR: Nickerson's or any recognized color fan may be used to determine the colors.