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Soybean designated AX7017-1-3

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Soybean designated AX7017-1-3

Abstract
A soybean seed is provided which exhibits an extremely high level of palmitic acid within the vegetable oil component of the seed. The soybean seed is designated AX7017-1-3 and bears ATCC Accession No. 97967. Palmitic acid is present in the endogenously formed vegetable oil in a concentration of at least 18 percent by weight (preferably at least 20 percent by weight) based upon the total fatty acid content as determined by gas chromatography. Descendants which exhibit a comparable palmitic acid content within the vegetable of the present invention are included within the concept of the present invention. A soybean plant also is provided upon the germination of the soybean seed. Such soybean plant commonly is capable of yielding comparable soybean seeds in a subsequent generation following self-pollination. The soybean seed preferably is provided within an assemblage of like seeds. A high level of stearic acid of at least 18 percent by weight (preferably at least 20 percent by weight) also can be present in the endogenously formed vegetable oil.

Keywords
Agronomy, Food Science and Human Nutrition

Disciplines
Agricultural Science | Agriculture | Agronomy and Crop Sciences | Food Science
A soybean seed is provided which exhibits an extremely high level of palmitic acid within the vegetable oil component of the seed. The soybean seed is designated AX7017-1-3 and bears ATCC Accession No. 97967. Palmitic acid is present in the endogenously formed vegetable oil in a concentration of at least 18 percent by weight (preferably at least 20 percent by weight) based upon the total fatty acid content as determined by gas chromatography. Descendants which exhibit a comparable palmitic acid content within the vegetable oil of the present invention are included within the concept of the present invention. A soybean plant also is provided upon the germination of the soybean seed. Such soybean plant commonly is capable of yielding comparable soybean seeds in a subsequent generation following self-pollination. The soybean seed preferably is provided within an assemblage of like seeds. A high level of stearic acid of at least 18 percent by weight (preferably at least 20 percent by weight) also can be present in the endogenously formed vegetable oil.
SOYBEAN DESIGNATED AX7017-1-3

CROSS-REFERENCE TO RELATED APPLICATIONS

This is a Continuation-in-Part of Ser. No. 689,128, filed Jul. 30, 1996, which is a Division of Ser. No. 376,466, filed Jan. 20, 1995 (now U.S. Pat. No. 5,602,311), which is a Continuation of Ser. No. 180,114, filed Jan. 12, 1994 (now abandoned), which is a Continuation of Ser. No. 839,328, filed Feb. 20, 1992 (now abandoned), which is a Continuation-in-Part of Ser. No. 461,341, filed Jan. 5, 1990 (now abandoned).

Field of the Invention

This invention relates to a novel soybean seed and plant characterized by an extremely high level of palmitic acid in the vegetable oil that is endogenously formed within the seed. Such soybean seed advantageously also includes a high level of stearic acid in the vegetable oil.

BACKGROUND OF THE INVENTION

Soybean seeds represent perhaps the most significant oilseed in the world. Soybean oil makes up approximately 28% of the world supply of fats and oils, has been considered to be the major vegetable oil produced and consumed in the United States, and more than 90% of the soybean oil is used in food products (World Soybean Research Conference III Proceeding, Shibles, R. (Ed.) 1985).

Soybeans thus represent a significant world-wide food source, providing an excellent source of protein. As such, soybeans represent potential alternatives to meats. Tofu and soymilk are two principal food products derived from soybean seeds. More than one billion people in China and Southeast Asia, it has been stated, rely on tofu as a major food protein source. (Proc. Int. Soya Protein Food Conf., American Soybean Assoc., p. 35 (1970)). Soy milk is similarly an important source for food protein.

One application for which soybean oil may be used is the production of plastic fats (e.g., shortenings and margarines). Such plastic fats are made with a matrix of solid fats whose interstices are filled with liquid oil. Solid fats can crystallize in several forms with different melting points and physical properties. The forms are commonly designated alpha, beta' and beta, with the beta form having the highest melting point and the greatest stability. Forms other than these three may also be present. The beta' form generally has the properties that are most usually desired in a plastic fat.

If the solid portion of the plastic fat contains about 15% or more of palmitic acid and the rest is stearic acid, it will stabilize in the beta' form. If the ratio of stearic/palmitic is higher, then the fat may convert to the beta form with its less desirable physical structure.

Soybean oil will most usually contain a level of about 10% palmitic acid or so. Accordingly, if such soybean oil is hydrogenated and made into a plastic fat, it will likely crystallize in the beta form. To prevent this, an oil such as cottonseed or palm oil that is rich in palmitic acid is blended with the soybean oil.

The use of either palm oil or cottonseed oil presents some difficulties. Some users thus consider palm oil to be undesirable based upon perceived health considerations. On the other hand, cottonseed oil is generally available only in limited amounts at a higher price than that of soybean oil. It would accordingly be highly desirable to be able to provide soybean varieties having sufficiently elevated palmitic acid contents so that plastic fats can be so that such products will stabilize in the beta' form.

Further, some producers for some plastic fat applications believe that soybean oil having a palmitic acid content in the range of about 13% or 14% to about 16% or so is preferred. For such applications, it would be highly desirable to be able to provide soybean varieties having a sufficiently high level of palmitic acid to use for blending with soybean varieties having more conventional palmitic acid contents to provide the desired intermediate range of palmitic acid content.

The palmitic acid levels in soybean seed oil range from 9.5% to 17.4% within the world collection (Erickson et al., Journal of Heredity, 79, p. 465, 1988). The Erickson et al. article reports the inheritance of altered palmitic acid percentages in two soybean mutants, C1726 and C1727. The level of palmitic acid in C1727 reported averages 17.3% palmitic acid in comparison to 11.5% in the oil of the parent cultivar ‘Century’.

Despite the clear need for soybeans having a level of palmitic acid above that present in the world collection at the present time, this objective still remains to be achieved.

SUMMARY OF THE INVENTION

A soybean seed designated AX7017-1-3 having ATCC Accession No. 97967 and its descendants are provided which yields an endogenously formed vegetable oil exhibiting a palmitic acid content of at least 18 percent by weight of the total fatty acid composition as determined by gas chromatography. A stearic acid content of at least 18 percent by weight also can be present in the endogenously formed vegetable oil. The soybean seed of the present invention preferably is provided within an assemblage of like seeds. A soybean plant formed upon the germination of the soybean seed of the present invention also is provided. Such soybean plant is capable of forming comparable soybean seeds in a subsequent generation following self-pollination.

In a preferred embodiment a soybean seed designated AX7017-1-3 having ATCC Accession No. 97967 and its descendants are provided which yields an endogenously formed vegetable oil exhibiting a palmitic acid content of at least 20 percent by weight and a stearic acid content of at least 20 percent by weight of the total fatty acid composition as determined by gas chromatography.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

According to one aspect of the present invention, the novel soybean seeds and plants characterized by palmitic acid contents of at least 18% (preferably at least 20%) were obtained by preparation of a mutant line developed by treating the cultivar Asgrow A1937 with N-nitroso-N-methylurea (NMU). Soybean seeds and plants which additionally are characterized by a stearic acid content of at least 18% (preferably 20%) are provided. The mutation procedure utilized will be described in detail hereinafter in the Examples. A mutant line has been designated A1937NMU-85.

Pursuant to a further aspect of the present invention, crossing of the parent mutant line A1937NMU-85 with a second mutant line, ElginEMS-421, has been found to provide a population of soybean seeds with palmitic acid contents significantly above that of the parent line Asgrow A1937. The preparation of the mutant line, ElginEMS-421, further will be described in conjunction with the Examples. Crossing of parent mutant lines A1937NMU-85 and ElginEMS-421 to obtain soybean lines can be carried out by
any desired hybrid formation technique. Standard hybridization techniques are, of course, well known and may be utilized. As an illustrative example, hybridization techniques are disclosed in Fehr, Principles of Cultivar Development, Vol. 1, Theory and Technique, Chapter 13, pp. 156–164, Macmillan Publishing Company, New York, 1987, which hybridization techniques are herein incorporated by reference.

Progeny from the crossing of A1377NMU-85 and ElginEMS-421 yielded soybean seeds wherein the palmitic acid content is greater than 18%, preferably greater than about 20%, and more preferably, greater than about 25%.

The fatty acid composition was determined by gas-liquid chromatography using the method as generally outlined in Graef et al. (Crop Sci., 25:1076–1079, 1985). Thus, in general, the method comprises (1) crushing the seed sample, (2) putting the crushed sample into a test tube with a hexane solvent and extracting the oil into the hexane, (3) the fatty acids in the oil are converted to their methyl esters using sodium methoxide and methanol, (4) water is added to inactivate the sodium methoxide catalyst, and (5) the methyl esters, which float to the top of the water layer, are diluted with hexane and become the sample that is introduced into the column of the gas chromatography apparatus.

As may be appreciated, this general methodology may be employed and specific aspects changed to lessen the time needed as desired. For example, the stationary phase selected for the columns will dictate the temperature at which the sample can be introduced.

None of the specifics utilized, e.g., capillary versus packed columns, are considered to affect to any appreciable extent the results obtained for an analysis. Rather, such specifics affect the time required for sample preparation and analysis.

The percentages of the fatty acids set forth herein, unless otherwise designated, thus are on a weight basis and refer to the percentage of the methyl ester of palmitic acid or other fatty acid compared to the total methyl esters of the fatty acid composition in the sample being analyzed. This can also be taken as the weight percentage of the fatty acid itself and that of its methyl ester as determined in the gas chromatography technique described herein is so minimal as may be ignored, as is commonly done in this field.

The gas chromatography techniques described herein are routinely used for analysis of the fatty acid composition of soybeans. The experimental error is considered to be within the range of from about 1 to 5% or so, depending upon the magnitude of the peak. For example, with a relatively large peak indicative of an oleic acid content of 50% or so, the experimental error may be as low as about 1% of the value, viz., 50 ±0.5%. At the other extreme, a small peak indicative of a stearic acid content of 4.0% may have an experimental error of about 5.0% of the value, viz., 4.0% ±0.2. A palmitic acid content of about 20% lies in the middle, with the expected error being about 2–3% of the reported value, viz., 20% ±0.4 or 0.6%.

As may be appreciated, the palmitic acid levels of the soybeans of the present invention set forth herein were obtained from soybeans grown in Iowa and Puerto Rico. Growth under climatic conditions cooler or warmer may result in a somewhat altered fatty acid composition. However, while the specific results may vary somewhat depending upon the specific growing conditions experienced, the progeny of the present invention will be characterized by extremely high palmitic acid contents relative to other soybean lines grown under similar conditions.

Soybean line A89-259098 is described in our copending application, Ser. No. 681,980, filed Jul. 30, 1996, the disclosure of said line being herein incorporated by reference. Such line exhibits a highly elevated stearic acid content. Soybean line AX4663-5-4-5 is described in our copending application, Ser. No. 08/686,771, filed Jul. 26, 1996. Such line exhibits an unusually high palmitic acid content. Soybean AX7017-1-3 of the present invention can be formed by a breeding program that includes the crossing of A89-259098 and AX4663-5-4-5.

The following Examples are illustrative, but not in limitation, of the present invention. The gas chromatography results obtained from the instrument itself are reported to two decimal points (i.e., “0.00”). As reported herein, the fatty acid values are set forth to one decimal point. Values of 0 or more in the second decimal point were raised (e.g., 4.29 is reported herein as 4.3), values of 4 or less are ignored (e.g., 4.24 is reported as 4.2), values of 5 are raised if the first decimal is odd (e.g., 4.15 is reported as 4.2) and ignored if even (e.g., 4.25 is reported as 4.2).

**EXAMPLE 1**

This Example describes the preparation of the mutant line A1937NMU-85.

Mutant line A1937NMU-85 was obtained from nitroso methyl urea (NMU) treatment of the parent variety Asgrow A1937. In May, 1985, 2,500 seeds of A1937 were soaked in 2.5 L distilled water in a 6 L flask for 9 hours at room temperature. The flask was aerated for the 9 hours of soaking. The water was drained from the flask, and 2.5 L of 2.5 mM N-nitroso-N-methylurea (NMU) in 0.1 mol [\(\text{M}\)] phosphate buffer at pH 5.5 were added. The seeds were soaked with agitation for 3 hours, the solution was drained and the seeds were rinsed twice with distilled water. Treated seeds were placed in containers to prevent drying and transported to the Agricultural Engineering and Agronomy Research Center near Ames, Iowa. The seeds were planted 2.5 cm deep in moist soil within 4 hours after the last rinse. The soil was watered regularly to keep it moist until seeding emergence. The properties of the mutant seed and their progeny were evaluated beginning with the M1 generation.

A similar number of seeds was harvested from each of the M1 (first mutant generation) plants in the population to obtain 2,000 M2 seeds. A random sample of 1,000 of the second generation M2 seeds from the population was planted in October at the Iowa State University-University of Puerto Rico soybean nursery at Isabel, Puerto Rico. About 2,000 M3 seeds were obtained by harvesting a similar number of seeds from each M2 plant. In February, 1,000 M3 seeds were planted in Puerto Rico. About 2,000 M4 seeds were obtained by harvesting a similar number of seeds from each M3 plant. In May, 1,000 M4 seeds were planted at Ames. Five hundred M5 plants were harvested individually from the population, M4 progeny of selected plants were planted in Puerto Rico in February, 1987; and the results confirmed the unique fatty acid composition of the M4 parent plant.

A 10-seed sample of the M4 plant from which A1937NMU-85 originated and its parent was analyzed by gas-liquid chromatography, and the results are set forth in Table 1:
A1937 parent were analyzed by gas-liquid chromatography, the properties of the mutant seed were planted 2.5 cm deep in moist soil within 4 hours after soaking. The water was drained from the flask, and 2.5 L of 0.025 M phosphate buffer at pH 7 were added. The seeds were soaked for 9 hours, the solution was drained and the seeds were rinsed twice with distilled water. Treated seeds were placed in containers to prevent drying and were designated AX4659 through AX4663 and were maintained as a separate subpopulation.

M₂ progeny from the M₁ plant ElginEMS-421 and that of its parent:

Seeds of the soybean A1937NMU-85 have been deposited under the terms of the Budapest Treaty at the American Type Culture Collection (ATCC) at 12301 Parklawn Drive, Rockville, Md. 20852, U.S.A. More specifically, 2,500 seeds of A1937NMU-85 were deposited on Jun. 18, 1996 and have been assigned ATCC Accession No. 97618.

EXAMPLE 2

This Example describes the preparation of the mutant line ElginEMS-421.

Mutant line ElginEMS-421 was obtained from ethyl methane sulfonate (EMS) treatment of the parent variety Elgin. In May, 1984, 2,500 seeds of Elgin were soaked in 2.5 L distilled water in a 6 L flask for 9 hours at room temperature. The flask was aerated for the 9 hours of soaking. The water was drained from the flask, and 2.5 L of 0.025 M EMS in 0.1 M phosphate buffer at pH 7 were added. The seeds were soaked for 9 hours, the solution was drained and the seeds were rinsed twice with distilled water. Treated seeds were placed in containers to prevent drying and transported to the Agricultural Engineering and Agronomy Research Center near Ames, Iowa. The seeds were planted 2.5 cm deep in moist soil within 4 hours after the last rinse. The soil was watered regularly to keep it moist until seedling emergence. The properties of the mutant seed and their progeny were evaluated beginning with the M₂ generation.

A similar number of seeds was harvested from each of the M₂ (first mutant generation) plants in a population to obtain 2,000 M₂ seeds for each population. A random sample of 1,000 of the second generation M₂ seeds from the population was planted in February at the Iowa State University-University of Puerto Rico Soybean nursery at Isabela, Puerto Rico. Five hundred M₂ plants were harvested individually from the population, and a 10-seed sample from selected plants was analyzed by gas-liquid chromatography to determine the fatty acid composition. M₃ progeny of the mutant plant were planted in Puerto Rico in November, 1986, and the results confirmed the unique fatty acid composition of the M₂ parent plant.

EXAMPLE 3

This Example describes the crossing of A1937NMU-85 and ElginEMS-421 to obtain the soybean lines characterized by high palmitic acid contents.

Crosses were made between individual plants of A1937NMU-85 and ElginEMS-421 at the Agricultural Engineering and Agronomy Research Center near Ames, Iowa, in the summer of 1987. The hybrid F₁ seeds obtained from the different plant-to-plant crosses were kept separate, and were designated AX4659 through AX4663 and AX4676.

The F₁ seed was planted in the Iowa State University-University of Puerto Rico nursery at Isabela, Puerto Rico, in October, 1987. F₂ seeds were obtained by natural self-pollination. Each F₁ plant was harvested individually, and the F₂ seeds of each were maintained as a separate subpopulation.

Forty F₂ seeds from each of the six crosses were planted in Puerto Rico in February, 1988. F₃ seeds were obtained by natural self-pollination. F₂ plants were harvested individually. A 5-seed sample from each F₂ plant was analyzed for fatty acid composition by gas chromatography.

Table V summarizes the analysis of the fatty acid composition of the F₃ seeds from individual F₂ plants:
Twelve F₃ seeds from each selected F₂ plant were planted in the Iowa State University-University of Puerto Rico nursery in October, 1988. F₃ seeds were obtained by natural self-pollination. Each F₂ plant was harvested individually. A 10-seed sample from each F₂ plant was analyzed for fatty acid composition by gas chromatography.

Table VI summarizes the analysis of the fatty acid composition of the F₄ seeds from individual F₃ plants:

<table>
<thead>
<tr>
<th>Seed Identification</th>
<th>Fatty Acid Composition</th>
<th>Palmitic Acid (16:0)</th>
<th>Stearic Acid (18:0)</th>
<th>Oleic Acid (18:1)</th>
<th>Linoleic Acid (18:2)</th>
<th>Linolenic Acid (18:3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX4659-2-3-9</td>
<td></td>
<td>21.3</td>
<td>4.1</td>
<td>15.9</td>
<td>50.4</td>
<td>8.2</td>
</tr>
<tr>
<td>AX4659-3-7-7</td>
<td></td>
<td>25.9</td>
<td>3.7</td>
<td>14.2</td>
<td>47.9</td>
<td>8.3</td>
</tr>
<tr>
<td>AX4659-3-8-8</td>
<td></td>
<td>23.9</td>
<td>3.7</td>
<td>17.5</td>
<td>46.6</td>
<td>8.2</td>
</tr>
<tr>
<td>AX4660-3-4-4</td>
<td></td>
<td>26.1</td>
<td>4.5</td>
<td>16.2</td>
<td>44.9</td>
<td>8.3</td>
</tr>
<tr>
<td>AX4663-5-2-9</td>
<td></td>
<td>25.9</td>
<td>4.4</td>
<td>17.7</td>
<td>44.4</td>
<td>7.5</td>
</tr>
<tr>
<td>AX4663-5-2-9</td>
<td></td>
<td>26.8</td>
<td>4.1</td>
<td>12.5</td>
<td>48.2</td>
<td>8.3</td>
</tr>
<tr>
<td>AX4659-3-7-8</td>
<td></td>
<td>23.6</td>
<td>3.6</td>
<td>15.7</td>
<td>48.7</td>
<td>8.4</td>
</tr>
<tr>
<td>A1937NMU-85</td>
<td></td>
<td>19.0</td>
<td>3.8</td>
<td>15.7</td>
<td>53.2</td>
<td>8.2</td>
</tr>
<tr>
<td>Elgin EMS-421</td>
<td></td>
<td>17.4</td>
<td>4.0</td>
<td>14.6</td>
<td>53.0</td>
<td>10.9</td>
</tr>
</tbody>
</table>

Thirty F₂ seeds from each selected F₁ plant were planted at the Agricultural Engineering and Agronomy Research Center near Ames, Iowa, in May, 1989. F₂ seeds were obtained by natural self-pollination. Each F₁ plant was harvested individually. A 5-seed sample from each of 10 F₂ plants tracing to an F₃ plant was analyzed for fatty acid composition by gas chromatography.

Table VII summarizes the analysis of the fatty acid composition of the F₂ seeds from individual F₁ plants, the parents, and C1727:

<table>
<thead>
<tr>
<th>Seed Identification</th>
<th>Fatty Acid Composition</th>
<th>Palmitic Acid (16:0)</th>
<th>Stearic Acid (18:0)</th>
<th>Oleic Acid (18:1)</th>
<th>Linoleic Acid (18:2)</th>
<th>Linolenic Acid (18:3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX4659-2-3-9</td>
<td></td>
<td>27.8</td>
<td>3.8</td>
<td>13.9</td>
<td>44.1</td>
<td>10.3</td>
</tr>
<tr>
<td>AX4659-3-7-7</td>
<td></td>
<td>23.6</td>
<td>3.5</td>
<td>15.1</td>
<td>44.4</td>
<td>9.6</td>
</tr>
<tr>
<td>AX4659-3-8-8</td>
<td></td>
<td>27.4</td>
<td>3.4</td>
<td>16.1</td>
<td>42.8</td>
<td>10.3</td>
</tr>
<tr>
<td>AX4660-3-4-4</td>
<td></td>
<td>27.7</td>
<td>3.8</td>
<td>15.6</td>
<td>43.2</td>
<td>9.7</td>
</tr>
<tr>
<td>AX4663-5-2-9</td>
<td></td>
<td>28.0</td>
<td>3.9</td>
<td>13.1</td>
<td>43.0</td>
<td>12.0</td>
</tr>
<tr>
<td>AX4663-5-4-4</td>
<td></td>
<td>26.3</td>
<td>4.0</td>
<td>12.4</td>
<td>43.8</td>
<td>11.5</td>
</tr>
<tr>
<td>AX4676-2-11-8</td>
<td></td>
<td>28.2</td>
<td>3.7</td>
<td>12.1</td>
<td>44.3</td>
<td>11.7</td>
</tr>
<tr>
<td>A1937NMU-85</td>
<td></td>
<td>19.6</td>
<td>3.9</td>
<td>17.5</td>
<td>50.1</td>
<td>8.9</td>
</tr>
<tr>
<td>Elgin EMS-421</td>
<td></td>
<td>16.6</td>
<td>4.0</td>
<td>19.8</td>
<td>49.0</td>
<td>10.6</td>
</tr>
</tbody>
</table>

This Example describes the crossing of AX4663-5-4-5 with A89-259098, a high stearic acid line, to obtain a soybean line according to the present invention characterized by an exceptionally high palmitic acid content. In subsequent generations the stearic acid content of the vegetable oil additionally was very high as reported.

Parent line AX4663-5-4-5 was obtained as described in Example 3. Parent line AX4663-5-4-5 is described in our copending application Ser. No. 686,771, filed Jul. 26, 1996. The disclosure of this line is herein incorporated by reference. Parent line A89-259098 was obtained as described in our copending application, Ser. No. 681,980, filed Jul. 30, 1996. The hybrid F₁, seeds obtained from the cross were designated AX7016-AX7019.

2,500 seeds of AX4663-5-4-5 were deposited on Dec. 26, 1995 at the American Type Culture Collection (ATCC) at 12301 Parkdawn Drive, Rockville, Md. 20852, U.S.A. and have been assigned ATCC Accession No. 97393.

1,250 seeds of A89-259098 were deposited on Dec. 26, 1995 at the American Type Culture Collection (ATCC) at 12301 Parkdawn Drive, Rockville, Md. 20852, U.S.A. and have been assigned ATCC Accession No. 97391. An additional 1,250 seeds of A89-259098 were deposited on Apr. 22, 1996.

F₁ seeds of the cross were planted in February, 1990, in the Iowa State University-University of Puerto Rico nursery at Isabela, Puerto Rico. F₂ seeds were obtained by natural self-pollination. Each F₁ plant was harvested individually, and the F₂ seeds of each were maintained as separate subpopulations.

Four individual F₂ seeds from each F₁ plant were split so that the embryonic axis was left intact. The portion without the embryonic axis (approximately one-third of the seed) was analyzed for fatty acid composition by gas chromatography.

Table VIII summarizes the analysis of the fatty acid composition of an F₂ seed having the high palmitic acid content and that of the parent lines:

<table>
<thead>
<tr>
<th>Seed Identification</th>
<th>Fatty Acid Composition</th>
<th>Palmitic Acid (16:0)</th>
<th>Stearic Acid (18:0)</th>
<th>Oleic Acid (18:1)</th>
<th>Linoleic Acid (18:2)</th>
<th>Linolenic Acid (18:3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX7017-4-3</td>
<td></td>
<td>30.4</td>
<td>5.2</td>
<td>10.1</td>
<td>42.6</td>
<td>11.7</td>
</tr>
<tr>
<td>AX4663-5-4-5</td>
<td></td>
<td>28.6</td>
<td>4.0</td>
<td>11.9</td>
<td>43.0</td>
<td>12.4</td>
</tr>
<tr>
<td>A89-259098</td>
<td></td>
<td>8.0</td>
<td>30.3</td>
<td>21.5</td>
<td>34.6</td>
<td>5.6</td>
</tr>
</tbody>
</table>

The split F₂ seed was planted at Ames, Iowa and the seeds that were formed on the resulting plant were harvested during 1990. Individual F₃ seeds from the F₂ plant were split and were analyzed for fatty acid composition. Four of the
fourteen seeds showed elevated concentrations of palmitic acid and stearic acid in the vegetable oil. The average fatty acid composition of the four F₃ seeds is presented in Table IX as follows:

<table>
<thead>
<tr>
<th>Seed Identification</th>
<th>Palmitic Acid (16:0)</th>
<th>Stearic Acid (18:0)</th>
<th>Oleic Acid (18:1)</th>
<th>Linoleic Acid (18:2)</th>
<th>Linolenic Acid (18:3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX7017-1-3</td>
<td>26.1</td>
<td>22.9</td>
<td>8.2</td>
<td>35.4</td>
<td>7.4</td>
</tr>
</tbody>
</table>

It will be noted that the concentration of stearic acid (18:0) substantially increased over that exhibited in the previous generation. The remaining portions of the four F₃ seeds were planted in Puerto Rico during February, 1991, and F₃ plants were formed. The F₃ plants were harvested during May. Ten individual seeds were analyzed for fatty acid content from each of the four F₃ plants. Seeds from each plant continued to exhibit elevated palmitic acid and stearic acid contents although it was somewhat variable within and among plants.

F₄ seeds from each plant were grown along with the parents at Ames, Iowa during 1991. Individual F₄ plants resulting therefrom and the parent plants were harvested. The average fatty acid composition of the endogenously formed vegetable oil of the seeds of the resulting F₄ plants and of the parent plants when grown at Ames, Iowa during 1995 is presented in Table X as follows:

<table>
<thead>
<tr>
<th>Seed Identification</th>
<th>Palmitic Acid (16:0)</th>
<th>Stearic Acid (18:0)</th>
<th>Oleic Acid (18:1)</th>
<th>Linoleic Acid (18:2)</th>
<th>Linolenic Acid (18:3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AX7017-1-3</td>
<td>22.9</td>
<td>20.6</td>
<td>9.3</td>
<td>38.3</td>
<td>9.0</td>
</tr>
<tr>
<td>AX4663-5-4-5</td>
<td>27.5</td>
<td>4.2</td>
<td>12.8</td>
<td>43.3</td>
<td>12.2</td>
</tr>
<tr>
<td>A89-259098</td>
<td>8.6</td>
<td>21.7</td>
<td>14.1</td>
<td>47.6</td>
<td>8.0</td>
</tr>
</tbody>
</table>

F₄ seeds from the above-identified plants were grown at Ames, Iowa during 1995. The fatty acid composition of endogenously formed vegetable oil of the F₄ plants was found to be consistent with the values presented in Table X.

Seeds of soybean AX7017-1-3 from the F₅ generation were deposited on Mar. 25, 1997 and have been assigned ATCC Accession No. 97967. Seeds of this deposit will be irrevocably and without restriction or condition released to the public upon the issuance of the patent pursuant to the terms of the Budapest Treaty.

Although the invention has been described with reference to a preferred embodiment, it is to be understood that variations and modifications may be resorted to as will be apparent to those skilled in the art. Such variations and modifications are to be considered within the purview and scope of the claims appended hereto.

We claim:

1. A soybean seed designated AX7017-1-3 having ATCC Accession No. 97967 and its descendants which yields an endogenously formed vegetable oil exhibiting a palmitic acid content of at least 18 percent by weight of the total fatty acid composition and a stearic acid content of at least 18 percent by weight of the total fatty acid composition as determined by gas chromatography.

2. A soybean seed according to claim 1 wherein the vegetable oil endogenously formed therein contains a palmitic acid content of at least 20 percent by weight.

3. A soybean seed according to claim 1 wherein the vegetable oil endogenously formed therein contains a stearic acid content of at least 20 percent by weight.

4. A soybean seed designated AX7017-1-3 having ATCC Accession No. 97967 and its descendants which yields an endogenously formed vegetable oil exhibiting a palmitic acid content of at least 20 percent by weight and a stearic acid content of at least 20 percent by weight of the total fatty acid composition as determined by gas chromatography.

5. A soybean seed according to claim 4 wherein the vegetable oil endogenously formed therein contains palmitic acid in a concentration of approximately 22.9 percent by weight, stearic acid in a concentration of approximately 20.6 percent by weight, oleic acid in a concentration of approximately 9.3 percent by weight, linoleic acid in a concentration of 38.3 percent by weight, and linolenic acid in a concentration of approximately 9.0 percent by weight.

6. Soybean seeds according to claim 1 that are provided as an assemblage of such seeds.

7. Soybean seeds according to claim 4 that are provided as an assemblage of such seeds.

8. A soybean plant produced by growing the seed of claim 1.


* * * * *