

WHAT ARE WE DOING WITH CASTOR BEANS?

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The castor bean, fruit of *Ricinus communis*, a species belonging to the spurge family (Euphorbiaceae), has been cultivated for various purposes since Biblical times. It is the Palma Christa of the Egyptians, sometimes referred to as Jacob's gourd, and was the source of oil used in making papyrus. *Ricinus* is a Latin term meaning dog-tick, which the seed was thought to resemble.

Although the original habitat of this species was Africa, commercial production was and still is centered in Brazil and British India. Most North American supplies have been imported from Brazil. During the 19th century a number of attempts were made to introduce commercial production in the United States, particularly in southern areas. Between 1860 and 1916 castor beans were grown as a farm crop in some sections of Kansas, Oklahoma, Missouri, and Illinois. In 1879 Kansas produced a total of 750,000 bushels.¹ In 1918 castor beans were grown in many southern and western states to provide oil for special purposes. Several thousand tons were produced, but following the war importations increased and domestic interest declined. Since then a few beans have been grown, chiefly for experimental purposes.

Adaptation.—The crop is adapted to a wide range of soil and climatic conditions. Commercial production, however, is confined within the territory south of the 38 parallel of latitude.

Observations indicate that on rich soils castor bean plants grow vegetatively without a corresponding production of seed. On soils of average fertility, seed yields are more closely correlated with vegetative growth.

Commercial varieties are for the most part annuals attaining an average height of approximately six feet in south central Illinois. Seeds are about the size of large beans and contain from 35 to 55 per cent

oil. These beans are found in spiny pods with a ratio of 65 to 80 per cent bean to hull by weight.

Composition of Castor Bean Plant and Oil.—The castor bean plant contains a substance, ricin, which is considered as having potential use in insecticides. In addition to oil, the seeds contain an alkaloid, ricinine, a poisonous substance belonging to the heterocyclic series of compounds of the pyridine group. The composition was determined by synthesis by Spath and Koller.² Castor oil contains a considerable percentage of the esters of palmitic acid and ricinoleic acid, the latter having a replaceable hydroxyl group. This is mentioned because this factor is important in the dehydration process and its subsequent use as a drying oil.

Castor oil is a viscous liquid of the fixed oil group having a specific gravity of 0.958 to 0.968 at 15° C. The iodine number is 82 to 90, and the saponification value is 177 to 187. It is soluble in alcohol, ether, and petroleum ether.³

Imports of Castor Beans and Utilization of Oil.—Imports of castor beans increased very materially during 1940, reflecting a growing demand for castor oil for industrial use. See Table I.

Small quantities of castor oil are used for medicinal purposes, but most of the oil is used in the manufacturing and processing of industrial products such as artificial leather, soap, ink, linoleum, lubricants, paints, varnishes, and for use in dyeing fabrics. During World War I, castor oil was used extensively as a lubricant for airplane motors. It still has a place as a special lubricant and as a recoil absorbing liquid in armaments.

Investigations on Castor Beans and Oil.—Research on the castor bean is divided into agricultural and industrial investigations. It is difficult to separate these phases along clear-cut lines for both are

¹ Crooks and Sievers. Mimeo. pub. U.S.D.A.

² DeAlbe, *Heterocyclic Compounds*, 1923.

³ Jamieson, Geo. S., *Vegetable Fats and Oils*. The Chemical Catalog Company, Inc., New York, 1932.

TABLE 1.—IMPORTS OF CASTOR BEANS AND ESTIMATED UTILIZATION OF CASTOR OIL

Year	Imports of castor beans	Consumption by drying industries
	1000 lbs.	1000 lbs.
1935.....	77,049	3,858
1936.....	164,077	4,794
1937.....	146,808	7,722
1938.....	114,072	6,043
1939.....	162,611	11,844
1940.....	237,789	24,858

interdependent. Agricultural research is concerned particularly with the production of the crop, including studies of environment, varieties and their soil adaptation, oil production, composition, cultural methods, and the development of machinery for harvesting. This brief statement encompasses a far-reaching program of agricultural research which eventually purposes to care for the wartime needs of the nation.

Research in industrial-chemurgical chemistry employs a utilization of practically all raw materials making up any part of the castor bean plant.

What Are We Doing With Castor Beans?—The Illinois Agricultural Experiment Station began preliminary work on this crop in 1938 with some large flowering varieties which were unsatisfactory

in maturity and yield. In 1939, three varieties were obtained from the U. S. Department of Agriculture and one from Kansas. Small test plantings were made and the beans harvested. Increased plantings of these varieties were made in 1940. In 1941, a number of new varieties were obtained. These were included in the tests which were made at several locations in south central and southern Illinois. Yield data from three locations are shown in Table 2.

In addition to beans, in 1941 stalks were also harvested. Field observations have indicated these stems were strong and fibrous. Sample yields, following a period of field curing and drying, averaged approximately 5,000 pounds for all varieties. This material has considerable promise for use in the manufacture of paper boxes.

Plant Breeders Work on Improvement.

—A number of important factors contribute to the difficulties of economical production of castor beans. A few are included here: (1) Nonuniform maturity, making it difficult to harvest all beans in a single picking; (2) tendency to shatter; (3) nonuniform height; and (4) some promising varieties mature too late in northern areas. The time elapsed since the initiation of this work has been too short for workers to obtain little

TABLE 2.—CASTOR BEAN YIELDS FOR 1939, 1940, AND 1941 AT URBANA, DIXON SPRINGS, AND ALHAMBRA, ILLINOIS

Variety	Yield			
	1939	1940	1941	Average
<i>Urbana—Central Illinois</i>				
	lb/A	lb/A	lb/A	lb/A
Arlington.....	466	1015.0	1554	1012
U. S. 4.....	701	1081.9	1376	1053
U. S. 7.....	1149.6	1052.0	1624	1275
Kansas Common.....	1175.2	1137.0	1570	1294
San Benita.....			1684	1684
Conner Type (Texas).....			1544	1544
Conner Type (Mo.).....			1296	1296
Doughty II (Texas).....			1738	1738
MG Kentucky.....			1596	1596
<i>Dixon Springs—Southern Illinois</i>				
Kansas Common.....		495.0	548.0	521.5
Arlington.....		525.0	615.0	570.0
USDA 4.....		490.0	595.0	542.5
USDA 7.....		332.0	672.0	502.0
<i>Alhambra—Southwestern Illinois</i>				
Kansas Common.....			824.0	824
U. S. 7.....			1016.0	1016
U. S. 4.....			746.0	746
Arlington.....			904.0	904
MG Kentucky.....			952.0	952
Conner Type (Texas).....			840.0	840
Conner Type (Mo.).....			820.0	820

more than an indication of definite favorable trends which should lead to a solution of these problems.

Culture and Harvesting Castor Beans.

—The planting and subsequent cultivation of castor beans are similar to corn, but the harvesting operations are more difficult. Significant research on better methods and means of harvesting and threshing this crop is under way.

In Illinois, castor beans are usually planted during May, depending upon soils and climatic conditions. Hand corn planters have been used, but it is possible to utilize regular corn planting machinery by substituting plates of correct sizes in the drill boxes. Rows are usually 40-42 inches wide, and plants are spaced either 36 or 40 inches in the row. Germination and emergence require approximately two weeks. Weeds are controlled by two or three cultivations with the corn cultivator; however, little care is necessary until harvest time after the plants have attained a height of 18-24 inches.

Combines have been used and show considerable promise that field harvesting will replace hand picking. A number of hulling machines have been built for removing beans from the capsules. The Illinois Agricultural Experiment Station evolved a small experimental huller which has been satisfactory. This problem is well on the way to a solution.

Agronomic research as proposed for 1942 is both intensive and extensive. A number of experiment stations are working in cooperation with the U. S. Department of Agriculture in a series of studies including the following: (1) Variety studies in 22 states; (2) planting dates in five states; and (3) spacing tests in five states. These are in addition to genetic studies already initiated.

Castor beans, as a crop, have shown the most promise in the large area between the cotton belt on the south and the corn belt on the north, centered near the southern tip of Illinois. It is realized that competition with other crops for space and labor limits this crop to the designated area.
