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CASTORBEAN PRODUCTION IN NEBRASKA

J. H. Williams and J. C. Swinbank

Castorbeans, known and used by man since biblical times, are being considered as a potential new crop for Nebraska. Increased demand for domestic production of castor oil for industrial purposes together with the development of more efficient harvesting equipment and improved varieties and hybrids have made castorbeans a promising crop for certain areas of the United States. Castorbeans are grown for the high quality oil which is used in the manufacture of paints, lacquers, varnishes, plastics and plasticizers, lubricants for jet engines, hydraulic fluids, nylon, pharmaceuticals, cosmetics and other products. In 1959 over 90% of the total castor oil used in the United States was imported.

Description of the Plant

The castorbean plant is a branched, coarse appearing plant with large leaves. It grows to a height of 3 to 12 feet depending upon the variety and growing conditions. In the temperate zones castorbeans are grown as annuals where the growing season from seeding to killing frost is at least 150 days. In Nebraska the length of growing season limits the crop to the southern part of the state. The plant has an indeterminant growth habit and continues to produce seed racemes until limited by lack of moisture, fertility or killing frost. Higher yields are produced in areas with longer growing seasons. Under adverse weather conditions, the seed capsules tend to open with resulting loss of seed. Commercial varieties are quite resistant to shattering under normal conditions. The seed is approximately the same size as a true field bean and contains 45 to 58 per cent oil.

Poisonous Properties

Both the seed and the plant contain alkaloids which are extremely poisonous when eaten by humans or livestock. Since the growing plants and crop residues are unpalatable to livestock, they are not considered hazardous unless the livestock is forced to eat them. Castorbeans should not be stored with livestock or human food. The presence of a single castorbean seed in a load of grain will reduce the grain to sample grade.

Castorbeans also contain a substance which causes allergy in some people. The allergenic substance, separate and distinct from the poisonous constituents, has been found in the leaves but is more commonly associated with the seed.

Because of these poisonous and allergenic properties, caution is needed in the production and handling of castorbeans.

Varieties and Yields

Castorbean varieties or hybrids can be grouped into two types, the normal-internode or tall type and the short-internode or dwarf type. Under irrigation in Nebraska the tall growing type may reach a height of 10 or more feet. The dwarf types seldom exceed 4 or 5 feet.

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feet. Severe lodging as a result of strong winds has been observed in the tall types. Under the same conditions, dwarf varieties did not lodge or shatter seed. Harvesting difficulties would be expected whenever severe lodging occurs.

Several dwarf varieties have been tested to a limited extent under irrigation in Nebraska. The variety Baker 296 appears to be the best available dwarf variety, although an earlier maturing variety would be preferred. Yields of Baker 296 have averaged 2,350 pounds per acre in four irrigated tests in two years at Lincoln and in Adams County.

In non-irrigated tests the tall types usually reach a height of only 6 feet, except in years of excessive rainfall, and yield more than dwarf varieties. At Lincoln during the 6-year period 1954 to 1959, Cimarron hybrid averaged 1,094 pounds per acre. It ranged from 477 pounds in 1955, a dry year, to 2,099 pounds in 1958, a wet year. During the 3-year period 1957-59, Cimarron hybrid outyielded the best dwarf variety by 15 per cent.

Soil and Fertility Requirements

Castorbeans should be grown on good, well-drained soil of average or better fertility. Soils which have a high moisture holding capacity and warm up early in the spring are desirable. Castorbeans should not be planted on soils subject to erosion since they have little soil-binding ability.

Fertilizer requirements for castorbeans in Nebraska have not been fully determined but tests indicate that nitrogen fertilizers at the rate of 40 to 100 pounds per acre may be needed on soil of average fertility for maximum yields. At the higher rates, approximately half of the nitrogen may be used as a preplant application and the remainder side-dressed at the last cultivation. An excess of nitrogen, however, or an extremely fertile soil may produce rank vegetative growth without a corresponding increase in yield. Response to phosphorous has not been noted except where the soils are known to be deficient in this element. Where cereals respond to phosphate, castorbeans are likely to benefit from a preplant application of 20-25 pounds of available phosphorous per acre.

Planting

A seedbed similar to that prepared for corn is satisfactory for castorbeans. The crop is grown in rows similar to corn. The distance between rows depends upon the type of harvesting equipment that will be used. Some two-row harvesters are designed for 36-inch row spacings; others, for 40-inch row spacings. If the row spacing differs from that for which the harvester is designed, seed loss will result during the harvesting operation.

Castorbeans are slow to germinate. They should be planted 1½ to 3 inches deep in moist, firm soil to prevent drying out. Seed is usually surface planted. When the surface soil is dry, seed should be planted in a shallow furrow to place it in moist soil.

The rate of seeding will depend upon the seed size and germination. Maximum yields will be obtained only with adequate stands. Ten to 14 pounds of good viable seed (90% germination or better) per acre will give the desired spacing of 8 to 14 inches between plants. A spacing of 8 to 10 inches between plants is desirable for dwarf types, which would require the higher rate of seeding.

Seed should be treated before planting with a fungicide. Seed treating materials commonly used on sorghum and corn are satisfactory.
Date of Planting

In Nebraska, the date of planting should coincide with corn planting—usually between May 1 and May 20. Castorbeans are susceptible to frost and should be planted after danger from frost has passed and the soil has warmed up. A soil temperature of 53° is considered optimum for uniform germination of the seed. From 10 to 20 days, depending upon the soil moisture, temperature, and depth of planting, is needed for castorbean seedlings to emerge. Castorbeans need as long a growing season as possible in Nebraska for maximum yields. Therefore, it is desirable to plant as early as possible and yet avoid frost damage.

Planting Equipment

Inclined or vertical plate planters are preferred for planting castorbean seed. Regardless of type of planter box used, it is essential that the machine be adjusted so that it does not crush the oily seed. Even a few crushed seeds can cause the holes in the plates to clog.

Corn planters with horizontal, edge drop plates can be used provided modified plates can be adapted to the machine. A plate of 5/16 to 3/8 inch, which is somewhat thinner than a corn plate, is about the correct thickness. Plates thicker or thinner break too much seed. The openings in the plate should be approximately 9/16 inch long and 1/4 inch wide. Oblong cells are better than round cells. If plates are being made, it is advisable to undercut the cells to permit the seed to drop freely. It is sometimes necessary to substitute soft spring or brush cut-off and knock-out paws for the metal mechanisms. Castorbean plates are available from several implement companies.

Cultivation

In the early stages of growth, castorbeans are poor competitors with weeds. A clean seedbed is essential. Seed is slow to germinate and seedlings grow slowly for the first few weeks after planting. Weed control during this early period is important. Harrowing or rotary hoeing before the castorbean seedlings emerge controls sprouting weed seeds. Do not harrow or hoe the castorbeans as they "come up" (gooseneck stage) because the plants may be permanently damaged or killed. If crusting of the soil occurs before the crop emerges, a light harrowing or hoeing may aid in obtaining good stands. Continued control of weeds is essential until the plants are large enough to shade the ground. After emergence of the castorbean seedlings, this can be accomplished by shallow cultivation with ordinary corn equipment. The castorbean plant has a deep tap root and a widespread, shallow fibrous root system which may be easily injured by deep or close cultivation.

Castorbeans are extremely sensitive to 2,4-D compounds. Chemical weed control cannot be recommended for castorbeans at this time.

Irrigation

In most years yields of castorbeans in Nebraska are substantially increased by irrigation. Irrigation is considered essential for satisfactory production in the south central and southwestern parts of the state. Castorbeans require less water than corn but it is important that adequate moisture be available during the period when the plants are flowering and setting seed (usually from late June through early
September). Plants should not be allowed to wilt severely at any time. Several light applications are probably better than a few heavy applications of water.

Over-irrigation should be avoided as castorbeans do not tolerate "wet feet" for any length of time. Lodging may also result from over-irrigation, especially in the case of the tall growing types.

Insects and Diseases

Insects have not been a major problem in castorbean production. However, cutworms and wireworms can reduce stands and, if known to be in the field, should be controlled. Other insects such as false chinch bugs may be of minor importance in some years.

No serious losses from diseases have occurred in castorbeans that are produced in the Great Plains area. However they are known to be susceptible to several diseases which could become problems as commercial production increases.

Harvesting

Harvesting usually begins about 10 to 14 days after the first killing frost. The seed capsules must be dry in order to harvest the crop with minimum loss of seed. Undue delay in harvesting after the crop is ready may result in losses from shattering.

Specially designed equipment is required to mechanically harvest castorbeans. Harvesting attachments which modify the John Deere model 55 combine for castorbean harvesting are available. With these attachments it is possible to harvest and dehull the seed in one operation.

Moisture content, foreign material and cracked or broken beans are considered in grading the seed. Castorbeans can be stored safely at 8 per cent moisture but discounts normally apply for moisture in excess of 6 per cent.

Place in the Crop Sequence

Castorbeans are not legumes but leave the soil in a more productive condition than other non-leguminous crops. In six-year tests at Lincoln, castorbeans showed no detrimental effects on the succeeding crops of corn and oats. The stalks and leaves decompose readily and are easier to disc in than corn or sorghum.

Castorbean seed shattered in the harvesting operation will volunteer the next year. Since castorbean plants and seeds are poisonous, the following crop should be one in which volunteer castorbeans can be well controlled. Care must be taken to prevent the seed from getting into grain that may be used for feed or food. 2,4-D sprays can be used to eliminate volunteer castorbean plants from corn, sorghum, and small grains.

Marketing

Castorbeans are grown only for the oil and must be marketed through the oil seed companies which deal with castorbeans. Potential growers should make marketing arrangements before they plant the crop. Recent prices have ranged from 5 to 7 cents per pound for seed delivered to seaboard markets.