

Technologies for Quality Seed Production in Castor

During flowering stage i.e. 45- 65 DAS. Retain plants with 1-10 ISF per spike as pollen source.

During first picking stage i.e. 90- 110 DAS Rogue out off-types based on spike type, compactness, capsule spines etc

Certified hybrid seed production

Isolation distance: Revised from 150 m to 300 m along with modified method of foundation seed production of female line.

Season and sowing time: *Rabi* and September 1st week to last week depending on the onset of winter season in different locations so that primary and secondary spikes coincide with cool season. If sowing is delayed beyond October, flowering period experiences higher temperatures in January or February resulting in higher number of ISF in female lines, leading to hybrid impurity (Self seed).

Row ratio: 3-4 rows female line: 1 row male with male lines all around the borders to ensure continuous pollen supply and avoid contamination from other sources.

Spacing: 90-120 cm x 60 cm. **Seed rate :** Female line: 2-3 kg/ac, male line : 1 kg/ac.

Roguing

The main principle in roguing of certified hybrid seed production is to keep the female line as completely female and get it fertilized by the desirable male or pollen line.

First stage (<30 days prior to primary spike initiation)

Morphological off-types both in female and male lines should be removed.

Second stage: In female line, remove, in addition to morphological off types, sex variants like monoecious, ISF in pistillate, revertants, hermaphrodite or bisexual flower at the tip of the spike. **In male lines:** Rogue out morphological off-types and monoecious plants with male flowers beyond 2nd whorl of flowers on main axis.

Third stage of roguing at secondary spike initiation:

Rogue out morphological off-types based on capsule

spininess, spike shapes, compactness of capsules etc. Rogue out sex-variants like revertants in second or third order and ISF in female lines. Production of ISFs increase with high temperature, low nutrition and moisture stress etc.

Fourth stage of roguing at tertiary spike initiation: Rogue out early revertants, plants with ISF, hermaphrodite.

Harvesting

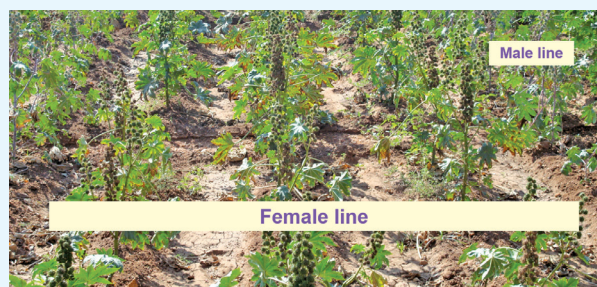
Harvest at physiological maturity when capsules turn light green and few bottom capsules dry.

Male line has to be Harvested and kept separately. Later harvest female line (hybrid seed) spike order wise and store separately. Do not collect dropped capsules.

Seed yield: Hybrid: 3-6 q/ac from female; Male: 4-5 q/acre.

Seed Standards

Factor	Standards for each class	
	Foundation	Certified
Stage of seed production		
Pure seed (minimum)	98.0%	98.0%
Inert matter (maximum)	2.0%	2.0%
Other crop seeds (maximum)	None	None
Weed seeds (maximum)	None	None
Seeds of other distinguishable varieties (maximum)	5/kg	10/kg*
Germination (minimum)	70%	70%
Moisture (maximum)	8.0%	8.0%
For vapour-proof containers (maximum)	5.0%	5.0%



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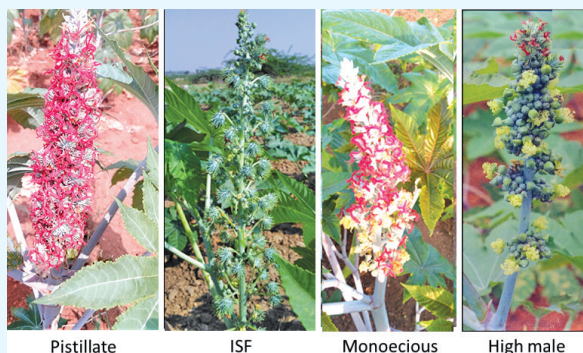
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Castor (*Ricinus communis*), is an important industrial oilseed crop with 45-55% oil and a unique fatty acid, ricinoleic acid (80-93% of oil). Castor oil and its derivatives are used in the manufacture of several industrial products like lubricants, medicine, laxatives, nail polishes, paintings etc. India accounts for 69% of the world's castor area and 85% of the production with a highest productivity of 1.8 t/ha (2016-17). Commercial exploitation of heterosis in castor led to a rise in productivity from 0.3 t ha^{-1} to $1.8 \text{ t ha}^{-1}</math> during the last five decades in India. More than 90 percent castor growing area, especially under irrigated conditions is occupied by castor hybrids.$

Castor is monospecific and belongs to family Euphorbiaceae ($2n=20$). Castor is a highly cross-pollinated crop by wind and insects to some extent as pollinating agents. Seed production in castor is challenging due to environmentally sensitive sex expression in parental lines. Success of seed production depends on good seed source, isolation distance and roguing.

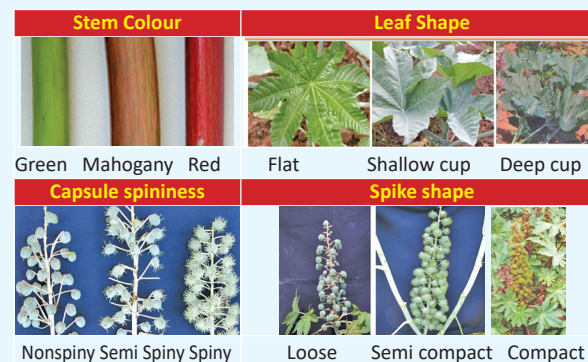
Basic Sex expression forms in castor: **Monoecious:** a spike with basal 1/3rd to half portion filled with male flowers and the upper portion female flowers; **Pistillate:** a spike with female flowers completely; **Interspersed Staminate flowers (ISF):** Staminate (male) flowers interspersed throughout the spike; **Revertant:** A pistillate spike that reverts to monoecious in later orders



Sex expression in castor is highly influenced by environmental conditions. Winter season, <math><30^{\circ}\text{C}</math> monthly

mean temperatures, young age of plants, high nutrition especially nitrogen promote female flowers in different spike orders. Where as summer season, $>32^{\circ}\text{C}$ monthly mean temperature, old age or late order spikes, low nutrition or nitrogen promote male flowers in different spike orders

Morphological characters: Castor has wide variation morphological characters like stem color, bloom and capsule spines, Plant type (Normal /dwarf), Branching (Divergent/ convergent), Shape of spikes (Conical, cylindrical, umbrella) etc.



Isolation requirement and time of sowing:

S. No.	Seed production stage	Isolation distance (m)	Season / time of sowing
Varieties and male parents of hybrids			
1	Foundation	600	June 2 nd Fortnight
2	Certified	300	
Female parents of commercial hybrids			
3	Foundation	1000	January 2 nd Fortnight
4	Certified hybrid	300	September 2 nd Fortnight

Seed Production of varieties or male lines:

Spacing: 90x45 cm or 90x60 cm; **Seed rate:** 2-3 kg/ acre

Roguing

First stage (Before flower initiation <math><30-45</math> days after sowing): Remove the morphological deviants

Second stage (During flowering stage i.e. 45- 65 DAS): Flowering of spike extends over a period of 10 to 15 days.

Keep the number of nodes to primary within the stipulated range. carry out second roguing for three to five rounds at intervals of two to three days to avoid any possible leftovers. Select highly pistillate or monoecious plants with male flowers restricted to the basal two whorls to ensure better productivity of varieties or male lines.

Third stage: During first picking stage i.e. 90-110 DAS, remove off types based on capsule spiny nature.

Seed production of castor hybrids

Castor hybrids are produced using a two line system, female (pistillate) and male (monoecious/ISF). Hybrid seed production involves 2 stages - 1. Foundation seed production of female and male lines and 2. Certified hybrid seed production.

Foundation seed production of female lines: Two methods are followed -Conventional and refined or modified method based on the pollen source used for seed production of female line.

Conventional method: Pistillate line maintained by allowing 25% monoecious or revertants in the female line as pollen source. It leads to low genetic purity and high roguing in hybrid seed production plots.

Refined or modified method: Pistillate lines are maintained in summer season to allow environmentally sensitive expression of interspersed staminate flowers (ISFs), which pollinate the pistillate line. There is no separate maintainer line or pollinator in this method. Pistillate line produces ISF in summer or $>32^{\circ}\text{C}$ but remain pistillate in the cool season.

Foundation seed production of female (pistillate) line by refined method

Plot selection: Fertile, neutral pH plots with irrigation and drainage facility without any voluntary castor plants.

Seed rate: 3-4 kg/ acre with 90-120 x 60cm spacing

Rouging: Remove morphological off-types based on stem color, bloom, plant type, leaf shape, spike type, capsule type, plant type etc. and sex variants like Monoecious and revertants at different spike orders-primary, secondary, tertiary etc.