Modern Production Technologies for Sustainable Castor Cultivation

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Introduction

Castor (*Ricinus communis* L.) is a unique oilseed crop known for its hardy nature and industrial importance. Unlike many other oilseeds, castor thrives in dry and marginal lands, making it a lifeline for farmers in arid and semi-arid regions. Its oil, rich in ricinoleic acid, is highly valued across industries—from lubricants and cosmetics to pharmaceuticals and biofuels. India is the global leader in castor cultivation, with states like Gujarat, Rajasthan, Andhra Pradesh, and Telangana contributing the most. While the crop has shown resilience to challenging environments, its full yield potential is often not realized due to outdated farming practices, imbalanced nutrient use, and pest challenges. In recent years, significant progress has been made in castor production technology. The development of high-yielding hybrids, improved soil and water management practices, and integrated pest and disease control strategies have opened new opportunities for increasing productivity and profitability.

Season and Climate

Castor is a versatile crop that can be cultivated throughout the year, particularly in tropical regions. It performs best under warm climates with moderate rainfall. An annual rainfall of 600–800 mm, well-distributed over the growing period, is ideal. The crop is sensitive to prolonged droughts and water stagnation, especially during critical growth stages like flowering and seed setting.

- **Kharif season**: June – July
- **Rabi season**: September – October
- **Summer season**: January – February

Soil Requirements

Castor grows well in red sandy loam soils with good drainage. While it can tolerate a range of soil types, well-drained soils are essential, as castor is sensitive to waterlogging. Poorly drained or compacted soils can adversely affect root development and yield. A neutral to slightly alkaline pH (6.0 to 7.5) is considered optimal for healthy crop growth.

Popular Castor varieties in Andhra Pradesh

S. No.	Variety/ Hybrid	Year of release	Duration (days)	Yield (q/ha)	Special Characters
Varieties					
1	Kiran (PCS-136)	2002	90-150	13-15 (R) 18-20 (I)	Red stem, double Bloom, non-spiny capsules. Moderately tolerant to *Botrytis*, Medium maturity, suitable for rice fallows, tolerant to drought
2	Jwala (48-1)	2007	90-180	11-12 (R) 18-20 (I)	Red stem, double bloom and non-spiny capsules. Resistant to fusarium wilt and moderately tolerant to *botrytis*
3	Pragathi (PCS-262)	2016	80-160	15-18(R) 18-20 (I)	Red stem with and double bloom. High oil content and test weight, Resistant to *Fusarium* wilt
Hybrids					
1	PCH-111	2012	90-180	14-15(R) 22-25 (I)	Green stem, double bloom, spiny capsules. Resistant to *Fusarium* wilt and moderately tolerant to sucking pests, semilooper and spodoptera
2	PCH-222	2012	90-180	16-18 (R) 35-38 (I)	Red stem, double bloom, spiny capsules. Resistant to *Fusarium* wilt
3	ICH-66	2019	90-180	15-17(R) 22-25(I)	Red stem, triple bloom, semi spiny capsules. Resistant to *Fusarium* wilt *Macrophomina* root rot and leafhopper
4	ICH-5	2022	90-180	15-16 (R) 25-28 (I)	Resistant to *Fusarium* wilt *Macrophomina* root rot and leafhopper

Seed Rate and Sowing

Proper seed rate and spacing are crucial for optimal plant population and better resource utilization in castor cultivation. The requirements vary based on soil type and moisture availability.

Situation	Seed rate (kg/ha)	Spacing(cm)
Rain fed	5.0	90 cm x 60cm
Heavy soils, irrigated	5.0	90 cm x90cm or 120cm x60cm
Light soils, irrigated	7.5	90 cm x 60cm

Nutritional Management

Efficient nutrient management plays a vital role in enhancing castor yield and maintaining soil health, especially under rainfed and resource-constrained conditions.

Basal and Fertilizer Application

- Apply FYM @ 5 t/ha as a basal dose, particularly under rainfed conditions to improve soil structure and microbial activity.
- For varieties under rainfed conditions, apply 60:40:30 kg N:P_2O_5: K_2O/ha, with:
  - 30 kg N as basal, and
  - The remaining 30 kg N in two equal splits at 30–35 DAS and 60–65 DAS.
- For hybrids under irrigated conditions, apply an additional 15 kg N/ha during each flush of later-order spike emergence to support higher nutrient demand and sustained yield.

Micronutrient Management – Zinc

In zinc-deficient soils (Zn < 0.6 ppm), symptoms include:

- Shortened internodes
- Reduced leaf size
- Delayed maturity
- Poor seed filling

To correct zinc deficiency, spray 0.5% $ZnSO_4$ solution at 50 and 90 DAS. This not only improves growth and seed development but also helps reduce sucking pest incidence.

Integrated Nutrient Management (INM)

INM promotes the combined use of organic, inorganic, and biological nutrient sources to ensure long-term soil fertility and sustainable productivity.

For rainfed castor: Apply 50% Recommended Dose of Fertilizers (RDF) + Seed treatment with Azospirillum + 25% N through FYM.

Under normal rainfall conditions: Application of FYM + 100% RDF has shown to give the highest seed yield.

Integrated Weed Management (IWM)

Weed competition, especially during the early growth stages, can significantly reduce castor yield. An effective Integrated Weed Management (IWM) strategy combines chemical and mechanical methods to ensure better weed control and crop growth.

Recommended IWM Module

- Pre-emergence application of Pendimethalin @ 1.0 kg a.i./ha (equivalent to 1.3–1.6 L/ha) within 2–3 days after sowing (DAS) in moist soil conditions.
- Post-emergence application of Quizalofop-p-ethyl @ 50 g a.i./ha (i.e., 300–400 ml/ha) to control grassy weeds.
- Two intercultivations (IC) at 20–25 DAS and 40–45 DAS.
- One hand weeding to manage broadleaf and resistant weed species.

Irrigation Management: Although castor is a drought-tolerant crop, timely supplemental irrigation can significantly improve yield, especially under rainfed conditions. Providing two supplemental irrigations of 20 mm each through drip irrigation during critical growth stages *viz.*, primary spike development and secondary spike development helps in mitigating the impact of dry spells.

Maturity and Harvesting

Castor is an indeterminate plant and is characterized by sequential flowering and spike formation. So, different order spikes come to maturity at different times. But, harvesting of matured spikes at right time before the seeds fall on the ground, is very important. The spikes can be harvested at physiological maturity or when colour of 60-70% of the capsules in a spike change from green to light yellow or brown. Yield loss will be significant if harvesting is delayed until all capsule in the spikes are fully dried.

In view of labour shortage utilization of castor threshers will reduce the damage to the capsules and increases the efficiency of threshing operation resulting in the more out turn and also more remunerative price. Nearly 12 labour and 10 hours' time per hectare can be saved due to mechanization of harvesting and threshing. Seeds has to be dried for 2-3 days till they attain safe moisture content of 9-10% and finally seeds are stored in gunny bags.

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