“SEA-Global Castor Conference-2024”

22-23 February, 2024, Ahmedabad, Gujarat

“Role of quality seed for raising Castor Productivity & Production ”

Dr. V. R. Akabari

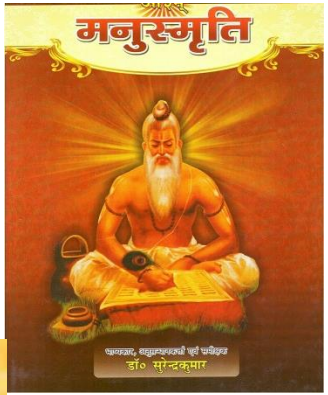
Assistant Research Scientist
Junagadh Agricultural University,
Junagadh

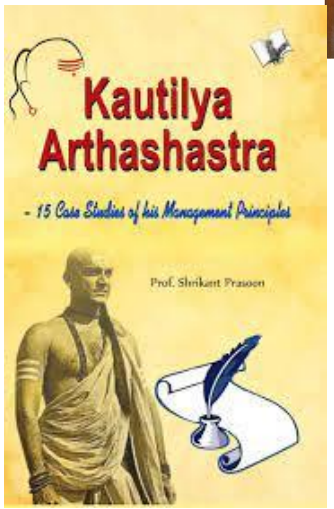
Introduction

- Seed refers to the fertilized, matured ovule that contains an embryonic plant, stored material and a protective coat or coats.
- Seeds are the keystone of agriculture.
- Expertise has restructured farming's to a great extent in day-to-day operations, but without a sturdy supply of high-quality seed, yields and crop eminence would be greatly decreased.
- Achieving and maintaining high seed quality is the goal of every professional seed producer.

Introduction

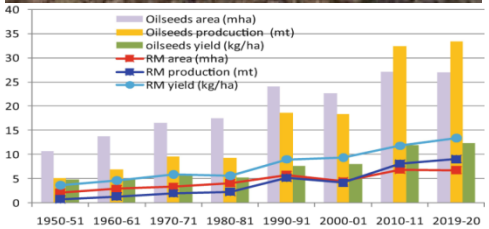
- The importance of quality seeds has been recognized from the time immemorial. The old scripture, Manu Smriti says “Subeejam Sukshetre Jayate Sampadyathe” i.e., Good seed in good soil yields copiously.
- In 5th century, Kautilya Artha Shasthra, mentioned seed dressing with milk, cow dung and honey to protect the seed during germination.





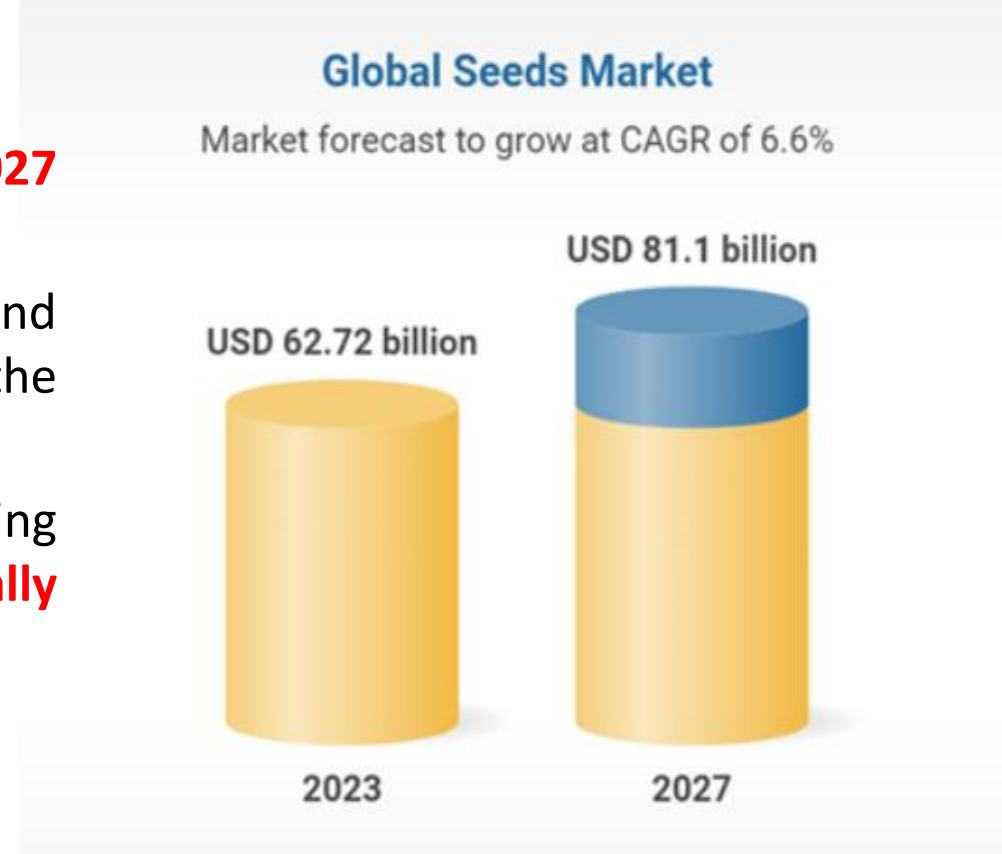
Introduction

- Food and nutritional security for the ever-growing population is the major challenge!
- Global population– 8.0 bn & India – 1.40 bn
- Access to good-quality seed: fundamental and most vital in crop production systems
- Seed - primary input for agriculture and allied industry
- Yields & productivity depends on the quality of seeds used by farmers
- Seed trade: supporting agriculture development & food security



Global Seed Scenario

- Global seed market: Now $**63 billion**
- Expected to register $ **81 billion by 2027** with CAGR of 6.6 %
- **Growing demand** for grains, oils, and vegetables is a significant driver for the seeds market
- Other reasons being the shift in farming practices, **adoption of commercially produced seeds by farmers**



Seed Development in Castor

- **The seed development occurs in three phases:**
- **Phase I: cell division:** Begins with ovule fertilization, ends when the seed has the maximum number of cells. During this phase, there is negligible accumulation of reserves (oil, protein, and starch), the seed grows close to its final size, and the water content keeps higher than 85%.
- **Phase II: seed filling:** Linear increase in the dry weight due to reserves accumulation. Usually, the Phase II does not overlap the cell division phase, and it ends when the seed reaches the physiological maturity.

  Physiological maturity: the seed reaches its maximum dry weight.
- **Phase III: desiccation phase:** Seed loses connection with the mother plant and passively loses water at a rate depending on environmental conditions.

Seed growth rate and seed filling duration

- Castor seed takes **60 days** for complete development, the seed expansion (length and width) occurs in around **19 days** after pollination, and minimal expansion occurs afterwards **(Chen *et al*., 2004)**.
- **Vallejos *et al.* (2011)** confirmed that the transition from Phase I to Phase II in castor seed occurred around **20–23 days** after pollination. SGR was found varying from **10.35 to 11.65 mg/day and the SFD varying from 30 to 51 days**. There was no difference among racemes of different orders
- **Severino (2012)** reported that SFD was **not influenced** in castor plants subjected to **reductions in source (defoliation) and sink (inflorescence clipping)**. Early flower initiation is commonly used as an indicator of earliness. However, an early maturation will depend also on a shorter SFD,

Castor seed content during growth

- The water content is at its maximum in the beginning of Phase I, and it continually decreases as reserves accumulate in the seed. In castor seed, physiological maturity was reached when the relative water content reached 22% (Vallejos *et al*., 2011)
- Oil and proteins accumulate in castor seeds at the same time, and there is negligible change in the balance between those two components during seed growth (Lucena *et al*., 2010).
- Ricin was among the proteins that begin accumulating in the early seed growth. It was first detected in castor seed at 28 days after pollination (Barnes *et al*., 2009).

Seed abortion

- Seed abortion is the reason that many ovules do not develop into seeds. Seed abortion can occur at any time before the beginning of dry matter accumulation in Phase II (Egli, 1998; Duthion and Pigeaire, 1991).
- The frequency of aborted seeds in castor plants varied from 3.1% in well-watered plants to 8.5% in drought-stressed plants. The probability to abort was not associated with the position in the raceme (bottom or top).
- A defoliation treatment applied after the raceme initiation significantly increased the frequency of aborted seeds from 4.5 to 14.8%, but a sink reduction did not influence the seed abortion rate (Severino, 2012).

Hence the quality seed should have

- High genetic purity
- High pure seed percentage (Physical purity)
- High germinability and vigour
- Higher field establishment
- Free from seed born disease
- Good shape, size, colour etc., according to the specification of variety
- High longevity / shelf life.
- Optimum moisture content for storage

- **Success in producing quality seed in castor in one area and failure in another area illustrates the importance of environmental influence on seed development and maturation.**

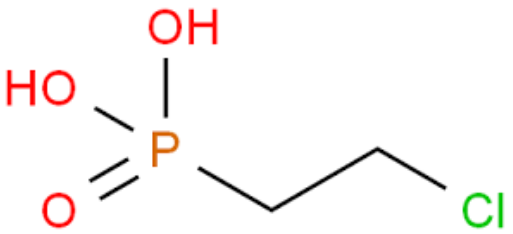
- **The stage of seed development at harvest also affects seed quality. The castor seeds mature sequentially within and between the racemes, leading to a variation in maturity stages at harvest. Seeds from different racemes are reported to vary in seed vigour, size and weight (Severino *et al*., 2013).**

- **In castor, seed weight is positively correlated with the germination ability and oil recovery from the seeds, *i.e.*, heavier seeds have better performance than light seeds (Severino *et al*., 2013).**

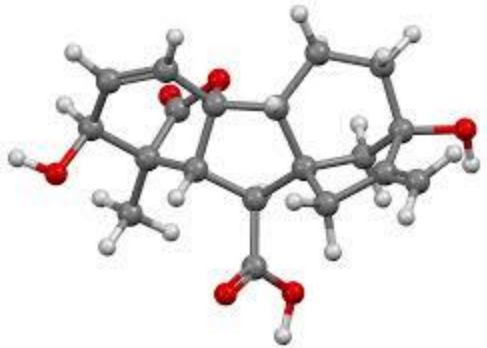
- **Production of high quality seeds does not happen by chance. Each step in the production system from planting the proper seed in appropriate time to following weed control practice, fertility program and harvest in the right time, cleaning the seeds, storage, and shipping is critical for achieving high quality seeds.**

Effect of chemical on quality seed in production in castor

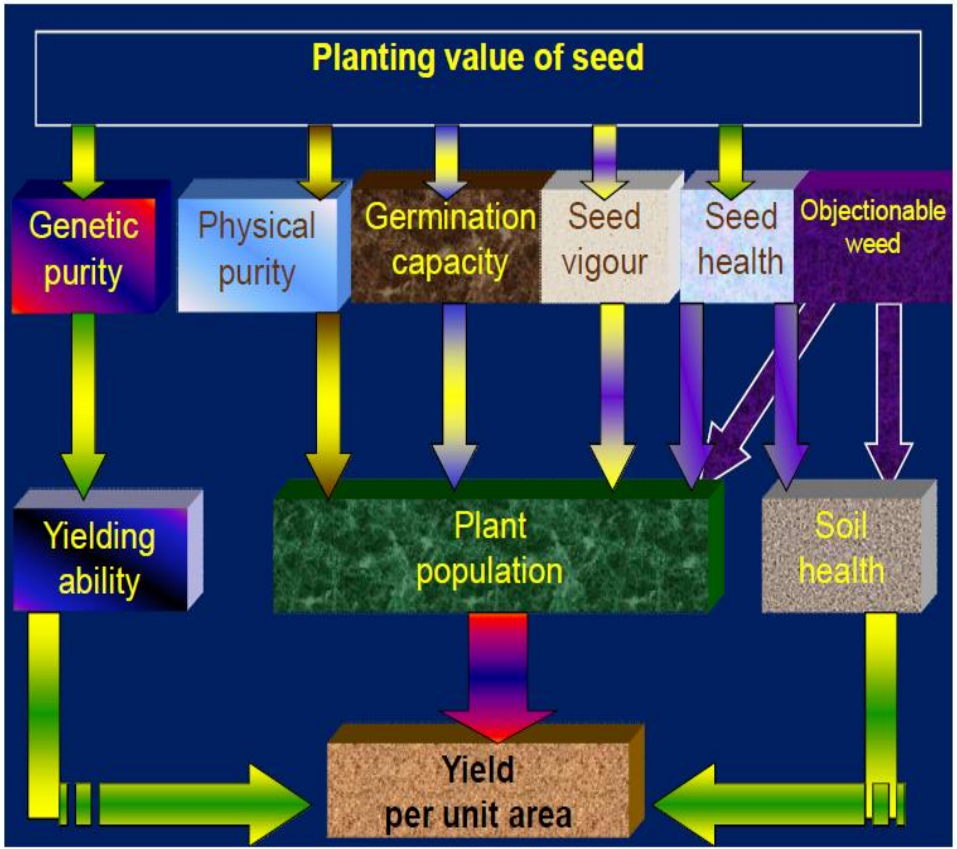
- **Dhedhi *et al.* (2010) -** The application of **ethrel 0.05%** at 45 and 65 DAS significantly **suppressed** the expression of **male flowers** (ISF), **increased** the tendency of **pistillate plants** and to produce quality seed.



- **Rajiv kumar *et al.* (2015)** - **Ethrel 0.1%** treated pistillate line exhibited **significantly less number of the ISF in primary spikes**. In addition, ethrel spray lead to reduced length of primary spike, increased spike compactness, early induction of flowering, early spike development, stunted stigma growth and reduced plant canopy.



Role of quality seed in production and productivity



- Ensures genetic and physical purity -Gives desired plant population
- Seedlings produced will be **more vigourous, fast growing** and can **resist pest and disease incidence** to certain extent.
- Capacity to **withstand the adverse conditions**
- Ensures **uniform growth and maturity**
- Development of root system will be more efficient that aids **absorption of nutrients efficiently** and result in higher yield.
- It will **respond well to added fertilizer** and other inputs.

- Seed is the ***indispensable input*** in agriculture. The cost of seed is typically **~5%** of the total cost of production. Yet it alone could contribute **10-15% yield increase**.
- It is the carrier of **genetic improvement** (internal), as well as **supplementary technologies**, which could be external or internal, and Incremental or Disruptive .
- *The goal is to maximize the planting value of every seed especially during emergence, stand establishment, and early growth stages both under optimal and sub-optimal conditions.*

Seed: Carrier of genetic improvement

Name of hybrid	Female	Male	Year of release
GCH 3	TSP 10 R	JI 15	1968
GAUCH 1	VP 1	VI 9	1973
GCH 2	VP 1	JI 35	1985
GCH 4	VP 1	48-1	1986
GCH 5	Geeta	SH 72	1996
GCH 6	JP 65	JI 96	1997
GCH 7	SKP 84	SKI 215	2007
GCH 8	JP 96	DCS 89	2017
GCH 9	SKP 84	PCS 124	2018

GCH-9: New released hybrid (2017)

Seed: Carrier of genetic improvement

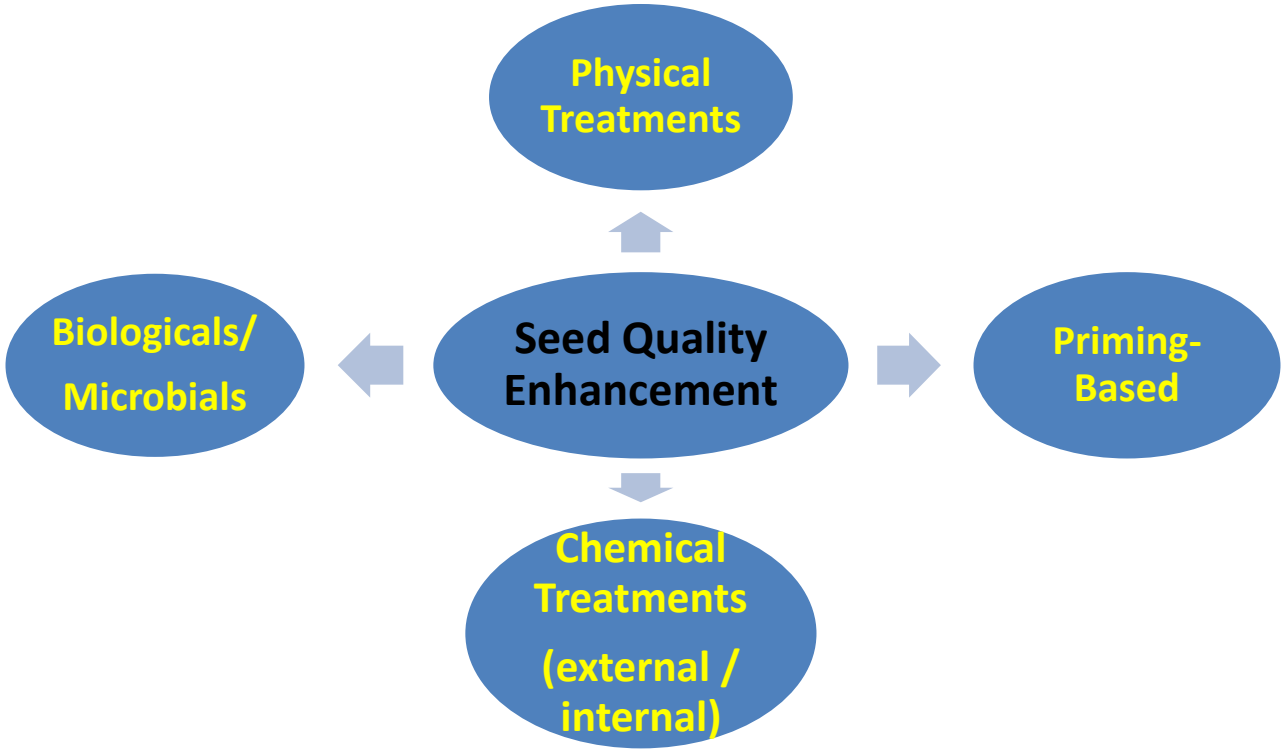
Year	Area (00 ha.)	Production (00 MT)	Productivity (kg/ha)
1995-96	3881	6134	1580
1996-97	3712	7371	1986
1997-98	3482	6865	1971
1998-99	3483	6945	1994
2006-07	3271	5888	1800
2007-08	3581	7083	1978
2008-09	4339	8517	1963
2009-10	4216	8314	1972
2018-19	5219	9443	1809
2019-20	7366	14321	1944
2020-21	6529	13452	2060
2021-22	6503	14016	2155

Release of GCH 5 and GCH 6

Release of GCH 7

Release of GCH 9

Types of Seed Enhancement Technology

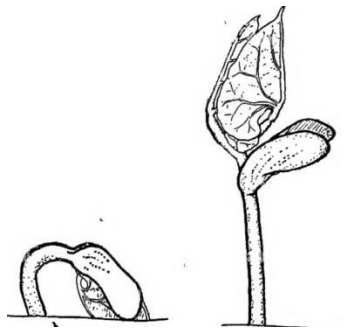


Role of quality seed in production: Castor Seed Priming

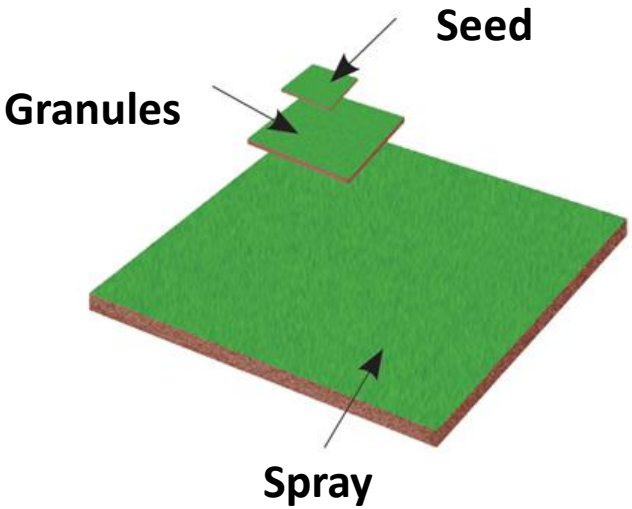
- Percentage of seed germination, germination index, speed of germination, seed vigour index, seedling shoot and root length, seedling root volume, seedling root and shoot dry weight and relative water content of castor were significantly higher with 2 per cent $ZnSo_4$ primed seed, **Hydropriming with 2 per cent $ZnSo_4$ for 12 hrs.** is the most promising priming technique for enhancing seedling characters and drought tolerance (**Thiruppathi *et al.*, 2018)**.

- **Lineker *et al.* (2018)** found that **priming of castor seed with $NaNO_3$ and PEG-6000** contributed most to better germination and establishment of seedlings under saline conditions.

- **Raza *et al.* (2023)** castor seed yield increase by seed **priming with salicylic acid 40 mg/L for 36 hrs.**



Reducing the Chemical Load



- By applying directly on the seed, use of pesticides can be reduced by 80-90% as compared to foliar spray
- Use of polymers further reduce the dust-off considerably
- Several inputs (biological or chemical) can be incorporated simultaneously

Thank You Very Much for Your Attention !