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BREEDING IN MAIZE



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Maize

- **Scientific name** - *Zea mays*
- $2n=2x=20$
- It also known as **queen of cereals** and **Drosophila** of crop plants.
- **Family**-Poaceae or Gramineae
- **Origin**-Mexico, Central America
- It is the crop under highest **researched**. Among all cereals in production it **ranks 1st** and it is mainly used for feed (61 %).



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- **Distribution-** USA, China, Canada, South Asian countries
- **Progenitor-** *Zea tunicata* & *Zea teosinte*
- **Wild Relatives :**
 - The gene **Zea** characterised by **male terminal inflorescence** with paired staminate spikelet and **lateral female inflorescence** with single or paired pistillate spikelet.
 - 1. *Zea mays* (corn) - $2n=2x=20$
 - 2. *Zea Mexicana* (annual teosinate) $2n=2x=20$
 - 3. *Zea perennis* (perennial 4x teosinte) $2n=4x=40$
 - 4. *Zea diploperennis* (perennial diploid teosinte) - $2n=2x=20$



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Breeding Objectives :

- **1.Yield-**
 - Complex character controlled by **polygenes**. Attention paid to have ideal plant type. **Mock and Pearce** 1st gave **ideotype** of maize. For maize varietal hybridization is not popular as difficulty in getting superior segregants.
- **2.Breeding for resistance-**
 - Shootfly, Heliothis are major pest to which **Mexican varieties** are resistance. **Downymildew, leaf blight** are major diseases. **Co1 & CoH2** are resistance and **Taiwan** line resistance to **downymildew**. **CMS- T** susceptible to Helminthosporium but **CMS-C & CMS-S** are resistance.



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- **3. For protein -**

- **Lysine** and **tryptophan** are main amino acids.

Protein of endosperm is called **Zein** contain **less lysine and tryptophan** thus nutritionally unbalanced but constitutes 80%. Embryo contains **20% protein** which have high **amino acid content**. Quality Protein Maize(QPM) examples-**Shakti, Ratan, Rotina**.

- **4. For oil-**

It have **linoleic** and **linolenic acid**. Germ (embryo) contain **12 to 15 % oil** .

- **5. High yielding baby corn-**

Zea mays var. sachharata - **green cob** can be eaten as salad.

CoBc 1 is latest variety of baby corn.



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Breeding Methods-

- **1.Introduction-**
- Portugeese 1st introduced maize to India which were Mexican lines.Initial varieties were all introduced one like **Sikkim primitive 1& 2.**
- **2.Mass selection-**
- Before **1945** mass selection was only method. Some mass selected varieties are **KT 1 in UP** and **RAS 1 in Rajasthan.**



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• **3. Ear to row method-**

- Proposed by **Hopkins** for **oil and protein** content improvement. This method is suitable for characters having high heritability like oil and protein Content but not for yield.

• **4. Modified ear to row method-**

- Proposed by **Lonquist**.
- Here single head harvested are raised in progeny rows in more than one location with local check .In main station the progeny rows used as crossing blocks. Pollen from best plant collect ,mixed and used for crossing. Based upon performance of overall location only 20% plants selected and sown in progeny row and cycle continued.



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• **5. Hybridization and selection-**

- Not popular as isolation of superior recombinant are not made.
- 1st hybrids are Ganga101, Ganga1, Decan, Ranjit. All are double cross hybrids.

• **6. Heterosis Breeding-**

- Instead of **CGMS**; detasseling of female inbred line if less costlier and followed in India. Crossing with inbred with **exotic origin** resulted best hybrids.
- Indian x Indian - 24 to 43% increase in yield
- **Indian x US dent-58% increase in yield**
- Indian dent x Caribbean Flint - 47 to 54% increase in yield



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- a. Single cross hybrids
- b. Three way cross hybrids- Ganga5 , Trishulatha
- c. Double cross hybrid- CoH3
- d. Double too cross hybrids- Whit kernal hybrid,Ganga safed 2,Histarch,Ganga4

7.Population Improvement :

Recurrent selection technique was initiated by Dhawan in **1963**.The objective is isolate superior inbreeds from population for their utilization for hybrid and synthetic variety production.



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Important points on Maize :

- **Inflorescence:**

- It is a **monoecious plant** & shows **protandry** thus cross cross pollinated. Male inflorescence is terminally present called **tassel** (compound spikelet) and female inflorescence present in lateral axil called **cob(spadix)**.

- **Institutes & programs:**

- **CIMMYT**- International Maize and Wheat Improvement Center, **Mexico**
- **IIMR**- Indian Institute of Maize Research,**ICAR**
- **Maize Research Center, Hyderabad.**
- **AICRP** on Maize in **1957**.



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