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BREEDING OF SORGHUM AND PEARL MILLET



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SORGHUM

- Scientific name:- Sorghum bicolour
- Family:- Gramineae
- Chromosome no(2n) = 20



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CENTRE OF ORIGIN

- It is generally accepted that Ethiopia is the centre of origin of Sorghum.

DISTRIBUTION

1. Global distribution:- the major sorghum producing countries are Africa, India, China, Pakistan, USA, Australia, Argentina and Mexico.
2. National distribution:-In India major sorghum growing states are Maharashtra ,Gujarat, Tamil Nadu, Karnataka ,Rajasthan and Madhya pradesh.



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WILD SPECIES

- The important wild species are Sorghum bicolor spp. arundinaceum ($2n=20$) , Sorghum halepense ($2n=4X=40$) .
- The diploid wild species S.arundinaceum($2n=20$) is considered to be the likely ancestor of cultivated sorghum.



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BREEDING OBJECTIVE

In sorghum major breeding objectives are:-

1. Higher grain yield :- Major yield components are panicle size and type , grains per panicle productive tillers per plant and test weight.
2. Quality :- Quality characters include chapatti and bread making qualities, protein and lysine content etc.
3. Disease resistance :- Major disease are leaf blight , zonate leaf spot, downy mildew, rust, ergot or sugary disease and charcoal disease.
4. Insect resistance:- in india stem borer ,stem fly and migde are importance disease.
5. Striga is a root parasite weed in sorghum.



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BREEDING PROCEDURES

- Breeding approaches which are used for sorghum improvement are of two type as presented below:-
 1. General method :- these methods includes introduction , pureline selection ,pedigree breeding ,back crossing and composite breeding .
 2. Special method:- such methods include mutation breeding disruptive mating and selection and biparental mating.



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PRACTICAL ACHIEVEMENT

- Hybrids are developed by using cytoplasmic male sterility.
- Kafir 60 is the source of male sterility.
- High lysine ethiopian mutant (IS 11167 and 11758) are used for quality improvement.
- Some important high yielding varieties and hybrids are :-
 1. Hybrids :- CSH 1, CSH 2, CSH 3 for kharif and CSH 7, CSH 8 and CSH 12 for rabi season.
 2. Varieties :- swati, CSV 1, CSV 2 for kharif and CSW7 and CSW 8 for rabi season.



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PEARL MILLET

- Scientific Name : *Penisetum americanum*
- Chromosome No : $2n=14$
- Origin : West Africa
- Distribution : Africa, India, Pakistan, South East Asia, USA and Europe



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Taxonomy

The genus Pennisetum is having more than 140 species. Stapf (1954) has divided the genus Pennisetum in to five sections viz.,

- 1. Gymnothrix
- 2. Eupennisetum
- 3. Penicillaria
- 4. Heterostachya
- 5. Brevivalvula
- THE cultivated Pennisetum glaucum belongs to the section penicillaria.



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Progenitors

- *Pennisetum purpureum*
- *P. qumulatum*
- *P. orientale*



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Wild relatives & forms

- 1. *P. perottettii*
- 2. *P. mollissimum*
- 3. *P. violaceum*
- 4. *P. versicolor*
- 5. *P. adonense*
- 6. *P. gymnothrix*
- The cultivated species of pennisetum is believed to have originated through hybridization with in these six species.



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Breeding objectives

- 1. Breeding for high grain yield
- 2. Breeding for improved grain quality
- 3. Breeding for drought tolerance



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4. Breeding for disease resistance
5. Breeding for alternate source of cytoplasm in male sterile plants
6. Breeding for to have high forage value



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Breeding procedure

1. Introduction : Hybrid bajra from Punjab.

Tift 23 A from USA

2. Selection : Pure line selection : Co 2, Co 3,

3. Hybridisation and selection

Interspecific hybridisation

Pennisetum glaucum X *P. purpureum*

Cumbu napier hybrids



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- **4. Heterosis breeding : Hybrid bajra**
- In earlier days before the identification of male sterile lines utilising the protogynous nature hybrids were released. The hybrids were produced by sowing both parents in the ratio of 1:1.
- After the discovery of cytoplasmic genic male sterile line Tift 23A by Burton in Tifton, Georgia led to development of hybrids. Earlier hybrids of India *viz.*, HB1, HB2 to HB5 were produced utilising Tift 23 A
- **5. Population improvement :**
- ICRISAT entry WCC 75 is an example for population improvement. This was developed from world composite by recurrent selection method. It was developed from derivatives of numerous crosses between diverse sources of germplasm and Nigerian early maturing land races known as 'Gero' millets. Another example is ICMV 155 of ICRISAT.



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- **6. Synthetic varieties :**
- Synthetics are produced by crossing in isolation a number of lines tested for their GCA. E.g. ICMS 7703.
- It is a result of crossing between 7 inbred lines of India x African crosses
- **7. Mutation breeding**
- At IARI Tift 23 A was gamma irradiated and 5071 A resistant to downy mildew was evolved. With this the hybrid NHB 3 was evolved (5071 A x J 104)



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- **Breeding centers:**

- International Crops Research Institute for Semi Arid Tropics (ICRISAT,) Hyderabad
- All Indian Pearl Millet improvement project (AIPIP) Jodhpur (Rajasthan)

- **Practical achievements**

- Varieties: PS B – 8, PSB 15, mukta
- Hybrids : HHB 45, HHB 50 from Hissan GHB 30, GHB – 27 from Gujarat

