

PEARL MILLET
***Pennisetum glaucum* (2n = 14)**
(Cumbu, Bajra, Bulrush millet)

Origin : West Africa.

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.

Origin and putative parents.

Stapf included 32 species in penicillaria. Of these 32 species found in Africa, six annuals are considered wild and probable ancestors of the cultivated one. They are

1. *Pennisetum 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.

Wild species utilised in breeding :

The other species in this section is *P. purpureum* a rhizomatous perennial having chromosome number $2n = 28$

cumbu napier hybrid = BN1

Tetraploid x Diploid - Triploid.

P. squamulatum ($2n = 46$) - Drought and cold resistant having apomictic line crossed with *P. glaucum* to evolve superior cold resistant fodder.

P. orientale : used for transferring apomixis.

P. setaceum *P. violaceum* : To transfer male sterile genes to *P. glaucum*

Inter generic crosses :

Buffel grass *Cenchrus ciliaris* or *Pennisetum ciliare* utilised to cross with cumbu for fodder improvement

Breeding objectives :

1. Breeding for high grain yield

To get high yields the following plant characters are necessary

- a) more number of tillers
- b) well filled, compact, long panicle.
- c) heavy grains.
- d) Uniformity of ripening.

Under irrigated conditions photo insensitivity and early maturity are essential for multiple and relay cropping.

2. Breeding for improved grain quality.

It can be achieved by incorporating yellow endosperm to improve vitamin A content or white endosperm to improve protein content.

3. Breeding for drought tolerance :

This can be achieved thro' evolving lines having shorter duration so that they can escape drought, lines with more adventitious roots, lines with high leaf water potential and high chlorophyll stability index are to be evolved.

4. Breeding for disease resistance

Downy mildew is the major disease. Ergot and smut comes next. Of late, rust at late stage is also becoming a major problem.

Lines having Local Bellary cytoplasm (732 A) are observed to be downy mildew resistant.

5. Breeding for alternate source of cytoplasm in male sterile lines.

Original Tift 23 A evolved at Tifton, Georgia is highly susceptible to downy mildew. Because of this the HB series went out of cultivation. The indigenous 732 A obtained from Bellary is resistant. Similarly L 111A of Ludhiana is also tolerant. A₁, A₂, A₃ and A₄ are there 732 A belongs to A₄ cytoplasm.

6. Breeding for sweet cumbu to have high forage value :

The forage cumbu must have following characters.

- a) high sugar content in the stem juice
- b) Increased leaf number with more breadth.
- c) Digestibility.

In this connection, short day plants with photo sensitiveness is preferred because they remain in vegetative phase for longer periods. It is ideal to breed dwarf varieties with reduced stem height

Wild species utilised.

P. purpureum

P. squamulatum

p. orientale

p. ciliare

Methods of breeding

1. Introduction : Hybrid bajra from Punjab.

Tift 23 A from USA

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

Mass selection the earlier released variety Co5 is result of mass selection. The variety Co6 is selection from Nigerian accession MS 7625 selected for high tillering, long panicle, dense seed setting and bold seeds along with downy mildew resistance.

3. Hybridisation and selection

Interspecific hybridisation.

Pennisetum glaucum x *P.purpureum*



Cumbu napier hybrids.

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.

X₁, X₂, X₃ are examples for this. In this case two hybrids are obtained.

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. But due to susceptibility to downy mildew they went out of cultivation. Even before the discovery of CGMS lines by Burton it was discovered by Madhava Menon and his coworkers at Coimbatore. Unfortunately due to failure of publishing it was not recognised.

To over come the problem of downy mildew male sterile lines L 111A and 732 A were isolated and at present used in breeding programme.

X5 L111A x PT 1921

X6 732 A x PT 3095.

X 7 L111 A x PT 1890

NHB 3 - 5071 A x J 104

There are number of CMS lines developed by private agencies like Nath seeds, Mahyco, Mahendra.

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.

At TNAU Composite Co7 was released during 1987.

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)

Future thrust :

1. Collection of un exploited land races and exotics, building up of germ plasm and utilising them.
2. Development of early maturing restorers with good combining ability.
3. Genetic and cytoplasmic diversification of male sterile lines.
4. Devising methodologies for wide hybridization and use of genetic engineering to evolve disease resistant varieties.

Bajra varieties suitable for Tamil Nadu

| Variety | Parentage | Duration |
|-------------------|-----------------|----------|
| Composites | | |
| K 3 | Composite | 85 |
| Co 7 | Composite | 90 |
| WCC 75 | Composite | 95 |
| Hybrids | | |
| X 6 | 732 A x PT 3090 | 90 |
| X 7 | L111A x PT 1890 | 90 |
| NHB 3 | 5071 A x J 104 | 90 |

TENAI (Fox tail millet)
Setaria italica ($2n = 18$)

A. Floral biology

Inflorescence is a spike, terminal, drooping. The spikelets are oval or elliptical in shape with two to three bristles. The spikelets contain two flowers partially protected by two membranous glumes. Lower floret with L_1 and P_1 , sterile; upper floret with L_2 , P_2 , stamens three, styles two, fruit a caryopsis.

B. Anthesis and pollination

Flowering proceeds from the top downwards in the main panicle and similarly from the tip down wards in each of the panicle branches. The stigmatic branches are the first to emerge. The anthers after emergence start dehiscing by longitudinal slits from the top to bottom the process taking about three minutes. Five to ten minutes after the emergence of the first anther, the other two are pushed out. After pollination the lodicules shrink and the glumes begin to close. The time taken for an earhead to complete its flowering varies from ten to fifteen days. From the third to sixth day to emergence a large number of flowers open. There are two times of flowering during a day, one between 10 p.m. and 12 midnight and other between 6 a.m. and 8 a.m. Self pollination is rule.