

CONTINGENCY PLAN OF PERAL MILLET FOR DROUGHT AND ABBERENT WEATHER CONDITIONS

Introduction

Pearl millet (*Pennisetum glaucum* (L). R. Br.) is cultivated on about 30m ha in more than 30 countries of five continents viz. Asia, Africa, North America and Australia. At individual country level, India has the largest area (7 million ha) with 9.25 million tons of production, Pearl millet is ranked third after wheat and rice and is grown in Rajasthan, Maharastra, Gujarat, Uttar Pradesh, Haryana, Tamil Nadu, Andhra Pradesh and Karnataka. Thus, most of the improved cultivars available (both open-pollinated varieties and hybrids), as such have high degree of adaptation and suitable for cultivation in drought-prone environments. However, genetic variability among these cultivars, both for maturity and drought tolerance, makes some of these cultivars more suitable for dry regions than others. Early maturity makes the cultivars more suitable by enabling them escape terminal drought (end-of-the-season). Western Rajasthan, and parts of Haryana, Gujarat, Karnataka and Maharashtra represent some of the most drought-prone environments, in term of the frequency and severity of drought, and scale at which is occurs. These drought-prone environments are characterized by low and erratic rainfall, besides its uneven distribution, acute moisture stress conditions and high evapo-transpiration. The soils are saline with pH around 8 and are also low in organic carbon, low to medium in phosphorus and high in potash content. These soils have low water retention capacity (90-120 mm of water in one meter of soil). Some of the hybrids and open-pollinated varieties, released so far by the Central Variety Release Committee of the Government of India, that are under cultivation in these environments, have been found to be especially suitable to tackle the drought problem from the cultivar perspective. There are other released cultivars that may be equally good or even better, but these are either cultivated on small scale, or have yet to be adopted in these environments.

Drought tolerant/drought avoiding hybrids and varieties

Hybrids: RHB 177, HHB 226, Bio 70, GHB 538, GHB 757, HHB 67 (Imp.) and HHB 234

Varieties: Dhanshakti, MBC 2, Pusa Composite 443 and CZP 9802

Drought contingency plan for rainy season crop

To conserve *in situ* rainwater, deep plough the field during summer on heavy soils of Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka and Eastern Rajasthan. A wider row spacing of 60 cm is advocated where rainfall is less than 400 mm.

Adopt suitable intercropping system select early maturing hybrids/composite of pearl millet under late onset of monsoon. Keep the crop weed-free by timely weeding. If dry spell occurs immediately after sowing, replant pearl millet in between the existing row or relay cropping may be practiced including short duration oilseed/pulse crops. Under normal onset of monsoon and occurrence of prolonged dry spell during grand growth period of the crop, reduce plant population to the extent of 25 to 40%. If drought prevails for 2-3 week during pre-flowering to grain setting stage, one life saving irrigation may be given if water is available.

STRATEGIES FOR PEARL MILLET CULTIVATION IN KHARIF SEASON

Under timely onset of monsoon

- Use recommended early duration hybrids/varieties (**Annexure - I**)
- Use recommended medium to late maturing hybrids/varieties for zone A & B (**Annexure - II & III**)
- Sowing should be done in 1st fortnight of July in north and central part of country. Dry sowing (prior to first monsoon rain) is recommended for Marathwada region of Maharashtra.
- Gap filling should be done after 2-3 weeks of sowing by transplanting the seedling to maintain plant population.
- Spreading of 5 ton FYM/ha over furrow or compaction of furrows will improve germination and plant stand in zone A1.
- Follow recommended crop geometry of 60 x 10-15 cm for zone A1 and 45 x 10-15 cm for zones A & B.
- Apply recommended doses of fertilizer 40:20 (N:P₂O₅ kg/ha) for zone A1, and 60:30 (N:P₂O₅ kg/ha) for zone A & B.
- In zinc-deficit-soils apply 10 kg/ha ZnSO₄ in soil or spray 2% ZnSO₄ on standing crop to correct zinc deficiency.
- Seed treatment with biofertilizers (Azospirillum and PSB) @ 250 ml/ha to get enhanced fertilizer use efficiency.
- Application of 25% recommended dose of nitrogen through organic sources and 75% through inorganic sources (urea) help to increase and sustain pearl millet productivity.
- Weed should be checked up to 30 days of crop growth stage either by doing hoeing and weeding at 15 & 30 days of sowing or pre-emergent application of Atrazine (50 WP) @ 0.5 kg a.i./ha super imposed with one hand hoeing.
- Dust mulching/organic mulching should be done or ridge and furrow should be made after 25-30 days after sowing for moisture conservation.
- Irrigation under prolonged dry spell should be applied at tillering, flowering and grain development stages, if water is available.

Late onset of monsoon

- Select early maturing hybrids/composites e.g. RHB 177, HHB 226, Bio 70, GHB 538, GHB 757, HHB 67 (Imp.), HHB 234, Dhanshakti, MBC 2, Pusa Composite 443 and CZP 9802
- Transplant the seedling with onset of monsoon where irrigation facility is available.
- Additional dose of 20 kg N/ha under excessive rains during vegetative phases.

Mid-season Correction

- Under normal onset of monsoon with the occurrence of prolonged dry spell during grand growth period, reduce plant population to an extent of 25-30% by harvesting every third row and using it either for fodder or mulch.
- Skip top dressing of nitrogen and spray 2% urea.

Pearl millet hybrids/varieties for Zone A1 (Less than 400 mm rainfall)

(Annexure - I)

Hybrids	Area of adaptation	Maturity group/duration and salient features
Dhanshakti (ICTP 8203 Fe 10-2)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Rajasthan, Haryana, MP, Gujarat, UP, Punjab	Early maturing variety containing high iron (76-91 ppm) and zinc (39-48 ppm), bold, globular, shining slate grey coloured seed, cylindrical – lanceolate earhead, resistant to downy mildew
HHB 234	Western Rajasthan and drier part of Gujarat and Haryana	Early maturing, candle shaped earheads with small bristles, medium seed size and tolerant to downy mildew
Bio 70 (MH 1632)	Western Rajasthan and drier part of Gujarat and Haryana	Early maturing, conical compact earheads, yellow anther colour, globular grey seed and tolerant to downy mildew
Mandor Bajra Composite 2 (MBC 2) (MP 489)	Rajasthan, Haryana, Gujarat	Early maturing, medium height, medium long semi compact cylindrical earheads, obvate grey coloured seed
HHB-226 (MH 1479)	Western Rajasthan and drier part of Gujarat and Haryana	Early maturing, medium height, dark green leaves, candle shaped bristled earheads, resistant to downy mildew
RHB 177 (MH 1486)	Western Rajasthan and drier part of Gujarat and Haryana	Early maturing, medium tall, cylindrical bristled earheads, resistant to downy mildew, light yellow anthers
HHB 216 (MH 1421)	Western Rajasthan and drier part of Gujarat and Haryana	Early maturing, resistant to downy mildew, candle shaped medium-long to long earheads with brownish long bristled
Pusa Composite 443 (MP 443)	Rajasthan, Haryana, Gujarat	Early maturity, medium tall, rod shaped earheads with bold grain

Pearl millet hybrids/varieties for Zone A (North-Western Zone)

(Annexure - II)

Hybrids	Area of adaptation	Maturity group/duration and salient features
Dhanshakti (ICTP 8203 Fe 10-2)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Rajasthan, Haryana, MP, Gujarat, UP, Punjab	Early maturing variety containing high iron (76-91 ppm) and zinc (39-48 ppm), bold, globular, shining slate grey coloured seed, cylindrical – lanceolate earhead, resistant to downy mildew
KBH 108 (MH 1737)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturing, tall plant height, purple anther colour, cylindrical very compact ear heads, obovate grey seed, resistant to downy mildew, blast and smut
GHB-905 (MH-1655)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Medium maturing, medium height, yellow anther colour, compact cylindrical earheads with bristles, resistant to downy mildew, globular grey brown seeds
Nandi-72 (MSH-238) (NMH 75)	Summer growing areas of Gujarat Maharashtra, Rajasthan and Tamil Nadu	Medium tall plant height, purple coloured anthers lanceolate thick compact earheads, resistant to downy mildew, globular deep grey seed.
MPMH 17 (MH 1663)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Medium maturing, medium height, yellow anther colour, compact lanceolate earheads with bristles, resistant to downy mildew, grey brown seeds
Kaveri Super Boss (MH 1553)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Late maturing, tall height, long compact cylindrical earheads, purple anther colour, globular grey coloured seed
Bio 448 (MH 1671)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturing, cylindrical compact earheads, yellow anther colour, globular grey seed and tolerant to downy mildew
HHB 197	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Medium maturity, bristled, high tillering, medium compact head and resistant to downy mildew
Nandi-70 (MSH 224)	Summer growing areas of Gujarat Maharashtra,	Medium plant height, cylindrical thick compact earheads, globular

Hybrids	Area of adaptation	Maturity group/duration and salient features
	Rajasthan and Tamil Nadu	deep grey seed.
MP-7872 (MH-1610)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturing, medium height, yellow anther colour, spindle earheads, grey coloured globular seed
MP-7792 (MH-1609)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturing, medium height, yellow anther colour, cylindrical earheads, grey coloured globular seed
86M86 (MH 1684)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Late maturing, Medium to tall plant height, conical very compact earheads, purple anther colour, grey hexagonal seeds
86M66 (MH 1617)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturing, medium height, conical compact earheads, brownish yellow anthers, broad leaves, purple node colour, grey seed colour, resistant to downy mildew
RHB-173 (MH-1446)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Medium maturity, medium to tall plant height, compact cylindrical ear heads, resistant to downy mildew
86M64 (MSH 203)	Summer growing areas of Gujarat Maharashtra, Rajasthan and Tamil Nadu	Late maturing, conical compact earheads, obovate light grey bold seeds, resistant to downy mildew
Nandi 61 (MH 1548)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturing, conical shaped non bristled compact earheads, bright yellow anther colour, bold grains resistant to downy mildew
HHB 223 (MH 1468)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Medium maturing, conical earheads with long purple bristled , resistant to downy mildew, tolerant to drought
JKBH 676	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP	Late maturity, Medium tall plant height, highly compact earheads, stay green fodder
B 2095 (MH 1257)	Rajasthan, Gujarat, Delhi, UP and MP	Medium maturity, medium tall, compact candle earheads, globular grey grains

Pearl millet hybrids/varieties for Zone B (South-Central Zone)

(Annexure - III)

Hybrids	Area of adaptation	Maturity group/duration and salient features
NBH 5767 (MH 1785)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturing, purple anther colors, medium plant height, compact lanceolate earheads, deep grey coloured grains
NBH 5061 (MH 1812)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturing, purple anther colors, medium plant height, compact lanceolate earheads, grey coloured grains
Dhanshakti (ICTP 8203 Fe 10-2)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu, Rajasthan, Haryana, MP, Gujarat, UP, Punjab	Early maturing variety containing high iron (76-91 ppm) and zinc (39-48 ppm), bold, globular, shining slate grey coloured seed, cylindrical – lanceolate earhead, resistant to downy mildew
Nandi-72 (MSH-238) (NMH 75)	Summer growing areas of Gujarat Maharashtra, Rajasthan and Tamil Nadu	Medium tall plant height, purple coloured anthers lanceolate thick compact earheads, resistant to downy mildew, globular deep grey seed.
Kaveri Super Boss (MH 1553)	Rajasthan, Gujarat, Haryana, Punjab, Delhi, UP and MP Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Late maturing, tall height, long compact cylindrical earheads, purple anther colour, globular grey coloured seed
Nandi-70 (MSH 224)	Summer growing areas of Gujarat Maharashtra, Rajasthan and Tamil Nadu	Medium plant height, cylindrical thick compact earheads, globular deep grey seed.
Pratap (MH 1642)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturity, medium plant height, cylindrical semi compact earheads, globular grey seed.
PKV-Raj (BBH 3)	Maharashtra	Medium maturing, Medium height, conical compact bristled earheads, grey coloured seed
ABPC-4-3 (MP 484)	Maharashtra	Late maturing, medium plant height, lanceolate earheads, globular grey seeds
86M86 (MH 1684)	Rajasthan, Gujarat, Haryana, Punjab, Delhi,	Late maturing, Medium to tall plant height, conical very compact

Hybrids	Area of adaptation	Maturity group/duration and salient features
	UP and MP Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	earheads, purple anther colour, grey hexagonal seeds
CO 9	Tamil Nadu	Medium maturing, medium height, Candle compact earheads, greyish yellow seed colour
Shine (VBBH 3040) (MH 1578)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturing, medium height, red node pigmentation, yellow anther colour, compact spindle shaped earheads resistant to downy mildew, grey bold seeds
PAC 909 (MH 1435)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturing, medium height, medium thick compact cylindrical earheads, light yellow coloured anthers, grey seed colour, resistant to downy mildew
Pusa Composite 612 (MP 480)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturity, medium to tall plant height, compact cylindrical earheads
86M64 (MH 1540)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Late maturing, conical compact earheads, obovate light grey seeds, resistant to downy mildew
86M53 (MH 1541)	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Late maturing, conical compact earheads, obovate grey bold seeds, resistant to downy mildew
86M64 (MSH 203)	Summer growing areas of Gujarat Maharashtra, Rajasthan and Tamil Nadu	Late maturing, conical compact earheads, obovate light grey bold seeds, resistant to downy mildew
RHRBH 9808	Maharashtra	Medium maturing, medium tall plant height, dark green leaves, cylindrical earheads, yellow anthers
Nandi 64 (MSH 199)	Summer growing areas of Gujarat Maharashtra, Rajasthan and Tamil Nadu	Late maturity, conical shaped earheads, light purple anther colour, light reddish plant base, resistant to downy mildew
GK 1051	Maharashtra, Karnataka, Andhra Pradesh, Tamil Nadu	Medium maturity, medium tall, cylindrical shaped ear heads with pearly grey grain