



# GOOD AGRICULTURAL PRACTICES (GAPs) FOR SMALL MILLETS



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## FINGER MILLET

Finger millet is generally grown as rainfed crop in Semi-arid tropics and sub-humid globally due to its natural ability to survive under less rainfall (500 to 1000 mm, annually) and low inputs. The following GAPs are prepared accordingly. However, finger millet can perform better under well-endowed environments and can respond to high inputs.

### Land preparation:

Achieve fine tilth by plowing 2-3 times (primary and secondary cultivation) and level the field to prepare ridges (30 – 60 cm apart) and furrows or raised (15cm) broad beds of 1.5 m width.

*Weeds are a major problem in small millets as the grassy weeds resemble the crop. After primary cultivation, irrigate the field to allow the weeds to germinate. Wait for 15 days and cultivate the field to prepare for sowing. This way, weeds can be prevented for up to two weeks.*

### Sowing time:

At the onset of the rainy season after receiving the first showers. If irrigation is available, can be done at the start of the season.

### Sowing method:

Seeds can be planted directly on the top of the ridge or in rows on a broad bed either manually or using a mechanical cone planter or precision planter or a seed drill. Ideally, keep 10 cm space between two plants and 30 cm between two rows. Seeds should be sown at a depth of 2-3 cm.

*Finger millet can be transplanted similarly to rice by raising a nursery. The 25-day-old seedlings can be transplanted on a wet main field.*

### Seed rate:

For line sowing either on ridges or on a broad bed, 4 kg/acre or 10 kg/ha is sufficient. Broadcasting is not preferred as yields are low. If needed to broadcast, use 15 kg/ha seed.

### Seed treatment:

Treat the seeds with Propiconazole @ 1ml/kg seed.

### Fertilizer application:

Application of farmyard manure (FYM) or compost @ 5 tonnes/ha is beneficial to achieve a healthy crop. The following chemical fertilizers are recommended additionally.

Nutrient	Requirement (Rainfed) (kg/ha)	Fertilizer requirement kg/ha	
		Fertilizer	Requirement (kg/ha)
N	40	Urea	88
P <sub>2</sub> O <sub>5</sub>	20	SSP	125
K <sub>2</sub> O	20	MOP	32

*Apply 50% of N, and a full dose of P and K as basal fertilizer. The remaining 50% of N can be applied during the vegetative phase (30 DAS) as top dressing.*

### **Irrigation:**

Need-based irrigations are to be given to achieve good yields. Even though millets are hardy crops, lack of timely irrigation reduces the yields significantly.

*Ensure drainage of excess water.*

### **Weed management:**

Manual weeding at 20-25 DAS followed by an interculture operation at 40 DAS.

### **Disease management:**

Blast is the main disease that affects finger millet. Seed treatment with Propiconazole @ 1ml/kg seed is recommended. During the crop growth period, spray Propiconazole @ 1 ml/l of water.

### **Insect management:**

Stem borer is the major pest in finger millet. Apply Chlorantriple @ 1 ml/3 l of water.

If armyworms or cutworms are observed, take up a dusting of Phasolone 5% @ 24 kg/ha.

### **Harvesting:**

Harvest manually when 80% of panicles turn yellow in color. The produce should be allowed to dry to reduce the moisture content of the seed to around 12%. The seed can be released by 1) threshing using threshers, 2) trampling by animals or manually by beating the heap with a stick on a threshing floor.

## FOXTAIL MILLET

Foxtail millet has a very short growing season, typically maturing in 70-90 days. It thrives in moderately fertile soils, ranging from sandy to heavy soils, flourishing with an annual rainfall of 500-700 mm. However, foxtail millet cannot withstand waterlogging or extreme drought.

### Land preparation:

Achieve fine tilth by plowing 2-3 times (primary and secondary cultivation) and level the field to prepare ridges (30 – 60 cm apart) and furrows or raised (15cm) broad beds of 1.5 m width.

*Weeds are a major problem in small millets as the grassy weeds resemble the crop. After primary cultivation, irrigate the field to allow the weeds to germinate. Wait for 15 days and cultivate the field to prepare for sowing. This way, weeds can be prevented for up to two weeks.*

### Sowing time:

At the onset of the rainy season after receiving the first showers. If irrigation is available, can be done at the start of the season.

### Sowing method:

Seeds can be planted directly on the top of the ridge or in rows on a broad bed either manually or using a mechanical cone planter or precision planter or a seed drill. Ideally, keep 10 cm space between two plants and 30 cm between two rows. Seeds should be sown at a depth of 2-3 cm.

### Seed rate:

For line sowing either on ridges or on a broad bed, 4 kg/acre or 10 kg/ha is sufficient. Broadcasting is not preferred as yields are low. If needed to broadcast, use 15 kg/ha seed.

### Seed treatment:

Treat the seeds with Propiconazole @ 1ml/kg seed.

### Fertilizer application:

Application of farmyard manure (FYM) or compost @ 5 tonnes/ha is beneficial to achieve a healthy crop. The following chemical fertilizers are recommended additionally.

Nutrient	Requirement (Rainfed) (kg/ha)	Fertilizer requirement kg/ha	
N	40	Urea	88
P <sub>2</sub> O <sub>5</sub>	20	SSP	125
K <sub>2</sub> O	20	MOP	32

*Apply 50% of N, and a full dose of P and K as basal fertilizer. The remaining 50% of N can be applied during the vegetative phase (30 DAS) as top dressing.*

**Irrigation:**

Need-based irrigations are to be given to achieve good yields. Even though millets are hardy crops, lack of timely irrigation reduces the yields significantly.

*Ensure drainage of excess water.*

**Weed management:**

Manual weeding at 20-25 DAS followed by an interculture operation at 40 DAS.

**Disease management:**

Blast is the main disease that affects foxtail millet. Seed treatment with Propiconazole @ 1ml/kg seed is recommended.

During the crop growth period, spray Carbendazim @ 0.1% or Tricyclazole @ 0.05%.

**Insect management:**

If armyworms or cutworms or shoot flies are observed, apply Chlorantrinirole @ 1 ml/3 l of water.

**Harvesting:**

Harvest manually when 80% of panicles turn yellow in color. The produce should be allowed to dry to reduce the moisture content of the seed to around 12%. The seed can be released by 1) threshing using threshers, 2) trampling by animals or manually by beating the heap with a stick on a threshing floor.

## PROSO MILLET

Foxtail millet has a very short growing season, typically maturing in 70-80 days. It thrives in areas with limited rainfall.

### Land preparation:

Achieve fine tilth by plowing 2-3 times (primary and secondary cultivation) and level the field to prepare ridges (30 – 60 cm apart) and furrows or raised (15cm) broad beds of 1.5 m width.

*Weeds are a major problem in small millets as the grassy weeds resemble the crop. After primary cultivation, irrigate the field to allow the weeds to germinate. Wait for 15 days and cultivate the field to prepare for sowing. This way, weeds can be prevented for up to two weeks.*

### Sowing time:

At the onset of the rainy season after receiving the first showers. If irrigation is available, can be done at the start of the season.

### Sowing method:

Seeds can be planted directly on the top of the ridge or in rows on a broad bed either manually or using a mechanical cone planter or precision planter or a seed drill. Ideally, keep 10 cm space between two plants and 30 cm between two rows. Seeds should be sown at a depth of 2-3 cm.

### Seed rate:

For line sowing either on ridges or on a broad bed, 4 kg/acre or 10 kg/ha is sufficient. Broadcasting is not preferred as yields are low. If needed to broadcast, use 15 kg/ha seed.

### Seed treatment:

Treat the seeds with Propiconazole @ 1ml/kg seed.

### Fertilizer application:

Application of farmyard manure (FYM) or compost @ 5 tonnes/ha is beneficial to achieve a healthy crop. The following chemical fertilizers are recommended additionally.

Nutrient	Requirement (Rainfed) (kg/ha)	Fertilizer requirement kg/ha	
N	40	Urea	88
P2O5	20	SSP	125
K2O	0	MOP	0

*Apply 50% of N, and a full dose of P as basal fertilizer. The remaining 50% of N can be applied during the vegetative phase (30 DAS) as top dressing.*

#### **Irrigation:**

Need-based irrigations are to be given to achieve good yields. Even though millets are hardy crops, lack of timely irrigation reduces the yields significantly.

*Ensure drainage of excess water.*

#### **Weed management:**

Manual weeding at 20-25 DAS followed by an interculture operation at 40 DAS.

#### **Disease management:**

Head smut (*Sphacelorrhca destruens*) is a prevalent disease of Proso millet although it is not common. Infected panicles exhibit elongation and thickening. Prior to harvest, the smut masses rupture. This ailment is transmitted through seeds and can be managed by treating seeds with organo-mercurial compounds like Ceresan, using a rate of 3g per kg of seed. Alternatively, hot water treatment can also be employed—soak the seeds in hot water at 55°C for 7-12 minutes.

#### **Insect management:**

Shoot fly can be an important pest for Proso millet, resulting in substantial yield reduction. Early sowing with the onset of monsoon is an effective and cost-efficient method of control. To address this issue, apply 15 kg of Thimet granules per hectare into the soil during field preparation.

#### **Harvesting:**

Proso millet is typically ready for harvest within 65-75 days from sowing, across most varieties. It's best to harvest the crop as it approaches maturity. In the upper heads, the seeds at the tip tend to ripen and shatter earlier than the lower seeds and later panicles. As a result, it's advisable to harvest the crop when approximately two-thirds of the seeds have ripened.

The produce should be allowed to dry to reduce the moisture content of the seed to around 12%. The seed can be released by 1) threshing using threshers, 2) trampling by animals or manually by beating the heap with a stick on a threshing floor.

## KODO MILLET

Kodo millet is well-suited to warm and dry climate conditions, and it exhibits high drought tolerance. This crop can thrive even in regions with low, scanty, and erratic rainfall patterns. It is known to grow successfully in areas that receive only 400 to 500 mm annual rainfall, making it a crop choice for cultivation in regions with limited water availability.

### Land preparation:

Achieve fine tilth by plowing 2-3 times (primary and secondary cultivation) and level the field to prepare ridges (30 – 60 cm apart) and furrows or raised (15cm) broad beds of 1.5 m width.

*Weeds are a major problem in small millets as the grassy weeds resemble the crop. After primary cultivation, irrigate the field to allow the weeds to germinate. Wait for 15 days and cultivate the field to prepare for sowing. This way, weeds can be prevented for up to two weeks.*

### Sowing time:

At the onset of the rainy season after receiving the first showers. If irrigation is available, can be done at the start of the season.

### Sowing method:

Seeds can be planted directly on the top of the ridge or in rows on a broad bed either manually or using a mechanical cone planter or precision planter or a seed drill. Ideally, keep 10 cm space between two plants and 30 cm between two rows. Seeds should be sown at a depth of 2-3 cm.

### Seed rate:

For line sowing either on ridges or on a broad bed, 4 kg/acre or 10 kg/ha is sufficient. Broadcasting is not preferred as yields are low. If needed to broadcast, use 15 kg/ha seed.

### Seed treatment:

Treat the seeds with Chlorothalonil or Mancozeb at the rate of 2g/kg seed.

### Fertilizer application:

Application of farmyard manure (FYM) or compost @ 5 tonnes/ha is beneficial to achieve a healthy crop. The following chemical fertilizers are recommended additionally.

Nutrient	Requirement (Rainfed) (kg/ha)	Fertilizer requirement kg/ha	
		Fertilizer	Requirement (kg/ha)
N	40	Urea	88
P <sub>2</sub> O <sub>5</sub>	20	SSP	125
K <sub>2</sub> O	0	MOP	0

Apply 50% of N, and a full dose of P as basal fertilizer. The remaining 50% of N can be applied during the vegetative phase (30 DAS) as top dressing.

**Using bio-fertilizers like *Azospirillum Brasiliense* (nitrogen-fixing bacterium) and *Aspergillus awamori* (phosphate-solubilizing fungus) can be beneficial for Kodo millet cultivation. The recommended application rate is 25 grams per kilogram of seeds.**

#### **Irrigation:**

Need-based irrigations are to be given to achieve good yields. Even though millets are hardy crops, lack of timely irrigation reduces the yields significantly.

**Ensure drainage of excess water.**

#### **Weed management:**

Manual weeding at 20-25 DAS followed by an interculture operation at 40 DAS.

#### **Disease management:**

The major disease affecting Kodo millet is head smut, caused by *Sorosporium paspali-thunbergi*. Since the pathogen is seed-borne, it can be managed by treating the seeds with Chlorothalonil or Mancozeb at the rate of 2g/kg seed.

#### **Insect management:**

Shoot fly can be an important pest for Kodo millet, resulting in substantial yield reduction. Early sowing with the onset of monsoon is an effective and cost-efficient method of control. To address this issue, apply 15 kg of Thimet granules per hectare into the soil during field preparation.

#### **Harvesting:**

When the crop attains maturity, the seeds will typically exhibit a golden-yellow or light-brown color. The produce should be allowed to dry to reduce the moisture content of the seed to around 12%. The seed can be released by 1) threshing using threshers, 2) trampling by animals, or manually by beating the heap with a stick on a threshing floor.

## LITTLE MILLET

Little millet is a rapidly growing, short-duration cereal crop known for its resilience in both drought-prone and waterlogged conditions.

### Land preparation:

Achieve fine tilth by plowing 2-3 times (primary and secondary cultivation) and level the field to prepare ridges (30 – 60 cm apart) and furrows or raised (15cm) broad beds of 1.5 m width.

*Weeds are a major problem in small millets as the grassy weeds resemble the crop. After primary cultivation, irrigate the field to allow the weeds to germinate. Wait for 15 days and cultivate the field to prepare for sowing. This way, weeds can be prevented for up to two weeks.*

### Sowing time:

At the onset of the rainy season after receiving the first showers. If irrigation is available, sowing can be done at the start of the season.

### Sowing method:

Seeds can be planted directly on the top of the ridge or in rows on a broad bed either manually or using a mechanical cone planter or precision planter or a seed drill. Ideally, keep 10 cm space between two plants and 30 cm between two rows. Seeds should be sown at a depth of 2-3 cm.

### Seed rate:

For line sowing either on ridges or on a broad bed, 3 kg/acre or 8 kg/ha is sufficient. Broadcasting is not preferred as yields are low. If needed to broadcast, use 12 kg/ha seed.

### Seed treatment:

Treat the seeds with Carboxin or Carbendazim at a rate of 2 g/kg of seed.

### Fertilizer application:

Application of farmyard manure (FYM) or compost @ 5 tonnes/ha is beneficial to achieve a healthy crop. The following chemical fertilizers are recommended additionally along with FYM.

Nutrient	Requirement (Rainfed) (kg/ha)	Fertilizer requirement kg/ha	
N	20	Urea	88
P2O5	20	SSP	125
K2O	0	MOP	0

**Using bio-fertilizers like *Agrobacterium radiobacter* and *Aspergillus awamori* (phosphate-solubilizing fungus) can be beneficial for little millet cultivation. The recommended application rate is 25 g per kg of seeds.**

#### **Irrigation:**

Need-based irrigations are to be given to achieve good yields. Even though millets are hardy crops, lack of timely irrigation reduces the yields significantly.

**Ensure drainage of excess water.**

#### **Weed management:**

Manual weeding at 20-25 DAS followed by an interculture operation at 40 DAS.

#### **Disease management:**

Grain smut (*Macalpinomyces sharmae*) a common disease of little millet. Seed treatment is an effective preventive measure. Planting disease-resistant cultivars is a key strategy. Varieties such as DPI 2394, PLM 202, OLM 203, DPI 2386, and CO 2 are known for their resistance to the disease, providing a natural defense against it.

#### **Insect management:**

Shoot fly can be an important pest for Little millet, resulting in substantial yield reduction. Early sowing with the onset of monsoon is an effective and cost-efficient method of control. To address this issue, apply 15 kg of Thimet granules per hectare into the soil during field preparation.

#### **Harvesting:**

Harvest manually when 80% of panicles turn yellow in color. The produce should be allowed to dry to reduce the moisture content of the seed to around 12%. The seed can be released by 1) threshing using threshers, 2) trampling by animals or manually by beating the heap with a stick on a threshing floor.

## BARNYARD MILLET

Barnyard millet is an early-maturing cereal native to India. It is known for its ability to thrive in low rainfall and fertility regions.

### Land preparation:

Achieve fine tilth by plowing 2-3 times (primary and secondary cultivation) and level the field to prepare ridges (30 – 60 cm apart) and furrows or raised (15cm) broad beds of 1.5 m width.

*Weeds are a major problem in small millets as the grassy weeds resemble the crop. After primary cultivation, irrigate the field to allow the weeds to germinate. Wait for 15 days and cultivate the field to prepare for sowing. This way, weeds can be prevented for up to two weeks.*

### Sowing time:

At the onset of the rainy season after receiving the first showers. If irrigation is available, can be done at the start of the season.

### Sowing method:

Seeds can be planted directly on the top of the ridge or in rows on a broad bed either manually or using a mechanical cone planter or precision planter or a seed drill. Ideally, keep 10 cm space between two plants and 30 cm between two rows. Seeds should be sown at a depth of 2-3 cm.

### Seed rate:

For line sowing either on ridges or on a broad bed, 3- 4 kg/acre or 8-10 kg/ha is sufficient. Broadcasting is not preferred as yields are low. If needed to broadcast, use 5-6kg/acre or 12-15 kg/ha seed.

### Seed treatment:

Treat the seeds with Chlorothalonil or Mancozeb at the rate of 2g/kg seed.

### Fertilizer application:

Application of farmyard manure (FYM) or compost @ 5 tonnes/ha is beneficial to achieve a healthy crop. The following chemical fertilizers are recommended additionally.

Nutrient	Requirement (Rainfed) (kg/ha)	Fertilizer requirement kg/ha	
		N	40
P <sub>2</sub> O <sub>5</sub>	20	SSP	125
K <sub>2</sub> O	0	MOP	0

*Apply 50% of N, and a full dose of P as basal fertilizer. The remaining 50% of N can be applied during the vegetative phase (30 DAS) as top dressing.*

***Using bio-fertilizers like Azospirillum Brasiliense (nitrogen-fixing bacterium) and Aspergillus awamori (phosphate-solubilizing fungus) can be beneficial for Kodo millet cultivation. The recommended application rate is 25 grams per kilogram of seeds.***

#### **Irrigation:**

Need-based irrigations are to be given to achieve good yields. Even though millets are hardy crops, lack of timely irrigation reduces the yields significantly.

***Ensure drainage of excess water.***

#### **Weed management:**

Manual weeding at 20-25 DAS followed by an interculture operation at 40 DAS.

#### **Disease management:**

To address grain smut, seed treatment with Carbendazim @2.5g/kg seed is advisable

#### **Insect management:**

Shoot fly damage can be tackled by applying 15kgThimet granules/ha into the soil during field preparation.

#### **Harvesting:**

When the crop attains physiological maturity, the seeds will typically exhibit ash colour. The produce should be allowed to dry to reduce the moisture content of the seed to around 12%. The seed can be released by 1) threshing using threshers, 2) trampling by animals, or manually by beating the heap with a stick on a threshing floor.

## Pictures: Crops

### a. Finger millet



**b. Foxtail millet**



c. Proso millet



d. Kodo millet



e. Little millet



f. Barnyard millet



## Field Operations:

### a. Land preparation



Forming ridges for sowing

**b. Sowing**



**Marking the plot according to the design of the experiment**



**Manual sowing**



**Mechanical planting**



**Attaining optimum plant stand**

**c. Transplanting**





**Transplanting of 25-day-old seedlings**

**d. Irrigation**



**Flood irrigation**



**Perforated irrigation**

**e. Gap filling**



f. Inter cultivation/Weeding



**Mechanical weeding**



**Manual weeding**

**g. Harvesting**



**Manual harvesting**



**Mechanical harvesting**

## h. Threshing



**Manual threshing**



**Mechanical threshing**



## About

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a pioneering non-profit organization focused on scientific research for development, committed to transforming dryland farming and agri-food systems. Working with global partners, ICRISAT develops innovative solutions to address hunger, poverty, and environmental degradation, benefiting 2.1 billion people across the drylands of Asia, Africa, and beyond.

ICRISAT was established under a Memorandum of Agreement between the Government of India and CGIAR, dated 28 March 1972. In accordance with the Headquarters Agreement, the Government of India has extended the status of a specified "International Organization" to ICRISAT under section 3 of the United Nations (Privileges and Immunities) Act, 1947 of the Republic of India through Extraordinary Gazette Notification No. UI/222(66)/71, dated 28 October 1972, issued by the Ministry of External Affairs, Government of India.

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