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MILLETS: SEED PRODUCTION GUIDE

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A cereal grain called millets is one of the oldest known foods to humans, perhaps even the first cereal grain used for domestic purposes. The crops provide food for people in areas where hunger is a common occurrence. Millets of many types, such as sorghum, pearl millet, finger millet, foxtail millet, little millet, barnyard millet, proso millet, and kodo millet, are farmed in India. Most of the farmers do cultivation of these crops indifferently because these crops neither get any special commercial value nor do the general public have special interest in eating them. But consider it the irony of the method or the mental tragedy of the civilized society that some of these crops are paramount in terms of nutritional value, even if their taste is not tempting. In order to encourage the growth of millets, some efforts have been made in many parts of India, particularly in regions most severely impacted by climate change. India designated 2018 as the "National Year of Millets." The Food and Agriculture Organisation (FAO) Council of the United Nations later agreed with India's proposal to recognise 2023 as the "International Year of Millets" in order to raise awareness of millets around the world and reintroduce these nutritious cereals to the food supply (Kumar *et al.* 2021). Seed production of any crop variety is an important aspect of its successful cultivation. Simple and accessible details of millet crops, such as seed production method and precautions to be taken during seed production is not there. Written knowledge of methods and precautions for seed production will prove useful to the farmers. That's why this seed production guide is being addressed for interested farmers and following is the description of seed production of these crops.

1. **Amaranth** : Chaulai, Sihul, Siryara, Rajgira, Bathu, Bithu, Tulsi, Dankhar, Kalji

Amaranth is grown to meet both the requirements of greens and grains. Amaranth can be grown satisfactorily from sea level to an altitude of 3000 meters. It grows well in the land

where water seeps well. Minerals like iron and calcium are found in plenty in its greens. Amaranth is cultivated for grains in the valleys of high hills. Although in some places it is also single-cultivated, but mixed cultivation of amaranth with maize, kidney beans, bhara, potato, urd, soyabean, ragi and colocasia is found in different parts of our state. Its plants are able to withstand water scarcity or drought and other unfavorable conditions strongly. In fact, Amaranth grows best in hot and dry conditions. On the contrary, good moisture is always needed for greens and amaranth.

Varieties: Among the advanced varieties of Amaranth, Annapurna, Suvarna are high yielding varieties. PRA 8801, PRA- 9401 and IC 35407 are also good yielding varieties. There are early ripening varieties and at some places it ripens even in 100 days, mostly it ripens in 100-120 days.

Rouging : In the crop being grown for seed production, it is necessary to take special care that only plants of that variety of the crop for which we want to prepare seeds should grow in them. If any plant looks different or strange, it is necessary to uproot such plants before flowering. Early weeding is also mandatory and one hoeing is required after 30-35 days of sowing.

Harvesting and threshing: Normally the crop is ready in 120-150 days. When ready, the grains ripen on the bunches/ bundles, but the bundles and plants look green. The problem of seed dispersal comes in the way of waiting for the plants to ripen, so the green ones should be cut on time. After drying, seeds can be obtained by beating with sticks or by running animals, collecting the grains, sifting and grinding. Keep in mind that the seed should be very clean.

2. **Pearl millet:** Bajra, Bajree, Sajje, Kambu, Sajja

There are several types of millet, but pearl millet is one of the most widely grown. African and Indian subcontinents have grown it since ancient times. It is possible to grow pearl millet at altitudes between 50m and 2000m above mean sea level. India has used it as a main food source for thousands of years. Due to the way it appears when it is processed into flour, bajra millet is also known as pearl millet. Protein, fibre, calcium, iron, magnesium, and vitamin B are all present in it, giving it a high nutritional value. The pearl millet crop is an annual summer crop well suited to rotation and double cropping. A wide range of soil types, from deep sands to clay loams, can be used to cultivate pearl millet. However, deep, productive soil with good drainage produces the highest yields and grain quality.

Varieties: These are the new varieties: ICTP 8203, GB 8735, ICMV 221 Wbr, ICRI- Tabi, Jira Ni, as well as hybrids ICMH IS 14002, ICMH IS 14003, ICMH IS 14009, ICMH IS 14011, ICMH IS 15012, ICMH IS 16265 and ICMH IS 16266 of pearl millet with high iron content developed from ICRISAT.

Rouging: A healthy crop requires effective weed management, and early emerging weeds need to be particularly well-controlled. Planning your crop rotations so that pearl millet follows a crop where grass-controlling herbicides were applied may be advantageous.

Harvesting and threshing: Grain can be harvested as soon as 40 days following flowering. Initiate harvesting when the seed moisture level falls below 15%. To increase the effectiveness of harvesting, dry both the leaves and the stems with a desiccant before using them. To achieve an effective harvest, specific modifications in the combine are required since pearl millet grain cannot readily detached from the seed head.

3. **Sorghum:** Jowar, Jwari, Juari, Jola, Cholam, Janha, Jonnal, Milo, Chari

After maize, rice, wheat, and barley, sorghum [*Sorghum bicolor* (L.) Moench] is the fifth most significant cereal in the world. A sorghum plant grows from seed, and its parts are widely used in different ways. Sorghum, an indigenous plant to Africa, will continue to be an essential staple diet for a lot of rural areas even if commercial requirements and applications shift over time. Sorghum can be grown in a variety of environments, but it prefers warm climates. It is also commonly cultivated at elevations up to 2300m in the tropics and in temperate regions. Sorghum can be a nutritious supplement because it is high in protein, devoid of gluten, and packed with antioxidants. Since the hull of sorghum is edible, the entire grain can be consumed. This implies that along with many other essential elements, it also provides greater fibre. Various types of soils can be used to grow sorghum. The ideal soils for sorghum production are loamy soils which are deep, fertile, and well-drained. However, it can work well in dry weather and shallow soils.

Varieties: The recently produced national varieties/hybrids are CSV-216R, CSV-18, CSV-22, CSH-15R, CSH-19R, and CSV-26 are just a few of the many better varieties for the rabi season than the local variety M35-1. Whereas, CSH 27, CSH 30 and CSH 35 are the best hybrids of kharif sorghum that are released at national level.

Rouging: For about 35 days after planting, keep the crop free of weeds. A two or three time inter-cultivation should be performed after sowing to control weed growth.

Harvesting and threshing: When sorghum achieves normal maturity, it should be harvested right away to lower the likelihood of mould growth. The remaining plants are harvested after the panicles. The grains are extracted from the harvested panicles by either human or machine threshing after the panicles are dried in the field for roughly a week. The grains are dried in the sun for 1-2 days after threshing to get the moisture level down to 10-12%.

4. Proso millet: Chena, Barri, Vari, Baragu, Variga, Pani Varagu, Cheena, Cheno

Proso millet (*Panicum miliaceum* L.) is a popular and significant member of the Gramineae family. Common millet is another name for proso millet. It is believed that it was domesticated in central and eastern Asia. As a result of its quick maturation, it is well suited to the hot summers that prevail in the tropics and at high elevations, where the growth season is very short and the soil is marginal and deficient in nutrients. These crops are grown as high as 2700 meters above mean sea level in the Himalayas. Growing it in areas with sparse rainfall is possible due to its drought resistance. Proso-millet is a rich source of niacin, B-complex vitamins, folic acid, P, Ca, Zn, Fe, essential amino acids, starch, and phenolic compounds (Gowda *et al.* 2022). A wide range of soil textures are suitable for growing proso millet, from sandy loams to clay soils of black cotton. The best conditions for growing proso millet are well-drained beds of loam or sandy loam that are free from stones and gravel, have a high level of organic matter, and are well-drained.

Varieties: Co-5, TNAU 151, TNAU 164, TNAU 145, TNAU 202, CO 4, K2, CO 3, CO 2, GPUP 21, GPUP 8 are some of the best varieties of proso millet with high yield potential.

Rouging: In order to yield quality seeds, the field should be kept weed-free for at least 35 days after planting. For removing broadleaf weeds, hand weeding is an option.

Harvesting and threshing: Once the earheads are fully developed, the harvesting should be done. Normally, 65 to 75 days after seeding, the crop is ready for harvest. When two thirds of the seeds are ready, the crop should be picked. The harvested earheads are threshed either manually or by bullocks crushing them under their feet. Winnowing is used to further clean the threshed grains. It is possible to delay threshing until the grain has a moisture content below 13%

5. Finger millet: Ragi, Mandika, Marwah, Mandua, Nagli, Nachni, Ragulu, Chodi, Keppai

Eleusine coracana is an annual herb, is farmed extensively as a cereal crop in the arid and semiarid regions of Africa and Asia. In India, it is also known as ragi. The mountains of Ethiopia and Uganda are home to finger millet. The ability of finger millet to endure cultivation at altitudes exceeding 2000 m above sea level, its strong drought tolerance, and the lengthy grain storage period are fascinating crop traits. The states that grow the most finger millet in India are Karnataka and Uttarkhand, Maharashtra, Orissa, Jharkhand, Andhra Pradesh, and Tamil Nadu. Finger millet grains are very nutritious and known for having the highest concentration of calcium (344 mg/100g grain), iron, zinc, dietary fibre, and essential amino acids. The crop can be produced in a variety of soils and at elevations ranging from the mean sea level to the foothills of the Himalaya. The crop is capable of withstanding a certain level of alkalinity. Alluvial, loamy, and sandy soil with adequate drainage are the best types of soil for finger millet.

Varieties: There are various improved varieties of finger millet grown all around the world. Some of the varieties grown in India are CO 9, CO 13, TRY 1, Paiyur 1, Paiyur 2, GPU 26, GPU 45, VR 708 etc.

Rouging: It is important to eradicate weeds when a plant is young and developing. At 25 days after sowing, hand hoeing should be done for inter-cultivation and weeding.

Harvesting and threshing: Depending on the area and the variety, the crop develops in approximately 95 to 110 days for early varieties and 115 to 125 days for medium to late varieties. With standard sickles, the ear heads are picked, and the straw is chopped closely to the ground. After being piled up, earheads are dried for three to four days in the sun. After thorough drying, threshing is done. In some locations the entire plant with the ear head is chopped when it is raining, piled, and then threshed.

6. Foxtail millet: Kangni, Kakum, Kang, Rala, Navane, Korra, Keppai, Thenai, Kaon, Kora

The annual grass foxtail millet, scientifically known as *Setaria italica* (also known as *Panicum italicum* L.), is cultivated for human consumption. The earliest evidence of foxtail millet cultivation was discovered in Cishan, China, along the historic Yellow River route. Foxtail millet can be cultivated at an altitude of 2000 m above mean sea level. Foxtail millet can be grown in temperate and tropical climates with low to moderate rainfall. It is also intolerant of intense drought or standing water. Foxtail millet is a powerful source of energy

since they are stuffed with excellent calories. Foxtail millet may thrive on a variety of soil types, including sandy and heavy clay soils, although it requires a moderately fertile, well-drained soil for high yields.

Varieties: Several varieties with high yield potential have been released for foxtail millet. Some of these varieties are SiA 3088, SiA 3156, SiA 3085, Lepakshi, SiA 326 etc.

Rouging: For higher yields, it is advised to do two inter cultivations and one hand weeding in line-sown crops. In a broadcast crop, two manual weedings should be done at 20–25 DAS.

Harvesting and threshing: Depending on the cultivar, the crop matures about 80 to 100 days. When the earheads are dry, the crop is harvested by either sickling the entire plant or picking the individual ears. Threshing the crop and grading the seeds are the part of post-harvesting.

7. **Kodo millet:** Kodon, Kodra, Harka, Arikelu, Arika, Varagu, Kodo, Kodua

The annual grain *Paspalum scrobiculatum*, also known as Kodo millet or Koda millet is grown primarily in Nepal as well as in India, the Philippines, Indonesia, Vietnam, Thailand, and West Africa, where it originated. Kodo millets are often grown in tropical and subtropical climates up to an altitude of 2100 m. It is cultivated in areas with 500–900mm of annual rainfall. Kodo millet has a high lecithin content and is very simple to digest. From stony and gravelly upland poor soils to loam soils, kodo millet is grown. Organically rich, deep, loamy soils are suitable for growing crops and yielding larger yields. The crop needs well-drained soils with a sufficient amount of moisture to grow consistently.

Varieties: JK-13, JK-48, GK-2, Vamban, IPS 147-1, JK-62, JK-76, GPUK-3, and Kherapa are a few of the important kodo millet's varieties.

Rouging: Weeds must be managed when plants are still in the early stages of development. Usually, two weedings separated by 15 days are enough. In a line-sown crop, weeding can be done with a hand or wheel hoe. Around 20 and 35 days following sowing, two hand weedings should be done.

Harvesting and threshing: In northern India, the crop matures for harvest during the Kharif season in the months of September or October. Once the ear heads are physically mature, the harvest is finished. The crop is typically ready for harvest in 100 days. Before threshing,

plants are chopped just above the ground, bunched, and stacked for a week. Additionally, the threshed grains are cleansed by winnowing.

8. Little millet: Kutki, Shavan, Sava, Same, Save, Samalu, Samai, Sama, Gajro, Kuri

The Little millet (*Panicum sumatrense*) is a member of the Gramineae (Poaceae) family. Little millet is a herbaceous annual that can reach a height of 30 cm to 1 m and can grow either straight or with folded blades. India domesticates and distributes little millet to Nepal, Pakistan, Sri Lanka, eastern Indonesia, and western Myanmar. In order to achieve good crop yields and proper development, the average temperature should be between 26 and 29°C. It can be grown upto an elevation of 2100 m above mean sea level. Little millet is a traditional crop in India, it is a nutritious grain that is very popular among health-conscious people. Magnesium is abundant in little millet, which benefits cardiovascular health. Little millet can thrive on a variety of soil types, including clay, loam, and sandy soils. The desired soil is one that has a lot of organic content and is good at holding moisture.

Varieties: In diverse regions of the world, thousands of advanced and hybrid types are grown. Only a few high-yielding cultivars may be able to be listed here: JK-4, JK-8, JK-36, OLM 203, JK, TNAU 63, CO 3, CO 4, K1, OLM 203, GV2 and GV1.

Rouging: For effective weed management, two inter-cultivations, one hand weeding in a line-sown crop and two hand weeding in a broadcast crop are required.

Harvesting and threshing: Crops for the Kharif season mature in September and October, while those for the Rabi season mature in January and February. When the seeds have reached maturity and the plant has gone yellow or brown, little millet becomes ready for harvest. Normally, it happens three to four months after planting. The seeds are ready for harvest if they are tough and challenging to smash. In little millet farming, threshing is the process of removing the grain from the plant's stem and chaff. It can be carried out manually by bashing the plants with a stick or mechanically by using a thresher.

9. Barnyard millet: Sanwa, Jhangora, Bhagar, Oodalu, Udhalu, Kodisama, Kuthiraivali

The ancient millet crop known as barnyard millet (*Echinochloa* species) is farmed around the world in warm, temperate climates. It is very popular in Asia, particularly in India, China, Japan, and Korea. In the northern hills of India, particularly in the foothills of the Himalayas, barnyard millet is extremely common. Due to its drought tolerance, barnyard millet is planted

as a rainfed crop. It can thrive in situations where there is some water logging. It is grown on the Himalayan slopes between sea level and 2000 metres above mean sea level. The barnyard millet, also known as Sanwa rice, has significant concentrations of minerals, protein, iron, calcium, and vitamin B complex. The crop can be cultivated on a variety of soil types, but sandy loam soils that drain well and are somewhat productive are preferable. Barnyard millet cannot tolerate standing water. Lateritic loams are the ideal habitat for it.

Varieties: Many different types of barnyard millet have been introduced recently. For various states, a number of cultivars with high yield potential have been released such as CO 1, CO 2, VL 172, VL 207, RAU 11, RAU 9 etc.

Rouging: It is recommended to perform two intercultivations and one hand weeding in line sown crops. In a broadcast crop, two-handed weeding is recommended.

Harvesting and threshing: When the panicle dries out, the crop is ready to be harvested. With the use of sickles, it is chopped at the ground level and stored in the field for roughly a week. Three to four pickings are generally needed for the collection of ear heads from the field. Trampling is done by using bullocks or any other suitable threshing machine.

Conclusion

In conclusion, millets cultivation offers a promising avenue for sustainable agriculture and food security. The comprehensive millets seed production guide presented in this article serves as a valuable resource for farmers looking to enhance their yields and overall crop quality. By understanding the intricacies of millets cultivation, from selecting the right varieties to implementing effective management practices, farmers can optimize their production and contribute to the resilience of agricultural systems.

Field Standards For Various Millet Crops:

Crop	Contaminants	Minimum distance (meters)		Seed rate(kg/ha)	Spacing (cm)	Sowing Time	Fertilizers (N:P:K) kg / ha	Yield
		Foundataion	Certified					
Amaranth	Fields of other varieties	400	200	1.5-2.5	50 × 15-20	April to first week of July	40:20:20	10-12 q/ ha
	Fields of the same variety not conforming to varietal purity requirements for certification	400	200					
Pearl millet	Fields of other varieties	400	200	3	45 × 10-15	Kharif crop (first two weeks of July) Rabi crop	40:20:00	16.4 q/ acre
	Fields of the same variety not conforming to varietal purity	400	200					

	requirements for certification					(first two weeks of October)		
Sorghum	Fields of other varieties of grain and dual-purpose sorghum	200	100	8-10	45 × 12-15	Kharif crop (third week of June to the first week of July) Rabi crop (second week of September to the first week of October)	Kharif (30:20:20) Rabi (40:20:00)	Kharif sorghum: 38-40 q/ha Rabi sorghum: 6.5-7.5 q/ha
	Fields of the same variety not conforming to varietal purity requirements for certification	200	100					
	Johnson grass (<i>Sorghum halpense</i> L.) Pers.)	400	400					
	Forage sorghum with high tillering and grassy panicle	400	400					
Proso millet	Fields of other varieties	3	3	10	22.5 × 10	Kharif crop (First two weeks of July) Rabi crop (February to March)	40-60:30:20	Irrigated conditions: 20-23 q/ha Rainfed conditions: 10-15 q/ha
	Fields of the same variety not conforming to varietal purity requirements for certification	3	3					
Finger millet	Fields of other varieties	3	3	8-10	22.5-30 × 7.5-10	Kharif crop (June to July) Rabi crop (September to October)	40:20:20	25-30 q/ha
	Fields of the same variety not conforming to varietal purity requirements for certification	3	3					
Foxtail millet	Fields of other varieties	3	3	8-10	25-30 × 8-10	Rainfed crop (June to August) Summer crop (January)	40:20:20	20-25 q/ha
	Fields of the same variety not conforming to varietal purity requirements for certification	3	3					
Kodo millet	Fields of other varieties	3	3	10-15	22.5 × 10	Between June and July	40:20:20	15-18 q/ha
	Fields of the same variety not conforming to varietal purity requirements for certification	3	3					
Little millet	Fields of other varieties	3	3	10-12	22.5 × 22.5	Kharif crop (June to July) Rabi crop (September to October)	40:20:20	15-20 q/ha
	Fields of the same variety not conforming to varietal purity requirements for certification	3	3					
Barnyard millet	Fields of other varieties	3	3	10-15	25 × 10	Kharif crop (June to July) Rabi crop (September to October)	40:20:20	12-15 q/ha
	Fields of the same variety not conforming to varietal purity requirements for certification	3	3					

 (Trivedi and Gunasekaran, 2013; Chapke *et al.* 2020)

References

- Chapke, R.R., Shyam Prasad, G., Das I.K., Hariprasanna, K., Singode, A., Kanthi Sri, B.S and Tonapi, V.A. (2020). Latest millet production and processing technologies. Booklet, ICAR-Indian Institute of Millets Research, Hyderabad 500 030, India: 82p
- Gowda, N.N., Siliveru, K., Prasad, P.V., Bhatt, Y., Netravati, B.P and Gurikar, C. (2022). Modern processing of Indian millets: a perspective on changes in nutritional properties. *Foods*. 11(4): 499.
- Kumar, A., Tripathi, M.K., Joshi, D and Kumar, V. (Eds.). (2021). Millets and millet technology. *Springer*, Singapore: 438p
- Trivedi, R.K and Gunasekaran, M. (2013). Indian minimum seed certification standards. The Central Seed Certification Board, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India, New Delhi, 401-402.