Good Agricultural Practices Manual for Millets of Arunachal Pradesh

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FOREWORD

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It is my pleasure to introduce the publication “Good Agricultural Practices Manual for Millets of Arunachal Pradesh,” prepared by Dr. Pradeepkumara N., Scientist (Vegetable Science), ICAR–CITH Regional Station, Dirang, in collaboration with Dr. Sangappa ICAR–Indian Institute of Millets Research (IIMR), Hyderabad. This manual is a significant contribution toward promoting millet cultivation and value addition in Arunachal Pradesh, particularly in West Kameng district, which offers favourable agro-climatic conditions for millets such as finger millet (Ragi), Buckwheat, Amaranth, Pearl Millet and Sorghum.

Millets are globally recognised for their nutritional richness, climate resilience, and role in sustainable agriculture. The declaration of 2023 as the International Year of Millets highlighted their importance in food and nutritional security. India, the world’s largest millet producer, recorded a production of about 180 lakh tonnes during 2024–25, reflecting growing farmer adoption and policy support. Arunachal Pradesh, with its diverse agro-ecologies, holds considerable potential for millet cultivation alongside traditional cereals, offering new opportunities for livelihood enhancement through value-added products.

Backed by the research leadership of ICAR-IIMR, this manual provides region-specific guidance on good agricultural practices for millets. It will serve as a useful reference for farmers, extension personnel, researchers, students, and policymakers, supporting improved productivity, sustainability, and market competitiveness of millets in the state.

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Introduction

Millets play a crucial role in sustaining the rainfed, high-altitude farming systems of West Kameng district in Arunachal Pradesh, located at elevations ranging from 8,000 to 15,000 meters above mean sea level. The district's agro-climatic conditions, characterized by a short growing season, low temperatures, and limited external inputs, are highly suitable for minor millets such as finger millet (*Eleusine coracana*) and foxtail millet *(Setaria italica*). These crops are resilient, require minimal water, and perform well under low-input management, making them ideal for the fragile hill ecosystems of the region. Agriculture in West Kameng is predominantly practiced by small and marginal farmers, particularly from the Monpa community, with average landholdings ranging from 0.5 to 1.0 hectare. Traditional millet cultivation is concentrated in areas such as Dirang, Sangti Valley, Chug Valley, Namshu, Nykmadung, Lish Village, and Rama Camp, where millets have been grown for generations as part of ancestral farming systems. Minor millets are deeply embedded in the food culture of the Monpa people and continue to form a vital component of their traditional diet, contributing to household food and nutritional security. The major millets cultivated in the district include foxtail millet, proso millet, kodo millet, little millet, barnyard millet, and finger millet. In addition, pseudo-millets such as buckwheat and amaranth are also grown in selected pockets. During the agricultural year 2022–23, West Kameng recorded a total millet production of approximately 932 metric tonnes from an area of 1,165 hectares, with an average productivity of about 8 quintals per hectare. This indicates substantial scope for productivity enhancement through improved technologies and systematic interventions.

West Kameng district is also emerging as a prominent agro-tourism destination, with popular tourist hubs such as Tawang, Bomdila, Dirang, Chug Village, and Sangti Valley attracting a large number of visitors annually. This growing tourism sector offers significant opportunities for marketing millet-based value-added products and beverages, thereby creating additional income avenues and employment opportunities for rural youth and women. Despite the strong production and market potential, millet cultivation in the district faces several challenges, including limited availability of high-quality and high-yielding seed material, low adoption of scientific

cultivation practices, inadequate knowledge of plant protection measures, and insufficient skills related to processing and value addition. To address these constraints, the proposed project aims to introduce scientific interventions such as the distribution of improved millet seed, field demonstrations of improved packages of practices, organization of farmer fairs, distribution of appropriate agricultural tools, and exposure visits to CAU, Pasighat for millet processing. These interventions are expected to enhance productivity, promote agro-tourism, empower women and youth, and improve the sustainable livelihoods of tribal farmers in alignment with the vision of Viksit Bharat 2047.

Vernacular names of millets:

English	Hindi	Telugu	Marathi	Kannada
Sorghum	Jowar	Jonna	Jowari	Jola
Pearl Millet	Bajra	Sajjalu	Bajri	Sajjai
Finger millet	Mandua	Ragulu	Nachni	Ragi
Little millet	Kutki	Samalu	Sava	Same
Kodo Millet	Kodho	Arikelu	Kodra	Harke
Foxtail millet	Kangni	Korralu	Rala	Navane
Barnyard millet	Sanwa	Udalu	Shamul	Oodalu
Proso millet	Barri	Varigalu	Vari	Baragu
Browntop millet	Choti kangni	Andu Korralu	Hari kangni	Korale

Nutritional health benefits of millets:

- Millets are packed with essential nutrients, including carbohydrates, proteins, dietary fiber, vitamins (such as B-complex vitamins like niacin, thiamine, and riboflavin), and minerals (such as calcium, iron, potassium, magnesium, and zinc).
- Millets are naturally gluten-free, making them suitable for people with gluten intolerance or celiac disease. They can be a valuable alternative to wheat and other gluten-containing grains.

- The high fiber content in millets can help lower cholesterol levels, reduce the risk of cardiovascular diseases, and promote heart health.
- The dietary fiber present in millets supports digestive health by promoting regular bowel movements, preventing constipation, and maintaining a healthy gut microbiota.
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- The dietary fiber present in millets supports digestive health by promoting regular bowel movements, preventing constipation, and maintaining a healthy gut microbiota.
- Millets contain essential minerals like calcium, phosphorus, and magnesium, which are crucial for maintaining healthy bones and preventing conditions such as osteoporosis and bone fractures.
- Millets, particularly pearl millet and finger millet, are good sources of iron, which is essential for the production of red blood cells and the prevention of iron-deficiency (anemia).

Food grains	Protein (%)	Fat (%)	Carbo-hydrate (%)	Dietary Fiber (TDF)	Iron (mg)	Ca (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)	Folic acid (ug)
Sorghum	10.0	1.73	67.7	10.2	3.95	27.6	0.35	0.14	2.1	39.4
Pearl millet	11.0	5.43	61.8	11.5	6.42	27.4	0.25	0.2	0.9	36.1
Finger millet	7.2	1.92	66.8	11.2	4.62	364	0.37	0.17	1.3	34.7
Foxtail millet	12.3	4.3	60.1	10.7*	2.8	31.0	0.59	0.11	3.2	15
Little millet	10.1	3.89	65.5	7.7	1.2	16.1	0.26	0.05	1.3	36.2
Barnyard millet	6.2	2.2	65.5	12.6**	5.0	20.0	0.33	0.1	4.2	-
Proso millet	11.5	3.5	64.5	9.6	2.0	30.0	0.41	0.28	4.5	-
Kodo millet	8.9	2.55	66.2	6.4	2.34	15.3	0.29	0.2	1.5	39.5

(Adapted from Indian Food Composition Tables-NIN, 2017; Nutritive Value of Indian Foods-NIN, 2007; *Smita D and Nirmala D Y, 2018; **Roopashree U *et al.*, 2014)

Cultivation Practices of Millets

Climate and soil requirement

Millets are hardy crops and can withstand harsh environmental conditions better than other cereals. They can be grown in both tropical and sub-tropical regions. They require warm and moderately humid climate for germination. The sustainable temperature for millet growth is 25-30^{o}C. Millet has wide adaptability to different soil from very poor to very fertile and can tolerate a certain degree of alkalinity. The best soils are alluvial, loamy and sandy loam soils with good drainage.

Land Preparation

Millets require fine tilth for crop establishment and initial root and shoot development. One ploughing followed by two to three harrowing and cross plantings is necessary to obtain fine tilth. Levelling of fields is necessary for adequate drainage.

Optimum time of sowing

Millets are grown in almost all the seasons of the year. The best time for sowing *Kharif* season crop is in the Mid of June to first week of July depending upon onset of monsoon. Whereas *rabi* crop is sown in the month of October to November and summer crop in the month of January to February.

Method of sowing

Millets can be grown in different methods of sowing. Some of the most followed methods are listed below:

1. Broadcasting – Spreading seed on levelled field without proper row spacing
2. Line sowing – Sowing will be done in lines with specified spacing between rows and plants
3. Ridge and furrow method – ridges and furrows will be laid and sowing will be done on the ridges or in the furrows.
4. Transplanting – This is followed in finger millet. Sowing will be done in nurseries and after the seedlings attain an age of 21 to 25 days they will be transplanted to main field.
5. Broad bed and furrow method – Broad beds will be laid along with furrows and sowing will be done on the broad beds.

Ridge and furrow and broad bed and furrow method is usually practiced in areas with low rainfall as they act as soil moisture conservation measures. In all these methods the seeds should be sown at a depth of 2.5 to 3 cm to assure good germination.

Broadcasting method can be avoided, if facilities and resources are available for line sowing or for any other method. In broadcasting, uneven distribution of seeds and high density of seedlings leads to reduced productivity.

Line sowing, transplanting methods are preferable.

Line sowing

Ridge and furrow method

Transplanting

Seed rate and spacing

Optimum seed rate and spacing ensure higher yields in millets. Seed rate depends on method of sowing and seed size. The recommended seed rate to achieve the required plant population of ~4.0 to 5.0 lakh plants/ha for most of the millets is listed below (Table 2). The recommended spacing depends on the method of sowing. The line to line distance at the time of sowing should be 20 to 30 cm and plant to plant distance should be 10 to 15 cm. In case of ridges, the spacing varies from 45 to 60 cm between the ridges.

Table 2: Optimum seed rate for higher yield in small millets

S.No.	Crop	Method of sowing	Seed rate
1	Finger millet	Line sowing	5 - 6 kg ha^{-1}
		Transplanting	4 kg ha^{-1}
2	Other Small millets	Line sowing	5 - 6 kg ha^{-1}
		Broadcasting	8 - 10 kg ha^{-1}

To maintain proper release of seed during tractor drawn/ bullock drawn seed drill, mixing of seeds with fine sand grains may be practiced. This assures the optimum plant population in field.

Seed treatment: Treat the seeds with thiram @ 2.5 g/kg of seed. Treating seeds with *Azospirillum brasilense* (N fixing bacterium) and *Aspergillus awamori* (P solubilizing fungus) @ 25 g/kg seed is advantageous. Treat the seeds first with seed dressing chemicals and then with bio-fertilizers.

To boast the seedling growth and initial establishment & tillering & to avoid soil borne pests and diseases.

Fertilizers/nutrient management

Millets responds well to fertilizer application especially to N and P. The recommended doses of fertilizers vary from state to state and with seasons. Apply recommended dose of fertilizers (Table 3) along with 10 t/ha of farmyard manure. Judicious use of organic and inorganic manures enhances the fertilizer efficiency. Entire P_2O_5 and K_2O are to be applied at sowing, whereas nitrogen is to be applied in two or three split doses depending upon moisture availability. In areas of good rainfall and moisture availability, 50% of recommended nitrogen is to be applied at sowing and the remaining 50% in two equal splits at 25-30 and 40-45 days after sowing. In areas of uncertain rainfall, 50% at sowing and the remaining 50% around 35 days after sowing is recommended.

Table 3: Recommended dose of fertilizers in small millets

Crop	Season	Dose
Finger millet	Irrigated	60:30:30 Kg NPK ha^{-1}
	Rainfed	40:20:20 Kg NPK ha^{-1}
Other Small millets	Irrigated	40:20:00 Kg NPK ha^{-1}
	Rainfed	20:20:00 Kg NPK ha^{-1}

Irrigation/ Water management

Millets are grown as rain-fed crop and require minimum irrigation. However, based on the availability of water, one life saving irrigation and 3 to 4 irrigations at critical growth stages i.e. tillering, flowering and grain developmental stage needs to be given. Summer crop requires 4-5 irrigations depending upon soil type and climatic conditions.

Weed Management

Millets does not compete well with weeds during early growth until four to five weeks after planting, the crop requires special attention during this phase. Adoption of preventive measures like proper seedbed preparation (to ensure uniform stands), appropriate spacing (to ensure adequate plant populations), covering the soil surface with intercrops or cover crops and practicing a proper crop rotation with densely growing legumes suppress weeds. Application of one pre-emergence spray followed by hand weeding at 20-25 DAS, effectively control the initial flush of weeds. Inter-cultivation/hand hoeing 2 or 3 times at 3, 5 and 7 weeks after sowing to check the weed growth and also help conserve soil moisture by providing top soil mulch. The list of recommended herbicides is given in the table 4.

Table 4. Herbicides recommended for small millets

Millets	Herbicide	Dose (kg/ha)	Time of application	Weeds controlled
Finger millet	Oxadiazone	1.0	Pre-Emergent	Broad-spectrum weed control
	Isoproturon	0.50-0.75	Pre-Emergent	Broad-spectrum weed control
	Butachlor	0.75	Pre-Emergent	Broad-spectrum weed control
Kodo millet	Isoproturon +	0.50	Pre-Emergent	Broad-spectrum weed control
	Intercultivation +	1	20 DAS	
	HW	1	40 DAS	
Proso millet	Atrazine	0.28-0.56	Pre-Emergent	Broad-spectrum weed control
	Propazine	0.28-0.56	Pre-Emergent	Broad-spectrum weed control

Soil and moisture conservation practices:

1. Summer ploughing and conservation or minimum tillage-two ploughings with MB plough + secondary tillage
2. Opening conservation furrow after every 6-8 rows
3. Ploughing across the slope

4. Dry sowing
5. Small section bunds at an interval of 10-12 m depending on the slope and levelling the depressions
6. Dead furrows at 3.3 to 4.0 m interval

Cropping Systems

Small millets fit well in cropping systems. Some of the promising cropping systems are listed below:

1. Millet + Black gram/green gram/cow pea
2. Millet + Sesamum/soybean/pigeon pea
3. Millet + Pigeon pea
4. Millet – Niger
5. Millets – Soybean

Harvesting: Harvesting at appropriate time is necessary to avoid shattering and post-harvest losses. The crop is ready for harvest in 70 to 150 days after sowing depending on crop and the variety.

Generally, Proso millet comes for harvesting in 70-75 days, Foxtail and Browntop Millet in 80-85 days, Barnyard millet in 95-110 days, Little millet in 110-115 days, Finger and Kodo millet in 120-130 days.

State wise popular varieties in Millets

Sorghum

State	Hybrid	Variety
Maharashtra	CSH 41, CSH 35, CSH 30, CSH 25, CSH 16, CSH 45.	PDKV Kalyani (AKSV – 181), (SPV 2029), CSV 34, CSV 31, CSV 27, CSV 20, CSV 40
Karnataka	CSH 41, CSH 35, CSH 30, CSH 18, CSH 45, CSH 48, CSH 16, CSH 42.	CSV 36, CSV 34, CSV31, CSV 27, CSV 17, CSV 15, CSV 39
Andhra Pradesh	CSH 41, CSH 35, CSH 30, CSH 25, CSH 14, CSH 42.	Palamuru jonna (SPV-2122), CSV 39, CSV 36, CSV 31, CSV 27, CSV 23, CSV 20, CSV 17, CSV 15, CSV 41.
Madhya Pradesh	CSH 41, CSH 25, CSH 23, CSH 18, CSH 17, CSH 16, CSH 30, CSH 42, CSH 48.	Raj Vijay Jowar 1862 (RVJ 1862), CSV 34, CSV 15, CSV 17, SPV 235, JJ 741, JJ 938, CSV 31, CSV 27.
Gujarat	CSH 41, CSH 35, CSH 27, CSH 25, CSH 18, CSH 16, CSH 13, CSH 30, CSH 42, CSH 48.	GJ-42 (SR-666-1), Palamuru jonna (SPV-2122), CSV 39, CSV 36, CSV 34, CSV 31, CSV 17, CSV 15, GJ 41, GJ 40, GJ 39, GJ 38, CSV 41, CSV 27.
Rajasthan	CSH 41, CSH 35, CSH 27, CSH 23, CSH 18, CSH 16, CSH 14, CSH 45, CSH 48.	Palamuru jonna (SPV-2122), CSV 39, CSV 36, CSV 31, CSV 23, CSV 20, CSV 17, CSV 27, CSV 41.
Tamil Nadu	CSH 41, CSH 35, CSH 27, CSH 18, CSH 17, CSH 16, CSH 14, CSH 48.	K-12, Palamuru jonna (SPV-2122), CSV 31, CSV 27, CSV 23, CSV 20, CSV 17, CO 26, T- 15, CSV 41.
Uttar Pradesh	CSH 27, CSH 25, CSH 23, CSH 18, CSH 16, CSH 14.	CSV 39, CSV 36, CSV 31, CSV 23, CSV 20, CSV 17, CSV 15, CSV 27
All India	CSH 41	CSV 27

Pearl Millet

State	Hybrid	Variety
Rajasthan	MPMH 35, DHBH 1397, GHB 905, MPMH 17, AHB 1269Fe, HHB 299	MP 535, ICTP 8203Fe, JBV 3, ICMV 221
Gujarat	MPMH 35, DHBH 1397, GHB 905, MPMH 17, AHB 1269Fe, HHB 299	MP 535, ICTP 8203Fe, PC 383, ICMV 221
Haryana	MPMH 35, DHBH 1397, GHB 905, MPMH 17, AHB 1269Fe, HHB 299	MP 535, ICTP 8203Fe, HC 20, HC 10, ICMV 221
Punjab	PHB 2884, DHBH 1397, GHB 905, MPMH 17, AHB 1269Fe, HHB 299	MP 535, ICTP 8203Fe, ICMV 221
Delhi	MPMH 17, MP 7872, MP 7792	JBV 3, PC 383, ICMV 221
Uttar Pradesh	DHBH 1397, GHB 905, MPMH 17, RHB 173, RHB 223	MP 535, ICTP 8203Fe, JBV 3, ICMV 221
Maharashtra	Phule Mahashakthi, PKV Raj, RARBH 9808, RHB 234, AHB 1269Fe	ICTP 8203Fe, ABPC-4-3, Parbhani Sampada, Samrudhi, ICMV 221, ICMV 155
Tamil Nadu	Co9, RHB 234, RHB 233, AHB 1269Fe, HHB 299	Co10, ICTP 8203Fe, CoCu 9, Samrudhi, ICMV 221, ICMV 155
Andhra Pradesh	AHB 1200Fe, ICMH 312	ICTP 8203Fe, ICMV 221, ICMV 155, Ananta
Karnataka	AHB 1200Fe, ICMH 312	ICTP 8203Fe, PC 612, ICMV 221, ICMV 155

Finger Millet

State	Varieties
Andhra Pradesh	VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), VR 847, PR 202, VR 708, VR 762, VR 900, VR 936, Vakula (PPR2700), VR 929, PPR 1012, PR 10-45
Bihar	VL Mandua 379 (VL 379), Arjuna (OEB-526), VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), RAU 8, VL379, OEB 526, OEB 532
Chattisgarh	Chhattisgarh Ragi-2 (BR-36), Arjuna (OEB-526), VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), VL 324, VL 315, VL 149, Indira Ragi1, Chhattisgarh 2, BR7, GPU 28, PR 202, VR 708 and OEB-526, OEB-532
Gujarat	VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), GNN 7, GNN 6, GN 5, GN 4
Jharkhand	VL Mandua 379 (VL 379), VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), A 404, BM 2
Karnataka	DHFM-78-3, Vakula (PPR 2700), Arjuna (OEB-526), VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), GPU 67, GPU 66, GPU 48, GPU 45, GPU 28, PR 202, MR 1, MR 6, Indaf 7, ML 365, KMR 340, KMR 301, KMR 204, KMR 360
Madhya Pradesh	VL Mandua 379 (VL 379), VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), GPU 28, PR 202
Maharashtra	VL Mandua 376 (VL 376), Phule Nachani 1 (KOPN 235), KOPLM 83, Dapoli 1, Dapoli 2
Orissa	VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), Arjuna (OEB-526), OEB 10, OUAT 2, BM 9-1, OEB 526, OEB532
Tamil Nadu	VL Mandua 376 (VL 376), Arjuna (OEB-526), GPU 28, CO 15, TNAU 946 (CO 14), CO 13, CO 12, CO 9
Uttarakhand	VL 379, VL Mandua 376 (VL 376), VL Mandua 352 (VL 352), VL 348, VL 324, VL 315, VL 149, VL 146, PES 400, PRM 1, PRM 2, VL 382

Foxtail Millet

State	Varieties
Andhra Pradesh and Telangana	SiA 3088, SiA 3156, SiA 3085, Lepakshi, SiA 326, Narasimharaya, Krishnadevaraya, PS 4, SiA 3223, CFXV-1
Bihar	RAU-2, SiA 3088, SiA 3156, SiA 3085, PS 4
Karnataka	DHFt 109-3, HMT 100-1, SiA 3156, SiA 3088, SiA 3085, SiA 326, PS 4, Narasimharaya, HN-46, CFXV-1
Uttar Pradesh	PRK 1, PS 4, SiA 3088, SiA3085, Sreelaxmi, Narasimharaya, SiA 326
Uttarakhand	PS 4, PRK 1, Sreelaxmi, SiA 326, SiA 3156, SiA 3085
Tamilnadu	TNAU 43, TNAU 186, TNAU 196, CO 1, CO 2, CO 4, CO 5, CO (Ten) 7, K2, K3, SiA 3088, SiA 3156, SiA 3085, PS 4, ATL-1
Rajasthan	Prathap Kangani-1 (SR 51), SR 11, SR 16 (Meera), SiA 3085, SiA 3156, PS 4

Barnyard Millet

States	Varieties
Andhra Pradesh &Telangana	DHBM 93-3, DHBM 23-3, CBYMV-1
Bihar	VL Madira 181, DHBM 23-3
Gujarat	Gujarat Banti1, DHBM 93-3, VL172
Karnataka	VL 172, RAU 11, VL 181, DHBM 93-3, DHBM 93-2, DHBM 23-3, CBYMV-1
Madhya Pradesh	DHBM 93-3, DHBM 23-3, CBYMV-1
Tamil Nadu	MDU-1, DHBM 93-3, DHBM 23-3, CO 1, CO 2, VL 181, VL 29, CBYMV-1
Uttarakhand	VL 172, VL 207, PRJ 1, VL 29, PRS 1, DHBM 93-3, DHBM 23-3
Uttar Pradesh	VL 172, VL 207, Anurag, VL 29, DHBM 23-3, DHBM 93-3, Kanchan, CBYMV-1

Proso Millet

State	Varieties
Andhra Pradesh & Telangana	TNAU 202, TNAU 164, TNAU 151, Sagar, Nagarjuna, CO 4, CO 3, ATL 1(TNPm230), GPUP 25
Bihar	ATL 1(TNPm 230), BR 7, TNAU 164, 145, PR 18, TNAU 202, GPUP 25
Chhattisgarh	TNAU 202, GPUP 25
Gujarat	TNAU 202, GPUP 25
Karnataka	ATL 1 (TNPm 230), DHPM-2769, GPUP 8, GPUP 21, TNAU 145, TNAU151, TNAU 164, TNAU 202
Madhya Pradesh	TNAU 202, GPUP 25
Tamil Nadu	ATL 1 (TNPm 230), Co5, TNAU 151, TNAU 164, TNAU 145, TNAU 202, CO 4, K2, CO 3, CO 2, GPUP 21, GPUP 8, GPUP 25
Uttarakhand	PRC 1, TNAU 145, TNAU 164, TNAU 151, GPUP 25
Uttar Pradesh	Bhawna, PRC 1, TNAU 145, TNAU 164, TNAU 151, GPUP 25

Little Millet

State	Varieties
Andhra Pradesh and Telangana	Chhattisgarh Kutki 1 (BL-6), DHLM 36-3, OLM 203, JK 8, LMV 518, CLMV-1
Chhattisgarh	Chhattisgarh Kutki 1 (BL-6), Chhattisgarh Kutki 2 (BL-4), JK 8, JK137, JK 36, DHLM 36-3
Gujarat	GNV-3, Chhattisgarh Kutki 1 (BL-6) GV 2, GV 1, OLM 203, JK 8, DHLM 36-3, DHLM 14-1, LMV 518
Jharkhand	Chhattisgarh Kutki 1 (BL-6), DHLM 36-3, LMV 518
Karnataka	DHLM 36-3, DHLM 14-1, Chhattisgarh Kutki 1 (BL-6), OLM 203, JK 8, LMV 518, BL-41-3, Hagari same-1, CLMV-1
Madhya Pradesh	Chhattisgarh Kutki 1 (BL-6), Jawahar Kutki 4 (JK 4), JK 8, JK 36, JK137, DHLM 36-3, LMV 518, CLMV-1
Maharashtra	Chhattisgarh Kutki 1 (BL-6), Phule Ekadashi (KOPLM 83), JK 8, OLM 203, DHLM 36-3, DHLM 14-1, LMV 518, CLMV-1
Orissa	Chhattisgarh Kutki 1 (BL-6), OLM 203, OLM 208, OLM 217, DHLM 36-3, DHLM 14-1, LMV 518, OLM 217
Tamil Nadu	Chhattisgarh Kutki 1 (BL-6), DHLM 14-1, DHLM 36-3, Paiyur 2, TNAU 63, CO 3, CO 4, K1, OLM 203, OLM 20, TNPSu177, LMV 518, CLMV-1

Kodo Millet	
State	**Varieties**
Andhra Pradesh and Telangana	RK 390-25, TNAU 86, ATL-2, BK-36
Chhattisgarh	Chhattisgarh Kodo-2, Jawahar Kodo 137, RBK 155, Indira Kodo 48, Indira Kodo 1, GPUK 3, JK 439, JK 98, JK 65, Chhattisgarh-2, RK 390-25, TNAU 86, ATL-2, BK-36
Gujarat	GK 2, GK 1, GPUK 3, JK 65, JK 13, RK 390-25, GAK-3, ATL-2, BK-36
Karnataka	GPUK 3, RBK 155, RK 390-25, TNAU 86, ATL-2, BK-36
Madhya Pradesh	JK 439, JK 137, JK 106, JK 98, JK 65, JK 48, JK 13, RBK 155, RK 390-25, GPUK 3, DSP9-1, TNAU 86, ATL-2, BK-36
Tamil Nadu	KMV 20 (Bamban), CO 3, TNAU 86, GPUK 3, RK 390-25, ATL-1, ATL-2, BK-36

Millets-Processing Machinery:

The use of machinery has become very important in the food value addition process. In the process of converting small grains into food, they need to be cleaned. As the kernels are small and have the husk attached to them, the process of dehusking can be difficult. But, due to the development of technology, various machines are now available in the market. Machines for refining pulses, removing small stones and lumps from them, dehusking machines, color sorters for separating the grain by color, flour mills, ghee making machines and grinding machines are now widely available. Knowledge of the operation and minor repairs of these machines in grain refining centers and food processing plants can definitely be profitable. Expensive machines are supplied by the state government on a subsidized basis, or are also available on custom hiring.

- **Primary Process:** Conversion of raw materials into food items
  - Cleaning of grains
  - Grading
  - Dehusking of grains
- **Secondary Process:** Conversion of food items into edible food products.
  - Grinding
  - Making it into a rawa
- **Tertiary food processing:** Production of convenience foods-soup, bread, biscuits, cakes, sweets etc.

Machinery required for the primary processing:

Grader-cum-aspirator: Primary cleaning is done using grader-cum-aspirator with support of sieve sizes depending on the grains. Choosing the right type of sieve is an important factor in obtaining good quality snacks. A grader separates grains from sand particles, stones, small sticks, clay clods, grass clippings, etc. The first sieve separates stones, sticks, grass, etc., which are larger than the cereal grains. The middle sieve separates fine grains and the final sieve separates fine and coarse sand particles.

Destoner: A destoner is used to remove small stones and soil of grain size from the grader. A destoner works on the principle of gravity. A destoner hopper consists of two sieves and a bed, these sieves grade the grains. The graded grains fall on the destoner bed. Here the lighter material moves towards the front and the heavier material moves towards the back.

Dehuller-cum-aspirator: Cleaned grains are passed through dehullers-cum-aspirator and the husk is removed.

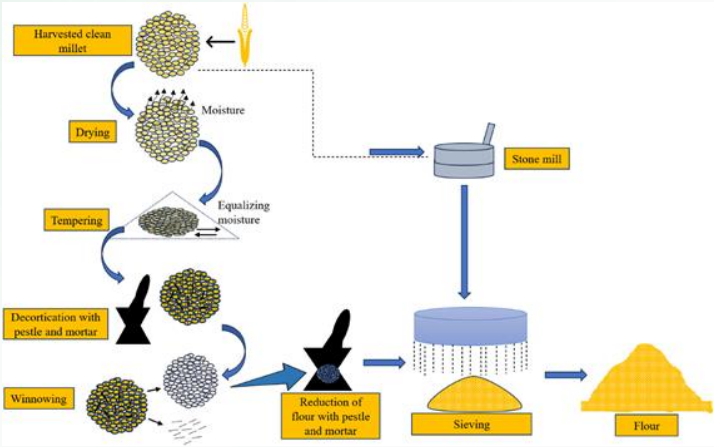
These dehullers can be classified into two types.

1. Centrifugal Dehuller
2. Abrassive Dehuller

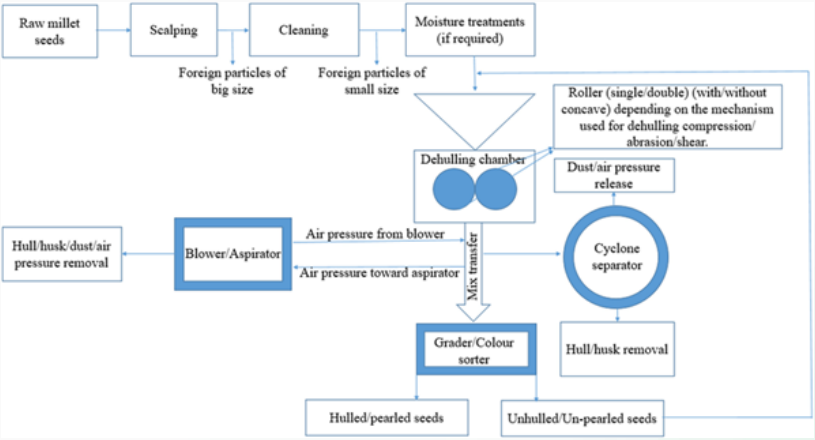
Centrifugal Dehullers: Centrifugal dehuller has an impeller which is responsible for husk removal. First the material is fed into the hopper and enters the impeller. There it is thrown up with great centrifugal force to the impeller casing. Due to the high impact, the husk is separated from the rice and sent to the aspirator. There light husk is collected at the back and small grain rice is collected at the front. Dehuller quality is measured on the retention of the remaining bran layer on small grain rice after dehulling.

Abrasive dehuller: Abrasive dehuller is classified into two types. One is emery type and the other is rubber roller type. Emery type dehuller uses grinding stones for husk removal. As the raw material passes through the grinding stones it is subjected to abrasion and the husk is removed. Rubber rollers are used instead of stones in the rubber roller type.

Grinding



Dehulling



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