

Soil conservation through small millets

cultivation on upland in rainfed region of Chhattisgarh

Adikant Pradhan¹, Anil Dixit², S. K. Nag³ and A. Sao⁴

College of Agriculture and Research Station, Jagdalpur (C.G.)
ICAR-National Institute of Biotic Stress Management, Baronda, Raipur 494 012, Chhattisgarh

Small millets include finger millet, kodo millet, little millet, barnyard millet, proso millet and foxtail millet which are dominated in rainfed region. These crops are grown under limited agricultural inputs on marginal and degraded lands where other cereals cannot perform well. Finger millet, kodo millet and little millet are very common in southern Chhattisgarh which is a staple food for most of the tribes next to rice, where rainfall varied from 1000-1500 mm during rainy season. Further, small millets fit better in these conditions due to its lesser water requirements. Its fast growing ability, weed suppressive nature, lower water requirement envisage them for conservation of natural resource. Finger millet, commonly known as Mandia or ragi, is the main food grain especially in dry areas of India. The grains contain higher nutrients contents, converted into flour for making cakes and puddings to provide a diet that is associated with hard work. The wider adaptability of the crop can be attributed to its C4 nature.

Keywords: Erosion, Rainfed region, Small millets, Soil conservation

THE small millets basically belong to grass family and it can grow like grasses over the field with different capacity of erosion control. Finger millet and kodo millet follows 60-120 days of duration to mature and maintain rooting depth of 30-60 cm with the soil loading capacity through roots ranges from 0.30 to 1.00 kg/plant under upland situation (Fig. 1.a, b, c & d). Soil, water, vegetation and weather are the most important natural resources which are must for the sustainable agriculture. Per capita cultivated land was 0.53 ha in 1950 and 0.14 ha in 2000 and it will further reduce to 0.10 ha I 2025. It is estimated that about 57.8% of the total geographical area of the country is potentially exposed to degradation through various reasons like water and wind erosion, water logging and salinization, ravines and shifting cultivation, mines and quarrying and landslides, etc.

Soil erosion is a process that leads to a huge amount of soil loss and

thus may lower the capacity of soil to support human life. For the protection of land form from erosion, it is imperative to adopt appropriate conservation measures. About 85% of total rainfall is received during monsoon period (June to September). In each of these months, there are 10-15 rainy days. The climate of the area is subhumid (moist). The arable land comprises 42% and the soils are classified into five order: entisols (10.4%), inceptisols (33.6%), Alfisol (35.20%), vertisols (19.9%), mollisols (0.8%) and rock-out crop (0.07%).

The soil erosion in the region is mostly caused by rain water resulting into the loss of top soil and terrain deformation. The loss of soil due to water erosion varies from terrain to terrain depending upon different land use/land cover intensity of rainfall. Since the erosion is the major factor for loss of top soil and imperative to undertake appropriate soil

conservation measures for prevailing erosion (Fig. 2.a, b, c & d). The conservation measures depend on types of soil and the degree of soil erosion.

Characteristics of small millets

Finger millet

- Hardy crop with the capacity to measure under stress
- Under limited moisture, it provides higher grain yield than some cereals
- Profuse fibrous roots help to retain soil intact

Kodo millet

- Rainfed, short stature crop with higher tillering
- Erosion resistance in slight slopy lands
- Suitable under low fertile soils

Little millet

- Short growth period (60-70 days)
- Provides the option for mid *kharif*



Fig. 1.a. Root of finger millet with intact soil



Fig. 1.b. Length of Kodo millet root



Fig. 1.c. Root of Kodo millet with intact soil



Fig. 1.d. Length of finger millet root

- pulses or cereals sowing
- Nearly 1 metre height produces good palatable fodder

Barnyard millet

- Early maturing crop
- Fast growing capacity utilize quickly the available resources
- Cover the soil due to wider leaf width as well as length

Proso millet

- Earliest maturing crop among small millets
- Profuse tillering can check the soil erosion
- Less rain is sufficient to mature

Foxtail millet

- Less nutrient exhaustive crop

- Wider leaf also help to reduce the droplet intensity
- Good fodder as animal feed

Measures for conservation

- Small millets should be sown with first shower of monsoon on prepared lands
- Sowing is always recommended as line sowing across the slope with seed drill at 30 cm apart in rows
- If slope is greater than rolling types then broadcast methods can be adopted under slight heavy soil but not under light soil
- In between rows, country plough or hoe is suggested to reduce weed population in initial 25-35 days after sowing
- After suppression of weeds, nitrogenous fertilizers application is beneficial for growth and development of small millets with good harvest.
- Harvesting of small millets should be done at fully matured crop leaving 8-10 cm long stubbles over the field to provide proper infiltration of rain water for next year

Benefits of small millets

- Barren and wasteland can be converted into cultivated land avoiding soil loss alongwith increasing soil stability
- Utilization of rainwater in situ by growing crop on such reclaimed lands

Table 1. Erosion concerned features of small millets

Crop	Duration (days)	Mean rooting depth (cm)	Mean soil load capacity (kg/plant)	Mean rooting dimension (cm ³)	Root volume (v/v)
Finger millet	90-130	55.00	1.00	20.00	0.325
Kodo millet	90-120	35.12	0.61	15.00	0.278
Little millet	60-90	60.00	0.42	12.00	0.215
Barnyard millet	70-80	65.01	0.91	20.00	0.314
Proso millet	60-70	40.15	0.60	15.00	0.208
Foxtail millet	75-85	38.05	0.36	10.00	0.245

Table 2. Recommended varieties of small millets for erosion prone areas

Crop	Varieties
Finger millet	Indira Ragi1, CG Ragi 2, GPU 28, VR 708, VL149, Ratnagiri, Godavari (PR-202), PES 400, PR 202
Kodo millet	Indira Kodo1, CG kodo1, JK 155, GPUK 3, JK 41, JK-48 (DPS-48)
Little millet	CG Kutki1, JK 8, Birsu Gundli 1, CO1, JK-2 (Dindori-2), TNAU-63
Barnyard millet	VL Mandira-8, Gujrat Banti-1, Anurag, RAU-3, VL Madira-29
Proso millet	Ram Cheena, Shyam Cheena, Varada, GPUP-8
Foxtail millet	Arjun, CO-1, Chitra, K-2, Nallamala Korra (SIA-326)



Fig. 2.a. Drilling of finger millet



Fig. 2.b. Established under with dry spell



Fig. 2.c. Measuring soil moisture



Fig. 2.d. Ragi in fruit plantation

Table 3. Yield performance of locations (q/ha)

Crop	Bastanar		Turenar		Ransargipal		Mean
	2017	2018	2017	2018	2017	2018	
Finger millet	25.02	21.05	16.48	17.15	18.25	20.15	19.68
Kodo millet	18.25	15.42	12.25	13.15	13.28	15.26	14.60
Little millet	7.04	8.15	6.15	7.14	5.16	6.35	6.67
Crop	Dongariguda		Matenar		Dharmaur		Mean
	2017	2018	2017	2018	2017	2018	
Barnyard millet	12.03	11.08	12.88	11.93	13.73	12.78	12.41
Proso millet	8.02	7.85	8.87	8.7	9.72	9.55	8.79
Foxtail millet	7.95	6.58	8.8	7.43	9.65	8.28	8.12

- Avoids huge amount of subsoil deposition in lower areas
- Useful in avoiding soil loss from plantation crops on sloppy uplands

The erosion control through vegetation is mostly depended on root and shoot features which reflect the ability of soil retention against the erosion agents whether it is fast runoff-water or fast moving winds. The finger millet can grow longer

and also help in holding soil higher (1 kg/plant) capacity than remaining small millets and the lower in foxtail millet because it has early growth as well as maturity. Another important aspect is rooting diameter inside soil which is higher under finger millet (20 cm) whereas lower in foxtail millet (10 cm) which leads to hold more soil by roots at the event of soil erosion during rainy season. The root volume (v/v) is more important than

diameter, because higher diameter of root may have lower volume due to less numbers of roots on plants *viz.* finger millet was found in field higher (0.325 v/v) than other small millets and barnyard millet was similar with 0.314 v/v (Tables 1, 2) and yield performance of different small millets has been given in Table 3.

The cattle rearing of this region is not the commercial husbandry but mostly the local types of milch as well as draught animals. Therefore, farmers avoid growing grasses on upland and hence, the cultivation of small millets could be substitute in such circumstance. These crops can also produce the grains keeping longer crop stands over barren lands.

¹S.G. College of Agriculture and Research Station, Jagdalpur (C.G.). ²ICAR-NBSM, Raipur (C.G.). ³Krishi Vigyan Kendra, Bastar (C.G.). ⁴College of Agriculture, IGKV, Raipur (C.G.). *Corresponding author's e-mail: adi19agr@gmail.com.