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Little millet: A climate resilient crop for higher farm income and water productivity in hilly areas of Odisha

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Little millet with short duration, and low water and nutrient demand is an ideal climate resilient crop for fragile uplands and hilly ecosystems. In addition, the grains are nutritious with medicinal value. The crop responds well to organic management practices. Transplanting is a better method of crop establishment, but direct seeding is very common. Inclusion of horsegram or greengram after little millet enhances the system productivity and stability.

Keywords: Cropping system, Organic nutrition, Water productivity

LITTLE millet (*Panicum sumatrense* L.) is a short duration and low external input demanding crop. Grains of little millet are highly nutritious and provide balanced food for human beings. It is one of the coarse cereals consumed after milling similar to rice. Straw of little millet is rich in nutrients and considered as a good cattle feed. The crop has a wider adaptability and it can withstand both drought and water logging. Being a short duration crop, it can fit well to different cropping systems. In India, it is the second important small millet crop next to finger millet. Madhya Pradesh, Chhattisgarh, Andhra Pradesh, Odisha, Karnataka, Tamil Nadu, Gujarat, Jharkhand, Maharashtra and Uttar Pradesh are major growing states covering an area of 2.34 lakh ha with annual production of 1.27 lakh tonnes and productivity of 544 kg/ha. In Odisha, little millet is popularly known as *Suan* and mostly cultivated in Koraput, Ganjam, Nuapada, Gajapati, Mayurbhanja, Rayagada, Balangir, Sundargarh and Kalahandi districts. It is grown in hill top, slope and base, and also in marginal uplands during *kharif* season both as a pure crop or mixed crop.

The area, production and consumption of little millet is gradually increasing after 2017 due to interventions under Odisha Millet Mission (OMM). Interestingly, little millet is gaining importance in some districts as a viable commercial food crop. At present, the low productivity of little millet is due to non-availability of quality seeds of improved varieties, sub-optimal plant population and inadequate nutrient and weed management. However, improved package of practices in demonstration plots indicates that there is tremendous scope for increasing little millet production. Based on research findings at Research Farm of ICAR-Indian Institute of Water Management (IIWM) and demonstration results in farmers' field, the following management practices are suggested for a sustainable little millet production.

Growing season

Little millet is normally cultivated during *kharif* season. Second fortnight of June to first fortnight of July is the optimum sowing time. But it can also be grown during summer season with irrigation. Second fortnight of January to first fortnight of February is suitable sowing time for the summer crop. The crop can be well fitted in rice fallow in irrigated lands.

Varieties

One of the recommended varieties of little millet can be adopted as per crop establishment method, consumer preference and market demand.

Seed treatment

Seed treatment with bio-stimulants is one of the proven practices to produce healthy seedling, better crop establishment, and disease tolerance. Soak 1 kg seed in 200 mL of *beejamrutha* for 15 min and dry it under shade.

Table 1. Recommended varieties of little millet for Odisha

Variety	Duration (days)	Average yield (t/ha)	Special characters
OLM-218 (Kalinga Suan-1)	92	1.68	Resistant to banded blight, leaf blight, smut and moderately resistance to shoot fly
OLM-217	105–110	1.5–1.6	Resistant to rust and grain smut
OLM-208	100–105	1.2–1.5	Moderately resistant to shoot fly
OLM-36 (Kolab)	95–100	1.1–1.2	Resistant to brown spot and sheath blight
OLM-20 (Sabar)	75–80	1.1–1.2	Drought tolerant
BL-6	90–95	1.2–1.4	Upland, rich in zinc and calcium

Alternatively, prepare a solution by mixing 500 mL cow urine in 2.5 L of water, and dip the seeds for 30 min with a muslin cloth. Otherwise as a simple practice, treat the seeds with *Trichoderma harzianum* dust + *Pseudomonas fluorescens* @10 g each/ kg seed.

Crop establishment

Direct seeding is common method of establishment. Demonstrations conducted in farmers' fields revealed that line sowing is better than the broadcasting. Field experiment conducted at ICAR-IIWM, Bhubaneswar research farm reported that line transplanting of little millet resulted in significantly higher grain yield as compared to direct seeding. During dry season, transplanting of seedlings is the only option. System of little millet intensification by using medium to long duration varieties improves resource use efficiency and farm income.

Seed rate and crop geometry

A seed rate of 8–10 kg/ha is ideal for line sowing whereas for broadcasting, 12–15 kg/ha is required. For transplanting, 5–6 kg/ha of seeds is sufficient. For line sowing, 22.5 cm × 10 cm is ideal to achieve optimum plant population and crop yield. Thinning of excess seedlings and gap filling at 15–20 days after sowing during the first intercultural operation is advocated.

Nursery management

Age and health of seedlings is one of the key yield enhancing factors. The nursery site should have assured irrigation and drainage facilities. About 300–400 m^2 area is sufficient to produce seedlings for one-hectare crop area. Raised seed bed of 1. 2 m width, 0.1 m height and convenient length are prepared. Add 2–3 baskets of FYM/cow dung per 10 m^2 nursery area. Seeds after mixing with sand in 1:2 ratio should be sown shallow in rows, 5–8 cm apart. After sowing, nursery beds are covered with a thin layer of well decomposed FYM/dry soil. Maintain soil moisture of nursery bed by sprinkling water at regular interval. About 15–20 days old seedlings are transplanted shallow (5 cm depth) at 1–2 seedlings/hill following a spacing of 22.5 cm × 10 cm. For system of little millet intensification, wider spacing of 25 cm × 25 cm is ideal.

Little millet nursery

Transplanting little millet in main field

Nutrient management

Integrated nutrient management is advocated. For organic nutrient management, apply 5 t/ha well decomposed FYM or 0.4 t/ha *ghanajeevamrutha* or 0.6 t/ha vermicompost at the time of land preparation. Spray 400 L/ha of *jeevamrutha* to the soil just after first intercultural operation. Rest 100 L/ha of *jeevamrutha* diluted with 500 L of water may be sprayed in two splits at panicle initiation and flowering stage. Spray *handikhata* @50 L/ha after mixing with 500 L of water in two splits (45–50 and 60–65 days of crop establishment).

Weed management

Inter-cultivation of little millet with a cycle weeder not only controls weeds but also improves soil aeration, promotes better root growth and nutrient uptake. Hand operated cycle weeder can be used for intercultural operation at 20 and 30 DAS. In transplanted field, cycle weeder should be used at 15 and 30 days after transplanting.

Water management

About 250–300 mm of water is required for 85–100 days varieties. The crop is normally grown in rainfed condition during *kharif season*. During the long dry spell, application of life saving irrigation at tillering and grain filling stage minimises the yield loss. The crop needs 3-4 irrigations during *rabi* and 4–5 irrigation during summer. Irrigation scheduling by using soil moisture sensor is beneficial in enhancing water productivity and profitability. Maintain optimum soil moisture at critical growth stages like tillering, flowering and grain filling stage. Field experiment conducted at ICAR-IIWM research farm revealed that scheduling of irrigation at 50% depletion of available soil moisture is optimum for higher grain yield and yield attributes.

Insect-pest and disease management

Little millet is more resistant to insect-pest and disease attack as compared to other millet crops. Shoot fly sometimes cause up to 39% yield reduction. Spraying of neem oil @4 mL/L of water two times at 10 days interval minimises the damage. In addition, spraying of *panhagavya* @5 L/ha mixed with 100 L of water at reproductive stage takes care of pest.

Among the diseases, blast is common. Need based spraying of *Pseudomonas fluorescens* @0.3% twice

Standard preparation procedure of *Handikhata*

Handikhata is traditional organic liquid manure used in agriculture both as nutrient source and pesticide. It is prepared at farm level by using locally available materials. The ingredients include 1 kg fresh cow dung, 5 L cow urine, 50 g jaggery (*gur*), and 1 kg each of neem (*Azadiracta* spp.), karanja (*Pongamia pinnata*), and arakha (*Calotropis* spp.) leaves. First, cow dung, cow urine, and jaggery are mixed thoroughly in the earthen pot of 5-7 L capacity. The leaves are chopped into small pieces and added to the mixture. The pot is then covered and kept in shade for 7 days for fermentation. After a week, the liquid portion (*Handikhata*) is extracted. Preparation and marketing of *Handikhata* are being promoted by OMM to ensure its availability to millet farmers.

Little millet at grain filling stage

Little millet crop at maturity

Table 2. Little millet based cropping systems for higher land and water productivity (Case study at Komana block of Nuapada district 2023–24)

Cropping system	Yield (*kharif*) kg/ha	Yield (*rabi*) kg/ha	LMEY kg/ha	Land productivity (kg/ha/day)	LUI (%)	PWP Kg/ m^3	EWP ₹/m^3
Little millet–fallow	750	-	750	9.4	30.8	0.09	4.8
Little millet–green gram	800	502	1866	12.4	41.1	0.22	10.5
Little millet–horse gram	850	440	1460	8.59	46.6	0.17	8.5

LMEY, Little millet equivalent yield; LUI, Land utilisation index; PWP, Physical water productivity; EWP, Gross economic water productivity.

at 10 days interval takes care of disease.

Harvesting and processing

Harvesting is done once the ear-heads are physiologically mature. The cleaned seeds should be sun dried to attain a safe moisture level of 12%. Seeds can be stored for longer period using gunny bags, nylon woven sacs or IRRI super bags. Little millet grains require primary and secondary processing. Destoning, dehulling, cleaning and drying are primary processing procedures required for obtaining good market price.

Cropping system

Little millet-based cropping systems have their own importance in tribal dominant regions. The crop is cultivated as a sole crop, inter crop, mixed crop and under different cropping sequence. Early harvest of little millet by the end of September to early October permits to grow another short duration pulses like horse gram and green gram. Cropping system approach helps in higher land and water use efficiency, higher farm income and reduces the dependence on external inputs

Economics

Under optimum level of management, little millet gives grain yield of 0.8–1.5 t/ha and 2.0–3.0 t/ha of stover yield. Survey conducted at farmers field of several districts of Odisha revealed that farmers sold their surplus amount of grains at local market only. Farmers normally get about ₹20,000–30,000/ha as net profit. Inclusion of pulses like horse gram or green gram in the cropping sequence significantly enhances the farm income.

SUMMARY

Little millet is short duration, low water requiring, economically competitive, and environmentally friendly crop with wider adaptability. It has high food and nutritional value and market demand. Availability of location specific farmers friendly high yielding varieties, quality seed materials, suitable management practices and processing technologies will ensure the wider adoption. Favourable government policies like implementation of Odisha Millet Mission, minimum support price, and inclusion of little millets in public distribution system may help in increasing area, production and consumption of little millet. The little millet based cropping system will help to address the problem of malnutrition by taking care of soil and the environment.

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