

Good agricultural practices for dry-season finger millet

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Dry season finger millet is gaining importance for crop diversification and intensification in rice based system. Finger millet is a good source of vitamins and minerals as compared to major cereal crops of India. This article provides information on short-duration high-yielding varieties (HYVs) such as 'Shree Ratna' and 'Arjun', healthy nursery management, and transplanting young seedlings followed by timely intercultural operations and irrigation which are pre-requisite for higher productivity and profitability in dry-season finger millet.

Keywords: Cycle weeder, Integrated nutrient management, Need-based pest management, Young seedlings

MILLETS are considered as climate resilient and nutritious grain crop, mostly grown in *kharif* season under rainfed ecology. Finger millet is the second important food crop next to rice in Odisha. The grains of finger millet are rich in carbohydrates, proteins, dietary fibre, fat, and amino acids such as tryptophan and methionine. The grains are also rich in calcium (344 mg/100 g), which is ten times more than that of rice and wheat. Being a short duration, low water requiring and high temperature tolerant crop, it can be grown during dry season under irrigated ecology. The low water (350–400 mm) and nutrient requirement of finger millet suggests that it can be the best alternative to the summer rice in tube well and groundwater irrigated area of Odisha. Due to the intervention under Odisha Millet Mission (OMM), the area under dry season finger millet is increasing, covering an area of 5.26 thousand ha with production of 5.49 thousand tonnes and productivity of 1,044 kg/ha. However, the average productivity is below the national average due to several factors. Adoptions of short duration high yielding varieties and suitable agricultural practices

can enhance the productivity and profitability of this production system.

Major yield limiting factors in dry season finger millet in Odisha

- Limited availability of quality seeds of high yielding varieties and locally improved varieties for dry season.
- Lack of timely intercultural practices to minimise crop-weed competition at early stage of crop growth.
- Lack of proper nutrient management to meet the nutritional need of the crop to achieve the potential yield during dry season.
- Lack of adequate irrigation facilities to maintain favourable soil moisture during critical growth stages particularly during reproductive stage.
- Lack of knowledge and means for need-based control of pest particularly ear head caterpillar and neck blast diseases at reproductive stage.
- Lack of awareness on critical management practices like seed treatment, quality seed, balanced plant nutrition, role of bio stimulants, irrigation scheduling and cropping system management.
- Lack of adequate facilities for drying, threshing and



Finger millet nursery on raised bed

processing of grains to improve quality with high shelf life to fetch reasonable price.

Good agricultural practices for dry season finger millet in Odisha

Selection of appropriate varieties: Use short duration varieties like 'Shree Ratna', 'Arjun', 'Bhairabi', 'VL 352', 'Sana Mandia' and other promising local improved varieties (LIV) of the region. Encourage certified seeds of HYV and LIV for realising the yield potential.

Seed bio-priming: To protect the seedlings from soil and seed borne pathogens, seeds should be treated with the dust formulation of *Trichoderma harzianum* + *Pseudomonas fluorescens* @ 5 g/kg seed each.

Nursery management: Age and health of seedlings are one of the key yield incrementing factors. Community nursery for seedling production should be encouraged. The land having assured irrigation and drainage facilities should be selected for developing nursery. About 200–300 m² area is sufficient to produce healthy seedlings for transplanting one-hectare main field. Raised seed bed of 1.2 m × 4.5 m × 0.1 m are prepared and add 2–3 baskets of FYM/cow dung + 1 kg single super phosphate (SSP) + 0.5 kg MOP + 0.5 kg Ammonium phosphate per 10 m² nursery area. Seeds should be sown at shallow depth in rows at 8 cm spacing. After sowing, nursery beds are covered with a thin layer of well decomposed FYM/dry soil. One day after sowing, apply light irrigation using pipe. Care should be taken to protect the seeds from termite and red ant by applying neem cake. Irrigation need



Healthy and young seedlings of finger millet

to be given at 10–12 DAS (days after sowing) using pipes to maintain soil moisture. Top dress with urea @ 500 g/bed at 12–14 DAS.

Crop establishment methods: System of finger millet intensification (SMI) and line transplanting are two promising crop establishment methods of finger millet during dry season. Seedlings of 12–14 and 20–25 days old are recommended for SMI and line transplanting, respectively. Aged seedling can be avoided by staggering the sowing date in nursery beds. Transplant seedlings upright at shallow depth (3–5 cm) @ one seedling/hill at 20–25 cm each row and plant spacing for SMI.

For line transplanting, use 2–3 seedlings/hill at 22.5 cm × 10 cm spacing. Experimental results revealed that transplanting of two weeks old seedlings at 20 cm × 20 cm spacing registered higher grain yield, straw yield, gross return, B:C ratio, physical water productivity (PWP) and economic water productivity (EWP) by 12.5, 9.9, 12.5,

19.8, 13.7 and 12.5%, respectively, as compared to transplanting of three weeks old seedling at 20 × 20 cm.

Intercultural operations and weeding: Intercultural operations and weeding at 20 and 40 days after transplanting (DAT) by cycle weeder proved beneficial than the manual weeding for better weed control and crop growth.

Nutrient management: Follow integrated nutrient management to obtain the potential yield of irrigated finger millet. Soil test crop response based nutrient supply is advocated to get a target yield. Use FYM @ 2 tonnes + 60-20-20 kg of N-P₂O₅-K₂O/ha to get optimum yield. Full dose of FYM + 50% N + 100% P₂O₅ + 100% K₂O is to be applied as basal dose at the time of land preparation. The remaining 25% N at 20–25 DAT (after first intercultural operation) as first top dressing and rest 25% N is applied at 40–45 DAT (after second intercultural operation).

Water management: Water management is the most important factor which affects the productivity of dry season finger millet. Normally, the crop needs 3–5 irrigations during *rabi* and 4–6 irrigation during summer season depending on soil type. Finger millet should be irrigated when 50% of available water is depleted. Irrigation scheduling by using soil moisture sensor is recommended for achieving higher water productivity and profitability. Maintaining optimum soil moisture at critical growth stages like tillering, flowering and grain filling stages is essential for higher water productivity, nutrient use efficiency and yield. Experimental findings at ICAR-Indian Institute of Water Management (IIWM), Bhubaneswar



Line transplanting



Interculture by cycle weeder



Demonstration in farmers field



Finger millet harvesting by a happy woman farmer

revealed that irrigation schedule at 50% depletion of available water resulted in similar grain yield, gross return, B:C ratio, physical and economic water productivity with irrigation at 40% depletion.

Pest management: Finger millet is known for its low pest pressure. However, dry season finger millet is often attacked by insect-pests like stem borer at vegetative stage and ear head caterpillar at maturity

stage. Need-based spraying of neem seed kernel extract @ 5 mL/L water controls the pests. Among the diseases, leaf blast at vegetative stage and neck blast at maturity infest the crop. Seed treatment with bio-agents followed by spraying of *Pseudomonas fluorescens* at 0.3% at flowering and 10 days later controls the diseases. As an alternate to bio-agents, need-based spraying of carbendazim @ 1 g/L water is effective against blast

diseases.

Harvesting and processing: Harvesting of the ear heads is done at physiological maturity when 80–85% grains turn brown in colour. Minimum two cuttings are needed to take care of the late emerged ear heads. Dry the harvested ear heads for 7–10 days for proper threshing. After threshing, dry the grains for 1–2 days to obtain grain moisture of about 12% for better shelf life.

Economics: Under optimum management, the crop yields 1,500–2,500 kg of grains and 2,000–3,000 kg/ha of stovers. Results of field experiment at ICAR-IWBM Bhubaneswar revealed that transplanting of 14 days old seedlings at 20 cm × 20 cm spacing resulted higher gross return of ₹101,900/ha with B:C of 2.24. Varieties 'Shree Ratna' and 'Arjun' resulted gross return of ₹100,960 and ₹92,240/ha, respectively.

Table 1. Yield, economics and water productivity of finger millet

Treatments	Plant height (cm)	Grain yield (kg/ha)	Straw yield (kg/ha)	Gross Return (₹/ha)	B:C	PWP (kg/m ³)	EWP (₹/ha)
Crop establishment methods							
C ₁	70.6	2,310	2,818	101,920	2.24	0.58	25.52
C ₂	70.4	2,053	2,565	90,620	1.87	0.51	22.69
CD (p=0.05)	NS	73	73	3,188	0.07	0.02	0.80
Varieties							
V ₁	70.4	2,084	2,818	92,240	1.96	0.49	21.85
V ₂	64.4	2,297	2,408	100,960	2.17	0.63	27.81
V ₃	76.5	2,162	2,847	95,610	2.03	0.51	22.65
CD (p=0.05)	1.6	61	80	2,698	0.06	0.02	0.69
Irrigation schedules							
I ₁	73.1	2,359	2,894	104,090	2.15	0.59	26.02
I ₂	71.9	2,340	2,872	103,260	2.19	0.57	25.42
I ₃	66.4	1,845	2,307	81,460	1.82	0.47	20.86
CD (p=0.05)	1.8	42	53	1,818	0.04	0.02	0.62

C₁: Transplanting of two weeks old seedlings at 20 × 20 cm, C₂: Transplanting of three weeks old seedlings at 20 × 10 cm, V₁: Arjun, V₂: Shree Ratna, V₃: Ganjam Local, I₁: Irrigation at 40% SMD (soil moisture depletion), I₂: Irrigation at 50% SMD, I₃: Irrigation at 60% SMD, PWP: Permanent wilting point, EWP: Economic water productivity, NS: Non-significant.

SUMMARY

Finger millet, a nutri-cereal, has a prominent place in Odisha. Hence, use of good agricultural practices such as improved varieties, system of millet intensification, line transplanting, intercropping operation by cycle weeder, integrated nutrient management and need-based control of pests, significantly enhance the dry season finger millet yield. The crop requires only 350–400 mm of water and produces 1,500–2,500 kg grain per hectare under proper management. This can help in crop diversification, and reduced use of water and fertiliser as compared the dry season rice and maize.

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