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Demonstration of finger millet (*Eleusine coracana* L. Gaertn.) ML-365 as a high yielding variety under irrigated condition for higher yield and income

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Abstract

Finger Millet (*Eleusine coracana* L. Gaertn.) is an important food crop grown under rainfed and irrigated condition. Finger millet crop is grown in summer (bore well) under irrigated condition where the yields were low due to growing of long duration local varieties. ICAR-Taralabalu Krishi Vigyan Kendra (KVK), Davangere conducted the Frontline demonstration on the integrated crop management practices in summer finger millet in Davangere district for three years in an area of 38 ha with 75 farmers. The Improved Crop Management practices *viz*., promotion of high yielding and short duration variety ML 365, integrated nutrient, pest and disease management technologies and irrigation at critical stages were demonstrated and compared with the farmers practice. Results indicated that demonstration of finger millet variety ML 365 with Improved Crop Management practices recorded higher grain yield of 32.39 qha^{-1} and farmers practice (GPU-28) recorded lower yield of 28.49 qha^{-1} and also observed the 13.07 percent increase yield over farmer's practice. The highest average net income was recorded in Demonstration plot of rs.61086.6ha^{-1} over the farmer's practice with rs.47155 ha^{-1}. Besides, farmers realized higher average benefit cost ratio (2.46) through the demonstration compared to farmer's practice (2.07). The improved production technology in high yielding variety of finger millet (ML-365) had improved the grain yield and net returns of the farmers growing under irrigated condition. In the present study, potential of the new variety and improved production technologies were demonstrated systematically and scientifically in the farmer's field along with farmers practice for further adoption in larger scale by farming community.

Keywords: Frontline demonstration. variety ML-365, irrigated condition

Introduction

Finger Millet (*Eleusine coracana* L. Gaertn.) is an important food crop grown under rainfed and irrigated condition. Finger millet is an important millet grown mainly as a staple food and fodder. Davangere district receives an annual rainfall of 625 mm and finger millet mainly grown as a rain fed crop and in some patches grown during the summer through bore well irrigation. In India the area under finger millet is 1.00 million hectares with a total production of 1.76 million tonnes and average productivity of 1747 kgha^{-1}. It comes in third place among millets, behind bajra and sorghum, and sixth place among Indian cereals, behind rice, wheat, maize, sorghum, and bajra. Karnataka is the top producer of finger millet in India. The major growing areas of finger millet is the southern parts Karnataka with low rainfall. Tumakur district stands first in production of finger millet, followed by Ramanagar, Bengaluru Rural, Hassan, Mandya, Kolar, Chikballapur, Shivamogga, Chikkamagaluru, Chamarajnagar, and Davanagere districts. The area under finger millet in Karnataka is about 1.19 million hectares with production of 1.98 million tonnes with productivity of 1661 kgha$^{-1.}$ Finger millet contains about 5-8% protein, 1-2% ether extractives, 65-75% carbohydrates, 15-20% dietary fibre and 2.5-3.5% minerals (Chethan and Malleshi 2007a) [3]. Growing children's and elderly people's bones can be strengthened by the natural calcium found in finger millet. Frequent consumption of finger millet promotes bone health, prevents osteoporosis, and may lower the risk of fracture. Earlier farmers were growing maize during the summer and the yield levels were good but the water requirement for the maize is more when compared to finger millet. In terms of crude fibre, amino acids, and minerals like calcium (344 mg/100g) and potassium (408 mg/100g), it is better than rice and wheat (Ashish Kumar Rai, *et al*., 2025) [2] It also contains anti nutrients such as phytates, polyphenols, tannins and trypsin inhibitor finger millet and its products helps in managing diabetes and its complications by regulation of glucose homeostasis and prevention of dyslipideamia. It also gives protection against the risk of cardiovascular disease, gastrointestinal cancers and other health issues. It has health beneficial effects, such as anti-diabetic, antidiarrheal, antiulcer, anti-inflammatory, antitumerogenic, atherosclerogenic effects, antioxidant and antimicrobial properties (Devi *et al*., 2014) [4]. Hence, there is a lot of scope for improving finger millet production and productivity.

Finger millet is being cultivated in an area of about 20,000 hectares in *kharif* and 15435 ha in summer Davangere

District. Earlier, the farmer growing the finger millet during the summer were using the old/local varieties without good management practices. Hence, the productivity of finger millet might be increased by growing suitable high yielding variety along with integrated crop management practices. Similar studies on crop yield increase by adoption of integrated crop management practices were reported by Subhashree *et al*., (2017) [7] in Finger millet. Considering the above facts, a frontline demonstration was proposed and conducted in the farmers' holdings to demonstrate the improved production technology of finger millet for higher productivity under irrigated condition.

Materials and Methods

Frontline demonstration was conducted to demonstrate the improved production technology of short duration variety in comparison with the existing farmers practice in the Agasanakatte Hireharakere and Kalledevrapura of Davangere District. The farmers who are growing the maize were targeted and replaced the same with finger millet during 2022, 2023 and 2024 summer season respectively.

ML-365 is known for its good grain and fodder quality, and its ability to perform well under delayed monsoon and irrigated conditions. Demonstration was conducted in an area of 38 ha with 75 farmers with three different location during 2022 to 2024. The soils of the demonstration fields were collected and analysed for its initial soil nutrients status. The results showed that the soils were slightly alkaline in soil reaction, non-saline, low in nitrogen, medium in phosphorus and potassium nutrient content. Demonstration and farmer practice was conducted in an area of 0.4 ha. In the Frontline demonstration, the integrated crop management practices like use of high yielding variety ML 365, Seed treatment with bio fertilisers, using of seed cum fertiliser drill for sowing of seeds and fertiliser, water management practices like sprinkler irrigation and integrated nutrient management, weed management and integrated pest and disease management practices along with mechanical harvesting and making the bales of fodder were demonstrated against the farmers practice. University of Agricultural Sciences, Bengaluru during 2008 released a Finger millet variety ML-365. The important characters of the variety are its duration of 100-105 days high yielding variety, tolerant to drought and blast disease and best fodder. In farmers practice, finger millet variety GPU -28 was grown with the existing non-integrated crop management practices such as manual broad casting and sowing, basal application of complex fertilizers, furrow irrigation management practices and indiscriminative use of pesticides for fall army worm management. But still today the variety is ruling and farmers prefer for its short duration and resistant to blast.

The details on the integrated crop management practices /interventions followed in the demonstration and farmers practice were given in Table 1. The farmers were trained with improved production technology of finger millet through on and off campus and conducted the method demonstration of seed treatment and sowing in seed cum fertiliser drill for the selected beneficiary farmers before the initiation of the demonstration

Regular follow up field visits were made by the scientist of ICAR - Taralabalu Krishi Vigyan Kendra, Davanagere for collection of observation and timely recommendation. The technologies in the package of practice of University of Agriculture Science, Bengaluru were used. The data from both the demonstration and farmers practices were collected at the time of harvest. The following were the observation collected were the data on plant height (cm), number of tillers per plant (number), and grain yield (kgha^{-1}) of finger millet crop were recorded. The economic parameters such as cost of production (Rs ha^{-1}), net return (Rs ha^{-1}) and benefit cost ratio were worked out based on the cost of critical inputs, cultivation practices and market price of the produce at time of selling. The critical stages for the irrigation were crop establishment, tillering stage, flowering stage, grain filling and grain maturing stage and irrigation intervals depend on the soil types during the summer. The fodder of finger millet is in high demand for dairy farmers. The extension gap, technology gap, technology index,% increase in the yield over farmer practice and benefit cost ratio were calculated using the following formula.

Extension gap = Demonstration yield - Local check yield (1)

Technology gap = Potential yield - Demonstration (2)

$$\text{Technology Index (\%)} = \frac{\text{Technology gap}}{\text{Potential yield}} \text{X} \quad 100$$

$$\text{Percent increase in yield} = \frac{\text{Demo yield} - \text{check yield}}{\text{Check yield}} \text{. X } 100$$

$$\text{Benefit cost ratio} = \frac{\text{Gross return (₹.ha-1)}}{\text{Gross Cost (₹.ha-1)}}$$

Results and Discussion

Results of the study clearly shows that demonstration of high yielding finger millet variety ML-365 with Integrated Crop Management practices recorded the average higher plant height (83.04 cm), higher number of tillers per plant (4.93) and number of finger per plant (6.04) Lower plant height (73.37 cm), number of tillers per plant (3.49) and number of fingers per plant (5.24) were recorded in farmers practice. (Table 2).

ML-365 high yielding finger millet variety will come to harvest before a week when we compared with the farmer practice. Cultivation of the high yielding finger millet variety ML-365 during the summer recorded the higher average grain yield of 32.39 qha^{-1} (Table: 3). Farmers practice recorded the lower average grain yield of 28.49 qha^{-1}. Adoption of improved practices increased the yield of finger millet to the tune of 13.07 per cent compared to the farmers practice under irrigated condition. The increased yield under demonstration might be due to the integrated management practices like growing of high yielding variety and providing the irrigation at critical stages. The similar observations of yield improvement through front line demonstration of integrated crop management practices had been reported by Raghunatha Reddy *et al*.,(2020) [6] and Anand Naik *et al*., (2016) [1] in sorghum. The disease incidence of blast was not observed in the demonstrated variety and it was 8.93 per cent in the farmers practice. Incidence of fall army worm pest was reported in both fields and suitable measures were taken to control the pest.

Table 1: Technology Gap in adoption of improved production practices in Finger Millet during 2022 to 2024 (3 years)

Si. No	Technology	Improved Practices	Farmer Practices	Gap in Adoption (100%)
1	Variety	ML- 365	GPU-28	100
2	Seed rate	12 kg/ha	25 kg/ha	High Seed rate
3	Seed Treatment	Bio Fertilisers- Azosprillium and PSB @ 500g/ha	No seed treatment	100
4	Macro Nutrients	100:40:40 NPK kg/ha	120:46:15	75
5	Nutrient sprays	13:00:45 @ 5g/l of water 35 days after Sowing	No sprays	100
6.	Micro Nutrients	Application of Zn and Fe @ 10kg/ha / EDTA spraying of Zinc and Iron involves applying these micronutrients, chelated with EDTA (ethylenediaminetetraacetic acid), to crops as a foliar spray. EDTA acts as a chelating agent, keeping the micronutrients	No application	100
8	Plant Protection Measures	Installation of pheromone traps Spraying of Neem oil 2ml/l followed Emmactin Benzoate +Thiamethoxam @ 2 g/l of water- only one spray	Spraying of Choloropyripous 2 ml/l followed by Spraying of Emmactin Benzoate @0.4 g/l of water. No of Sprays -3No.	50
9	Number of Irrigations	06	11	50

Table 2: Average Observation of the growth and yield parameters for 3 years

Technology	Plant height (cm)	No of tillers/plant	Number of fingers/plant	Test weight (1000 seeds) g
Demonstration (ML-365)	83.04	4.93	6.04	1.96
Farmers Practice (GPU-28)	73.37	3.34	5.24	1.93

Table 3: Finger Millet yield under demonstration and farmers practice.

Year	Potential yield qha^{-1}	Demonstrated plot ICM (ML-365) qha^{-1}	Farmers Practice Non - ICM (GPU-28) qha^{-1}	Increase in yield over Farmers Practice (%)
2021-22	38	30.95	27.88	11.01
2022-23	38	38.79	34.43	12.66
2023-24	38	27.45	23.18	15.55
Average	38	32.39	28.49	13.07

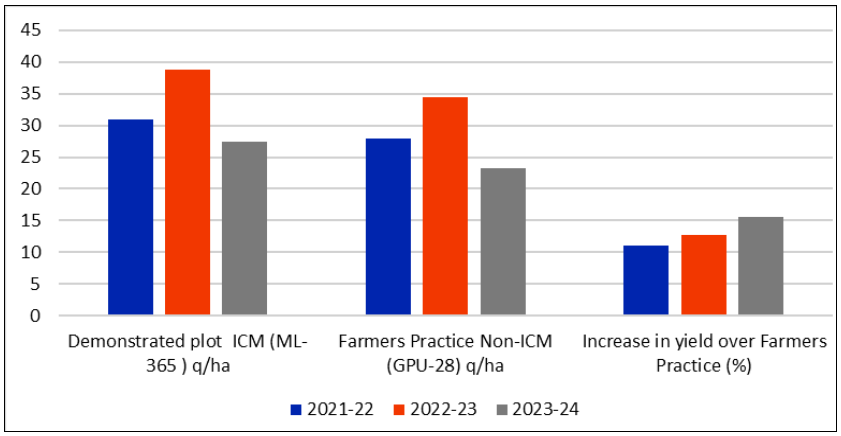

Fig 1: Comparison of Yield (q/ha) of Var. ML-365 v/s GPU-28 for a period of 3 years

Table 4: Comparison of economics of Finger millet cultivated under Demonstration and farmers field (check)

Year	Demonstration				Farmers Practice				Additional returns (₹ha$^{-1)}$
	Gross Cost (₹ha$^{-1)}$	Gross Return (₹ha$^{-1)}$	Net Return (₹ha$^{-1)}$	B:C	Gross Cost (₹ha$^{-1)}$	Gross Return (₹ha$^{-1)}$	Net Return (₹ha$^{-1)}$	B:C	
2021-22	32359	95951	63592	2.96	36720	86440	49720	2.35	13872
2022-23	50180	106673	56493	2.12	50668	94683	44015	1.86	12478
2023-24	47900	111075	63175	2.31	47100	94830	47730	2.01	15445
Average	43479.6	104566.3	61086.6	2.46	44829.3	91984.3	47155	2.07	13931.6

The average gross cost, gross return and net return of ₹43479.6 ha^{-1}, ₹.104566.3 ha^{-1} and ₹61086.6 ha^{-1} were recorded for three years. The highest gross return and net return of Rs.111075 and Rs.63592 were recorded during the

year 2024 and 2022 respectively. Highest Benefit cost ratio of 2.96 was obtained during 2022 and lowest B:C ratio was recorded 2.12 during the year 2023 under the demonstration (Table 4). In farmer's practice, the average gross cost (₹44829.3 ha^{-1}), gross return (₹91984.3 ha^{-1}), net returns (₹47155 ha^{-1}) and B: C ratio (2.07) were recorded. The difference in the net returns and B:C ratio varies mainly due to fluctuation in the market price of produce(Seeds and Fodder) and cost of critical inputs. The additional returns obtained in the demonstration is mainly due to high yielding varieties and irrigation to crop at critical stages of the crop growth. Similar studies were reported by (Anand Naik *et al*., (2016) [1] in sorghum, M. A. Vennila *et al*., (2020) [8] in finger millet and Raghunatha Reddy *et al*.,(2020) [6] in Finger millet (ML-365).

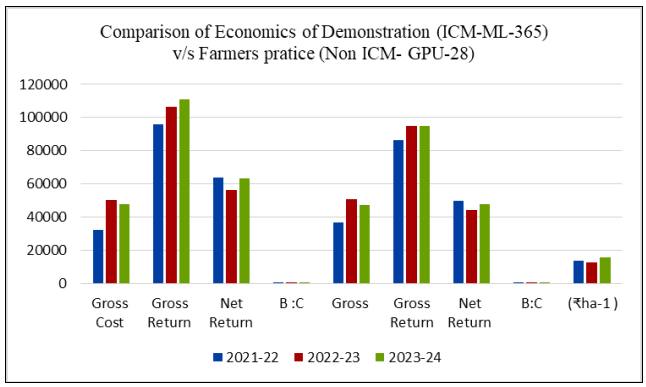

Fig 2: Comparison of Economics of Demonstration (ICM-ML-365) v/s Farmers Practice (Non-ICM-GPU-28)

Conclusion

In conclusion the results of the demonstration revealed that cultivation of finger millet variety ML 365 with improved integrated crop management practices increased the yield and income of the farmers under irrigated condition. In addition, the introduction and replacement of finger millet high yielding variety with local varieties and maize crop has satisfied the farmer's preferences such as high tiller production, early maturity and good fodder variety and 30 percent of water saved by growing summer finger millet. Due to this, area of growing finger millet can be increased for utilisation of water saved. Farmers were convinced with high yielding finger millet variety ML-365 for summer season under bore well irrigation.

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