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Performance evaluation of open precision farming of snap melon in summer paddy fallows

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Abstract

Snap melon is commonly cultivated in summer paddy fallows and river basins during the months November to March in Kerala. Farmers get yield of 15-18MT/ ha in traditional farming during a period of 70-80 days. Higher labour cost for weeding and irrigation is a constraint in Snap melon farming. Open precision farming that require less labour for weeding and irrigation can be alternative to traditional farming. The major components of open precision farming are fertigation and mulching. Performance evaluation of open precision farming was conducted in summer paddy fallows located at Alangad, Ernakulam. Mulching reduces the weed competition in the early crop growth, thereby significantly increases yield. Fertilizer use efficiency also is maximised as the soluble nutrients are being fed in the rootzone without much weed competition. Overall crop management becomes easier in open precision farming system and the whole system can be operated with minimal labour requirement. Mulching alone increases the yield by 30-35% whereas drip irrigation and mulching with proper nutrient management increases yield upto 140-150% when compared the traditional method of snap melon cultivation. Proper scheduling of fertigation of 19.19.19, 13.0.45 and micronutrient sprays complimented significantly along with drip irrigation and mulching.

Keywords: precision farming, snap melon, yield

Introduction

Snapmelon (*Cucumis melo* L. Momordica Group; 2n=2x=24) whose origin is considered to be Africa is a morphologically diverse outcrossing species which belong to the family *Cucurbitaceae*. This crop is also considered as a native to India, the center of domestication of melon with earliest melon remains at the Indus Valley site of Harappa dated between 2300 and 1600 BC. Snap melon is a popular crop in the semi arid regions of western, northeastern and south India. It is also cultivated in other countries of Southeast Asia, for instance Myanmar (Yi *et al*., 2009) and Vietnam. Snap melon is commonly called ‘phut,’ which means ‘to split.’ Fruit cracking during maturity is either longitudinal or starting in the middle of fruit, though in some instances only skin peeling (longitudinal or random) occurs (Dhillon *et al*., 2007). It is also known by other names such as ‘phootkakari’ or ‘kakadia’. Due to it’s habbit of bursting at the time of ripening, it is called *Pottuvellari* in Malayalam. The nutrient rich Snap melon is gaining popularity in river bed cultivation in Kerala due to it’s demand to prepare fresh juice in summer and also due to its short duration. The tender fruits are also used as salad and an ingredient in vegetable dishes. The fruits have good amount of water and dietary fibre which helps in managing constipation and digestive disorders.

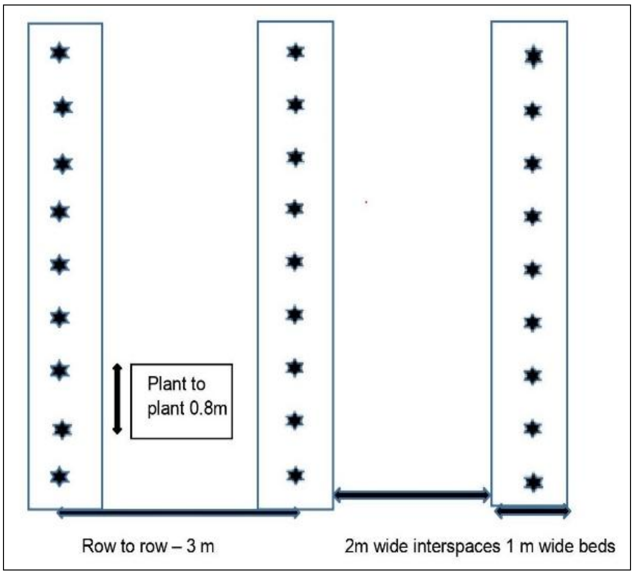
Short days coupled with low temperatures increase the number of female flowers in snap melon. If the temperature is high and above 35 degrees, there will be predominance of male flowers which ultimately reduces yield. Hence in Kerala conditions the ideal period of cultivation is from Mid of November to March. Heavy rains during June to October and peak summer during April to May is not suitable for Snapmelon cultivation as the flower get dropped and there will be very less fruit setting. Rains during fruit development and maturity damages 50-60 per cent of the ready to harvest fruits. Hence a certain amount of risk is involved in snap melon cultivation in Kerala if untimely rains coincide with the fruit development stage.

Snap melon grows in a wide range of soil, but it grows best in well drained sandy loams or loamy soils having pH ranging from 6.5 to 7.5. It grows well in a temperature range of 18-32 °C with 22-25 °C as optimum. Perishability of the melonis one of the key issues of this crop. Shelf life is only 2-4 days. Hence farmers can incur loss if marketing is not assured at the time of fruit development itself.

Open precision farming is a system of farming under protected cultivation which is adopted by farmers cultivating in open conditions without any protective structures like polyhouses, rain shelters *etc*. The main components of open precision farming are fertigation and mulching. Fertigation and mulching complement each other as fertigation without mulching is not advisable because of loss of nutrients through volatilization and leaching. Open precision farming optimises the farm income and the initial investment for drip irrigation and fertigation setting can be used for 6-7 years. The increase in yield from the open

precision farming normally cover up the additional cost required for setting up fertigation in the first year itself.
Objective of this study was to evaluate the production potential of snap melon in open precison farming and to estimate the saving in cost of production in comparison to traditional farming.

Materials and Methods
Summer rice fallows near Alangad, Ernakulam10.1024ºN, 76.2915ºE was selected for the study during the months November to March. Field was prepared by ploughing with cultivator followed by manual bed making. Raised beds 100 in numbers each 12 meter long, 0.25 m height and 1 meter wide were made in 1 acre area. The row to row spacing of 3 meters and plant to plant spacing of 0.8 meters was maintained. Plant to plant distance is maintained at 80 cm, where two plants were planted in 20 cm spacing across the bed which ultimately grows on either side of the bed. The two plants growing in one basin were trained on opposite sides, so that the interspaces of 2 meters got filled within 25-30 days.



Liming was done at the rate of 500 kg per hectare to ameliorate the pH value of 5.2. *Basal manuring* was done using farm yard manure at the rate of 20 MT/ ha. Neem cake at the rate of 500 kg/ha was also applied. Cow urine diluted at 1:7 ratio with water was sprayed twice at 10 days interval at the rate of 500 litre per hectare. *Drip irrigation* was installed as per the lay out in Figure 1. Filed pipes of 50 mm were connected to 75 mm main line and 16mm laterals were connected using a gromet type washer. Punching was done in plain drip tubes at 80 cm spacing and microtubes were laid in the exact centre of the bed with microtubes connected to the punched holes. A ventury was connected at the inlet hose to mix soluble nutrients. *Mulching* was done using 30 micron thick 1.20 m wide black and silver mulching sheets. Holes of 100 mm size were made on the mulching sheets at 0.80m to plant saplings. Microtubes were positioned to ensure irrigation to the root zone. Following fertigation schedule was adopted:

Table 1: Fertigation schedule

Days after Sowing	Nutrient	Quantity kg/ha
10	19.19.19	6.0
20	19.19.19	7.5
30	19.19.19	9.0
40	13.00.45	7.5
50	13.00.45	7.5
50	13.00.45	7.5

Spraying of micronutrients at the rate of 3g/litre and 15g NPK 16.16.16 mixture per plant was provided. Pheromone traps were placed at the rate of 13 traps/ha. The performance of precision farming plot was compared with traditional snap melon growing practice by farmers. Traditional method includes basal manuring with farm yard manure 25 tons/ ha and top dressing with cow dung, ground nut cake, cow urine slurry diluted 7 times with water (2 litre mix / plant).
Flowering habits and crop duration was recorded by observing days to first male and female flower initiation, sex ratio, days from seed sowing to first harvest and total crop duration. Fruit characters and yield were also recorded by observing length, diameter and average weight of fruits, average yield per plant, total yield and yield per unit area. Seed yield was also recorded.

Results and Discussion
Observations made on first male flower initiation, first female flower initiation, sex ratio, days to first harvest, crop duration characteristics are furnished in Table 2. The male flower initiation happens first in snap melon when grown in the Rabi season of Kerala during November to March. This is a general characteristic of snap melon as the male flower develops before the female flower development. At the time of female flower initiation also male flowers blooms in order to ensure proper pollination. Early flowering was observed in case of precision farming. The Sex ratio was higher in traditional farming (3.65) than in precision farming (2.83). It was observed that from female flower initiation to first harvest takes 22 days in case of traditional farming and 20.5 days in case of precision farming. The earliest first harvest was recorded in precision farming (38.8 days) than traditional farming (44.3 days). Total crop duration was lesser in traditional farming (73.3 days) than in precision farming (86.5 days). It was inferred that the open precision farming significantly increased the crop duration because of the extended flowering and more number of branches which is clear in the data shown below (+13.2 days crop duration for precision farming compared to traditional farming).
There was an observed earliness of 2.3 days and 4 days in the initiation of the first male and first female flowers, respectively, under open precision farming. The sex ratio was higher in open precision farming (3.65), indicating a greater availability of female flowers. Similarly, the first harvest was 5.5 days earlier in open precision farming. Additionally, the total crop duration was extended by 13.2 days compared to traditional snap melon cultivation.

Table 2: Floral characters and crop duration

Farming system	First male flower initiation (days)	First female flower initiation (days)	Sex ratio	Days to first harvest (days)	Crop duration (days)
Traditional farming	19.8	22.3	2.83	44.3	73.3
Open Precision farming	17.5	18.3	3.65	38.8	86.5

Data on fruit diameter, weight, yield per plant, experimental yield, productivity, and seed yield are presented in Table 3, indicating a positive correlation between total yield, fruit length, diameter, and weight. The maximum fruit length (45.3 cm) and diameter (37.4 cm) were recorded under precision farming, whereas traditional farming resulted in a fruit length of 37.1 cm and a diameter of 34.1 cm. The average individual fruit weight was significantly higher in precision farming (2.78 kg) compared to traditional farming (1.83 kg). Similarly, the average yield per plant was 3.90 kg under precision farming, whereas it was only 2.26 kg in traditional farming. Precision farming also demonstrated a substantial increase in productivity, recording 22.31 MT/ha, which was 39.9% higher than the 15.94 MT/ha observed in traditional farming. Additionally, seed yield was 32.4 kg/ha in precision farming, compared to 23.8 kg/ha in traditional farming. Overall, the adoption of precision farming resulted in a 21% increase in fruit length, 9.7% increase in fruit diameter, 51.91% increase in fruit weight, 72.56% increase in yield per plant, 145% increase in experimental yield, 39.9% increase in productivity, and 36.1% increase in seed yield. These findings highlight the significant advantages of precision farming over traditional vegetable cultivation, demonstrating its potential for enhanced yield and efficiency.

Table 3: Morphological and quantitative characters

Farming system	Fruit length, cm	Fruit diameter, cm	Fruit weight, kg	Yield per plant, kg	Productivity, MT/ha	Seed yield, kg/ha
Traditional farming	37.1	34.1	1.83	2.26	15.94	**23.8**
Open Precision farming	45.3	37.4	2.78	3.90	22.31	**32.4**

Cost economics for precision farming and traditional farming was worked out and tabulated in Table 4. The cost of cultivation for traditional farming was Rs. 2.20 lakhs/ha and the cost for precision farming was Rs. 2.93 lakhs/ha. The benefit-cost ratio in case of traditional farming was 1.81 and that for precision farming 1.91.

Table 4: Cost economics

Sl. No.	Item	Amount, Rs. lakhs/ha	
		Traditional farming	Open Precision farming
COST			
1	Land Preparation, LS	0.45	0.45
2	Liming, 500 kg	0.06	0.06
3	Organic Manure, 20 MT	0.85	0.85
4	Seed, 500 g	0.04	0.04
5	Fertilizer, LS	0.12	0.18
6	Mulching, 3200 m^2	0.00	0.23
7	Drip system, 3200 m	0.00	0.45
8	Weeding, LS	0.20	0.05
9	Plant Protection, LS	0.08	0.08
10	Harvesting, LS	0.20	0.35
11	Transportation, LS	0.20	0.20
	TOTAL	2.20	2.93
B. BENEFIT, Sale of fruits, @ Rs 25/ kg		3.98	5.58
C. BC ratio		1.81	1.91

Conclusion

Precision farming enhanced snap melon yield by 40.2% compared to traditional cultivation. The benefit-cost ratio for precision farming was 1.91, slightly higher than 1.81 in traditional farming. Although the difference in benefit-cost ratio during the first year is minimal, from the second year onwards, the cost of cultivation in precision farming decreases as drip tubes, pipes, and other infrastructure become assets that can be reused for 3-4 seasons. However, precision farming requires an additional initial investment of ₹73,000 per hectare.

Seed yield was also higher under precision farming, recorded at 32.4 kg/ha, which was 36.1% more than in traditional farming. Properly harvested and dried seeds from selected true-to-type fruits can be used for the next season or sold, with farmers receiving an average price of ₹6,000 per kg of seeds.

Proper marketing strategies are important, as the shelf life of snap melon is limited to 3-4 days. Harvesting at the optimal stage is essential, as delayed harvesting can cause fruit cracking either immediately after harvest or while still in the field. Given its short duration and high profitability, snap melon cultivation under precision farming can be effectively recommended for summer paddy fallows and riverbeds in Kerala.

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