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## Viable vegetable based intercropping system in Sweet orange cv. Mosambi

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### Abstract

Effective utilization of interspaces between the mosambi plants in the orchard would be a viable and profitable intercropping system for sustainable profit. Field investigation carried out during 2003-04 under red and laterite situation of semi arid agro-climatic zone of West Bengal reveal that some vegetable crop may be grown with out irrigation for effective utilization of soil moisture and also to uplift the socio-economic condition of the farmers. This research work was carried out to find the best intercropping combination in between mosambi and some profitable vegetable crop such as leafy radish (*Raphanus sativus* L.), guwar (*Cyamopsis tetragonoloba* L.), groundnut (*Arachis hypogea*) etc. with out irrigation. From the experiment it was proved that the leafy radish gave good economic return in one month. Whereas, groundnut also capable to give good economic support to the farmer in short period. Guwar give the highest economic return among these.

**Keywords:** Sweet orange, Mosambi, Intercrop.

### Introduction

The most important commercial citrus types in India are the mandarin orange followed by sweet orange, commonly known as tight skin orange, which is botanically known as *Citrus sinensis*, a highly polyembryonic species of Chinese origin. Citrus occupies a prominent place among the extensively grown subtropical fruits. It is the third major commercially cultivated fruit crop of India after mango and banana Mosambi is an important cultivar of sweet orange and introduced from USA. Trees are medium to large and generally planted at a spacing of 5m x 5m. Intercropping is the cultivation of two or more crops simultaneously on the same field. In case of fruit orchard, intercrops are generally planted in between rows of the main or base crop, with a view to obtain some extra yield without sacrificing the main crop or base crop yield. Intercropping of citrus with

Ground nut, cotton or soyabean in kharif season and with wheat or gram in rabi season can be successful. The intercrops not only generate an extra income but the practice also helps to check the soil erosion through ground coverage and improves the physico-chemical properties of the soil. Intercropping is one of the techniques of land utilization for optimum production (Bhattanagar *et al.* 2007). The successful crop mixture exploits variation between component crops by extending the sharing of resources over time and space (Lithourgidis, *et al.*, 2011). Effective utilization of interspaces between the mosambi plants in the orchard would be a viable and profitable intercropping system for sustainable profit. It also lowers the need of external inputs and improves the stability and diversity (Chandra, *et al.*, 2013) if ecological niches are kept in the mind while selecting

the inter crops. Farmers in the rain fed region are resource poor. Crop production and productivity fluctuate year-to-year due to vagaries of weather. An experiments is therefore, conducted to determine the best intercropping combination in between mosambi and some profitable vegetable crops. This may also serve the twin objective of better utilization of growth resources including light, nutrient, and soil moistures and ensuring the farmer's remunerative returns.

## Materials and Methods

The experiment was carried out at the Regional Research Station of Bidhan Chandra Krishi Viswavidyalaya, Jhargram, West Midnapore, West Bengal during the period of 2003-2004. The experimental sweet orange orchard has red and laterite soil. Red and laterite soils are generally acidic and have Cation Exchange Capacity, low to moderate base saturation. (Sehgal *et al.*1998). The climate of the experimental area is semi-arid climate with average rainfall varies between 1100 and 1500 mm. The experiment was conducted by using three intercrops. The intercrops used to study their performance were leafy radish (*Raphanus sativus* L.), guwar (*Cyamopsis tetragonoloba* L) and ground nut (*Arachis hypogea* L). The main crop is sweet orange cv. Mosambi that is planted at a spacing of 5m x 5m. Intercrops are grown without irrigation and with minimum supply of fertilizers to achieve additional income with minimum input. Yield and Physico-chemical characters of the main crop and yield of the intercrops were taken as parameters.

## Results and Discussion

Considering the moisture need of the plant and economic condition of the farmers of this region, crops of different duration are taken as treatment. All intercrops are planted in 7<sup>th</sup> July 2004, in between spaces of the base crop. During investigation, it was

found that among different intercrops leafy radish gave good return with in one month. Leafy radish gave a yield of 45q/ha (Table-2) and faced a good market price through out its harvesting period. Whereas, groundnut also capable to give good economic support to the farmers in short period. From the groundnut 6.88q/ha additional yield was achieved and it also faced a good price. Among the intercrops guwar gave the highest economic return ie.48.44q/ha. Guwar faced a higher market price in the early period of its harvesting and also gave moderate economic support during the last period of harvesting. Among these intercrops, guwar stand for the maximum period (Table-1).

During the investigation it was found that the yield of main crop is not hampered by the intercrops. From the experiment it was revealed that the main crop ie. Mosambi gave the same yield with groundnut and radish as an intercrop, whereas, mosambi with guwar (cluster bean) gave some what lower yield (Table-2). In case of physico-chemical parameter, groundnut + mosambi gave the large size fruit with highest TSS (9.4<sup>0</sup>Brix) and juice percentage (63.53) i.e. best quality fruit, followed by mosambi + leafy radish (TSS 9.1<sup>0</sup>Brix and juice percentage 56.68). Similarly, the juice percentage and TSS of the in the (Guwar + Mosambi ) system was found to be 50.00 and 7.8<sup>0</sup>Brix respectively (Table-3).

In case of leaf NPK content, the base crop gave more or less same result. Guwar + mosambi gave maximum nitrogen content and low amount of potassium content. In case of soil organic carbon, it was found highest in guwar + mosambi along with sole crop (Table-4). The results of the investigation revealed that the intercropping was found effective in increasing the plant growth, fruit yield and quality of main crop i.e. sweet orange.

**Table-1: Schedule of intercrop and irrigation**

Intercrop	Date of sowing	Date of 1 <sup>st</sup> harvest	Date of last harvest	No. of irrigation
Mosambi + groundnut	07.07.2004	-----	09.10.2004	Nil
Mosambi + leafy radish	07.07.2004	04.08.2004	09.08.2004	Nil
Mosambi + guwar	07.07.2004	13.09.2004	11.11.2004	Nil
Mosambi	-----	-----	-----	Nil

Table-2: Total return from the experiment

Intercrop	Mosambi fruit/plant	Mosambi yield(q/ha)	Intercrop yield(q/ha)	Returns (Rs.)		
				Mosambi	intercrop	Total Return
Mosambi + groundnut	26.67	14.40	06.88	16,336	15,640	31,976
Mosambi + leafy radish	26.33	17.38	45.00	16,064	27,000	43,064
Mosambi + guwar	25.67	12.32	48.44	15,536	29,220	43,256
Mosambi	22.00	9.68	-----	12,660	-----	12,660

Table-3 : Leaf NPK content of the base crop and organic carbon content of the soil

Intercrop	Nitrogen (%)	Phosphorus (%)	Potassium (%)	Soil Organic Carbon(%)
Mosambi + groundnut	2.51	1.53	2.56	0.12
Mosambi + leafy radish	2.26	1.28	2.26	0.18
Mosambi + guwar	2.67	1.78	1.78	0.75
Mosambi	2.48	1.29	2.57	0.75

Table-4: Physico-chemical parameter of the mosambi fruit (main crop)

Intercrop	Fruit-breath (cm)	Fruit-length (cm)	Fruit-weight (g)	TSS (°B)	Juice (%)	Acidity (%)	V-C mg/100g of Juice	Total Sugar Content (%)	TSS/ acid ratio
Mosambi + groundnut	6.52	6.53	134.25	9.4	63.53	0.34	35.34	8.65	1.09
Mosambi + leafy radish	6.54	6.54	165.00	9.1	56.68	0.22	36.48	8.20	1.11
Mosambi + guwar	6.42	6.36	120.00	7.8	50.00	0.31	39.50	7.27	1.08
Mosambi	6.00	6.10	100.00	7.0	45.00	0.38	32.00	7.20	0.97

According to Lakshmanan (1990) intercropping is the means through which the economy of Indian villages can be improved. Ghosh and Pal (2010) obtained highest net return from Mosambi + groundnut combination (Rs. 35,820.0/ha) followed by Mosambi + okra (Rs. 22,520.0/ha) and Mosambi + cowpea (Rs. 22,420.0/ha). From the data, it is evident that all the intercrops of the experiment are capable to provide additional support to the farmers. Similar findings also achieved by the Bhatnagar *et al.* (2007) and Swain *et al.*, (2013) in intercropping trial in Kinnow and in Guava respectively. Bhuva *et al.* (1988) also reported that mango intercropped with tomato and cluster bean gave greatest financial return per hectare. Vacant space present between the adjacent rows of citrus can be successfully utilized for cultivation of seasonal vegetables. There are several advantages in growing of

intercrops in orchard. Besides providing income to the growers, it controls weed population, check soil erosion, conserve soil moisture and organic matter and protects the soil from leaching of nutrients. From the experiment it can be concluded that for short term intercropping system leafy radish is best in citrus orchard. On the other hand guwar gave maximum return as an intercrop but the cropping duration is somewhat more than the leafy radish. So, in this zone, among these three intercrops farmer can be choose any of them to achieve additional support. The study will help the farmers to select the suitable intercropping systems in the zone. However, further studies are necessary for inclusion of various other intercrops which are location specific and to confirm the long term effect of intercropping as suggested above.

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