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Performance of short duration cassava accessions for improved tuber yield and quality

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Abstract
Cassava is one of the most important tuber crops valued for its starch content in tubers. Most of the commercially grown cassava varieties are long duration which requires more crop maintenance *viz.*, fertilizer application, irrigation, weeding and other plant protection measures, which is quite expensive for the cassava growers. With this back ground, the present investigation was carried out to assess the performance of short duration accessions in five locations for high tuber yield and starch content. The results of the experiment revealed that the maximum tuber yield (49.18 t ha^{-1}) was recorded in TCa 12-6 and minimum tuber yield (31.97 t ha^{-1}) was registered in Sree Vijaya. The highest starch content (30.29%) was recorded in TCa 12-6. The best cooking quality and maximum organoleptic score based on 9-point Hedonic Scale rating (7.52) was observed in TCa 12-6.

Keywords: Cassava, short duration, tuber yield, starch content

Introduction
Manihot esculenta Crantz. is commonly called as Cassava or tapioca belonging to the family Euphorbiaceae which is well known for its tubers and suited for cultivation in marginal soils. This crop can be cultivated both in irrigated and rainfed conditions (Pugalendhi and Velmurugan, 2020) [10]. In India, Cassava is cultivated in an area of 1.73 lakh hectares with a production of 49.50 lakh tonnes (NHB, 2019). In India, Kerala and Tamil Nadu account for about 80% of the total acreage and in Tamil Nadu, it is cultivated in Salem, Namakkal, Dharmapuri districts followed by Cuddalore, Villupuram, and Kanyakumari. Tapioca is considered as the cheapest source of Carbohydrates among the cereals, tubers and root crops and is a staple diet in many parts of Africa, South America and Asia. About 500 million people eat tapioca in the World. Nutritionally, it contains 98% Carbohydrates and appreciable amount of Calcium and Vitamin-C. Tubers are harvested and processed into starch and further into sago grains, vermicelli and chips (Velmurugan *et al.* 2017) [11]. It has several commercial uses *viz.*, dextrin, glucose, core binder, stabilizer, adhesives, sizing yarns, as thickener for printing clothes, *etc.*, It is the raw material for an array of processed products. Realizing its potentiality as raw material in industries its cultivation has been extended to Tamil Nadu, Andhra Pradesh, Karnataka and Orissa.

The tuber initiation starts two months after planting and harvesting can be done between nine and eleven months depending on the variety. The culinary varieties mature early when compared to industrial varieties. Being a tuber crop, the yield depends mainly on the nutritional status of soil and judicious application of fertilizers. The long duration varieties requires extended crop maintenance *viz.*, regular fertilizer application, irrigation, weeding and other plant protection measures, which is quite expensive for the cassava growers. With this back ground, evaluation of short duration cassava varieties with high tuber yield and starch content was conducted. In the present investigation, the short duration accessions were compared with the existing varieties for high tuber yield and starch content at five different locations.

Materials and Methods
The multilocational trial was conducted in major cassava growing areas *viz.*, Kottavadi, Thamayanur, Azhagapuram, Vadachennimalai and Chinnasalem. The planting was taken up during second week of December and the harvest of tuber was done during the last week of September. The setts of cassava accessions TCa 12-5, TCa 12-6, TCa 12-9, Tca 12-10, Sree Jaya, Sree Vijaya and Co2 were planted in ridges and furrows at a spacing of 90 x 75 cm.

The standard cultivation practices recommended for cassava (Crop production techniques of Horticultural crops, 2013) were adopted uniformly in all experimental plots. Irrigation was given at weekly intervals following furrow method from planting to three months after planting and subsequently at 15-20 days interval until harvest. The organoleptic scoring (9-point Hedonic Scale) was done based on the methods suggested by Lim (2011) [3]. The data on various yield and quality parameters recorded were analyzed by adopting the statistical methods of Panse and Sukhatme (1985) [9].

Results and Discussion

The mean data on tuber yield and starch content was recorded and the pooled mean data was calculated across the locations. Among the entries tested, there was significant difference for tuber yield across the locations. The maximum tuber yield (49.18 t ha^{-1}) was recorded in TCa 12-6 and minimum tuber yield (31.97 t ha^{-1}) was registered in Sree Vijaya (Table1). The short duration cassava accession TCa 12-5 recorded tuber yield of 45.20 t ha^{-1} across the locations. There was a significant difference among the short duration cassava accessions for starch content. The highest starch content (30.29%) was recorded in TCa 12-6 followed by(28.15%) in TCa 12-5. The starch content of Sree Jaya (24.74%) and Co2 (24.30%) was on par with each other. Among the accessions tested, Sree Vijaya registered the lowest starch content of 22.83% (Table 2). The organoleptic score was done mainly based on the softness or mealyness of the tubers after boiling and cooking time. The best cooking quality and maximum organoleptic score based on 9-point Hedonic Scale rating (7.52) was observed in TCa 12-6 (Table 3). The organoleptic score of Sree Jaya (6.39), Sree Vijaya (6.45), Co2 (6.67) and TCa 12-5 (5.51) was on par with each other (Table 3).

The potential for genetic improvement of any crop relies on the ability to successfully use the existing genetic resources, including the related wild species. Hence, collection, conservation and evaluation of diverse crop plants with desirable traits are essential for the breeding programmes (Mekbib and Deressa, 2016) [6]. Further the cassava accession, TCa 12-6 might have better partitioning of photosynthates thereby resulting in high starch accumulation in tubers. Similar finding was reported by Adebisi (2001) [1], Maxted *et al.*, (1997) [5], Nahn *et al.*, (1995) [7] and Malice and Baudoin (2009). For commercial cultivation in Tamil Nadu, farmers prefer the short duration accessions/varieties with high tuber yield and starch content for industrial exploitation.

Table 1: Performance of short duration cassava for tuber yield (t/ha)

Accessions	Tuber yield (t ha^{-1})					Mean tuber yield (t ha^{-1})
	(Location-1) Kottavadi	(Location-2) Thamayanur	(Location-3) Azhagapuram	(Location-4) Vadachennimalai	(Location-5) Chinnasalem	
TCa 12-5	41.96	46.21	46.39	46.22	45.20	45.20
TCa 12-6	47.73	50.20	48.79	51.85	47.31	49.18
TCa 12-9	34.26	35.69	35.19	39.11	40.20	36.89
Tca 12-10	35.61	33.05	37.44	35.90	34.703	35.34
Sree Jaya	34.97	37.16	37.93	37.04	38.50	37.12
Sree Vijaya	32.10	30.47	32.51	31.96	32.81	31.97
Co2	35.67	33.09	32.82	32.66	34.12	33.67
CD(0.05)						3.63
SEd						1.80
CV						13.49

Table 2: Performance of short duration cassava for starch content (%)

Accessions	Starch content (%)					Mean Starch content (%)
	(Location-1) Kottavadi	(Location-2) Thamayanur	(Location-3) Azhagapuram	(Location-4) Vadachennimalai	(Location-5) Chinnasalem	
TCa 12-5	28.79	29.31	27.43	27.43	27.81	28.15
TCa 12-6	31.20	29.39	30.21	30.21	30.45	30.29
TCa 12-9	25.65	27.91	23.83	23.83	28.64	25.97
TCa 12-10	28.91	26.44	27.00	26.15	27.20	27.14
Sree Jaya	24.00	26.32	24.34	24.34	24.68	24.74
Sree Vijaya	22.80	24.00	21.90	23.49	22.00	22.83
Co2	23.00	25.10	24.70	25.20	23.50	24.30
CD(0.05)						2.09
SEd						1.03
CV						16.30

Table 3: Performance of short duration cassava for organoleptic evaluation (9-point Hedonic Scale)

Accessions	Over all acceptability (9-point Hedonic Scale)					Mean (over all acceptability) (9-point Hedonic Scale)
	(Location-1) Kottavadi	(Location-2) Thamayanur	(Location-3) Azhagapuram	(Location-4) Vadachennimalai	(Location-5) Chinnasalem	
TCa 12-5	6.00	5.26	5.50	5.70	5.08	5.51
TCa 12-6	8.10	7.43	7.60	7.10	7.36	7.52
TCa 12-9	4.50	4.33	4.52	4.10	4.29	4.35
TCa 12-10	3.70	4.92	4.50	5.20	3.90	4.44
Sree Jaya	7.30	6.25	6.32	6.47	5.59	6.39
Sree Vijaya	5.80	6.75	6.20	6.40	7.10	6.45

Co2	6.70	6.50	6.90	6.10	7.15	6.67
CD(0.05)						1.59
SEd						0.79
CV						4.71

Conclusion

The long duration cassava varieties requires more crop maintenance *viz.*, regular fertilizer application, irrigation, weeding and other plant protection measures, which is quite expensive for the cassava growers. With this back ground, the present investigation was carried out to assess the performance of short duration accessions in five locations for high tuber yield and starch content. The results of the experiment revealed that the maximum tuber yield (49.18 t ha^{-1}) was recorded in TCa 12-6 and minimum tuber yield (31.97 t ha^{-1}) was registered in Sree Vijaya. The highest starch content (30.29%) was recorded in TCa 12-6. The best cooking quality and maximum organoleptic score based on 9-point Hedonic Scale rating (7.52) was observed in
TCa 12-6.

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