



‘KAU UTHAMA’: A Short Duration Cassava Variety for Upper Kuttanad Region of Kerala

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Abstract

To evolve a suitable short duration cassava variety for the flood prone riverine alluvium of Upper Kuttanad areas, an experiment was conducted at Agricultural Research Station, Thiruvalla using three popular short duration varieties viz., Sree Jaya, Sree Vijaya, Sree Prakash from ICAR-CTCRI, Thiruvananthapuram, Vellayani Hraswa from Kerala Agricultural University, Thrissur and a landrace namely Vettikavala Local from Vettikavala, Kottarakkara. The experiment was conducted during the period from 2012 to 2016. The five genotypes (varieties and landrace) were evaluated for their growth characters, yield components and quality parameters. Among the genotypes, ‘Vettikavala Local’ performed well in yield trials and farm trials, with high tuber yield per plant (3.97 kg) while tuber had a starch content of 22.52%. Besides it possess better plant type, cooking quality and crop duration of 6 months. The genotype was found to be promising and suitable for riverine alluvium of Upper Kuttanad region and therefore it was released with the name ‘KAU Uthama’ by Kerala Agricultural University in 2018.

Key words: Short duration, cassava, tuber yield, Upper Kuttanad, Central Travancore

Introduction

Upper Kuttanad tracts of Central Travancore region are highly prone to flood and hence the area experiences a short crop growing season of 7 months from October - November to April - May. Enhancement of crop productivity in such situation emerges as a major challenge. Cassava (*Manihot esculenta* Crantz), a starch rich tuber crop introduced to Kerala from Brazil (Srinivas, 2009) and once known as the poor man’s food, has attained the status of secondary staple food in Kerala and a multipurpose crop for the 21st century (Sabita et al., 2016). Cassava is able to sustain adverse weather conditions as the plant morphology of this crop favours its survival over the adverse environments. It plays a major role in poverty alleviation and it can be used as a food crop as well as an industrial crop (Cock, 1982). As compared to the major cereal crops, cassava can produce higher food calories (El-Sharkowy, 2012) and also serve as a low cost energy source (Lebot, 2009). Many cassava varieties are good source of minerals which can be used

for addressing the malnutrition problem of low income groups (Mohan et al., 2019). According to Suja et al., (2010), for effective utilization of moisture and nutrients and to generate income, short duration (6-7 months) cassava varieties are best suited for marginal farmers. Short duration varieties with good culinary properties fit well into existing cropping systems in Kerala (Sunitha et al., 2018). Uplands of Upper Kuttanad region are highly suitable for cultivation of cassava. Intensification of agriculture can be done in the existing cropping system, by the development of short duration varieties. Taking into account of these aspects, an experiment was conducted to evaluate the performance of some short duration cassava genotypes and to identify a most suitable one for the flood prone riverine alluvium of Upper Kuttanad areas.

Materials and Methods

Three popular short duration cassava varieties released from the ICAR-Central Tuber Crops Research Institute,

Sreekariyam (Sree Jaya, Sree Vijaya, and Sree Prakash), one from Kerala Agricultural University (KAU), Thrissur (Vellayani Hraswa) and a landrace from Central Travancore region (Vettikavala Local) were taken for evaluation. Experiment was conducted during the period from 2012 to 2016 at Agricultural Research Station, Thiruvalla, Pathanamthitta District, Kerala. This location is at 9° 35' N latitude and 76° 56' E longitude. The crop was planted during November and harvested during May. Need based irrigation was given at critical stages of growth. The trial on evaluation of cassava genotypes was laid out in Randomized Block Design (RBD) with 3 replications. Cultivation practices specified as per Package of Practices Recommendation: Crops (2007) by KAU were adopted uniformly in all the experimental plots and fertilizer at the rate of 50:50:50 kg NPK ha⁻¹ was supplemented. Collection and multiplication of the varieties were done from 2010 to 2012. Evaluation trials, preliminary yield trials and comparative yield trials were conducted during three years from 2012 to 2014. The genotypes were evaluated for their growth parameters viz., plant height, duration and yield components like number of tubers, tuber girth, tuber weight, tuber yield per plant and quality parameters such as starch content (%), HCN content, crude fibre, organoleptic scoring, cooking quality etc. Tolerance to major pests and diseases were also recorded. Starch content was determined by using the method outlined by Moorthy and Padmaja (2002). The cyanide and crude fibre analysis were done according to the procedure described by Padmaja et al., (2005). Evaluation of sensory characteristics and organoleptic quality was done using 5 point hedonic scale. The data on various quantitative and qualitative parameters were analyzed statistically applying the technique of analysis of variance (Panse and Sukhatme, 1985). Based on yield performance and duration of genotypes, On Farm Trials were conducted in 13 different locations in Pathanamthitta and Alappuzha districts during 2015.

Results and Discussion

The data on the performance of cassava varieties in the trials are given in Fig. 1 to 6. Variation among genotypes was found in yield

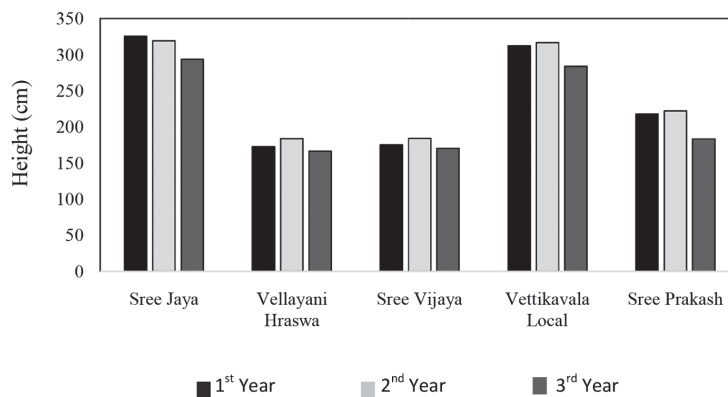


Fig. 1. Plant height of cassava varieties during three consecutive years

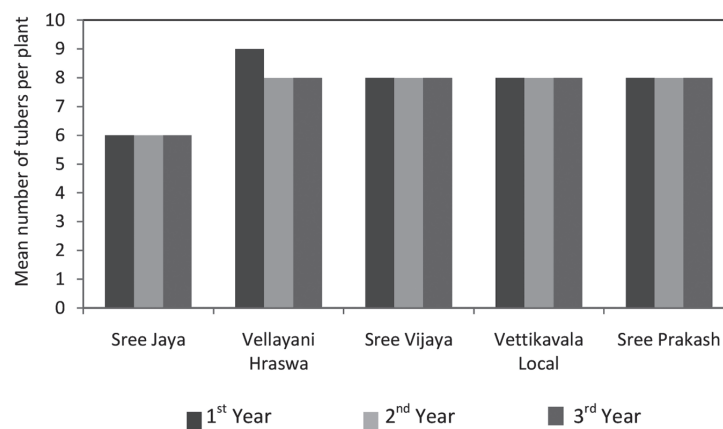


Fig. 2. Number of tubers per plant of cassava genotypes during three consecutive years

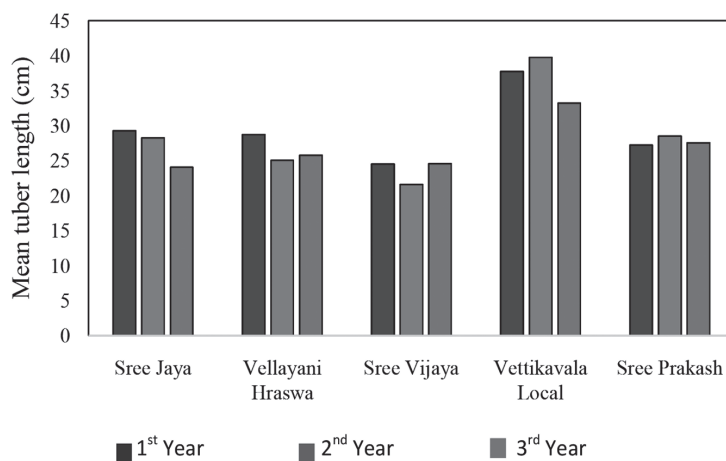


Fig. 3. Tuber length of cassava genotypes during three consecutive years

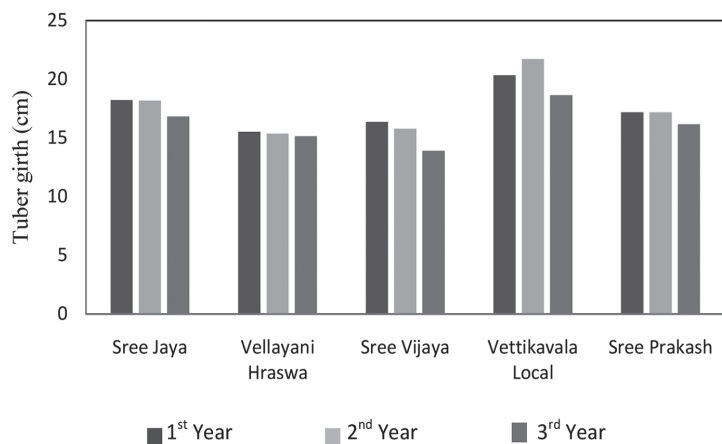


Fig. 4. Tuber girth of cassava genotypes during three consecutive years

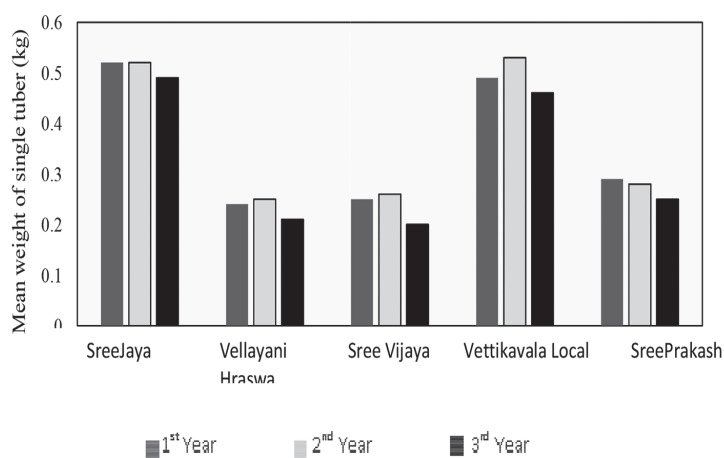


Fig. 5. Mean weight of tuber of cassava genotypes during three consecutive years

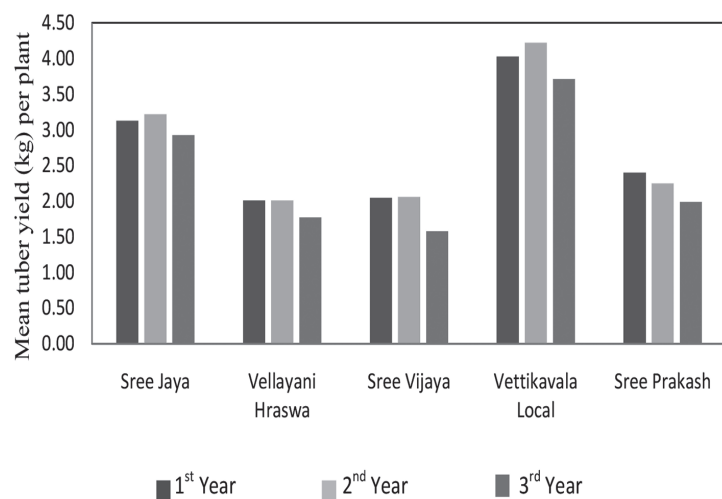


Fig. 6. Tuber yield of cassava genotypes during three consecutive years

components and quality parameters (Table 1 and 2). Results of the study revealed that the range of growth parameters especially plant height varied from 312.72 cm (Sree Jaya) to 174.19 cm (Vellayani Hraswa). The accession 'Vettikavala Local' had a plant height of 304.18 cm which was on par with the variety Sree Jaya. Minimum plant height was recorded in the variety Vellayani Hraswa (174.19 cm) which was on par with the variety Sree Vijaya (176.5 cm). According to Agahiu et al. (2011), the main yield attributing components are tuber number, length and diameter. Among the genotypes, number of tubers was highest for the variety Vellayani Hraswa (8.31) followed by accession 'Vettikavala Local' (8.13), yet the difference was not statistically significant. Variety Sree Jaya produced the minimum number of tubers (6.04 per plant). Maximum tuber length (36.92 cm) was observed in the accession 'Vettikavala Local' and was significantly superior to other varieties. Minimum tuber length (23.50 cm) was found in the variety Sree Vijaya. Tuber girth was highest for the accession 'Vettikavala Local' (20.22 cm) which was significantly higher than the rest of the varieties. Minimum tuber girth was recorded in the variety Sree Vijaya (15.34 cm) which was on par with the variety Vellayani Hraswa (15.35 cm). Variety Sree Jaya had the maximum single tuber weight (0.51 kg) which was on par with the accession 'Vettikavala Local' (0.49 kg). The minimum single tuber weight was recorded in the variety Vellayani Hraswa (0.23 kg) followed by Sree Vijaya (0.24 kg). Tuber yield was highest in the accession 'Vettikavala Local' (3.98 kg per plant and 59.50 t ha⁻¹ respectively) and was found significantly superior to all other varieties. Variability in yield and yield components in cassava were reported by Muluaem and Ayenew (2012) and Singh et al., (2017). Pooled analysis showed that the accession 'Vettikavala Local' was significantly superior to all other genotypes in tuber length, girth and yield. The results pertaining to quality analysis (organoleptic score and cooking time) of different accessions under study is given in

Table 1. Data on the tuber yield of cassava varieties during three consecutive years.

Variety	Tuber yield (t ha ⁻¹)			
	1 st year	2 nd year	3 rd year	Pooled mean
Sree Jaya	46.98	47.25	43.82	46.01
Vellayani Hraswa	30.13	30.21	26.39	28.90
Sree Vijaya	30.48	30.82	23.54	28.27
Vettikavala Local	60.36	62.96	55.23	59.50
Sree Prakash	37.34	33.48	29.81	33.53
CD (0.05)	2.24	2.92	1.93	2.47

Table 2. Pooled data on the performance of cassava varieties during 1st, 2nd and 3rd year

Variety	Plant height (cm)	Number of tubers	Tuber length (cm)	Tuber girth (cm)	Mean wt. of tuber (kg)	Tuber Yield (kg per plant)	Tuber yield (t ha ⁻¹)
Sree Jaya	312.72	6.04	27.17	17.74	0.51	3.09	46.01
Vellayani Hraswa	174.19	8.31	26.50	15.35	0.23	1.93	28.90
Sree Vijaya	176.50	7.91	23.50	15.34	0.24	1.89	28.27
Vettikavala Local	304.18	8.13	36.92	20.22	0.49	3.98	59.50
Sree Prakash	207.64	8.05	27.75	16.84	0.27	2.21	33.53
CD(0.05)	12.78	0.23	3.50	1.02	0.02	0.13	2.47

Table 3. Five point hedonic scale based organoleptic score ranged from 4.3 (Vettikavala Local) to 3.3 (Sree Vijaya). Accession 'Vettikavala Local' was rated as 'Excellent' and other varieties as 'Good'. Cooking time varied from 17 minutes (Sree Jaya) to 45 minutes (Sree Vijaya) and it was 19 minutes for the accession Vettikavala Local.

Accession 'Vettikavala Local' out yielded the check variety Vellayani Hraswa in the on farm trials conducted at various locations in Pathanamthitta and Alappuzha districts during 2015-2016. In the on farm trials, the mean yield increase of the accession 'Vettikavala Local'

Table 3. Organoleptic score and cooking time of tubers of five cassava genotypes

Variety	Organoleptic score	Cooking time (min)
Sree Jaya	Good (4.0)	17
Vellayani Hraswa	Good (3.8)	27
Sree Vijaya	Good (3.3)	45
Vettikavala Local	Excellent (4.3)	19
Sree Prakash	Good (3.5)	25

Excellent: 4.1-5 Good: 3.1-4
Medium: 2.1-3 Poor: 1.1-2

Table 4. Rainfall data in mm at 13 locations located in Alappuzha and Pathanamthitta District (during October-November 2012-13 to 2016-17)

Year	District	October	November	December	January	February	March	April	May
2012-13	Alappuzha	151.0	105.2	5.5	24.0	88.4	49.8	40.3	137.4
	Pathanamthitta	158.9	120.1	26.0	9.0	24.4	92.0	47.0	154.0
2013-14	Alappuzha	186.4	71.5	15.2	0.2	23.3	32.7	143.8	250.6
	Pathanamthitta	268.4	306.1	18.0	2.9	35.8	36.4	287.0	295.1
2014-15	Alappuzha	311.0	93.8	52.3	3.2	5.2	98.9	237.0	295.1
	Pathanamthitta	401.2	94.6	77.2	7.8	18.3	76.0	477.0	177.0
2015-16	Alappuzha	375.9	189.7	120.4	5.9	56.0	45.6	24.6	296.6
	Pathanamthitta	546.4	336.0	79.1	0.5	4.6	70.0	123.3	247.4
2016-17	Alappuzha	5.9	56.0	45.6	29.9	0.9	86.2	40.3	287.9
	Pathanamthitta	224.1	193.9	7.8	30.9	0.0	314.5	100.0	260.1

Source: IMD, Rainfall Statistics of India 2012 and 2017

over the check variety Vellayani Hraswa was 21.96 t ha⁻¹, the percentage increase being 65.18. Data on plant characters, yield and organoleptic qualities emphasized the superiority of the accession 'Vettikavala Local'. The accession showed consistently good performance during the trials and found as the best. Short duration cassava varieties having a tuber yield of 25-35 t ha⁻¹ and a harvest period of 7 months can be recommended for cultivation in India (Nedunchezhiyan et al., 2006). In the on farm trials, the potential yield of the accession was found to be 59.50 t ha⁻¹ and the average yield was 55.60 t ha⁻¹ with a maturity period of 180 days onwards. It produced highest mean tuber yield (3.97 kg per plant) and out yielded all the other short duration cassava varieties tested. Above all it has an excellent cooking quality with starch content of 22.52% and crude fibre of 1.05%.

Conclusion

The trial on the evaluation of suitable short duration cassava genotypes for the flood prone riverine alluvium of Upper Kuttanad region revealed that the accession 'Vettikavala Local' excelled in all aspects compared to other varieties tested. It grows up to a height of about 3 m. The tubers are cylindrical with a neck length of 1-2 cm. The skin colour of the tuber is light brown and rind is pink. Potential yield and average yield are 59.50 t ha⁻¹ and 55.60 t ha⁻¹ respectively. Tuber had HCN content of 42.42 µg CN g⁻¹ (ppm) and crude fibre content of about 1.05%. It is a short duration cassava variety (180 days). Considering these attributes, the accession 'Vettikavala Local' has been released as a variety named 'KAU Uthama' for Upper Kuttanad region of Kerala in 2018. This particular variety can be raised profitably in Upper Kuttanad region, immediately after the cessation of monsoon period and can be harvested before the onset of south west monsoon, besides excellent cooking quality making it very peculiar among other short duration cassava varieties.

References

- Agahi, A.E., Baiyeri, K.P and Ogbuji, R.O. 2011. Correlation analysis of tuber yield and yield related characters in two cassava (*Manihot esculenta* Crantz) morphological-types grown under nine weed management systems in the Guinea savanna zone of Nigeria. *J. Appl. Biosci.*, **48**: 3316–3321.
- Cock, J. H. 1982. Cassava: A basic energy source in the tropics. *Science*, **218**: 755–762.
- El-Sharkawy, M.A. 2012. Salt-tolerant cassava: The role of integrative Eco physiology-breeding research in crop improvement. *Open J. Soil Sci.*, **2**: 162-186.
- Mohan, G., Raju, J., Shiny, R., Abhilash, P.V., Soumya, S., Sheela, M.N. and Byju, G. 2019. Biochemical, mineral and proximate composition of Indian cassava varieties. *Int. J. Chem. Stud.*, **7**(4): 1059-1065.
- Kerala Agricultural University. 2007. *Package of Practices Recommendation: Crops (13th Ed.)*. Directorate of Extension, Kerala Agricultural University, Mannuthy, Thrissur. 360 p.
- Lebot, V. 2009. *Tropical Root and Tuber Crops: Cassava, Sweet Potato, Yams and Aroids*. CAB Publishers, Cambridge, London, UK. 413 P.
- Moorthy, S.N. and Padmaja, G. 2002. A rapid titrimetric method for the determination of starch content in cassava tubers. *J. Root Crops*, **28**: 30-37.
- Mulualem, T. and Ayenew, B. 2012. Cassava (*Manihot esculenta* Crantz) varieties and harvesting stages influenced yield and yield related components. *J. Nat. Sci. Res.*, **2**(10): 122–128.
- Nedunchezhiyan, M., Naskar, S.K., Ranasingh, N. and Saurabh, A. 2006. A new food crop for dry farming: Cassava. *Orissa Rev.*, **63**: 41-42.
- Panse, V.G. and Sukhatme, P.V. 1983. *Statistical methods for agricultural workers*. ICAR. New Delhi. pp 134-192.
- Padmaja, G., Moorthy, S.N., Bala Nambisan, Lila Babu, Sundaresan, S., Sajeev, M.S., Nanda, S.K., Susan John, K., Rajalekshmy, L., Sudha Devi, K.S. and Manikantan Nair, M. 2005. *Analytical Methodologies for Tropical Tuber Crops. Laboratory Manual Series 02*, Central Tuber Crops Research Institute, Thiruvananthapuram, Kerala, India, 119 p.
- Srinivas, T. 2009. Impact of research investment on cassava production technologies in India. *Aust. J. Agric. Resour. Econ.*, **53**: 367– 383.
- Sabitha, S., Byju, G. and Sreekumar, J. 2016. Projected changes in mean temperature and total precipitation and climate suitability of cassava (*Manihot esculenta* Crantz) in major growing environments of India. *Indian J. Agric. Sci.*, **86**(5): 647-653.
- Singh, K.J., Devi, A.K.B. and Sulochanadevi, L. 2017. Evaluation of Short duration cassava (*Manihot esculenta* Crantz) varieties under Manipur condition. *Int. J. Adv. Res. Sci. Eng. and Technol.*, **4**(7): 4286-4289.
- Sunitha, S., James, G., Sheela, M.N., Suresh, K.J. and Mukherjee A. 2018. *Tuber crops varieties released/recommended for release by AICRP on tuber crops over five decades*. ICAR-All India Co-ordinated Research Project on Tuber Crops, ICAR-CTCRI, Kerala, India.
- Suja, G., John, K.S., Sreekumar, J. and Srinivas, T. 2010. Short duration cassava genotypes for crop diversification in the the humid tropics: Growth dynamics, biomass, yield and quality. *J. Sci. Food Agric.*, **90**: 188-198.