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Effects of NPK Fertilizers on Yield Attributes and Yield of Cassava (*Manihot esculenta* Crantz) Variety Vellayani Hraswa for Southern Laterites (Agro Ecological Unit 8)

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ABSTRACT

The study entitled "Effect of NPK fertilizers on yield attributes and yield of cassava (*Manihot esculenta* Crantz) variety Vellayani Hraswa for Southern Laterites (Agro Ecological Unit 8)" was carried out in the farmer's field, Mottamoodu, Naruvamoodu PO Pallichal, Thiruvananthapuram, Kerala from June 2021 to December 2021. The result revealed that fertilizer treatments significantly influenced tuber length, tuber girth, total no. of tubers plant^{-1} mean tuber weight, tuber yield ha^{-1} and top yield ha^{-1}. Application of fertilizers @ 50 : 37.5:100 kg NPK ha^{-1} recorded the highest tuber length, tuber girth, mean tuber weight and tuber yield ha^{-1}. Significantly higher top yield was obtained with the fertilizer treatments @ 75:12.5:100 kg NPK ha^{-1}.

Keywords Agro ecological unit, Cassava, Nutrient management, *Manihot esculenta* Crantz.

INTRODUCTION

An agro ecological unit is a distinct agro climatic and geographical area having particular relevance in agricultural production. The State of Kerala in Indian subcontinent has been divided into 23 distinct AEUs (KSPB 2013). The AEU 8 (Southern Laterites) extends to the south western part of Thiruvananthapuram district in Kerala covering Thiruvananthapuram city and Nemom, Athiyannoor, Parassala, Perumkadavila and Vellanadu blocks comprising 24 panchayats and one municipality. It covers an area of 38727 ha. The region lies between 8°21'30.6" N latitude and 77° 05' 04" E longitude at an altitude of 28 m above the mean sea level. Land use is dominantly coconut plantations. Narrow valleys are cultivated with rice, vegetables, tapioca and banana (KSPB 2013).

Cassava (*Manihot esculenta* Crantz), belonging to the family Euphorbiaceae, is considered as the future food crop as regards to its biological efficiency coupled with ability to sustain under changing climate. In India, cassava is the second most important tuber crop after potato. In India, the cultivation of cassava is mainly done in Kerala, Tamil Nadu, Andhra Pradesh, Nagaland, Meghalaya, Assam. Cassava is the secondary staple food of Keralites. During the past two decades, cassava cultivation in uplands has declined in Kerala, whereas it has caught up in lowlands sequentially after main crop of rice or banana and vegetables. The crop holds a predominant position in cropping systems of Southern Kerala and occupies an area of 3690 ha in AEU 8 (GOK 2019).

Vellayani Hraswa is a high yielding and early maturing cassava variety with 6-7 months duration, branching habit and excellent cooking quality. This

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Table 1. Effect of fertilizer treatments on the yield attributes.

Treatments	Length of the tuber (cm)	Girth of the tuber (cm)	Total no. of tubers per plant	Mean tuber weight (kg)
T_1 - 50:25:100 kg NPK ha^{-1}	31.87^{cde}	20.81^{bcd}	4.50^{cd}	0.60^{b}
T_2 - 50:12.5:100 kg NPK ha^{-1}	31.62^{de}	20.44^{bcd}	4.25^{d}	0.48^{cd}
T_3 - 75:25:100 kg NPK ha^{-1}	37.00^{ab}	22.96^{ab}	6.25^{a}	0.68^{ab}
T_4 - 75:12.5:100 kg NPK ha^{-1}	31.00^{de}	21.79^{bc}	5.25^{bc}	0.59^{bc}
T_5 - 50:25:75 kg NPK ha^{-1}	29.75^{e}	19.43^{cd}	3.75^{d}	0.44^{d}
T_6 - 50:12.5:75 kg NPK ha^{-1}	22.50^{f}	18.02^{d}	3.75^{d}	0.41^{d}
T_7 - 75:25:75 kg NPK ha^{-1}	34.50^{bc}	22.68^{ab}	5.67^{ab}	0.67^{ab}
T_8 - 75:12.5:75 kg NPK ha^{-1}	33.50^{cd}	21.35^{bc}	5.25^{bc}	0.58^{bc}
T_9 (Control) - 50:50:100 kg NPK ha^{-1} (Modified as 50: 37.5:100 kg NPK ha^{-1} on soil test basis)	37.68^{a}	25.24^{a}	6.50^{a}	0.78^{a}
SEm(±)	0.94	0.936	0.332	0.045
CD (0.05)	2.818	2.807	0.995	0.134

variety is preferred for high intensive and year round cultivation by farmers of AEU 8. The nutrient management of this variety is at present based on blanket recommendation for varieties with different duration and growth habits.

Soil research laboratories of Kerala have disclosed several unpredictability in nutrient availability in 23 agro-ecological units of the state (Nair *et al.* 2013). Soil test based recommendations ensure balanced fertilizer use. Development of scientific nutrient management practices will help the farmers of the Agro Ecological Unit 8 in judicious use of nutrients and to achieve better productivity overcoming soil fertility constraints.

In this backdrop the present study is proposed to develop nutrient management practices for short duration cassava variety Vellayani Hraswa for AEU 8.

MATERIALS AND METHODS

Field experiment

Based on the survey details (soil sampling and analysis, assessing the constraints faced by cassava farmers), a field was selected in Pallichal Panchayat, Nemom block which represent the general fertility status of AEU 8.

The field experiment was conducted at the field of Sri Suresh Kumar, Kushavoor veedu, Mottamoodu, Naruvamoodu PO Pallichal, Thiruvananthapuram, Kerala from June 2021 to December 2021. The field is located at 8° 26' 39.8" N latitude and 77° 02' 06.6" E longitude at an altitude of 132 m above mean sea level. Vellayani Hraswa was the cassava variety used for experimentation. It is a high yielding and early maturing cassava variety with 6-7 months duration, branching habit and excellent cooking quality was developed at the Instructional Farm, College of Agriculture, Vellayani, Thiruvananthapuram by clonal selection in 2003 and released from Kerala Agricultural University. This variety is preferred for intensive and year round cultivation by farmers. The experiment was laid out with 9 treatments (T_1 - 50: 25: 100 kg NPK ha^{-1}, T_2 - 50 : 12.5 : 100 kg NPK ha^{-1}, T_3 - 75 : 25 : 100 kg NPK ha^{-1}, T_4 - 75 : 12.5 : 100 kg NPK ha^{-1}, T_5 - 50 : 25 : 75 kg NPK ha^{-1}, T_6 - 50 : 12.5 : 75 kg NPK ha^{-1}, T_7 - 75 : 25 : 75 kg NPK ha^{-1}, T_8 - 75 : 12.5 : 75 kg NPK ha^{-1} and T_9 (control) - 50 : 50 : 100 kg NPK ha^{-1} (Soil test based) with three replications in Randomized Block Design. All other management practices will be done as per the package of practices recommendation (KAU 2016).

Cassava sets are planted at a distance of 90 cm × 90 cm. Farm yard manure was applied @ 12.5 t ha^{-1} at the time of land preparation. Calculated quantities of Urea, Rajphos and Muriate of Potash were applied in order to supply the treatment doses. N and K_2O was applied in three split doses as 1/3 basal, 1/3 two month

Table 2. Effect of treatments on the tuber yield and top tield.

Treatments	Tuber yield (t ha^{-1})	Top yield (t ha^{-1})
T_1 - 50:25:100 kg NPK ha^{-1}	38.58^{bcd}	7.71^{e}
T_2 - 50:12.5:100 kg NPK ha^{-1}	36.42^{cde}	8.33^{e}
T_3 - 75:25:100 kg NPK ha^{-1}	41.52^{b}	12.21^{bc}
T_4 -75:12.5:100 kg NPK ha^{-1}	39.25^{bc}	14.43^{a}
T_5 - 50:25:75 kg NPK ha^{-1}	34.68^{e}	9.20^{de}
T_6 - 50:12.5:75 kg NPK ha^{-1}	33.95^{e}	10.80^{cd}
T_7 - 75:25:75 kg NPK ha^{-1}	40.12^{b}	11.73^{bc}
T_8 - 75:12.5:75 kg NPK ha^{-1}	35.67^{de}	13.56^{ab}
T_9 (Control)–50 : 50 : 100 kg NPK ha^{-1} (Modified as 50 : 37.5 : 100 kg NPK ha^{-1} on soil test basis)	45.06^{a}	11.10^{cd}
SEm (±)	1.125	0.684
CD (0.05)	3.373	2.050

after planting and 1/3 three months after planting, P_2O_5 was applied as basal.

The observations on yield attributes like top yield ha^{-1}, tuber yield ha^{-1}, length of the tuber, girth of tuber, mean tuber weight and number of tubers plant^{-1} were recorded. At the harvest stage, tubers were taken from the net plot and weight of the fresh tubers was recorded and converted it to tuber yield ha^{-1}. Top yield was calculated by taking the total weight of the stem and leaves of the plants from the net plot at the time of harvest and converted to t ha^{-1}. Tubers from the observational plants were pooled, ten tubers were selected randomly, the weight of each tuber was recorded, the average worked out and expressed in kg. The average length of tubers was worked out in cm by measuring the length of ten selected tubers. Girth measurements were recorded from the same tubers that were used for length measurements. Girth values were recorded at three places viz., one at the center and the other two at half way between the center and both the ends of the tuber. The average of these values, in cm, was taken as the tuber girth. The total number of tubers from each observational plant was recorded.

RESULTS AND DISCUSSION

Yield attributes and yield

The effect of treatments on the yield attributes of

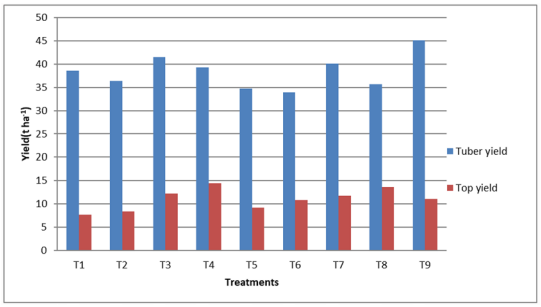

Fig. 1. Effect of fertilizer treatments on the tuber yield and top yield.

cassava was shown in the Table 1. Application of fertilizers @ 50:37.5:100 kg NPK ha^{-1} recorded the longest tubers (37.68 cm) which was on par with T_3 (75:25:100 kg NPK ha^{-1}). Application of fertilizers @ 50: 37.5:100 kg NPK ha^{-1} recorded the highest tuber girth (25.24 cm) and total number of tubers plant^{-1} (6.50) and mean tuber weight (0.78 kg) which was on par with T_3 (75:25:100 kg NPK ha^{-1}) and T_7 (75:25:75 kg NPK ha^{-1}). Levels of P had significant influence on tuber girth. According to Pooja (2018) application of 50 kg P_2O_5 ha^{-1} produced higher tuber girth. The positive response shown by yield parameters to N and K could be directly linked to the well-developed photosynthetic surfaces and increased physiological activities leading to more assimilates being produced and subsequently translocated and utilized in rapid tuber development and production. Both N and K have been shown to be necessary for cassava root initiation, increase in tuber size and number (Ayoola and Makinde 2007).

It can be seen from Table 2 and Fig. 1 that fertilizer treatments significantly influenced the tube yield ha^{-1} and top yield ha^{-1}. Application of fertilizers @ 50: 37.5:100 kg NPK ha^{-1} recorded the highest tuber yield ha^{-1}. Significantly higher top yield was obtained with the fertilizer treatments T_4 (75 : 12.5:100 kg NPK ha^{-1}) which was on par with the fertilizer treatment T_8 (75:12.5:75 kg NPK ha^{-1}).

Sekhar (2004) observed that with increase in N level, there was no significant difference in tuber number and length of cassava var Vellayani Hraswa under varying levels of N @ 50, 75 and 100 kg N ha^{-1}. Pamila (2003) reported that the top yield increased with increase in N level. Imas and John

(2013) reported that only N did not affect cassava tuberization but significant increased the numbers of tuberous roots. Nguyen *et al.* (2014) reported that cassava yield increased up to 40 kg N ha^{-1}. But no further significant yield increases were observed with higher rates of applied N.

According to John *et al.* (2007) N and P interaction increased N-induced P absorption, resulting in growth stimulation and enhanced uptake of both elements and also an increased supply of K significantly affects the activity of starch synthatase enzyme in tuberous roots and resulted in higher tuber yield. The positive growth response to the applied potassium is attributable to their role in cell multiplication and photosynthesis which increased the size and length of the leaves and stems (Uwah *et al*. 2013).

Application of K fertilizer increased the N content in the yield and the total N uptake of the crops, leading to improved nitrogen use efficiency (Aulakh and Malhi 2005). Mulualem *et al.* (2021) also reported a decline in the rate of cassava yield increase as N fertilizer rates increased from 80 to 120 kg ha^{-1} in an experiment where 0, 40, 80 and 120 kg ha^{-1} N fertilizers were applied.

CONCLUSION

The fertilizer treatments had a significant influence on the yield and yield attributes of cassava in Agro Ecological Unit 8. The result revealed that fertilizer treatments significantly influenced tuber length, tuber girth, mean tuber weight, tuber yield ha^{-1} and top yield ha^{-1}. Application of fertilizers @ 50 : 37.5 : 100 kg NPK ha^{-1} recorded the highest tuber length, tuber girth, mean tuber weight, total number of tubers $plant^{-1}$ and tuber yield ha^{-1}. Significantly higher top yield was obtained with the fertilizer treatments @ 75:12.5:100 kg NPK ha^{-1}.

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