



Tuber crops growing different soil types of Kerala

- The blanket recommendation for cassava is NPK @ 100:50:100 kg ha<sup>-1</sup> along with Farm Yard Manure (FYM) @ 12.5 t ha<sup>-1</sup>.
- For applying the recommended NPK @ 100:50:100 kg ha<sup>-1</sup>, the quantity of factomphos, urea and MOP to be applied is 250, 109 and 167 kg ha<sup>-1</sup> respectively or 217, 250, 167 kg urea, Rajphos/Mussooriphos and MOP respectively.
- Cassava is calcium efficient and aluminium tolerant and hence there is no need to apply lime or dolomite.
- Mg is a much required nutrient by tropical tuber crops and the blanket recommendation for cassava is MgSO<sub>4</sub> @ 20 kg ha<sup>-1</sup>.
- Zn status of the soils of Kerala are average and the blanket recommendation is ZnSO<sub>4</sub> @ 12.5 kg ha<sup>-1</sup>.
- Status of B in Kerala soils are low, application of B is required wherever B is marginal and the blanket recommendation is application of borax @ 10 kg ha<sup>-1</sup>.
- Since blanket application of Mg,Zn and B continuously in the same field did not cause any substantial response, it is better to apply these nutrients as per soil test .
- The response to application is found poor if the status of the applied nutrient is above the soil critical level.

The criteria for soil test based application of Mg, Zn and B is given in Table 5.

**Table 5. Soil test based recommendation of FYM, Mg, Zn and B for cassava**

Soil Mg status (meq 100g <sup>-1</sup> )	Application of MgSO <sub>4</sub> (kg ha <sup>-1</sup> )	Soil Zn status (ppm)	Application of ZnSO <sub>4</sub> (kg ha <sup>-1</sup> )	Soil B status (ppm)	Application of borax (kg ha <sup>-1</sup> )	Organic carbon (%)	Application of FYM (t ha <sup>-1</sup> )
0-0.25	20	<0.2	12.5	<0.2	10	<0.50	12.50
0.25-0.50	15	0.2-0.3	10	0.2-0.5	7.5	0.5-0.75	10.00
0.50-0.75	10	0.3-0.4	7.5	0.5-1.0	5.0	0.75-1.00	7.50
0.75-1.00	5	0.4-0.6	5	1-2	2.5	1.00-1.50	5.00
>1.00	2.5	>0.6	2.5	>2	0	>1.50	2.50

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# Soil test based integrated nutrient management (INM) in Cassava



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Tropical tuber crops like cassava, sweet potato, elephant foot yam, yams, taro, tannia and arrowroot constitute an important group of tuberous vegetables and are regarded as the secondary staple for the people of Kerala. These crops are rich in starch/energy with a productivity of 20-100 t ha<sup>-1</sup>. Cassava is locally known as *kappa*, *maracheeni*, *kolli* and *cheeni*. As per the statistics (2017-18), in India, cassava is cultivated in an area of 0.173 million hectares with a production of 4.95 million tonnes and the productivity is 34.94 t ha<sup>-1</sup>. In Kerala, the area, production and productivity is 0.62 lakh hectares, 23 lakh tonnes and 26.96 t ha<sup>-1</sup> respectively.

#### Need for nutrient management in tropical tuber crops

- As the productivity of these crops are very high, there is substantial removal of nutrients from the soil.
- To maintain the yield and sustain the soil productivity, there is a need to replenish the soil fertility through organic manures and chemical fertilizers.
- Organic manures like farm yard manure (FYM), green manuring *in situ* with cowpea, coir pith compost, vermicompost, crop residue or ash either alone or in combination can improve the soil physical, chemical and biological properties.
- Chemical fertilizers, containing major nutrients like nitrogen (N), phosphorus (P) and potassium (K) and secondary nutrients like calcium (Ca), magnesium (Mg) and sulphur (S) and micronutrients like zinc (Zn) and boron (B) are required for the vegetative growth and yield of cassava.
- As the major tuber crops growing soils of Kerala are very rich in nutrients like iron (Fe) and manganese (Mn), there is no need to supply these nutrients from external sources.

#### Nutrient status of cassava growing lowlands and uplands of Kerala

Soil samples were collected from the nine major cassava growing districts of Kerala viz., Thiruvananthapuram, Kollam, Pathanamthitta, Alappuzha, Kottayam, Idukki, Ernakulam, Palakkad and Malappuram covering 44 blocks and 80 panchayats including lowlands and uplands. Based on the chemical analytical data, the mean nutrient status of the uplands and lowlands growing cassava of the above districts are given in Table 1 and 2 respectively.

- The soils of Kerala are mostly acidic with a pH ranging from 4-6 with medium to high organic carbon status (above 0.5%).
- The available nitrogen (N) is low (up to 280 kg ha<sup>-1</sup>), whereas available phosphorus (P) is high to very high (> 25 kg ha<sup>-1</sup>), available potassium (K) is low to medium (< 280 kg ha<sup>-1</sup>), exchangeable calcium (Ca) and magnesium (Mg) are very low (below the critical levels of less than 1.5 and 1.0 meq 100 g<sup>-1</sup> soil respectively).
- The status of micronutrients like iron (Fe), copper (Cu),

manganese (Mn) is very high and well above their soil critical levels.

- Among the micronutrients, boron (B) is found deficient in all soil types of Kerala especially in the laterites and sandy loam soils.



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**Table 1. Nutrient status of the major cassava growing districts of Kerala (Uplands)**

Name of districts	pH	Organic carbon %	(kg ha <sup>-1</sup> )			meq 100g <sup>-1</sup>		ppm			
			N	P	K	Ca	Mg	Fe	Mn	Cu	Zn
Thiruvananthapuram	4.78	0.43	191.5	31.4	141.1	0.73	0.42	26.8	12.6	0.76	0.92
Kollam	4.93	0.80	193.3	26.3	110.0	0.57	0.28	42.8	10.6	1.76	1.11
Pathanamthitta	4.83	0.88	372.4	13.9	353.2	0.65	0.36	29.7	20.7	1.99	1.00
Alappuzha	4.51	0.74	185.7	181.1	229.0	0.88	1.09	32.3	15.7	0.91	1.29
Kottayam	5.12	1.42	310.9	111.8	438.2	1.78	1.96	26.9	11.7	2.50	2.12
Idukki	4.89	2.20	339.0	52.3	501.4	2.06	1.07	35.0	18.9	1.48	1.66
Ernakulam	4.79	0.64	253.8	29.3	197.6	0.68	1.18	27.3	44.2	1.70	1.12
Palakkad	4.35	0.72	136.8	86.4	299.4	1.04	1.04	25.8	33.5	0.66	1.04
Malappuram	4.62	0.60	135.3	60.6	266.2	1.00	0.74	43.1	40.5	2.62	1.73
Kerala (Mean)	4.76	0.94	235.4	66.0	281.8	1.04	0.90	32.2	23.2	1.67	1.33



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**Table 2. Nutrient status of the major cassava growing districts of Kerala (Lowlands)**

Name of districts	pH	Organic carbon %	(kg ha <sup>-1</sup> )			meq 100g <sup>-1</sup>		ppm			
			N	P	K	Ca	Mg	Fe	Mn	Cu	Zn
Thiruvananthapuram	4.44	0.54	222.1	70.8	219.2	0.68	0.38	89.5	16.6	3.30	1.50
Kollam	4.63	0.69	229.1	17.3	101.2	0.52	0.23	47.0	6.6	1.62	0.69
Pathanamthitta	5.00	0.86	300.7	15.4	107.5	2.00	0.40	22.9	9.5	2.63	0.82
Alappuzha	4.30	1.30	244.9	122.5	156.2	0.70	0.95	39.1	23.3	0.88	1.01
Kottayam	4.46	1.53	341.8	123.5	346.8	1.42	1.28	25.1	5.6	1.79	1.87
Idukki	5.18	1.38	280.9	71.9	388.4	2.04	1.09	45.0	19.6	3.29	2.84
Ernakulam	4.83	0.92	307.7	33.0	141.9	0.94	1.38	31.0	17.3	1.63	0.62
Palakkad	4.72	1.00	213.9	56.3	534.2	1.35	1.34	36.7	21.3	1.71	1.13
Malappuram	4.33	0.79	207.4	55.0	382.1	1.22	1.05	49.0	25.5	2.94	1.54
Kerala (Mean)	4.65	1.00	261.0	62.9	264.2	1.21	0.90	42.8	16.1	2.09	1.33

#### Soil test based integrated nutrient management for cassava

- Fertilizers containing N, P, K, Mg and Zn which are to be applied for the soils of the major cassava growing districts of Kerala are given in Tables 3 and 4.
- In both locations, based on soil nutrient status, the rate of FYM as well as chemical fertilizers could be reduced to the extent of 10-25% or even up to 50% and P need not be applied in some districts.

- Factomphos is mostly used by the farmers which contains N:P:K:S @ 20:20:0:13 per cent and hence the S requirement of the crop is met.
- P is less mobile in the soil system and its plant uptake is less compared to N and K. Moreover, high P in the soil can reduce the availability of micro nutrients like Zn.
- Care should be taken to strictly adhere to need based application of nutrients.
- Since excess N can cause bitterness in cassava tubers, N and FYM application too should be based on requirement.
- K being the key nutrient essential for both tuber yield and quality of cassava tubers, K should be applied.
- Due to very high P, if the recommendation is not to apply any P, 25% of the recommended dose of P can be given as a maintenance dose.
- FYM and P can be given as basal at the time of land preparation. Half N and half K within one month of sprouting of the setts and the remaining half N and half K within two months of the first top dressing.

**Table 3. Fertilizer cum manurial recommendation for the major districts of Kerala (Uplands)**

Name of districts	FYM	N	P	K	Urea	Factomphos	MOP	MgSO <sub>4</sub>	ZnSO <sub>4</sub>
	(t ha <sup>-1</sup> )	(kg ha <sup>-1</sup> )							
Thiruvananthapuram	12.5	106	13	94	204	63	157	15	2.5
Kollam	7.5	91	22	106	149	112	177	15	2.5
Pathanamthitta	7.5	91	42	37	108	208	62	15	2.5
Alappuzha	10	97	13	71	183	65	118	2.5	2.5
Kottayam	5	78	13	25	141	65	42	2.5	2.5
Idukki	5	54	13	25	89	65	42	2.5	2.5
Ernakulam	10	97	19	71	171	93	118	2.5	2.5
Palakkad	10	97	13	48	183	65	80	2.5	2.5
Malappuram	10	97	13	60	183	65	100	5	2.5
Kerala (Mean)	8.6	90	18	60	157	89	100	7.5	2.5



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**Table 4. Fertilizer cum manurial recommendation for the major districts of Kerala (Lowlands)**

Name of districts	FYM	N	P	K	Urea	Factomphos	MOP	MgSO <sub>4</sub>	ZnSO <sub>4</sub>
	(t ha <sup>-1</sup> )	(kg ha <sup>-1</sup> )							
Thiruvananthapuram	10	97	13	71	183	65	119	15	2.5
Kollam	10	97	36	106	134	178	177	20	2.5
Pathanamthitta	7.5	91	42	106	108	208	177	15	2.5
Alappuzha	5	78	13	83	141	65	138	5	2.5
Kottayam	5	71	13	37	126	65	62	2.5	2.5
Idukki	5	78	13	25	141	65	42	2.5	2.5
Ernakulam	7.5	91	13	94	170	65	157	2.5	2.5
Palakkad	5	84	13	25	154	65	42	2.5	2.5
Malappuram	7.5	91	13	25	170	65	42	2.5	2.5
Kerala (Mean)	7	86	18	64	147	93	106	7.5	2.5