

**Table 2: Preparation of different grades of the CF mixtures**

**a. CF1: Grade : N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O: Mg: Zn: B @ 8: 11: 21: 3.84: 0.84: 0.315**

Sl. No.	Fertilizers	Composition	Quantity required (g/kg or kg/ton of the CF mixture)
1	Urea	N-46%	80.3
2	Di ammonium phosphate (DAP)**	N-18%, P <sub>2</sub> O <sub>5</sub> -46%	239.1
3	Muriate of potash (MOP)	K <sub>2</sub> O-60%	350
4	Magnesium sulphate (MgSO <sub>4</sub> )	Mg-16%	218.8
5	Zn Sulfate (Mono) (ZnSO <sub>4</sub> )	Zn-33%	30.3
6	Borax	B-10.5%	28.6
7	Total mass without filler		947.1
8	Filler (Gypsum/any inert material)		40.9
9	Total mass		988
10	Steam/water		12

\*\*If DAP is not available, mix 94 g or 94 kg urea (in addition to 80.3 g/ 80.3kg urea) 55g or 55kg Mussooriphos/Rajphos for each kg or ton of the CF mixture

**b. CF2: Grade : N: P<sub>2</sub>O<sub>5</sub>: K<sub>2</sub>O: Mg: Zn: B @ 6: 3: 30: 3.5: 0.8: 0.3**

Sl. No.	Fertilizers	Composition	Quantity required (g/kg or kg/ton of the CF mixture)
1	Urea	N-46%	50.1
2	Di ammonium phosphate (DAP)**	N-18%, P <sub>2</sub> O <sub>5</sub> -46%	260.9
3	Muriate of potash (MOP)	K <sub>2</sub> O-60%	400
4	Magnesium sulphate (MgSO <sub>4</sub> )	Mg-16%	156.3
5	Zn Sulfate (Mono)	Zn-33%	37.9
6	Borax	B-10.5%	38.1
7	Total mass without filler		949.9
8	Filler (gypsum/any inert material)		38.1
9	Total mass		988
10	Steam		12

\*\*If DAP is not available, mix 103 g or 103 kg urea (in addition to 50.1g/50.1kg urea) and 600 g or 600 kg Mussooriphos/Rajphos for each kg or ton of the CF mixture.

**Table 3: CF's and rates of CF's suitable for different tuber crops**

CF's	Rate kg ha <sup>-1</sup>	Crops	Basal application of CF's (g/plant)	Top dressing (g/plant)	
				Urea	MoP
CF1	500	Cassava	41	29	14
CF2	500	Cassava	41	27	15
CF1	625	Greater yam	51	36	18
CF2	625	Greater yam Elephant foot yam	51	33	21

\* Plant requirement (g/plant) was arrived based on the spacing for cassava, EFY and greater yam as 90×90 cm accommodating 12345 plants in one hectare.



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## Customized fertilizers for tuber crops under intercropping in coconut gardens of Kerala



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Tropical tuber crops like cassava, sweet potato, yams, aroids and minor tuber crops are not only important as edible food crops but also have industrial, medicinal and nutraceutical uses. These crops have high biological efficiency, tolerance to marginal environments and pests, high yield potential, high starch content and have excellent physico-chemical and biochemical properties in making many value added products. Because of the high productivity of these crops, the nutrient extraction from the soil is also very high. As in the case of other nutrients, these crops too require major, secondary and micronutrients for their growth and yield.

### Customized Fertilizers: Concept and Development

- Though we have different types of nutrient recommendation involving major nutrients, secondary nutrients and micronutrients independently, the latest concept is the development of fertilizer mixtures specific to crops and soils containing these nutrients based on soil nutrient availability and plant requirement.
- Since all the required nutrients are mixed in one formulation, there is ease in the application and hence saving of labour cost.
- As the grades of the customized fertilizer (CF) formulations are based on crop's need as per plant uptake, innate nutrient supplying capacity of the soil and taking into account the fertilizer use efficiency, this is more precise and hence the indiscriminate use of fertilizers can be avoided to a great extent.
- The synergistic effect of nutrients in the mixture also adds to the significance of these CF mixtures.

### Development of CF mixtures in elephant foot yam under intercropping in coconut

The concept of designing fertilizer mixture was done primarily for elephant foot yam (EFY) under intercropping in the coconut gardens of Kerala for the two major tuber crops growing soils belonging to agro ecological unit (AEU) 3 (Onattukara sandy plain) and AEU 9 (south central laterite). The different grades (percentage of nutrients) of the fertilizer mixture developed with EFY as test crop for the two AEU's based on soil test crop response (STCR) and response curve (RC) approaches at two rates was further tested in other crops like cassava and yams under intercropping. The customized fertilizer (CF) usually have 20%N, full P and 70%K, in addition to the required secondary and micronutrients in full. The rest 80%N and 30%K will be applied as top dressing. We have developed four grades of the customized fertilizer mixtures (CF's) following standard protocols. Field experiments to develop the CF's were carried out in farmers' fields of these two AEU's. The details of the three grades of the CF's is as follows:

**Table 1: Details of the CF's developed for AEU 3 and AEU 9**

CF's Name	AEU	Approach	Grade (N: P <sub>2</sub> O <sub>5</sub> : K <sub>2</sub> O: Mg: Zn: B @)
CF1	3	STCR	8: 11: 21: 3.84: 0.84: 0.315
CF2	9	STCR	6: 3: 30: 3.5: 0.8: 0.3
CF3	9	RC	7: 3: 25: 4: 1.25: 0.4

### Farmers' field experiments in the development of CF mixtures



### On farm testing of CF's in EFY, cassava and greater yam

- Among the four grades, three grades were tested at farmers' fields in one location in AEU 3 and two locations in AEU 9 and found that, all CF's applied @ 625 kg ha<sup>-1</sup> as best with a BC ratio of 4.02 against 2.75 and 2.95 respectively for PoP and farmers' practice.
- The best grade among the three was selected based on the large scale field experimentation conducted at the five major EFY growing districts of Kerala viz., Thiruvananthapuram, Kollam, Pathanamthitta, Kottayam and Ernakulam and CF2 was found as the best giving a BC ratio of 5.44.
- These mixtures were tested for cassava and yams under intercropping in coconut and found that, for cassava CF1 and CF2 @ 500 kg ha<sup>-1</sup> was good and for greater yam CF1 and CF2 @ 625kg ha<sup>-1</sup> was good.
- It could be established that, all CF formulations were best for different tuber crops at different rates with respect to tuber yield, tuber quality attributes and soil quality compared to PoP and farmers' practice

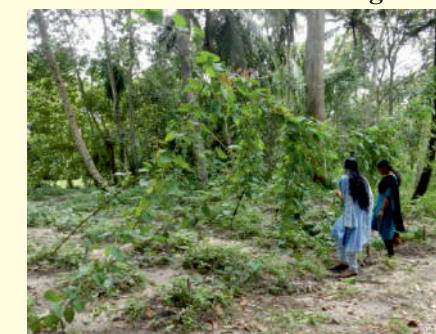
### OFT's on use of CF mixtures in EFY



### OFT's on use of CF mixtures in cassava



### OFT's on use of CF mixtures in greater yam



### Preparation of CF mixtures

The quantity of component fertilizers to be mixed for making the different CF mixtures with grades as below are given in Tables 2a and 2b.

