Cassava *(Manihot esculenta Crantz)*

French: Manioc; Spanish: Yuca; Italian: Iucca, mandioca; German: Tapioka, Maniok; Portugese: Mandioca

Crop data

Annual (1-2 years). Harvested part: roots; in some cases young leaves. Grown in tropical and subtropical climates, generally at beginning or end of rainy season; cuttings 20 cm in length from mature stems are planted vertical, inclined or horizontal, 5-10 cm below soil surface.

Roots harvested 10-12 months after planting (but may range from 6 to 18 months; there is no fixed time of maturity).

Plant density: 8 000-16 000 per ha; often intercropped with rice, maize and grain legumes.

Optimum soil requirements for cassava

Preferably grown on light to medium soils, well-drained, pH 4.5-7.5. The crop is adapted to semi-arid conditions; it needs adequate soil moisture mainly during planting; once sprouted, it can withstand several months of drought; generally, it is not irrigated, but in some areas responds markedly to irrigation.

Cassava is well adapted to very acid soils with high levels of exchangeable Al. For that reason, is it seldom necessary to apply lime. The plant is also well adapted to low levels of available P, but requires fairly high levels of K, especially when grown for many years on the same plot. The crop is susceptible to Zn deficiency and often shows Zn deficiency symptoms at early stages of growth.

Optimum requirements:

pH 4.5-7.5; exchangeable Al < 80 % saturation; available P > 5 ppm; exchangeable Ca > 0.25 me/100 g dry soil; exchangeable K > 0.17 me/100 g dry soil; conductivity < 0.5 mmhos/cm; exchangeable Na < 2.5 % saturation; available Zn > 1 ppm; available Mn > 5 ppm; sulphate-S > 8 ppm.

Nutrient demand/uptake/removal

Nutrient uptake and removal - Macronutrients								
Yield t/ha	**Plant**	**Source**	**kg/ha**					
			N	**P2O5**	**K2O**	**MgO**	**CaO**	**S**
45	Fresh roots	Amarasiri,	62	23	197	36	17	3
	Whole plant	1975	202	73	343	179	183	15
37	Fresh roots	Howeler, 1985	67	38	122	14	22	7
	Whole plant		198	70	220	47	143	19
18	Fresh roots	Sittibusaya*	32	8	41	6	7	1
	Whole plant		95	23	77	52	23	7
9	Fresh roots	Sittibusaya*	13	2	5	3	4	0.2
	Whole plant		39	7	12	14	29	2
* personal communication								

Nutrient uptake and removal - Micronutrients							
Yield t/ha	Plant	Source	g/ha				
			Fe	Mn	Zn	Cu	B
37	Fresh roots	Howeler, 1985	900	60	170	30	70
	Whole plant		n.a.	1090	660	80	200

Plant analysis data

The youngest fully expanded leafblades without petioles (4th-5th leaf from top) at 3-4 months after planting provide the best indicator tissue. Petioles, stems and roots have much lower concentrations of N, P, and K. Adequate K is very important for starch synthesis and translocation and increases the plant's resistance to anthracnose.

Analysis of 4th - 5th leaf, 4 months after planting									
Supply	% of dry matter						ppm		
	N	P	K	Mg	Ca	S	Fe	Mn	Zn
Optimum	5.4	0.4	1.7	0.30	0.80	0.28	130	80	45
Deficient	4.7	0.3	1.0	0.27	0.65	0.24	100	45	25
Source: Howeler, 1983									

Fertilizer recommendations

Low yield level	
at 1 month after planting	half N, all P2O5 and half K20
at 3-4 months after planting:	half N and half K2O
High yield level	
at planting:	one-third N, all P2O5, one-third K2O
at 2 months after planting:	one-third N, one-third K2O
at 5 months after planting:	one-third N, one-third K2O

Nutrients may be applied either as organic manure, wood ash or mineral fertilizers. Organic manures and rock phosphate are generally incorporated in the whole soil during land preparations; wood ash is incorporated with the soil in the planting hole; while mineral fertilizers are applied in short bands near the planting stake and covered with soil, generally as a basal NPK dressing at planting or at 30 days, with 1 or 2 top dressings of N and/or K2O at 2-4 months after planting, when enough soil moisture is available. Rates depend on soil fertility status and yield levels:

Preferred nutrient forms:

There appears little difference between nitrate or ammonium forms of N. Being adapted to acid soil, cassava can make good use of rock phosphates, but generally responds better to soluble sources of P2O5 such as single or triple superphosphates. K can be applied as chloride or sulphate, but the former is generally cheaper. Wood ash is also a good source of K. Compound fertilizers are most convenient, if available, but they should either be high in N and K2O or should be supplemented by top dressings of urea and KCl. Zn can be applied as Zn sulphate to the soil if pH < 6.0. Foliar sprays of 1 % Zn sulphate can also be applied, or stakes can be dipped for 15 min in 2 % Zn sulphate before planting.

Present fertilizer recommendations:

Thailand - (north east and south-eastern region). 95 kg N, 45 kg P2O5, 95 kg K2O per ha. This can be applied as 300 kg/ha 15-15-15 at planting, followed at 3 months by a side dressing of a further 50 kg N and 50 kg K2O per ha.

India - (Kerala state): 12.5 t f.y.m., 100 kg N, 25 kg P_2O_5, 100 kg K_2O per ha. The f.y.m. is incorporated before planting; half the N and K_2O and all the P_2O_5 are banded near the stake at planting, and the remaining half of the N and K_2O is side dressed near the plant at 45-60 days after planting.

Indonesia - (Java and southern Sumatra): 100 kg N, 50 kg P_2O_5, 100 kg K_2O per ha. All the P_2O_5 and one-third of the N and K_2O are applied at planting and two-third of the N and K_2O at 3-4 months (after harvesting the intercrop).

Colombia - (Eastern Plains): 500 kg dolomitic lime, 80 kg N, 100 kg P_2O_5, 100 kg K_2O, 20 kg S and 10 kg Zn per ha. The dolomitic lime is applied once every 4-5 years and is broadcast and incorporated before planting. P_2O_5 can be applied as rock phosphate, also broadcast and incorporated, or as triple superphosphate (TSP), diammonium phosphate (DAP) nitrophosphate or compound fertilizer. An alternative is to apply 200 kg/ha of DAP and 50 kg K_2O/ha as KCl at planting followed at 3 months by 45 kg/ha N as urea and 50 kg/ha K_2O as KCl, side dressed.

Brazil - (East-central states and Campo Cerrado): 30 kg N, 85 kg P_2O_5, 60 kg K_2O per ha. The fertilizer is applied in the planting furrow at time of planting, but care should be taken that it is not in direct contact with the planting stake.

Further reading

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