Drip Fertigation in Cassava

Cassava (*Manihot esculenta* Crantz) needs adequate soil moisture for sprouting and subsequent establishment of the planted setts. In Tamil Nadu and parts of Andhra Pradesh, where cassava tubers are used for industrial purposes, it is grown under irrigation. In most of the other states where the tubers are used for human consumption or as cattle feed, cassava is grown as a rainfed crop, utilizing the monsoon rains. However, supplementary irrigation during the drought period gives higher tuber yield.

Drip irrigation is the most efficient system for the supply of water and nutrients for crop production. It delivers water and nutrients at the right place, *ie.*, directly to the plant's root zone, in the right amounts, at the right time, and in the right form, so each plant gets exactly what it needs, when it needs, to grow. In cassava also, drip fertigation system is found to increase the water and nutrient use efficiencies.

Cassava field

Water requirement

Water requirement of cassava mainly depends on local weather and soil conditions and stage of the crop. For cassava varieties having 9-10 months duration, four distinct phases of growth can be identified with respect to water requirement. These are sprouting and initial establishment (20 days), canopy establishment and tuber development stage (20-180 days), fast tuber bulking stage (180-240 days) and maturity stage (240-300 days). For short duration varieties having 6-7 months duration, the stages can be 20 days, 20-150 days, 150-180 days and 180-210 days respectively for sprouting and initial establishment, canopy and tuber development, tuber bulking stage and maturity stage. Accordingly the crop coefficient, which determines the evapotranspiration demand of the crop also varies. A dry spell during tuber maturity phase hastens maturity and proper tuber bulking. Drip irrigation is found economic during summer season, and cassava requires irrigation at the rate of 100% cumulative pan evaporation (CPE). The optimum water requirement of cassava is observed as 350-400 mm for short duration varieties (6-7 months) and 550-600 mm for long duration varieties (9-10 months).

Under humid tropical climate of Kerala, evaporation values ranges from 4-5 mm during summer months and 3-4 mm during other periods. Accordingly, based on the water requirement of the crop, the following irrigation schedule may be followed using a drip system.

Cassava under drip irrigation

Drip irrigation requirement of cassava

*Period (days)	Summer months (l/day)		Supplementary irrigation during other months (l/day)	
	Per ha	Per one cent	Per ha	Per one cent
Initial	8400-10500	33-42	6300-8400	25-34
Mid	22400-28000	90-112	16800-22400	67-90
Late	8400-10500	33-42	6300-8400	25-34

*Initial 1-20 days; Mid 20-150 days for short duration varieties and 20-180 days for long duration varieties; Late 150-180 days for short duration varieties and 180-240 days for long duration varieties.

Drip irrigation frequency can be fixed based on soil type and may be given once in two days or three days for light soils. Irrigation can be with less frequency for heavy soils. Drip irrigation ensures more than 90% efficiency, but for other methods *viz.*, furrow irrigation, hose irrigation etc. only 40-50% efficiency is expected. Hence more water is required to meet the crop demand.

Drip fertigation schedule

Drip irrigation can be combined with fertigation by installing a fertigation unit with fertilizer mixing tank, filter, control valve etc. for larger areas or a ventury system for smaller areas. Though for fertigation, liquid fertilizers and water soluble mixed fertilizers are preferred, water soluble straight fertilizers are more economic. For Kerala soils, an NPK rate of 100-50-100 kg/ha is recommended for cassava. Phosphorus fertilizer, required for initial root establishment can be applied as basal soil application. Nitrogen and potassium fertilizers can be applied through fertigation and the quantity is fixed based on the duration of varieties and the crop requirement as per stage of the crop.

Different types of fertigation units

For normal duration varieties (9-10 months) fertigation may be followed upto 6-7 months, whereas for short duration varieties, fertigation may be restricted to initial 4-5 months.

For cassava, fertigation may be given at weekly intervals. Based on the studies at ICAR-CTCRI, application of 50% nitrogen and potassium within 60 days after planting (DAP), 30% during 60-90 DAP and the rest 20% during 90-120 DAP is found ideal for short duration varieties. Also it was found that 25% of nitrogen could be saved if fertigation is followed in short duration varieties. Accordingly the fertigation schedule developed for cassava in Kerala is as follows.

Cassava under drip fertigation

Fertigation schedule for short duration varieties of cassava

Period(weeks)	Short duration varieties			
	kg per ha per week		g per one cent per week	
	Urea	Muriate of potash	Urea	Muriate of potash
2nd	6	6	24	24
3rd,4tf	7	8	28	32
5th,6th,7th	11	10	44	40
8th,9th,10th,11th,12th	13	13	52	52
13th	9	14	36	56
14th,15th,16th,17th	9	9	36	36
Total	163 kg urea≈ 75 kg N	167 kg MOP≈ 100 kg K_2O	652 g urea≈ 300 g N	668 g MOP≈ 400 g K_2O

Fertigation schedule for long duration varieties of cassava

Period(weeks)	Long duration varieties			
	kg per ha per week		g per one cent per week	
	Urea	Muriate of potash	Urea	Muriate of potash
2nd,3rd,4th,5th	8	6	32	24
6th,7th,8th,9th	9	6	36	24
10th,11th	10	6	40	24
12th,13th,14th,15th,16th,17th	11	9	44	36
18th,19th,20th	9	7	36	28
21st,22nd	6	6	24	24
23rd,24th,25th,26th	6	5	24	20
Total	217 kg urea≈ 100 kg N	167 kg MOP≈ 100 kg K_2O	868 g urea≈ 400 g N	668 g MOP≈ 400 g K_2O

Drip irrigated Cassava, variety Sree Vijaya

Drip irrigation and ground cover mulching


Harvested tubers of cassava

Advantages of drip fertigation

- Economy in water use
- Higher water and nutrient use efficiency
- Lesser weed growth in the interspaces
- Labour and energy saving

Challenges of drip fertigation

- High initial investments
- Periodical maintenance of the system is necessary
- Readily soluble solid or liquid fertilizers only can be used
- Proper clean up is necessary against clogging

Control of clogging in drip systems

***Physical clogging*:** Mainly due to deposition of sand, silt or other suspended solids. An adequate filtration system can prevent physical clogging of drip system.

***Chemical clogging*:** Mainly due to mineral precipitation of calcium, magnesium, iron or manganese. Acid injection, to lower irrigation water pH can reduce chemical clogging of drip emitters.

***Biological clogging*:** Mainly due to bacteria, fungi or algae that can cause slime accumulation. Proper chlorination and disinfection procedures can control biological clogging of drip irrigation system.

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