Drip Fertigation in Taro

Taro (*Colocasia esculenta* (L.) *Schott* is a staple food in African, Oceanic and south Asian countries and plays a crucial role in food security, holding 9th position among world food crops. It is primarily grown as a vegetable for its edible starchy cormels, but its petiole and leaves are also used as vegetable for nutritional and medicinal purposes. It prefers moist conditions for better growth and yield. In areas where rainfall is less, supplementary irrigation is required for successful production.

Taro field

There are two main production systems used in taro cultivation: upland irrigated or rainfed conditions and the wet land or low land flooded conditions. Under rainfed conditions, supplementary irrigation by sprinkler or surface irrigation has to be given during the dry spell for attaining high yield. It is essential to maintain soil moisture at field capacity, which when falls, should be supplemented with irrigation. Moisture may not be limiting, when cultivated in paddy lands or swampy conditions. However, under rainfed or upland conditions, irrigation should be assured. After planting in any season, 2-8 irrigations may be required depending upon the onset and distribution of monsoon. Usually furrow or flood irrigation is followed. Corm bulking stage of taro occurs between 4th and 6th month period, which is considered as the most critical period of water deficit stress.

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 taro also, drip fertigation system is found to increase the water and nutrient use efficiencies.

Taro under drip irrigation

Water requirement

Water requirement of taro mainly depends on local weather and soil conditions and stage of the crop. Most of the varieties have a duration of 6-8 months. For taro, four distinct phases of growth can be identified with respect to water requirement. These are sprouting and initial establishment (1-3 to 4 weeks), rapid root and shoot establishment (3 to 10 weeks), maximum growth and corm development (10 to 20 weeks) and rapid accumulation of dry matter in aerial parts (20 to 24 weeks) and thereafter senescence and maturity. Slight variation in these phases is expected depending upon the actual duration of variety. Accordingly the crop coefficient, which determines the evapotranspiration demand of the crop also varies. A dry spell of 2-3 weeks towards the end hastens maturity and stop further vegetative growth or sprouting of mature cormels.

Drip irrigation is found economic during summer season, and taro requires continuous irrigation upto six months during summer and drip irrigation at 100 % cumulative pan evaporation (CPE) is found optimum. The optimum water requirement of upland taro is observed as 600 to 650 mm for a period of six months.

Under humid tropical climate of Kerala, evaporation values ranges from 4-5 mm during peak 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.

Drip irrigation requirement of taro

*Period (weeks)	Summer months (l/day)		Supplementary irrigation during other months (l/day)	
	Per ha	Per one cent	Per ha	Per one cent
Initial	29400-36750	118-147	22050-29400	88-118
Mid	32200-40250	129-161	24150-32200	96-129
Late	30800-38500	123-154	23100-30800	92-123

*Initial: upto 4 weeks; Mid: 4 - 20 weeks; Late: 20-24 weeks

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.

Use of suitable mulching materials can reduce the water requirement of taro. Mulching with green/dry leaves during the initial stages will retain soil moisture and enhances sprouting and can reduce the frequency of irrigation. It is found that drip irrigation along with mulching with porous ground cover mat or crop residues can reduce the water requirement of the crop to half, thereby saving 50% of irrigation water.

Mulching with porous ground cover mat

Drip fertigation schedule

Wherever drip irrigation is followed, fertigation can be combined, especially for nitrogen and potassium fertilizers, which are regularly required for growth and tuberization. For this, a fertigation unit with fertilizer mixing tank, filters, control valve etc. may be installed 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.

Different types of fertigation units

For taro, fertigation may be given at weekly intervals. Based on the studies at ICAR-CTCRI, fertigation in taro results in a saving of 25% each of nitrogen and potassium requirements. In place of the standard recommendation of 80-25-100 kg/ha, a lower nutrient dose of 60-25-75 kg N, P_2O_5 and K_2O is sufficient per hectare, if drip fertigation is adopted. Full phosphorus is applied as basal application. Fifty percent of nitrogen and potassium may be applied during the first three months, 25% during the fourth month and the rest 25% during the fifth month through fertigation. Accordingly the fertigation schedule developed for taro in Kerala is as follows.



Taro under drip fertigation

Fertigation schedule for taro

Period(weeks)	kg per ha per week		g per one cent per week	
	Urea	Muriate of potash	Urea	Muriate of potash
3rd	4	3	16	12
4th	4	5	16	20
5th,6th,7th	6	6	24	24
8th	7	6	28	24
9th,10th	7	7	28	28
11th,12th,13th	9	8	36	32
14th,15th,16th,17th	8	8	32	32
18th	7	7	28	28
19th	7	6	28	24
20th,21st	5	5	20	20
Total	130 kg urea≈ 60 kg N	125 kg MOP≈ 75 kg K_2O	520 g urea≈ 240 g N	500 g MOP≈ 300 g K_2O

Harvested cormels of taro

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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