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Economics of Conventional and Drip Irrigated Coconut Cultivation in Palakkad district, Kerala

***Rinshina T.*[1] *and Seenath Peedikakandi*[2*]**
[1]*PG. Scholar, Department of Agricultural Economics,*
College of Agriculture, Vellanikkara, Kerala Agricultural University, India.
[2]*Assistant Professor, Department of Agricultural Economics,*
College of Agriculture, Vellanikkara, Kerala Agricultural University, India.

(Corresponding author: Seenath Peedikakandi)*
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ABSTRACT: The study examined the economic aspects of coconut cultivation under conventional and drip irrigated coconut systems in the Palakkad district of Kerala. Data were collected from 50 drip-irrigated farms (DIF) and 50 conventionally irrigated farms (CIF) across two blocks of the district. The findings indicated that CIF have higher cost of cultivation compared to the DIF. The higher cost of cultivation under CIF was mainly attributed to their higher irrigation cost (30 per cent higher than that of DIF). The annual maintenance cost of DIF was 11 per cent lower than CIF. The yield from drip irrigated farms was 19,035 nuts/ha, which was 10 per cent higher than that of CIF. The net returns were ₹70,470/ha/year for drip irrigated farms and ₹30,543/ha/year for conventionally irrigated farms. DIF was found to be better performing with respect to higher productivity, higher net returns and lower cost of cultivation.

Keywords: Coconut cultivation, drip irrigated farms (DIF), conventionally irrigated farms (CIF), economics, yield, returns.

INTRODUCTION

Water scarcity is a pressing global issue that affects many regions, especially those with limited access to freshwater resources. It has significant implications in agriculture, as the sector heavily relies on water for irrigation. As demand for water increases due to population growth and climate change, agriculture faces mounting challenges in ensuring sustainable water use and food security. Considering the water scarcity, one of the methods introduced to increase the water use efficiency in Indian agriculture is drip method of irrigation (DMI). In contrast to surface irrigation methods, drip irrigation delivers water directly to the crop's root zone through a system of pipes, significantly reducing water loss due to evaporation and distribution (Narayanamoorthy, 2005). A well-designed and properly managed drip irrigation system can achieve an on-farm irrigation efficiency of approximately 90 per cent, while surface irrigation typically has an efficiency of only around 40 per cent.

Coconut, often called the "tree of paradise," plays a significant role in Kerala's agricultural economy. The coconut palm supports food security and livelihoods for a large population in the state. In Kerala, coconut is cultivated on 7.6 lakh ha, with a productivity of 7,402 nuts/ha (CDB, 2024), which is much lower compared to other states. The primary reason for this is attributed to extensive cultivation under rainfed conditions.

The coconut palm requires a continuous supply of water and nutrients from the soil to sustain the production of fronds, inflorescences, and nuts throughout the year (Jayakumar *et al*., 2017). Summer irrigation for coconut palms can significantly improve yields. Irrigating the palms could increase female flower production and helps to reduce premature nut fall. Effective methods for water application include micro-sprinklers, and drip irrigation. Drip irrigation is the most suitable irrigation system for coconut due to its wider spacing and it could enhance the yield of palms and reduces water wastage (KAU, 2024).

Given the increasing demand for water, it is important to find ways to use water more efficiently, especially for crops like coconut that need a lot of water throughout the year. By using this system, farmers can deal with water scarcity and make coconut farming more sustainable and profitable in the long run. Comparing the costs and returns of the coconut cultivation under water use efficient drip irrigation and less efficient conventional irrigation would help to understand the profitability of investments on irrigation. It also helps to suggests measures to make the cultivation more profitable. Taking these factors into account, present study was undertaken to estimate and compare the economics of coconut cultivation under drip and conventionally irrigated.

MATERIAL AND METHODS

The study was carried out in the Palakkad district of Kerala, which was specifically chosen due to its low groundwater recharge (CGWB, 2022). The district is known as the "Granary of Kerala" as it is one of the agriculturally better performing districts in the state. Eastern part of the district is facing water shortage, especially during the months of December to May due to influence of western Ghats. Coconut is the major crop in this region, which was cultivated mainly under irrigated condition.

From the district, two CD blocks namely Chittur and Kollengode were purposively selected owing to their highest area under drip irrigated coconut cultivation. For comparing the economics, a total of 100 coconut farms were selected, with 50 drip irrigated farms and 50 conventional irrigated farms. In each block, 25 farms using drip irrigation and 25 using conventional irrigation were chosen, ensuring an equal representation of both methods. Farms having yield stabilized WCT palms (18-28 years' age) under above specified condition for the last three consecutive years were only selected for ensuring uniformity. The data regarding the cost of cultivation, yield, price of output were collected from the respondents through field survey.

A. Cost of cultivation

Coconut is a perennial crop with both establishment and maintenance phase. The average productive life span of the coconut is 60 years with 7 years of vegetative phase. Cost of cultivation of cultivation of perennial crops is the sum of amortized establishment cost, maintenance cost, and interest on working capital. The establishment cost of coconut is amortized for 60 years.

- Total cost of cultivation = Amortized maintenance cost + Annual maintenance cost + Interest on working capital
- Amortized establishment cost = $\frac{y\,[i\,(1+i)^n]}{[1-(1+i)^n]}$

Where, y = total establishment cost
i = interest rate (7%)
n = productive life span of coconut palms (60 yrs)

- Interest on working capital = m * i
  m = annual maintenance cost
  i = interest rate (7%)

B. Cost of irrigation

For DIF, the cost of irrigation includes the amortized cost of drip and the annual maintenance cost of drip along with the of amortized cost of well, amortized cost pump set and other accessories and electricity cost. For CIF, the cost of irrigation comprises the amortized cost of irrigation channels and annual maintenance cost along with the of amortized cost of well, amortized cost pump set, tanks and other accessories and electricity cost.

The amortized cost on investment =

$$Y * (1 + i)^{EL}) * i] / [(1 + i]^{(AA)} - 1,$$

Where,

Y= Compounded investment = Historical investment cost $*$ $(1 + i)^{(AA)}$

EL = economic life of the items
For well = 20 yrs (FAS, 2015)
Drip irrigation system = 15 years (NABARD, 2021)

Gross returns. The gross returns were calculated by multiplying average output price with the average yield obtained from the coconut palms.

Gross returns = Average yield * Average price of the output

Net returns. The net returns were calculated by subtracting total cost of cultivation from the gross returns.

Net returns = Gross returns – Total cost of cultivation.

RESULTS AND DISCUSSION

A. Establishment Cost

The establishment cost for DIF and CIF was ₹276,505/ha and ₹281,889/ha respectively. The major share of the establishment cost was attributed to labour (73%) and irrigation expenses (18%). There was only a slight variation in establishment costs of DIF and CIF. The coconut farms had an average age of about 24 years, and considering this, most of the drip-irrigated palms were under conventional irrigation during the establishment phase. This is the reason for the minimal variation in the establishment costs between the two regimes. This result matched with the findings of Reddy *et al.* (2017), that the establishment cost of coconut cultivation in Tamil Nadu was ₹2,28,082/ha.

B. Maintenance Cost

The major components of maintenance cost of coconut farms were cost of FYM, fertiliser, human labour, machine labour and Irrigation expenses. The annual maintenance costs were ₹130,441/ha for DIF, which was 11 per cent lower compared to CIF (₹144,485/ha). The significant difference in the maintenance cost of both regimes, mainly due to high labour and irrigation expenses in the conventionally irrigated farms. The labour charges for DIF and CIF were₹74653/ha and ₹68580/ha respectively (The labour cost for the irrigation was accounted in the irrigation cost). Labour costs were 9 per cent higher for conventional farms due to increased weeding expenses. The irrigation cost for DIF and CIF were ₹22038/ha and ₹31399/ha respectively. The higher irrigation cost in the CIF due to the construction and annual maintenance of the irrigation channels. Harvesting charges were not incurred, as the farmers were selling their produce directly to traders from Tamil Nadu, who determine the price after deducting the harvesting charges. This result aligned with the findings of Kishore and Murthy (2017), that the maintenance cost of coconut cultivation in Karnataka was ₹1,61,827/ha. Similar findings were observed in that study of the coconut production in Sindhudurg district

C. Yield and Returns

Drip irrigated farms achieved a higher yield of 19,035 nuts/ha/year compared to 17,350 nuts/ha/year under conventional irrigation. Gross returns were ₹229,737/ha for drip irrigation and ₹208,718/ha for conventional irrigation. The net returns from drip irrigation farms were ₹70,470/ha/yr, more than twice the ₹30,543/ha/yr

achieved by conventional farms. These findings were consistent with those of Chinnah and Suresh (2023), who reported net returns of ₹33,474/ha for small-scale coconut farmers in Tamil Nadu. However, the returns from drip irrigation farms were significantly higher due to the yield-enhancing potential of the drip irrigation system. Narendra *et al*., (2021) reported the yield of Arecanut in karnataka district was higher in the drip irrigation method (9.62qtl/acre) compared to sprinkler (8.56qtl/acre) and flood (8.22 qtl/ acre) irrigation method.

Table 1: Establishment cost of conventionally irrigated farms (Rs/ha).

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Seedlings	4442							4442 (1.9)
FYM	327	397	429	677	799	914	1091	4633 (1.6)
Fertiliser	984	1454	1497	1601	1714	2056	2399	11705 (4.1)
Soil ameliorants	200	180	180	200	500	800	1000	3060 (1.1)
Human labour	26932	24300	28096	29701	31834	33350	33746	207958 (73.7)
Irrigation	6645	6677	6993	7353	7403	7465	7554	50091 (17.6)
Total	39531	33007	37194	39533	42250	44585	45789	281889

Table 2: Establishment cost of drip irrigated irrigated farms (Rs/ha).

Particulars	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
Seedlings	4523	0	0	0	0	0	0	4523 (1.6)
FYM	329	411	427	669	792	921	1061	4609 (1.7)
Fertiliser	845	1307	1347	1441	1542	1851	2159	10493 (3.8)
Soil ameliorants	200	180	180	200	500	800	552	2612 (1.0)
Human labour	26913	23878	27400	28888	31052	32519	32937	203587 (73.6)
Irrigation	6575	6900	7009	7343	7418	7685	7750	50681 (18.3)
Total	39385	32676	36364	38542	41304	43776	44459	276505

Table 3: Maintenance cost of farms (Rs/ha/year).

Particulars	CIF	DIF
FYM	18302 (12.7)	18034 (13.8)
Fertiliser	16545 (11.4)	18035 (13.8)
Soil ameliorants	3583 (2.5)	3754 (2.9)
Human labour	58222 (40.3)	56093 (43.0)
Machine labour	16431 (11.4)	12487 (9.6)
Irrigation cost	31402 (21.7)	22038 (16.9)
Total	144485	130441

Note: The labour charge for the maintenance of channels and operating pumps included in the irrigation cost

Table 4: Total cost of cultivation (Rs/ha/year).

Particulars	CIF	DIF
Total establishment cost	281889	276505
Amortised establishment cost	20079	19695
Maintenance cost	144485	130441
Interest on working capital	10114	9131
Total cost of cultivation	174679	159267

Table 5: Yield and returns of the farms (Rs/ha/year).

Particulars	CIF	DIF
Yield (Rs/ha)	17350	19035
Gross returns (Rs/ha)	208718	229737
Total cultivation (Rs/ha)	174679	159267
Net returns (Rs/ha)	30543	70470

CONCLUSIONS

The study highlights the economic advantages of drip irrigation over conventional methods in coconut farming. While the establishment costs for both systems were similar due to conventional irrigation system during the initial phase in both the regimes. There were significant differences in maintenance and irrigation costs between two regimes. Drip irrigation could reduce annual maintenance costs by 11 per cent and irrigation costs by 30 per cent, primarily due to lower labour and energy expenses. Drip irrigation systems delivered significantly better results, with yields of 19,035 nuts per hectare per year and net returns of ₹70,470 per hectare per year, exceeding the ₹30,543 per hectare returns from conventional farms by more than double. This underscores its economic benefit and making it a viable and sustainable option for farmers in the study area.

FUTURE SCOPE

Further studies should explore the long-term benefits of drip irrigation, including its impact on water conservation and soil health. Government incentives and training programs can enhance adoption among farmers. Expanding the scope to include environmental benefits, such as groundwater recharge and reduced carbon footprint, could further validate the sustainability of drip irrigation.

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