

Enhancing profitability of oil palm based cropping system

through resource use efficient technologies with farmer-scientist and stakeholders interface

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Location and selection of area

The project was initiated by adopting villages i.e. Challa-chintalapudi and Makkinavarigudem, West Godavari district, Andhra Pradesh.

Challachintalapudi and Makkinavarigudem villages of Denduluru and T. Narsapuram mandal were selected from West Godavari District, Andhra Pradesh. The rationale behind selection of these two villages is that they are representative of the district comprising all the four different soil types, viz. Alfisols, vertisols, incepsisols and entisols and farmers cultivate a large variety of

horticultural and agricultural crops in the villages (Table 1). The major plantation crops grown in the selected villages are coconut and oil palm. Participatory Rural Appraisal (PRA) tools administered at village level helped in problem identification.

Number of farm families

The project was initiated with 1010 farm families.

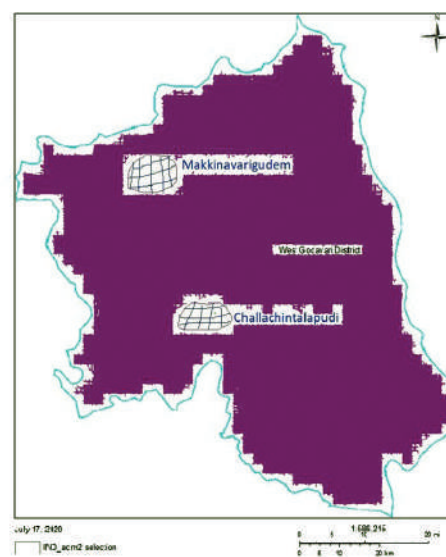
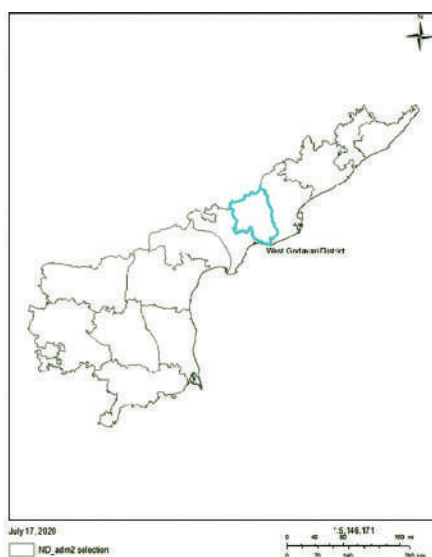
OBJECTIVES

- To assess and refine resource use efficient technologies for enhancing profitability of oil palm based cropping system.

- To identify and integrate economically viable and socially acceptable entrepreneurial activities as models of enhanced earnings to the oil palm growers, women and rural youth.
- To build a network of linkages with different entities around the oil palm plantations of farm households for facilitating access of information, technology, inputs and other deliverables to attain higher returns.

INTERVENTION

The following four modules were implemented in the selected two villages.



Location of two selected villages.

Table 1. Interventions implemented in two villages of West Godavari District of Andhra Pradesh

Module	Intervention
i) Crop based module	Weather based irrigation scheduling in oil palm. Nutrient application to oil palm through fertigation. Integrated pest management of leaf eating caterpillar and bag worm in oil palm. Integrated disease management of Basal Stem Rot (<i>Ganoderma</i> spp.) in oil palm. Mechanization of harvesting of bunches in oil palm.
ii) Horticulture based module	Coconut and Oil Palm based cropping system.
iii) NRM based module	Recycling of biomass obtained from oil palm plantation.
iv) Livestock based module	Fodder grass for livestock. Doubling farm income by introducing fish in farm ponds in coconut / oil palm cropping system.

Weather based irrigation scheduling in oil palm

Rationale of the intervention: Oil palm is an introduced crop to India and it responds very well to management, viz. irrigation and nutrient application. ICAR-IIOPR developed and standardized water and nutrient management technologies for better use efficiency of these resources. This technology was demonstrated with a lateral spread of 200 ha. Mobile based GSM starters helped in providing exact quantity of water without much human intervention. Because of which a considerable saving in irrigation water could be recorded which could be utilized for growing additional crops like maize, banana, pineapple, etc. Farmers of these villages are well aware of the need for irrigation in oil palm. But in their opinion, giving more water leads to enhanced production. In order to

change their mindset, series of awareness programmes (Table 2) were conducted to convince that excess water is not good for the crop, rather it is detrimental as it leaches most of the applied nutrients into deeper layers in the soil. After getting convinced, few farmers adopted IIOPR intervention.

In our study, we compared two treatments, viz. (i) improved irrigation strategy with PET based recommendation, (ii) Farmers' practice – Continuous supply of water for 7 to 8 hours in a day.

Information to farmers

Farmers were intimated on weekly basis about the water to be given both in terms of quantity and number of hours through mobile messaging service. The mobile starters record the quantum of water given and the number of hours the pump has run. This information was

collected from all the farmers while evaluating the performance of this intervention.

This intervention helped in saving around 400 mm of water from an area of 2 ha, which could be utilized for cultivation of additional crops. Depending upon the type of additional crop cultivated, the farmers could realize very high net returns ranging from 20 to 80%. Moreover, the sensor based starter could reduce the drudgery.

Impact

In this study, IIOPR implemented intervention in 57 ha of oil palm area by supplying 32 mobile based starters and compared with the regular practice of farmers in two villages. The new intervention resulted in almost same yield levels of oil palm (22-26.7 t/ha/year) in comparison with control (23-27 t/ha/year) and there was a saving of power and labour @3 hrs/day (₹ 15/day) and 2 persons/month (₹ 600/month) respectively. With this saving in water, the farmers resorted to

Table 2. Farmers scientists interface meetings conducted

Programme organised	No. of programmes	No. of participants
Demonstrations	70	1641
Interface meetings	8	346
Field visits	85	1029
Awareness campaigns	8	288
Training programmes	3	114
Group meetings	7	95
Total	181	3513



Demonstration on weather based irrigation scheduling.



Skill demonstration on soil and leaf sample collection.

Table 3. Impact of weather based irrigation scheduling in oil palm

Parameter	Irrigation (l/palm/day)	Electricity (hrs/day)	Manpower requirement/month	Oil palm FFB yield (t/ha)	Net income from additional crop	Net income
Treatment						
Weather based irrigation scheduling with the help of on/off mobile pump starter	173-308	7	10	22-26.7	From fodder grass ₹15,000/ ha, from banana ₹1,05,000/ ha, from maize ₹73,750/ha	₹1,50,300 (26.7×9000 = 240300) + ₹12,675 + ₹15,000 (or ₹1,05,000 or ₹73,750)
Control–Farmers’ practice	300-450	3	12	23-27	Nil	₹1,53,000 (27×9,000=2,43,000)
Continuous Drip irrigation without considering any weather parameter (except rainfall)						
Difference	127-142	4	2	0.4-1.0	15000-105000	₹30,675 (fodder)/₹1,20,675 (banana)/₹88,750 (maize)

*Cost of production of oil palm @ ₹ 90,000/ha/year, FFB price taken as ₹9,000/tonne.

growing of additional crops like fodder grass (Super Napier), banana and maize (Table 3).

Due to new intervention in oil palm irrigation, a farmer could achieve an additional net benefit ranging from ₹ 30,675 to ₹ 120,675/ ha depending upon the type of additional crop grown from the irrigation water saved.

The new intervention improved the net returns by 20 to 80% depending upon the selection of additional crop suitable for the area.

Drawbacks and lessons learnt

Convincing farmers about the water requirement was really a tough task, as they all had one opinion that providing more water enhances the yield in oil palm. IOPR team of scientists conducted a series of meetings and awareness campaigns to make them understand the harmful effects of excessive irrigation.

It is learnt from this experience that with continuous efforts, it is possible to motivate the farmers about the adoption of new technology, which saves lots of valuable inputs.

Nutrient application to oil palm through fertigation

Rationale of the intervention: Oil palm is a heavy feeder of nutrients and water, which requires a judicious management of both these resources. Recommendation schedules for nutrients were standardized for different age groups of oil palm plantations (through soil application

applied in four equal splits at quarterly intervals). ICAR-IOPR had developed fertigation technique to improve the nutrient use efficiency and to reduce the usage of chemical fertilizer use in oil palm plantations. Moreover, improper method and quantity of nutrient application, and inadequate soil moisture affect oil palm growth and yield. Excess application of nutrients causes toxicity of some of the nutrients and reduces the uptake of others and sub optimal nutrient use influences plant growth adversely and it results in reduced yield. To demonstrate the importance of applying exact quantities of nutrients as per the recommendations and soil and plant nutrient status, 52 soil and leaf samples were collected in 165 ha oil palm plantations in the two adopted villages and estimated the macro- and micro-nutrients. Depending upon the nutrient status, recommended doses of nutrients were estimated in individual farms and applied them through fertigation method. Fertigation improves the nutrient use, as it is applied at monthly intervals and resulting in better uptake in solution form.

The two treatments evaluated were: T1, Providing nutrients to oil palm plantations through fertigation (based on soil and leaf nutrient analysis) at monthly intervals; T2, Farmers practice (Soil application of general recommended dose (N:P:K @ 1200:600:1200) in one or two splits).

Information to farmers

Generally, nutrient advisories are given based on soil and leaf nutrient analysis results in oil palm. It is recommended to revise these advisories once in two years. In this intervention, we analysed soil and leaf samples before implementing the intervention. Accordingly, the advisories were formulated and implemented. To implement this intervention, periodical campaigns were conducted (Table 4) in both the villages on the importance of nutrient management, impacts of excess and deficient applications of nutrients, purpose of soil and leaf sampling and how to collect samples in a scientific manner. With those interactions, many farmers were inspired to implement the intervention.

Impact

Observations were collected at periodical intervals on overall condition of the crop, soil and plant nutrient status, FFB yields and estimated the economics of implementing this intervention. In fertigation, the recommended dose is

Table 4. Farmers scientists interface meetings conducted

Programme organised	No. of programmes	No. of participants
Demonstrations	30	974
Interface meetings	6	153
Field visits	20	242
Awareness campaigns	5	110
Training programme	3	114
Total	64	1593

Table 5. Fertigation based on soil and leaf nutrient status for doubling farm income in oil palm plantations

Treatment	Amount of fertilizers used (kg/ha)			Cost of fertilizers (₹/ha)	Cost of reduction in labour (₹/ha)	Yield (t/ha)	Gross returns (₹/ha)	Net returns (₹/ha)
	DAP/SSP	Urea	MOP					
Fertigation based on soil and leaf analysis	94 (DAP)	150	143	2298.30 + 900 + 2288 = 5486.30	1500	24.37	2,07,145	1,23,855.15
Farmers' practice	536.25 (SSP)	373	286	3882.45 + 2238 + 4576 = 10696.45	-	23.45	1,99,325	1,09,325
Difference				5210.15	1500	0.92	7,820	14,530.15

*(For estimating gross and net returns, cost of cultivation was taken as ₹ 90,000/ha and FFB price as ₹ 8500 per tonne). Net returns were calculated by subtracting cost of cultivation from gross returns and adding the savings on fertilizers and labour due to the adoption of intervention. (Price of Urea : ₹ 6.0/kg, DAP : ₹ 24.45/kg, SSP : ₹ 7.24/kg, MOP : ₹ 16.00/kg)

only 50% of the recommended dose (soil application). Further, through soil and leaf analysis based approach, the nutrient requirements have come down substantially. With this technique, there was no reduction in FFB yield of oil palm and an improvement in nutrient use efficiency has been noticed. Application of fertilizers through fertigation using soil and leaf analysis based recommendations improved the net returns by 13.29% (Table 5).

Net income increased by 13.29% due to the intervention accounting to a slight improvement in yield, reduction in cost of fertilizers and labour inputs. Apart from this, a significant improvement in soil

Table 6. Cost benefit ratio of fertigation intervention

Crop	Yield (t/ha)	Price (₹)	Gross Income (₹/ha)	Cost of cultivation (₹/ha)	Net income (₹/ha)	B:C ratio
Oil Palm	25	8500/t	2,12,500	83,750	1,28,750	1.53
Maize	7.5	15,000/t	112,500	75,000	37,500	
Total			3,25,000	1,58,750	1,66,250	1.04

nutrient status in terms of organic carbon and available nutrients also recorded.

Drawbacks and lessons learnt

Most of the farmers were not aware that nutrient recommendations depend upon periodical review of nutrient status in soil and leaf. Further, many were not aware that normal fertilizers can be used in fertigation. They were of the opinion that only liquid fertilizers are suitable for this technique, which are very expensive. Through continuous interactions, IOPR scientists could clarify their apprehensions and explained that it is a simple and highly effective technique to enhance the nutrient use efficiency of normal fertilizers. It was also observed that, reduced doses of nutrients in fertigation could improve the soil macroflora. The lesson learnt is that farmers need to be explained the exact benefits of the technology and its merits over existing method for bringing a change.

SOCIAL IMPACT

Under Farmers FIRST programme of ICAR-Indian Institute of Oil Palm Research, two of its interventions were implemented and it was demonstrated that both these technologies are highly efficient in resource conservation, enhancing profitability, improving soil condition and improved cropping intensity of system in the two villages.

The technological interventions resulted in saving of power and labour (₹ 12,675/ha/year). The yield was at par with that of recommended practice. The quantum of water saved from 1 ha land was 18,161-20,306 l/ha/day in both the villages. With this saving in water, the farmer could achieve an additional net benefit ranging from ₹ 30,675 to ₹ 1,20,675 per hectare depending upon the type of additional crop grown (fodder grass (Super Napier), Banana and Maize).

Application of fertilizers through fertigation using soil and leaf analysis based recommendations improved the net returns by 13.29%. It was demonstrated that by implementing these two technological interventions combinedly, an oil palm farmer can achieve nearly 33 to 93% improvement in his net profit depending on the additional crop selected.

WAY FORWARD

- Efforts to create awareness among the farmers about the need for soil and leaf nutrient analysis based fertigation in oil palm plantations.
- Provision of ventures to oil palm growers for fertigation and also for horizontal spread of this technology to other crops while conserving valuable input resources along with saving in labour.

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Success Story

A Success Story of Mr Simhadri Appaji Srinu, aged 39 years, resident of Challachinatalapudi village, West Godavari District, Andhra Pradesh also has been recorded who adopted fertigation technology in his ten year old oil palm plantation and could grow maize as inter crop from the irrigation water saved by adopting weather based irrigation management. He applied fertilizers as per the soil and leaf analysis test-based recommendation through fertigation method. His net income increased from ₹ 1,28,750 to 1,66,250 (an increase of ₹ 37,500 or 29.12%) (Table 6).

