



Estimation of cost of production of oil palm in Andhra Pradesh

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Introduction

Oil palm (*Elaeis guineensis*) is cultivated in an area of 2.3 lakh ha across 11 states in India (Ravichandran *et al.*, 2014). Andhra Pradesh, Karnataka, Tamil Nadu, Mizoram and Kerala are the major oil palm growing states in the country, of which Andhra Pradesh alone has a share of more than 65 per cent in area under the crop (Ravichandran *et al.*, 2014). This perennial crop has an economic life span of about 30 years, comprising of three distinct phases *viz.*, juvenile period (1-3 years), yield stabilizing period (4-8 years) and stabilized yield period (9-30 years). The economic part of oil palm is bunch of fruits which are commonly referred as Fresh Fruit Bunch (FFB). From this FFB, crude palm oil is extracted from mesocarp and palm kernel oil is extracted from palm kernels. Oil palm is having the pride of giving highest oil yield per unit area (4-6 tonnes of oil ha⁻¹) among all the oil seed crops of the world. Under the present agricultural scenario, in which farmers generally feel that the profitability from farming is declining, it is important to assess the economics of cultivation of any crop. This is true in case of perennial crops, where farmers invest their assets *i.e.*, land, irrigation, manpower *etc.* for more than three decades and the major decisions taken are irrevocable. Estimation of cost of cultivation of perennial crops or their farming systems were earlier done both under optimum management conditions (research conditions) as well as under farmer's field conditions (Sairam *et al.*, 1997; 1999; 2004; Maheshwarappa *et al.*, 2000; Ray *et al.*, 2000).

Kalidas *et al.* (2011) estimated the scientific formula for fixing support price for oil palm through estimation of cost of production as well as processing. The overall objective of the paper is to estimate various cost components involved in cost of cultivation of oil palm under farmer's field condition and to estimate the cost of production of one tonne of oil palm FFB.

The study was conducted in West Godavari District of Andhra Pradesh purposively, since it is having highest area of 56,000 ha, among all the districts in India under oil palm plantations. From the district, 8 mandals having maximum area under oil palm were selected and from each mandal, 4 villages having maximum area were selected. From each village, 4-6 oil palm farmers were randomly selected across the land holdings. Primary data was collected through personal interview of farmers using pre-tested interview schedule with sample size of 182 oil palm growers (25 oil palm plantations in pre bearing state, 58 in yield stabilizing state and 99 plantations in yield stabilized stage) as respondents. The interview schedule was prepared after a thorough discussion with subject matter scientists of oil palm. A pilot study was conducted in non-sample area for pre-testing the interview schedule and necessary modifications were made in the schedule. The primary data collected pertained January to December, 2010.

Systematic stratified random sampling technique was applied for making an unbiased estimation procedure as well as to make the results applicable for all oil palm growing regions of the state.

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The primary data collected were tabulated and computerized and the cost of cultivation was estimated separately for juvenile period, yield stabilizing period and stabilized yield period assuming the life span of oil palm is 30 years under Indian conditions. In order to give weightage for the expenditure incurred during juvenile period, the concept of annuity value was adopted. The cost covered for annuity included Total Variable Cost (TVC) *i.e.*, expenditure incurred by the farmers in the establishment and maintenance of oil palm garden in the first three years with interest (10%) on total variable cost for the first three years apportioned equally over a period of next 27 years. Based on the mean productivity ha⁻¹, cost of production of one tonne of oil palm FFB was calculated. However, when the oil palm cultivation is undertaken in holdings without adequate infra-structural facilities, the farmer was incurring expenditure additionally on bore well, pump, motor, transformer, micro-irrigation system, implements *etc.* annuity value for such farmers was separately worked out. Here, the cost covered for annuity included TVC incurred during the first three years with interest (10%) on TVC for the first three years, cost of bore well-constructed, pump and motor, transformer, micro irrigation system installed, shed constructed *etc.* with interest (10%) on investment. The total cost thus arrived at was distributed over a period of next 27 years to arrive at the annuity value. Based on the mean productivity ha⁻¹, cost of production of one tonne of oil palm FFB was calculated separately for such farmers.

During the pre-bearing phase of oil palm (upto third year), the major expenditure were incurred towards planting cost, irrigation, manures and fertilizers, plant protection, cultural operations and miscellaneous expenditures. The respective share of these costs as a percentage to TVC during first year was 24.8, 9.0, 4.4, 1.0, 3.1 and 57.8. The major miscellaneous expenditure includes labour for watch and ward, fencing, maintenance of motors and other farm machineries. The respective figures during second year were 9.4, 8.5, 12.6, 0.4, 5.5 and 63.3 per cent. As compared to the first year, expenditure incurred towards watch and ward and fencing have increased. During the third year, the share of planting was 15.4 per cent, mainly for tank silt and farm yard manure application, the share of irrigation increased to 13.1 per cent. The respective

Table 1. Cost of cultivation of oil palm during pre-bearing phase (₹ ha⁻¹)

Cost particulars	I Year	II Year	III Year
1. Planting			
Cost of seedling	3092	0	0
Tank silt	5216	2507	3626
Land preparation (ploughing & leveling)	3519	0	0
Farm yard manure/VC/PM/neem/castor cake	6075	4101	6999
Fertilizer	2069	816	2510
Pit making	1855	0	0
Planting	786	0	0
Gap filling	478	2143	514
Ablation	283	1424	259
	23373	10991	13908
2. Irrigation			
Basin making	2630	2304	4011
Irrigation channel preparation	3038	758	998
Irrigation	2830	6809	6862
	8498	9871	11871
3. Manure and fertilizer			
Manure (FYM/VC/PM)	2802	11730	7243
Fertilizer	1330	2894	2464
	4132	14624	9707
4. Plant protection			
Pesticide	930	464	591
Fungicide	0	0	0
	930	464	591
5. Cultural operation			
Weeding	1500	4545	4543
Weedicide	1003	1261	705
Mulching	428	650	306
	2931	6456	5554
6. Other miscellaneous			
Labour for irrigation, watch and ward, <i>etc.</i>	17757	16904	13535
Fencing	10426	20728	5256
Approach road	3935	1919	812
Irrigation charges-electricity	601	1548	827
Maintenance of motor	4416	3271	3690
Maintenance of transformer	2573	5045	2879
Maintenance of tractor	943	5287	8649
Maintenance of implements	464	752	562
Travel charges	3322	5993	1871
Micro irrigation maintenance cost	354	2538	1912
Insurance	0	0	0
Visits to processing units for information, <i>etc.</i>	2720	1640	878
Land revenue and other cesses	116	65	87
Imputed value of family labour/other miscellaneous costs	6896	7679	7443
	54523	73369	48401
Total variable cost	94388	115775	90031
Interest on working capital @ 10%	9439	11577	9003
Total cost ha⁻¹	103827	127352	99034

share of manures and fertilizers, plant protection, cultural operations and miscellaneous expenditures was 10.7, 0.6, 6.1 and 53.7 per cent. The TVC during the first three years was respectively ₹ 94388, ₹ 115775 and ₹ 90031 per ha and the respective total was ₹ 103827, ₹ 127352 and ₹ 99034 per ha (Table 1). The annuity value calculated for the establishment of oil palm plantation (total cost for first three years was of ₹ 330213 ha⁻¹ distributed over a period of next 27 years) was ₹ 12230 ha⁻¹.

During pre bearing phase, costs incurred for maintenance of motor, transformer, tractor, travel charges, implements, fencing *etc.* was 28.3 per cent (Table 2). Planting cost incurred was 12.3 per cent for only gap filling during first, second and third year, however planting material for initial planting will be supplied by government on subsidy. Only 7.2 per cent was incurred for purchase of manures and fertilizers during pre-bearing phase for applying them while planting the seedlings in the pits in the main field, while the recommended fertilizers dose was provided to the farmers on subsidy by the government. Cost on herbicide under cultural operation was incurred 0.9 per cent and only 0.6 per cent cost incurred for purchase of pesticides.

During pre bearing phase, expenditure on labour for irrigation, watch and ward, fencing, approach road, imputed value of family labour *etc.* was 30.4 per cent. Cost on basin and irrigation channel preparation for providing irrigation was incurred 10 per cent. Labour cost on cultural operations *i.e.*, weeding, removal of excess fronds, mulching *etc.*, incurred was 3.9 per cent, labour cost for manures and fertilizers application was 2.2 per cent.

Table 2. Input and labour costs during pre-bearing phase

Particulars	Input costs	% of TVC	Labour costs	% of TVC
Planting	37011	12.3	11261	3.7
Irrigation	-	0.0	30240	10.0
Manures and fertilizers	21775	7.2	6688	2.2
Plant protection	1985	0.6	-	0.0
Cultural operation	2969	0.9	11972	3.9
Other costs	85021	28.3	91272	30.4
Total	148761	49.5	151433	50.4
Total variable cost	300194			

Yield stabilizing phase

The estimated cost of cultivation of oil palm during the yield stabilizing phase (4 to 8 years) and stabilized yield phase (9 to 30 years) is given in Table 3. During the stabilizing phase, the share of miscellaneous expenditure was 41.7 per cent, followed by manures and fertilizers (26.3%), harvesting, collection and transport charges (16.8%), cultural operation (8.4%), irrigation (5.5%) and plant protection (1.0%). The cost of cultivation during this phase was ₹ 114892 ha⁻¹ and with an annuity value of ₹ 12230 ha⁻¹, the total cost of cultivation was ₹ 127122 ha⁻¹, with a mean FFB yield of 12.38 t ha⁻¹, the cost of production of one tonne of FFB was worked out as ₹ 10268 per tonne. When expenditure incurred towards infrastructural facilities that were newly created for oil palm cultivation was also added, the cost of production of one tonne of FFB during stabilizing yield period was worked out as ₹ 11451.

Table 3 shows that during the stabilized yielding phase (9 to 30 years) also miscellaneous expenditure mainly comprising of watch and ward, fencing and maintenance of farm machineries have the maximum share of 40.7 per cent in the TVC, followed by manures and fertilizers (26.0%) and harvesting, collection and transport (18.6%). The other expenditures include expenditure for performing cultural operations (7.5%), irrigation (6.2%) and plant protection (0.7%).

Considering an annuity value of ₹ 12230 ha⁻¹, the total cost of cultivation of oil palm was ₹ 137416 ha⁻¹ with a mean yield of 19.81 t ha⁻¹, the cost of production for one tonne of FFB was ₹ 6936.

Though cultivation of oil palm is recommended for holdings with adequate irrigation facilities in many states in India, oil palm crop cultivation was also promoted in holdings without the required infra-structural facilities. In such holdings, farmers are incurring heavy expenditure on digging bore well, cost of motor and pump, erection of transformer, micro-irrigation system, farm shed, fencing, purchase of farm implements *etc.* The cost of establishing such infra-structure was arrived at ₹ 359640 ha⁻¹. By adding 10% interest on the cost incurred for establishment of infrastructure becomes the total investment on infrastructure facilities during the juvenile period (₹ 395604). The cost thus arrived was distributed over the next 27 years of crop duration to arrive at the annuity value which

Table 3. Cost of cultivation of oil palm during stabilizing and stabilized phase (₹ ha⁻¹)

Cost particulars	4-8 years (stabilizing)		9-30 years (stabilized)	
	₹ha ⁻¹	% of TVC	₹ha ⁻¹	% of TVC
1. Irrigation				
Basin making	3848	3.3	4456	3.5
Irrigation channel preparation	1306	1.1	958	0.7
Irrigation	1253	1.0	2378	1.9
2. Manures and fertilizers				
Manures (FYM/VC/PM)	17069	14.8	18269	14.5
Fertilizers	13203	11.4	14362	11.4
3. Plant protection				
Pesticide	1256	1.0	973	0.7
4. Cultural operation				
Tank silt	414	0.3	233	0.1
Land leveling			39	0.0
Weeding	3376	2.9	2216	1.7
Herbicide	1712	1.4	1444	1.1
Removal of excess fronds	2421	2.1	3347	2.6
Mulching	1746	1.5	2130	1.7
5. Harvesting, collection, transport <i>etc.</i>				
Harvesting	7859	6.8	9738	7.7
Collection and loading	6639	5.7	7751	6.1
Transport of FFB	4820	4.2	5860	4.6
6. Miscellaneous				
Labour for irrigation, watch and ward <i>etc.</i>	13838	12.0	12361	9.8
Fencing	2475	2.1	1782	1.4
Approach road	3096	2.6	2503	2.0
Electricity	594	0.5	669	0.5
Maintenance of motor	6100	5.3	8168	6.5
Maintenance of transformer	2521	2.1	2753	2.2
Maintenance of tractor	2985	2.6	5414	4.3
Maintenance of implements	730	0.6	2134	1.7
Travel charges	2448	2.1	3017	2.4
Micro irrigation	3472	3.0	1820	1.4
Insurance	110	0.1	329	0.2
Visits to processing units	1575	1.3	1602	1.2
Land revenue and cesses	68	0.0	87	0.0
Imputed value of family labour miscellaneous costs	7958	6.9	8393	6.7
Total cost of cultivation	114892	100.0	125186	100.0
Mean yield (tonnes ha ⁻¹)	12.4	19.8		
Cost of production of one tonne of FFB (₹)	9280		6319	

was worked out to be ₹ 14652 ha⁻¹. When expenditure incurred towards infrastructural facilities that were newly created for oil palm cultivation was also added, the cost of cultivation was ₹ 152068 ha⁻¹, the cost of production of one tonne of FFB during stabilized yield phase was worked out as ₹ 7676.

Results from the Table 4 indicate that, during the yield stabilizing phase, maximum cost of 26.3 per cent was incurred on manures and fertilizers. Since the crop has reached bearing period, recommended dose of fertilizer need to be applied along with micro nutrients. Costs incurred on maintenance of motor, micro irrigation, tractor, transformer *etc.* was 17.9 per cent, 1.8 per cent cost incurred on herbicide, tank silt *etc.* and only 1.0 per cent cost incurred for purchase of pesticide.

Labour cost for irrigation, watch and ward, fencing, approach road including imputed family labour was 23.8 per cent. Cost of harvesting, collection and transportation of bunches was 16.8 per cent. Labour cost for cultural operations *i.e.*, land leveling after rainy season, weeding, herbicide application, excess frond removal, cutting them into pieces and mulching in the palm basin was 6.5 per cent. About 5.5 per cent was incurred for basin making, irrigation channel preparation and irrigation cost, out of the total cost of labour during yield stabilizing phase.

During the yield stabilized phase, cost on manures and fertilizers was 26.0 per cent, on par with that of stabilizing period. Cost on maintenance of motor, transformer, tractor and travel charges *etc.* was 20.7 per cent. Cost on cultural operations such as removal of excess fronds, cutting them into pieces for mulching, weeding *etc.* was 1.3 per cent and only 0.7 per cent cost was incurred for plant protection, of total variable cost during yield stabilized phase.

Labour cost on irrigation, watch and ward, fencing, approach maintenance and imputed value of labour was 20 per cent, wherein harvesting charges were incurred 18.6 per cent, harvesting costs were more to that of yield stabilizing phase (Table 4). Since the palms have grown taller, harvesting the bunches from these palms requires skill and time. For preparation of basins, irrigation channels and irrigation accounted 6.2 per cent. Cultural operations such as weeding, removal of

Table 4. Input and labour costs during yield stabilizing phase and yield stabilized phase

Cost particular	Yield stabilizing phase (4-8 years)				Yield stabilized phase (9-30 years)			
	Inputs	% of	Labour	% of	Inputs	% of	Labour	% of
	(₹)	TVC	(₹)	TVC	(₹)	TVC	(₹)	TVC
Irrigation	-	-	6407	5.5	-	-	7792	6.2
Manures and Fertilizers	30272	26.3	-	-	32631	26.0	-	-
Plant Protection	1256	1.0	-	-	973	0.7	-	-
Cultural operation	2126	1.8	7543	6.5	1677	1.3	7732	6.1
Harvesting, collection and transport	-	-	19318	16.8	-	-	23349	18.6
Other costs	20603	17.9	27367	23.8	25993	20.7	25039	20.0
Total	54257	47.2	60635	52.7	61274	48.9	63912	51.0
Total variable cost			114892				125186	

excess fronds and cutting them into pieces for mulching was costing 6.1 per cent during yield stabilized phase.

Conclusion

This paper has estimated the cost of production of oil palm under farmer's field conditions. The total cost of cultivation of oil palm during the first three years of oil palm crop duration was ₹ 330213 ha⁻¹. The cost of cultivation of oil palm during the stabilizing phase (4 to 8 years) was ₹ 114892 and the cost of production of one tonne of FFB was ₹ 10268 and given weightage to the infrastructural facilities the same had increased to ₹ 11451. During the stabilized phase (9 to 30 years), the total cost of cultivation was ₹ 137416 ha⁻¹ and the cost of production was ₹ 6936 tonne⁻¹ of FFB and with weightage to infrastructural facilities the same was ₹ 7676 tonne⁻¹ of FFB.

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