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### Unveiling the complex hidden drivers behind Intercrop removal in Oil Palm with Garrett ranking method, a study in Andhra Pradesh

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#### Abstract

A study was taken up to find out reasons for uprooting of intercrops in oil palm based cropping system in Eluru and East Godavari districts of Andhra Pradesh in India. Data collected on reasons for uprooting of intercrop-cocoa, from oil palm plantations. The Garrett's ranking technique was used to find out the most significant reason/s which influenced the oil palm growers for uprooting of cocoa as intercrop from oil palm plantations. Majority of the inter crop uprooted oil palm growers belong to small and medium farmers category. Reasons for uprooting of cocoa from oil palm are monkey problem, believed that oil palm yield increased due to removal of intercrop, poor yield of intercrop, inconvenience for harvesting of oil palm (pole / climbing), problem in movement of tractor, oil palm become more remunerative, want to focus on oil palm cultivation, dropping of intercrop price, snakes or rats problem, height of oil palm, labour shortage, loss in intercrop/not remunerative, raise in labour wages, physical damage to intercrop due to falling of oil palm leaves at harvesting times, increasing cost of intercrop cultivation, high cost of inputs, more drudgery, over shading, crowding of cropping system, intercrop become unproductive, marketing problem, piling of oil palm fronds in intercrop row, land holdings become less due to distribution among family members, tedious processing of intercrops, influence of neighbors, ignorance of intercrop management, social issues and completion of inter crop age.

**Keywords:** Oil palm growers, intercrops, Garrett ranking, oil palm, cocoa, reasons, uprooting

#### Introduction

Oil palm (*Elaeis guineensis* Jacq.) is a major producer of vegetable oil and the highest edible oil yielder (4-6 t ha<sup>-1</sup>) among oil seed crops grown in the world (Corley & Tinker, 2016; FAO, 2022) [3]. It is cultivated in an area of 6.20 lakh hectares (NMEO-OP, 2025) spread in 14 states in India. It is perennial in nature with economic life for 25-30 years (Corley & Tinker, 2016) [3] and normally planted in an equilateral triangular system with 9m x 9m x 9m spacing (DOPR, 2013). During juvenile phase, lot of area is left having potential to grow intercrops (Nair, 1993) [11]. Similarly, there is sufficient inter space and enough light penetration through oil palm canopy in adult plantations (Corley and Tinker, 2016; Nair, 1993) [3]. Inter cropping is a process of growing subsidiary crops between two widely spaced rows of the main crop (Willey, 1979; Andrews & Kassam, 1976) [1, 15]. The prime objective of inter cropping is production of more output by utilizing freely available resources like land and light between two rows of the main crop (Willey, 1979; Lithourgidis *et al.*, 2011) [10, 15]. Often, inter cropping is chosen as an insurance against the risk of the main crop failure or to ensure a stability of crop yields in variable environments (Andrews & Kassam, 1976; Beets,

1982) [1, 2]. Annual crops such as cereals except rice, pulses, oil seeds, vegetables, flowers, tobacco, cotton, biennials like sugarcane and banana, perennial crops like papaya and pineapple, fodder crops etc. are grown as inter crop during the juvenile phase. Crops like cocoa, Java long pepper, black pepper, banana, pineapple, heliconia, red ginger are grown in mature oil palm plantations (Ramachandrudu *et al.*, 2018) [13]. Wide scope exists for growing intercrops by utilizing both horizontal and vertical space, available sunlight and shade in oil palm plantations, to attain more net income from unit area (Ramachandrudu *et al.*, 2018; Lithourgidis *et al.*, 2011) [10, 13]. However, of late farmers have been facing problems while growing intercrops in oil palm and forcing them to uproot intercrops. Intercrops were removed in an area of 248 ha in oil palm, recorded during the study. This paper is an attempt to identify the reasons for uprooting of intercrop and present them as per the perception of oil palm growers. Garrett's Ranking Technique (Garrett & Woodworth, 1969) [8] is used to identify reasons for uprooting of intercrops in oil palm as per the perceived priority given by the oil palm farmers of Andhra Pradesh.

## Objective

To identify the reasons perceived by farmers for uprooting of Intercrops-Cocoa in oil palm.

## Methodology

The study was conducted in Eluru and East Godavari districts of Andhra Pradesh during 2024-25, since major area of oil palm with cocoa as intercrop exists. Primary data were collected from 90 farmers selected at random from two districts, particularly who uprooted intercrops in oil palm. Structured questionnaire was developed and administered to get the data from the sample farmers. The structured questionnaire was used in the form of interview keeping in

mind the literacy gap in the farmers. The study was conducted in four blocks of Eluru district (Denduluru, Jangareddygudem, Pedavegi, and T. Narasapuram) and two blocks of East Godavari district (Devarapalli and Chikkala). The study area comprised 22 villages, namely Challachintalapudi, Makkinavarigudem, Lakkavaram, Seethampeta, Kollivarigudem, Dibbagudem, Lakshmiapuram, Vegiwada, Duggirala, Rayudupalem, Mysannagudem, Borrapalem, Bandamcherla, Vegavaram, Ramcherlagudem, Pangidigudem, Nimmalagudem, Rajupothepalli, Thirumalapuram, Ketavaram, Devarapalli, and Chikkala.

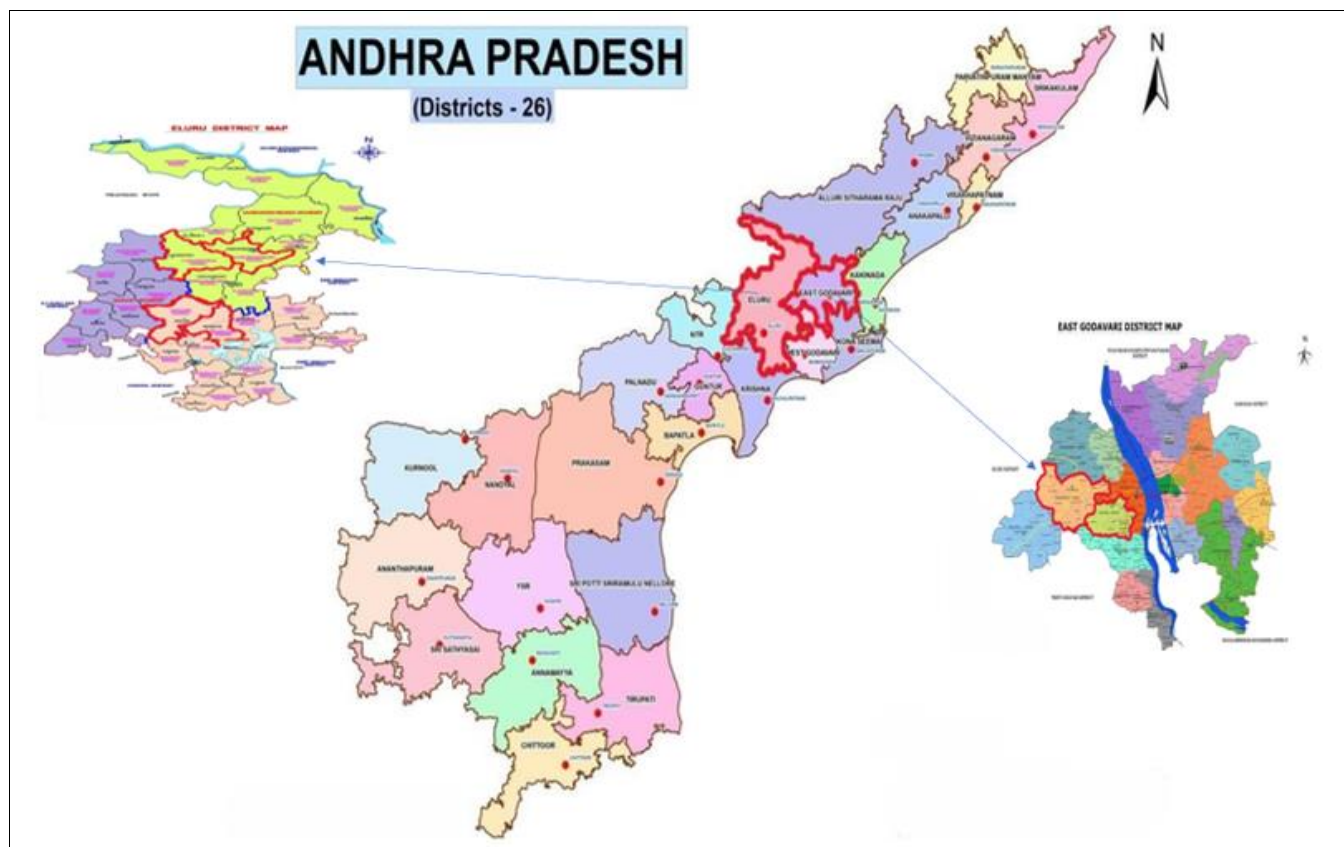


**Fig 1:** Selected blocks in the districts of study area

Data on reasons for uprooting of intercrops in oil palm were obtained. Farmers were asked to rank the reasons/problems faced by them based on their perceived experience. Garrett's Ranking Technique was applied to study the preference, change of orders of perceived problems and advantages into numerical scores.

## Garret's Ranking Technique

This method used to find the most significant factor which had influenced the respondent for the perceived reason. In this Garret's Ranking technique, the respondents ranked different problems and outcome based on their impact thereby converting into score value and rank with the help of the following formula:

$$\text{Percent Position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

## Where;

- $R_{ij}$  = Rank given for the  $i$ th variable by  $j$ th respondents
- $N_j$  = Number of variable ranked by  $j$ th respondents

## The Percent Positions and Garrett value

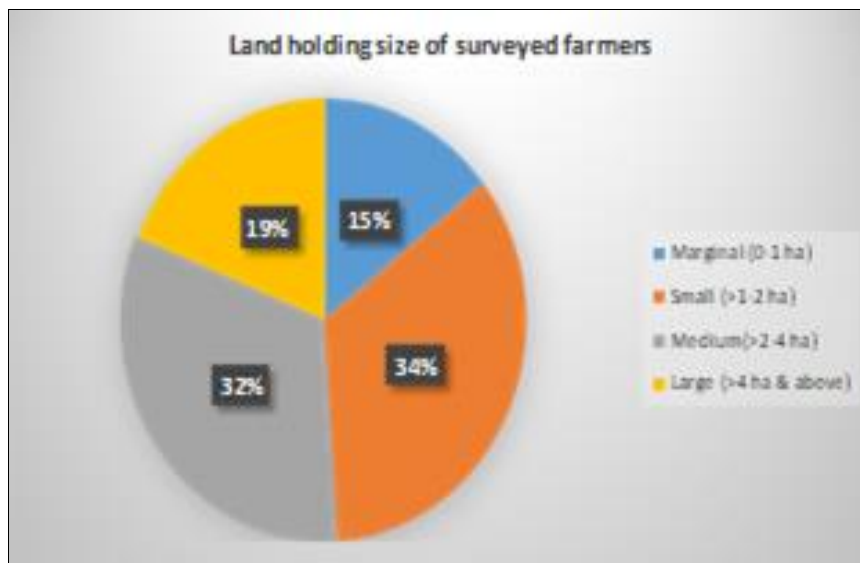
The Garret ranks were calculated by using appropriate Garret Ranking formula. The based on the Garret ranks, the garret value was calculated. The Garret tables and scores of each reasons/problems in the above table, and multiplied to records scores in next table, finally by adding each row, the total Garret score were obtained.

$$\text{Percent Position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

## Results and Discussion

**Table 1:** Distribution of surveyed respondents according to their size of landholding (n=90)

| S. No. | Type of farmers          | Frequency | Percentage (%) |
|--------|--------------------------|-----------|----------------|
| 1.     | Marginal ( $\leq 1$ ha)  | 13        | 15             |
| 2.     | Small (1.1-2 ha)         | 31        | 34             |
| 3.     | Medium (2.1-4 ha)        | 29        | 32             |
| 4.     | Large ( $>4$ ha & above) | 17        | 19             |
| Total  |                          | 90        | 100.00         |

**Fig 2:** Landholding pattern of surveyed farmers

Findings from Table 1 represent the distribution of the 90 surveyed respondents based on their size of landholding. The results indicate that the majority of farmers (34%) belonged to the small farmers, followed by 32% medium farmers (2.1-4 ha) category, 19% are large farmers, while 15% are under marginal farmers. Overall, the findings reveal that most of the respondents (66%) belong to small and medium landholders, reflecting the dominance of relatively smaller to medium farm sizes in the study area.

#### Application of the Garret's Ranking Technique

An attempt has been made to find out the reasons for uprooting of intercrops in oil palm by the farmers. The

identified reasons for uprooting intercrops in oil palm are ranked by making use of the Garrett's Ranking Technique. The technique was used to rank the perceived preference opined by the respondent oil palm growers on different factors and aspects of uprooting intercrops in oil palm.

With the help of Garrett's Table, the percent position estimated is converted into scores by referring to the table given by Garret and Woodworth (1969) [8]. Then for each factor, the scores of each individual are added and then total value of scores and mean values of score is calculated. The factors having highest mean value is considered to be the most important factor, in that order ranking was obtained.

**Table 2:** Reasons perceived by oil palm growers for Uprooting of Intercrop-Cocoa.

| Problems/Reasons for removing intercrops in oil palm              | Ranks given by the Respondents |     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
|-------------------------------------------------------------------|--------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
|                                                                   | 1st                            | 2nd | 3rd | 4th | 5th | 6th | 7th | 8th | 9th | 10th | 11th | 12th | 13th | 14th | 15th | 16th | 17th | 18th | 19th | 20th | 21st | 22nd | 23rd | 24th | 25th | 26th | 27th | 28th | 29th | 30th |
| Height of oil palm                                                | 0                              | 2   | 1   | 3   | 3   | 4   | 2   | 9   | 4   | 5    | 6    | 4    | 9    | 7    | 9    | 5    | 4    | 4    | 3    | 2    | 1    | 2    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    |
| Inconvenience for harvesting of oil palm bunches(Pole / Climbing) | 3                              | 11  | 10  | 8   | 6   | 8   | 19  | 9   | 6   | 6    | 0    | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Oil palm leaves are falling on intercrop                          | 0                              | 0   | 2   | 0   | 4   | 2   | 0   | 2   | 1   | 2    | 8    | 11   | 7    | 9    | 4    | 7    | 10   | 3    | 3    | 3    | 5    | 1    | 1    | 1    | 3    | 1    | 0    | 0    | 0    | 0    |
| Damage to intercrop due to oil palm leaves                        | 0                              | 0   | 0   | 1   | 0   | 3   | 0   | 0   | 2   | 0    | 1    | 0    | 0    | 0    | 0    | 1    | 2    | 1    | 2    | 6    | 1    | 7    | 3    | 5    | 8    | 8    | 16   | 12   | 6    | 5    |
| Increasing cost of cultivation on intercrop                       | 0                              | 0   | 0   | 0   | 0   | 0   | 1   | 12  | 3   | 6    | 4    | 7    | 9    | 6    | 8    | 2    | 12   | 2    | 4    | 3    | 3    | 2    | 1    | 1    | 1    | 0    | 3    | 0    | 0    | 0    |
| Monkey problem                                                    | 50                             | 12  | 4   | 2   | 4   | 2   | 3   | 4   | 4   | 0    | 0    | 1    | 1    | 1    | 0    | 0    | 1    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 0    | 0    | 0    | 0    |
| More drudgery                                                     | 0                              | 0   | 0   | 0   | 0   | 1   | 0   | 2   | 13  | 4    | 5    | 5    | 7    | 7    | 3    | 4    | 4    | 7    | 2    | 3    | 6    | 3    | 4    | 0    | 2    | 0    | 4    | 1    | 3    | 0    |
| Labour shortage                                                   | 0                              | 0   | 0   | 1   | 2   | 3   | 4   | 8   | 12  | 3    | 14   | 7    | 4    | 8    | 0    | 2    | 1    | 8    | 0    | 3    | 4    | 1    | 0    | 3    | 1    | 0    | 0    | 1    | 0    | 0    |
| Loss in intercrop/not remunerative                                | 1                              | 0   | 3   | 1   | 4   | 3   | 3   | 2   | 2   | 6    | 8    | 5    | 11   | 2    | 6    | 6    | 5    | 4    | 1    | 3    | 4    | 1    | 1    | 0    | 3    | 2    | 2    | 0    | 1    | 0    |
| Ageing of intercrop                                               | 1                              | 1   | 0   | 0   | 0   | 0   | 1   | 0   | 0   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 1    | 2    | 0    | 1    | 3    | 0    | 9    | 10   | 19   | 42   |
| Intercrop become un productive                                    | 0                              | 0   | 0   | 1   | 0   | 1   | 0   | 3   | 0   | 7    | 1    | 3    | 7    | 4    | 3    | 14   | 6    | 4    | 6    | 3    | 5    | 3    | 3    | 3    | 3    | 3    | 3    | 3    | 1    | 0    |
| Influence of neighbors                                            | 0                              | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0   | 0    | 0    | 0    | 1    | 0    | 1    | 2    | 1    | 2    | 7    | 4    | 2    | 4    | 8    | 5    | 4    | 8    | 15   | 14   | 4    |      |

|                                                                     |    |    |    |    |    |    |    |   |   |    |   |    |   |    |   |   |   |    |    |   |   |   |    |    |    |    |   |    |    |    |
|---------------------------------------------------------------------|----|----|----|----|----|----|----|---|---|----|---|----|---|----|---|---|---|----|----|---|---|---|----|----|----|----|---|----|----|----|
| Dropping of intercrop price                                         | 1  | 2  | 5  | 8  | 7  | 1  | 4  | 4 | 2 | 8  | 5 | 5  | 0 | 6  | 7 | 0 | 1 | 5  | 5  | 1 | 1 | 1 | 3  | 3  | 2  | 1  | 0 | 1  | 1  | 0  |
| Raise in labour wages                                               | 0  | 0  | 0  | 2  | 1  | 1  | 1  | 3 | 7 | 6  | 7 | 13 | 7 | 3  | 9 | 3 | 3 | 4  | 4  | 2 | 2 | 6 | 2  | 2  | 0  | 1  | 1 | 0  | 0  | 0  |
| Costly inputs                                                       | 0  | 0  | 0  | 0  | 0  | 1  | 3  | 2 | 8 | 6  | 9 | 5  | 2 | 10 | 8 | 8 | 1 | 4  | 3  | 7 | 1 | 2 | 2  | 2  | 3  | 0  | 3 | 0  | 0  | 0  |
| Marketing problem                                                   | 2  | 0  | 1  | 0  | 0  | 0  | 1  | 0 | 1 | 2  | 1 | 1  | 4 | 5  | 7 | 6 | 5 | 4  | 10 | 6 | 2 | 7 | 10 | 8  | 1  | 1  | 2 | 3  | 0  | 0  |
| Ignorance of intercrop management                                   | 0  | 0  | 0  | 1  | 0  | 3  | 0  | 0 | 0 | 0  | 0 | 0  | 0 | 0  | 0 | 1 | 1 | 0  | 3  | 2 | 3 | 4 | 4  | 10 | 11 | 9  | 4 | 15 | 8  | 11 |
| Oil palm become more remunerative                                   | 0  | 3  | 6  | 11 | 13 | 13 | 4  | 7 | 4 | 10 | 2 | 3  | 2 | 0  | 2 | 2 | 1 | 0  | 0  | 0 | 1 | 1 | 1  | 3  | 0  | 1  | 0 | 0  | 0  | 0  |
| Land holdings become less due to distribution among family members. | 0  | 0  | 0  | 0  | 0  | 1  | 1  | 1 | 2 | 1  | 1 | 1  | 2 | 1  | 2 | 4 | 3 | 8  | 5  | 7 | 5 | 8 | 10 | 6  | 4  | 9  | 4 | 4  | 0  | 0  |
| Oil palm yield increased due to removal of intercrop                | 19 | 19 | 10 | 12 | 4  | 6  | 7  | 0 | 1 | 2  | 0 | 2  | 0 | 0  | 0 | 0 | 1 | 1  | 1  | 1 | 0 | 1 | 1  | 0  | 1  | 1  | 0 | 0  | 0  | 0  |
| Tedious processing of intercrops                                    | 0  | 1  | 1  | 0  | 0  | 0  | 0  | 0 | 0 | 0  | 0 | 0  | 1 | 0  | 1 | 2 | 3 | 6  | 5  | 4 | 4 | 6 | 16 | 10 | 8  | 6  | 7 | 4  | 3  | 2  |
| No proper marketing                                                 | 0  | 0  | 1  | 1  | 0  | 0  | 0  | 0 | 0 | 0  | 0 | 1  | 1 | 0  | 1 | 0 | 6 | 3  | 4  | 3 | 8 | 3 | 4  | 6  | 15 | 8  | 7 | 7  | 8  | 3  |
| Want to focus on oil palm cultivation                               | 0  | 1  | 4  | 8  | 15 | 9  | 14 | 3 | 5 | 5  | 4 | 2  | 5 | 4  | 1 | 2 | 0 | 0  | 3  | 0 | 0 | 0 | 0  | 0  | 2  | 0  | 3 | 0  | 0  | 0  |
| Over shading                                                        | 0  | 6  | 2  | 1  | 1  | 1  | 1  | 3 | 4 | 1  | 1 | 0  | 1 | 4  | 1 | 6 | 3 | 6  | 5  | 6 | 9 | 7 | 6  | 3  | 2  | 6  | 2 | 0  | 2  | 0  |
| Piling of oil palm fronds in intercrop row                          | 0  | 0  | 1  | 1  | 0  | 0  | 1  | 0 | 1 | 0  | 4 | 3  | 4 | 3  | 6 | 6 | 6 | 3  | 6  | 6 | 8 | 9 | 3  | 4  | 3  | 7  | 1 | 3  | 1  | 0  |
| Problem in movement of tractor                                      | 0  | 9  | 12 | 16 | 13 | 9  | 4  | 3 | 6 | 6  | 4 | 2  | 0 | 1  | 0 | 2 | 0 | 0  | 0  | 1 | 0 | 1 | 0  | 0  | 1  | 0  | 0 | 0  | 0  | 0  |
| Crowding of cropping system                                         | 2  | 2  | 2  | 1  | 0  | 0  | 2  | 2 | 0 | 2  | 2 | 3  | 1 | 5  | 5 | 4 | 6 | 10 | 2  | 8 | 7 | 6 | 3  | 2  | 4  | 2  | 3 | 3  | 1  | 0  |
| Snakes or rats problem                                              | 0  | 1  | 3  | 2  | 8  | 16 | 10 | 8 | 0 | 1  | 3 | 4  | 2 | 1  | 4 | 1 | 3 | 0  | 5  | 3 | 5 | 0 | 1  | 2  | 0  | 2  | 1 | 1  | 3  | 0  |
| Poor yield of Intercrop                                             | 11 | 20 | 22 | 9  | 3  | 2  | 4  | 3 | 2 | 1  | 0 | 0  | 1 | 2  | 2 | 0 | 0 | 0  | 1  | 2 | 2 | 0 | 0  | 1  | 2  | 0  | 0 | 0  | 0  | 0  |
| Social issues                                                       | 0  | 0  | 0  | 0  | 2  | 0  | 0  | 0 | 0 | 0  | 0 | 1  | 0 | 0  | 0 | 0 | 0 | 1  | 0  | 1 | 0 | 2 | 3  | 9  | 3  | 13 | 7 | 7  | 18 | 23 |

**Calculation of Garret Value and Ranking:** The calculation of Garrett value and ranking of problems faced by oil palm growers were calculated were given here under in Table.3.

**Table 3:** Percent positions and Garrett values

| S. No. | Factors/Reasons                                                     | $100(R_{ij}-0.5)/N_j$ | % Position value | Garrett value |
|--------|---------------------------------------------------------------------|-----------------------|------------------|---------------|
| 1.     | Height of oil palm                                                  | $100*(1-0.5)/30$      | 1.67             | 90            |
| 2.     | Inconvenience for harvesting of oil palm bunches(Pole / Climbing)   | $100*(2-0.5)/30$      | 5.00             | 82            |
| 3.     | Oil palm leaves are falling on intercrop                            | $100*(3-0.5)/30$      | 8.33             | 77            |
| 4.     | Damage to intercrop due to oil palm leaves                          | $100*(4-0.5)/30$      | 11.67            | 74            |
| 5.     | Increasing cost of cultivation on intercrop                         | $100*(5-0.5)/30$      | 15.00            | 70            |
| 6.     | Monkey problem                                                      | $100*(6-0.5)/30$      | 18.33            | 68            |
| 7.     | More drudgery                                                       | $100*(7-0.5)/30$      | 21.67            | 66            |
| 8.     | Labour shortage                                                     | $100*(8-0.5)/30$      | 25.00            | 63            |
| 9.     | Loss in intercrop/not remunerative                                  | $100*(9-0.5)/30$      | 28.33            | 61            |
| 10.    | Ageing of intercrop                                                 | $100*(10-0.5)/30$     | 31.67            | 60            |
| 11.    | Intercrop become un productive                                      | $100*(11-0.5)/30$     | 35.00            | 58            |
| 12.    | Influence of neighbours                                             | $100*(12-0.5)/30$     | 38.33            | 56            |
| 13.    | Dropping of intercrop price                                         | $100*(13-0.5)/30$     | 41.67            | 54            |
| 14.    | Raise in labour wages                                               | $100*(14-0.5)/30$     | 45.00            | 52            |
| 15.    | Costly inputs                                                       | $100*(15-0.5)/30$     | 48.33            | 51            |
| 16.    | Marketing problem                                                   | $100*(16-0.5)/30$     | 51.67            | 49            |
| 17.    | Ignorance of intercrop management                                   | $100*(17-0.5)/30$     | 55.00            | 48            |
| 18.    | Oil palm become more remunerative                                   | $100*(18-0.5)/30$     | 58.33            | 46            |
| 19.    | Land holdings become less due to distribution among family members. | $100*(19-0.5)/30$     | 61.67            | 44            |
| 20.    | Oil palm yield increased due to removal of intercrop                | $100*(20-0.5)/30$     | 65.00            | 42            |
| 21.    | Tedious processing of intercrops                                    | $100*(21-0.5)/30$     | 68.33            | 41            |
| 22.    | No proper marketing                                                 | $100*(22-0.5)/30$     | 71.67            | 39            |
| 23.    | Want to focus on oil palm cultivation                               | $100*(23-0.5)/30$     | 75.00            | 37            |
| 24.    | Over shading                                                        | $100*(24-0.5)/30$     | 78.33            | 35            |
| 25.    | Piling of oil palm fronds in intercrop row                          | $100*(25-0.5)/30$     | 81.67            | 32            |
| 26.    | Problem in movement of tractor                                      | $100*(26-0.5)/30$     | 85.00            | 30            |
| 27.    | Crowding of cropping system                                         | $100*(27-0.5)/30$     | 88.33            | 26            |
| 28.    | Snakes or rats problem                                              | $100*(28-0.5)/30$     | 91.67            | 23            |
| 29.    | Poor yield of intercrop                                             | $100*(29-0.5)/30$     | 95.00            | 18            |
| 30.    | Social issues                                                       | $100*(30-0.5)/30$     | 98.33            | 10            |

Ranking obtained based on the total scores, for the problems expressed by the oil palm growers for uprooting of intercrop were calculated and furnished here under in Table 4.

**Table 4:** Perceived reasons and their rankings based on oil palm growers response

| Sr. No. | Reasons                                                                | Total Scores | Avrg. Scores<br>(Total scores/90) | Rank   |
|---------|------------------------------------------------------------------------|--------------|-----------------------------------|--------|
| 1.      | Height of oil palm                                                     | 5043         | 56.03                             | X      |
| 2.      | Inconvenience for harvesting of oil palm bunches<br>(Pole / Climbing)  | 6255         | 69.50                             | IV     |
| 3.      | Oil palm leaves are falling on intercrop                               | 4668         | 51.87                             | XIV    |
| 4.      | Damage to intercrop due to oil palm leaves                             | 2935         | 32.61                             | XXVI   |
| 5.      | Increasing cost of cultivation on intercrop                            | 4646         | 51.62                             | XV     |
| 6.      | Monkey problem                                                         | 7290         | 81.00                             | I      |
| 7.      | More drudgery                                                          | 4372         | 48.58                             | XVII   |
| 8.      | Labour shortage                                                        | 4937         | 54.86                             | XI     |
| 9.      | Loss in intercrop/not remunerative                                     | 4787         | 53.19                             | XII    |
| 10.     | Ageing of intercrop                                                    | 1714         | 19.04                             | XXX    |
| 11.     | Intercrop become un productive                                         | 4153         | 46.14                             | XX     |
| 12.     | Influence of neighbors                                                 | 2741         | 30.46                             | XXVII  |
| 13.     | Dropping of intercrop price                                            | 5117         | 56.86                             | VIII   |
| 14.     | Raise in labour wages                                                  | 4706         | 52.29                             | XIII   |
| 15.     | Costly inputs                                                          | 4565         | 50.72                             | XVI    |
| 16.     | Marketing problem                                                      | 4049         | 44.99                             | XXI    |
| 17.     | Ignorance of intercrop management                                      | 2693         | 29.92                             | XXVIII |
| 18.     | Oil palm become more remunerative                                      | 5757         | 63.97                             | VI     |
| 19.     | Land holdings become less due to distribution<br>among family members. | 3668         | 40.76                             | XXIII  |
| 20.     | Oil palm yield increased due to removal of<br>intercrop                | 6687         | 74.30                             | II     |
| 21.     | Tedious processing of intercrops                                       | 3294         | 36.60                             | XXIV   |
| 22.     | No proper marketing                                                    | 3080         | 34.22                             | XXV    |
| 23.     | Want to focus on oil palm cultivation                                  | 5607         | 62.30                             | VII    |
| 24.     | Over shading                                                           | 4275         | 47.50                             | XVIII  |
| 25.     | Piling of oil palm fronds in intercrop row                             | 3941         | 43.79                             | XXII   |
| 26.     | Problem in movement of tractor                                         | 6154         | 68.38                             | V      |
| 27.     | Crowding of cropping system                                            | 4226         | 46.96                             | XIX    |
| 28.     | Snakes or rats problem                                                 | 5109         | 56.77                             | IX     |
| 29.     | Poor yield of intercrop                                                | 6540         | 72.67                             | III    |
| 30.     | Social issues                                                          | 2171         | 24.12                             | XXIX   |

**Understanding the reasons for uprooting of intercrops in oil palm by farmers:** Based upon Garrett Ranking Technique it was revealed that “Monkey Problem” is the major problem with highest Garrett score of 7290 and an average score of 81.00. Accordingly, oil palm yield increased due to removal of intercrop with average scores of 6687 and an average score 74.30 is represented second. The calculation with an average score of 6540 and an average score of 72.67 ranked poor yield of intercrop third. Obstructing of harvesting of oil palm (Pole / Climbing) with average scores of 6255 and an average score 69.50 ranked four. Problem in movement of tractor with average scores of 6154 and an average score 68.38 ranked five. Oil palm become more remunerative with average scores of 5757 and an average score 63.97 ranked six. Want to focus on oil palm cultivation with average scores of 5607 and an average score 62.30 ranked seven. Intercrop price fallen with average scores of 5117 and an average score 56.86 ranked eight. Snakes or rats problem with average scores of 5109 and an average score 56.77 ranked nine. Height of oil palm with average scores of 5043 and an average score 56.03 ranked ten. Labour shortage with average scores of 4937 and an average score 54.86 ranked eleven. Loss in intercrop/not remunerative with average scores of 4787 and

an average score 53.19 ranked twelve. Raise in labour wages with average scores of 4706 and an average score 52.29 ranked thirteen. Oil palm leaves are falling on intercrop with average scores of 4668 and an average score 51.87 ranked fourteen. Cost of cultivation on intercrop is becoming more with average scores of 4646 and an average score 51.62 ranked fifteen. Inputs become costly with average scores of 4565 and an average score 50.72 ranked sixteen. Drudgery is more with average scores of 4372 and an average score 48.58 ranked seventeen. Over shading with average scores of 4275 and an average score 47.50 ranked eighteen. Crowding of cropping system with average scores of 4226 and an average score 46.96 ranked nineteen. Intercrop become un productive with average scores of 4153 and an average score 46.14 ranked twenty. Marketing problem with average scores of 4049 and an average score 44.99 ranked twenty one. Piling of oil palm fronds in intercrop row with average scores of 3941 and an average score 43.79 ranked twenty two. Land holdings become less due to distribution among family members with average scores of 3668 and an average score 40.76 ranked twenty three. Processing of intercrops become tedious with average scores of 3294 and an average score 36.60 ranked twenty four. No proper marketing with average scores of 3080 and

an average score 34.22 ranked twenty five. Damage to intercrop due to oil palm leaves with average scores of 2935 and an average score 32.61 ranked twenty six. Neighbors removed, hence we removed with average scores of 2741 and an average score 30.46 ranked twenty seven. Ignorance of intercrop management with average scores of 2693 and an average score 29.92 ranked twenty eight. Social issues with average scores of 2171 and an average score 24.12 ranked twenty nine. Age of intercrop is over with average scores of 1714 and an average score 19.04 ranked least. The average score and ranks of different reasons/causes are shown in the Table 4. On further in depth interviewing and use of ethnographic approach a lucid view of the problems were presented.

### **Height of oil palm**

As oil palm attains greater height with age, intercrop operations become increasingly difficult. The tall stature reduces accessibility for intercrop monitoring, spraying, and harvesting activities. Farmers reported that taller palms create physical and management challenges in the inter-row spaces. This ultimately discourages continuation of intercrops in mature plantations.

### **Obstruction to harvesting of oil palm (Pole/climbing)**

Intercrops often obstruct the movement of workers involved in FFB harvesting of oil palm using poles or climbing methods. Dense intercrop vegetation restricts visibility and reduces working space around the palm base. Farmers perceive that intercrops delay their harvesting operations, manoeuvrability and increase labour requirements. Hence, intercrops are removed to facilitate smooth FFB harvesting.

### **Falling of oil palm leaves on intercrop**

Dry and senescent oil palm fronds frequently fall into intercrop plots, causing mechanical disturbance. This problem becomes more severe during windy conditions and pruning operations. Farmers reported that fallen leaves cover intercrop plants, often break the branches and twigs of cocoa plants. Sometimes obstruct and reduce light availability. Repeated cleaning increases labour and cost, leading to intercrop removal.

### **Damage to intercrop due to oil palm leaves**

Oil palm fronds falling on intercrops cause physical injury such as stem breakage, leaf tearing, and uprooting of young plants. Crops like cocoa, banana and spices are particularly affected due to their tender growth habit. Farmers indicated that repeated damage reduces yield and increases replanting costs. This makes intercropping economically unattractive.

### **Increased cost of cultivation of intercrops**

Farmers reported that the cost of intercrop cultivation has increased due to higher labour wages, costly inputs, and additional maintenance requirements. Intercrops require frequent weeding, irrigation, plant protection, and pruning. In mature oil palm plantations, operations become more complex and costly. As a result, farmers often discontinue intercrops to reduce financial burden.

**Monkey problem:** In parts of Andhra Pradesh, especially in Eluru and East Godavari districts, farmers have been

traditionally growing cocoa as intercrop in oil palm plantations to doubling income. However, rising monkey attacks have become a major issue, causing significant crop damage and financial loss. Monkeys are frequently seen plucking and damaging cocoa pods before harvest. They also break branches and uproot young plants, which hamper growth and reduce yield. Farmers report that guarding the plantations or installing barriers is both expensive and ineffective in affected areas. Due to the continuous losses and difficulty in controlling the problem, many farmers in Andhra Pradesh have started removing cocoa from their oil palm plantations. Some are shifting to other intercrops that are less attractive to monkeys, while others are avoiding intercropping altogether to reduce labor and cost. This growing wildlife conflict is now influencing farm decisions in cocoa-growing areas of the state. The monkey menace has become a key reason for the decline of cocoa cultivation under oil palm, forcing a change in traditional farming practices.

### **Drudgery**

Intercropping increases the workload to farm families due to multiple crop management activities. Farmers reported that repeated operations like pruning, weeding, harvesting, and cleaning fallen fronds cause physical strain. In addition, the need for constant monitoring increases drudgery, especially for women and elderly farmers. This discourages continuation of intercrops.

### **Labour shortage**

Shortage of skilled and unskilled labour has become a serious problem in oil palm-based intercropping systems. Farmers reported difficulty in hiring labour during peak periods for intercrop harvesting and oil palm operations. Labour scarcity leads to delayed cultural operations, resulting in yield loss. Consequently, farmers prefer monocropping to reduce labour dependency.

### **Loss in intercrop / Not remunerative**

Farmers perceived that intercrops are no longer profitable due to low yields and market fluctuations. Input costs often exceed the income generated from intercrops. In several cases, intercrops are unsuccessful to provide expected supplementary returns. Therefore, farmers opted to uproot intercrops and focus on oil palm alone.

### **Ageing of intercrop**

Perennial intercrops such as cocoa become aged over time, leading to decline in productivity. Farmers reported that old plants show reduced flowering and fruit set, resulting in poor yields. Rejuvenation or replanting requires additional investment and time. Hence, many farmers remove the intercrop instead of renewing it.

### **Intercrop becomes unproductive**

Intercrops gradually become less productive due to dense shade, nutrient competition, and ageing. Farmers observed reduced crop vigour and yield over successive years. The decline in productivity affects net returns and discourages continued cultivation. Thus, intercrops are uprooted when they fail to provide economic benefit.

**Neighbours removed hence we removed**

Farmers reported that intercrop removal decisions are mostly influenced by neighbouring farmers. When nearby oil palm growers uproot intercrops, others follow assuming it improves oil palm yield or reduces problems. This social influence contributes to adoption of monocropping practices. Such collective decisions are common in closely located oil palm farming communities.

**Intercrop price fallen**

Market price decline of intercrops was reported as a major reason for discontinuation. Farmers observed that reduced selling price does not compensate for cultivation and harvesting costs. Price instability increases financial risk and discourages investment. Hence, farmers uproot intercrops when market returns become uncertain.

**Rise in labour wages**

Increasing labour wages have raised the cost of intercrop cultivation considerably. Intercrops require frequent labour-intensive activities such as harvesting, pruning, and plant protection. Farmers reported that wage hikes reduce profit margins even if yield is good. This leads to preference for oil palm monocropping.

**Inputs become costly**

The rising cost of fertilizers, pesticides, planting material, and irrigation has reduced the profitability of intercrops. Farmers reported that intercrops demand additional nutrient and pest management investments. High input costs without assured market price results in economic loss. Hence, intercrops are removed to reduce farm expenditure.

**Marketing problem**

Farmers reported difficulties in selling intercrop produce due to lack of organized markets and price assurance. Middlemen dominance and transport costs further reduce profit. Marketing fluctuations in cocoa pose a major constraint due to unstable market prices and lack of assured procurement mechanisms. Farmers often face sudden price drops during peak harvest seasons, leading to reduced profitability and financial insecurity. The absence of regulated markets and limited access to real-time price information further weakens farmers' bargaining power. As a result, cocoa growers are compelled to depend on local traders, often resulting in distress sales and lower returns. These constraints compel farmers to discontinue intercrops.

**Ignorance of intercrop management**

Many farmers lack adequate technical knowledge on intercrop-specific management practices. Improper pruning, over/under fertilizer application, and pest control lead to poor performance of intercrops. Farmers reported that extension support for intercrops is limited compared to oil palm. Due to low confidence and inadequate skills, intercrops are removed.

**Oil palm becomes more remunerative**

Farmers perceived oil palm as a more stable and assured income crop compared to intercrops. With improved yields and assured procurement by processing mills, oil palm profitability increased. Farmers felt that intercrops divert

resources and attention from oil palm management. Therefore, many prefer to concentrate only on oil palm cultivation.

**Land holdings become less due to distribution among family members:**

Farmers reported that land fragmentation due to division among family members reduced the available area for diversified cropping. Smaller holdings require simplified management and reduced labour burden. Intercropping becomes difficult in fragmented land due to limited spacing and operational constraints. Hence, farmers remove intercrops to manage oil palm efficiently.

**Oil palm yield increased due to removal of intercrop**

Some farmers perceived that removal of intercrops improved oil palm yield due to reduced competition for nutrients, moisture, and light. Intercrops might have also restrict irrigation distribution and nutrient use efficiency. Farmers perceived yield improvement as a direct benefit of monocropping. This belief encourages uprooting of intercrops.

**Processing of intercrops becomes tedious**

Intercrop produce such as cocoa often requires fermentation, drying and grading. Farmers reported that processing is time-consuming and requires skill and infrastructure. Without proper facilities, processing becomes burdensome and reduces net profit. Hence, farmers avoid intercrops that require post-harvest processing.

**No proper marketing**

In many regions, farmers lack access to reliable buyers and organized supply chains for intercrops. Price fluctuations and delayed payments create dissatisfaction. Farmers reported that they cannot store produce for long periods due to perishability. Therefore, marketing uncertainty becomes a strong reason for uprooting intercrops.

**Want to focus on oil palm cultivation**

Farmers expressed that managing intercrops reduces attention toward oil palm nutrient management, irrigation, and harvesting schedules. Intercropping increases complexity in farm planning and labour allocation. Since oil palm is a long-term high-value crop, farmers prioritize its management. Thus, intercrops are removed to reduce management burden.

**Over shading**

As oil palm canopy expands, shading increases and light availability for intercrops declines. Shade-sensitive crops exhibit reduced growth, flowering, and yield under low light conditions. Farmers observed progressive yield decline of intercrops with palm age. Therefore, intercrops are uprooted when shading becomes severe.

**Piling of oil palm fronds in intercrop row**

Pruned oil palm fronds are often piled between rows as part of biomass management. Farmers reported that frond piling occupies intercrop space and obstructs intercrop operations. It also creates favourable habitat for pests, snakes and rodents. Hence, intercrops are removed to allow proper frond management.

### Problem in movement of tractor

Intercropping restricts tractor movement for pesticide spraying and FFB collection. Farmers reported that intercrops narrow the working space and increase operational difficulty. Mechanization becomes inefficient and sometimes impossible in dense intercropped space. Therefore, intercrops are removed to facilitate machinery operations.

### Crowding of cropping system

Farmers perceived that intercropping leads to overcrowding and poor field aeration. Crowded systems increase competition for water and nutrients, affecting both main crop and intercrop performance. It also complicates intercultural operations and harvesting. Thus, farmers remove intercrops to avoid congestion.

### Snakes or rats problem

Farmers reported increased incidence of snakes and rodents in intercropped gardens due to dense vegetation and frond piles. These pests pose safety risks to labourers and cause damage to crops. Rodents may feed on fruits, pods, and tender stems of intercrops. Due to fear and crop loss, farmers uproot intercrops.

### Poor yield of intercrop

Low yield of intercrops was frequently reported due to over shade, pest incidence, and poor soil fertility. Farmers might have perceived that intercrops do not perform well in mature plantations compared to juvenile stages. Reduced yield results in poor net income and wastage of resources. Hence, intercrops are removed when productivity becomes uneconomical.

### Social Issues

Farmers reported that social conflicts related to labour sharing, boundary disputes, and theft of intercrop produce affect intercrop cultivation. Some intercrops attract outsiders, increasing risk of pilferage. Disagreements among family members over labour allocation and income sharing also influence decisions. Such social constraints contribute to discontinuation and uprooting of intercropping.

### Conclusion

The Garrett Ranking Technique was considered appropriate for identifying the major reasons for uprooting intercrops in oil palm plantations and the associated constraints. This method is particularly useful because it converts respondents' preference-based rankings into mean scores, enabling the identification of the most critical factors based on the highest mean value. Initially, the respondents provided their preferential order for the listed problems without any predetermined ranking. These problems were systematically identified through in-depth interviews with farmers. The final ranking results clearly reflected the priority concerns perceived by farmers regarding intercrop management in oil palm-based cropping systems. In order to use the resources efficiently, the policy and research focus need to be given on the above aspects for successful adoption of intercrops in oil palm based cropping system.

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