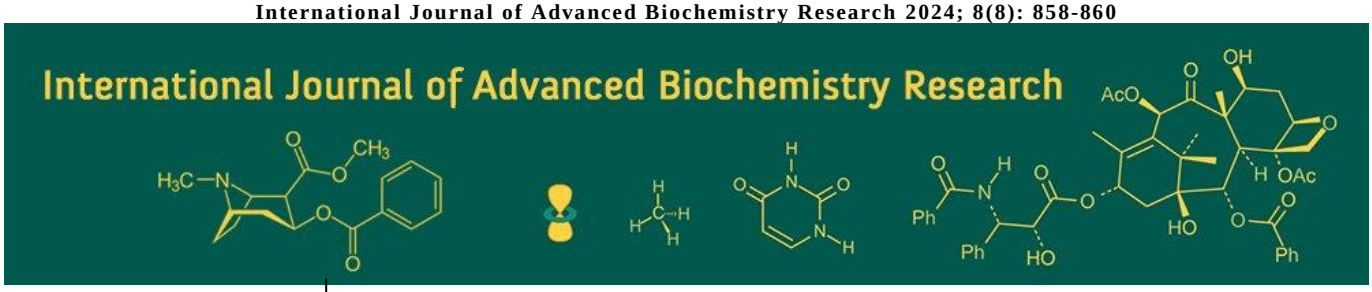


**ISSN Print:** 2617-4693
**ISSN Online:** 2617-4707
IJABR 2024; 8(8): 858-860
www.biochemjournal.com
Received: 25-05-2024
Accepted: 30-06-2024

**SVK Narayana Rao**
Research Schoolar,
Department of Agronomy,
College of Agriculture,
Rajendranagar, PJTSAU,
Hyderabad, Telangana, India

**Kadasidappa MM**
Assistant Professor,
Department of Agronomy,
Agricultural College Palem,
PJTSAU, Hyderabad,
Telangana, India

**K Naganjali**
Assistant Professor,
Department of Agronomy,
Agricultural College
Aswaraopet, PJTSAU,
Hyderabad, Telangana, India

**M Ramprasad**
Assistant Professor,
Department of SS and AC,
Agricultural College
Aswaraopet, PJTSAU,
Hyderabad, Telangana, India

**Corresponding Author:**
**SVK Narayana Rao**
Research Schoolar,
Department of Agronomy,
College of Agriculture,
Rajendranagar, PJTSAU,
Hyderabad, Telangana, India

# Evaluation of intercrop yield and economics in juvenile oil palm at central Telangana zone

**SVK Narayana Rao, Kadasidappa MM, K Naganjali and M Ramprasad**

**DOI:** https://doi.org/10.33545/26174693.2024.v8.i8k.1881

**Abstract**
A field study on "Evaluation of intercrop yield and economics in juvenile oil palm at Central Telangana Zone" was conducted during early *rabi* season of 2023-24 at College Farm, Agricultural College Aswaraopeta, Badradrikothagudem district, Telangana to evaluate the profitable intercrops in young oil palm orchard. The different crops *viz.*, maize, finger millet, foxtail millet, cowpea, green gram, groundnut and okra were tested as intercrops in juvenile phase of the oil palm orchard. There is ample scope for intercropping in oil palm plantation during initial years of planting since the canopy is not fully developed. Among the different intercrops Oil palm + Groundnut recorded the highest gross returns (Rs. 169,893 ha$^{-1}$), net returns (Rs. 105,643 ha$^{-1}$), and benefit-cost ratio (1.64), followed by maize intercropping. However, Oil palm + Maize had the highest individual crop yield (7,248.8 kg ha$^{-1}$) and groundnut equivalent yield (2375.7 kg ha$^{-1}$) among other crops.

**Keywords:** Intercropping, juvenile stage, oil palm, crop equivalent yield

## Introduction
Oil palm (*Elaeis guineensis* Jacq) is a significant commercial plantation crop, originally from West Africa and now widely cultivated in Southeast Asia, particularly in Malaysia and Indonesia. As a perennial oil-yielding crop, oil palm is typically planted in a triangular or hexagonal pattern with a spacing of 8.5 m x 8.5 m x 8.5 m, resulting in row spacing of approximately 7.5 m. The crop has a lifespan of 30-35 years. During the initial three years after planting, while the palms are still in their pre-bearing stage, farmers can grow locally suited crops in the interspaces. During this juvenile phase, oil palm occupies only 5-15% of the total area (Suresh and Rethinam, 2001) [2], creating ample opportunity for intercropping. Intercropping during this phase is recommended as a strategy to mitigate uncertainties and risks in agricultural production while ensuring income stability for farmers. Research has shown that intercropping during the juvenile phase of oil palm does not adversely affect its growth (Reddy *et al*., 2004) [14]. Additionally, recent studies highlight the role of intercropping in enhancing biodiversity, improving soil health, and increasing overall system productivity within oil palm plantations (Rahman *et al*., 2021; Tan *et al*., 2022; Hasanuddin *et al*., 2023) [8, 23, 4]. Therefore, adopting suitable intercropping systems in orchards is crucial for a sustainable and prosperous agricultural future.

As the palms mature, typically after 6-7 years, their expanding canopy reduces light penetration, making crop selection for intercropping more challenging. The choice of intercrops is heavily influenced by the local environment, which affects the relationship between palm age and light transmission through the canopy (Gerritsma and Soebagyo, 1999) [2]. In the first three years of oil palm cultivation, there is significant potential for efficiently utilizing both horizontal and vertical space for intercrops, which can provide additional employment and income for small and marginal farmers (Reddy and Prasad, 2011) [13]. The selection of intercrops is site-specific, depending on the farmer's familiarity with the crop and its marketability. For instance, okra has been recommended as a profitable intercrop during the juvenile phase of oil palm in the Tungabhadra command area (Reddi *et al*., 2015) [11]. Other studies have also identified various vegetables, legumes, and medicinal plants as suitable intercrops that not only provide economic benefits but also enhance soil fertility and reduce pest pressure (Ismail *et al*., 2022; Sulaiman *et al*., 2021) [5, 19].

Moreover, recent advancements in agroforestry practices and precision agriculture have opened new avenues for optimizing intercropping in oil palm plantations, ensuring sustainable land use and long-term profitability (Nguyen *et al*., 2023; Zhang *et al*., 2023) [7, 25]. Given this context, the present study aims to identify the ideal intercrops for newly planted oil palm gardens and to evaluate the economic viability of the system during the pre-bearing period of the oil palm plantation.

## Materials and Methods

A field study on " Evaluation of intercrop yield and economics in juvenile oil palm at Central Telangana Zone " was conducted during the early *rabi* season of 2023-24 at the College Farm, Agricultural College Aswaraopeta, Badradrikothagudem district, Telangana, to evaluate profitable intercrops in a young oil palm orchard. The experiment was laid out in a randomized block design with three replications during 2023-24. The gross plot size for each treatment was 51.84 m², focusing on intercropping studies.

Oil palm was planted at a distance of 8.5 m × 8.5 m in a square manner. The crops maize, finger millet, foxtail millet, cowpea, green gram, groundnut, and okra were grown as intercrops in the oil palm plantation as treatments, following all recommended practices for each intercrop. Additionally, there is a treatment involving Oil Palm as a sole crop.

The climate of the experimental region is semi-arid (dry). The weekly mean maximum temperature ranged from 26.9 °C to 34.2 °C, with an average of 30.9 °C, throughout the crop growth period, while the weekly mean minimum temperature ranged from 16.1 °C to 23.9 °C, with an average of 19.7 °C. In terms of relative humidity, the weekly mean RH-I (morning) ranged from 47.0% to 76.3%, with an average of 60.0%, while the RH-II (afternoon) ranged from 83.4% to 96.4%, with an average of 90.0%. Using the USWB Class - A open pan evaporimeter, the weekly mean bright sunshine hours per day ranged from 3.1 to 8.2 hours, with an average of 5.6 hours. Weekly mean evaporation ranged from 2.0 to 5.1 mm per day, with an average of 3.4 mm per day. The wind speed stretched from 0.1 to 3.2 km $hr^{-1}$. A total of 350.7 mm of rainfall was observed during the crop growth period.

The cost of cultivation, economics and benefit cost ratio were worked out based on the prevailing market prices.

Since oil palm does not yield during the juvenile phase, crop yield equivalents need to be calculated based on the best-performing crop in that region i.e., groundnut. Therefore, the yield of the intercrops was converted to groundnut equivalent yield (GEY) to emphasize its significance.

Ground nut equivalent yield was calculated as per formula given below:

$$\text{Ground nut equivalent yield (GEY)} = \frac{\text{Yield of intercrop X Price of intercrop}}{\text{Price of ground nut}}$$

The data were statistically analyzed by the method described by Gomez and Gomez (1984) [3].

## Results and Discussion

The yield data of various crops in inter cropping system presented in Table 1. revealed that, maize recorded the highest yield (7248.8 kg $ha^{-1}$) the other intercrops have relatively lower yields, ranging from around 1,000 to 1,700 kg $ha^{-1}$.

Among all the intercrops tested, maize has recorded significantly higher groundnut equivalent yield (GEY) (2375.7 kg $ha^{-1}$) than green gram (1367.8 kg $ha^{-1}$), cowpea (1270.2 kg $ha^{-1}$), foxtail millet (1022.5 kg $ha^{-1}$), finger millet (961.6 kg $ha^{-1}$) and bhendi (642.9 kg $ha^{-1}$) (Table 2). The significantly lowest GEY was recorded with the bhendi among all the treatments. The difference in GEY was mainly as a consequence of differences in the yield and price of individual component crops. These results are in accordance with the findings of Rajput and Shrivastava (1996) [9], Tomar (1998) [24], Kler *et al*. (1998) [6], Sujatha *et al*. (2006) [18], Avinash *et al*. (2013) [1] and Singh *et al*. (2022) [16].

**Table 1:** Yield of intercrops in oil palm intercropping systems

| Treatment | Yield (kg $ha^{-1}$) |
|---|---|
| Oil palm + Maize | 7248.8 |
| Oil palm + Finger millet | 1594.4 |
| Oil palm + Fox tail millet | 1725.0 |
| Oil palm + Cow pea | 1021.2 |
| Oil palm + Green gram | 1019.2 |
| Oil palm + Groundnut | 2664.2 |
| Oil palm + Bhendi (Okra) | 1012.3 |
| Oil palm Sole crop | 0 |

## Economics

The data pertaining to gross returns, net returns and B: C ratio of different intercropping system in oil palm is presented in table 2. For obtaining these values, the prices of the input and sale of commodities were taken from the prevailing market prices.

The gross returns after harvest were significantly influenced by the intercropping systems. Among the tested systems, oil palm + groundnut yielded the highest gross returns (Rs. 169893 $ha^{-1}$), outperforming oil palm + maize (Rs. 151501$ha^{-1}$) and other treatments. Green gram (Rs. 87223 $ha^{-1}$) and cowpea (Rs. 81000 $ha^{-1}$) were on par but surpassed bhendi, finger millet, and foxtail millet. The lowest gross returns (Rs. 40998 $ha^{-1}$) were recorded with oil palm + bhendi.

The net returns were highest with oil palm + groundnut (Rs. 105643 $ha^{-1}$), followed by oil palm + maize (Rs. 80251 $ha^{-1}$). Green gram (Rs. 53023 $ha^{-1}$) and cowpea (Rs. 23369 $ha^{-1}$) performed better than bhendi, foxtail millet, and finger millet, with bhendi showing the lowest net returns (Rs. 11748 $ha^{-1}$).

The benefit-cost ratio was highest for oil palm + groundnut (1.64), followed by green gram (1.55) and cowpea (1.50) were found to be at each other, while bhendi recorded the lowest ratio (0.40). These findings align with previous studies by Sharma *et al*. (2021) [15].

**Table 2:** Ground nut equivalent yield and Economics of the different crops intercropping with oil palm during 2023-24

| Treatment | Ground nut equivalent yield (Kg. ha$^{-1}$) | Cost of cultivation (Rs ha$^{-1}$) | Gross return (Rs ha$^{-1}$) | Net return (Rs ha$^{-1}$) | B:C ratio |
|---|---|---|---|---|---|
| Oil palm + Maize | 2375.7 | 71250 | 151501 | 80251 | 1.13 |
| Oil palm + Finger millet | 961.6 | 37950 | 61319 | 23369 | 0.62 |
| Oil palm + Fox tail millet | 1022.5 | 39950 | 65203 | 25253 | 0.63 |
| Oil palm + Cow pea | 1270.2 | 32442 | 81000 | 48558 | 1.50 |
| Oil palm + Green gram | 1367.8 | 34200 | 87223 | 53023 | 1.55 |
| Oil palm + Groundnut | 2664.2 | 64250 | 169893 | 105643 | 1.64 |
| Oil palm + Bhendi (Okra) | 642.9 | 29250 | 40998 | 11748 | 0.40 |
| Oil palm Sole crop | 0.00 | 0 | 0 | 0 | 0 |
| SE m+- | 36.35 | 912.25 | 2317.97 | 1490.12 | 0.03 |
| CD at 5% | 110.25 | 2767 | 7030.77 | 4519.77 | 0.08 |

## Conclusion

Based on the results it was concluded Oil palm + Groundnut recorded the highest gross returns (Rs. 169,893 ha$^{-1}$), net returns (Rs. 105,643 ha$^{-1}$), and benefit-cost ratio (1.64), closely followed by maize intercropping. Oil palm + Maize had the highest individual crop yield (7,248.8 kg ha$^{-1}$) and groundnut equivalent yield (2375.7 kg ha$^{-1}$) among other crops. Bhendi intercropping had the lowest economic performance across all parameters. Overall, groundnut and maize emerged as the most suitable and economically viable intercrop options for juvenile oil palm gardens in Central Telangana Zone.

## References


1. Avinash R, Sharma P, Kumar N. Yield and economic benefits of intercropping systems in juvenile oil palm plantations. Int J Agronomy. 2013;2013:1-7.
2. Gerritsma W, Soebagyo FX. An analysis of the growth of leaf area of oil palms in Indonesia. Exp Agric. 1999;35(3):293-308.
3. Gomez KA, Gomez AA. Statistical procedures for agricultural research. New York: John Wiley and Sons, Inc.; c1984.
4. Hasanuddin H, Nurmayulis N, Manurung H. Sustainable intercropping practices in oil palm plantations: A review. J Sustain Agric. 2023;45(1):123-137.
5. Ismail R, Ahmad S, Ibrahim M. Intercropping with medicinal plants in oil palm plantations: Impact on soil fertility and pest management. Agron J. 2022;114(3):589-602.
6. Kler DS, Singh A, Singh S. Intercropping in oil palm: An economic analysis. Agric Syst. 1998;57(2):113-122.
7. Nguyen TQ, Pham DH, Le TH. Agroforestry and intercropping strategies in oil palm plantations: Innovations for sustainable land use. Agrofor Syst. 2023;98(2):257-270.
8. Rahman MH, Saadun N, Habibullah-Al-Mamun M, Hossain MS. The effects of intercropping on biodiversity and soil health in oil palm plantations. Environ Res. 2021;199:111215.
9. Rajput AM, Shrivastava GK. Intercropping systems in oil palm: A review. Indian J Agron. 1996;41(2):235-240.
10. Reddi GHS, Prasad VR. Intercropping in oil palm: Economic benefits for small farmers. J Plantation Crops. 2011;39(3):438-442.
11. Reddi GHS, Prasad VR, Satyanarayana T. Okra as an intercrop in juvenile oil palm: A case study from the Tungabhadra command area. Indian J Agric Res. 2015;49(5):437-442.
12. Reddi S, Patil GDR, Chandravathi B, Maheswarappa HP. Studies on vegetables as intercrops in juvenile oil palm plantation and its economics. Karnataka J Agric Sci. 2015;28(4):494-496.
13. Reddy VM, Prasad MV. Banana - A potential intercrop in juvenile oil palm plantation. Int J Oil Palm. 2011;8(1 and 2):55-56.
14. Reddy VR, Suresh K, Narayana S. Intercropping in juvenile oil palm plantations: Growth and yield assessment. Int J Agric Sci. 2004;10(2):213-219.
15. Sharma A, Patel D, Kumar V. Evaluation of intercrops in oil palm cultivation: Yield and economic analysis. J Agron Crop Sci. 2021;207(4):345-356.
16. Singh R, Gupta P, Mehta S. Comparative yield and economics of intercrops in oil palm: A review. J Crop Sci Agric Res. 2022;20(3):210-220.
17. Singh R, Kumar V, Chauhan N. Evaluation of intercropping systems in young oil palm orchards under subtropical conditions. J Crop Improvement. 2022;36(4):458-471.
18. Sujatha M, Prasad K, Reddy GC. Economic returns from intercropping in oil palm plantations. Indian J Agric Sci. 2006;76(5):321-324.
19. Sulaiman MZ, Haron MA, Aziz MA. Intercropping strategies for enhancing soil fertility in oil palm plantations. J Trop Agric. 2021;58(4):789-797.
20. Sunitha S. Intercropping options for young oil palm plantations. J Plantation Crops. 2010;38(1):79-84.
21. Sunitha S. Oil palm production technology for rainfed areas. In: Compendium of Lecturers on Oil Palm Production Technology. 3rd ed. p. 71-74.
22. Suresh K, Rethinam P. Determination of canopy size in oil palm plantations - A survey. Int J Oil Palm. 2001;2(2):55.
23. Tan HK, Lim KH, Ng CH. Intercropping in oil palm plantations: Effects on ecosystem services and sustainability. Agriculture. 2022;12(3):498.
24. Tomar SS. Performance of different intercrops in oil palm plantations. J Plantation Crops. 1998;26(3):152-156.
25. Zhang X, Liu Y, Chen L. Precision agriculture in oil palm intercropping: Enhancing productivity and sustainability. Precis Agric. 2023;24(1):79-95.