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RESEARCH PAPER

# Response of Oil Palm (*Elaeis guineensis* Jacq.) to Different Levels of Nutrients and Irrigation in Red Sandy Loam Soils of West Godavari District

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## ABSTRACT

**In an experiment on oil palm, planted during 1988 with four levels of NPK and three methods of irrigation at Agricultural Research Station, Vijayarai, the cumulative yield data of five years from 1995-96 to 1999-2000 indicated significant difference in yield due to irrigation and fertilizers, while their interaction was found to be non-significant. Basin irrigation has recorded maximum number of bunches (8.95), maximum yield of Fresh Fruit Bunches (FFB)/palm (114.41 kg) and yield/ha (14.12 t/ha) while drip irrigation has recorded maximum bunch weight (13.05 kg), which was on par with basin irrigation (12.96 kg). Lowest yield was recorded in control. Among the fertilizer treatments, $F_3$(1200g $N_2$ + 600g $P_2O_5$ + 2700g $K_2O$/palm/year) recorded maximum number of bunches (8.74), maximum bunch weight (13.02 kg), maximum yield of FFB per palm (116.29 kg) and maximum yield of FFB/ha (14.35 t/ha) followed by $F_2$ (800g $N_2$ + 400g $P_2O_5$ + 1800g $K_2O$/palm/year). Lowest yields were recorded in the treatment $F_0$(control). The effect of the treatments on number of bunches/palm, bunch weight and yield are discussed in detail.**

**Keywords**: Oil palm, irrigation, nutrients, fertilizers, nitrogen, phosphorus, potassium.

## INTRODUCTION

Oil palm, the highest oil yielding crop, is gaining importance in India in recent years. Though it is being cultivated as a rainfed crop in high rainfall regions of the world, for the first time it is being cultivated as irrigated crop in India. Yields are consistently lower in countries, where there is a regular dry season. Extensive studies have confirmed that rainfall deficits can be compensated by provision of irrigation. During many months in a year, rainfall is much less than the potential evapo-transpiration (PET). The aim of irrigation is to compensate for rainfall deficiencies and to ensure that water is no longer a limiting factor for growth, development and yield. The general method of deriving irrigation requirement is based on PET, where PET= Pan Evaporation X Crop Factor (Uday Kumar, 1997). Oil palm is a heavy consumer of fertilizer and one of the significant research contributions to oil palm production is the recognition of adequate fertilization for maximum production. A rough estimate of nutrients removed by a crop producing 25t of FFB/ha/year is 93.5 kg of nitrogen, 11.0 kg of phosphorus and 92.7 kg potassium. There is need to replenish the nutrients removed annually in order to achieve maximum production.

In addition, magnesium and calcium are also required in huge amounts (Abraham, 1994). The theoretical yield of oil palm has been estimated to be 44t/ha/year producing an oil yield of 17t/ha/year (Corley, 1985). The objective of the present study is to assess the fertilizer and irrigation requirement of oil palm in red sandy loams of West Godavari District of Andhra Pradesh, which has the largest area under oil palm in India.

## MATERIALS AND METHODS

The paper presents the experiment, which is part of All India Co-ordinated Research Project on oil palm initiated during 1988 in red sandy loam soils at Agricultural Research Station, Vijayarai, West Godavari District. Improved *tenera* hybrids were planted in a strip plot design at the rate of six palms/plot in 9 x 9 m spacing replicated three times.

**Treatments:**

1. Fertilizers:

   a. $F_0$: No fertilizers
   b. $F_1$: 400g $N_2$ + 200g $P_2O_5$ + 900g $K_2O$/palm/year
   c. $F_2$: 800g $N_2$ + 400g $P_2O_5$ + 1800g $K_2O$/palm/year
   d. $F_3$: 1200g $N_2$ + 600g $P_2O_5$ + 2700g $K_2O$/palm/year

Fertilizers are applied in two equal split doses.

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2. Irrigation :
   a. Control (no irrigation)
   b. Basin irrigation
   c. Drip irrigation

The irrigation requirement was calculated based on the canopy size and pan evaporation. The weather data for five years was as follows: mean maximum temperature of 36.22$^0$C, mean minimum temperature of 20.54$^0$C, mean relative humidity of 62.16%, mean rainfall of 1128.5 mm and mean pan evaporation ranged from 3 mm to 9 mm/ day during the reported period.

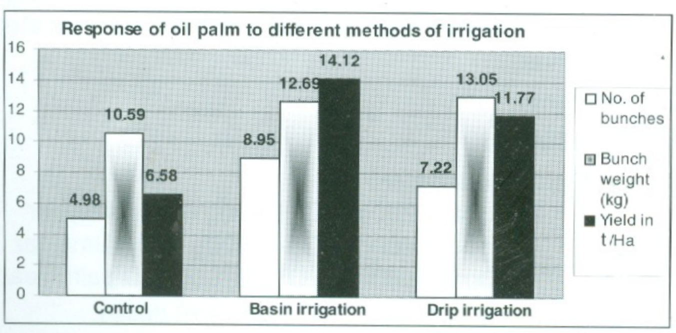
## RESULTS AND DISCUSSION

The cumulative yield data of five years from 1995-96 to 1999-2000 are presented in Tables 1 and 2. The interaction effects between irrigation and fertilizers were found to be non-significant. Therefore, the effect of irrigation and fertilizers are discussed separately.

The effect of irrigation on number of bunches, bunch weight, yield of FFB (fresh fruit bunches) per palm and yield of FFB per hectare were found to be significant (Table 1). Maximum number of bunches were produced in basin irrigation (8.95) and lowest were produced in control (4.98). Maximum bunch weight of 13.05 kg was recorded in drip irrigation, which was on par with basin irrigation (12.69 kg) and lowest in control (10.59 kg). Highest yield of FFB per palm was recorded in basin irrigation (114.41 kg) and lowest in control (53.30 kg). FFB yield/ha was maximum in basin irrigation (14.12 t/ha) and lowest in control (6.58 t/ha). Basin irrigation recorded 114.59 % increase in FFB yield per hectare over control.

**Table 1: Response of oil palm to different methods of irrigation**

| S.No | Treatments | Mean no. of bunches/ palm | Mean bunch weight (kg) | Mean yield of FFB/ palm (kg) | Mean yield of FFB/ ha (t/ha) |
|---|---|---|---|---|---|
| 1. | Control | 4.98 | 10.59 | 53.30 | 6.58 |
| 2. | Basin irrigation | 8.95 | 12.69 | 114.41 | 14.12 |
| 3. | Drip irrigation | 7.22 | 13.05 | 95.35 | 11.77 |
| CD at P = 0.05 | | 0.46 | 0.34 | 6.44 | 1.08 |

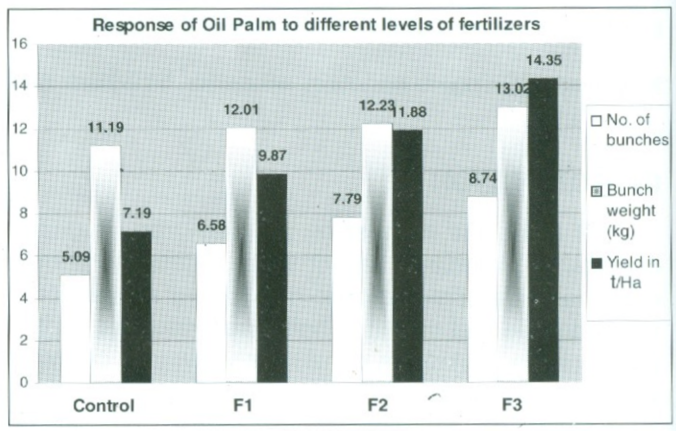



The effect of fertilizers on number of bunches was significant (Table 2). Maximum number of bunches were recorded in $F_3$ (8.74) followed by $F_2$ (7.79) and lowest in $F_0$ 5.09) The effect of fertilizers on bunch weight was not significant, however, maximum bunch weight was recorded in $F_3$ (13.02 kg) and lowest in $F_0$ (11.19 kg). The influence of fertilizers on FFB yield/palm and yield/ha was also significant. Highest FFB yield of 116.29 kg/palm and 14.35 t/ha was recorded in $F_3$ followed by $F_2$ (96.21 kg/ palm and 11.88 t/ha). Lowest FFB yield was recorded in $F_0$ (58.27 kg/palm and 7.19 t/ha). The treatment $F_3$ has recorded 99.58 % increase in FFB yield/ha over $F_0$.

**Table 2: Response of oil palm to different levels of fertilizers**

| S.No | Treatments | Mean no. of bunches/ palm | Mean bunch weight (kg) | Mean yield of FFB/ palm (kg) | Mean yield of FFB/ ha (t/ha) |
|---|---|---|---|---|---|
| 1. | $F_0$ | 5.09 | 11.19 | 58.27 | 7.19 |
| 2. | $F_1$ | 6.58 | 12.01 | 79.97 | 9.87 |
| 3. | $F_2$ | 7.79 | 12.23 | 96.21 | 11.88 |
| 4. | $F_3$ | 8.74 | 13.02 | 116.29 | 14.35 |
| CD at P = 0.05 | | 0.20 | NS | 2.66 | 0.48 |

FFB: Fresh fruit bunches NS: Not Significant




The improved yield due to increased fertilizers and irrigation could be because of increase in both number of bunches and bunch weight. The results indicated that the prime factor effecting yields was irrigation. Irrigation was also found to improve yield of FFB by 120 – 200 % in West Africa (Taffin and Daniel, 1976) and 21% in Ivory Coast (Prioux *et al.,* 1992). Irrigation is not only required for normal metabolic processes of crop but also to regulate the emergence of female inflorescences (Jyothi and Venkateswarlu, 1995). Even with adequate irrigation, the prevailing atmospheric stress due to low relative humidity and high vapour pressure deficit (VPD) may have an effect on yield. Stomatal closure in oil palm leaves was observed when VPD increased from 1.0 kPa, and stomatal conductance was severely reduced when VPD reached 1.9 kPd (Kallarackal, 1996). Prolonged dry season created large water deficits indicating oil palm could not be grown as rainfed crop. Water loss by transpiration was as high as 2.0 – 5.5 mm/day, which was attributed to the unstressed condition of the plants due to irrigation. Thus water stress or dry air could cause stomatal closure, slowing down the physiological activity of the palm, lowered photosynthetic activity and accumulation of reserves. These low photosynthetic reserves resulted in low sex ratio reduced plant growth and inflorescence size. Jyothi and Venkateswarlu (1995) reported that water stress caused more male inflorescence production, reduced inflorescence length, spike let number and total number of flowers on inflorescence.

## CONCLUSION

The experiment revealed encouraging effects of irrigation and fertilizers on yield of oil palm. The results indicated that optimum yields could be obtained through adequate irrigation and fertilizer application.

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