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**RESEARCH PAPER**

# Irrigation and NPK Requirement of Oil Palm for Tungabhadra Command Area

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## ABSTRACT

**Field experiment was conducted at Agricultural Research Station, Gangavathi to work out the irrigation and NPK requirement of adult oil palm in black soils of Tungabhadra command area. Drip and basin irrigation recorded 24 and 22 per cent higher FFB yield over 50% basin irrigation. Application of 1200:600:2700 g N,$P_2O_5$ and $K_2O$/palm recorded higher FFB yield of 11.14 and 14.74 t/ha during 2005 and 2006 respectively. A combination of drip irrigation and 1200:600:2700 g N,$P_2O_5$ and $K_2O$/palm recorded higher FFB yield which, however, remained on par with the combination of basin irrigation and application of 1200:600:1200 N,$P_2O_5$ and $K_2O$/palm.**

**Key words :** Oil Palm, Drip irrigation, FFB, net returns

## Introduction

Oil Palm (*Elaeis guineensis* Jacq.) is a recently introduced perennial oilseed crop in India covering an area of 93153 ha in various states of India. Irrigation and fertilizers are critical inputs for higher yield in oil palm. Irrigation studies at Pedavegi revealed that drip irrigation with IW/CPE ratio of one recorded higher FFB yield (NRC-OP,2006). Similarly, application of 1200:600:1200 g N,$P_2O_5$ and $K_2O$ palm$^{-1}$ recorded higher FFB yield after fourth year of planting under rainfed conditions at Palode (NRC-OP,2006). However such information is limited under irrigated conditions and hence the present investigation was taken up.

## Materials and Methods

Field experiment was conducted at Agricultural Research Station, Gangavathi of University of Agricultural Sciences, Dharwad, Karnataka state . The soil was medium deep black clay and had a pH 8.3, available N 247 kg ha$^{-1}$, available P 23.8 kg ha$^{-1}$ and exchangeable K 456 kg ha$^{-1}$. Tenera palms developed from NRC-OP RS-Palode were planted during 1989. Three irrigation methods (50% basin irrigation(Io), basin irrigation($I_1$)and drip irrigation ($I_2$) as main plot and four NPK levels (No NPK, 400:200:900; 800:400:1800 and 1200:600:2700 g N,$P_2O_5$ & $K_2O$ palm$^{-1}$ year$^{-1}$) as sub plot treatments were tried in strip plot design with three replications along with control treatment of basin irrigation and 1200:600:1200 g N,$P_2O_5$ & $K_2O$ palm$^{-1}$). Irrigation was scheduled based on the product of basin area and mean monthly evaporation expressed in l palm$^{-1}$day$^{-1}$. For drip irrigation half the quantity of water that is given to basin irrigation was provided. Fertilizers were applied in two equal splits. Observations on bunch yield and yield parameters were recorded for 2005 and 2006 and statistically analysed and presented.

## Results and Discussion

**Effect on FFB yield :** The drip irrigation recorded 24 and 22% and basin irrigation recorded 21 and 18% higher FFB yield than 50% basin irrigation during 2005 and 2006 respectively (Table 1). The water requirement was 835 and 731 mm in the case of drip irrigation as against 1244 and 1282 mm the case of basin irrigation during 2005 and 2006 respectively implying a saving of 33 and 43 per cent in water.

Application of $F_3$ level NPK recorded higher FFB yield of 11.14 and 14.74 t ha$^{-1}$ during 2005 and

**Table 1 : FFB yield and yield parameters of oil palm as influenced by irrigation and NPK levels.**

| Treatments | FFB yields ( t $ha^{-1}$) | | No. of bunches $palm^{-1}$ | | Bunch weight (kg $bunch^{-1}$) | |
|---|---|---|---|---|---|---|
| *Irrigation* | 2005 | 2006 | 2005 | 2006 | 2005 | 2006 |
| $I_O$ | 7.36 | 9.23 | 3.67 | 4.28 | 13.11 | 14.50 |
| $I_1$ | 9.34 | 11.25 | 4.93 | 5.16 | 13.50 | 15.29 |
| $I_2$ | 9.69 | 11.86 | 4.77 | 5.11 | 14.10 | 16.19 |
| *CD (p=0.05)* | 1.71 | 1.55 | NS | NS | 0.68 | NS |
| *NPK levels* | | | | | | |
| $F_O$ | 6.03 | 6.88 | 3.34 | 3.81 | 12.20 | 12.73 |
| $F_1$ | 7.94 | 9.37 | 4.09 | 4.28 | 13.55 | 15.46 |
| $F_2$ | 10.07 | 12.14 | 5.30 | 5.50 | 13.45 | 15.58 |
| $F_3$ | 11.14 | 14.74 | 5.10 | 5.80 | 15.08 | 17.55 |
| *CD (p=0.05)* | 0.96 | 0.83 | 0.83 | 0.75 | 0.56 | 2.59 |
| *Interaction* | | | | | | |
| $I_OF_O$ | 4.83 | 5.80 | 2.83 | 3.56 | 10.32 | 11.31 |
| $I_OF_1$ | 6.44 | 8.48 | 3.27 | 3.90 | 13.44 | 15.47 |
| $I_OF_2$ | 8.83 | 9.94 | 4.43 | 4.90 | 13.91 | 14.26 |
| $I_OF_3$ | 9.36 | 12.7 | 4.13 | 4.76 | 14.78 | 16.96 |
| $I_1F_O$ | 6.39 | 6.88 | 3.43 | 4.17 | 13.61 | 11.85 |
| $I_1F_1$ | 8.51 | 10.5 | 4.33 | 4.96 | 13.60 | 14.90 |
| $I_1F_2$ | 10.36 | 12.43 | 6.10 | 5.29 | 12.36 | 16.51 |
| $I_1F_3$ | 12.08 | 15.21 | 5.87 | 6.22 | 14.44 | 17.89 |
| $I_2F_O$ | 6.87 | 7.95 | 3.77 | 3.72 | 12.67 | 15.02 |
| $I_2F_1$ | 8.88 | 9.13 | 4.67 | 3.98 | 13.61 | 16.00 |
| $I_2F_2$ | 11.02 | 14.04 | 5.37 | 6.31 | 14.08 | 15.96 |
| $I_2F_3$ | 11.98 | 16.30 | 5.30 | 6.43 | 16.05 | 17.79 |
| control | 11.30 | 15.61 | 6.00 | 6.80 | 13.20 | 16.06 |
| *CD (p=0.05)* | NS | NS | NS | NS | 1.15 | NS |

$I_0$ : 50% basin irrigation
$I_1$ : Basin Irrigation
$I_2$ : Drip Irrigation

$F_O$ : No NPK
$F_1$ : 400;200:900 g $N,P_2O_5$ &$K_2O$ $palm^{-1}$
$F_2$ : 800;400:1800 g —"—
$F_3$ : 1200;600:2700 ——"——
Control : $I_1$x 1200:600:1200 $N,P_2O_5$ & $K_2O$/palm

**Table 2 : Soil available NPK and economics of Oil palm as influenced by irrigation and NPK levels.**

| Treatments | Available Soil NPK (kg ha$^{-1}$) | | | Net returns (Rs ha$^{-1}$) | |
|---|---|---|---|---|---|
| *Irrigation* | AV.N | AV.$P_2O_5$ | AV.$K_2O$ | 2005 | 2006 |
| $I_O$ | 161 | 21.38 | 833 | 17819 | 26216 |
| $I_1$ | 152 | 25.58 | 833 | 25411 | 35317 |
| $I_2$ | 161 | 21.02 | 800 | 24333 | 34286 |
| CD (*p=0.05*) | NS | 2.55 | NS | 3981 | 3056 |
| *NPK levels* | | | | | |
| $F_O$ | 143 | 14.88 | 520 | 12439 | 17476 |
| $F_1$ | 165 | 20.40 | 711 | 20209 | 26629 |
| $F_2$ | 159 | 26.92 | 938 | 26722 | 37007 |
| $F_3$ | 165 | 28.45 | 1120 | 30715 | 46646 |
| CD (*p=0.05*) | 6.9 | 2.87 | 68.0 | 3621 | 2486 |
| *Interaction* | | | | | |
| $I_OF_O$ | 140 | 13.46 | 533 | 9531 | 13896 |
| $I_OF_1$ | 177 | 20.64 | 800 | 14694 | 23889 |
| $I_OF_2$ | 159 | 24.99 | 907 | 23367 | 28362 |
| $I_OF_3$ | 168 | 26.44 | 1093 | 23685 | 38715 |
| $I_1F_O$ | 149 | 16.67 | 560 | 12854 | 18726 |
| $I_1F_1$ | 149 | 23.61 | 667 | 24024 | 32949 |
| $I_1F_2$ | 149 | 30.18 | 987 | 28797 | 39567 |
| $I_1F_3$ | 159 | 31.85 | 1120 | 35970 | 50025 |
| $I_2F_O$ | 140 | 14.53 | 467 | 14931 | 19807 |
| $I_2F_1$ | 168 | 16.94 | 667 | 21909 | 23049 |
| $I_2F_2$ | 168 | 25.57 | 920 | 28002 | 43093 |
| $I_2F_3$ | 168 | 27.05 | 1147 | 32490 | 51196 |
| Control | 160 | 25.50 | 700 | 34105 | 53500 |
| CD (*p=0.05*) | NS | NS | 80.73 | NS | 3427 |

$I_0$ : 50% basin irrigation
$I_1$ : Basin Irrigation
$I_2$ : Drip Irrigation

$F_O$ : No NPK
$F_1$ : 400;200:900 g N,$P_2O_5$ &$K_2O$ palm$^{-1}$
$F_2$ : 800;400:1800 g —"—
$F_3$ : 1200;600:2700 ——"——
Control : $I_1$x 1200:600:1200 N,$P_2O_5$ & $K_2O$/palm

2006 which was significantly superior than other NPK levels. The treatment recorded 46 and 53 per cent higher FFB yield over no NPK control.

The interaction effect was non significant. The combination $I_2F_3$ recorded 11.98 and 16.30 t $ha^{-1}$ during 2005 and 2006 respectively followed by the combination $I_1F_3$ with an FFB yield of 12.08 and 15.21 t $ha^{-1}$ during 2005 and 2006 respectively. However, both $I_1F_3$ and $I_2F_3$ remained on par with the control treatment of basin irrigation and 1200:600:1200 g N,$P_2O_5$ & $K_2O$ which recorded an FFB yield of 11.3 and 15.61 t $ha^{-1}$ during the 2005 and 2006. The results are in agreement with those reported from Palode (NRC-OP,2006).

The higher FFB yield in the case of $F_3$ level NPK was due to a combination of yield parameters mainly the bunch number and bunch weight. $F_3$ level NPK recorded significantly more number of bunches (5.10 and 5.80 no $bunch^{-1}$) and higher bunch weight (15.08 and 17.55 kg $bunch^{-1}$) than no NPK control and $F_1$ level NPK.

Among the treatment combinations $I_2F_3$ had higher mean number of bunches and higher mean bunch weight However the control treatment (Basin irrigation x 1200:600:1200 g N,$P_2O_5$ & $K_2O$ $palm^{-1}$)also recorded similar number of bunches and mean bunch weight.

**Economics :** During both 2005 and 2006 net returns(NR) were significantly higher with basin or drip irrigation than 50% basin irrigation (Table 2). Similarly, $F_3$ level NPK recorded significantly higher NR of Rs 30715 and Rs 46646 $ha^{-1}$ during 2005 and 2006 than other NPK levels. Interaction effect was significant during 2006. The combination $I_2F_3$ recorded significantly higher NR of Rs 51196 $ha^{-1}$followed by $I_1F_3$ with a NR of Rs 50025 $ha^{-1}$, which however, remained on par with control treatment with a net returns of Rs 53500 $ha^{-1}$ during 2006.

**Soil analysis**

**Soil available N :** Soil available N did not vary significantly for irrigation treatments. However all the NPK levels recorded significantly higher available N (159-165 kg $ha^{-1}$ respectively ) than no NPK control (143 kg $ha^{-1}$). Interaction effect remained non significant for available soil N.

**Soil available P** : Basin irrigation recorded significantly higher soil available P (25.58 kg $P_2O_5$ $ha^{-1}$) than no irrigation (21.38 kg $ha^{-1}$) or drip irrigation treatment (21.02 kg $ha^{-1}$).

Among the NPK levels it was significantly higher with either $F_3$ (28.45 kg $P_2O_5$ $ha^{-1}$) or with $F_2$ (26.92 kg $ha^{-1}$) level NPK than $F_1$( 20.4 kg $ha^{-1}$) or no NPK control (14.88 kg $ha^{-1}$). Interaction effect remained non significant.

**Available K :** The soil available K did not vary significantly for irrigation treatments. However, NPK levels had significant effect on available K. It was significantly higher in the case of $F_3$ level NPK (1120 kg $K_2O$ $ha^{-1}$) as compared to other NPK levels. Similarly among the treatment combinations $I_2F_3$ ( Drip irrigation x 1200:600:2700 g NPK) or $I_1F_3$ ( Basin irrigation x 1200:600;2700 g NPK ) recorded very high values of soil exchangeable K (1147 and 1120 kg $K_2O$ $ha^{-1}$ respectively) indicating that scope exists for reduction of K fertilizers.

The study thus revealed that application of 1200:600:2700 g NPK $palm^{-1}$ either with basin or drip irrigation recorded higher FFB yields. However, the treatment had recorded very high levels of available soil potassium and also that FFB yields remained on par with the control treatment it can be inferred that application of 1200:600:1200 g N,$P_2O_5$ & $K_2O$ $palm^{-1}$ appeared to be optimum for black soils under Tungabhadra command.

**REFERENCES**

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