# Effects of water availability on growth, flowering and fruiting of mango (*Mangifera indica*)

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## Introduction

Among the Malaysian fruit trees, mango (*Mangifera indica* cv Chukanan) is one of the crops most sensitive to drought. Lack of water has been the main limiting factor in determining the success of transplanted mango plants. Mohd. Razi et al., (1994) reported that vegetative growth of durian was greatly reduced by water deficits due to a reduction in leaf growth and photosynthetic capabilities. However, these reports on the effects of water stress were mainly confined to their vegetative growth stages. Effect of water deficit on the reproductive growth are even more important on account of their direct relationship with plant yield. Flower initiation, fruit set, premature fruit drop, fruit growth and fruit quality are importance aspects of yield potential that are considerably affected by water availability. These have been proven in the studies on papaya by Masri (1995). Observation suggests that considerable water deficit is needed to initiate flowering in mango. However, information on the roles of water in affecting other reproductive parameters is still lacking.

## Materials and Methods

Cultural practices

Mango plants of Chukanan clone at the MARDI Research Station, Pasir Putih, Kelantan were used in this experiment, They were planted in 1996 at 7.5m x 7.5m. The soil type at the experiment site is sandy clay loam. Fertilization, irrigation and other agronomic practices prior to inception of treatments were applied as recommended by Zainal Abidin et al., (1991).

Treatments and experiment design

Treatment pertaining to the different levels of moisture were obtained by placing different number of emitters per tree. The trial was carried out during the drought months so as to coincide with the occurrence of flowering and fruiting as well as to minimise errors which might arise from the disturbances of rainfall. At the commencement of the experiment, the mango trees were 5 years old and had reached maturity. Treatment were imposed prior to the expected time of flowering and fruiting. The treatments were designated as T0 (without irrigation and rain-fed); T1 (1 emitter/tree), T2 (2 emitter/tree), T4 (4 emitter/tree). The microsprinkler was run continuously for 45 minutes daily. The locations of these emitters in relation to tree trunk are shown in Figure 1. Treatments were arranged in a randomised complete block design with three replications. Each replication consisted of a single tree. Data were analysed using the Analysis of Variance (ANOVA) and the differences between treatment means were compared by the Least Significant Different (LSD) method.

## Results and Discussion

Mengel and Kirkby (1982) pointed out that for most crop species, the optimum Ψs lies in the range of –0.20 MPa and –0.5 MPa. It was observed that T2 consistently had the Ψs well below –0.5 MPa throughout the experiment period. The significantly lower value (more negative) of Ψs indicating that plant under T0 treatment had experience water stress. In contrast, plants under T4 treatment had abundant water with their Ψs constantly around –0.1 MPa and as such were not stressed. With Ψs fluctuating between –0.2 MPa and –0.5 MPa, plants in T1 and T2 could be considered as having moderate stress.Soil moisture had tremendous effects on flower initiation mango trees. It is popularly believed that mango tree need a certain level drought to trigger flowering. Onset of flowering usually occurs during the drought months. However, insufficient water supply for a continuous long period failed to stimulate the trees to produce more flowers. This was observed in plant under T0 treatment. Johnson et al., (1992) also found severe stress decreased flowering in peach. In contrast, continuous oversupply of water as depicted by T4 treatment also produced less number of flowers. This is in agreement with Elfving's (1994) report that flowering in apple is usually reduced or absent in vigorous trees. In the present study, it was the moderate water level treatments (T1 and T2) that produced the number of flowers. Several other work also similarly suggest that moderate stress increases flowering (Johnson et al. 1992; Elfving 1994). It is relevant to mention that the actual drought had begun about 4 weeks prior to the inception of these treatments. This means that after exposure to 4 weeks of drought, mango tree need to be moderately irrigated to induced more flowers. They could not flower profusely if they were exposed to long drought or overirrigated conditions.

Table 1: Effect of different soil moisture levels on flower initiation and fruit set of mango cv Chukanan

| Treatment | No. of emitters/tree | No. of inflorescence | No. of flowers | Flowers/ inflorescence | Fruit set (%) |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Primary branch | | | | | |
| T0 | 0 | 6.0bc | 37.3b | 5.7b | 79.1a |
| T1 | 1 | 10.7ab | 166.5a | 14.8a | 84.4a |
| T2 | 2 | 12.8a | 199.8a | 15.7a | 84.5a |
| T4 | 4 | 2.2c | 20.2b | 8.9b | 85.8a |
| Secondary | | | | | |
| branch | 0 | 5.3b | 41.8c | 7.6b | 82.8a |
| T0 | 1 | 12.5a | 169.2a | 13.8a | 88.3a |
| T1 | 2 | 9.8ab | 105.2b | 10.7ab | 75.7a |
| T2 | 4 | 4.5b | 31.2c | 6.7b | 86.9a |
| T4 | | | | | |

## Conclusions

Soil moisture had tremendous effects on flower initiation and fruitlet drop but not fruit set of mango cv Chukanan. A continuous insufficient or oversupply of water during drought failed to initiate more flowers. The trees that received moderate irrigation water produced the highest number of flowers. Fruit set was unsurprisingly high in mango cv Chukanan but was not influences by soil moisture status. Although fruit set was high, premature fruitlet drop was also excessive particularly under the restricted soil moisture conditions. It was shown that moderate irrigation after 4 weeks of drought could substantially increase fruit yield. However, more detail studies on this aspect are critically needed.

## Benefits from the study

validation of flowering and fruiting of mango by deficit irrigation

## Patent(s), if applicable:

Nil

## Stage of Commercialization, if applicable:

Nil

## Project Publications in Refereed Journals

MOHD RAZI ISMAIL AND MOHAMAD HAMAD AWAD (2002) Survival of mangosteen plants in the field in responses to shading and water stress. Journal Malaysian Applied Biology ; 31: 21-26

## Project Publications in Conference Proceedings:

Nil

*Graduate Research*

| Name of Graduate | Research Topic | Field of Expertise | Degree Awarded | Graduation Year |
|---|---|---|---|---|
| **Adiwrman Izhar** | **Effect of water stress on mangosteen plants** | **Plant Physiology** | **PhD** | **In progress** |
| **Siti Zaharah Sakimin** | **Root restriction on mango** | **Plant Physiology** | **MSc** | **In progress** |
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