THE INTERNATIONAL JOURNAL OF SCIENCE & TECHNOLEDGE

# Flowering and Fruiting of Yellow Passion Fruit (Passiflora Edulis, Var F. Flavicarpa. Deg) as Influenced by Different Fertilizer Applications in Kiambu and Embu Counties, Kenya

**Mwirigi Peter**
Senior Research Administrator, Department of Agriculture Science Technology, Kenyatta University, Kenya
**Joseph Gweyi-Onyango**
Senior Lecturer, Department of Agriculture Science Technology, Kenyatta University, Kenya
**Maina Mwangi**
Senior Lecturer, Department of Agriculture Science Technology, Kenyatta University, Kenya

***Abstract:***
*Yellow passion fruit (Passiflora edulis f. flavicarpa Deg.) is increasingly becoming an important fruit crop in Kenya and especially in Embu County due to its apparent adaptation to the hot arid conditions. The main objective of this study was to assess flower induction and fruit formation of yellow passion under varying fertilizer treatments. Sixty four plants belonging to KPF4 variety were grown in two sites at Kenyatta University (KU) Farm and at a selected farmer's orchard in Embu. The experiment was laid out in a Factorial Complete Randomized Block Design with planting and top dressing fertilizers as the main factors. The planting fertilizers were Farmyard manure and Diammonium phosphate (DAP) while the top dressing was Calcium ammonium nitrate (CAN) and Nitrabor. The treatments included 100g DAP+20kg Manure+50g Nitrabor; 100g DAP+10kg Manure+50g Nitrabor; 100g DAP+50gCAN; 100g DAP+50gNitrabor; 10kg Manure+50g CAN; 10kg Manure+50g Nitrabor; 20kg Manure+50gCAN; 20kg Manure+50g Nitrabor; 50g DAP+10kg Manure+50g CAN, 50g DAP+50g CAN, 50g DAP+50g Nitrabor and Control (no fertilizer). Data recording begun at the onset of the first flower bud and the number of unopened flower buds, open flowers and young unripe fruits was recorded on a weekly basis. Results indicate that there were significant differences (≤0.05) among the treatments for the three variables. Additionally, for the open flowers, there were differences for the two sites with Embu having the highest average of open flowers. The combined treatments of 100g DAP+10kgManure+50g Nitrabor and 20kg Manure+50g Nitrabor showed the best results in terms of flower and fruit formation. Probably the commercial Nitrabor fertilizer (15.4% N + 25.9% CaO + 0.3% B) had an effect on the flowering possibly due to its enhanced boron content and improved solubility of calcium. The unripe fruits on the other hand had significant differences in the seasons but there were no major observational differences between the two sites. This probably can be attributed due to the high number of fruit drop and especially in the Embu which arose as a result of the prolonged dry spell. This study has demonstrates that varying fertilizer application can have significant impact on the flowering and fruit formation of yellow passion which are key determinants of the potential yield of an orchard.*

***Keywords:*** *Agronomic management, fertilizer application, flowers, fruits*

## 1. Introduction

In Kenya the yellow passion fruit (Passiflora edulis, var f. flavicarpa.deg) variety has sour and sweet cultivars which are mostly suited to low altitudes. The variety also thrives well in mid altitudes of up to 1500m above sea level and lately there has been increased production of this fruit in semi-arid regions of Embu, Meru, Tharaka Nithi and Kirinyaga counties (HCDA, 2013). The strength of yellow passion is that it is thought to be more tolerant to Fusarium wilt, a disease that has severely reduced purple passion fruit productivity. Worldwide, it is believed that the genus Passiflora originated in where the yellow passion is the preferred commercially grown (Oliveira et al., 2012). Brazil is also the main producer of the fruit in the world (Janick and Paul, 2008).

Yellow passion fruit has increasingly found a special niche among farmers in Embu County especially due to its relative drought tolerance and high yield productivity. The fruit is mainly grown for export but it is also finding acceptance in the local market where it is mainly used in blending juices made from the purple variety (HCDA, 2013). Nevertheless, general productivity is poor due to inefficiencies in fertilizer application and the adoption of correct agronomic practices. This therefore calls for analysis of agronomic management and especially soil assessment which can determine the plant's

nutritional behavior. In addition, since each nutrient has a particular and specific function in the growth of the plant, imbalances can result in poor yield and fruits of low quality. This problem is further exacerbated by deficit in water especially for irrigation while the little that is available is normally high in salinity due to increased evaporation and poor drainage in the area. (Doneen and Westcot, 1988). The problem is further made worse by incorrect use fertilizers. According to Ayers and Westcot (1999), yellow passion is highly sensitive to changes in salinity and the correct application of fertilizers and imbalances in these factors can highly affect its production (Costa et al., 2001; Freire et al., 2010; Dias et al., 2011). All these factors affect the overall fruit form index leading to malformed, deformed and shriveled fruits that are of poor quality hence low acceptance by the consumer.

The main purpose of this study was to evaluate flower induction and fruit formation of yellow passion under varying fertilizer treatments in two different ecological study sites.

## 2. Materials and Methods

Sixty four plants belonging to KPF4 variety were grown in two sites at Kenyatta University (KU) Farm and at Ugweri farmer's orchard in Embu.

### *2.1. Experimental Design*

The experiment was laid out in a Factorial Complete Randomized Block Design with planting and top dressing fertilizers as the main factors. The planting fertilizers were Farmyard manure and Diammonium phosphate (DAP) while the top dressing was Calcium ammonium nitrate (CAN) and Nitrabor. The treatments included 100g DAP+20kg Manure+50g Nitrabor; 100g DAP+10kg Manure+50g Nitrabor; 100g DAP+50gCAN; 100g DAP+50gNitrabor; 10kg Manure+50g CAN; 10kg Manure+50g Nitrabor; 20kg Manure+50gCAN; 20kg Manure+50g Nitrabor; 50g DAP+10kg Manure+50g CAN, 50g DAP+50g CAN, 50g DAP+50g Nitrabor and Control (no fertilizer).

### *2.2. Data Recording and Analysis*

Data recording begun at the onset of the first flower bud and the number of unopened flower buds, open flowers and young unripe fruits (fruits formed) was recorded on a weekly basis for two consecutive seasons of December 2016 and April 2017. The data collection was continued until approximately 80% of the flowers had formed fruits. Analysis of variance using SAS software version 9.1 was performed on the data.

The data was coded as follows:

| Treatment | Code | Treatment | Code |
|---|---|---|---|
| 100gDAP+20kgManure+50gNitrabor | 1 | 20kgManure+50gCAN | 7 |
| 100gDAP+10kgManure+50gNitrabor | 2 | 20kgManure+50gNitrabor | 8 |
| 100gDAP+50gCAN | 3 | 50gDAP+10kgManure+50gCAN | 9 |
| 100gDAP+50gNitrabor | 4 | Control | 10 |
| 10kgManure+50gCAN | 5 | 50gDAP+50gCAN | 11 |
| 10kgManure+50gNitrabor | 6 | 50gDAP+50gNitrabor | 12 |

*Table 1*

## 3. Results and Discussions

Results indicate that there were significant differences ($\leq 0.05$) among the treatments (Table 2).

| **Dependent Variable: Flower Bud Initiation** | | | | | |
|---|---|---|---|---|---|
| Source | DF | Sum of Squares | Mean Square | F Value | Pr>F |
| Model | 16 | 68076.8636 | 4254.804 | 15.61 | <.0001 |
| Error | 278 | 75782.133 | 272.5976 | | |
| Corrected Total | 294 | 143858.9966 | | | |
| | | | | | |
| **Dependent Variable: Open Flower** | | | | | |
| Source | DF | Sum of Squares | Mean Square | F Value | Pr>F |
| Model | 16 | 19701.77955 | 1231.36122 | 17.06 | <.0001 |
| Error | 278 | 20062.54588 | 72.16743 | | |
| Corrected Total | 294 | 39764.32542 | | | |

| Dependent Variable: Fruits Formed | | | | | |
|---|---|---|---|---|---|
| Source | DF | Sum of Squares | Mean Square | F Value | Pr>F |
| Model | 16 | 116328.2391 | 7270.5149 | 12.57 | <.0001 |
| Error | 278 | 160753.0965 | 578.2485 | | |
| Corrected Total | 294 | 277081.3356 | | | |

*Table 2: Analysis of the Various Dependent Variables for Fertilizer Treatment in Kenyatta University Farm and Ugweri Orchard*

Additionally, for the flower bud initiation and open flowers, there were differences for the two sites with Embu having the highest average number of flower buds and open flowers (Figure 1).

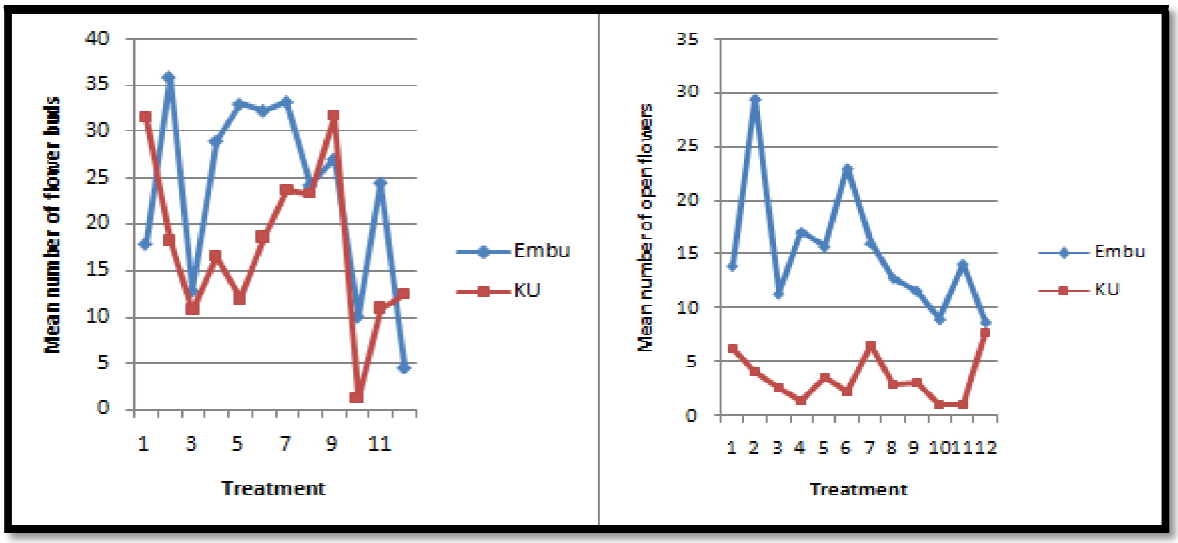


*Figure 1: Comparison of the Mean Number of Flower Buds and Open Flowers in the Two Study Sites*

The combined treatments of 100g DAP+10kgManure+50g Nitrabor and 20kg Manure+50g Nitrabor showed the best results in terms of flower and fruit formation for the two sites (Figure 2). Probably the commercial Nitrabor fertilizer (15.4% N + 25.9% CaO + 0.3% B) had an effect on the flowering possibly due to its enhancedboron content and the improved solubility of calcium. On the other hand, treatments 9, 10 and 11 which were lacking the Nitrabor showed less number of opened flowers and fruits formed. This study further agrees with findings by Freit as et al. (2006 ) which demonstrated that deficit in nitrogen deficit can affect the quality of the fruits, reduce their yield (number of fruits) and also influences °Brix and the content of vitamin C.

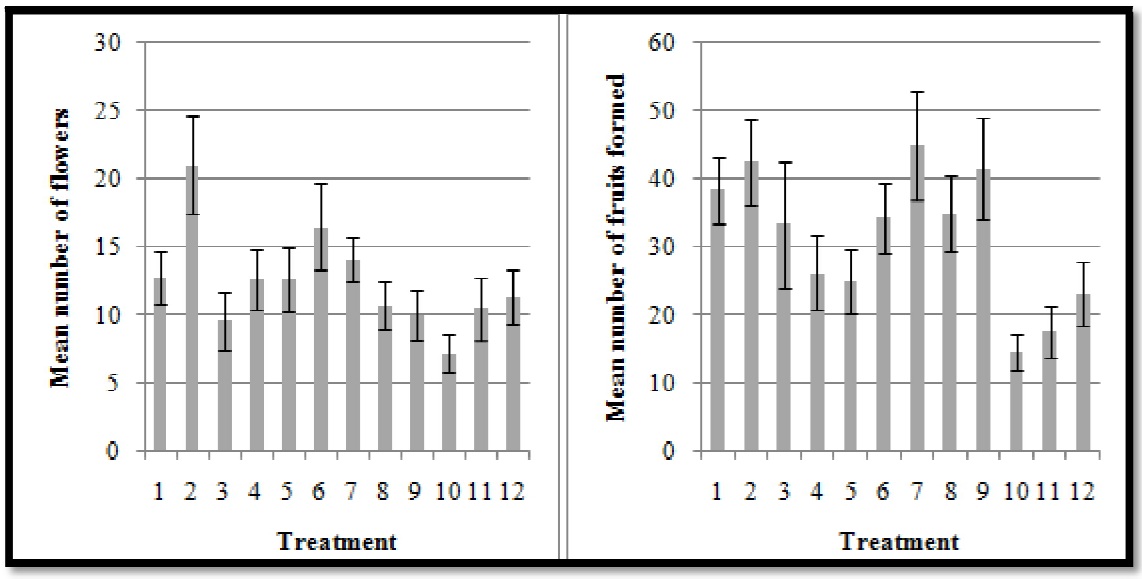


*Figure 2: Mean Number of Open Flowers and Fruits Formed at the Two Sites of Study*

The number of fruits formed increased over the season and had differences in the seasons but there were no major observational differences between the two sites. However a high number of fruit drop and especially in Embu was observed which arose as a result of the prolonged dry spell.

**4. Conclusion**

This study has demonstrates that varying fertilizer application can have significant impact on the flowering and fruit formation of yellow passion which are key determinants of the potential yield of an orchard.

**5. References**


i. Ayers, R.S.; Westcot, D.W. (1999). A qualidade da águanaagricultural. Campina Grande: UFPB, pp. 1-158, (FAO: Drainage paper, 29).
ii. Costa, J.R.M.; Lima, C.A.A.; Lima, E.D.A.; Cavalcante, L.F.; Oliveira, F.K.D. (2001). Caracterização dos frutosdemaracujáamareloirrigados com águasalina. RevistaBrasileira de EngenhariaAgrícolae Ambiental, 5 (1): 143-146.
iii. Doneen, L. D. and D. W. Westcot (1988). Irrigation practice and water management. Irrigation and Drainage Paper No. 1, Rome, FAO.
iv. Freitas, M. S. M., P. H. Monnerat, L. G. R. Pinho, and A. J. C. Carvalho. (2006). Mineral deficiency of macronutrients and boron in sweet passion fruit: fruit quality. Revista Brasileira de Fruticultura 28: 492–496. [Crossref], [Google Scholar]).
v. Horticultural Crop Development Authority (HCDA). National Horticulture Validated Report. 2013.
vi. Janick, J., Paull, R.E., (2008). The Encyclopedia of Fruit and Nuts. CABI, London.
vii. Oliveira, E.J., Dias, N.L.P., Dantas, J.L.L., (2012). Selection of morpho-agronomic descriptors for characterization of papaya cultivars. Euphytica 185, 253–265.