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Reasons Behind and Solutions for Mango Fruit Tree Blossom Drop. A review

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ABSTRACT

This review aims to provide an overview of the scientific literature on mango flowering and associated management techniques. The factors influencing mango flowering can be categorized as environmental e.g. air temperature, water relations, and phytohormone control of abscission, or plant-related (e.g. mutation status, photosynthesis, plant hormones, and irrigation). Varietal differences can also be observed in the pattern of fruit drop. Various attempts have been made to improve fruit set and yield through good pruning, irrigation, nutritional management, hormonal regulation and the use of some bio stimulants.

Keywords: Mango, plant hormonal, irrigation, nutrient, fertilizer

Introduction

In nature, mango trees produce a large number of flowers, but only a small proportion of these set fruit. There are two different types of flower: male flowers, which have one or more stamens and a completely abortive or reduced pistil, and hermaphrodite flowers, which have one or more fertile stamens and functional female organs. Pruning is one of the most important cultural practices for mango trees. The aim is to shape the plant canopy and maintain a balance between the roots and shoots. The following factors can limit fruit set in mango trees:

1. Factors involved in mango flowering
   1.1. Factors involved in mango flowering, such as environmental factors, water relationships, photo period, temperature, and plant hormones.
2. Mango flowering management:
   2.1. Pruning
   2.2. Irrigation management
   2.3. Fertilizer management
   2.4. Use of growth regulators.
   2.5. Use of biostimulants.

1. Factors involved in mango flowering

1.1. Factors involved in mango flowering such as environment factors, water relationships and photo period, temperature and plant hormones

Cavalcante (2020) Found that environmental factors involved and that interfere positively or negatively with mango flowering are air temperature, water relations and photoperiod, with the latter having the lowest impact. Despite much information available, the effect of climatic variables has not been evaluated separately.

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Pérez-Barraza *et al.* (2018) in a study with the mango cultivar Ataulfo concluded that the beginning of floral bud development was stimulated at night temperatures around 15° C.

Clonan *et al.* (2020) recorded that floral induction coincided with maximum daily temperatures between 28-32° and minimum nocturnal temperature between 20 C° for the varieties.

Pérez *et al.* (2019) concluded that low temperature has an effect on mango pollen viability and that there is a differential genotypic response, with a record of pollen grain germination of 67% (Kensington) 45% (Ostean) and 58% (kent) at a controlled temperature of 25° C.

Ravishanker *et al.* (2021) indicated that might temperatures between 8 or15° C (46-59° F) with day time temperatures around 20° C (68° F) are required for mangoes flowering. Significant changes in temperature also have a positive effect on flowering.

Halder and Hasan (2020) recommended Soil moisture stress (75 kp or even less) before mango flowering initiation to promote a uniform flowering. However, Soil moisture stress can complement low temperature requirement) depending on the mango cultivar and thus stimulate flowering. A proper water management during pre-flowering is important because when orchards are lights soils, flowering can be more abundant even at high temperatures as this soil can reduce their moisture levels quickly.

De Souza *et al.* (2016) noted that water demands of the cultivar tommy Atkins vary with the phonological phases, with an average daily consumption of 38 mm at flowering 4.25 mm at physiological fruit drop stages 3.56 mm at fruit duration and 3.0 mm at fruit maturation during the entire production cycle consumption varied from 403 to 420 mm.

Srinivasa Rao *et al.* (2016) observed that drought anticipates flowering compared to plants under normal growing conditions and attributed such a response to vegetative inhibition, thus increasing time for floral stimulus accumulation.

Nyoman Rai *et al.* (2008) studied the flower and fruit ABA, IAA and carbohydrate contents in relation to flower and fruit drop on Mangos teen trees and observed that the abscised flowers and fruits had a high ABA content, low IAA and low supply of photos synthase (low totals sugar content in the leaf tissue). The excessive abscission flower and fruits might have been caused by high ABA content, Low IAA and a low supply of photosynthetic. Based on these results application of synthetic IAA accompanied to prevent mangos teen flower and fruit abscission.

Saleem *et al.* (2008) considered the development controllers application influences vegetative and regenerative behavior of Blood Red' Sweet orange. They wind up that GA at 45 mg/L application diminished bloom drop as well as natural produce to drop.

Abd El-moneim *et al.* (2007) considered that impact of GA_3 and Zinc splashes for ameliorating yield and fruit quality of Washington Navel orange trees developed beneath sandy soil conditions. In this ponder they concluded that application of GA_3 at 10 ppm with zinc decreased natural product drop % and increscent in yield of plant.

Sun *et al.* (2009) studied the impacts of ethylene and IMCP (1-methyl clopropene) on bud and blossom drop in miniphalacnops is (orchid) cultivars and watched that the ethylene inhibitor I-MCP, (1-methylcyclopropene) diminished ethyl level induced flower bud drop. I – MCP pretreatment restrained the ethylene induced in cerement in ABA levels effectively. I MCP conaticipate ethylene activity and repress senescence forms such as reduced water substance increased membrane penetrable and up tiff ABA contact.

Bangerth (2000) concluded that the immoderate abscission of mangos teen flowers and fruits might have been caused by high ABA substance Low IAA and provide low supply of photo synthases, low supply of photosynthetic appeared by the lower sugar substance, takes of from the shoots with abscised flower and fruit the rate of abscission indifferent fruit the rate of abscission indifferent fruits are brought down by utilizing GA, IAA and I. MCP at distinctive rate so amid generation and postharvest periods of fruits. These coupons ought to be kept in orange to extend yield and have great quality gather and as well as variables related to ethylene can be the potential reason actuating flower drop so-ethylene content should also be kept in the consideration for keeping the rate of abscission low and rate of yield high.

Nautiyal *et al.* (2022) showed that various causes of fruit drop that highlights to high Abscisic acid (ABA) content and low jndol-3-a etic acid (IAA) and low deliver of Photosynthetic and improve Nitrogen application, improper fertilization, Auxin deficiency heavy crop load. The reduction of this problem has been success fully controlled through the application of some plant growth hormones including GA_3 with Zn and ethylene and 1-MCP.the mayor reasons of flower detachment is related to ethylene production in a specific amount. And also, the statue of the leaf NPK is not the main concern of flowers drooping/drop.

2. Mango flowering management

2.1. Effect of pruning

Maloba *et al.* (2017) claimed that photosynthetic rate can be used as productivity index. Although, excessive pruning may reduce leaf area, which in turn, supports crop development the authors also verified that pruning and tip pruning increased that number of in fluorescence's with fruits in all canopy parts. According to them, moderate pruning had a better performance than severe priming. The latter resulted in fewer inflorescences with fruits in the upper part and whole canopy, Moreover, they stated that pruning causes no increase in inflorescences relative distribution, with fruits in different canopy parts. Lastly, sever pruning may have increased light levels but the expose of Leaf area reduction, decreasing crop development support.

Persello *et al.* (2019) evaluated two mango pruning factors: pruning intensity, defended at the tree scale as the amount of fresh biomass removed peruint of campy volume, and pruning severity, defined at the a xis scale as the distance between the pruning point and the distalen of the axis, the author concluded that vegetative growth intensity increased with pruning severity (pruned axes aid axis diameter (prunded and unpruned axes) but waves not affected by pruning intensity. They also observed that pruning intensity and severity influenced the dynamics of vegetative growth.

Although these authors did not directly assess mango of lowering, the increase in plant branches consist of an important measure.

Oliveira *et al.* (2017) studied the effect of PBZ associated with the sprouting of "Uba" mango branches and reported that plant with brouch sprouting had consequently, increased number of fruits per branch, without deleterious effect on fruit quality. On the other hand, the need for tip pruning or not depends on bruch maturity and has to be evaluated by an experienced produce/ consultant. Moreover, it's not a production of high performance mango varieties.

Elkhishen (2015) evaluated four pruning treatments, removal of half-length terminal shoots, removal of whole terminal shoots, tipping and control (no fruning) and concluded that removing half-length terminal shoots from was the most effective treatment to regulator flowering and productivity forcutiva/ Alphonse.

de Sousa Ferraz *et al.* (2020) studied the mango Atkins grown in the Brazilian semi avid region and concluded that, in trees mechanically pruned in atraplzoidal shape, the number of terminal braches, brach denity fruit denity and number of fruits per branch vary with the side (east and west) and position in the canopy. Terminal branches and fruit production concentrates to the west side of the plant and lower part of the canopy. The authors noted that in high yield or chards pruned in a trapezoidal shop, that number of fruits per terminal branch is 1.15.

Sarkhosh *et al.* (2018) evaluated the effect of six tip pruning times between April and July (cooler and dry weather) at four weekly intervals, in low commercial mango cultivars (Honeygdd and calypso-B74). These authors observed that control trees had 95 ± 1.45% of their canopy flowered.

2.2. Effect of irrigation management

dos Santos *et al.* (2015) evaluated the effect of different Etc values on Tommy Atkins mango in Brazil, nam-ely:a) irrigation with 100% Etc alternating either side every 15 days, C) irrigation with 80% Etc alternating emitter Sid every 15 days, d) irrigation with 60% ETc alerating emitter Sid every 15 days. The kc used to calculate evaportrans- privation during assessment phases ranged from 0.45 to 0.87.

Fonseca *et al.* (2018) studied organic cultivation of "Uba" mango in lencois Brazil and reported that flowering percentages ranged from 17.90% for application of 100% irrigation depth and 45.25% for applications of 50%, during 120 days, when comparing both treatments, they observed at 156% increase in flowering rate with water deficit. However, it is important to highlight that the study region has a mid-climate during the flowering induction phase.

Spreer *et al.* (2009) evaluated response of different levels of available water using a ke of 0.80for the control they observed that a reduction of 50% of this blue decreased productivity by only 3%, with better results for the partitioning of water extraction (alternating sides of irrigation in systems with two lines of drippers per low plants) in dry years.

Sliva (2019) assess the effect of five irrigation depths (24, 36, 48,60boond 100% of the Etc., and identified that an irrigation depth of 54% of the Etc. promoted a higher number de plant inflorescences (102). These authors used the Kc values for Etc. accusation ranged between 0.3 and 0.8 with phonological phase studied, whereas the Kc we in the farm studied was 1.6 thus a reduction of 0.54 is suggested of Kent in the Brazilian semi-arid.

Faria *et al.* (2016) found that reducing irrigation level to 0% or 25% of the ETc at flowering and 100% of the Etc. at fruiting stage may stimulate for al induction for mangoes of the cultivar' Tommy At kins' grown in Brazilian semi-arid regains.

Simões *et al.* (2021) concluded that a reduction in irrigation depth by up to 66% of Etc. in creased water use efficiency, but the highest net revenue was obtained with a depth of 80% of ETC.

Carr (2014) concluded that value varies between 0.65 and 1.05, with the frequency and extent of soil surface welting (linked to irrigation method) as well as vegetative canopy density however, this author may have overestimated wet and Kcadequany, obtaining higher Kc values as discussed by souse (h.d), which is dangerous for productive system of mango trees, Ali *et al.* (2018) Found that irrigation of Mango (*Mangifera indica* L) Cv. keih at 100% of reference (Eto) and cultivated under house condition to obtain the positive effect on vegetative growth, productivity and fruit quality through increasing fruit set percentage and saving water.

dos Santos *et al.* (2015) on Tommy Atkins mango found that irrigation levels treatments at 100% ETs increased initial fruit set percentage significantly as compared with other treatments during both experimental seasons.

Halder and Abu Hasan (2020) literature have advised suspension of irrigation to stimulate water stress in mango trees, regard less of the mango cultivar and production system. However, the practice is extremely not recommended since other factors are involved in the flowering process, which can and should be considered, the main impact is growth stoppage that prevents plants to vegetate, in addition to decreasing gibberellin synthesis, a ground promoter, Branch maturation acceleration by water shortage is related to ethylene l and Abscisic acid synthesis It, in turn, speeds up and standardize branch maturation and hence flower in guniformization.

Durán Zuazo *et al.* (2019) carried out alysineter experiment with the "Ostan" mango in Granadgs pain aiming to evaluate plant water use efficiency through ke values. They abservaethatkc values presented three main stages during the mango phenolgoical cycle, being flowering (kc = 0.34), fruit setting k_c=0.67 and fruit growth (k_c = 063).

2.3. Effect of fertilizer management

Hamilton *et al.* (2015) evaluated the effect of nitrogen fertilizer application time on fruit yield and leaf allocation for, Kensington pride mangoes as a function of varying n contents in leaf dry matter , they concluded that the rate of N from fertilizers was significantly higher in Fruits from trees with low foliar N contents and when N was applied before flowering, the results indicate that leaf N allocation and N contents in mango trees differ depending on leaf N contents and fertilization time.

El-Motaium *et al.* (2019) concluded that nitrogen fertilization significantly increase inflorescence lengths In 'Kent mango trees in Brazilian semiarid region.

Lobo *et al.* (2019) identified that before flowering, nitrogen content in the first season evaluated was 17.78 g kg^{-1}, and during the full flowering the average content was 14.84 g kg^{-1}, therefore, there was a decrease of 16.53% in a short period of time. These results indicate that nitrogen fertilization management should consider this consumption but a lays having as reference the foliar n content at the beginning of floral induction.

Muengkaew *et al.* (2017) found that addition calcium and boron at (40% calcium (ND_3) 2.9 H_2O and 0.3 boron (H_3BO_4) promoted an increase pollen germination from about 25 to 60%, this indicates the importance of these nutrients for the flowering of the Mahachno k mango trees. At the same time, these authors also reported that foliar application of a Ca – B solution at a concentration of 300 ml/L^{-1} also generated positive effects on fruit production and consequently productivity.

Barbosa *et al.* (2016) highlighted that most macro and micronutrient tables were made for non-irrigated conditions. Therefore, studies on B availability under irrigated conditions. Are still needed especially in semi-arid regions.

Where, soil and climate conditions are peculiar. These authors also recommended that borate fertilization must be carried out before flowering by applying two fertigation treatments with 50 g of H_3BO_3 plant plus five sprays with H_3BO_3 (First Two (0.3%) and other (0.2%).

Oldoni *et al.* (2018) evaluated the effects of born fertilization on production and quality of palmer mango fruit and recommended five sprays with H_3BO_4 First two (0.3%) and the remaining (0.2%) J into the soil with 0.40 mg B dm^3.

El-Hoseiny *et al.* (2020) associated humic acids with born to minimize alternate bearing in "Zebda" mango and observed morphological, physiological, bio chemical and genetic effects, such effects influence plant growth and fruit quality. They then recommended two sprays of 0.3% humic acid with 600 mg/L^{-1} of boric acid before following and a third 30 days after the first, i.e still with the flowering period.

Maklad *et al.* (2020) evaluated the efficiency of foliar application of calcium, zinc and boron individually or in combination at different times and concentrations on flowering yield and fruit quality and observed effects on panicle length, male flowers, hermaphrodite flowers and number of flowers per panicle, with effect on fruit product in. These authors recommended four foliar applications containing calcium (calcium chelate 13%), zinc (zinc chelate 13%) and boron (boron chelate 10%) at 25 ml^{-1}.

Tenreiro (2020) revealed that different Ca sources and application forms and the respective effects on flowering productivity, pulp and peel nutritional content and fruit quality for the mango cultivar "Tommy Atkisns". The authors observed that in general flowering rates varied between 13.58% and 29.33 for the Casaubce Ca Saubce CaC_2,$2H_2O$ the highest flowering rates were observed for applications via fertigation (29.33%) and foliar + fertigation (24.64%). When applied via foliar, the use of noble resources of calcium, such as those complexes with Organic acids or soluble with amino acids, presented higher flowering percentages (22.25%) and 23.10%, respectively) compared to Ca $cl_{2.}$ $2H_2O$ (13.58%) On the other hand Ca $cl_{2.2}$ H_2O showed higher flowering rates as than Ca complexes with Drganic acids and water soluble Ca+ amino acids when applied by fertigation.

Maloba *et al.* (2017) compared the use ethephon individually in the mango varieties with ethephon plus potassium nitrate they observed that spraying with 4% KNQ was beneficial for flowering and that ethephon can be sprayed 600 ppm, since dose of 1000 ppm had positive effect on flowering but increased fruit drop.

2.4. Use growth regulators

The ease of plant growth regulator (PGR) application and the efficiency of the treatment is a promising alternative to irrigation in the development to effective, fruit drop reducing crop management strategies may also optimized crop loqds and enhanced financial returns to growers winches 2011 Higher fruit drop in density is generally associated with periods of lower Auxin concentration in mango fruit. The efficacy of exogenously applied GA_3 to pre and post a thesis inflorescences to enhance fruit set and retention have been in conclusive (Singh *et al.* 2017).

Singh *et al.* (2017) showed that maximum fruit retention in using urea 1% +2,4 D at is 15 ppm (45.4%) followed by using urea 1% +2,4-Dat 15 p.pm (45.4%) followed by suing urea 1% +2.4-D at is ppm (45.5%) followed by using NAA at 5 ppm 2,4-D at 10 ppm (44.3 %)resulting significantly increased the total number of fruits in urea 1% + 2,4-D at 15 ppm (244.3 fruits /tree) followed by NAA at 5 ppm +2,4-D at 10 ppm.(241.6 fruits/tree) as compared to control (17.3%) fruit retention and 181 fruits/tree) Hence, The combination of recommended dose of fertilizer, i.e. 400:400:900 g NPK/plant/ yea' along with urea 10% +2,4 D at 15 ppm foliar praying thrice during April, July and September can be used to control the fruit drop in Khasi mandarin.

Oliveira *et al.* (2020), the application of 19 a.i. of P, BZ per linear meter of compoy in palmer mango results, at the cellular level, in reductions of starch reserves and accumulation of calcium oxalate crystals, phenolic compounds, and lipophilic substances in the mesophyll, floral differentiation requires 13 days (starting 103 days after PBz application) with the formation of inflorescence and flower axes.

Morales-Martinez *et al.* (2020) evaluated several PBz treatments followed by nitrate applications in mango trees of the cultivar Tommy Atkins. They recorded that the number of panicles per plant arranged from I36.0 to I 58.38 control to 288.5 ± 75.17 for PB zat 10g aiper linear meter of canopy diameter when associated with application of 6% nitrate.

De Souza *et al.* (2018) concluded that PBa application in palmer many via irrigation was more effective at 1.3gai per liner meter of comopy. They observed that despite the greater productivity and number of fruit per plant, panicle lengths were reduced from 40 cm to 20 cm between the doses of 0.7 and 1.3 a per linear meter of canopy, respectively. Therefore, in spite of panicle compact thing there was no reduction in productivity yet for the mango cultivar Uba.

Oliveira *et al.* (2017) concluded that PBA application up to a dose of 1.62 gaiperlinear meter of comppy, combined with tip pruning, increases flowering and has not effect on fruit quality.

Husen *et al.* (2021) compared different PBZ and ethephone treatments for the mango cultivar "Arumanis" in Egypt they noted that PBz Potentiated flowering (flowering time, number of panicles, panicle length, panicle width and immature panicles), while ethephon sped up flowering (number of panicles) compared to the control, especially at 400 m $L.L^{-1}$ and 600 ml L^{-1}.

Kishore *et al.* (2019) assessed the mango cultivar Arka Neekachalkasari ' and reported that PBz advanced flower budburst and increased flowering intensity, percentage of bisexual Flowers, Fruit production and productive efficiency at a dose of 0.25 a riper linear meter of comopj. In mango cultivation, PBz or any other gibberellin inhibitory may be associated with ethephon depending on the mango cultivar vigor. More vigorous varieties and to require the use of ethephon, depending on the climatic conditions (especially air temperature) during flowering induction, Certain temperatures, which are no very, stimulating to flowering, may require the use ethephon with PBz, especially for more vigorous associated with PBz, especially for more vigorous varieties such as kent and tommy Atkins.

dos Santos Silva *et al.* (2021) found that keitt mango trees in the first production cycle in Brazil treated with 1.0 gaiPBz per liner meter of canopy showed a minimum flowering Percentage of 70%, reaching 100% when PBZ was associated with folic acid.

Silva *et al.* (2014) evaluated VCZ application to irrigated "Palmer" mango trees under semi-arid conditions in Brazil. The authors observed that foliar applications of 500, 1000 and 1500 mgL^{-1} of UCZ was not effective in controlling vegetative growth and promoting flowering. However, applications of 600mgL^{-1} of UCZ to the soil increased the number of panicles per plant to 17 which is much higher than the control (32.25 panicles / plant).

Cavalcente *et al.* (2020) compared its use in Palmer mango cultivation in the Brazilian a semi-arid with PBZ. These authors observed that MTZ at 1.39 ai per linear meteor of canopy has an inhibitory effect on gibberellin biosynthesis in mangles, but affects $AG_1 + AG_3$ and AG_4 diversely. Although MTZ conptentially be used in mango flowering management, studies are still required to determine a specific practice.

Carreiro *et al.* (2022a) They observed significant effect on gas exchange, therefore it promotes a high co assimilation rate, conversely, PBZ is more effective in chlorophyll a and total chlorophyll accumulations, while FPM did not affect these photo synthetic pigments.

Carreiro *et al.* (2022b) evaluated FPM and concluded that at a dose of 1.3g aiper liner meter of canopy, this molecule is efficient in inhibiting GA_3 biosynthesis and promotes accumulations of organic reserves in a similar way to PBZ but does not influence that vegetative growth and flowering of Tommy Atkins mango in the tropical semiarid. Although FPM could potentially be used to inhibit gibberellin biosynthesis in mango, further studies are needed to determine specific management practices.

2.5. Use of some bio stimulants

Kondo (2009) indicated a certain role played by Jasmines when applied on fruit trees for resisting environmental stresses and temperature fluctuations in preharvest stage because it appeared that jasmines oil in beher protecting small mongo fruits against climate fluctuations and lowering fruit drop.

Reyes-Díaz et al (2016) reasonable explanation for lowering fruit drop by methyl jasmonate (M.J) was presented citing that M.J. caused decreasing inactivity of enzymes involved in the hydrolysis of glycoside links of cell wall molecules and by consequences keeping fruit firmness and lowering fruit drop.

Muengkaew *et al.* (2016) found that after spraying mango trees with methyl jasmonate a noticeable increase in fruit pulp color was noticed after strong and measurements of phytocom pounds indicated an increase in phenyl Amin ammonia lays (PAL), carotene and anthocyanin content of fruitwhich may explain this increase in yellowness of fruit pulp.

Ibrahim *et al.* (2022) concluded that all three treatments of chitosan, kaolin and Jasmine oil on mango trees gave positive results with both Eiwess and Hendi Mango fruits as a preharvest applications on mango trees and were more effective on slowing maturity and keeping a good quality of Eiwess and Hendi mango fruits till 3 weeks in cold storage e (13°C) but after 4 weeks, chilling injury damage appeared on fruits , therefore it is recommended to store these mango varieties no more than 3 weeks on cold storage and in the meantime a ply these bio stimulants on the mango trees in the preharvest stage especially on Eiwess mango trees. Kaolin and jasmine oil, available may be used successfully to limit fruit drops in the preharvest stage and to enhance mango quality during cold storage.

Sajid *et al.* (2020) found that when chitosan at 1% applied on peach after 50 days of full bloom it improved most of the peach attributes (fruit volume, yield per tree, fruit firmness, acidity and vitamin C content and TSS%)

El-Deen *et al.* (2015) concluded that treatments of spraying Kaolin, young mango trees gave a high effect on improved growth parameters of these trees.

Zaghloul *et al.* (2017) specified that spraying Kaolin eat 4% there times in summer months of mandarin trees, was effective in reducing fruit pre harvest disorders and improving yield and fruit quality et harvest.

Mudo *et al.* (2020) assessed the effect of different branch maturation strategies using k sources (K_2SO_4 and K_2O) combined with bibs stimulant composed of water soluble K (12% KCL) organics fact ants and years extract on "Tommy Atkins' mango flowering in a semiarid region. Their results showed that initial bio stimulate sprays (First, second and third applications and first and second applications) complemented with the fourth application with k_2SO_4 as well as bio stimulant combined with K_2SO_4 had better results for the number of reproductive and undifferentiated shoots, with average of 7.7 reproductive as shoots perm canopy treatments containing Kcl in place of K_2SO_4 showed Alou performance for flowering.

Dash *et al.* (2021) evaluated the effects of applications with Ascophyllum on opossum (1000, 300 and 5000 ppm), homobrassinolide. 0,0.1,0.3 and 0.5 ppm) and trai continual (1.3 and 5 ppm) during the flowering and early fruit during the flowering and early fruits development of the mango cultivar kesar these authors found that flowering intensity in treatments with hondorassinotslide ranged from 67.64 to 70.37 , while for plant treated with Ascophyllumpossum it was from 64.50 to 66.17% they also reported that triacontanol (5ppm) produced the longest and widest panicles produced the longest and widest panicles (26.45 and 17.13)

Morales-Payan (2013) applied a bio stimulate (14.4% free amino acids and 7% nitrogen) at 3L per hectare per application on Edward mango trees in pure to Rico. They observed on increase in the number of fruits by 18.1% compare to plants of the control treatment with bio stimulant), but on reduction in fruit average weight.

Teixeira Lobo *et al.* (2019) studied the effect of several bio stimulants sprayed between the end of floral induction and full bloom. They found that bio stimulant containing nutrients (nitric nitrogen 10.0%, potassium oxide 5.0%, calcium oxide 7.15%, magnesium oxide 1.2% and boron 0.1) and l-1 amino acid seaweed extract reduced fruit abscission, promoting a 45.5% increase in fruit retention.

Gomes *et al.* (2008) evaluated the performance of a bio stimulate composed of citric biomass, citric flavonoids , ascorbic acid, citric phloalexims, lactic acid, citric acid , polyphenols, vegetable glycerin and organic acids applied during Floral , induction together with Kno_3 IN Tommy Atkins. They found that bio stimulant increased productivity by increasing the number of panicles an average by 0.16 per plant compared to the control.

Cheena *et al.* (2016) revealed that the highest percent of flowering (73.36%) was recorded in (KH_2PO_4) 1% + KNO_3 1%) and lowest in control (49.00% & 5.41%). The highest yield per tree (114.67kg) was noticed in (KH_2PO_4) 1% + KNO_3% and lowest (75.13 KG) in control which was on with k_2HPO_4 1% (73.98 kg) in mango.

Conclusion

Mango flowering is influenced by environmental elements (such as air temperature, water relations, and phytohormones that affect abscission) as well as plant-related factors (such as mutation status, photosynthesis, plant hormones, and irrigation). The pattern of fruit drop is another indication of varietal diversity.

Reference

Abd El-moneim, E. A.A., M.M.M. Abd El Migeed and O. M.M. Ismail, 2007. GA_3 and zinc sprays for improving yield and fruit quality of Washington Navel orange trees grown under sandy soil conditions. Res. J. Agric. Biol. Sci., 3(5), 498-503. https://www.aensiweb.net/AENSIWEB/rjabs/rjabs/2007/498-503.pdf

Ali, M. A., G. Abdelnasser, A. A. Ismaeil and G. Bayoumi, 2018. Effect of different irrigation levels on growth, yield and fruit quality of mango Cv. Keitt grown under screen house. J. Adv. Agric. Res., 23(1), 148-167.

Barbosa, L. F. S., Í. H. L. Cavalcante and A.M. N. Lima, 2016. Physiological disorder and productivity of 'Palmer' mango associated with boron nutrition. Revista Brasileira de Fruticultura, 38(1), 1- 9. https://doi.org/10.1590/0100-2945-273/14

Bangerth, F., 2000. Abscission and thinning of young fruit and their regulation by plant hormones and bio regulators. Plant Growth Regulation, 31, 43-59. https://doi.org/10.1023/A:1006398513703

Carr, M.K.V., 2014. The water relations and irrigation requirements of mango (*Mangifera indica* L.): a review. Experimental Agriculture, 50 (1): 1-23. DOI: https://doi.org/10.1017/S0014479713000288

Cheena J., M. Hanuman Naik and P. Prasanth, 2016. Studies the effect of certain chemicals on flower regulation and fruiting in Mango (*Mangifera indica* L.) CV. Baneshan. Int. J. Adv. Res. 4(12): 610-614. DOI: 10.21474/IJAR01/2437

Carreiro, D.A., R.A. Amariz, L.G. Sanches, I.A. Amariz, L.A. Rolim, A.J.S. Santos and Í.H.L. Cavalcante, 2022b. Fenpropimorph on organic compounds accumulation, biosynthesis of giberelic acid, and flowering of mango. Emirates Journal of Food and Agriculture.

Carreiro, Daniel de A., R. A. e Amariz, L. G. Sanches, J. T. Lobo, V. B. de Paiva Neto, Í. H. L. Cavalcante, 2022a. Gas exchanges and photosynthetic pigments of 'Tommy Atkins' mango as a function of fenpropimorph. Rev. Bras. Eng. Agríc. Ambient., 26 (4), 26(4):239-247. https://doi.org/10.1590/1807-1929/agriambi.v26n4p239-247

Cavalcante, Í.H.L., G.J. Nogueira e Silva, Cavacini, J.A. et al., 2020. Metconazole on Inhibition of Gibberellin Biosynthesis and Flowering Management in Mango. Erwerbs-Obstbau 62, 89–95. https://doi.org/10.1007/s10341-019-00466-w

Clonan, M., V. Hernaman, K. Pearce, M. Hopkins, A. Moise and C. McConchie, 2020. Impact of climate change on flowering induction in mangoes in the Northern Territory, Earth Systems and Climate Change Hub Report No. 16, NESP Earth Systems and Climate Change Hub, Australia. https://nespclimate.com.au/wp-content/uploads/2019/05/Mango-CS-scope-summary.pdf

Dash, A., D. Samant, D.K. Dash, S.N. Dash and K.N. Mishra, 2021. Influence of Ascophyllum nodosum extract, homobrassinolide and triacontanol on fruit retention, yield and quality of mango. Journal of Environmental Biology, 42(4), 1085-1091. http://doi.org/10.22438/jeb/42/4/MRN-1541.

de Sousa Ferraz, L. E. C., Í. H. L. Cavalcante, J. Teixeira Lobo and J. Gomes da Cunha, 2020. Terminal branch density and fruit production in the canopy of high-yield mango orchards. Eur. J. Hortic. Sci. 85(2): 118–122. https://doi.org/10.17660/eJHS.2020/85.2.6

De Souza, M. A., W. L. Simões, A. C. Mesquita, , M. A. C. Mouco, B. L. S. Cavalcante , M. J. M. Guimarães, 2018. Chemigation management for floral induction of 'Palmer' mango in the Lower-Middle São Francisco Valley. Irriga, 23(3), 442-453. DOI: http://dx.doi.org/10.15809/irriga.2018v23n3p442-453

De Souza, P. P. J. De Oliveira, J. C. Rodrigues, A. M. L. De sousa, R. T. De Lima, E. J. P. Da Rocha and S. Ortega-Farias, 2016. Water requirement estimate for the reproductive period of mango orchads in the northeast of the state of Pará, Brazil.Revistabrasileira de fruticultura, 38(3), e-311.https://doi.org/10.1590/0100-29452016311

dos Santos, M., B. Neves, B. da Silva and S. Donato, 2015. Yield, Water Use Efficiency and Physiological Characteristic of "Tommy Atkins" Mango under Partial Rootzone Drying Irrigation System. Journal of Water Resource and Protection, **7**, 1029-1037. doi: 10.4236/jwarp.2015.713084.

dos Santos Silva, L., K. Â. Oliveira de Sousa, E. C. V. Pereira, L. A. Rolim, J. G. da Cunha, M. C. Santos, M. A. da Silva and Í. H. L. Cavalcante, 2021. Advances in mango 'Keitt' production system: PBZ interaction with fulvic acids and free amino acids. Scientia Horticulturae, 277, 109787.

DOI: 10.1016/j.scienta.2020.109787

Durán Zuazo, V. H., C. R. Rodríguez Pleguezuelo, B. Gálvez Ruiz, S. Gutiérrez Gordillo and I. F. García-Tejero, 2019. Water use and fruit yield of mango (*Mangifera indica* L.) grown in a subtropical Mediterranean climate. International Journal of Fruit Science, 19(2): 136–150. https://doi.org/10.1080/15538362.2018.1493960

El-Hoseiny, H. M., M. N. Helaly, N. I. Elsheery and S. M. Alam-Eldein, 2020. Humic Acid and Boron to Minimize the Incidence of Alternate Bearing and Improve the Productivity and Fruit Quality of Mango Trees. HortScience, 55(7), 1026–1037. https://doi.org/10.21273/HORTSCI15053-20

Elkhishen, M. A., 2015. Effect of pruning severity on flowering and fruiting of mango (*Mangifera indica* L) Cv. Alphonso in off-year season. Egyptian Journal of Horticulture, 42(2), 785-794. DOI: 10.21608/jpp.2007.221334

El-Motaium, R. A., A.E. A. Shaban, S. H. Badawy and A. S. A. Ibrahim, 2019. Alleviation of alternate bearing phenomenon in mango (*Mangifera indica* L.) trees using boron and nitrogen fertilization. Journal of Plant Nutrition, 42(20), 2861–2872. https://doi.org/10.1080/01904167.2019.1659319

El-Deen, E. M. A. Z., M. F. Attia, F. H. Laila, M. F. M. Shahin, E. A. E. Genaidy and M. A. Merwad, 2015. Soil mulching and foliar ant transpirations effect on soil, growth and nutrients status of young mango trees cultivated in Toshka. International Journal of Agricultural Technology 11(3):1013-1032. http://www.ijat-aatsea.com

Faria, L.N., A. A. Soares In memoriam, S. L. R. Donato, M. R. dos Santos and L. G. Castro, 2016. The effects of irrigation management on floral induction of 'Tommy Atkins' mango in Bahia Semiarid. Engenharia Agrícola, 36 (3): 387-398. https://doi.org/10.1590/1809-4430-Eng.Agric.v36n3p387-398/2016

Fonseca, N., E.F. Coelho and R.S. Vieira, 2018. Water deficit in the induction of flowering and increased productivity of 'Ubá' mango under organic cultivation in the Chapada Diamantina region, Bahia. Cruz das Almas: Embrapa Cassava and Fruit Production. http://www.infoteca.cnptia.embrapa.br/infoteca/handle/doc/1090440

Gomes, E.C., J. Barbosa, W.S. Ribeiro, M.A.D. Marques, J.O. Perez, J.L.O. Freire. and A. N. Lima, 2008. Use of the Ecolife biostimulant for floral induction in 'Tommy Atkins' mango in the São Francisco Valley, Petrolina, PE. Engenharia Ambiental, 5(2): 86-93. https://doi.org/10.1590/1983-21252020v33n206rc

Halder, S., and Md Abu Hasan, 2020. Climate change and mango production. Chem. Sci. Rev. Lett, 9 (33):55-57. Chemical Science Review and Letters. DOI:10.37273/chesci.cs122050121

Hamilton, D., C. Martin, M. Bennet, M. Hearnden and C.A. Asis, 2015. Effect of tree leaf N status and N application time on yield and fruit N partitioning of mango. In XI International Mango Symposium 1183 (pp. 161-166). DOI: 10.17660/ActaHortic.2017.1183.22

Husen S., E.Y Ishartati, M. Muhidin, D. D. Siskawardani, A. Rizky, A. Syaifudin and J. Onthong, 2021. Modified Off–Season Technology to the Flowering Time and Fruit Yield of Arumanis Mango (*Mangifera indica* L.). E3S Web Conf.Volume 226.The 1st International Conference on Bioenergy and Environmentally Sustainable Agriculture Technology (ICoN BEAT 2019). https://doi.org/10.1051/e3sconf/202122600045

Ibrahim, W. M., H. E. Elzayat, F. K. M. Shaaban and A. M. R. A. Abdelaziz, 2022. Effect of some bio stimulants on mango fruit drop and quality. Egyptian Journal of Agricultural Research, 100(3): 381-393. https://doi.org/10.21608/ejar.2022.128707.1218

Kondo, S., 2009. Roles of jasmonates in fruit ripening and environmental stress. In XI International Symposium on Plant Bio regulators in Fruit Production 884 (pp. 711-716). DOI: 10.17660/ActaHortic.2010.884.96

Kishore, K., H. S. Singh, D. Sharma, T. R. Rupa, R. M. Kurian and D. Samant, 2019. Influence of paclobutrazol on vegetative growth, nutrient content, flowering and yield of mango (*Mangifera indica* L.) and its residual dynamics. Journal of Agricultural Science and Technology, 21(6), 1557-1567. 20.1001.1.16807073.2019.21.6.19.8

Maloba, S., J. Ambuko, M. Hutchinson, and W.O. Owino, 2017. Effects of ethephon and potassium nitrate on off-season flower induction in mango. Research Application Summary, 241- 246.

Maklad, T. N., O. A. O. El-Sawwah and S. A. Nassar, 2020. Effect of calcium, zinc and boron treatments on flowering, yield and fruit quality of mango Ewais cultivar. Journal of Plant Production, 11(12): 1463-1468. DOI:10.21608/JPP.2020.149819

Morales-Martinez, M., P. A. Moscoso-Ramírez, M. Castelán-Estrada, and A. Contreras-Oliva, 2020. Effect of nitrates alone or with paclobutrazol on flowering induction and production in mango Cv. Tommy Atkins. Biotecnia, 22(2): 20-27. https://doi.org/10.18633/biotecnia.v22i2.1242

Morales-Payan, J. P., 2013. Influence of foliar sprays of an amino acid formulation on fruit yield of 'Edward' Mango. In X International Mango Symposium 1075 (pp. 157-159). Doi: 10.17660/ActaHortic.2015.1075.17

Mudo, L. E. D., J. T. Lobo, D. De Almeida Carreiro, J. A. Cavacini,, L. Dos Santos Silva and Í. H. L. Cavalcante, 2020. Leaf gas exchange and flowering of mango sprayed with bio stimulant in semi-arid region. Revista Caatinga, 33, 332-340. https://doi.org/10.1590/1983-21252020v33n206rc

Muengkaew, R., P. Chaiprasart and I. Warrington, 2016. Changing of physiochemical properties and color development of mango fruit sprayed methyl Jasmonate, Scientia Horticulturae, 198, 70-77. https://doi.org/10.1016/j.scienta.2015.11.033.

Muengkaew, R., P. Chaiprasart and P. Wongsawad, 2017. Calcium-Boron Addition Promotes Pollen Germination and Fruit Set of Mango. International Journal of Fruit Science, 17(2):147–158. https://doi.org/10.1080/15538362.2016.1259085

Nautiyal, P., V. Supyal, A. S. Rathore, E. Singh, A. Chaudhary, S.Rayeen, S. Pal, A. Tiwari, S. Khaniya and N. Deo (2022). Causes and control of flower drop in fruit crops. The Pharma Innovation Journal, 11(2): 1165-1168.

Nyoman Rai, I., R. Poerwanto, L.K. Darusman and B.S. Purwoko, 2008. Flower and Fruit ABA, IAA and Carbohydrate Contents in Relation to Flower and Fruit Drop on Mangosteen Trees. In IV International Symposium on Tropical and Subtropical Fruits 975 (pp. 323-328). DOI:10.17660/ActaHortic.2013.975.39

Oliveira, G.P., D. L. de Siqueira, L. C. C. Salomão, P. R. Cecon and D.L.M. Machado, 2017. Paclobutrazol and branch tip pruning on the flowering induction and quality of mango tree fruits. Pesquisa Agropecuária Tropical, 47(1), 7-14. https://doi.org/10.1590/1983-40632016v4743861

Oliveira, M. B., M.G. F. Figueiredo, M. C. T. Pereira, M. A. do Carmo Mouco, L. M. Ribeiro and M. O. Mercadante-Simões, 2020. Structural and cytological aspects of mango floral induction using paclobutrazol, Scientia Horticulturae, 262, https://doi.org/10.1016/j.scienta.2019.109057.

Oldoni, F.C.A., A. M. N. Lima, Í. H. L. Cavalcante, K. dos Santos M. de Sousa, M. A. Carneiro and I. R. B. de Carvalho, 2018. Boron fertilizing management on fruit production and quality of mango Cv. Palmer in semiarid. Revista Brasileira de Fruticultura, 40, e-622. https://doi.org/10.1590/0100-29452018622

Persello, S., I. Grechi, F. Boudon, F. Normand, 2019. Nature abhors a vacuum: Deciphering the vegetative reaction of the mango tree to pruning,European Journal of Agronomy, 104, 85-96. https://doi.org/10.1016/j.eja.2019.01.007.

Pérez, V., M. Herrero and J. I. Hormaza, 2019. Pollen performance in mango (*Mangifera indica* L., Anacardiaceae): Andromonoecy and effect of temperature. Scientia Horticulturae, Elsevier BV. http://doi.org/10.1016/j.scienta.2019.04.070

Pérez-Barraza, M. H., E. Avitia-García, R. Cano-Medrano, M. A. Gutiérrez-Espinosa, T. Osuna-Enciso and A. I. Pérez-Luna, 2018. Temperature and gibberellin inhibitors in the flowering process of 'Ataulfo' mango. Revista Fitotecnia Mexicana, 41(4A), 543-549. https://www.scielo.org.mx/pdf/rfm/v41n4a/0187-7380-rfm-41-4a-543.pdf

Srinivasa Rao, N.K., K.S. Shivashankara and R. H. Laxman, 2016. Abiotic stress physiology of horticultural crops (Vol. 311). New Delhi, India: Springe P: 169-181. https://link.springer.com/content/pdf/10.1007/978-81-322-2725-0.pdf

Ravishankar, H., N Sharma and V.K. Singh, 2021. The mango genome. In. Kole, Chittaranjan (ed) Alternate flowering in mango, Homestead; Springer, P95-110. https://link.springer.com/series/11805

Reyes-Díaz, M., T. Lobos, L. Cardemil, A. Nunes-Nesi, J. Retamales, L. Jaakola, M. Alberdi and A. Ribera-Fonseca, 2016. Methyl Jasmonate: An Alternative for Improving the Quality and Health Properties of Fresh Fruits. Molecules, 31;21(6):567. doi: 10.3390/molecules21060567.

Sajid, M., A. Basit, Z. Ullah, *et al*., 2020. Chitosan-based foliar application modulated the yield and biochemical attributes of peach (*Prunus persica* L.) cv. Early Grand. Bull Natl Res Cent., 44, 150. https://doi.org/10.1186/s42269-020-00405-w

Saleem, B. A., A. U. Malik, M. A. Pervez and A. S. Khan, 2008. Growth regulators application affects vegetative and reproductive behavior of 'Blood Red' sweet orange. Pak. J. Bot., 40(5), 2115- 2125.

Sarkhosh, A., C. McConchie and A. Khadivi, 2018. The effects of different tip-pruning times on flowering, yield, and maturity of two mango cultivars in subtropical climate of Northern Territory (Katherine region) from Australia, Scientia Horticulturae, 234, 140-145. https://doi.org/10.1016/j.scienta.2018.02.039.

Silva, K. K. A., E. O. Ono, M. A. do Carmo Mouco, G. J. Nogueira, R. J. M. de Souza, N. C. da Silva, and R.D.C.B. da Silva, 2014. Uniconazole in the flowering and production of mango (Mangifera indica L.) cv. Palmer.. Magistra, 26(4), 505-514. https://www.alice.cnptia.embrapa.br/alice/bitstream/doc/1016806/1/Mouco2014.pdf

Simões, W. L., M. de Andrade, V. Pimenta, do Carmo Mouco, M. Aparecida, C. de Sousa, J. Sebastião, F. de Lima and J. Ricardo, 2021. Production and quality of Kent Mango (*Mangifera indica* L.) under different irrigation systems in the Semi-Arid Northeastern Brazil. Revistaem Agronegocio e Meio Ambiente, 14(2). doi.10.17765/2176-9168.2021v14n2e7832

Singh, S.R., L. Wangchu, B. Singh, B. N. Hazarika and A. K. Pandey, 2017. Effect of PGRs combination on pre-harvest fruit drop of Khasi mandarin (Citrus reticulata Blanco.). Indian Journal of Agricultural Research, 51(2): 167-172. DOI:10.18805/ijare.v0iOF.7635

Spreer, W., S. Ongprasert, M. Hegele, J. N. Wünsche and J. Müller, 2009. Yield and fruit development in mango (Mangifera indica L. cv. Chok Anan) under different irrigation regimes, Agricultural Water Management, 96, Issue 4, 574-584. https://doi.org/10.1016/j.agwat.2008.09.020.

Sun, Y., B. Christensen, F. Liu, *et al.*, 2009. Effects of ethylene and 1-MCP (1-methylcyclopropene) on bud and flower drop in mini *Phalaenopsis* cultivars. Plant Growth Regul., 59, 83–91. https://doi.org/10.1007/s10725-009-9391-y

Tenreiro, I.G.P., 2020. Sources and methods of calcium application on the productivity and fruit quality of mango in the Lower-Middle São Francisco Valley. M.Sc. Dissertation – Federal University of São Francisco Valley, Petrolina, 73 p. https://producaovegetal.univasf.edu.br/Arquivos/igor.pdf

Teixeira Lobo, J., Í. H. Lucena Cavalcante, , A. M. Nascimento Lima, Y. A. Carvalho Vieira, P. I. Rodrigues Modesto and J. Gomes da Cunha, 2019. Biostimulants on Nutritional Status and Fruit Production of Mango 'Kent' in the Brazilian Semiarid Region. HortScience, 54(9), 1501–1508. https://doi.org/10.21273/HORTSCI13753-18

Zaghloul, A., H. Ennab and M. El-Shemy, 2017. Influence of kaolin sprays on fruit quality and storability of Balady Mandarin. Alexandria Science Exchange Journal, 38(October-December), 661 670. DOI:10.21608/ASEJAIQJSAE.2017.4102