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Effects of Gibberellic Acid on Fruit Growth and Fruit Development of Mangosteen (*Garcinia mangostana* Linn.)

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Abstract The different concentrations of gibberelic acid (GA_3) applied by spraying on the 15-year-old magosteen trees during the full bloom and fruit setting stage. The study was conducted at the Chumphon Research and Training Centre, Faculty of Agriculture, Rajamangala University of Technology Srivijaya, Chumphon province from Mach, 2009 to Mach, 2010. The experiment was used the Completely Randomized Design (CRD) with 5 replications. The different GA_3 concentrations were evaluated: 0 25 50 75 and 100 ppm. The results of the study showed no significant differences among treatment means between GA_3 applied in different concentrations with control in parameter of fruit size (width and length) and fruit weight during fruit growth and fruit development at 15-45 days. After 60-120 days, the result showed differences among treatment means between GA_3 applied in different concentrations with control in parameter of fruit size (width and length) and fruit weight. Also, the different concentrations of GA_3 was affect of peel weight and aril weight. The total soluble solid (TSS) was recorded data that there is no significance found on the sweetness of fruit obtained from both treated and untreated trees.

Keywords: mangosteen, gibberellic acid, GA_3**,** fruit growth**,** fruit development

Introduction

Garcinia mangostana Linn. (Mangosteen), family Guttiferae, is named as the 'Queen of tropical fruit' because it is one of the best tasting fruits in the world. It can be cultivated in tropical areas especially in Thailand, Malaysia, the Philippines and Indonesia. Nowadays mangosteen is important in economically of Thailand for exported to Asia and Western countries. The volume of production in Thailand is increasing from 1991 the export recorded 31.27 M baht increasing to 700 M baht in the year 2009 (Department of Interior Commercial, 2009). The area of mangosteen planting also increasing the data

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was recorded 72,197 rais (11,551.52 hectares) in 1985 and increasing to 300,000 rais (48,00 hectares) in 2009 (Department of Agricultural Extension, 2000). The problem in mangosteen production in Thailand in nowadays the low quality of mangosteen fruit for example the weight of fruit are lower standard, because the farmer they lack of knowledge of mangosteen production and then if they had a knowledge for improved the quality of products by using the some chemical to increased standard mangosteen fruit, they can get the high profit. The plant growth regulators (GA_3) exogenously applied to tomato plant it was stimulated and cell enlargement in embryo seed and peel of tomato (Varga and Bruinsma, 1986). Also if we trail to use this chemical to the mangosteen plant for the effect of fruit growth and development, it will be to improved the quality of mangosteen.

The objectives of the study were assessed the effects of GA3 on fruit growth and development of mangosteen and determined the optimum rate of GA3 that could increase the size of fruit and yield mangosteen.

Materials and methods

Plant materials

The experiment was conducted at the Chumphon Research and Training Centre, Faculty of Agriculture, Rajamangala University of Technology Srivijaya, Chumphon province, the southern of Thailand. Fifteen-year–old field-grown mangosteen trees were used in this study from April, 2009 to Mach, 2010. Plants under investigation were grown in the same location and were subject to rigorously similar cultural practices.

Treatments

A completely randomised design (CRD) with single tree plots replicated five times, a total of 25 mangosteen trees were used as experimental units where one tree represent a replicate of the different treatments. The treatments included untreated trees (0 ppm) and gibberelic acid (GA_3) treated trees at 25, 50, 75 and 100 ppm, the compound was applied as foliar sprays 50 litre of aqueous solution was sprayed to canopy into a 1 tree, during the full bloom and fruit setting stage in April, 2009.

Data recording and analysis

Fruit size was examined after sprayed GA_3 at different concentrations, the fruit size (width and length) of mangosteen fruits will be collected 25 fruits per tree and determined at 15, 30, 45, 60, 90 and 120 days.

Fruit weight was examined after sprayed GA_3 at different concentrations, the fruit weight of mangosteen fruits will be collected 25 fruits per tree and determined at 15, 30, 45, 60, 90 and 120 days.

Fruit quality was examined at the harvesting time of mangosteen fruits at 120 days will be collected 25 fruits per tree to determined of the aril/peel and Total Soluble Solid (TSS)

The data were analyzed for significant statistical differences using program-R and treatment means were statistically compared using Duncan's Multiple Range Test (DMRT)

Results and discussion

Fruit Size

The different concentrations of GA_3 applied on mangosteen trees did not affect the fruit size from 15 days up to 45 days period of application. However, noticeable effect was noted from 60 up to 120 days period of application as shown on Table 1. However, the effect of GA_3 concentration was showed from 60 and 120 days of application, comparable width and length of fruit was affected from trees applied with GA_3 concentration 25, 50, 75 and 100 ppm which are significantly wider and longer than the control. On the other hand, the data was also noted on the treated with different concentrations of GA_3 after 60 and 120 days which produced comparable size of fruit that are relatively longer and wider than the fruits obtained from the control.

Fruit Weight

The different concentrations of GA_3 applied on mangosteen trees did not affect the fruit weight from 15 days up to 45 days period of application. However, noticeable effect was noted from 60 up to 120 days period of application as shown on Table 2. Interestingly, mangosteen trees applied with GA_3 from 25 to 100 ppm produced comparable mean weight of fruit range from 44.88 g to 51.50 g and significantly increased after 120 days of application with a recorded mean weight ranging from 85.16 to 89.39 g. The weight of mangosteen fruits obtained from treated trees was found significantly heavier

compared with the control trees with mean weight of 44.21 and 79.25 g at 60 and 120 days application of GA_3.

Table 1. Fruit size (cm) of mangosteen fruit as affected by different concentrations of GA_3

Concentrations (ppm)	Time after spraying of GA_3 (days)											
	15		30		45		60		90		120	
	W	L	W	L	W	L	W	L	W	L	W	L
Control	2.30	2.31	2.93	2.91	3.69	3.57	4.24^{c}	4.19^{c}	4.95^{c}	4.90^{c}	5.49^{b}	5.27^{b}
25	2.33	2.32	3.030	3.01	3.71	3.62	4.49^{ab}	4.56^{ab}	5.12^{b}	5.10^{b}	5.74^{a}	5.36^{ab}
50	2.34	2.31	3.12	3.08	3.75	3.66	4.71^{a}	4.89^{a}	5.37^{a}	5.34^{a}	5.83^{a}	5.71^{a}
75	2.32	2.30	3.03	3.01	3.71	3.67	4.63^{a}	4.83^{a}	5.35^{a}	5.32^{a}	5.80^{a}	5.67^{a}
100	2.31	2.31	2.96	2.92	3.72	3.69	4.65^{a}	4.77^{a}	5.34^{a}	5.30^{a}	5.75^{a}	5.57^{a}
F-test	ns	ns	ns	ns	ns	ns	*	*	**	**	**	**
CV.(%)	3.10	3.99	3.9	3.85	3.44	2.74	4.58	3.90	3.01	3.14	3.26	3.07

Remark : W = width , L = length

Means with different letter in each column were significantly different at ($p \leq 0.05$) tested by DMRT

Table 2. fruit weight (g) of mangosteen fruit as effected by different concentrations of GA_3

Concentrations (ppm)	**Days after spraying of GA_3**					
	15	**30**	**45**	**60**	**90**	**120**
Control	10.45	17.97	29.97	44.21^{c}	78.04^{b}	79.25^{c}
25	10.98	18.03	30.16	44.88^{b}	79.51^{ab}	85.16^{ab}
50	11.30	20.59	30.87	51.50^{a}	83.35^{a}	89.39^{a}
75	11.00	20.02	30.14	50.79^{a}	83.21^{a}	88.86^{a}
100	10.98	19.46	30.32	49.87^{a}	81.89^{ab}	85.18^{ab}
F-test	ns	Ns	ns	*	*	**
CV. (%)	3.51	4.41	3.88	3.36	3.61	5.05

Means with different letter in each column were significantly different at ($p \leq 0.05$) tested by DMRT

Fruit Quality

The mangosteen fruits harvested at 120 days of GA_3 application were used and served as the bases of gathering the data for aril weight, peel weight. As presented on Table 3, application of different GA_3 concentrations ranging from 25-100 ppm showed a significant effect on mangosteen fruits. The aril weight and peel weight of mangosteen fruits obtained from treated trees was found significantly heavier compared with the control trees. This is evident based from the recorded data that there is significance found on the weight of aril and weight of peel of fruit obtained from the treated and untreated trees. The total soluble solid (TSS) was recorded data that there is no significance found on the sweetness of fruit obtained from both treated and untreated trees.

Table 3. Effects of GA3 at different concentrations on fruit weight (g), aril weight(g), peel weight (g) and TSS (^{0}Brix) of Mangosteen at the harvesting time (120 days)

Concentrations (ppm)	**Harvesting time (120 days)**			
	fruit weight(g)	**aril weight(g)**	**peel weight(g)**	**TSS(^{0} Brix)**
Control	79.25^{c}	29.36^{c}	49.89^{c}	19.52
25	85.16^{ab}	30.22^{ab}	54.94^{a}	19.91
50	89.39^{a}	32.18^{a}	57.21^{a}	20.01
75	88.86^{a}	32.00^{a}	56.86^{a}	19.92
100	85.18^{ab}	31.22^{a}	53.96^{ab}	19.61
F-test	**	**	**	ns
CV.(%)	5.05	6.38	4.86	4.93

Means with different letter in each column were significantly different at ($p \leq 0.01$) tested by DMRT

The growth and development of mangosteen fruit in terms of size and weight was determined through application of different GA_3 concentration applied by spraying at the full boom and fruit setting stage, after 15, 30, 45, 60, 90 and 120 days. The result of fruit growth and development on fruit width, fruit length and fruit weight were showed the direction of fruit growth and development related together. The average mean of fruit growth and development the result of all treatments significant different with control after 60 to 120 days. According of the reported of Varga and Bruinsma (1986), Mapelli *at al*. (1978) the effected of GA_3 to stimulated of cell division and cell enlargement in seeds and embryo of tomato fruit and also the reported of

Thongin (1998) the effected of GA_3 on fruit growth and development of guava at concentration 0, 50, 100, and 200 ppm the result of the experiment were showed the effect of GA_3 on fruit size (fruit width and fruit weight) different significant between control with all of treatments. The aril weight and peel weight at the harvesting time were showed the average of among means significant different of all treatment GA^3 applied, that mean the GA_3 were effected to increase the aril weight and peel weight, but were not affected to the TSS.

Conclusion

Base from the results of the study, the size and weight of mangosteen fruits could be improved through the application of GA_3 at minimum concentration of 50 ppm and should be harvested after 120 days of application.

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