Journal of Agricultural Technology 2016 Vol. 12(7.1):1261-1266
Available online http://www.ijat-aatsea.com
ISSN 1686-9141

Effect of Petroleum Oil on Fruit Development of Mangosteen (*Garcinia mangostana* Linn.)

Chit-aree Loetchai[1], Khampet Werawat[1], Sringenngarm Tana[1], Prathumyot Wikanya[1], Frank B. Matta[2]

[1] Faculty of Agricultural Technology, Rambhi barni Rajabhat University
[2] Department of Plant and Soil Science, Mississippi State University

Chit-aree L., K. Werawat, S. Tana, P. Wikanya, F. B. Matta (2016). Effect of Petrolium Oil on Fruit Quality of Mangosteen (*Garcinia mangostana* Linn.). Journal of Agricultural Technology 12(7.1):1259-1264.

The effect of petroleum oil on fruit development of mangosteen was investigated. Four concentrations (0, 1.5, 2 and 2.5 ml/L) of petroleum oil were sprayed on 16 mangosteen trees. The petroleum oil was sprayed at one week intervals four times when the flowers started to bloom. The following data was collected every two weeks following treatment application; fruit width, fruit length, fruit fresh weight, fruit dry weight, peel thickness, and pulp diameter. Results showed that there was no significant difference among treatments. However, the quality of treated fruit trended to be higher than that of the control.

Keywords: Mangosteen, Petrolium oil, Fruit quality

Introduction

Mangosteen (*Garcinia mangostana* Linn.) is an important exported fruit of Thailand. Because of its unique shape and good taste, this fruit is very popular among Thai people and foreigners so that it is known as the queen of fruit. Scientists discovered various antioxidants in mangosteen, especially xanthone (Office of agricultural research and development region 8). Thus, mangosteen is being utilized as a medicinal fruit. The first priority in consumption of mangosteen is food safety, since mangosteen trees are sprayed with pesticides to control insects and diseases. A major problem in mangosteen production is fruit damage by thrips which are presently controlled with pesticides. Several insect control methods have been investigated including petroleum oil (Affandi and Emilda, 2009; Affandi and Emilda, 2010; Sdoodee *et al*., 2006).

Petroleum oil is well-known as a plant protectant and is used as a pesticide in the production of many plants including mangosteen (Rae *et al*., 1997;Najar-Rodriguez *et al*., 2007; Najar-Rodriguez *et al*., 2008). It is an

Coressponding Author: Chit-aree L. **E-mail:** loetchai151980@hotmail.com

Aricultural 12no7.1(1261-).indd 1261 19/12/2559 22:49:25

organic compound solution that is considered safe for farmers and consumers. Most petroleum oil studies on mangosteen involved insect control and did not include studies on fruit growth. Therefore, the purpose of this experiment was to investigate mangosteen fruit development as influenced by petroleum oil.

Materials and methods

The experiment was conducted from February to May 2016 at Makham, Chanthaburi province (east of Thailand). Sixteen mangosteen trees, approximarely 20 years old and 5m in height were selected for the treatment. Four mangosteen trees were used for each treatment. Four concentrations (0, 1.5%, 2% and 2.5% v/v) of petroleum oil in water were sprayed on the plants 4 times (at flowering and 1, 2 and 3 weeks after flowering). After spraying, 10 fruits per tree were collected every two weeks for 10 weeks. Width, length, and fresh weight of fruit were recorded. Then fruit were cut and peel thickness and pulp diameter were measured. The cut fruit were dried at 80°C in an oven for 3 days then fruit dry weight was recorded. All results were analyzed by analysis of variance and means separated by Duncan's multiple range test (DMRT).

Results

Fruit width of mangosteen gradually increased with time after petroleum application. Fruit width at week 10 ranged from 45.27 to 50.12 mm depending on treatment. However, there was no significant difference among treatments. (Table 1).

Fruit height, also increase with time after application of petroleum oil depending on treatment. However, there was no significant difference among treatments, except on week 6th when 2% petroleum oil resulted in 46.03 mm. (Table 2).

Table. 1 Effect of petroleum oil on mangosteen fruit width.

Treatment	Fruit width (mm)					
	0 wk	2 wk	4 wk	6 wk	8 wk	10 wk
Petroleum oil 0%	27.19	34.32	37.16	42.02	46.06	45.27
Petroleum oil 1.5%	27.46	34.12	37.06	41.15	48.24	50.12
Petroleum oil 2%	27.55	35.46	39.81	41.85	47.24	48.67
Petroleum oil 2.5%	28.06	35.99	36.23	43.80	48.73	46.18
F-test	ns	ns	ns	ns	ns	ns

ns = not significant at $P \leq 0.05$.

Aricultural 12no7.1(1261-).indd 1262 19/12/2559 22:49:25

In contrast to fruit width and fruit height, peel thickness decreased with time of petroleum oil application. However, there was no significant difference among treatments, except at 8 weeks after petroleum oil application where 2.5% petroleum oil significantly increased peel thickness compared to the control (0 % petroleum oil) (Table 3).

Table. 2 Effect of petroleum oil on mangosteen fruit height weeks after sampling.

Treatment	Fruit height (mm)					
	0 wk	2 wk	4 wk	6 wk	8 wk	10 wk
Petroleum oil 0%	27.54	38.15	40.07	44.06^{ab}	44.06	44.11
Petroleum oil 1.5%	27.89	41.23	40.85	44.76^{ab}	44.89	45.91
Petroleum oil 2%	28.24	34.98	43.61	43.44^{b}	44.71	46.10
Petroleum oil 2.5%	27.18	38.84	39.29	46.03^{a}	45.93	44.75
F-test	ns	ns	ns	*	ns	ns

Means with different letters in each column are significantly different (P≤0.05) according to DMRT. *significant at P≤0.05; ns = not significant at P≤0.05

Table. 3 Effect of petroleum oil on peel thickness weeks after sampling.

Treatment	Peel thickness (mm)					
	0 wk	2 wk	4 wk	6 wk	8 wk	10 wk
Petroleum oil 0%	8.65	7.45	7.59	7.21	6.14^{b}	5.86
Petroleum oil 1.5%	8.69	8.47	7.68	7.40	6.54^{ab}	6.32
Petroleum oil 2%	8.77	8.49	9.89	7.55	6.78^{ab}	6.26
Petroleum oil 2.5%	8.49	8.47	7.93	7.57	7.15^{a}	6.53
F-test	ns	ns	ns	ns	*	ns

Means with different letters in each column are significantly different (P≤0.05) according to DMRT. *significant at P≤0.05; ns = not significant at P≤0.05.

Pulp diameter of mangosteen gradually increased with time after petroleum oil application. However, there was no significant difference among treatments (Table 4). At week 10 after petroleum oil application pulp diameter ranged from 33.41 mm for 2.5% petroleum oil to 37.78 mm for 1.5% petroleum oil. Zero % petroleum oil resulted in 33.87 mm pulp diameter.

Fruit fresh weight of mangosteen increased with time after petroleum oil application. However, there was no significant difference between treatments,

Aricultural 12no7.1(1261-).indd 1263 19/12/2559 22:49:25

except, at 0 wk where 2.5% petroleum oil resulted in 17.43 g fruit weight compared to the control with 13.70 g and 1.5% petroleum oil with 13.98 g. At 10 wk after petroleum oil application, fruit weight ranged from 50.39 g for the control to 64.17 g for 1.5 % petroleum oil (Table 5).

Table. 4 Effect of petroleum oil on pulp diameter of mangosteen week after sampling**.**

Treatment	Pulp diameter (mm)					
	0 wk	2 wk	4 wk	6 wk	8 wk	10 wk
Petroleum oil 0%	12.61	19.43	25.96	29.86	33.50	33.87
Petroleum oil 1.5%	12.72	18.33	25.70	29.77	34.56	37.78
Petroleum oil 2%	12.83	18.90	27.90	29.67	34.04	35.32
Petroleum oil 2.5%	12.50	19.38	24.75	29.87	34.73	33.41
F-test	ns	ns	ns	ns	ns	ns

ns = not significant at P≤0.05.

Table. 5 Effect of petroleum oil on fresh weight of mangosteen fruit weeks after sampling.

Treatment	Fruit fresh weight (g)					
	0 wk	2 wk	4 wk	6 wk	8 wk	10 wk
Petroleum oil 0%	13.70^{b}	23.12	38.21	44.67	50.54	50.39
Petroleum oil 1.5%	13.94^{b}	23.86	38.51	46.44	57.94	64.17
Petroleum oil 2%	16.10^{ab}	25.49	46.71	48.33	54.06	57.85
Petroleum oil 2.5%	17.43^{a}	26.88	36.22	50.03	60.13	54.13
F-test	*	ns	ns	ns	ns	ns

Means with different letters in each column are significantly different (P≤0.05) according to DMRT. *significant at P≤0.05; ns = not significant at P≤0.05.

The treated mangosteen trees showed higher fruit dry weight in comparison with that of the control fruits. The dry weight was highest in fruits of mangosteen trees treated by 1.5% petroleum oil while the lowest fruit dry weight was found in the result of the control fruits (Table 6).

Aricultural 12no7.1(1261-).indd 1264 19/12/2559 22:49:26

Table. 6 Effect of petroleum oil on fruit dry weight. Weeks after sampling.

Treatment	Fruit dry weight (g)					
	0 wk	2 wk	4 wk	6 wk	8 wk	10 wk
Petroleum oil 0%	3.49[b]	6.52	10.11	11.56	15.94	17.06
Petroleum oil 1.5%	3.66[b]	6.87	10.60	12.67	18.09	24.44
Petroleum oil 2%	4.05[ab]	7.64	13.06	12.41	17.02	20.21
Petroleum oil 2.5%	4.56[a]	7.77	9.84	14.09	19.50	18.35
F-test	*	ns	ns	ns	ns	ns

Means with different letters in each column are significantly different (P≤0.05) according to DMRT.
*significant at P≤0.05; ns = not significant at P≤0.05

Discussions

Beattie (2005) reported that petroleum-based spray oils offer many benefits compared to broad spectrum pesticides. Petroleum oils are as effective or more effective than broad spectrum synthetic pesticides for the control of a wide range of pests and diseases. Many pests can be controlled simultaneously. Petroleum oils have less harmful effects on the natural enemies of citrus pests. and do not stimulate other pest outbreaks. Pests do not develop resistance to broad spectrum pesticides (Beattie, 2005). According to Sdoodee et. al.(2006), petroleum oil spray at concentration of 2% was the most effective in thrip control followed by the treatment of petroleum oil spray concentration of 1% and the both treatments were not significantly different from insecticide spray treatments. Thongier, T. and J., Thongier (2014) also founded that the spraying mangosteen trees with petroleum oil at 83.9%EC + Thai neem aza at 0.5%, petroleum oil at 83.9%EC + tobacco at 3%, and petroleum oil at 83.9%EC + derris 1% were more than 90% effective in controlling thrips. In this experiment thrip control was not reported. However, in this experiment petroleum oil ranging from 1.5% to 2.5% did not have a detrimental effect on fruit growth as measured by fruit width, fruit height, peel thickness, pulp diameter, and fruit fresh weight indicating that petroleum oil at such concentrations is safe to use and still maintain adequate fruit growth and quality.

Aricultural 12no7.1(1261-).indd 1265 19/12/2559 22:49:26

References

Affandi and D. Emilda. (2009). Mangosteen thrips: collection, identification and control. Journal of fruit and ornamental plant research 17: 219-233.

Affandi and D. Emilda. (2010). Effect of mulching, sanitation and yellow fluorescent sticky trap application on population and critical attack period of thrip on mangosteen. Agrivita 32: 277-284.

Beattie, A. (2005). Using petroleum-based spray oil in citrus. Available at : http://www. dpi.nsw.gov.au. Office of agricutural research and development region 8. Available at : www.oard8.go.th/information/kpi/mangosteen/58/mgPDF/1.pdf

Najar-Rodriguez, A.J., G.H., Walter and R.K., Mensah. (2007). The efficacy of a petroleum spray oil against *Aphis gossypii* Glover on Cotton. Part 1: mortality rates and sources of variation, Pest Manag. Sci. 63: 586-595.

Najar-Rodriguez, A.J., N.A., Lavidis, R.K., Mensah, P.T., Choy and G.H., Walter. (2008). The toxicological effects of petroleum spray oils on insects-evidence for an alternative mode of action and possible new control options. Food Chem. Toxicol. 46: 3003-3014.

Rae, D.J., W.G., Liang, D.M., Watson, G.A.C., Beattie and M.D., Huang. (1997). Evaluation of petroleum spray oils for control of the Asian citrus psylla, *Diaphorina citri* (Kuwayama) (Hemiptera: Psyllidae), in China. International journal of pest management 43: 71-75.

Sdoodee, S., S., Chanaweerawan and M. Lim. (2006). Development the methods of enhancing fruit quality of mangosteen in Southern Thailand. Department of plant Science, Faculty of Natural Resources, Prince of Songkla University.

Thongier, T. and J., Thongier. (2014). The efficacies of plant extracts, bioinsecticides, oil and insecticides for controlling mangosteen thrips (Thysanoptera: Thripidae). Acta Hortic.

Wedding, R.T., L.A., Riehl and W.A. Rhoads. (1951). Effect of petroleum oil spray on photosynthesis and respiration in citrus leaves. Plant Physiology 27: 269-278.

Aricultural 12no7.1(1261-).indd 1266 19/12/2559 22:49:26