Influence of Pruning on Flowering, Yield and Fruit Quality of Longan

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Abstract

This study was carried out to evaluate the influence of pruning on floral emergence, fruiting, yield and fruit quality in longan. Fifteen years old "Daw" longan trees were pruned in June 2013 at Agricultural Technology Research Institute, Rajamangala University of Technology Lanna, Lampang province. The longan pruning for removing some branches consisted of 4 treatments, i.e. 25, 50 and 75 % compared with no pruning. The result revealed that there was no effect of treatment on floral emergence or leaf flushing after potassium chlorate application. However, the 25-75 % pruning gave greater new shoot length, leaf width and leaf greenness than that of no pruning. The pruning treatments increased fruit size while the highest pruning (75 %) decreased yield and the no pruning produced the lowest yield.

Keywords: Longan; Pruning; Flowering; Yield

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1. Introduction

Longan (*Dimocarpus longan* Lour.) is grown almost all the tropical and subtropical regions of Thailand where it is the largest exporter of longan (flesh, dried, frozen and canned fruits) in the world. The area under production in 2014 was 169,928 hectares which yielded approximately 994,904 metric tons (Office of Agricultural Economics, 2015). The general cultural practice to manage longan orchards in Thailand, trees are pruned annually promptly after harvest that the pruning can reduce insect and d isease problems, increase the ease for orchard management and fruit quality (Sritontip, 2013). Pruning is very effective method for stimulating new shoot growth in lychee (Menzel *et al*., 2002). The pruning is very important practice for longan orchard management. However the heavy pruning may decrease flowering and yield, while no pruning and very light pruning can not reduce canopy density or increase air penetration into canopy. Recently, there has been a trend toward size control or high density orchard system due to the scarcity of labor and high management cost for large size tree. A compact size tree is more convenient for pest and disease control, fruit thinning and fruit harvest. Moreover, pruning enhances leaf flushing and renews vegetative growth, as well as increases fruit size and quality (Sritontip, 2013).

The appropriate pruning is of the great economic benefit for northern longan growers. Branches and leaves removal have positive effect on sun light, air penetration and control size. Increased light interception offers the best method to increase leaf and whole canopy photosynthesis. Light is the single most important factor controlling the fixation of atmospheric carbon dioxide by the leaves for growth and development (Wünsche and Lakso, 2000). In apple tree, the photosynthetic process is necessary for carbohydrate production that more than 90% of the total dry matter produced from photosynthesis by leaves (Hansen, 1977). In sweet orange, it was found that pruning increased number of new shoots per branch and per tree (Sritontip *et al*., 2009). However, the optimum levels of pruning were not yet clear for grower management. Pruning strategy is an important role in such a vegetative growing system. Pruning is primarily aimed at maintaining good light exposure of all the canopy parts during the vegetative growth period (Lakso and Corelli-Grappadelli, 1992).

Normally, the potassium chlorate ($KClO_3$) can induce off season flowering in longan. The gardener can manage fruit product at almost any time of the year because of higher price received than that in normal season (Sritontip *et al.*, 2005a;

Sritontip *et al.*, 2005b). The heavy pruning is normally affected on alternate bearing in lognan, then $KClO_3$ can resolve that problem. However, the different degree of pruning conveys its effect on different vegetative growth and also time of mature leaf stage during for $KClO_3$ treatment of longan.

This research aimed to study on pruning levels on optimum growth and yield of longan orchard in the upper northern part of Thailand.

2. Materials and Methods

The 15-years old longan trees grown in field condition with 5x10 meter spacing were randomly selected. The experimental design used was a Completely Randomized Design (CRD), comprised of 4 replications and 4 treatments i.e. 1) no pruning, 2) 25% pruning, 3) 50% pruning, and 4) 75% pruning as shown in figure 1. Pruning treatments were carried out on July 10th, 2013 and the study was carried out from July 2013 to September 2014 at Agricultural Technology Research Institute, Rajamangala University of Technology Lannna, Lampang province. All longan trees were mini sprinkle irrigated, fertilized and managed according to a standard commercial practice. The fertilizer management had 3 times consisted of 1. After pruning putted 1 kg/tree 46-0-0, macro and trace element suggested by Khaosumain *et al*., (2013), 2. After fruit setting pruning gave 1 kg/tree 46-0-0 and 3. After fruit setting pruning gave 0.5 kg/tree 0-0-60. The potassium chlorate ($KClO_3$) was applied on November 10th, 2013 at the 20 g/m^2 $KClO_3$ rates for soil drench that the canopy width 4 m. length 5 m. total 20 m^2 the longan tree were treated 400 g $KClO_3$ (Sritontip *et al.*, 2005a; Sritontip *et al.*, 2005b).

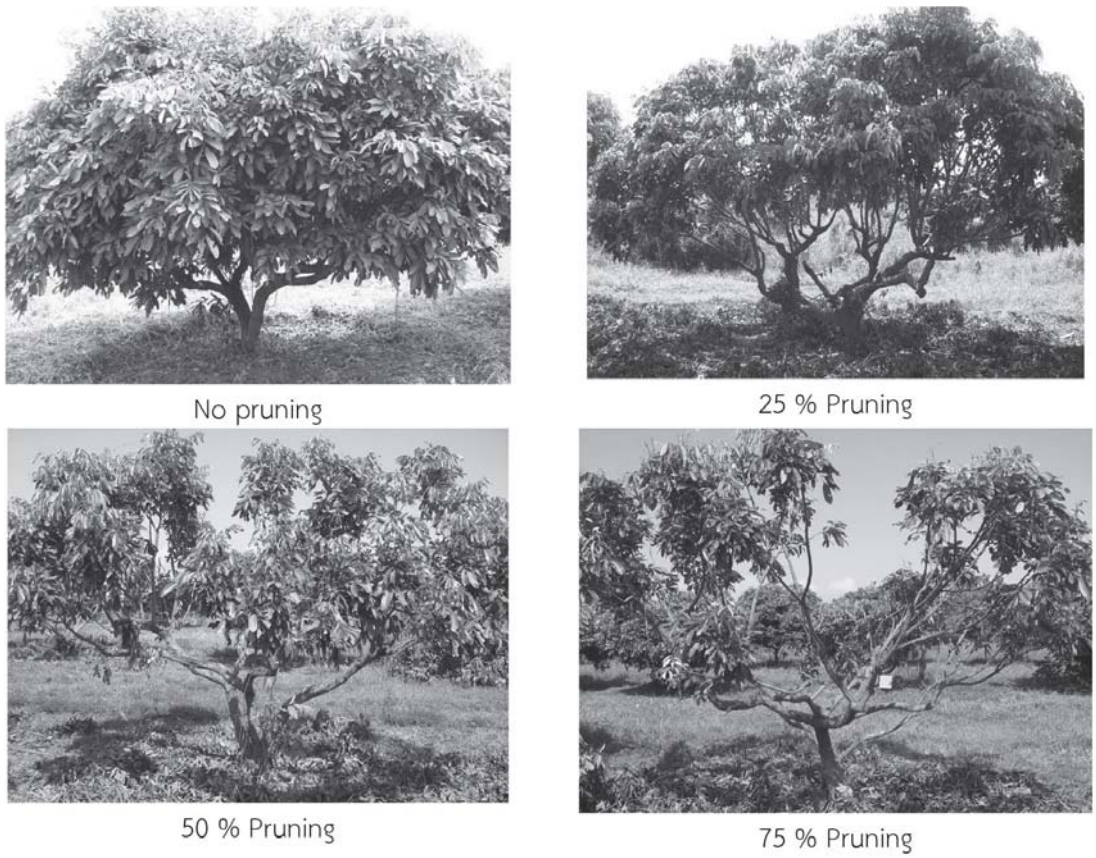

Figure 1 The pruning levels of experiment consisted of longan trees for the no pruning, 25%, 50% and 75% pruning

The collected data, the flower emer gences and leaf flushing were counted under 1 square meter 4 times around the trees (the north east south and west) after measurement the data were separate to percentage of flowering and percentage of leaf flushing. The growth of panicle and leaf flushing were collected as panicle length, panicle diameter, new shoot length; leaf width, leaf length and leaf green color (SPAD, Minolta, Japan),

The fruit quality after harvest was recorded as fruit width, fruit length, fruit thickness, number of fruit/panicle, panicle weight, yield, fruit parts (peel thickness, aril thickness and seed diameter) and total soluble solid (Hand refractrometer).

All parameters were subjected to statistical analysis of variance (ANOVA). Statistical differences with *p*-values less than 0.05 were considered significant and

the means were compared by Dunans's new multiple range test (DMRT).

3. Results and Discussion

After $KClO_3$ application, there were no significant differences among treatments on flowering percentage; leaf flushing percentage, panicle length or panicle diameter after application of pruning treatments on lognan trees (Table 1).

The 25-75 % pruning treatments increased new shoot length; leaf length and leaf green color when compared with no pruning. However, there was no effect on leaf width (Table 2).

Among the pruning levels, it was found that pruning treatments produced greater fruit width, fruit length and fruit thickness than no pruning (Table 3).

Table 1 Percentage of flowering and leaf flushing, panicle length and panicle width of longan trees after the application of pruning treatments

Treatments		Flowering (%)	Leaf flushing (%)	Panicle length (cm)	Panicle diameter (cm)
No	pruning	69.14	30.86	17.31	0.62
25%	pruning	77.90	22.10	20.72	0.74
50%	pruning	82.39	17.61	22.25	0.74
75%	pruning	76.31	23.69	22.63	0.80
F-test		NS	NS	NS	NS

* Mean within column with different alphabets differed significantly at P<0.05, NS=Non Significant

Table 2 New shoot length; leaf width, leaf length and leaf green color of longan trees after the application of pruning treatments

Treatments		New shoot length (cm)	Leaf width (cm)	Leaf length (cm)	Leaf green color
No	pruning	17.34b	4.12	13.67b	52.65c
25%	pruning	20.50a	4.21	14.18a	55.3b
50%	pruning	20.75a	4.36	14.56a	54.92b
75%	pruning	20.28a	4.57	14.82a	57.35a
F-test		*	NS	*	*

* Mean within column with different alphabets differed significantly at P<0.05, NS=Non Significant

Table 3 Effects of pruning levels on fruit width, fruit length and fruit thickness of longan after the application of treatments

Treatments	Fruit width (cm)	Fruit length (cm)	Fruit thickness (cm)
No pruning	2.65 b	2.25 b	2.26 b
25% pruning	2.74 a	2.38 a	2.40 a
50% pruning	2.74 a	2.48 a	2.45 a
75% pruning	2.75 a	2.49 a	2.46 a
F-test	*	*	*

* Mean within column with different alphabets differed significantly at P<0.05, NS=Non Significant

The pruning treatments had no effect on number of fruit/ panicle of longan. However, the 50 and 75 % pruning treatments increased panicle weight. The no pruning treatment had the lowest yield, while the 75 % pruning reduced yield (Table 4).

Table 4 Effects of pruning on number of fruit/panicle, panicle weight and yield of lognan trees after application of treatments

Treatments	Number of fruit/panicle	Panicle weight (g)	Yield (kg)
No pruning	25.00	261.37 b	12.50c
25% pruning	32.67	297.10 ab	28.75bc
50% pruning	25.50	346.35 a	47.50a
75% pruning	31.33	362.53 a	33.75ab
F-test	NS	*	*

* Mean within column with different alphabets differed significantly at P<0.05, NS=Non Significant

All treatments of pruning gave similar peel thickness, aril thickness, seed diameter and total soluble solid (TSS) of longan fruit (Table 5).

Table 5 Effects of pruning levels on fruit parts and total soluble solid after the application of treatment

Treatments	Fruit parts (cm)			TSS (°Brix)
	Peel thickness	Aril thickness	Seed diameter	
No pruning	0.08	0.60	1.40	17.88
25% pruning	0.09	0.63	1.42	18.81
50% pruning	0.08	0.66	1.45	18.50
75% pruning	0.08	0.64	1.46	17.69
F-test	NS	NS	NS	NS

* Mean within column with different alphabets differed significantly at P<0.05, NS=Non Significant

This experiment indicated that the pruning of longan trees produced vigorous for new shoot length, leaf size and leaf greenness when compared with no pruning, this was probably due to pruning stimulated terminal bud break in longan tree. The pruning longan trees had been a reduction in the top growth, gave a positive effect on light and air penetration into the canopy and decreased leaf and branch density while no pruning had light interception. Pruning cut promote local re-growth, which interacted with the natural growth and branching patterns (Costes *et al*., 2006). The branches and leaves removal from longan trees Increased light interception inner canopy. The experiment in apple found that leaves inner and middle canopy positions had photosynthesis efficiency (Fv/Fm) less than 75% of leaves in the outer canopy. (Li and Lakso, 2004). Leaf photosynthesis is the source of carbohydrates for vegetative growth and also fruit development. The all pruning longan trees increased panicle weight, yield, fruit width, fruit length and fruit thickness due to pruning trees remove out of shoot and leaf that it was positive effect on light distribution in canopy. The result confirmed by Diczbalis and Drinnan, (2007) reported that the pruning treatments increased in fruit size by thinning (6-17g) with helped to compensate for the loss in numbers of fruit to some extent, however total yield was still dramatically reduced. The research in "Sensation" mango reported that the 50 % thinned enhanced fruit weight when compared with no thinned (Davie and Stassen, 1997). The intensity of pruning with an early peach cultivar was important to improve light environment and vegetative growth which both increased fruit growth (Siham *et al.,* 2005). However, no pruning gave the lowest fruit production and also the heavy pruning level reduced fruit

production when compared with 25 and 50% pruning. This result was similar with Kumar *et al*. (2010) showed that the fruit yield decreased with the increase in severity of pruning in 'Flordaking' and 'Saharanpur' 'Prabhat' peaches, but fruit weight, size, TSS, sugar and acid content were significantly increased by pruning (Kumar *et al*., 2010). There was no beneficial of different types of pruning on of fruit peel thickness, aril thickness, seed diameter and TSS. The similar result with Savage *et al.* (1964) who studied in peach. Furthermore, fruit mass was greater for pruning strategy 25 generative buds, as compared to the pruning strategies 50 and 75 generative buds. However, yield efficiency and biennial bearing index were not affected by pruning strategies (Pavičić *et al*., 2004)

4. Conclusion

This research has shown that pruning levels of longan trees canopy produced the effect on some physiological changes but did not influence on flower emergence and leaf flushing percentage. Longan trees with 25-75 % pruning gave greater new shoot length, leaf width and leaf greenness than that of no pruning. The pruning treatments increased fruit size, while the highest pruning (75 %) decreased yield and the no pruning produced the lowest yield. Thus, it was suggested that the level of longan tree pruning would be 50 %.

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