Effect of Paclobutrazol with Ethephon on Flowering and Leaf Flushing of Lychee Cv. Hong Huay

Tawatchai Chaltrakulsub[1/], *Ryosuke Ogata*[2/] *and Suranant Subhadrabandhu*[3/]

Abstract : In November-December, 1989, single spray of paclobutrazol followed by two sequential sprays of ethephon at the concentration of 500:(300:300), 750:(400:400) and 1,000:(500:500) ppm. were applied on the half tree plot of the 8 years old lychee cv. Hong Huay, compared to the check on the other half and the untreated control trees which were not sprayed. The experiment was performed in the orchard at Mae Tang District, Chiang Mai, Thailand. It was found that, all treatments did not affect percentage of flowering and leaf flushing, while there was no different and no correlation between sprayside and non sprayside on the same lychee tree. In the meantime from October-November 1989, single spray of paclobutrazol followed by single sprays of ethephon at the concentration of 500:(300), 750:(400) and 1,000:(500) ppm. were applied on whole tree plot of the 6 years old lychee cv. Hong Huay, compared to the untreated control. The experiment was performed in the orchard at San Kum Pang District, Chiang Mai, Thailand. It was found that, paclobutrazol : (ethephon) 1,000:(500) ppm. reduced the percentage of leaf flushing about 10 percents compared to the untreated control, while all chemical treatments did not affect the percentage of flowering.

Index words : Paclobutrazol, Ethephon, Flowering, Leaf Lushing, Lychee

INTRODUCTION

Lychee is mainly grown in the northern part of Thailand, where the climate is classified as sub-tropical, it is known to be less adaptable than other crops. Selecting an suitable site for the required variety is essential for the profitable yields. It is essential that lychees must be grown in sites where conditions and management of the crop compliment with the trees natural fruiting cycle. Since lychee is rather sensitive to the growing conditions, so only few places in

1/ Faculty of Agriculture, Chiang Mai University, Chiang Mai 50200 THAILAND.

2/ Faculty of Agriculture, Utsunomiya University, Utsunomiya 321, JAPAN.

3/ Faculty of Agriculture, Kasetsart University, Bangkok 10900 THAILAND.

Thailand are suitable for producing lychee commercially(Subhadrabandhu, 1990). Even the most suitable location is selected for growing lychee, the lack of profuse and irregular flowering is the major problem. This problem has been attributed to several factors, although often there has been no obvious explanation(Menzel, 1983).

Improvment of genetic and new technique of cultural practice including application of plant growth regulators, are investigated but the results are variable. Menzel and Simpson (1990) concluded that the main reason of low and irregular cropping is excessive vegetative growth in the 1-2 months before panicle formation and subsequently poor flowering in spring. They tried to control excessive vegetative growth by the application of paclobutrazol as foliar spray at the concentration of 1,000-4,000 ppm. and soil drench at 0.25-1.00 gm. ai./m^2 tree ground cover. They found that lychee trees increased in flowering with paclobutrazol only when the growth retardant inhibited vegetative growth for 1-2 months before panicle emergence. There was no improvement in flowering when paclobutrazol merely delayed the vegetative flush.

However, ethephon was reported to increase lychee flowering in Thailand (Subhadrabandhu, 1986) and in China (Huang and Weng, 1978). Application of paclobutrazol or ethephon alone were reported to increase flowering in many fruit tree, whereas some scientists reported to use paclobutrazol plus ethephon for increasing flowering in pear (Jaumien, *et al.*, 1986 b).

There are several experiments indicating the use of more than one growth regulator to be better than when each was applied separately for the increase in the flowering of fruit crops. Such as, the SADH and ethephon in combination could promote flowering in apple (Karaszewska, *et al.*, 1986; Sansavini and Bonomo, 1986; Bangerth, *et al.*, 1986).

The object of experiment reported hear was to evaluate the effects of annual paclobutrazol and ethephon applied in combination treatments, on flowering and vegetative flushing of lychee cv. Hong Huay in the northern part of Thailand.

MATERIALS AND METHODS

First trial

The 8 years old lychee cv. Hong Huay were used as the half tree plot (half tree = 1 experimental unit) in unequal replication of completely randomized design (10-12 replications).

The combination of single spray of paclobutrazol followed by two sequential sprays of ethephon were tested. The treatments on half tree plot are as follow :

Treatment 1 - control

Treatment 2 - paclobutrazol : ethephon - 500 : (300 : 300)

Treatment 3 - paclobutrazol : ethephon - 750 : (400 : 400)

Treatment 4 - paclobutrazol : ethephon - 1,000 : (300 : 300)

Treatment 5 - check 1 (untreated on another side of treatment 2)

Treatment 6 - check 2 (untreated on another side of treatment 3)

Treatment 7 - check 3 (untreated on another side of treatment 4)

Application date :

paclobutrazol - 15 December, 1989.

ethephon 1st spray - 25 November, 1989.

ethephon 2nd spray - 22 December, 1989.

Location : Mae Tang district Chiang Mai, Thailand. Latitude 19°15' North.

Second trial

The 6 years old lychee cv. Hong Huay were used as the whole tree plot (one tree = 1 experimental unit) in unequal replication of completely randomize design (11-12 replications).

Single spray of paclobutrazol followed by single spray of ethephon at the concentration of 500 : (300), 750 : (400) and 1,000 : (500) ppm. were tested compared to the untreated control.

Application date : paclobutrazol - 30 October, 1989.

ethephon - 15 November, 1989.

Location : San Kum Pang district Chiang Mai, Thailand. Latitude 18° 45' North.

RESULTS AND DISCUSSION

First trial

It was found that, every treatment did not affect the percentage of flowering and leaf flushing, while there was no different and no correlation between sprayside and non sparyside on the same lychee tree.

Second trial

It was found that, paclobutrazol : (ethephon) = 1,000 : (500) ppm. reduced the percentage of leaf flushing about 10 percents compered to the untrated control (Table 1), while all chemical treatments did not affect the percentage of flowering.

Table 1 Percentage of leaf flushing

Treatment	Data transformed by $\sqrt{x+1}$	Raw data (%)
Control	3.60 a *	11.96
P : E **= 500 : (300) ppm.	4.95 a	23.50
P : E = 750 : (400) ppm.	4.78 a	21.94
P : E = 1,000:(500) ppm.	1.57 b	1.46

* The means which followed by different letters are significantly different by LSD ($P < 0.05$)

** P : E = Paclobutrazol : Ethephon

It was found that application of paclobutrazol and ethephon in both trials did not affect flowering of lychee cv. Hong Huay, but the highest rate reduced leaf flushing in the second trial, while in the first trial, there was very few leaf flushing in this orchard site, which seemed to indicate that the chemical treatment could not show the effect because of very low leaf flushing percentage in this orchard. These might be indicated that, vegetative growth at that period was not strong and it was noticed that the flowering percentage on untreated control tree was very low (12-17%). This might be reasoned that the chemical treatment could not increase flowering of lychee, if the natural flowering percentage is too low! Menzel and Simpson (1990) also reported that the potential for improved productivity is limited to orchards with moderate bloom (40-60%). Then the main problem is that growers can not predict the level of flowering of their trees in advance to determine if the chemical would be applied.

In the second trial, flowering percentage of the untreated control was also very low (11-12%), the same as in the first trial, but the leaf flushing percentage was high enough that the chemicals could show their effect. These results suggested that the chemicals combination of paclobutrazol: (ethephon) concentration might be higher than 1,000 : (500) ppm. for effective retardation of vegetative growth. The range of chemicals concentration to be tested in further experiment might be 1,000 - 5,000 ppm. , 1-2 sprays for paclobutrazol while 300-500 ppm. , 1-2 sprays for ethephon, but it seemed to be that the date of appliction have to be investigated more seriously.

Cytokinin is another group of plant growth regulator, which should be considered to be used in combination with paclobutrazol and ethephon.

Chen (1990) reported that total cytokinin content increased in the xylem sap at thirty days before flower bud formation and reaching a maximum during flower bud formation and full bloom. He concluded that the high content of cytokinin - like substances is correlated with

flower bud formation in lychee as in mango (Chen. 1987). and in *Sinapis alba* L. (Lejeune, *et al.* , 1988).

Mclaughlin and Greene (1984) reported that an interaction between gibberllins and cytokinins was demonstrated clearly in their investigation that, GA_3 reduced but BA increased flowering of Gloden Delicious' apple, whereas Napier, *et al.* (1986) reported that single application of BA, applied during the flower induction phase, increased flowering in *Leucospermum*.

In the next experiment, paclobutrazol, ethephon and BA might be suggested to be used together in combination for increasing the flowering of lychee cv. Hong Huay.

CONCLUSION

1. The first trial

Every chemical treatment did not affect percentage of flowering and leaf flushing, while there was no different and no correlation between sprayside and non sprayside on the same lychee tree.

2. The second trial

The treatment, paclobutrazol : (ethephon) 1,000:(500) ppm. reduced the percentage of leaf flushing about 10 percents compared to the untreated control, while all chemical treatments did not affect the percentage of flowering.

LITERATURE CITED

Bangerth, F., M., Freimuller, and R.K., El-Mahdy. 1986. Effects of growth regulators on endogenous hormones in apple shoot tips and possible relations to flower formation. Acta Horticulturae 179 : 271-272.

Chen, W.S. 1987. Endogenous growth substances in relation to shoot growth and flower bud development of mango. J.Amer. Soc. Hort. Sci. 112(2) : 360-363.

Chen, W.S. 1990. Endogenous growth substances in xylem and shoot tip diffusate of lychee in relation to flowering. Hort Science. 25(3) : 314-315.

Huang, P., and S., Weng. 1978. The effect of delayed shoot treatment of fruit bearing of litchi tree. J. Chin. Soc. Hort. Sci. 24(2,3) : 121-126.

Jaumien, F., M., Wiktorowicz, and B.,O sinska. 1986. Vegetative growth control and fruiting of young pear trees treated with CCC, SADH, paclobutrazol and a mixture of these compounds with CEPA. Acta Horticulturae. 179:221-228.

Karaszewska, A., B., Jankowska, M., Mika, and M.J., Grochowska. 1986. Effects of growth regulator treatments on the hormone pattern in the trunk and the collar tissue of apple trees. Acta Horticulturae. 179 : 185-194.

Lejeune, P., J.M., Kinet, and G.,Bernier. 1988. Cytokinin fluxes during floral induction in the long day plant *Sinapis alba L.* Plant Physiol. 86 : 1095-1098.

Mclaughlin, J.M., and D.W., Greene. 1984. Effects of BA, GA_{4+7} and Daminozide on fruit set, fruit quality, vegetative growth, flower initiation, and

flower quality of 'Golden Delicious' apple. J. Amer. Soc. Hort. Sci. 109(1) : 34-39.

Menzel, C.M. 1983. The control of floral initiation in lychee . A Review. Scientia Horticulturae 21 : 201-215.

Menzel, C.M., and D.R., Simpson. 1990. Effect of paclobutrazol on growth and flowering of lychee (*Litchi chinensis*).Aust. J. Exp. Agric. 30:131-7

Napier, D.R., G., Jacobs, J.V., Staden, and C., Forsyth. 1986. Cytokinins and flower development in *Leucospermum*. J. Amer. Soc. Hort. Sci. 111(5) : 776-780.

Sansavini, S., and R., Bonomo. 1986. Growth and yield control in apple meadow orchard. Acta Horticulturae. 179:263-266.

Subhadrabandhu, S. 1986. Studies of plant growth regulator effects on tropical and subtropical tree fruits of Thailand. Acta Horticulturae. 175 : 291-298.

Subhadrabandhu, S. 1990. Lychee and longan cultivation in Thailand. Rumthai Publication, Bangkok, Thailand. 40 p.