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Effects of naphthaleneacetic acid on fruit in 'Jiefangzhong' loquat

J. Wu* and S. Lin**
*Department of Resources and Environment, Putian Higher Professional College, Putian 351100, China
**The College of Horticulture, South China Agricultural University, Guangzhou 510642, China

SUMMARY – Effects of naphthaleneacetic acid (NAA) on fruit quality of 'Jiefangzhong' loquat were studied. NAA at different concentrations was sprayed at the full-bloom stage and young fruit stage, respectively. The results showed that the fruit quality was improved by spraying 20 mg/l naphthaleneacetic acid at full-bloom stage, and there was no significant effect on fruit quality when treated with 15-50 mg/l naphthaleneacetic acid at young fruit stage (when young fruits are bigger than peas). This may be related to the increase of indoleacetic acid and kinetin in the fruits when the young fruits pass the "pea stage".

Key words: 'Jiefangzhong' loquat, NAA, fruit quality, plant growth regulator.

RESUME – *"Effets de l'acide naphtalène acétique sur le fruit du néflier 'Jiefangzhong'". Les effets de l'acide naphtalène acétique (ANA) sur la qualité du fruit du néflier 'Jiefangzhong' ont été étudiés. De l'ANA à différentes concentrations a été pulvérisé au stade pleine floraison et au stade jeune fruit, respectivement. Les résultats montrent que la qualité du fruit a été améliorée par la pulvérisation de 20 mg/l d'acide naphtalène acétique au stade pleine floraison, et qu'il n'y a pas d'effet significatif sur la qualité du fruit avec un traitement à 15-50 mg/l d'acide naphtalène acétique au stade jeune fruit (lorsque les jeunes fruits sont plus grands que des pois). Ceci peut être lié à l'augmentation d'acide indol-acétique et kinétine dans les fruits lorsque les jeunes fruits passent le stade "pois".*

Mots-clés : *Néflier 'Jiefangzhong', ANA, qualité du fruit, régulateur de croissance des plantes.*

Introduction

In Fujian province of China, the planted area of loquat and the output of it constitute one third of those in the whole country. The planted area and the output of loquat in Putian City accounts half of those in Fujian Province, which occupies an important place in the China's loquat industry. Changtai Town in Putian was conferred on an honorable title of "The Home of Loquat" and has been selected as the production base of 'Jiefangzhong' Loquats by the Ministry of Agriculture and the demonstration area of modern agriculture as well as the demonstration area of agricultural industrialization and standardization.

'Jiefangzhong' is a variation of seedings of Dazhong loquat. Its average single fruit weighs 61.04 g with the maximum reaching 172 g, more heavier than the once heaviest loquat in the world-Japan's Tanaka loquat (the maximum single fruit weight being 165 g). It is a fine cultivar with high and stable yields as well as big size.Therefore it has been introduced and planted in Guangdong, Guangxi and Sicuan, etc. Just in Putian of Fujian Province the planted area of this cultivar has reached 6700 ha. It has become the most important and a key cultivar for popularization in the province. However, 'Jiefangzhong' loquat's commercial value was reduced by it's too sour (according to the taste of the Asian). Researches on improving the fruit quality by spraying growth regulators have been made by experts both home and abroad. Our experiment reveals a possible way of improving the fruit quality by studying the effects of NAA treatment on the fruit quality of 'Jiefangzhong' Loquat.

Materials and methods

Experiments were carried out in Fuhai Orchard in Fujian Province, using 6 year-old 'Jiefangzhong' loquat trees of normal growth, similar total branches and panicles, growing in red soil with pH 5.90.

Flowers and fruits were thinned according to their characteristics. Flower-thinning consists of cluster-thinning and bud-thinning. Flower clusters with less than 9 leaves on each bearing branch and mother-bearing branch were thinned, and maintaining a ratio of 3:2 between the bearing branch and the vegetative branch. Bud-thinning means to cut off the top of the cluster and the branched secondary axes at the base and leave 2-3 branched secondary axes in the middle section of the cluster and then cut off 1/3 of the end of the remaining secondary axes. After that 40-50 flowers must be left on each flower cluster, and after fruit-thinning, 4 fruits must be left on each fruit cluster. After the above steps, a similar number of fruits on the experimented trees should be ensured.

The concentration of NAA used (Caoyang Second Reagent Works, Shanghai) were 15 mg/l, 20 mg/l, 30 mg/l and 50 mg/l. Each treatment was added 0.1% Tween-80. Another treatment with merely 0.1% Tween-80 was provided as a check group. A randomized design with single plot of 3 replication each was used. Experiment were run for 2 years (1999-2000). On Dec. 12, 1999 (full-bloom stage), each tree was sprayed with 500 ml on the panicles while those unbloomed ones were being thinned. On Feb. 10, 2000 (young-fruit stage), another spray was applied in the same way. In every tested tree quadrant, 5 panicles of similar size were chosen as check ones. When the fruits were ripe, 50 fruit samples from each replication were measured for their weight, edible rate, total soluble solids (TSS) content and Vitamin C content. TSS of juice was measured with the refractometer. Total acid content was determined by titration with 0.1N NaOH, and Vitamin C concentration was determined by 2.6-Dichlorophenolindophenol sodium salt dihydrate.

Results and discussion

Effects of NAA treatment on fruit quality at full-bloom stage

Table 1 indicates that the application of NAA of different concentrations during full bloom period increases the weight of the single fruit, and the weight increases with the concentration of NAA. The fruits treated with 15 mg/l and 20 mg/l have uniform fruit size, while the fruits treated with 50 mg/l NAA show larger difference in fruit sizes. Edible rate and soluble solids content increase when treated with NAA at various concentrations. The titrable acids content also increases with NAA concentration. But in terms of Vitamin C content, there is no significant difference between the tested group and the check one in each treatment. As for the ratio of soluble solids to titrable acids, the treated group was higher than or similar to that of the check one except when treated with 50 mg/l. Optimum result was obtained when treated with 20 mg/l. All the fruits treated with NAA became ripe 4-6 days earlier.

Table 1. Effects of NAA treatment on fruit quality at full-bloom stage[†]

Concentration (mg/l)	Single fruit weight (g)	Edible rate (%)	TSS[††] (%)	TA[†††] (%)	Vit. C[††††] (mg/100g)	TSS/TA ratio
15	69.3b	70.0a	9.9b	0.45b	0.98b	22.0b
20	71.5ab	71.3a	10.9a	0.46b	1.00a	23.7a
30	72.0a	70.5a	10.3b	0.46b	0.99b	22.6ab
50	72.5a	71.3a	10.0b	0.48a	1.00a	20.8c
CK	66.2c	69.5a	9.8c	0.45b	0.98b	21.8b

[†]Different letters within column indicate the significant difference at 5% level with Duncan's test.
[††]TSS = Total soluble solids.
[†††]TA = Titrable acids.
[††††]Vit. C = Vitamin C.

After pollination, stylus and ovary are stimulated to secret endogenous hormone so that the content of auxin and cytokinin in young fruits are high, and thus forming a nutrient center. At the same time, however, abscisic acid content in young fruits is also high, forming a resistance to auxin and cytokinin and leading to the growth of young fruit in a stagnant situation.

Ding *et al.* (1988) reported that treatment with NAA 1-100 mg/l at flowering stage significantly increased the rate of pollen germination. Our experiment showed that the application of NAA

increased the single fruit weigh, edible rate, soluble solids content and titrable acids content. Yet in terms of edible rate, soluble solids content and the ratio of soluble solids to titrable acids, application of NAA 20 mg/l produced the best result.

The above mentioned results may relate to the fact that NAA increased the auxin and kinetin in the fruits.

Effects of NAA treatment on fruit quality at young-fruit stage

Table 2 indicates that the application of NAA of different concentrations increases the weight of a single fruit. However, the weight of a single fruit decreases when the NAA concentration increases from 15 mg/l to 50 mg/l. There is no significant difference in soluble solids content and Vitamin C content between the tested group and the check one. Titrable acids content increased with NAA concentration. Compared to the check one, edible rate is a little lower except for those treated with 30 mg/l. The ratio of soluble solids to titrable acids of the fruit is slightly higher than the check one when treated with 15 mg/l and 20 mg/l NAA. The ratio is lower than the check one when treated with 30 mg/l and 50 mg/l.

Table 2. Effects of NAA treatment on fruit quality at young-fruit stage†

Concentration (mg/l)	Single fruit weight (g)	Edible rate (%)	TSS†† (%)	TA††† (%)	Vit. C†††† (mg/100g)	TSS/TA ratio
15	70.1a	69.5a	10.0a	0.46a	0.98a	21.7a
20	69.2a	69.7a	10.3a	0.47a	0.94a	21.9a
30	68.9a	71.2a	9.8a	0.49a	0.95a	20.0b
50	68.5a	68.9b	9.7a	0.49a	0.95a	19.8c
CK	65.7b	70.0a	9.7a	0.46a	0.96a	21.1ab

†Different letters within column indicate the significant difference at 5% level with Duncan's test.
††TSS = Total soluble solids.
†††TA = Titrable acids.
††††Vit. C = Vitamin C.

After mid Feb, there comes the 2nd peak period of auxin and cytokinin in the fruits, which may be related to the division and expansion of cells, Chaudhary *et al.* (1990) reported that spraying the fruit with NAA during "pea-stage" and repeating it one week later had yielded better results in single fruit weight, edible rates, soluble solids content and reducing sugar content. Our results show that during young fruit stage (fruits little bigger than peas), application of 15 mg/l and 20 mg/l produced better results than those of 30 mg/l and 50 mg/l in single fruit weight, soluble solids content, the ratio of soluble solids to titrable acids. But compared with the treatment at full-bloom stage, its effect on improving the fruit quality is not so satisfactory, which may be due to the fact that auxin and kinetin contents increased after "pea-stage". The fruit size and the accumulation of nutrients may relate to the content of auxin and cytokinin as well as the time it lasted. Therefore, to improve the fruit quality of 'Jiefangzhong' loquat with auxin in young-fruit stage, the time and the method of treatment are of vital importance.

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