Abstract

Research of the *Curcuma* production improvement for trade was carried out in 6 activities as follows;

Activities 1: The studies on effect of water use and fertilizer application rates on growth and development of *Curcuma* spp.

Rhizomes of Patumma (*Paracurcuma*) cultivars 'Chiang Mai Pink' and Krajeaw (*Eucurcuma*) cultivars 'Golden reign' were selected for experiment. The result showed that at 16 weeks after planting (WAP) Patumma 'Chiang Mai Pink' supplied with 1.5 grams and 3.0 fertilizer per month gave the higher of plant height, fresh weight, dry weight, flower stalk length, flower size and number of green and pink bract than no fertilizer supply treatment. And at 20-24 WAP, plant supplied with fertilizer 3.0 grams/month gave the highest of leaf area. In additions, at 16 WAP stage all treatment gave crop coefficient (Kc) more than other stages.

In Krajeaw 'Golden reign' the result found that at 20 WAP plant supplied with fertilizer 1.5 and 3.0 grams/month gave the highest of plant height, leaf area, fresh weight and flower quality. And at 20 WAP stage all treatment gave crop evapotranspiration (ETc) and crop coefficient (Kc) more than other stages

Activities 2: The studies on effect of fertilizer rate to enhance plant seedlings from tissue culture The result found that at 12 WAP Patumma 'Banrai Red' supply with fertilizer for 2 times/week gave the highest of plant height, size of flower and number of bracts. Moreover, there was faster on days to flower than other treatments and gave the longer day for flower senescence. At harvest stage, it was found that plant supply with fertilizer 2 times/week gave the highest of bulb fresh weight, length of storage root and number of storage root. In Krajeaw 'CMU Miracle', it was found that at 10 WAP plant supply with fertilizer 2 times/week gave the highest of plant height, plant width, number of leaf per plant, flower stalk length, flower length, size of flower number of bracts and flower senescence day. At harvest stage, it was found that plant supply with fertilizer 2 times/week gave the highest of bulb fresh weight and number of storage root.

Activities 3: The studies on effects of plant growth regulators on potted plant production. (Continued 2nd years)

Experiment 3.1: The studies on effect of paclobutrazol soaking on growth of ornamental Curcuma. At 20 WAP, the result found that rhizome soaking in paclobutrazol concentration at 500 mg/l, gave the shortest plant height, number of shoots per clump and number of green bract on 'Chiang Mai Pink' cultivar. While, in

'Doi Tung Red' cultivar there was no significantly different in plant height but at 500 mg/l of paclobutrazol gave the shortest flower stalk length (at 15 WAP). In Krajeaw 'Mannee Siam' it found that rhizome soaked with 1,500-2,000 mg/l of paclobutrazol gave the shortest of flower size (at 20 WAP). In addition, there were found that 'Buachan' cultivar soaked with 1,000-2,000 mg/l of paclobutrazol gave the shortest plant height, number of leaf per plant, number of bract and flower stalk length (at 20 WAP).

Experiment 3.2: The studies on effect of paclobutrazol pouring methods on growth of ornamental Curcuma.. The result showed that Patumma 'Chiang Mai Pink' and 'Doi Tung Red' (at 15 WAP) and Krajeaw 'Mannee Siam' and 'Buachan' cultivar (at 20 WAP) supplied at 1,500-2,000 mg/l paclobutrazol for 2 times gave the shortest plant height and flower stalk length when compared with other treatments.

Activities 4: The study on effects of packaging (vacuum bag (5%O_2 + 10% CO_2), active packaging and non-packed) and stored at room temperature (28.44±0.26°C and 75.56±0.93%RH) and low temperature (14.83±0.17°C and 75.78±1.51%RH) for 2, 4 and 6 days on quality and vase life of cut curcuma 'Banrai Red' were investigated. The results indicated that storage temperatures had the effects on gas compositions inside packaging, coma bract freshness and coma bract color, but had no effects on weight loss and pigment contents of coma bract. Curcuma flowers were packed in vacuum bag can help to maintain the coma bract freshness and delayed color change of coma bract. Cut curcuma packed in vacuum and active bags significantly lower in water loss. Non-packed flowers had higher carotenoid contents of coma bract than flower packed in vacuum and active bags. However, packaging materials had no effects on anthocyanin contents of coma bract. The results also found that storage times had effects on weight loss, coma bract freshness and coma bract color. Storage time for 2, 4 and 6 days had no effects on O_2 and CO_2 concentrations inside packaging and anthocyanin contents of coma bract.

The study on effects of packaging (vacuum bag (10%O_2 + 5% CO_2), active packaging and non-packed) and storage at low temperature (14.18±0.15°C and 71.81±1.30%RH) for 2, 4 and 6 days on quality and vase life of cut curcuma 'Banrai Red' were investigated. The results showed that flower were packed in vacuum bag had the lowest weight loss. Moreover, vacuum bag had lower O_2 and higher CO_2 than active bag and non-packed. Curcuma flowers were packed in vacuum and active bag can help to maintain the coma bract color, coma bract freshness, stem color and stem freshness. Flower were stored for long time had higher weight loss, lower O_2

concentration in package, higher CO_2 concentration in package, lower evaluation quality (coma bract color, coma bract freshness, stem color and stem freshness) than that flower were stored for short time. Flower were packed in vacuum bag (10%O_2 + 5% CO_2) had the longest vase life followed by flower were packed in active bag. Curcuma flower were stored at low temperature for 2, 4 and 6 days had the vase life which 6, 4 and 4 days, respectively.

Cut curcuma 'Lanna Snow'were packed in vacuum bag (5%O_2 + 10% CO_2) compared with flower were packed in active packaging and non-packed flower. Flower were stored at room temperature (31.30±0.47°C and 89.40±2.42%RH) and low temperature (14.80±0.25°C and 76.00±2.40%RH) for 2, 4 and 6 days. The results found that packed flower had lower weight loss than non-packed control. Vacuum bag had lower O_2 concentration and higher CO_2 concentration than active bag. In addition, the results indicated that flower were packed in packaging delayed changes of coma bract color, coma bract freshness, stem color and stem freshness during storage. However, types of package had no effect on physico-chemicals of curcuma flower. Curcuma flower were packed in active bag had the longest vase life. Flower were stored for 2 days had longer vase life that that stored for 4 and 6 days. Storage temperatures had no effect on vase life of curcuma flower.

Mild vacuum storage (MV) to maintain freshness by experimenting in Curcuma "Manee Siam". The experimental design was a randomized complete 2x3 processing of 5 replications. The first factor was 2 types of packaging: 100% air package and 50%air package. Other factor was storage temperature (5, 15 degree Celsius and room temperature). Data recording was the vase life, percentage of fresh weight loss of inflorescence and dry weight inflorescence. The results showed that the 50 percent air package had the most vase life of 2.43 days, and storage at room temperature for3.55 days which differenced statistically significant at the confidence level of 95Percentage. Curcuma "Manee Siamese" after storage at 5 degrees Celsius for 3 days had 90-100 percentage of damaged flowers.

Experiment 4.2: Mild vacuum storage (MV) to maintain freshness by experimenting in Krajeaw 'Manee Siam' and Patumma 'Lanna Snow'. The experimental design was a randomized complete 2x3 processing of 5 replications. The first factor was 2 types of packaging: 100% air package and 50% air package. Other factor was storage temperature (5, 15 degrees Celsius and room temperature). Data recording was the vase life, percentage of fresh weight loss of inflorescence and dry weight inflorescence. In Krajeaw 'Manee Siam' the results showed that the 50 percent air package had the most vase life of 2.43 days, and storage at room

temperature for 3.55 days which differenced statistically significant at the confidence level of 95 Percentage. Curcuma “Manee Siam” after storage at 5 degrees Celsius for 3 days had 90-100 percentage of damaged flowers.

In Patumma ‘Lanna Snow’ the result found that 50% air package had the longest vase life (4.55 days). Flower were stored at 15 degrees Celsius had the longest vase life (6.35 days) which differenced statistically significant. Patumma ‘Lanna Snow’ after storage at 5 degrees Celsius for 3 days had 100 percentage of damaged flowers.

Activities 5: Effects of packaging materials on quality during transport and vase life of cut Curcuma were studied. Cut Curcuma were packed in developed retail and whole sale box and commercially corrugated box (control) prior to simulating vibration at frequency of 2.5 Hz for 1 hour using ASTM D999 method. The results found that flowers were packed in developed box had lower percent damage than that flower were packed in commercially corrugated box. After that, studies on the effect of different packing methods on quality and vase life of cut curcuma. Curcuma flowers were wrapped with stencil paper, foam net and non-wrapped flowers. All samples were put into developed boxes prior to simulating vibration. The results indicated that inflorescences wrapped with stencil paper prior to transporting effectively extend postharvest quality during transport and significantly extended inflorescences vase life of cut Curcuma.

Activities 6: Japan market demand research for Patumma and Krajeaw.

Japan marketing trial test for Curcuma trading was done by participated in the 15th INTERNATIONAL FLOWERS & PLANTS EXPO, TOKYO or IFEX 2017, held October 11-13, 2017 in Chiba, Tokyo, which is considered the largest flower trade show in Japan. More than 40,000 visitors attended the event.

According to participation in trade shows throughout the duration of the event and information obtained from the questionnaire, it was found that Japan customer pay attention to the pratumma and krajeaw and there were visitors from many fields such as flower growers, flower auction staff, flower designer and flower sellers. Japanese customers are interested in buying cut flowers of pratumma and krajeaw from Thailand and the flowers must be vase life for 7-10 days. The market demand for cut flower most will be in July – September period. The most popular color of Pratumma is white, light pink color. In addition, Krajeaw is very interested in Japanese customers because the flowers are large with colorful, eye-catching. It is a new flower varieties and exotic beautiful that Japanese flower arrangers want to use it for flowers decoration. Moreover, Pratumma cultivars “RoPF ElF” was awarded the

Excellence Award - the overseas grower which award winning varieties will also be strongly promoted in Japan's leading flower shops and flower arrangement schools. It is a good opportunity to promote the use of pratumma and krajeaw in Japan.