Contract No. 53-32 U4-4-241

REPORT NO. 3

(SEMI-ANNUAL REPORT FOR OCTOBER 1985-MARCH 1986)

DEVELOPMENT OF CUT FLOWER INDUSTRY IN THE HIGHLANDS TO REPLACE OPIUM BASED AGRICULTURE

INVESTIGATORS

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Mr. Sangtham	KOMKRIS	Co-Worker
Mrs. Nopmanee	TOPOONYANONT	Co-Worker
Mr. Sutep	ANURAKCHINA	Field Assistant
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CONTENTS

SUMMARY

This report is the third report of "Development of Cut Flower Industry in the Highlands to Replace Opium-Based Agriculture" Project. The report includes five papers on various subjects. The first paper is a study on the management of flower shops in Thailand. The study reflects the infancy of the business and points out many ways for improvement.

The other four studies deal with Lisanthus, gladiolus, chrysanthemum, and gerbera.

Lisanthus is a new introduced cut-flower crop. It was found to be another potential crop for the highlands.

Gladiolus flowers are popular in Thailand and the highlands can produce high-quality flowers. The report on site testing and cultural methods of different varieties of gladiolus will improve the commercial production of this plant.

Chrysanthemum is another important cut-flower crop and it is always necessary to run a test on new imported varieties in order to be prepared for fluid state of marketing.

The last paper is a report on new hybrids of gerbera. The paper describes the procedure of making various crosses between imported and Thai strains of gerbera.

INTRODUCTION

Since Thailand has been importing cut flowers from the Netherlands and Japan for many years, the trend in imports is increasing every year. In the year 1983, the value of cut flower imports was about 3,800,000 Baht.

Carnation, tulip, chrysanthemum, lily, gerbera, and alstroemeria are the most popular imported cut flowers. In the meantime, researches on various aspects of cut flower production on the highlands such as carnation, chrysanthemum, gladiolus, gypsophila, statice and gerbera have been done during the past years, and have already proved that they have very high potential to substitute opium production. But the cut flower production is still limited due to many problems, such as cultivation technique for high quality and year-round production, diseases, postharvest handling and marketing. These problems should be solved before going into cut flower industry.

The Royal Project in cooperation with the Highland Agriculture Project of Kasetsart University has been carrying out research on the development of cut flower industry in the highlands to replace opium based agriculture. The project was started in November 1984, supported by the USDA for three years. Plan of work has been set as follows :

1. Survey the quantity of various cut flower species presently imported into Thailand and develop strategies for producing these or similar species of comparable market demand.

2. Select cultivars of various cut flower species which produce well in the highlands paying particular attention to the simplicity of growing and marketing.

3. Maintain pathogen-free stocks of cut flowers through tissue culture and multiply for use by hilltribe growers.

4. Train hilltribe growers in the cultural practices and techniques for growing and marketing cut flowers. Develop extension publications, training aids, and selected materials to facilitate technology transfer.

5. Evaluate market potentials and assist hilltribes in marketing cut flowers.

TECHNICAL MANAGEMENT STUDIES OF FLOWER SHOPS IN THAILAND

INTRODUCTION

Flower production is becoming an important business of Thai farmers. Most products except the orchid which was mainly exported, are for local consumption. Cut-flower farmers earn higher average income per hectare than vegetable and fruit growers. From the data collected by the Departments of Commercial Relations and Custom, it indicated that Thailand imported several kinds of flowers. The import value increased annually during the period 1975 to 1984 costing several millions in Thai currency. Those imported were temperate flowers, many of which could be grown in Northern Thailand especially in Chiang Mai province (Oradee, 1986). However, the flower shops did not prefer the local products due to the low quality. The goal of the 'Development of cut flower industry in the highlands to replace opium based agriculture' Project is to reduce the flower import volume by using modern technology in production and cut-flower treatment so that the local flowers would have equally good quality as the imported ones. The Project requires the data on local market of the cut-flowers which were not available currently, therefore the necessary data were collected from the retail and wholesale flower shops in the Bangkok Metropolis area.

MATERIALS AND METHODS

A survey on the operation of the retail flower shops and the flower importers was conducted. Questionnaires were distributed to 53 flower shops (Table 1). The collected data were analysed and given in percentage.

RESULTS AND DISCUSSION

The flower market in Thailand faces certain limitations -- both in the consumption sector and season. Flowers were mainly used in the Bangkok Metropolis, only a small portion was consumed upcountry. Although Thailand observed several important cultural occasions through the year, flowers were mainly used on New Year and Valentine's Day (Table 2). On each occasion, people preferred to send flowers in order to show affection, respect and thoughtfulness, the practice of which is very popular. Although a large volume of flowers was used on the two occasions, the flower shop business could carry on because there were also demand on other occasions such as graduation day, birthday, Christmas, funeral, inauguration ceremony, hospital visits and to express congratulations (Table 2).

Some 98.11 per cent of the flower shops purchased both local and imported flowers, 1.98 per cent purchased exclusively imported flowers, but no flower shops were found to buy local flowers alone (Table 3). There were several standards of flower shops; their customers had different ages and financial status. Therefore, the flowers being offered in those shops would be imported, which

Table 1. Flower shops importing the flowers and retail flower shops being surveyed.

Area (Road)	No. of shops
Ngam Wongwan	3
Dejo	1
Baan Dinsor	1
Prachathippatai	6
Phahonyothin	9
New Petchburi	2
Rajda Pisek	2
Rajvithee	4
Lard Prao	2
Silom	3
Sukhumvit	17
Phyathai	3
Total	53

was very expensive, and locally produced, which was not quite as expensive. Nearly every flower shop must offer the colorful imported flowers which could not be produced in Thailand or could be produced but at a lower quality (Sompian 1981, Oradee 1986) to attract the well-to-do customers and upgrade their business. Therefore, not a single florist would sell only local flowers. The flower shops selling only imported flowers must be the importer-distributor of foreign flowers as well as retailing to own customers. Importing flowers for retailing alone would not be cost efficient.

The countries of origin for those imported flowers were the Netherlands and Taiwan. All flower shops bought flowers produced in the Netherlands; and 46.06 per cent of the flower shops, in Taiwan (Table 4). The Netherlands produce a great varieties of temperate flowers for local consumption as well as export to Europe and Asia. Its production and post-harvest technologies were very advanced, the flowers were found to be still in good quality when arriving at the destination. Although the flowers from the Netherlands were rather expensive, they were marketable. The only significant competitor was Taiwan, which did not produce as many varieties or as good quality, but cheaper as Taiwan was closer to Thailand. Taiwan flowers just entered the Thai market recently. From the Department of Commercial Relations data, flowers were also imported from Japan, Norway, the United States, Germany, England and Australia, but actual data were not available in the flower shops survey. Probably the import was minimal and not on a regular basis.

Table 2. Seasons of flower using.

Season	Percentage
New Year	78.85
Valentine's Day	75.00
Graduation Day	7.69
Birthday	1.92
Inauguration	1.92

Table 3. Sources of flowers.

Source	Percentage
Both foreign and local	98.11
Only foreign	1.98
Only local	0

Table 4. Countries of origin of foreign flowers.

Countries of origin	Percentage
The Netherlands	100.00
Taiwan	49.00

As for the ordering procedure, 96.23 per cent of the florists ordered through the middlemen and 3.77 per cent used direct order (Table 5). As each flower shop sold only a small amount of imported flowers, direct order by each individual shop were not feasible. However, a number of florist shops ordered the flowers directly from the countries of origin as they also distributed to other retail shops as well. Most flower shops carried carnation, lily, gypsophila, chrysanthemum (standard type) and tulip as these are more popular among the consumers. The chrysanthemum (spider type, spray type and exhibition type), daffodil, gerbera, iris and statice were imported minimally (Table 6). Therefore the technological development of flower production should rationally emphasize only the more popular flowers so as to effectively reduce the import volume. Plan should also accommodate other flowers as well since some might become popular in the future.

The imported flowers were mostly dry-packed, using no wet material covering over cut flower stalks. There were only small amount of wet-packed flowers (Table 7). The wet-packed method kept flowers fresh because from the wet material covering the stalk ends they could absorb water plus other nutrients such as sucrose and germicides which could significantly extend the shelf-life of these flowers (Ketsa et al, 1986). Most imported flowers were soaked in the preservative solution and precooled before shipment. They were deposited with nutrients in the flora and coated with germicides at the stalk ends (Halevy and Mayak, 1981); reducing the rate of transpiration, respiration and the building up of ethylene (Farnham et at

1979, Rij et al, 1979). The wet-packing method might be appropriate for some flowers when the weather was hot as in summer.

About 81.13 per cent of the flower shops found the imported flowers in good condition upon arrival; some damages were observed by few flower shops (Table 8). Those imported flowers were kept in good quality from the production plot, then treated properly after harvest and kept the quality until the final arrival at the customers. The damages were therefore kept minimal, but with certain unavoidable incidence; the exporters could not have full control. Subsequent damages might be caused by the flight delay and careless loading and unloading. Frequent damages to the imported flowers were the broken stalk, creased petal and wilted flowers. Only few florists found more severe damages such as collapsed flower, pale-colored petal and bruised petal (Table 9). The flower stalk might be broken during the transportation due to careless loading and unloading of the flower package, despite the excellent packing. The creased petal might occur when the large flowers with large and delicate petals were being bundled too tightly. The long distance of shipping and sudden exposure to high temperatures in Thailand could also cause the flowers to wilt as they must transpire heavily.

As for the local purchase, 93.34 per cent of flower shops bought from producers or distributors, only 5.66 per cent grew their own (Table 10). It was easier and less risky to buy flowers. For Those florists growing their own flowers they were unable to provide a great varieties and therefore unable to offer flower arrangement services.

Table 5. Flower import methods.

Methods	Percentage
Through the middlemen	96.23
Direct order	3.77

Table 6. Types of imported flowers.

Types of flowers	Percentage
Carnation	100.00
Lily	83.85
Gypsophila	51.92
Chrysanthemum (standard type)	40.58
Tulip	30.77
Chrysanthemum (spider type)	11.54
Chrysanthemum (spray type)	7.69
Daffodil	7.69
Gerbera	3.85
Chrysanthemum (exhibition type)	1.92
Iris	1.92
Statice	1.92

Table 7. Packaging methods of imported flowers.

Methods	Percentage
Dry-packed	94.34
Wet-packed	16.98

Table 8. Damages of imported flowers upon arrival and package opening.

Damage	Percentage
Exist	18.87
Not exist	81.13

Table 9. Characteristics of damages of imported flowers.

Characteristics	Percentage
Broken stalk	58.70
Creased petal	54.35
Wilt	43.48
Collapsed flower	15.22
Pale-colored petal	2.17
Bruised petal	2.17

About 71.15 per cent of flower shops had their flowers delivered, 55.77 per cent bought at Pak Klong Talard Wholesale Market, only 9.62 per cent ordered directly from growers in the provincial area (Table 11). The flowers to be ordered direct might have been the ones not handled at Pak Klong Talard, especially those preferring cool weather such as carnation, lily, gypsophila, gladiolus, some varieties of chrysanthemum and statice (Oradee, 1986). The flowers purchased at Pak Klong Talard were mainly roses, chrysanthemum (standard type), anthurium, marigold, gerbera and orchid (Sompian, 1981). All flowers in the flower shops were brought in from other provinces, except Nongkhaem which was in the Bangkok Metropolis. Chiang Mai including the Royal Project was a major source of flowers (Table 12), because they had the suitable environment for growing various kinds of temperate flowers all year round, even the flowers native to the Central Region did better in Chiang Mai (Oradee, 1986). Other growing areas provided less varieties of flowers, only those not requiring low temperature such as orchid, rose, anthurium and gerbera as earlier stated.

The most popular among customers were carnation, rose and orchid; the less popular were gladiolus, lily, tulip, aster, chrysanthemum and gerbera (Table 13). The customer's preference depended on shape, color, price, meaning and utilization. Carnation was sold by all flower shops, both imported and locally purchased (Oradee, 1986). Although rose and orchid were not imported, they were favorable among customers. Several shops imported lily, gypsophila, chrysanthemum (standard type) and tulip (Table 6) which were not as popular

Table 10. Sources of local flowers.

Place of origin	Percentage
Purchased from others	93.34
Grown by themselves	5.66

Table 11. Purchase methods for local flowers.

Methods	Percentage
Have it delivered	71.15
Buy at Pak Khlong Talard	55.77
Direct order from other provinces	9.62

Table 12. Sources of flowers purchased.

Source	Percentage
Chiang Mai	79.14
The Royal Project (Chiang Mai)	41.18
Sampran	20.59
The Watershed Conservation, Chiang Mai	2.94
Khun Varaporn, Chiang Mai	2.94
Pathum Thani	2.94
Nongkhaem	2.94
Ratchaburi	2.94
Cholburi	2.94

due to small volume and high price. They were used within a limited circle. Although almost all varieties of imported flowers could be grown in Thailand, the florists preferred not to buy the locally grown because its vase-life was too short, the flower stalk was small and weak, the flower was not quite attractive and often affected with disease and pests. Moreover, the color was not very bright, the quality was inconsistent, the flower was sometimes collapsed or shocked, unable to recover; its small receptacles often broken, and with burnt petal (Table 14). Those blemishes are results of inappropriate environment and mishandling of the flowers while in flower beds and after harvest. Some share certain problems peculiar to most other kinds of flowers, for example: carnation was troubled with worms during summer, its flower was shocked from ethylene (sleepiness), with burnt petal in the rainy season and broken receptacles. However, there is a hopeful sign for the effort to improve the quality of temperate flowers in Thailand, as 98.09 per cent of the flower shops, in Thailand would be willing to buy the produces if the quality was equal to the imports; and price, cheaper (Table 15). Therefore, if the technology for cut-flower production and post-harvest were improved, the flowers would have better quality and be able to attract more sale, thus reducing the import volume of foreign flowers.

Most florists, 92.45%, kept the flowers in their cold storage (Table 16) -- small refrigerator, easily movable -- as the volume of each order would not be large enough to be kept in a walking cold room. Each stock would be cleared within one week.

All florists kept their flowers by the wet method in the refrigerator (Table 17). By this method the flower stalk would remain in the water or water mixed with preservative solution (Lutz and Hardenburg, 1968). Normally the vase-life of the flowers treated by the wet method would be shorter than the dry method (Halevy and Mayak, 1981). Since the florists would not keep the flowers for more than one week, the wet method should not have much effect on the flower storage. The number of flower shops with or without air-conditioners were about the same (Table 18). The air-conditioned flower shops sold imported flower and were situated in important trade centers or first-class hotels: their customers were high-class. The temperature therein would be lower than the surroundings, thus, extending the vase-life of flowers. The low temperature slowed down the rate of transpiration, ethylene build-up and other changes that occurred in the flowers (Reid, 1985). All flower shops did not install the air filter or ethylene absorbent at the refrigerator or within the air-conditioned parts (Table 19). Perhaps this was because the owners lack the knowledge on possible danger to the flowers from ethylene. If the ethylene accumulated up to 0.02 - 0.5 ppm. within the storage or shop, it could shorten the flower's vase-life (Abeles, 1972). Therefore, in the storage or in the shop free from ethylene, the flowers would last longer.

About 91.84 per cent of flower shops changed the water for the flowers daily, only a few would change the water twice a day all through the selling period. Water would be added everyday and replaced when it became unclear (Table 20). Water was indispensable for cut-flowers as well as for flowers on plants.

Table 13. Popularity of customers to flowers in the flower shops.

Popular flowers	Percentage
Carnation	87.50
Rose	60.00
Orchid	37.56
Gladiolus	5.00
Lily	5.00
Tulip	5.00
Aster	2.50
Chrysanthemum (spray type)	2.50
Chrysanthemum (standard type)	2.50
Gerbera	2.50
Chrysanthemum (spider type)	2.50

Table 14. Reasons for decline to purchase local flowers.

Reasons	Percentage
Short life	72.00
Short stalk	40.00
Not intriguing	28.00
Having disease and pest	24.00
Small and bending stalk	22.00
Not bright and beautiful color	12.00
Inconsistent quality	8.00
Not straight stalk	6.00
Collapsed or shocked flower unable to recover	4.00
Small flower	2.00
Broken receptacles	2.00
Burnt petal	2.00

Table 15. Acceptance or willingness to purchase local flowers if the quality equals the imported ones and cheaper.

Acceptance	Percentage
Willing to buy	98.09
Will consider	1.92
Not willing to buy	0

Table 16. Methods of flower storage, if great volume for each purchase.

Methods	Percentage
Cold storage	92.45
Not using cold storage	7.55

Table 17. Methods of cold storage for flowers.

Methods	Percentage
Dry method	0
Wet method	100.00

The flowers with their stalk placed in water could wilt, if they transpired more moisture than they absorbed (Mayak et al, 1974) because the absorption of water through xylem was blocked by the clogging caused by microorganisms in the water (Larsen and Frolich, 1969). If there were high concentration of microorganisms in the water used, the xylem could be blocked quite rapidly resulting in wilting (Mayak et al, 1977). Any water replacement, whether done every day or two days, could not help if the xylem was blocked. About 96.23 per cent of flower shops cut stalk tip off and 3.77 per cent cleaned the stalk each time they replaced water (Table 21). Such daily practice was enabling the flower to absorb water better. However, this posed another problem. If the flower stalk become too short, it would be unattractive to customers; the water may also cause the entire stalk to rot. If other methods, such as the use of preservative solution in the water, should be adopted, it would not be necessary to change water and cut the stalk tip everyday. This would solve the sale problem and save the time. The preservatives destroy the microorganisms in the water that cause the xylem blocking (Halevy and Mayak, 1981). The 82.69 per cent of flower shops did not use the solution, only 13.46 per cent employed it regularly (Table 22). The preservative solution should be used everyday by the growers and florists (Anon, 1981). There were several ways of application. The two most popular were: to dip the flower stalk in the solution briefly before shipment or used, and to immerse the end of the stalk in the solution all the time during display for sale or for other uses (Halevy and Mayak, 1981).

Table 18. Air-conditioning to a low temperature for flower shops.

Air-conditioning to low temperature	Percentage
Air-conditioned	47.17
Non air-conditioned	52.83

Table 19. Installation of air filter or ethylene absorbent in the air-conditioned cool storage or flower shop.

Installation of air filter or ethylene absorbent	Percentage
Not installed	100.00
Installed	0

Table 20. Change of water while waiting for selling in the shop.

Change of water	Percentage
Once per day	91.84
Twice per day	2.04
Twice for the whole period	2.04
Adding water everyday	2.04
Change of water when unclear	2.04

The preservative solution consists primarily of sucrose, germicide and organic acid (Lutz and Hardenburg, 1968). Sucrose would be the nutrient for the flower (Nichols, 1973), the germicide would reduce the germ population in the water which would retard the blocking of the xylem and the rot of the stalk so immersed (Larsen and Gromarty, 1967), the organic acid would stabilize the pH of the solution and help the flower to absorb better while delay the growth of the germ in the water (Morousky, 1971). Therefore the flowers treated by the solution would have longer vase-life. However, most growers in Thailand still lack the knowledge about post-harvest technology of flowers, especially the utilization of the preservative solution. The florists know more about this technique and should be the ones who used the solution. But the survey showed that most florists did not use the preservative solution because they had an experience that it did not work, or they were unsure if it would work. Other reasons were that they felt it was unnecessary, or did not know where to buy, or found its use inconvenient (Table 23). The preservative solution had been tested successfully elsewhere with temperate flowers at low temperatures and with good quality water. In Thailand it had been used with locally grown flowers at high temperatures, and with low quality water. The florists, therefore, might find it unsatisfactory. Even the solution made in Thailand (Table 24) was not applicable to all kinds of flowers (Halevy and Mayak, 1981). The florists might feel that the preservative solution was unnecessary because they could sell out flowers within a short period and/or they simply lack the knowledge on post-harvest technology of flowers. That the growers and florists did not use the preservative solution might be one of the reasons why the local flowers had short vase-life (Table 25).

Table 21. Cutting stalk tips during the change of water.

Cutting stalk tips	Percentage
Cutting stalk tips	96.23
Washing stalk tips	3.77
Not cutting stalk tips	0

Table 22. Application of preservative solution in the water for flower immersion.

Solution application	Percentage
Not applied	82.69
Applied regularly	13.46
Sometimes	3.85

Table 23. Reasons why not using parservative solution.

Reasons	Percentage
Once used but unworkable	41.18
Unsure if it worked	33.33
Felt unnecessary	15.69
Not know where to buy	7.84
Think it inconvenient	1.96

Table 24. Sources of preservative solution purchased or on use.

Source	Percentage
Foreign countries	96.67
Local	3.33

Table 25. Problems on short vase-life.

Problems on short vase-life	Percentage
Exist	82.96
Not exist	17.04

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A STUDY OF GROWTH OF LISANTHUS FOR USE AS A CUT FLOWER

INTRODUCTION

Lisanthus, formerly called Eustoma, is a recently developed cut flower. Dr.Oradee Sahavacharin obtained F_1 hybrid seeds, variety Rusillianus, from Fukukaen Nursery & Bulb, Japan. The seeds were sown on 6 May 1986 at Inthanon Floriculture Research Project, Khunglang village, Chomthong, Chiang Mai to evaluate Lisanthus growth and flower production for use as a cut flower.

MATERIALS AND METHODS

The Lisanthus seeds were sown in an 1:1 mixture of sand and ground coconut mesocarp fiber. The seeds were placed in 0.5-1.0 cm.-deep rows without covering. When seedlings produced the first pair of true leaves, they were transplanted to wider spacing and when they had 4 pairs of leaves, again transplanted to 3.5 inch pots. When the seedlings were big and healthy enough, they were transplanted into growing beds using 20x20 cm. spacing.

Shortly after germination, 26-0-0 fertiliser at the rate of 10 gm/10 liters of water was given to the seedlings every 7 days. At the time of transplanting into beds, 15-15-15 fertiliser at the rate of 10 gm/plant was placed at the bottom of the holes as basic fertiliser. When the plants started shooting, 12-14-12 fertiliser at the rate of 10 gm/plant was given to the plants 2 times at 1 month interval. Bifolan was foliarly sprayed to the plants every week.

Chemical pest control was performed weekly using the followings : Lonacol, Dithane M 45, Daconyl, Benlate, and Terrachlor for fungal diseases, Lannate, Neuvacron, Ambush, and Vidate-L for insects.

Some major diseases and insects

1. Fusarium wilt which is caused by Fusarium sp. attacked the plant as early as at seedling stage, especially when germinating media was too wet. In growing beds, most diseased plants, showing stem rot symptoms at soil surface, became wilted and finally died.

2. Slug destroyed the plants at every stage of growth. It sometimes even destroyed flower. Poisonous bait was an effective control.

3. Stem cutworm cut the plants down at stem. The worms concealed themselves in the soil at stem base.

4. Mite attacked seedlings by sucking sap from the plants, resulting in stunt growth of shoots.

RESULTS

It was found that Lisanthus grown at Inthanon Floriculture Research Project germinated in 18 days after sowing. At first, seedlings grew rather slowly, having small tapered leaves with a diameter of 3 mm. When the seedlings were 55 days old, they produced the first pair of true leaves with a diameter of 6 mm. First

transplanting into plastic boxes using wider spacing was done afterward. This first transplanting was very difficult since the roots were too long. When the seedlings had 4 pairs of leaves in the following 32 days, they were transplanted into 3.5 inch pots. Sixty two more days after pot transplanting, the seedlings were planted in beds. Lisanthus first flowered after growing in beds for 82 days, and early pinching increased the number of flowers per plant. The Lisanthus flowers, ranging from white to pink to violet in color, are cup (or saucer)-shape. The diameter of a flower is about 5 cm. Each flower has 5 single petals, about 4 cm. wide. Vase life of the flower was approximately 10 days.

DISCUSSION

Because it was our first experience in growing Lisanthus, there were a number of mistakes and errors. Seed sowing and seedlings transplanting, for example, were very difficult. The seedlings were slow growing and very vulnerable to diseases. First transplaning was cumbersome because the shoot/root was not in good proportion, for example, the root was as long as 3 cm. while the diameter of leaves was still 3 mm. As soon as seedlings began to crowd, they should be promptly transplanted. To obtain healthy, easy-to-transplant seedlings, one should sow the seeds very lightly. The attack of mite at the time of transplanting into pots also reduced shoot growth.

The soil should have been steamed or fumigated to reduce the amount of Fusarium spores before planting. Lisanthus grown under 50% shade of saran produced healthier plants and longer flower stem than those grown under plastic. Lisanthus is a perennial; regrowth normally occurs after heavy cutting to the base of the plant.

In order to gain more experiences and answers to problems for improving growing methods and other cultural practices, more experiments are needed to be done.

CONCLUSION

Lisanthus could be grown as a cut flower at Inthanon Floriculture Research Project. However, many aspects of flower quality have to be improved before the plants can be grown commercially.

Table 1. Time of growth stages of Lisanthus at Inthanon Floriculture Research Project, Chomthong, Chiang Mai

Time of growth	Days
- Seeding-- germination	18
- Germination-- first transplanting	55
- First transplanting-- transplanting into pot	32
- Transplanting into pot-- transplanting into bed	62
- Germination-- transplanting into bed	149
- Transplanting into bed-- flowering	82
- Germination-- Flowering	231

Table 2. Major characteristics of Lisanthus at flowering time at Inthanon Floriculture Research Project, Chomthong, Chiang Mai.

Plant no.	Height (cm)	No.of flowers per plant	No.of petals per flower	Petal width (cm)	Flower diameter (cm)
1	25.0	10	5	4.0	6.0
2	27.0	11	5	3.0	4.0
3	23.0	4	5	3.5	5.0
4	27.0	7	5	4.0	5.5
Average	25.5	8	5	3.6	5.1

TESTING OF GLADIOLUS VARIETIES GROWN AT DIFFERENT CONDITIONS

INTRODUCTION

Gladiolus is a corm crop giving long spikes, bright-colored flowers, long strong stalk, with long vase life appropriate to be used as cut-flower. It is also easy to grow. In Thailand it can be grown all through the year. The flowers as produced are of good quality that it is not necessary to import. However, there are some problems on the varieties. Currently there are limited number of varieties grown at the commercial scale. This may lead to the decline of popularity of the flower as the cut-flower circle always looks for new intriguing commodities.

The Development of Cut-flower Industry Project has made every effort to secure new varieties to replace the old ones by ordering gladiolus corms of some 21 varieties from the Netherlands (Table 1) to be grown on trial in Chiang Mai. It was hoped that they could obtain new varieties which could yield beautiful and good quality flowers and grow well in Thailand. If such was acquired, mass propagation would be conducted for further promotion at the commercial scale.

MATERIALS AND METHODS

The experiment was conducted by growing those corms at

1. Ang Kha Noi Village, Tambon Ban Luang, Amphoe Chomthong, Chiang Mai province, at the altitude of 1,200 meters above sea level.

2. Royal Project Experiment Station, Tambon Huay Luek, Amphoe Chiang Dao, Chiang Mai province, at the 600 meter above sea level attitude.

They were grown in various kinds of shade as follows:

1. Shade with plastic.

2. Shade with saran.

3. Shade with plastic and saran.

4. Without shade.

RESULTS

From the comparison among the growth of plants and quality of gladiolus flowers grown at different places, it was found that the gladiolus planted at Ang Kha Noi grew better and had better quality in terms of flower, endurability of flower spikes, number of flowers on the spikes, than those grown at Huey Luek Royal Project Station.

Table 1. Flower color, perimeter of corm and average weight of the corm of 21 gladiolus varieties imported from the Netherlands to be grown in Chiang Mai Province.

	Varieties	Flower color	Perimeter of corm (cm.)	Average weight (g.)
1.	Bon Voyage	pink	10.70	12.30
2.	Bono's memory	pale purple	8.40	5.20
3.	Eurovision	rea	9.07	6.80
4.	Fidelio	red purple	8.70	5.90
5.	Greenland	greenish yellow	8.81	5.32
6.	Goldfield	yellow	8.99	6.34
7.	Herman Van der Mark	orange red	10.74	12.70
8.	Jessica	pink	8.64	8.20
9.	Mad vahldiek	pale violet	8.68	5.30
10.	Marianna	beige	8.87	7.26
11.	Nicole	crimson	8.71	5.20
12.	Nova lux	yellow	8.67	5.10
13.	Oscar	dark red	9.36	6.96
14.	Paganini	violet	8.79	7.30
15.	Piccolo	scarlet	8.60	5.80
16.	Praha	pink	11.12	14.20
17.	Royal violet	violet with white	8.32	5.76
18.	Sancerre	white	8.72	5.96
19.	Superwhite	white	8.35	7.60
20.	White prosperity	white	8.83	5.60
21.	Yellow stone	greenish yellow	11.39	14.08

From the experiment on growing gladiolus in different kinds of shades, it was found that outdoor planting yielded the best growth and best quality flowers.

The varieties yielding good quality flowers appropriately used as cut-flowers were:

Yellow flowers : Goldfield, Nova Lux, Yellow Stone

White flowers : Sancerre, Superwhite, White Prosperity

Pink flowers : Praha

Red flowers : Nicole, Oscar

Besides, some varieties had potential to be developed as cut-flowers as they had some interesting characteristics such as intriguing color, but having scent, small flowers or short spikes e.g. Fidelio, Berno's memory, Mad vahldiek, Royal violet and Paganini. The varieties improvement might be conducted by using the tissue culture technique plus the application of mutagen to increase the number of chromosomes. It was hoped that this should improve the characteristics of those varieties -- thicker petal, larger flower and longer spike.

The tissue culture technique was also employed in the propagation of the varieties giving good quality flowers.

The gladiolus corms for varieties testing were planted in early July 1986. It was expected that the corms and cormels could be collected at the end of December 1986 to early January 1987.

Figure 1. Gladiolus flowers from the imported corms, from left to right : Oscar (dark red), white Property (white), Mad vahldiek (pale violet), Nova lux (yellow), Fedelio (rea purple), and Praha (pink).

TESTING AND SELECTION OF IMPORTED CHRYSANTHEMUM VARIETIES

INTRODUCTION

Currently Thailand still imports a large amount of chrysanthemum both as single flowers and sprays from The Netherlands and Taiwan each year. Although chrysanthemum can be grown in Thailand, the flower color and quality are not very good. Therefore, the Royal Project has introduced new varieties from Japan, Taiwan and The Netherlands for testing and selection for the best and appropriate ones to be grown as cut-flowers.

MATERIALS AND METHODS

The testing and selection were conducted at the Cut-flower Research Station of the Royal Project, Ban Khun Klang, Doi Inthanon, Amphoe Chomthong, Chiang Mai province, which was located at the altitude of 1,200 meters above sea level. After flowering, the color, shape and type of flowers including the resistance to white rust (Japanese Rust) were recorded and are shown in Tables 1, 2 and 3.

RESULTS

The varieties as selected are as follows:

Japanese varieties:

Ja 5	HAKUTENGO
Ja 14	MAIHIME
Ja 21	SANYOBIJIN
Ja 24	SEIKOUNOYUKI
Ja 25	SEKAIIEKI

Taiwanese varieties:

TW 5	TA-SHIN-HON
TW 7	KUAN-SHEN-CHU
TW 8	MOON-RU (YAME JI)
TW 9	MARERA
TW 9	MURERA (PINK)
TW 12	PAI-TSIN-SHIN
TW 18	T2-RED FLOWER
TW 1	SHIAO-CHIN-HON
TW 26	KAO-YUEN-TSU-HSWER
TW 27	SHIN-LEE-HONG
TW 30	SHIN-MIIAO-HSING
TW 31	KIKAHITO

Varieties from the Netherlands:

HL 3	STATUSMAN
HL 4	YELLOW CAPPA
HL 16	DELTA
-	PING PONG
-	CREMON

Table 1. Japanese varieties.

Code	Varieties	plant date short day	Flower open date	Flower color	Flower shape	Type		Disease Resistance	Selected Varieties
						Single	Spray		
Ja 1	Arumanohikari	22 Sept.87	***	white	Single		✓	-	-
Ja 2	Ehigasa	22 Sept.87	***	pink	Single		✓	-	-
Ja 3	Eusyu-kogiku	22 Sept.87	8 Dec.86	white	Single		✓	-	-
Ja 4	Ginmeikan	22 Sept.87	22 Nov.86	white	Single		✓	-	-
Ja 5	Hakutengu	22 Sept.87	22 Nov.86	white	Incurve	✓		+++	✓
Ja 6	Jyurokoga	22 Sept.87	39 Nov.86	yellow	Single		✓	++	-
Ja 7	Kankobai	22 Sept.87	10 Nov.86	red	Decorative		✓	-	-
Ja 8	Kan-kogiku	22 Sept.87	**	white	Single		✓	-	-
Ja 9	Kan-koyuki	22 Sept.87	**	white	Single		✓	-	-
Ja 10	Kinko	22 Sept.87	25 Nov.86	yellow	Decorative		✓	-	-
Ja 11	Kinyo	22 Sept.87	11 Nov.86	Yellow	Single		✓	-	-
Ja 12	Kinpa	22 Sept.87	20 Nov.86	dark yellow	Decorative		✓	++	-
Ja 13	Kinriki	22 Sept.87	17 Nov.86	pale yellow	Decorative		✓	++	-
Ja 14	Maihime	22 Sept.87	20 Nov.86	pink	Spoon		✓	++	-
Ja 15	Meimon	22 Sept.87	17 Nov.86	white	Decorative	✓		-	-
Ja 16	Odainoyuki	22 Sept.87	15 Nov.86	white	Semidouble		✓	+++	-
Ja 17	Okayamakeiwa	22 Sept.87	17 Nov.86	pink	Decorative		✓	+	-
Ja 18	Otomezakura (Red)	22 Sept.87	20 Nov.86	pink	Decorative	✓		-	-
Ja 19	Otomezakura (White)	22 Sept.87	25 Nov.86	white	Decorative	✓		-	-
Ja 20	Otomezakura (Yellow)	22 Sept.87	22 Nov.86	yellow	Decorative	✓		-	-
Ja 21	Sanyobijin	22 Sept.87	30 Nov.86	yellow-pink	Spider	✓		-	✓
Ja 22	Seikouohana	22 Sept.87	17 Nov.86	pink	Incurve			+++	-

Table 2. Chrysanthemum varieties from Taiwan.

Code	Varieties	plant date short day	Flower open date	Flower color	Flower shape	Type		Disease Resistance	Selected Varieties
						Single	Spray		
		22 Sept.87	**	shocking pink			✓		
TW 13	Hon-Yu	22 Sept.87		(farmer all white)	Single		✓	-	-
TW 14	Hong-Fuang	22 Sept.87	17 Nov.86	white-yellow pink	Single		✓	-	-
TW 15	Tsin-Shin-Tsu-Hong	22 Sept.87	17 Nov.86	purple	Incurve	✓		-	-
TW 16	Tsu-Hon	22 Sept.87	17 Nov.86	pink	Decorative	✓		-	-
TW 17	Shin-Fan-Tsu-Ri	22 Sept.87	25 Nov.86	yellow	Incurve	✓		+++	-
TW 18	Ta-Red Flower	22 Sept.87	20 Nov.86	purple	Decorative	✓		-	✓
TW 19	Shiao-Chin-Hon	22 Sept.87 22 Sept.87	17 Nov.86	orange	Single		✓	-	✓
TW 20	Semi Spider Type	22 Sept.87	20 Nov.86	purple	Semi Spider	✓		++++	-
TW 21	Tsin-Shin-Tsu-Fa								
TW 22	Shiu-Fan-Tsu-Fue								
TW 23	Tsin-Shin-Tsu-Hon	22 Sept.87	15 Nov.86	orange	Incurve	✓		++++	-
TW 24	Hong-Houng								
TW 25	Shiau-Ting-Niang	22 Sept.87	19 Nov.86	pale purple	Single		✓	-	-
TW 26	Kao-Yuen-Tsu-Hs wer	22 Sept.87	20 Nov.86	white	Single		✓	-	✓
TW 27	Shin-Lee-Hong	22 Sept.87	17 Nov.86	purple	Decorative	✓		-	✓
TW 28	Ten-Kan-Tao	22 Sept.87	17 Nov.86	pink	Single		✓	-	
TW 29	Pac-Niao	22 Sept.87	17 Nov.86	white	Decorative	✓		+	-
TW 30	Shin-Miiao-Hsing	22 Sept.87	20 Nov.86	red with yellow	Decorative	✓		-	✓
TW 31	Kikahito	22 Sept.87	17 Nov.86	purple	Single		✓	+	✓

Table 3. Chrysanthemum varieties from the Netherlands.

Code	Varieties	plant date short day	Flower open date	Flower color	Flower shape	Type		Disease Resistance	Selected Varieties
						Single	Spray		
H1 2	Dark Mirus	22 Sept.87	22 Nov.86	pink	Single			+++	-
H1 3	States man	22 Sept.87	22 Nov.86	yellow	Pompon			-	
H1 4	Yellow Cappa	22 Sept.87	17 Nov.86	yellow	Anemone			-	
H1 16	Delta	22 Sept.87	17 Nov.86	pink	Single			-	
	Ping Pong	22 Sept.87	25 Nov.86	white	Pompon			-	
	Cremon	22 Sept.87	22 Nov.86	yellowish white	Anemone			+++	

Remarks *** successive flowering, the plant shape was Rosette which needed varnalizate.

** "hard" varieties, flowers not yet open

Severity of White Rust disease (Japanese Rust)

- \- Not infected
- \+ mildly infected
- ++ not so severely infected
- +++ severely infected
- ++++ very severely infected

PRODUCTION OF NEW HYBRIDS OF GERBERA

INTRODUCTION

Gerbera is very popular among local and foreign consumers. The market demand for gerbera was increasing steadily. There are in production three strains of gerbera -- Thai strains, double-flowered, not marketable abroad; American strain having 1-2 rays of ray florets, colorful, serving suitably as the bed flowers not the cut-flowers; and European strains having 1-3 rays of ray florets serving best as the cut-flowers because of its bright color and enduring blooming. The import of European strain seeds is too costly, at 7-10 Baht per seed, in spite of low germination percentage. From those seeds the plants gave variable-colored flowers, only small number of plants had good shape and quality suitable for cut-flowers. Therefore, the Project produced own quality seeds, using the good variety plants that the Royal Project imported from the Netherlands and certain selected Thai strains.

MATERIALS AND METHODS

Female parent plant was prepared by using white thin cloth bag, 12 x 13 cm., to cover the flower soon after budding. One day before full bloom (petal color and carpel were quite visible, but the anther had not yet released the pollen) the forceps were used to pick out the part of the disc floret which was packed at the head

and destined to be male reproductive parts, leaving only the female reproductive parts -- ray floret and the part of the disc floret -- which was the hermaphrodite flower but served as the female flower (located in circle between the disc floret and the ray floret).

For the male parent plant, similar white thin cloth bag was used to cover the flower of Beatrix variety before blooming. Then the pollens were collected on the petridish. A brush was used to obtain the pollen and then touch the end of the stigma (Figure 1) of every flower, and the flower was covered with the bags.

RESULTS AND DISCUSSION

Breeding of the European strains imported and cultivated by the Royal Project at Doi Inthanon had already been done. Those were the parent stocks. The breeding between the European strains was carried out. Seeds could be collected after 20-25 days at the average of 48.42 seeds per flower as shown in Table 1.

Table 1. Number of seeds from the breeding of European strains.

Parents	No. of flowers	Total No. of seeds	Average seeds/flower
Clementine x Beatrix	15	469	31.26
Agnes x Beatrix	5	122	24.40
Peter x Beatrix	7	309	44.14
Veronics x Beatrix	10	1,029	102.90
Helios x Beatrix	7	357	51.0
Cleopatra x Beatrix	4	76	19.0
Victoria x Beatrix	4	180	45.0
Applebloesem x Beatrix	9	792	88.0
Fleur x Beatrix	2	40	20.0
Belinda x Beatrix	5	210	42.0
Sanger x Beatrix	5	110	22.0
Shymphony x Beatrix	7	298	42.57
Jetty x Beatrix	4	60	15.0
Claudia x Beatrix	6	97	16.17
Nadya x Beatrix	5	206	41.2
Marleen x Beatrix	10	702	70.2
Total	105	5,084	48.42

In addition, the cross breeding between the European and Thai strains was also made. Seeds were collected after 28 days. The average number of seeds was much less than the breeding of the European strains -- 4.3 seeds per flower, as shown in Table 2.

Figure 1. Gerbera seed production.

a. collect the pollen.

b. brush the pollen on the end of the carpel.

c. cover after breeding.

d. seeds to be planted.

Table 2. Number of gerbera seeds obtained from the cross-breeding between Thai strain and European strain.

Parents	No. of flowers	Total No. of seeds	Average seeds/flower
Lueng Thor x Beatrix	10	33	3.3
Khao Chakyao x Beatrix	10	25	2.5
Khai Phra Lor x Beatrix	10	70	7.0
Total	30	128	4.3

All the hybrid seeds were planted at Doi Inthanon. It was found that the germination percentage was as high as 90 per cent. Further study was carried out to select good quality plants for cut-flowers. It was planned that the tissue culture technique would be used to propagate the selected plants for further distribution to farmers.

REFERENCE

Bargozzi C. and L. Quagliotti. 1978. Current Research on Breeding of Gerbera. Proc. Eucarpia Meeting on Carnation and Gergera. 57-68.