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Forcing of Tree Peony by Chemicals and Low Tempertaure Treatment, and Retarding by Long-term Cold Storage

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化学物質および低温処理によるボタンの促成開花および長期冷蔵による抑制開花

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Introduction

Commercial production of tree peonies has been focused on propagation of nursery plants. However, the propagation by grafting needs hard labor and must be completed in a limited period (Sep. -Oct.). In contrast, consummers are also getting more interested in cut and pot flowers than garden plants through change of housing conditions. So, some farmmers are shifting to production of cut and pot flowers by forcing or semi-forcing. Although flower production after late Jan. is stable, that in Dec. timed for New Year Days is very difficult, bringing about problems of flowering delay to Jan., poor development of leaf or abortion of flower bud.[1)]

This report describes preliminaly tests of flowering in Dec. by breaking dormancy of flower buds by chemicals and low temperature treatment, and flowering in autumn by long-term storage in subfreezing condition.

Materials and Methods

Two year old grafted-plants of cv. Taiyo in which flower buds reached perianth formation stage were dug on Sept. 22, wrapped with moist sphagnum moss and then treated with low temperature at 4°C. Forty days after treatment, the plants were exposed to 1 % C_2H_4 at 23°C for 3 days, 100 % N_2 at 23°C for 4 days or saturated ethanol vapor at 20°C for 30 minutes in plastic bags or containers. The rest of the plants were immersed in hot water at 40°C for 90 minutes. All the plants (6 plants per treatmnet) were then planted in pots (ϕ 24 cm) and grown in a glasshouse heated above 13°C (Fig. 1). Sprouting rate was checked every five days after planting. Harvest date of flowers (upper one fourth of perianth breaking from calyx), days to harvest from sprouting, cumulative temperatures (degree. days) from planting to harvest, leaf size on 7th node, length of flower stalk and flower diameter at anthesis were recorded.

For retarded flowering, three year old grafted-plants of cv. Kaoh were dug on March 12 and stored in plastic bags at 4°C or at −2°C after preliminary storage at 4°C for 5 days. The plants stored at 4°C were potted on June 11 and June 25, and those stored at

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−2°C, on Sept 7 and Oct 18. Flowering was checked 14-30 days after planting.

Results

All the treatments considerably promoted sprouting although the final percentage in hot water treatment was lower than that in control (Fig. 2). In preliminary experiments, 1 ml of 3% benzyladenin and 0.5% gibberellin (GA_3) solution administered to flower buds promoted sprouting but inhibited their growth. Supernant of 10% $CaCN_2$ solution also inhibited the growth with occasional necrotic death by phytotoxicity. But, garlic paste treatment after cold for 30 days promoted both sprouting and growth of flower buds (Fig. 3).

Harvest date of flowers accelerated 7-10 days in the treated plants although days to harvest from sprouting delayed 4-5 days (Table 1). Cumulative temperatures from planting to harvest decreased in the treated plants due to accelerated sprouting. Leaf development or extension was very poor in control plants but it was promoted by the treatments, particularly by C_2H_4 (Fig. 4). Flower diameter in treated plants was slightly smaller, but length of flower stalk was almost the same between control and treated plants.

For retarded flowering, a plant taken out on June 11 from storage at 4°C flowered normally on June 27, but another plant taken out on June 25 became blind. A plant taken out on Sept. 7 from storage at −2°C became blind, but another one taken out on Oct 18 flowered normally on Nov. 18.

Table 1. Effect of chemicals and hot water treatment on flowering of tree peony

Treatment	Average harvest date (month/day)	Cumulative temperatures from planting to harvest (degree·day)	Days to harvest from sprouting	Leaf size on 7th node (length×width) (cm)	Length of flower stalk at harvest (cm)	Flower diameter at flowering (cm)	Final percentage of harvested flowers (Dec. 26)
Control	12/22	919	24	1.3×1.7	27.3	13.8	80
C_2H_4	12/12	688	28	8.3×8.0	27.4	11.3	67
N_2	12/13	688	29	5.3×5.8	30.0	9.8	60
C_2H_5OH	12/12	745	29	5.6×5.6	26.3	12.0	50
Hot water	12/15	795	29	6.2×8.3	27.5	12.8	33

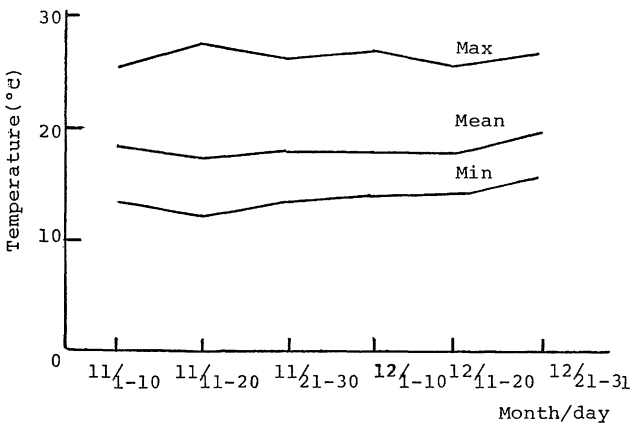

Fig. 1 Temperature in a heated glasshouse (average values by 10 days)

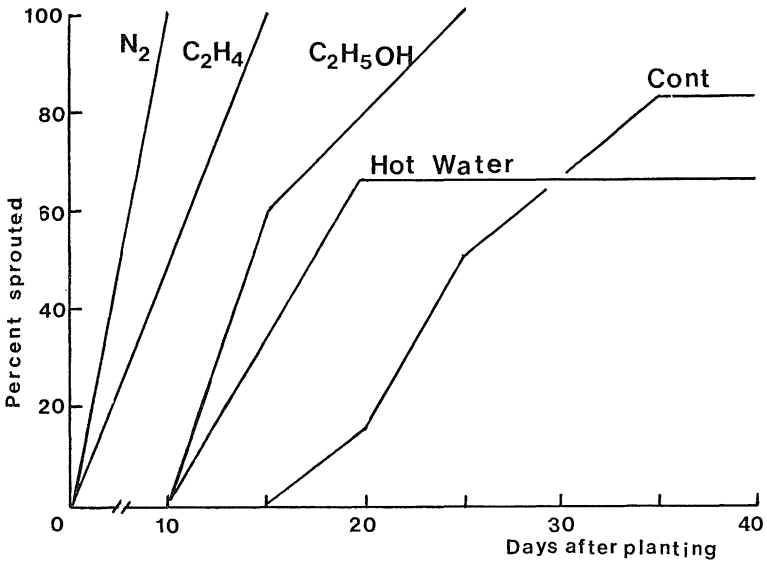

Fig. 2 Effect of chemicals and hot water treatment on sprouting.

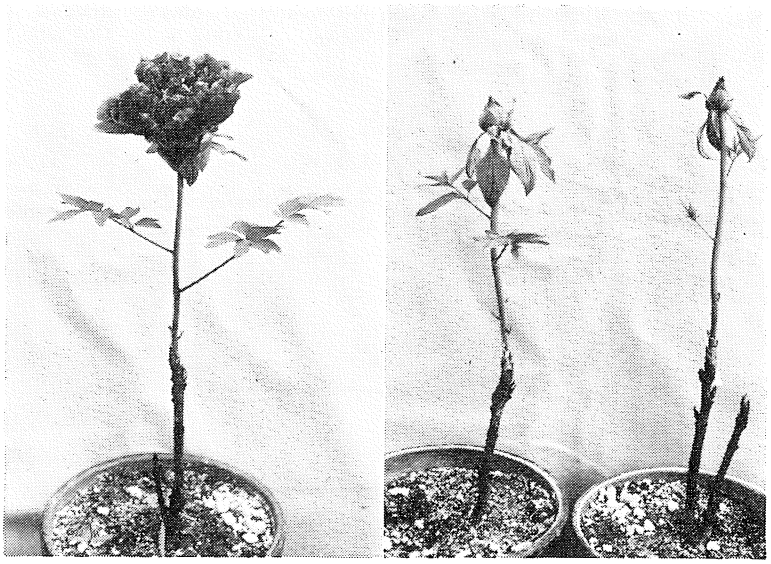

Fig. 3 A flowered plant by garlic paste treatment (left) and untreated control plans (right) (photographed on Dec. 8, 1982). Both plants were stored for 30 days at 4°C before the treatment.

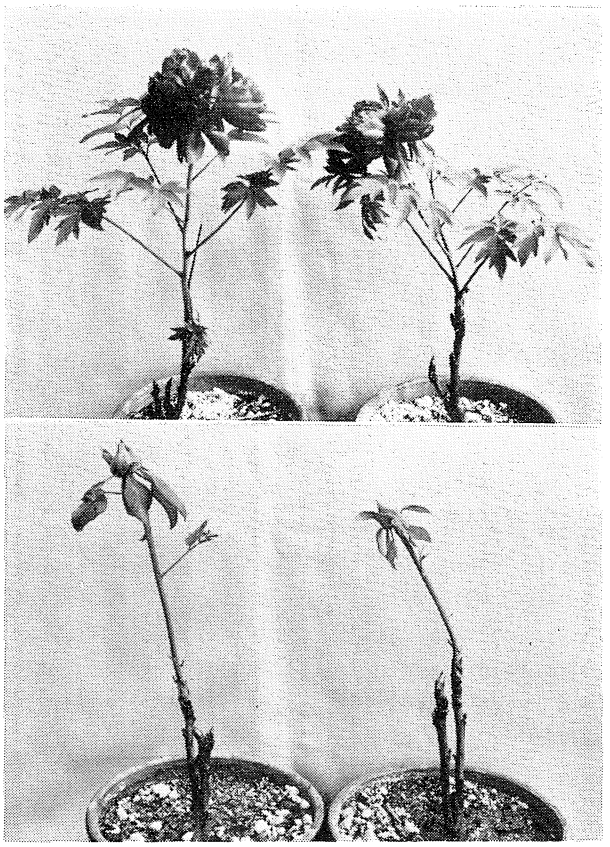

Fig. 4 Flowered plants by 1% C_2H_4 treatment (upper) and untreated control plants (lower) (photographed on Dec. 15, 1982). Plants were stored for 40 days at 4°C before the treatment.

Discussion

Forcing of tree peony has been practiced by breaking dormancy of flower buds with low temperature treatment (0-3°C) for 40 days.[1] However, flowering in Dec. is very erratic and frequently accompanies poor development of leaf or abortion of flower bud (blindness). Auther[2] reported that ethanol and acetaldehyde vapor, nitrogen, carbon mono (or di) oxide, calcium cyanamide and hot water treatment interrupted corm dormancy, accelerated sprouting and flowering in spring-flowering gladiolus. In tree peony also, some of these chemicals and hot water treatment promoted sprouting. Although action mechanism of these treatments has not been studied in tree peony, stimulation to respiration might be involved in promotion of sprouting as shown in gladiolus corms.[3] Leaf development was also promoted by the treatments. Probably, low temperature treatment for 40 days was not long enough to break leaf dormancy. Chemicals and hot water would have compensated for shortage of low temperature. However, stem elongation after sprouting in treated plants was slow and development of floral organ measured by flower diameter was slightly inferior. This is probably because nutrient sink in control plants was only flower buds. There seems a nutritional competition between leaf and flower bud because removal of a young flower

bud shortly after planting considerably promoted leaf development. Occurrence of blindness in the treated plants would be partly attributable to nutritional competition. Another reason for blindness seems to be forced sprouting of premature flower buds since floral stage just after low temperature treatment was still at androecium formation. Such a problem may be dissolved by delaying start of low temperature treatment or by extending the treatment duration so that floral stage is more advanced and becomes more resistant to blindness. Ten day delay of planting date (Nov. 10) is still permissible for harvest in the end of Dec. if chemicals were treated.

As for retarded flowering, occurrence of blindness would be due to high temperature injury at planting or due to delay of digging time at which the buds were about to sprout. Such a problem may be counteracted by proper temperature control at planting or by earlier digging in Feb.

Summary

Forcing of cut and pot flowers in tree peony (*Paeonia suffruticosa*) timed for New Year Days and retarding for autumn flowering were tested.

Saturated ethanol vapor, 1% ethylene and 100% nitrogen promoted sprouting of flower buds and extension of leaves, and accelerated harvest date of flowers when they were treated to the plants in which bud dormnacy was partially broken by low temperature treatment. Rate of blindness was low in ethylene treatment, but still higher than in control.

For retarded flowering, plants stored at 4°C and −2°C for months flowered normally in June and in Nov, respectively.

References

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摘　　要

ボタン（*Paeonia suffruticosa*）の正月出荷のための切花・鉢物促成開花，および秋出しのための抑制開花が検討された．低温処理により休眠が少し破れた株に，エタノール蒸気，1%エチレンおよび100%窒素ガスを施与すると，発芽および葉の伸展が促され，開花期も早められた．ブラインド発生は，エチレン区で少なかったが，対照区よりは多かった．抑制開花のために，4°Cおよび−2°Cで数か月貯蔵された株は，それぞれ6月と11月に開花した．