PEONIES AS A POTENTIAL FORCING CROP

T. G. Byrne
Department of Environmental Horticulture, University of California, Davis

The genus *Paeonia* (Family Paeoniaceae) consists of over 30 species most of which are of European or Asian origin. There are two horticultural groups: the woody "tree" types and herbaceous peonies. The latter are derived principally from *P. lactiflora* (Siberia) and *P. officinalis* (Europe), and consist of a large number of cultivars developed over many years and grown mainly as garden plants in cold winter climates. These are very hardy, bushy perennials 2 to 4 feet tall that die back in the winter but develop new flowering stems each spring from a tuberous crown. The blooms make excellent cut flowers. They store well and exhibit much the same vase characteristics as cut roses. Interest in herbaceous peonies as a commercial crop in this country apparently was abetted by the establishment of a large variety garden at the University of Illinois in 1926; by 1935 some 2000 acres of the plants are reported to have been in production in the vicinity of Evansville, Indiana, and horticulturists at Purdue University were investigating a number of cultural and post-harvest concerns of local growers. One of their more important conclusions was that flowers harvested when the buds first show color maintain their quality when stored dry for 3 to 4 weeks at 1°C (34°F). Field-grown cut-peonies continue as a minor floricultural commodity in the midwest, although today's total acreage is greatly reduced.

Locally, herbaceous peonies were grown as a cut-flower field crop in the Mission San Jose district of the city of Fremont, CA, for many years, even though freezing temperatures in that particular locale are rare. Although this planting has been moved to a nearby coastal valley where it is exposed to more extreme temperatures, it is still subject to production problems related not to climate but to the timing of the harvest period: it lasts only from late May until early June and misses most of the prime spring market. A solution to this problem may be to force the plants, since it has been reported that peony clumps may be forced successfully after a period of natural cooling.

Preliminary research at Davis indicates that herbaceous peonies do indeed have potential as a late winter/early spring low-energy greenhouse forcing crop. One obvious question is: How much chilling is required to break dormancy? To answer this, large dormant plants were dug from the field in Sunol during the winter, divided at Davis into crown segments of about 20 cm diameter, planted in a sand/peat/redwood sawdust medium in 15.2 liter plastic containers and maintained outdoors. Sufficient natural cooling was received by 'Festiva Maxima' the following fall and early winter to allow flower forcing as early as mid-December, but increasing the duration of the natural cold treatment before forcing resulted in longer shoot growth and more flower buds per shoot (Table 1).

Experiments with artificial cooling at Davis indicate that peony flower bud dormancy can be broken by storing dormant plants for a minimum of four weeks at 6°C, or about the temperature of a typical household refrigerator (Table 2.). However, increasing the storage time at this temperature to six weeks, or reducing the storage temperature to just above freezing for four weeks, increased the total number of shoots that grew during forcing (Table 3).

Peonies appear to initiate flower buds regardless of the environment, so every shoot is potentially a harvestable flower. Initiation probably occurs soon after the current season's flowers bloom; developing flower buds were observed at Davis in the larger basal buds of 'Sarah Bernhardt' in late June. On the other hand, initiation in 'Festiva Maxima' has been reported as occurring in late August in Japan. Long days do not appear to promote senescence and dormancy in her-

Table 1. Growth characteristics of 'Festiva Maxima' peonies grown outdoors and forced at different times during the winter (Davis, 1983-84).

Date Forced	Shoots/plant			Date First Harvest
	Total	> 10 cm	Flowering	
15 Dec	3.2	2.6	2.6	19 Feb
15 Jan	13.8	7.6	4.6	19 Mar
15 Feb	20.0	11.0	7.2	28 Mar
Not forced	14.0	10.8	11.0	29 Apr
SE	1.41	1.79	1.52	

Table 2. Growth characteristics of 'Festiva Maxima' peonies after storage at 6°C for 0,2,4,6, or 8 weeks (Davis, 1983-84).

Cold Storage (Weeks)	Shoots/plant			Forcing Time (Days)
	Total	> 10 cm	Flowering	
0	0.6	0.0	0.0	-
2	1.2	0.0	0.0	-
4	8.4	6.8	4.6	67.2
6	11.0	7.2	4.8	66.8
8	13.4	9.8	7.8	68.9
SE	1.43	1.34	1.28	

baceous peony as they do in a many other plants. The evidence is unclear, however, because plants given 24 hours of light (natural day plus supplemental incandescent light) at Davis during the summer and fall were also subjected to declining temperatures. Plants were observed to be dormant as early as late September regardless of photoperiod.

Days to first flower (48-52) in the greenhouse appears also to be unaffected by photoperiod; temperature seems to be the controlling factor in the development of peony flowers. Dormant plants must receive a minimum amount of chilling to break dormancy, but generally do not grow when dormancy has been broken naturally because the winter temperature is too low. Bud break and development occurs only when temperatures warm up in the spring. The time of bud break can be advanced by forcing, which takes about eight weeks at typical rose greenhouse temperatures (night minimum = 17°C).

Peony flower buds are highly susceptible to *Botrytis* infection. The underlying cause appears to be bud atrophy (withering), which could be due either to low shoot water potential (unlikely, because plants were well irrigated); metabolite insufficiency; competition between leaf and flower bud, or sensitivity of young flower buds to high temperature. The degree of bud sensitivity appears to vary with cultivar, and single flowers have not been affected at Davis.

Table 3. Growth of 'Festiva Maxima' peonies after 6 weeks of storage at greenhouse ambient and four cool-store temperatures (Davis, 1983-84).

Storage Temperature °C/°F	Shoots/plant		
	Total	> 10 cm	Flowering
Greenhouse ambient	0.6	0.0	0.0
14/59	0.4	0.0	0.0
10/50	3.8	3.4	2.4
6/42	11.0	7.4	4.8
1/34	17.0	9.4	4.4
SE	1.10	1.25	1.17

It may be that simply lowering the forcing temperature will result in less flower bud atrophy. This would certainly save on fuel costs! However, this would also result in longer crop time and perhaps infringe upon other seasonal crop space. A better approach might be to evaluate available cultivars and select those that are adapted to forcing as well as being otherwise suitable for commercial use. Using such selections, it may be feasible to grow peonies in the field and to dig, divide and force them in the greenhouse for earlier markets. A possible shorter-term alternative might be simply to grow them in the ground and force them in place under cold plastic.

Reference:

Byrne, T.G. and A.H. Halevy. 1986. Forcing herbaceous peonies. J. Amer. Soc. Hort. Sci. 111:379-383.

Environmental Horticulture Extension
Cooperative Extension
University of California
Davis, CA 95616

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Roy Larson
Horticulture
No. Carolina State Univ.
Raleigh, NC 27650