CULTURAL PRACTICE STUDIES WITH CUT FLOWERS, 2005

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EXECUTIVE SUMMARY:

The 2005 cultural practice studies with cut flowers were conducted in conjunction with variety trials at the East Ithaca Gardens site, both in the high tunnel, and in the open field. Time of planting studies with snapdragons and Rudbeckia were conducted in both locations. The most significant findings of our 2005 trials are listed below:

1. Snapdragons originally developed for winter and spring/fall production appear to be better adapted to late planting in the tunnel than our standard summer varieties. All varieties were inhibited from flowering in the hot summer conditions, but the winter/spring/fall types resumed flowering more quickly than the summer types, and produced higher yields as a result.
2. The length of harvested stems of cut flower species were increased by 25% when plants were grown under a shade canopy that reduced light by 50%, but the number of stems harvested per plant declined by 31%. Side curtains that sheltered the plants without reducing incident light increased stem length by 14%, without significantly decreasing yield. Rudbeckia, lisianthus and Trachelium reacted similarly to the treatments. Use of red vs. black shade material had similar effects on stem length and yield.
3. Although many sunflower varieties used as cut flowers are listed as day neutral in seed catalogs, controlled studies are demonstrating that this may not be so. We conducted 2 trials in 2005 in which seedlings were given 12 or 16 h daylengths for the first 3 weeks, and then transplanted to field or tunnel. Sunrich Orange flowered 3 weeks earlier after short day treatment in Trial 1, and 11 days sooner in Trial 2, with correspondingly shorter stem length and flower diameter. Procut Bicolor was **delayed** by 16 days with short day treatment in Trial 2. Procut Lemon, Strawberry Blonde and The Joker were unaffected by the daylength treatments. More extensive trials are planned for 2006.
4. Sunflowers are often grown at high densities to produce flowers that are small enough to satisfy the consumer. Forcing the plants to branch by topping may

produce enough stems that lower plant densities can be used. When sunflower plants were topped in the vegetative stage, leaving either 4 or 6 leaves, the plants produced 2.6 and 3.5 branches, respectively. For the earlier variety, Procut Orange, the stem length and flower diameter of the branches was marginally too small for commercial use, and a malformation of the flowers on these branches further reduced their usefulness. Sunrich Orange, on the other hand, flowered nine days later, and had more acceptable flower size when topped.

5. Topping of two varieties of lisianthus had a more modest effect on stem numbers, increasing yield per plant from 5 to 6.6 stems, and not significantly affecting stem length or time of flowering. Again, topping of this species deserves further study.
6. A time of planting study with Rudbeckia confirmed that sowing some varieties (eg. Indian Summer) of this species in June or later results in reduced stem length and for plantings sown in July, complete inhibition of flowering. Goldilocks, on the other hand, showed similar yields and stem lengths in all four plantings, from early March to early July, and is probably daylength neutral in response. Results of the stem elongation trial with Prairie Sun Rudbeckia indicated that stem length declines steadily with later harvests. For longest stems, Indian Summer and Prairie Sun appear to require long days.

SNAPDRAGON TIME OF PLANTING STUDIES:

Snapdragon varieties are classified into “Flowering Groups”, which indicate their adaptation to greenhouse production in different seasons of the year. According to this scheme, Group I varieties are best adapted to cool, low light, short day conditions of the winter, Group IV varieties are most productive in high light and long day conditions of the summer, with the intermediate numbers indicating adaptation to the changing conditions of spring and fall. For field production in the Northeastern US, we have generally used Group III-IV varieties such as Rocket. With season extension techniques such as high tunnels, the earlier spring transplant dates may be suitable to at least Group III, or even Group II varieties. Similarly, extending the growth period into late fall may prove suitable for these types as well. These date of planting studies were conducted to shed light on this subject.

Materials and Methods: Five varieties, ranging in Flowering Group from I to IV were sown on 4 dates, and transplanted either into the high tunnel or the field (Table 1). Spacing was 9 x 9in., with 4 rows on the bed, and 20 (tunnel plots) or 12 (field plots) plants per plot. There were two replications in each planting. At this spacing, plants produced many side branches, and this was encouraged by leaving 4 nodes at the base of the main stem at first harvest.

Table 1. Sowing, transplanting and harvest dates for four snapdragon trials, and the location of the trial after transplanting.

Trial no.	Sowing date	Transplant date	Harvest dates		Location
			First	Last	
1	Feb. 17	April 15	May 31	Aug. 16	High tunnel
2	March 15	May 17	June 8	Oct. 12	Field

3	June 2	July 27	Sept. 15	Nov. 7	Tunnel
4	June 22	Aug. 15	Sept. 7	Nov. 7	Tunnel

Results and Discussion: Temperatures during the summer of 2005 were about 5 F above the 30-year average temperatures (see Variety Trial results). This resulted in a cessation of bloom during late August in the first two plantings. As a consequence, Trial 1 was terminated at that time, while Trial 2 had no harvestable flowers from mid-August to late September, when harvests resumed, until mid-October (Table 2).

Table 2. Classification and source of five snapdragon varieties used in the time of planting studies, as well as the yield per plant in each planting.

Variety	Flowering group	Source	Stems per plant			
			Planting 1	2	3	4
Chantilly	1-2	Takii	6.8	9.3	8.3	3.4
Costa Mix	1-2	Johnny's	7.4	7.2	5.4	2.6
Apollo	2-3	PanAm.	5.6	7.4	6.2	2.0
Rocket Mix	3-4	Johnny's	8.7	8.0	4.6	1.9
Potomac Plum Blossom	3-4	PanAm.	3.8	5.7	2.6	1.0

Yields of marketable stems were highest in the outdoor planting, but also respectable for Plantings 1 and 3 in the tunnel (Table 2). Potomac Plum Blossom was consistently low yielding in all trials. The variety started flowering late, and in the trials that went through the hot period, it was slow in resuming productivity. The other Group III-IV variety, Rocket, showed a similar tendency in the later plantings, whereas the first three varieties were quicker to start and to resume production. This may indicate that there is promise for Group I-III varieties in early and late plantings, especially in tunnels.

Table 3. Stem length of five snapdragon varieties in the time of planting studies.

Variety	Flowering group	Source	Stem length, cm			
			Planting 1	2	3	4
Chantilly	1-2	Takii	62	54	52	52
Costa Mix	1-2	Johnny's	55	46	50	54
Apollo	2-3	PanAm.	70	63	62	74
Rocket Mix	3-4	Johnny's	70	47	48	57
Potomac Plum Blossom	3-4	PanAm.	68	58	66	57

Stem lengths tended to be greater for the varieties in the Groups II to IV (Table 3). Apollo was taller than Rocket in Plantings 2 to 4, and would have benefited from support to reduce the incidence of lodging in the tunnel trials.

Table 4. Days to first harvest for five snapdragon varieties grown in the time of planting studies.

Variety	Flowering group	Source	Days to first harvest			
			Planting 1	2	3	4
Chantilly	1-2	Takii	104	85	105	100
Costa Mix	1-2	Johnny's	103	85	105	105
Apollo	2-3	PanAm.	107	88	105	109
Rocket Mix	3-4	Johnny's	129	99	105	105
Potomac Plum Blossom	3-4	PanAm.	117	91	116	105

Earliness of the varieties was related to the Flowering Group, and to the number of leaves formed on the main stem below the lowest floret (Tables 4,5). Flowering was delayed by cool temperatures in the first and perhaps the fourth plantings, while the start of harvests in Planting 3 was likely delayed by the warm summer temperatures.

Table 5. Main stem node no. in the snapdragon time of planting studies.

Variety	Flowering group	Source	Main stem node no.			
			Planting 1	2	3	4
Chantilly	1-2	Takii	20	18	--	16
Costa Mix	1-2	Johnny's	20	19	--	28
Apollo	2-3	PanAm.	20	20	--	21
Rocket Mix	3-4	Johnny's	40	26	--	24
Potomac Plum Blossom	3-4	PanAm.	46	34	--	38

Flower quality of the individual varieties: Chantilly produced open-faced florets on relatively short racemes, and the spacing between individual florets was somewhat too wide to be pleasing. Costa Mix has conventionally-shaped florets. Costa had the shortest stems of any in the trial, and the mix consisted almost exclusively of white and dark red flowers. Apollo had open-faced florets and tall stems, with spacing among florets wider than desirable. Apollo Ivory was used in this trial.

The results of the trials indicate that there is scope for tunnel snapdragon production, with a sowing date of early June. There is need for a more extensive testing of varieties in Flowering Groups I to III to determine the ones best suited to this production period.

STEM ELONGATION TRIAL:

Many species of flowers grown as cut flowers would be more marketable if their stems were longer. The current trial is a continuation of work started in 2004, in which we attempted to stimulate stem elongation of three species, namely lisianthus, Trachelium and Rudbeckia with shading and shelter treatments.

Materials and Methods: Seeds of the 3 species were sown in 72-cell trays in the greenhouse, starting lisianthus (Echo Champagne) on Feb. 2, Trachelium (Jemmy Antique Rose in Reps I and II, and a mix of varieties in Rep III) on Feb. 15, and Rudbeckia (Prairie Sun) on March 15. Plants were transplanted May 26 outdoors at East Ithaca Gardens, with 9 x 9 in. spacing between plants of lisianthus and Trachelium (20 plants per subplot) and 12 x 12 in. spacing for Rudbeckia (15 plants). The experiment was arranged in a split plot design, with shading treatments as main plots, and species as subplots. Shading treatments consisted of black and red shading material (Chromatinet) supplied by Signature Supply Co. (www.signaturesupplyonline.com) . Both materials intercepted 50% of incident radiation, and were draped over the plots on frames 5 ft. high, 4 ft. wide and about 15 ft. long. In the side curtain treatments, fabric was only hung on the east, south and west sides of each plot, leaving top and north side open. The shading treatments had only the north side open for harvesting. Cover treatments were put in place June 9, and remained on the plots until the end of the harvesting season in early November. Harvests were made as needed, at the marketable stage of the flower stems, and each stem's length and its diameter just above the cutting point were measured.

Results and Discussion: Stem length was increased by 25% when plants were grown under a shade canopy, and by 14% in the side curtain canopy (Table 6). Shading treatments reduced stem yield by 31%, whereas side curtains had no significant effect on number of stems per plant. Although we had expected to see thinner, weaker stems in the shading treatments, the opposite tended to occur. Average stem size was not affected by the curtain treatments.

Table 6. Stem length, stem number per plant and stem diameter of three cut flower species when shaded with 50% shade fabric, or provided with side curtains, in an outdoor experiment.

Treatments	Stem length, cm	Stem number/plant	Stem diameter, mm
Control	37.0c	11.4a	4.5b
Canopy, black	46.2a	7.2c	4.7ab
Canopy, red	46.9a	8.5bc	4.8a
Side curtain, black	41.2b	9.7ab	4.5b
Side curtain, red	42.8b	10.0ab	4.5b
Treats. stat. signif.	***	***	**
Lisianthus	45.9a	6.3c	4.0b
Trachelium	41.6b	8.9b	4.2b
Rudbeckia	41.1b	12.8a	5.6a
Species stat. signif.	***	***	***
Treat. x Species interaction signif.	n.s.	n.s.	*

Although the shade canopy treatments stimulated stem extension to the greatest extent, the reduction in yield would argue against use of such treatments. The design of our shade canopy was also not convenient for harvesting, and would need to be higher. The results indicate that side curtains would be a more convenient way of stimulating stem extension. Presumably the curtains are reducing plant movement, and are acting as windbreaks. Such effects could also be achieved by alternating rows of tall and short crops in the field, planted at right angles to the prevailing wind, a practice already in use in some cut flower growers' fields. Our results indicate that the three species of cut flowers tested reacted similarly to the treatments imposed, except with regard to stem thickness. The significant treatment x species interaction arose from the lack of treatment effects on lisianthus, in comparison to the other two crops (not shown). In contrast to the results of the 2004 trials, the red fabric did not cause an additional stimulation of stem growth, nor did it have less adverse effect on stem yield.

During the harvest season, that extended from late June through October, the length of the harvested stems of Rudbeckia declined steadily (Fig. 1). Differences among shading treatments were maintained, but stem length in October was less than half that in July. This is likely related to the decreasing daylength, and is also found in the time of planting study, described below.

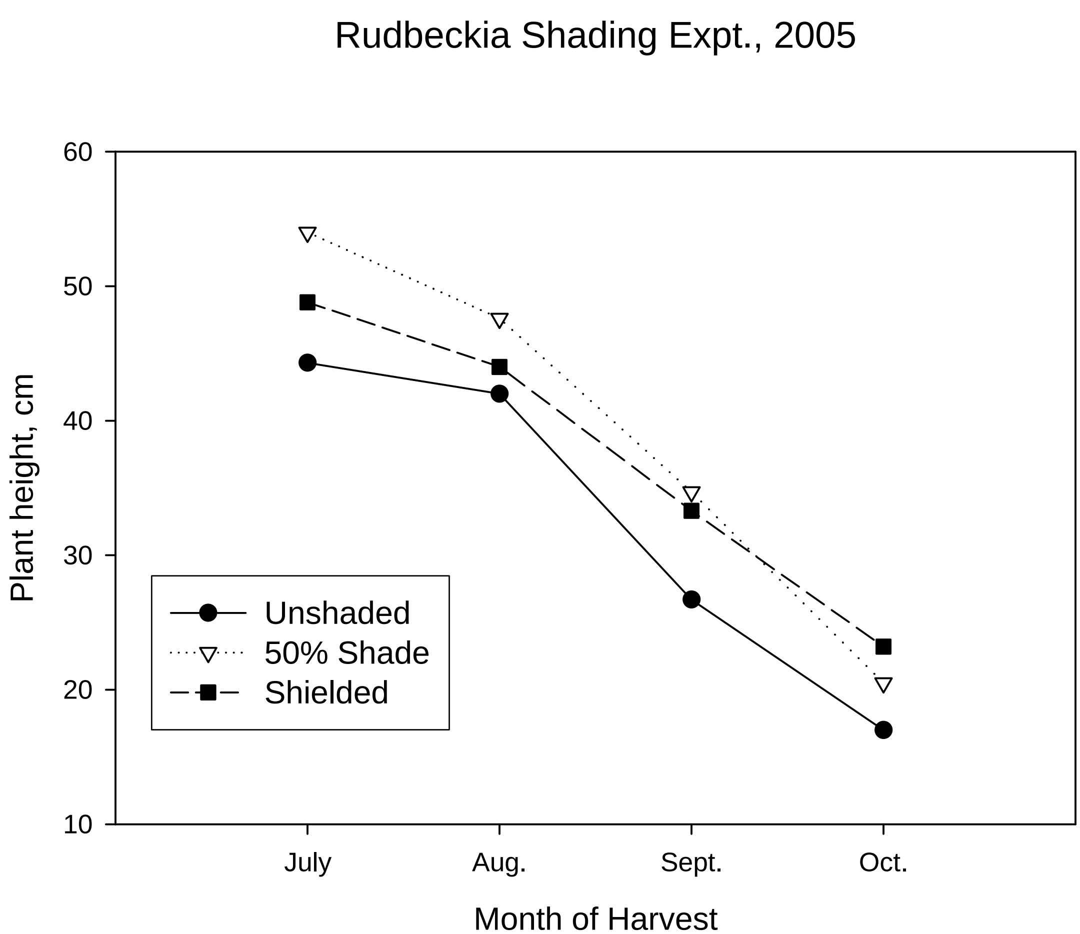

Fig. 1. Length of harvested stems of Rudbeckia Prairie Sun during the harvest season, comparing the three shading treatments.

SUNFLOWER DAYLENGTH TRIALS:

Sunflower has become one of the most popular cut flower species grown in the Northeastern US, and market demand is strong for most of the year. Season extension using high tunnels is tempting, but it means that the plant is going to be growing at daylengths early and late in the year, under which the specific variety was probably not developed. Since most modern sunflower varieties are day-neutral, out of season production is not a problem, but recent published research indicates that some varieties of sunflower listed in seed catalogs as day-neutral are actually flowering sooner in short day conditions. In particular, Blacquiere et al. (2002) found that 'Sunrich Orange' and 'Sunbright' will flower earlier if subjected to daylengths of 12 h or shorter in the first 3 weeks of growth, than if the plants are grown in 14 to 16 h daylength. The present experiments were conducted to check these findings, and extend them to varieties used here.

A. TRIAL 1

Materials and Methods: Seeds of four varieties of sunflower, namely Sunrich Orange, Procut Lemon, Strawberry Blonde and The Joker, were sown in 128-cell seedling trays in a 25/20 C greenhouse, and subjected to either 12 hours or 16 hrs photoperiod on a controlled daylength bench. The plants were kept at the controlled daylength for 3 weeks, and then transplanted to field plots at East Ithaca Gardens, in beds covered with green plastic mulch, and watered with trickle irrigation. Spacing was 9 x 9 in. in four rows on 4 ft. wide beds, with 2 plants per hole. Rep. 1 was sown April 26 and transplanted May 18; Reps 2 and 3 were sown May 2 and transplanted May 26. There were 24 plants per plot.

Results and Discussion: The daylength during the first 3 weeks of growth influenced only Sunrich Orange significantly (Table 7). With this variety, plants grown in 12 hour photoperiod flowered 3 weeks earlier, and were 41% shorter than those grown in 16 h daylength. The size of the flower was also proportionally smaller. The shorter daylength triggered the plants to flower after initiating 11 leaves, compared to 19 leaves in the plants treated with long days. The other 3 varieties did not show a hastening of flowering under the influence of the shorter daylength, and had similar plant size in both treatments.

Our results substantiate the published findings of Bacquiere et al. (2002), and indicate that seed catalog descriptions of the alleged lack of daylength sensitivity of Sunrich Orange need to be revised. For early flowering, keeping the daylength short in the early seedling stage could be useful with this variety, but flower size will be significantly smaller as a result.

Table 7. Effect of daylength during the first 3 weeks of growth on time to flowering, plant stem length, flower disk diameter and main stem leaf number of four sunflower varieties.

Variety	Daylength, hours	Days to flower	Stem length, cm	Flower disk diameter, cm	Main stem leaf no.
Sunrich Orange	12	62	75	4.2	11
	16	84	127	6.7	19
Procut Lemon	12	71	93	4.8	14
	16	74	104	5.5	16
Strawberry Blonde	12	81	457	5.8	24
	16	79	149	5.4	22
The Joker	12	81	159	6.4	22
	16	76	135	5.8	19
Significance		***	***	***	***

B. TRIAL 2

Materials and Methods: A second trial was sown in 72-cell trays on July 27 and transplanted to the high tunnel on August 25. Because of space limitations, only two varieties were included, Sunrich Orange, and Procut Bicolor (assumed to be day neutral, as was Procut Lemon in the first trial). The two varieties were grown under either 12 hour or 16 h daylength for the first three weeks after emerging. Two additional treatments were applied only to Sunrich Orange: one week of 16 h daylength, followed by 2 weeks at 12 h, or the reverse (two weeks of 16 h, followed by one week of 12 h). There were two replications, and spacings and plants per plot were as in the first experiment, except that plants were thinned to one per hill.

Results and Discussion: Treatment of Sunrich Orange sunflower seedlings with 12 hour photoperiod for the first three weeks again reduced time to flower, and inhibited vegetative growth and size of the flower (Table 8). Results were not as dramatic as in the first experiment, presumably because of the higher temperatures prevailing in late summer. The results of the transfer treatments indicate that the seedlings are already sensitive to daylength in the first week after emergence. Plants exposed to long days in the first week after emergence flowered 6 days later than those grown in short days throughout. Two long day weeks initially caused a further delay in flowering, and increase in plant size.

Table 8. Effect of daylength during the first 3 weeks after emergence on days to flowering, plant and flower size and main stem node number in 2 varieties of sunflower.

Variety	Daylength treatment	Days to flower	Stem length, cm	Flower diameter, cm	Main stem leaf number
Sunrich Orange	12 hrs	51	53	4.0	16
	16 hrs	62	81	4.6	21
	16 h 1 week fb.12 h 2 weeks	57	62	4.2	18
	16 h 2 weeks fb. 12 h 1 week	59	73	4.2	21
Procut Bicolor	12 hrs	73	139	6.8	25
	16 hrs	57	91	5.3	19

Contrary to expectations, Procut Bicolor was **delayed** 6 days by the short day treatment, and showed a corresponding **increase** in plant and flower size. Although this reaction has not been reported before for this specific variety, sunflower is known to have some varieties that flower earlier in long days (Thomas and Vince-Prue, 1997). Since the Procut series of varieties is thought to be day neutral, this again indicates that each line needs to be checked. A more extensive study of daylength response of sunflowers grown as cut flowers is planned for 2006.

PLANT TOPPING TRIALS:

With many cut flower species, we are interested in harvesting not only the main stem, but also branches that arise from the basal nodes of the plant. Removing the main growing point before the first flower opens will stimulate earlier branching, but these branches may be shorter, and the flowers arising from them smaller than the main stem flower they replace. The following exploratory experiments were conducted with sunflower and lisianthus whether topping should be practiced.

A. SUNFLOWER:

Seeds of Procut Orange and Sunrich Orange were sown in 128-cell trays in artificial mix in the greenhouse on June 6, and transplanted to the field on June 28. Spacing in the field was 9 x 9 in., with 4 rows in a bed, mulched with green plastic mulch and irrigated by two trickle lines per bed. Treatments consisted of an untreated control, and removal of the main stem growing point when the plants had either 4 or 6 fully expanded leaves. Treatments were arranged in randomized complete block design, with 3 replications. When individual flowers had colored petals that were just opening, and formed a right angle with the floral disk, flowers were harvested, and stem length, leaf number and flower disk diameter were measured. In the case of topped plants, stems were harvested at the point of attachment to the main stem.

Results and Discussion: Removing the stem apex when the plants had either 4 or 6 expanded leaves forced the plants to branch, and these branches flowered about a week after the control plants (Table 9). Topping also reduced the size of the flowers, and the branches that were formed had fewer nodes, and these branches were 35% shorter than the unpruned plants. Topping increased the number of stems per plant from 1 to 2.6 and 3.5, for those topped at the 4 and 6 leaf stage, respectively. In general, the two varieties reacted similarly to the treatments, resulting in no significant interactions of treatment x variety. Sunrich Orange flowered 11 days after Procut Orange, and thus was significantly taller, with a 38% increase in flower diameter. Topping of Sunrich Orange resulted in branches with 15 leaves, compared to 24 leaves on the control plants. In Procut Orange, branches had significantly fewer leaves, averaging 7 in comparison to 20 on control plants (Table 10). This resulted in a significant treatment by variety interaction (at the 1% level). Topped plants of Procut Orange showed a significant incidence of malformed flowers, with irregular disk shapes, and petals forming in the disks. Sunrich Orange had a much lower incidence of this disorder, but since this variety flowered later than Procut Orange, it is difficult to know if this is a varietal difference, or due to an interaction of the variety with the climate at the time.

In summary, the topping treatments produced significant increases in plant stem numbers, but in the case of Procut Orange, the flowers were marginally too small for commercial use, and the malformation mentioned above further reduced marketable yield. The later-flowering Sunrich Orange produced larger flowers and longer stems when topped, and is worth evaluating again with this treatment.

Table 9. Plant height, flower disk diameter, leaf number per stem, stems per plant and days to flower for 2 sunflower varieties in a topping experiment.

Treatments	Stem length, cm	Flo. Disk dia., cm	Leaf no.	Stems/plant	Days to flower
Procut Orange	76	4.8	11	2.3	62
Sunrich Orange	100	6.6	18	2.4	73
Stat. sign.	***	***	***	n.s.	***
Control	115a[z]	7.8a	22a	1.0c	63b
Topped at leaf 4	78b	5.0b	11b	2.6b	70a
Topped at leaf 6	72b	4.4b	10b	3.5a	70a
Stat. sign.	***	***	***	***	***

[z]Means within a column followed by the same letter are not significantly different as determined by Duncan Multiple Range Test at the 5% level.

Table 10. The effect of apex removal (topping) at two times on cut flower characteristics of 2 varieties of sunflower.

Variety	Treatment	Stem length, cm	Disk dia. cm	Leaf no.	Stems/ plant	Flower date, DAS
Procut Orange	Control	101	7.0	19.7	1.2	59
	Topped at leaf 4	69	3.9	7.5	2.4	63
	Topped at leaf 6	59	3.6	6.3	3.4	64
Sunrich Orange	Control	128	8.6	23.6	0.9	68
	Topped at leaf 4	88	6.1	15.3	2.8	76
	Topped at leaf 6	84	5.2	14.9	3.6	76
Interact. Sign.		n.s.	n.s.	**	n.s.	n.s.

B. LISIANTHUS:

Materials and Methods: Seeds were sown Feb. 4, and transplanted on May 19 to the field at East Ithaca. The two varieties used in the trial were single-flowered Laguna 2,3 Rose Deep, and Laguna 4 Rose Deep (both from PanAmerican). In the field, plots consisted of 12 plants, spaced 9 x 9in. apart, with 4 rows across the bed. Beds were covered with green plastic mulch that allows transmission of heat, but not of visible radiation. Two trickle irrigation lines per bed provided water when needed. There were 3 replications. Topping treatments consisted of an untopped control, and topping at transplanting, leaving the three basal nodes of the main stem.

Results and Discussion: Topping the two varieties of lisianthus at node 3 resulted in a 32% increase in stem number per plant, without affecting the length of the harvested stems. Flowering date was also not significantly altered by apex removal. The reactions of the two varieties were also not different, nor did the two varieties have inherently different productivity earliness or stem length. The study will be repeated in 2006 with a wider range of plant material.

Table 11. Effect of plant apex removal on number of stems per plant and harvested stem length for two lisianthus varieties. The varietal differences and variety x treatment interaction were not significant.

Treatment	Stems per plant	Stem length, cm
Control	5.0	41
Topped	6.6	42
Stat. signif.	*	n.s.

RUDBECKIA TIME OF PLANTING STUDY:

Rudbeckia hirta is a short-lived perennial with showy flowers and extended vase life, that would be a desirable cut flower if it could be harvested during summer and fall. In a 2004 planting at the end of June in the high tunnel, five varieties of this species produced only a few flowers, even though plant growth was vigorous in the tunnel. When plants were grown in either 12 hour or 16 hour daylengths in a greenhouse, only those in long days flowered, and if transferred to short days, continued to produce flowers, but the later flowers produced successively shorter stems. The current trial was therefore planted at four dates to determine the latest date at which Rudbeckia would produce flowers of acceptable stem length.

Materials and Methods: Two varieties of Rudbeckia, Indian Summer (Johnny's) and Goldilocks (Benary), were sown on March 5, May 2, June 2 and July 1. Spacing in the field was 12 x 12in., with three rows on the bed, mulched with green plastic mulch and irrigated by two trickle lines under the plastic. There were 15 plants per plot, with two replications. The first two plantings were transplanted to the field, the last two to the high tunnel, about 6 weeks after sowing.

Results and Discussion: Productivity was highest in the earliest planting, and especially for Indian Summer, declined precipitously for later plantings (Table 12). The last planting of Indian Summer had very few flowers, and those that appeared were nearly without stems, and were not harvested. Goldilocks was not as vigorous or productive, but it was more consistent in stem length when comparing spring with summer plantings.

The results are similar to those obtained with late plantings in 2004, although those did not include the variety Goldilocks. It would appear from the 2005 results that Goldilocks is insensitive to daylength. The results also suggest that Indian Summer not be planted later than early to mid-May. The short stems in later plantings of this variety reflect the decline in stem length of Rudbeckia hirta Prairie Sun in later harvests in the stem elongation trial described above.

Table 12. Effect of sowing date on productivity, earliness and stem length of two varieties of Rudbeckia. The March and May plantings were in the field, those sown in June and July were transplanted into the high tunnel.

Variety	Sowing date	Stems per plant	Stem length, cm	First harvest date	First harvest, days from sowing
Indian Summer	March 5	13.5	46	6/25	112
	May 2	3.9	52	8/20	110
	June 2	2.2	39	9/3	93
	July 1	0.2	29[z]	10/5[z]	96[z]
Goldilocks	March 5	8.6	37	6/30	117
	May 2	5.0	31	7/19	78
	June 2	6.8	38	8/11	70
	July 1	4.0	32	9/14	75

[z]very few stems produced by Indian Summer in this planting

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