Table 4. The effect of cumulative light energy (Em^{-2}) on the average number of breaks[z] and fresh weight of 3 seed geranium cultivars.

Cultivar		Light treatments 1 Natural light 24HPS, 2 Saran	2 Natural light 24HPS, 1 Saran	3 Natural light	4 Natural light 12HPS	5 Nautral light 24HPS
Sprinter Scarlet						
Breaks	Expt. I	1.1a[y]	2.4b	2.3b	3.6c	5.4d
	Expt. II	1.4a	2.7b	2.3b	3.5c	4.6d
Fresh wt (g)	Expt. I	31.2ab	27.8c	28.5ac	33.6b	26.6c
	Expt. II	19.7a	22.0bc	19.8ab	24.2c	23.2c
Sprinter White						
Breaks	Expt. I	1.0a	2.1b	2.2b	1.8ab	4.0c
	Expt. II	1.2a	2.2b	2.5b	2.8b	3.6c
Fresh wt (g)	Expt. I	29.4a	33.6	29.7a	29.5a	25.1b
	Expt. II	19.9a	21.4ab	19.8a	24.3b	22.5ab
Ringo						
Breaks	Expt. I	1.0a	2.5b	2.3b	2.5b	4.1c
	Expt. II	1.4a	2.4b	2.8bc	2.9c	3.6c
Fresh wt (g)	Expt. I	24.7ab	27.6ac	24.8ab	27.8c	24.0b
	Expt. II	18.9a	21.7b	23.1b	26.1c	21.8b

[z]Growing point 0.5 cm from the stem or more with 3 fully developed leaves.

[y]Mean separation in rows by Duncan's multiple range test, 5% level.

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Bench Chip Budding of Field Roses[1]

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Additional index words. grafting, *Rosa hybrida, Rosa multiflora*

Abstract. **A high percentage of successful bud unions were obtained by bench chip budding selected *Rosa hybrida* L. budwood on dormant, unrooted *Rosa multiflora* Thunb. understock. Chip budding was successful using both hand technique and a Liliput grafting tool. Parafilm strips were the most effective graft wrapping material.**

Texas is the largest producer of field rose bushes with a $15 million industry. Under present practices, many Texas growers harvest less than 65% of cuttings planted. New techniques are needed to more effectively produce field roses which are individually handled 20-25 times during their 2-year production cycle (Table 1). Bench chip budding (2) has potential advantages of eliminating production steps since cutting switches, de-eying cuttings (removing lower buds to prevent suckering), and budding can be done at the same time indoors during the "downtime" of winter, reducing time and discomfort to the worker who would bud on a bench vs. conventional T-budding in the field. Other advantages of bench chip budding are budding onto dormant understock vs. field seasonal dependence on T-budding to maintain active understock cambium, and reducing the growth cycle since a 3-6 month advantage may be gained in the development of the scion.

This study was undertaken to investigate bench chip budding as a more efficient system for producing field roses.

Experiment 1. To evaluate graft wrapping materials and techniques in the bench budding process, a 2 x 4 factorial experiment in randomized complete block design was initiated in March, 1979. 'Blaze' and 'Spartan' rose scions were chip budded onto 20 cm long unrooted *R. multiflora* rootstock and 4 graft wrapping materials and techniques were compared: plastic budding tape removed after 3 weeks, Parafilm tape–a waterproof, flexible, stretchable, thermoplastic film with a paper backing (American Can Co., Greenwich, Conn.) removed after 3 weeks, Parafilm tape retained and Parafilm tape retained with bud exposed. There were 20 grafts per treatment which was replicated 4 times. Budded rose cuttings were stored in a dark growth chamber at 27°C for 2 weeks in polyethylene bags containing moist sphagnum and then potted in 15 cm pots containing 1 peat:1 perlite by volume and placed in a cold frame to root. Data were taken after 5 weeks.

Experiment 2. To characterize bench chip budding of roses grown under commercial conditions of East Texas, a 2 x 2 x 2 x 2 factorial randomized complete block design was initiated in December, 1979. Chip budding of 'Blaze' and 'Climbing White American Beauty' budwood onto dormant 'Brooks

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Table 1. Two-year field rose production cycle, East Texas.[z]

Step	Date	Procedure
1	Nov. 1980–Feb. 1981	Multiflora hardwood cuttings placed in field for rooting
2	Mar.–Aug. 1981	Budwood collected and stored from late Fall 1980, T-budded to active multiflora understock; no budding during dry summer without irrigation
3	Oct.–Dec. 1981	Breaks from multiflora understock used as hardwood cuttings
4	Dec. 1981–Jan. 1982	Scion budwood forced during previous season is cut back before cutting back multiflora understock
5	Feb.–Mar. 1982	Budded multiflora understock cut back to force scion bud break
6	Sept.–Dec. 1982	Rose bushes planted in Nov. 1980 pruned for budwood and later dug and processed for storage and shipping

[z]Grading, storage and packaging processes have been omitted.

Table 2. Effect of bench chip budding by hand and by Liliput budding tool using Parafilm strips and budding rubbers when budding 'Blaze' and 'Climbing White American Beauty' to the rootstocks Brooks 56 and a disease-indexed *R. multiflora*.

Treatment		Bud union (%)			
		'Blaze' bud		'Climbing White American Beauty' bud	
Budding method	Wrapping material	Rootstock Brooks 56	Rootstock Multiflora[z]	Rootstock Brooks 56	Rootstock Multiflora[z]
Hand	Parafilm	87a[y]	53b	93a	80a
	Budding rubber	67b	27c	67b	73a
Tool	Parafilm	93a	93a	87a	87a
	Budding rubber	80a	87a	67b	80a

[z]*R. multiflora* indexed free of spring dwarf and mosaic virus.

[y]Mean separation within column by Duncan's multiple range test, 5% level.

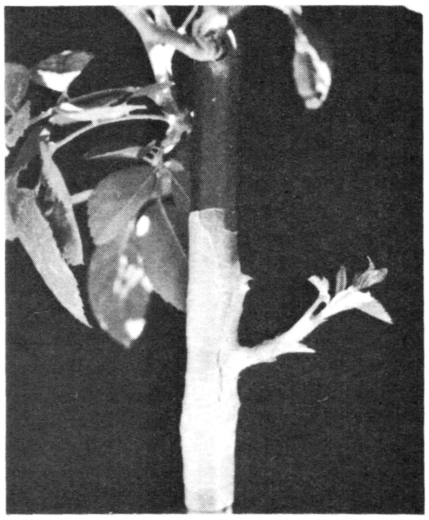

Fig. 1. Chip bud of 'Blaze forcing through Parafilm wrapping strip. Foliage is from multiflora rootstock which will later be cut back to recycle cuttings.

56' and a disease-indexed *R. multiflora* were compared when budded by hand technique and with a Liliput budding tool (J.E. Heitz, Inc., St. Helena, Calif.); parafilm strips and conventional rose budding rubbers were used to wrap grafts. Fifteen grafts in each of the 16 treatment configurations were replicated 5 times. Budded cuttings were stored in a dark growth chamber at 24°C for 1 week in polybags containing moist sphagnum and planted under field conditions in East Texas. Data were taken after 14 weeks and plants remained in the field for future evaluation.

In Experiment 1, 90-100% successful bud unions occurred regardless of wrapping material used, or whether tape was removed, retained, or graft was wrapped without covering the bud. Parafilm overwrapping was not a barrier to bud forcing (Fig. 1).

In Experiment 2, successful bud unions occurred with both the Liliput budding tool and hand budding techniques (Table 2). Poorer responses occurred with hand chip budding of 'Blaze' budwood on the indexed understock which may have been attributable to smaller bud pieces used; it has been our observation that 2-3 cm bud pieces are more effective in chip budding of dormant rose understock. Parafilm was more effective than budding rubbers traditionally used by growers, possibly due to reducing desiccation and acting as a protective barrier (Table 2). Some girdling and tissue necrosis occurred with budding rubbers, since grafts were buried under the soil and budding rubbers were not subjected to ultraviolet light breakdown, which normally happens in the above ground T-budding process. Parafilm used in combination with grafting rubbers has worked well with difficult-to-graft black walnut (1); however, our results with roses indicate that Parafilm alone, wrapped 2-3 times around the graft, is sufficient.

These data indicate that bench chip budding can be used to improve the production efficiency of field roses in Texas.

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Tall Fescue Sod Production with Plastic Netting[1]

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Additional index words. Festuca arundinacea, sod netting, turfgrass

Abstract. **Good quality sod of tall fescue (*Festuca arundinacea* Schreb.) was produced in 4.5 months with spring seeding and 9 months with fall seeding. A high seeding rate (40 g/m^2) resulted in turf shoot competition during the early establishment period and increased the severity of *Helminthosporium* leaf spot. However, the high seeding rate produced a sod with increased quality, turf cover, and sod strength.**

In the transition zone between regions of adaptation for cool and warm season turfgrasses, tall fescue is widely seeded for home lawns, parks, athletic fields, and general turfgrass sites. Sod does not hold together well for cutting, delivery, and laying and is seldom used. Kentucky bluegrass (*Poa pratensis* L.) often is seeded in mixtures with tall fescue to provide sufficient sod strength. Sod strength sufficient to lift the turf usually is not achieved for 12 to 18 months. Then, if the more aggressive bluegrass

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