Reprint file please: (PC/19)

PC 19 - 1989 repo

WELSH COLLEGE OF HORTICULTURE

HORTICULTURAL DEVELOPMENT COUNCIL FUNDED PROJECT

ON

NATURAL SEASON CHRYSANTHEMUMS

FINAL REPORT ON WORK CONDUCTED FROM JULY - DECEMBER 1989.

Introduction:

This trial, devised by local growers working in conjunction with ADAS advisors and the College staff, addressed a number of problems relating to flowering date and flower quality of blooms for the Christmas market. Treatments were selected which would substantiate results obtained in the 1988 trial and which would open up new lines worthy of further investigation.

Trial Objectives

1. To establish dates for blackout treatment which will ensure flowering of American Beauty and Shoesmith Salmon Cultivars for the Christmas market.

2. To compare block raised and bare root transplants in the production of Shoesmith Salmon Cultivars

3. To compare the effects of removal of all low level leaves at rubbing down with that of removing shoots only on American Beauty Cultivars.

4. To investigate further the cause and possible control of pre-harvest and post-harvest flower/capitulum "rot"" in the cultivar May Shoesmith.

5. To investigate the potential benefits of using CO2 enrichment for the production of Natural Season Blooms.

Crop Culture and treatment applied

Two glasshouse, 96' x 43' and 92' x 30' were prepared for planting; the glass cleaned, the soil sterilised to a depth of 8 inches and base dressing applied in accordance with Ministry of Agriculture recommendations for a liquid fed crop.

Rooted cuttings (block raised and bare root) were planted on the following dates:

American Beauty,	bare root,	4th August
May Shoesmith,	bare root,	2nd August
Shoesmith Salmon,	bare root,	22nd July
Shoesmith Salmon,	block raised,	17th July

All cultivars were planted at 31 plants per m2, stopped 10 days after planting and rubbed down to leave two shoots to each plant. Leaf stripping (removal of leaves from main stem below breaks) was carried out at rubbing down, on designated plants of American Beauty cultivars.

Temperatures were maintained above 10°c throughout with ventilation occurring at 17°c when CO2 enrichment was not in use and 21°c when CO2 enrichment was in use. One house received CO2 enrichment at 1000 rpm, provided by direct combustion of propane, from early October to early December.

Flowering date was manipulated as follows:-

Night break lighting, tungsten filament 100 lux,
11.00 p.m. - 1.00 a.m., 8th August to 21st September.

May Shoesmith (1 bed)

Blackout, dense black plastic, 7.00 p.m. - 8.00 a.m.:

May Shoesmith (1 bed), 24th August - 14th September

American Beauty Cvs. 24th August - 21st September (4 weeks) and
31st August - 21st September (3 weeks)

Shoesmith Salmon Cvs. 17th August - 21st September (5 weeks)
24th August - 21st September (4 weeks)

Flower stem and pedicel length was controlled throughout using Alar:

May Shoesmith - 3 weeks after stopping 0.06% ai
6 weeks after stopping 0.06% ai
buds visible 0.125 % ai
early pre-disbudding 0.25 ai

American Beauty Cultivars
- 0.125% ai 16th September
0.25% ai 9th October
0.25% ai 17th October
0.125% ai 27th October (CO_2 enriched house only)

Shoesmith Salmon Cultivars
- 0.125% ai early pre-disbudding
0.25% late pre-disbudding

All plants were liquid fed according to the following schedule:

Standard regime - stopping to end of September
200 ppm N : 200 ppm K
of September - Flower colour
150 ppm N : 200 ppm K

Trial Regime (low N) May Shoesmith only:
Stopping - end of August 200 ppm N : 200 ppm K
end of August - end of September 100 ppm N : 200 ppm K
end of September - flower colour 66 ppm N : 200 ppm K

A routine spray programme for Western flower thrip, Aphid and Botrytis was carried out throughout the crop life using:

for Western flower thrip Decis/Hostaquick)
Malathion) sprayed in rotation
Blex) every 3 -14 days
Dichlorvos) as necessary

Results and Discussion

1. May Shoesmith: Effect of manipulation of flowering date and use of a low nitrogen feeding regime on the incidence of pre and post harvest flower shatter.

The use of night break lighting and blackout treatments produced plants which flowers on the following dates:

Plants with blackout treatment - Mid November
(24th August - 14th September)

Plants with no day length treatment - early December
(true natural season)

Plants with night break lighting - Late December
(8th August - 21st September)

Flower head quality was unaffected by flowering date but the stem length of those plants receiving blackout treatment was very short.

The incidence of flower shatter was unaffected by nitrogen treatment but was affected very significantly by the occurrence of a boiler failure on the nights of the 9th December and the 15th December. This allowed the temperature in the glasshouse to fall to 0.5°c and the humidity to rise to 100% 0, Figure 1.

Flower samples removed from the house on 7th December showed no incidence of flower shatter whilst flowers from the same plots showed a 100% incidence of shatter after the heating failure on the night of the 9th December. Affected flowers initially had centre petals with a translucent appearance (not unlike glassiness in lettuce); these petals then turned brown and botrytis entering as a secondary infection caused the capitulum to rot.

Flowers in an immature state of development (showing colour) were much less affected by the heating failure (lit bed) but samples held for a three day period in cold store showed a significant increase in the incidence of shatter, Table 1.

for Aphid	Pirimor	) as necessary
	Ambush C	)
for Botrytis	Thiram	) sprayed in rotation
	Bravo	) every 14 days
	Rovral	)

All plants were drenched with Gamma-Col, 7 days after planting and two sprays of Tilt were applied in October as a precaution against White Rust.

Flowers were harvested three times a week and assessed in relation to head size, stem length and strength. Samples of May Shoesmith were taken for shelf life trials to assess the post harvest occurrence of flower shatter and small samples of American Beauty cvs were weighted to assess the effects of CO2 enrichment not shown by assessment of head size only.

FIG.1 MAY SHOESMITH

Temperature and Humidity Profile for 9th/10th December 1989.

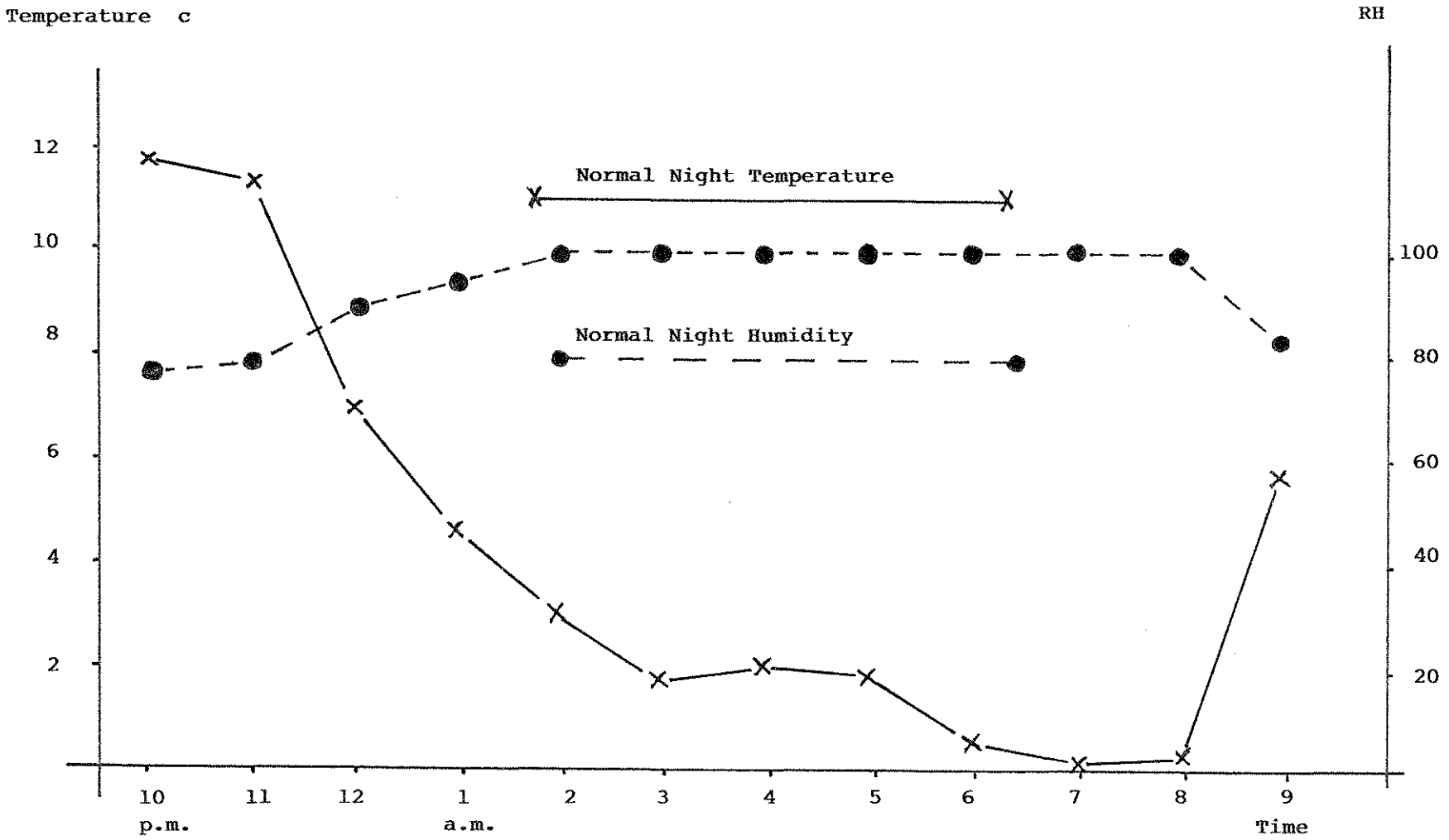

Table 1: The incidence of flower shatter pre and post harvest in May Shoesmith.

a)

On the bed pre- harvest	Day length treatment	% shatter	
	Blacked out (November flowering)	< 1%	
	Natural Season (Early December flowering)	0% 7th December	100% 10th December
	With lighting (late December flowering)	< 10%	

b)

Sample Date	Day length treatment	% shatter after 2 weeks at 20°c	Three days at 31°c then twelve days at 10°c
14th November	Blacked out	20%	
21st November	Blacked out	7%	
7th December	Natural Season	0	
27th December	With night break lighting	35%	64

2. American Beauty Cultivars:

a) The effects of blackout treatment on flowering date and flower quality.

Blackout treatment advanced the date of flowering but had no effect on the percentage of the crop that was marketed as "24" grade, Table 2. However, visual assessment of the crop showed that stem length was reduced when the flowering date was advanced (approximately 30% of the yellow American Beauty receiving a four week blackout treatment was graded as short (< 60cm)). Flowering dates for comparable treatments applied in the 1988 trial differed by only two days.

Table 2: The effect of blackout on American Beauty Cultivars.

Strain	% 24 grade	Date of 50% flowering 1989	1988
White "C"			
Blackout 4 weeks	57	12th December	14th December
Blackout 3 weeks	54	16th December	--
No blackout	59	19th December	21st December
Early Yellow			
Blackout 4 weeks	62	9th December	
Blackout 3 weeks	62	14th December	
No Blackout	64	15th December	

It was also noted that blackout treatment caused a more even bud initiation and thus flowering over a shorter period.

b) The effect of Carbon Dioxide Enrichment on flower quality in American Beauty cultivars:

Carbon Dioxide enrichment produced only a small increase in the percentage of the crop in the "24" grade, Table 3, and a small increase in the weight of the harvested blooms. The most noticeable difference between the enriched plots and the non-enriched plots being greater leaf size and stem strength. A straw pole of growers conducted on the Open Day on 7th December showed that most growers (80%) considered the crop quality to be greater where enrichment had been practised. CO2 enrichment did promote pedicel extension (presumably as a result of the high temperature and humidity prevailing whilst enrichment was taking place), which required the use of an extra spray of Alar on 27th October on American Beauty Cultivars.

Table 3: The effect of CO2 enrichment on flower quality in Cultivars of American Beauty.

Cultivar	Day length treatment	With Enrichment % 24 Grade	With Enrichment Weight AV/Bloom	Without Enrichment % 24 Grade	Without Enrichment Weight Av/Bloom
White "C"	Blackout 4 weeks	57	-	57	-
	Blackout 3 weeks	55	57 + 3	53	52 + 2
	No blackout	60	-	58	-
Early	Blackout 4 weeks	67	-	58	-
	Blackout 3 weeks	73	72 + 22	52	56 + 4
	No blackout	72	-	56	-

c) The effect of leaf stripping on flower quality in cultivars of American Beauty:

Removal of the lower leaves at rubbing down, a cultural practice designed to lessen the risk of disease at flower, caused a noticeable reduction in the rate of growth of the plants after rubbing down. This resulted in a proportion of the flowers on the beds blacked out for four weeks having short stems and an overall reduction in the percentage of the crop in the "24" grade. At no stage of the crop development was a disease problem encountered. Table 4.

Table 4: The effect of leaf stripping on the flower quality of American Beauty.

	% crop 24 Grade	
	With stripping	Without stripping
American Beauty White "C"	52%	60%
American Beauty Early Yellow	52%	59%

3. Shoesmith Salmon Cultivars

a) The effect of using block raised material.

Block raised material - cuttings rooted in 3.8 cm blocks by Premier Plants were planted two weeks after striking and the performance of these plants compared with bare rooted material, rooted by Frank Rowe, and planted three weeks after striking. We cannot ascertain whether the cutting material was taken from the same stock area.

The block raised material established faster than bare root material and maintained this advantage through to the final flowering performance. Table 5.

Table 5

Cultivar	No. of blooms harvested (maximum possible 270) per plot		Percentage blooms in size grade "24"	
	bare root	block raised	bare root	block raised
Crimson	215	234	62	73
Bright Bronze	151	202	67	80
Yellow	230	245	78	84

b) The effect of Carbon Dioxide enrichment on flower quality in cultivars of Shoesmith Salmon.

Carbon Dioxide enrichment resulted in a higher percentage cut as bloom grade, Table 6, with the effect being most pronounced in plots where establishment was poor.

Table 6

	No. of blooms harvested per plot (Maximum possible 270).			
	bare root		block raised	
	without CO2	with CO2	without CO2	with CO2
Blackout 5 weeks:				
Crimson	196	243	247	258
Bronze	146	224	249	272
Yellow	229	229	259	234
Blackout 4 weeks				
Crimson	236	217	206	241
Bronze	114	204	202	243
Yellow	196	224	259	203
No Blackout:				
Crimson	185	212	215	234
Bronze	165	220	220	248
Yell	245	260	250	265

As with American Beauty Cultivars, stem strength and leaf area was slightly increased by the addition of CO2.

N.B.: The difference in numbers between flowers harvested as blooms and the maximum number of flower stems possible is made up of bunch grade stems and does not result from substantial plant loss.

c) The effect of Blackout treatments on flowering dates of Shoesmith Salmon cultivars.

Blackout treatment advanced the date of flowering more than anticipated from the results obtained in 1988. Table 7. This may be related to the use of an earlier planting date or to small seasonal differences in light and temperature. As with American Beauty cultivars, blackout out treatment affected stem length (earlier blackout treatment equating with shorter stems at harvest) and the evenness of bud initiation. In all blacked out beds once over disbudding is possible and flowers are harvested over a shorter period (2 weeks cf 3 weeks for natural season plants).

Table 7: The effect of blackout treatments on the flowering dates of Shoesmith Salmon cultivars.

Day length Treatment	Date of Flowering 1989 Crimson	1989 Yellow	1988 Bronze	1988 Bronze
Blackout:				
5 weeks	21st November	21st November	23rd November	-
4 weeks	2nd December	3rd December	15th December	-
3 weeks	-	-	-	3rd January
No Blackout	17th December	15th December	20th December	9th January

Conclusions

1. May Shoesmith

The results obtained show a very positive correlation between a period of low temperature and high humidity and the incidence of flower shatter, but we cannot at this stage attribute the incidence of shatter specifically to one factor or the other. What is of note however is that flowers are most sensitive at full maturity and that the effect results from only a few hours exposure to the low temperature/high humidity conditions. Thus shatter may be stimulated by boiler failure pre-harvest or exposure to low temperature and high humidity during the marketing chain, e.g. in unheated transport, on unheated market stands or in cold store. These are all unpredictable happenings which could relate to the unpredictable occurrence of shatter noted by growers.

A further trial is necessary to consolidate these results and identify the critical levels of temperature, humidity and length of exposure needed to induce flower shatter in this cultivar.

2. American Beauty

Blackout dates can now be predicted reasonably reliably for crops in the North West intended to flower at Christmas. For the White "C" strain a two or three week blackout treatment is to be recommended, whilst the Early Yellow strain will flower for Christmas without blackout treatment. Sufficient shoot growth is needed before the onset of blackout treatment to ensure that stem length is satisfactory at the time of flowering. Shoot length at the onset of blackout should be a least three inches, which for a Christmas flowering crop can be achieved from a late July/early August planting date. Planting dates for crops blacked out to flower in the pre-Christmas period need to be correspondingly earlier to ensure a satisfactory shoot length at the onset of blackout.

Leaf stripping significantly reduced the rate of growth in the weeks immediately following rubbing down and resulted in a poor plant performance whilst giving no benefit in relation to disease control. This practice may be of considerable value in other cultivars where death of the lower leaves and their subsequent infection with Botrytis is problematical, but is not to be recommended for use on American Beauty cultivars.

Carbon dioxide enrichment produced a small improvement in head size and a more noticeable increase in stem strength and leaf area. This effect is more noticeable with the Early Yellow than the White "C" strain. We have not investigated, to date, the relative market returns for the enrichment and unenriched plots but growers are of the opinion that the improvement to crop quality justifies the extra cost involved in supplying CO_2.

3. Shoesmith Salmon

The use of block raised material has many advantages over the use of bare root material particularly where problems arise with root production on the cuttings of some cultivars, e.g. Bright Bronze. Management of the crop post-planting is easier for block raised material and the rate of establishment and percentage establishment is greater. The results obtained cannot be entirely attributed to the use of blocks owing to the uncertainty of the origin of the initial cutting material, however results look promising and the practice worthy of further consideration.

Carbon Dioxide enrichment is of greatest benefit to plants where establishment is poor as a result of using poorly rooted bare rooted material. Growers visiting the trial were not convinced that the use of CO2 was necessary provided that adequate establishment was achieved. Small leaf area and weak stem strength was not a problem throughout all plots and these are the factors most affected by supplementary CO2. More work is needed before clear recommendations can be made.

Flowering date is clearly influenced by blackout treatment but is also affected by planting date and/or season variations. We do not at this stage have sufficient information to recommend a treatment which will guarantee flowering for Christmas. We can however say that bud initiation is better and more even when blackout treatment is used and that shoot growth of at least four inches is necessary at the onset of blackout treatment to ensure that blooms have a satisfactory stem length at flowering.

As in the previous year, the trial generated considerable interest and discussion amongst growers nation wide and has contributed to our understanding of production schedules and techniques used for Christmas bloom production.

Growers who may wish to discuss the results further may contact either the College staff at Northop or Mrs Claire Streit, ADAS, Crewe.

A further trial, which will consolidate the results of this trial, is planned for the 1990 season.