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Ergebnisbericht

F/E-Projekt: Sortiments- und Verfahrensentwicklung zur Produktion neuer Topfpflanzen für den Absatzschwerpunkt "Valentinstag" in Zusammenarbeit mit dem Horticultural Development Council, GB

Kurztitel: Neue Topfpflanzen Valentinstag, Intraplan B-Nr. 050076

Technical Report

Collaborative research programme in partnership with Saxon State Institute for Agriculture, Pillnitz, Germany, for development of “new” ornamental plants for early seasons sales

Short title: New pot plants Valentine, HDC-Project No PC247

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1. Entrance and overall aim of the project

The most cultivated crops in spring time are primroses, *viola* and pansies. The growers are not satisfied because of problems with selling the plants and because of the low prices they get for them on the market. This is the same situation for growers in Great Britain as well as in Germany. Therefore a search for alternative spring plants to enlarge the assortment of species in spring time during the last 8 years has increased. This has been done for the benefit and profitability of cultivators. A look into the catalogues of young plant providers shows already a new age for perennials is evolving. On the other hand the customers are looking for novelties. It is always trendy to buy something 'elite' as this increases the chance of the plant been sold. This project in 2005/2006 was focused on the development of simple production strategies for early flowering spring plants in pots ahead the main traditional bedding plant season which growers can adopt.

In consequence of the step by step development of the project and form of cooperation there are three parts:

I The assortment from UK (so called UK trial) with the aim to test a special seed propagated assortment for its suitability as early pot plant with different treatments for precultivation, cooling and lighting at forcing period

II The fertilisation trial with the aim to optimize the depot fertilisation for 5 varieties that were suitable in principle as pot plants for early season sales. This trial was combined with the different treatments for precultivation, cooling and lighting at forcing period as part I.

III The additional assortment Kieft Seeds used the chance to involve a further assortment precultivated for another purpose into the forcing variants.

2. Material

Perennials exist in a considerably wide spectrum of colours and shapes. All species have their special biological rhythm. Some species loose their leaves in wintertime, while other species keep them. Other species need to grow up to a defined size ore adult stage to become able to induce florescence. A lot of species need a signal or a complex of signals for the initiation of the flowering process. These signals have not been known for every species in detail as yet. Phase of cooling, amount of light and the amount of temperature are different strong factors. Perennials in pots for early spring selling have to meet the following demands:

- the period of flowering should be definite,
- the flower should be before the natural flower,
- there should be a good flowering in the first year,
- the habit should be compact,
- long lasting flowers, long shelf life in heated rooms,
- homogeneity within a species.

2.1. Assortment from UK

The 21 species which were determined in Pillnitz were perennials. A commercial company supplied two different plug sizes from 10 species, so a bigger plug was distinctly older than a smaller plug (except *Papaver* and *Lupinus* have had the same sowing week). All species were grown from seeds by the nursery W J Findons.

Table 1: Species, plug and pot sizes in UK trial

number	Species	plug in cm	pot size in cm
01	*Aquilegia flabellate* ‘F1 Spring Magic Blue&White’	2	8
01	*Aquilegia flabellate* ‘F1 Spring Magic Blue&White’	5	10
02	*Delphinium Cultivars* ‘Guardian Blue’	2	10
03	*Digitalis purpurea* ‘Camelot Cream’	2	10
03	*Digitalis purpurea* ‘Camelot Cream’	5	12
04	*Papaver nudicaule* ‘Garden Gnome’	2	8
04	*Papaver nudicaule* ‘Garden Gnome’	5	10
05	*Lupinus nanus* ‘Gallery Blue’	2	10
05	*Lupinus nanus* ‘Gallery Blue’	5	12
06	*Lobelia speciosa* ‘F1 Fan Scarlet’	2	10
06	*Lobelia speciosa* ‘F1 Fan Scarlet’	5	12
07	*Scabiosa japonica var. alpina* ‘Ritz Blue’	2	10
07	*Scabiosa japonica var. alpina* ‘Ritz Blue’	5	12
08	*Echinacea purpurea* ‘Primadonna Deep Rose’	5	12
09	*Geranium sanguineum* ‘Light Pink’	2	8
09	*Geranium sanguineum* ‘Light Pink’	5	10
10	*Dianthus deltoids* ‘Confetti Carmine Rose’	5	10
11	*Penstemon heterophyllus* ‘Electric Blue’	5	12
12	*Geum coccineum* ‘Cooky’	5	10
13	*Heuchera sanguinea* ‘Ruby Bells’	5	12
14	*Leucanthemum x superbum* ‘Crazy Daisy’	5	12
15	*Penstemon digitalis* ‘Mystica’	5	12
16	*Delphinum grandiflorum* ‘Summer Stars Blue’	5	12
17	*Coreopsis grandiflora* ‘Baby Sun’	5	12
18	*Arenaria montana*	2	8
18	*Arenaria montana*	5	10
19	*Chaenarhinum origanifolium* ‘Blue’	2	8
19	*Chaenarhinum origanifolium* ‘Blue’	5	10
20	*Scabiosa japonica var. alpina* ‘Blue Diamonds’	2	10
20	*Scabiosa japonica var. alpina* ‘Blue Diamonds’	5	12
21	*Saxifraga x arendsii* ‘Carpet Purple’	5	10

2.2. Assortment fertilisation trial

The fertilisation trial included species which were already successful in previous trials. Two new cultivars of *Ajuga* were taken. *Ajuga* and *Lithodora* were delivered by AGREXCO, Israel. *Androsace* has been grown from seeds. The interest was focused on how the species react to different amounts of depot fertiliser. There was some information about a higher requirement of nutrients by the new pot plants as thought before. And there is the fact that in the precultivation outdoor a part of these nutrients is washed out by rainfall. The trial should supply these needs and show the borderline for damages by over-fertilisation.

Table 2: Species and pot sizes in fertilisation trial

number	species	pot size in cm
1	*Ajuga reptans* 'Variegata'	9
2	*Ajuga reptans* 'Rosea'	9
3	*Ajuga reptans* 'Mini Mahagoni'	9
4	*Androsace septentrionalis* 'Star Dust'	9
5	*Lithodora diffusa* 'Heavenly Blue' agrexco	11
6	*Lithodora diffusa* 'Heavenly Blue' LfL	11

2.3 Additional assortment Kieft Seeds

The trial contained 28 species which were delivered from Kieft Seeds, Netherlands. These species were tested to see if they fit to the programme of selling before the bedding plant season.

Table 3: Species and pot sizes in additional assortment Kieft Seeds

number	Species	pot size in cm
1	*Agastache astromontana* 'Pink Pop'	11
2	*Anacyclus depressus* 'Spring Carpet'	11
3	*Aquilegia vulgaris* 'Clementine® Blue'	11
4	*Aquilegia vulgaris* 'Clementine® Dark Purple'	11
5	*Aquilegia vulgaris* 'Clementine® Red'	11
6	*Aquilegia vulgaris* 'Clementine® Rose'	11
7	*Aquilegia vulgaris* 'Clementine® Salmon Rose'	11
8	*Aquilegia vulgaris* 'Clementine® White'	11
9	*Barbarea rupicola* 'Sunnyola'	11
10	*Calceolaria biflora* 'Goldcap'	11
11	*Chaenorhinum origanifolium* 'Summer Skies'	11
12	*Chiastophyllum oppositifolium* 'Solar Yellow'	11
13	*Digitalis grandiflora* 'Dwarf Carillon'	11
14	*Erigeron karvinskianus* 'Stallone'	11
15	*Erysimum perovskianum* 'Goldrush'	11
16	*Mimulus x hybridus* 'Bounty Orange'	11
17	*Mimulus x hybridus* 'Bounty Red'	11
18	*Mimulus x hybridus* 'Bounty Rose'	11
19	*Mimulus x hybridus* 'Bounty Yellow'	11
20	*Nepeta nervosa* 'Pink Cat'	11
21	*Primula acaulis* 'F1 Exp. Heritage Light Yellow'	11
22	*Primula acaulis* 'F1 Exp. Heritage White'	11
23	*Primula acaulis* 'Heritage Creme F1'	11
24	*Rosa chinensis* 'Angel Wings'	11
25	*Salvia roemeriana* 'Hot Trumpets'	11
26	*Silene maritima* 'Icecups'	11
27	*Sisyrinchium californicum* 'Yellow Stone'	11
28	*Veronica prostrata* 'Nestor'	11

3. Methods

To get plants to bloom before the bedding plant season a forcing period is inevitable. The main idea was to grow plants under outside conditions before frost, there after to store either under unheated polytunnel or in a frost protected cold greenhouse to satisfy the criteria of cooling. Normally the growers need the space for poinsettias so that the forcing can start at week 50. Species which come to flower shortly before Valentine's day or at the beginning of March would be beneficial because the growers need the space already for bedding plants after that time.

3.1 Work plan UK trial

Compared to the trial in the UK there was no storage of plugs before potting. The plugs which arrived in late October were potted immediately and were cultivated with higher temperatures for rooting for two weeks. After that the storage started either in an unheated polytunnel or in a cold greenhouse. The plants got just 5 weeks time for the phase of cooling before forcing. Forcing started in three greenhouse compartments with different light treatments. In each compartment the plants were placed in three replications and 14 plants per plot.

Table 4: Journal of UK trial

wk	date	location	treatments
42	20.10.+ 21.10.05	H 13.4	potting plants in substrate: Stender D 400 Geotorf for 8 cm pots, Stender SO Mix M2 with Xylit for 10 cm/12 cm pots, for rooting: temperatures h:14 ℃, v: 16 ℃
43		H 13.4	0.02 % Discus + 0.01 % Karate Zeon + 0.1% Wuxal Amino
	28.10.05	H 13.4	Cold misting with Confidor WG 70 + Karate Zeon
44	04.11.05	H 13.4	0.035 % Confidor WG 70 + 0.02% Discus and 0.015 % Break Thru
45	from 4.11.05	H 13.4	temperatures h: 2 ℃, v: 4 ℃
45	7.+ 8.11.05	polytunnel + H 13.4	moving plants for storage into unheated polytunnel tunnel or cold greenhouse h: 2 ℃, v: 4 ℃, in the polytunnel the vents started with a temperatures of 8 ℃ to 10 ℃
46	18.11.05	H 13.4 and polytunnel	0.2 % Dithane ultra + 0.035% Confidor WG 70 + 0.25 Wuxal Amino
47	24.11.05	H 13.4 and polytunnel	watering with Steinernema feltiae
49	05.12.05	H 12.2+ H12.3 and polytunnel	0.2 % Polyram WG
		H 13.4 to H12.3/12.2	plants from cold greenhouse changing the place, temperatures still h: 2 ℃, v: 4 ℃
50	15.+ 16.12.05	H 12.1, H 12.2, H12.3	placing the plants in different treatments
	17.+ 18.12.05	H 12.1, H 12.2, H12.3	from Friday to Monday (~ 60 hours) plants were pushed with high temperatures h: 20 ℃, v: 23 ℃
51	22.12.05	H 12.1, H 12.2, H 12.3	0.17 % Perfekthion + 0.1% Rovral
	19.12.05	H 12.1, H 12.2, H12.3	back to lower temperatures h: 10 ℃, v: 12 ℃ and l ight treatments start
		H 12.1:	supplementary light 3000 lx, 20 hours, 4:00-24:00 = 0.13 mol/m²; 8,13 W/ m² PAR
		H 12.2:	photoperiodic light, 100 lx/m², 20 hours, 4:00-24:00 = 0.0044 mol/ m²; 0,275 W/ m² PAR
		H 12.3:	ambient daylight (from sunset to sunrise the plants were covered to protected them from other light treatments)
1		H 12.1, H 12.2, H 12.3	0.17 % Perfekthion + 0,1% Rovral+ 0,1% Ortiva + 0.015% Break Thru
	02.01.06	H 12.1, H 12.2, H 12.3	raising temperatures h: 12 ℃, v: 15 ℃

	04.01.06	H 12.1, H 12.2, H 12.3	cleaning plants from old leaves, *Delphinium* middle, *Papaver* strong
5	02.02.06	H 12.1, H 12.2, H 12.3	fertilisation with 0.2 % Flory 1 rot (20-5-10-2-micros) all 12 cm and 10 cm pots

3.2 Work plan fertilisation trial

The different amount of depot fertiliser was applied during potting per single pot.
Fertilisation:

1. approx. 200 mg N per plant (1,5 g Manna Cote Mini 4 M 19-6-11)
2. approx. 700 mg N per plant (3,5 g Manna Cote Mini 4 M 19-6-11)
3. approx. 1200 mg N per plant (6 g Manna Cote Mini 4 M 19-6-11)

Forcing was started in three greenhouse compartments for the different light treatments. In each compartment the plants were placed in three replications of 12 plants by *Ajuga* and *Androsace* and of 16 plants by *Lithodora*.

Table 5: Journal of fertilisation trial

wk	date	location	treatments
27	5.7.2005	H 14.1	propagation of *Lithodora* from own stock plants (small polytunnel for rooting)
28	13.7.2005	H 14.1	sticking cuttings of *Ajuga* in QP 40 trays, substrate: Stender D 400 with Geotorf and cuttings of *Lithodora* from agrexco in QP 20 trays in turf-sand mixture, first watering with Previcur N 0.15 % (small polytunnel until rooting)
29	18.7.2005	H 14.7, 14.8	0.015 Discus+ 0.1% Tamaron+ 0.3% Wuxal Amino all *Ajuga* + *Lithodora*
31	2.8.2005	H 11.2	sowing of *Androsace*
33	18.8.2005	outdoor terrain	potting *Ajuga* and setting rooted seedlings into pots by *Androsace* in substrate: Stender D 400 with Geotorf and with fertiliser Manna Cote Mini 4M 19-6-11 in three amounts: 1.5 g; 3.5 g; 6 g per pot, *Androsace* covered with fleece 5 days long because of the weak plants
35	26.8.2005	outdoor terrain	potting of *Lithodora* in substrate: Hansa Torf Stender D 400 with Geotorf and three different amounts of fertiliser 1.5 g; 3.5 g; 6 g per pot
40	6./7.10.05	H 14.7, H 14.8 and polytunnel	moving plants for storage into unheated polytunnel or cold greenhouse h: 2℃, v: 4℃, in polytunnel the v ents starting with temperatures of 8 ℃ to 10 ℃
41	11.10.05	H14.7, H14.8 and polytunnel	0.2 % Dithane Ultra + 0,02 % Discus + 0.2 % Wuxal Amino
42		H 14.7, H 14.8 and polytunnel	spacing and trimming of *Ajuga reptans* ‘Rosea’ and *Ajuga reptans* ‘Mini Mahagoni’
43		H14.7, H14.8 and polytunnel	0.02 % Discus + 0.01 % Karate Zeon + 0.1 % Wuxal Amino
44	04.11.05	H14.7, H14.8 and polytunnel	0.035 % Confidor WG 70 + 0.02 % Discus + Break Tru
46	18.11.05	H14.7, H14.8 and polytunnel	0.2 % Dithane Ultra + 0.035% Confidor WG 70+ 0.25 % Wuxal Amino
47	24.11.05	H14.7, H14.8 and polytunnel	watering with Steinernema
49	05.12.05	H14.7, H14.8 and polytunnel	0.2 % Polyram WG
50	15.+16.12.05	H 12.1	placing the plants in different treatments
	17.+18.12.05	H 12.1	from Friday to Monday (~ 60 hours) plants being pushed with temperatures h: 20 ℃, v: 23 ℃
51	22.12.2005	H 12.1	0.17 % Perfekthion + 0.1% Rovral
	19.12.05	H 12.1, 12.2, 12.3	back to temperatures h: 10℃, v: 12℃ and light treatments start

		H 12.1:	supplementary light 3000 lx, 20 hours, 4:00-24:00 = 0.13 mol/ m²; 8.13 W/ m² PAR
		H 12.2:	photoperiodic light, 100 lx/m², 20 hours, 4:00-24:00 = 0.0044 mol/ m²; 0.275 W/ m² PAR
		H 12.3:	ambient daylight (from sunset to sunrise the plants are covered to protected from other light treatments)
1		H 12.1	0.17% Perfekthion + 0.1% Rovral+ 0.1 % Ortiva + 0.015 % Break Thru
	2.1.2006	H 12.1, 12.2, 12.3	raising temperatures h: 12℃, v: 15℃
2	04.01.06	H 12.1, 12.2, 12.3	spacing of *Ajuga*, *Androsace*, cleaning of *Ajuga* more or less
3	19.01.06	H 12.1, 12.2, 12.3	spacing of *Lithodora*

3.3 Work plan additional assortment Kieft Seeds

The trial started with sowing seeds which have been delivered from Kieft Seeds, Netherlands. The date of germination is added in annex. Because of the low number of plants, the forcing was realised only with supplementary light and in one replication with 8 plants per plot.

Table 6: Journal of additional assortment Kieft Seeds

wk	date	location	treatments
32	12.08.05	controlled cold store	sowing of all species in substrate: Stender VM, first watering with Previcur 0,15 %, controlled cold storage 5 ℃
33	17.08.05	controlled cold store	controlled cold storage 15 ℃
34	22.08.05	H 14.1	seeds which germinated moved to compartment H 14.1; h: 16 ℃, v: 18 ℃
34-37		H 14.7	setting of the rooted seedlings into pots with substrate: ED 73 with Optifer
40		H 14.7 and irrigation mat = FM	moving plants for storage to an irrigation mat (outdoor conditions) or cold greenhouse h: 2 ℃, v: 4 ℃,
41	11.10.05	H 14.7 and FM	0.2 % Dithane Ultra + 0.02 % Discus + 0.2 % Wuxal Amino
43		H 14.7 and FM	0.02 % Discus, 0.01 % Karate Zeon + 0.1% Wuxal Amino
44	04.11.05	H 14.7 and FM	0.035 % Confidor WG 70; 0.02 % Discus + 0.015 % Break Thru
46	18.11.05	H 14.7 and FM	0.2 % Dithane Ultra, 0.035 % Confidor WG 70 + 0.25 % Wuxal Amino
47	24.11.05	H 14.7	Watering with Steinernema feltiae
49	05.12.05	H 14.7 and FM	0.2 % Polyram WG
50	15.+16.12.05	H 12.1, H 12.2, H 12.3	placing the plants in different treatments
	17.+18.12.05	H 12.1, H 12.2, H 12.3	from Friday to Monday (~ 60 hours) plants were pushed with higher temperatures: h: 20℃, v: 23℃
51	22.12.2005	H 12.1	0.17 % Perfekthion+ 0,1% Rovral
	19.12.05	H 12.1, H 12.2, H 12.3	back to low temperatures: h: 10 ℃, v: 12 ℃ and li ght treatments started
		H 12.1:	supplementary light 3000 lx, 20 hours, 4:00-24:00 = 0.13 mol/m²; 8,13 W/ m² PAR
1		H 12.1	0.17% Perfekthion+ 0,1% Rovral+ 0,1% Ortiva + 0.015% Break Thru
	2.1.2006	H 12.1	raising temperatures: h: 12 ℃, v: 15 ℃

3.4 Collection of data and shelf life test

During the forcing period, every second or third day the plants were controlled. If one plant fulfilled the specific criterias for flowering, the measurements and ratings were done. Four plants of each plot were measured when possible. The following data were collected:

Date of flowering
Height of leaves in cm
Height of flower in cm
Plant diameter in cm
Number of flowers per plant
Number of buds per plant
Fresh weight in g
General value (rating 1….9, 1 = very bad; 5 = middle; 9 = perfect)
General value per plot (rating 1….9, 1 = very bad; 5 = middle; 9 = perfect)
Market value per plot (rating 1….9, 1 = very bad; 5 = middle; 9 = perfect)
Homogeneity per plot (rating 1….9, 1 = very bad; 5 = middle; 9 = perfect)

During every period of the trial, the temperature, the air humidity and the irradiation were recorded by data loggers. Special appearances on species, e.g. diseases were documented. Albums of digital photos were made which show the species in different factor combinations at planting, at the beginning of storage, at the beginning of forcing and at flowering.
The shelf life test was run in a separated room with following conditions:

- artificial light with 300 – 500 lx for daily 12 hours = 0.022 mol/ m²; 1.375 W/ m² PAR
- temperature 20 ℃ – 22 ℃
- air humidity 40 % - 60 %

The shelf life, in days were recorded and notes were taken to record the reason for the discarded plant.

Picture 1: Plants of *Papaver*, *Androsace* and *Geum* in shelf life test under standard conditions, watered by glass fibre yarn

3.5 Temperature and light conditions at Pillnitz trials

It is important to have a look at these specific data to compare them with conditions in United Kingdom and to answer for the question how the storage period could influence the trial. Plants from UK trial started in greenhouse 13.4. From 7th of November they went for storage purpose to the greenhouses 12.3 and 12.3 or to an unheated polytunnel respectively. During this phase of cooling (only 5 weeks) the plants in polytunnel have got the double amount of days with a minimum temperature under 4℃ than in c old greenhouse. The plants from fertilisation trial and additional trial started their storage just on 6th/7th October. They have got a longer period of lower temperatures in total and more days with a minimum temperature under 4℃ in polytunnel than in cold greenhouses to o.

Table 7: Temperature conditions

	Sum of temp. from averages per days in ℃ x days 6th of Oct.- 16th of Dec.	Sum of temp. from averages per days in ℃ x days 4th of Nov.- 16th of Dec.	Days with temp. below 4°C	Days with temp. below 3°C	Days with temp. below 0°C
H 13.4/12.2	703.9	284.6	15	5	
H 13.4/12.3	691.3	272.0	5	10	
H 14.7	651.3	289.4	9		
H 14.8	628.7	277.2	10	4	
Polytunnel	529.3	165.0	45	41	22
Polytunnel UK trial (7th Nov. - 16th Dec.)			38	36	22

During forcing period, the three greenhouse compartments were exposed to different amount of light like the diagram indicates. The plants received 50% more light until Valentine's day and about 40 % more light until the 5th of March with supplementary light comparing one photoperiodic and one ambient daylight. The level of temperatures was a little bit higher in the greenhouse compartment with supplementary light because of the radiated heat of the lamps.

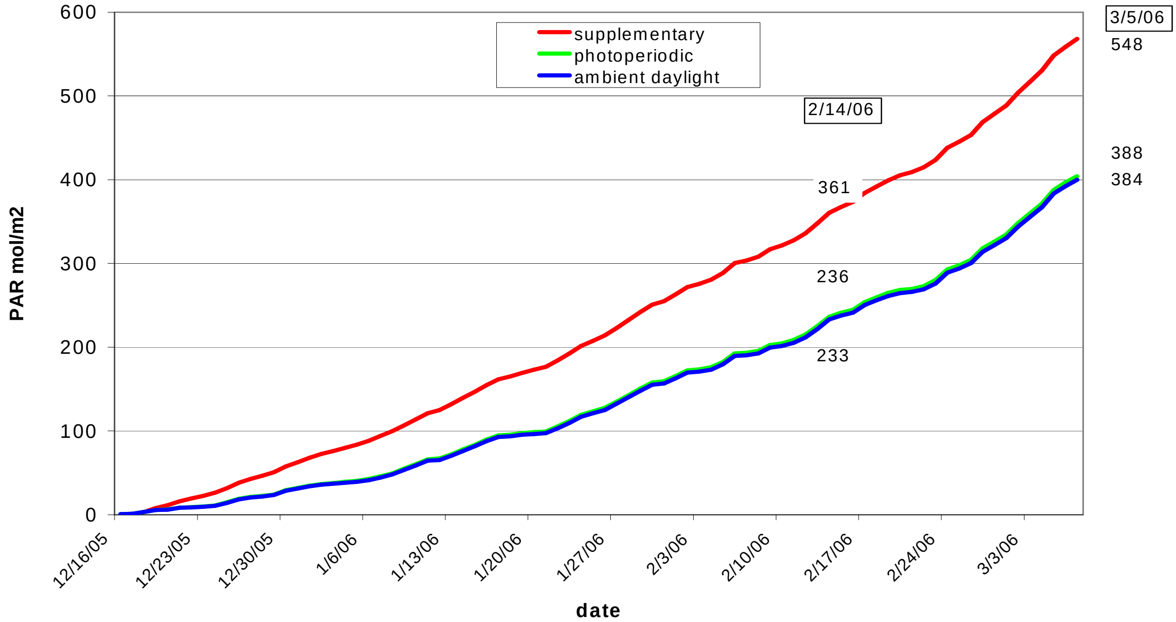

Diagram 1: Development of light summaries in the different light treatments

Sum of temperatures from 16th of December to the 5th of March:

- Greenhouse 12.1 supplementary light: 997.8 ℃ x day s
- Greenhouse 12.2 photoperiodic light: 981.5 ℃ x day s
- Greenhouse 12.3 ambient daylight: 983.4 ℃ x days

3.6 Statistical evaluation

The data from UK trial and from the fertilisation trial were analysed with help of the statistic programme SPSS. With the two factor analysis of variance, the significances of the single factors were determined as well as there would be interactions between the factors. The averages of data were compared by BONFERRONI test (with α = 0.05). This test is more accurate in results than other multiple average tests because of the slightly different numbers of cases in the trial. All data from the trials and the most important results of the analysis by SPSS programme were saved on a DVD which is contained in the annex. In addition important tables of averages and diagrams for the species and factor combinations are printed out and contained in annex.

4 Results

The following report of results indicates a positive outcome, thus making these plants possible to be sold in the commercial market.

4.1 Results UK trial

The priority aim of the trial in Pillnitz was to reach the selling date Valentine's day or at least to finish the crop before the bedding plants need the space in the greenhouses. From chosen species, 13 species received more or less data until week 10. The last date of data collection was the 6th of March beginning week 10. Not all plots received the 14 plants. The exact amount is listed in the average table of the species in annex. The time for storage in polytunnel or cold greenhouse was from week 45 to week 50. The factor storage had no influence on parameters of all species. Most species were influenced by lighting. Some species had different pot sizes because of different delivered plug sizes and reacted on that. All bar diagrams for species and pot sizes and the influence of lighting on plant parameters are included in annex. The stages of growth and development are collected in a ULEAD PhotoImpact album and in a web browser readable slide show which are saved on the DVD in the annex.

4.1.1 *Aquilegia* F1 'Spring Magic Blue & White' (Ranunculaceae)

These species with its amazing big blue and white flowers, is very attractive as single plant and looks great in spring arrangements as well. The single flower does not keep so long under living room conditions. It is important that the plant has a lot of buds which are still able to open up inside the house. A cooler place has the advantage that the shelf life is longer. Not 100 percent of plants came to flowering even under supplementary light. The reason for that is that the plants were not adult enough in autumn to initiate flowers. The bigger plants in 10 cm pots received more percent of flowering plants than plants from smaller plug size in 8 cm pots. The date of flowering was given per plant with one bud showing colour.

Picture2: Week 7; *Aquilegia* 'F1 Spring Magic Blue & White'

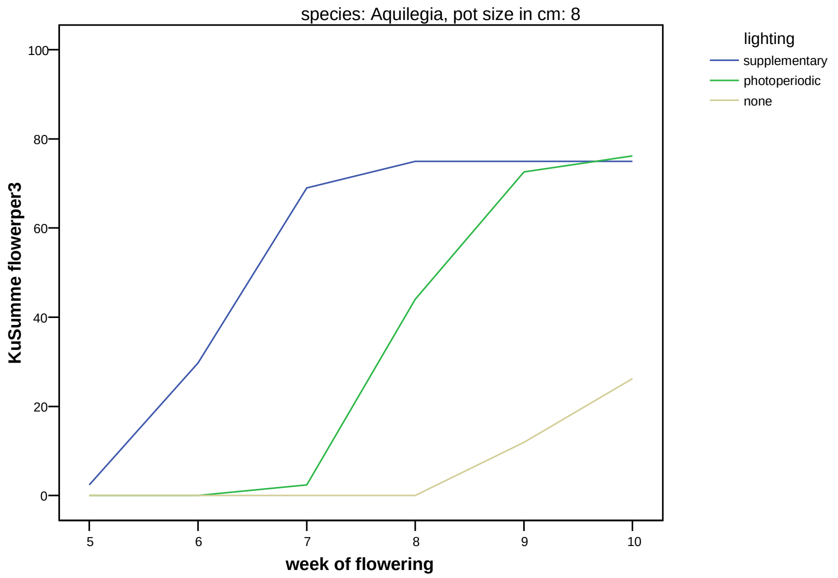

Diagram 2: Development of the percentage of flowering plants in dependence of different light treatments by *Aquilegia* 'F1 Spring Magic Blue & White'; 8 cm pot size

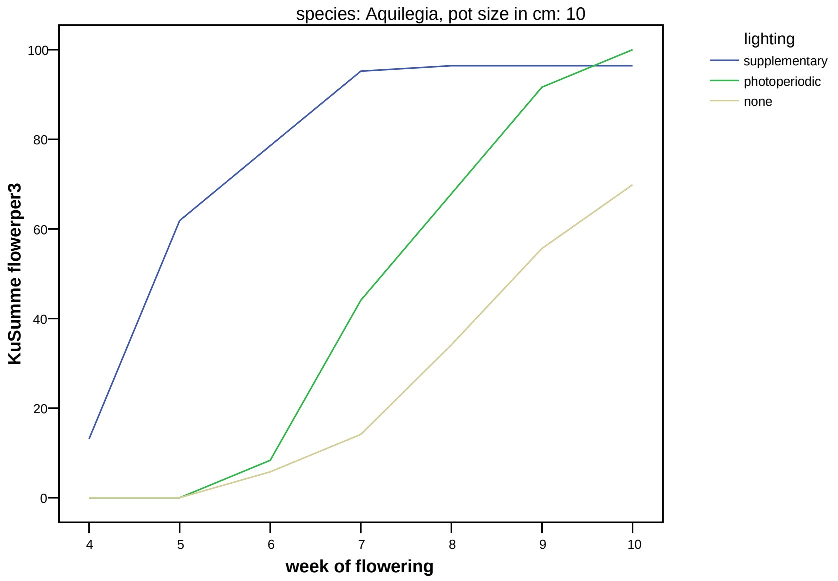

Diagram 3: Development of the percentage of flowering plants in dependence of different light treatments by *Aquilegia* 'F1 Spring Magic Blue & White' ; 10 cm pot size

Duration of crop (weeks from the beginning in week 50 to the flowering date)
Plants with supplementary light bloom 2 weeks earlier than plants with photoperiodic light and 3 weeks earlier than plants with ambient daylight. Plants with supplementary light were ready for selling before Valentine's day.

Height of leaves, height of flowers, diameter and fresh weight, number of buds
The leaves of plants were 5 to 7 cm higher and 8 to 10 cm wider with supplementary and photoperiodic light than plants with ambient daylight. The plants in the 10 cm pot were bigger than plants in the 8 cm pot. The height of flowers with ambient daylight were significant shorter than with the other light treatments. In fact, the flowers were low lying between the leaves and there was no stretching of flower stems. The reason for that was the missing phase of cooling. It is interesting that the photoperiodic light and even better the supplementary light have compensated this deficit. Plants with supplementary light had more

fresh weight than plants with ambient daylight. Only plants from bigger plug size have 1-2 more buds with supplementary light than plants with photoperiodic and ambient daylight.

General value
Plants from bigger plug size have got better marks than plants from smaller plug size but showed over all a low level of general value. This is because the plants did not have enough time in autumn to develop leaves for a good habit. Plants with supplementary light and photoperiodic light received better marks than plants with only ambient daylight.

Shelf life test
The shelf life under living room conditions was very different. The shortest time in test was 6 days, while the longest time was 14 days. The duration of shelf life depended on the buds per plant which were still opened at the beginning. The first flower always dropped of after 6-7 days.

Recommendation for *Aquilegia* F1 Spring Magic 'Blue&White'
The potting should take place earlier, e. g. approximately in week 26 to 30. Outdoor conditions might be better for compact shape until period of frost. Storage should take place for about 9 weeks (week 40 to 50) in a cold greenhouse (h: 4°C, v: 6°C). Special research in *Aquilegia* F1 'Spring Magic' was done at research station in Hannover-Ahlem. The results indicate that plants with 10 weeks cooling stretch the flower stem more and have the double amount of flowers per plant and they were 3.5 weeks earlier than plants without cooling (9 weeks in greenhouse 14°C). A test with substrates r ecommends peat substrate for best growth.

4.1.2 *Papaver nudicaule* 'Garden Gnome' (*Papaveraceae*)
The clear shining colours of these species can lighten a grey early spring day. The single plant is not so attractive because of the high flower stem above the leaves but in arrangements as a background plant or as a cut flower, the crop could be interesting.
Only the plants with supplementary and photoperiodic light came into flowering and reached 100 percent of flowering plants (except 8 cm pot photoperiodic light 95 and 98%).
That fact shows that the long day is important for *Papaver*. The date of flowering was given with one open flower per pot.

Picture 3: Week 5; *Papaver nudicaule* 'Garden Gnome', suppl. light; 10 cm pot

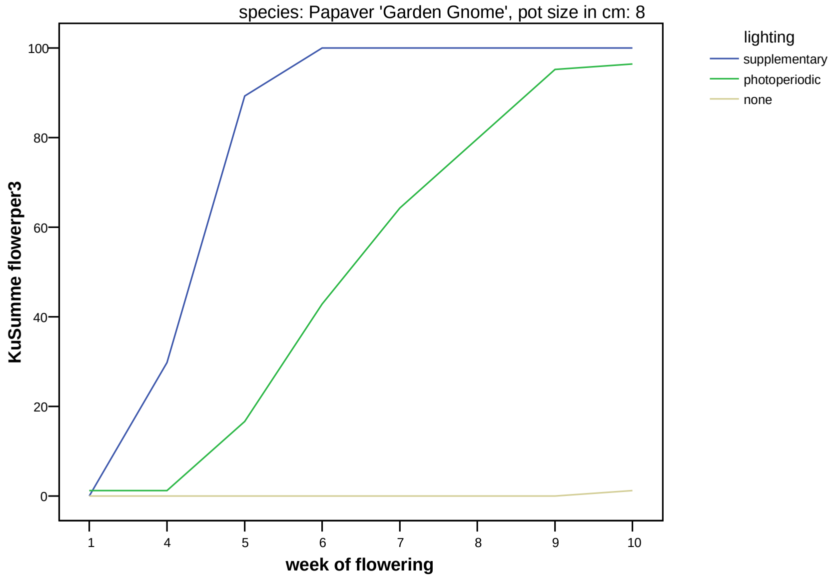

Diagram 4: Development of the percentage of flowering plants in dependence of different light treatments by *Papaver nudicaule* 'Garden Gnome'; 8 cm pot size

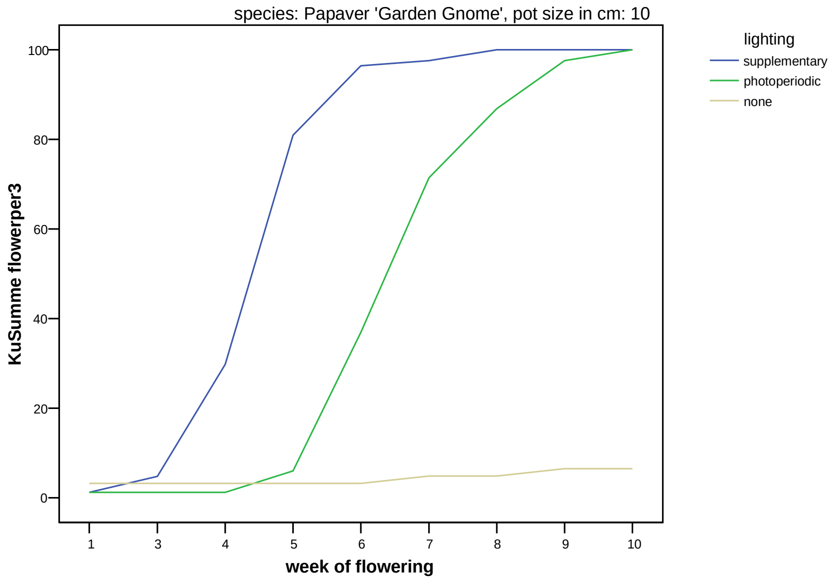

Diagram 5: Development of the percentage of flowering plants in dependence of different light treatments by *Papaver nudicaule* 'Garden Gnome'; 10 cm pot size

Duration of crop (weeks from the beginning in week 50 to the flowering date)
Plants with supplementary light were two weeks earlier than plants with photoperiodic light and reached 100 percent of flowering to Valentine's day. There was no difference in the duration of crops in different pot sizes.

Height of leaves, height of flowers, diameter and fresh weight, number of buds
The plants with supplementary and photoperiodic light had higher leaves than plants with ambient daylight only. The flowers from plants in 8 cm pots were 4 cm higher with supplementary light than with photoperiodic light. Plants with photoperiodic light were wider than plants with supplementary light, not because of more leaves but by the slackly growth.

Plants in pot size 10 cm were stronger in growth. They had double fresh weight, were wider and higher in leaves and had in average 3 to 4 buds comparing to plants in 8 cm pots with 1 to 2 buds per plant.

General value
The general value for 8 cm pots was low between 3 and 4 at the 9 point scale. There were not enough leaves and the flower stems were to high. The plants in 10 cm pots grew better. The plants with supplementary light have got the better marks (average 6.3) than plants with photoperiodic and ambient daylight.

Shelf life test
The shelf life under living room conditions varies intensely. The shortest time was 7 days, the longest time 20 days. It was depended from the buds per plant which were still opened up at the beginning of the test. The first flower always trickled after 7 days. The plants from supplementary light still opened the buds under low light conditions in comparison most plants with photoperiodic light showed no development of the invested buds.

Recommendation for *Papaver nudicaule* 'Garden Gnome'
The potting should be around 5 weeks earlier (week 35, 10 cm pot) to get more growth and more flowers in the end. Because of the trickling of the flowers after 7 days, there have to be enough buds and the supplementary light in the forcing period should be applied. The storage in cold greenhouse is better for the development of leaves than in unheated polytunnel. The high flower stem is not comfortable for selling on trolleys. It could be that the breeders have already compact species with the same bright colour range. The trial was carried out with no growth regulators. Application of plant growth regulators could be a chance to shorten the flower stems. In 2001 there was *Papaver miyabeanum* 'Pacino' in trial. The potting of this plants took place yet in week 29 and 30. This was too early. The plants already produced buds und flowers in autumn. The size was suitable for 9 cm pots. The light yellow-green colours were not so attractive like in 'Garden Gnome'. The flowering started week 7 with supplementary light and shelf life was 6 days. That's why this species was not in the following trial seasons.


Picture 4: Week 7 (2002); *Papaver miyabeanum* 'Pacino'

But *Papaver* makes a name of it as a cut flower. The research station in Wuerzburg-Veitshöchheim was testing Poppy 'Bussana' bred for cut use (about 70 cm) from Comtoir Paulinois (France). In October 16 plants were planted per m² in 8 cm thin film substrate (air temperature 7 ℃). First flowers came in January an d following until week 11. One plant had in average 12.5 flowers (about 200 flowers per m²).

4.1.3 *Geum coccineum* 'Cooky' (*Rosacea*)

The colour orange is a typical spring colour. Therefore this species is attractive as a single plant and in arrangements. Not all plants came into flowering. This could be because of the development of leaves at first. At the beginning the young plants were already different in growth and size. There were not many plants per plot. In all three light treatments some plants were flowering before Valentine's day. The plot with supplementary light had higher percentage in flowering. The date of flowering was the date of first opened flower per pot.

Picture 5: Week 3; *Geum coccineum* 'Cooky', suppl. light; 10 cm pot

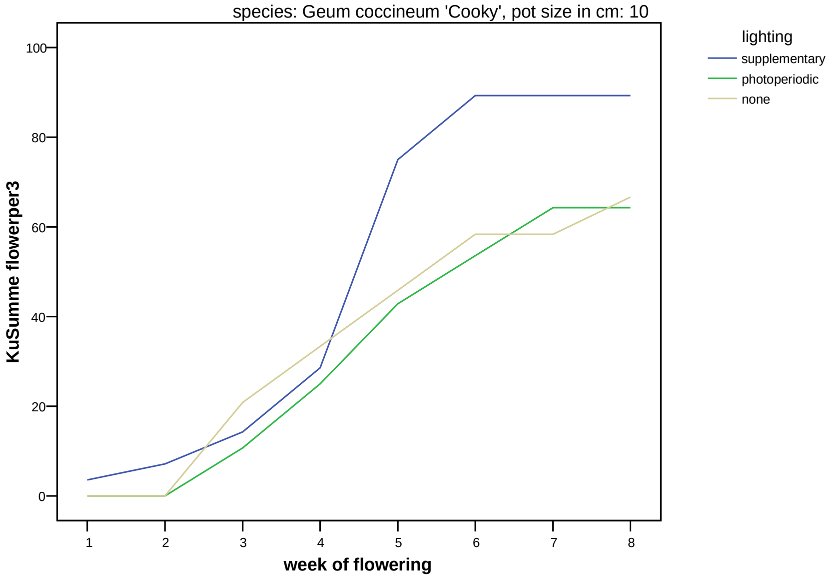

Diagram 6: Development of the percentage of flowering plants in dependence of different light treatments by *Geum coccineum* 'Cooky'

Duration of crop (weeks from the beginning in week 50 to the flowering date),
Height of leaves, height of flowers, diameter and fresh weight, number of buds
General value
All parameters were not influenced by lighting. The height of leaves with photoperiodic light was significantly higher but not mentionable. The general value was in the middle level. The flowering stems were sometimes very stretched and sometimes there were not enough flowering stems with buds.

Shelf life test
The shelf life under living room conditions was different. The shortest time was 9 days, while the longest time 14 days. It was depended on the buds per plant which were still opened an the start of the test. The wilted flower looked like brown orange parchment and only after hard touching, the flowering leaves trickled down. The leaves were still looking attractive.

Recommendation for *Geum coccineum* 'Cooky'
Make sure that young plants are developed uniformly. Start early in week 30 to 35 to get more growth and hopefully more flowers. Storage is possible in cold greenhouse or polytunnel. Supplementary and photoperiodic light have the advantage that more plants come into flowering over a shorter time and before Valentine's day. But ambient daylight is possible too for early spring flowering. Until now growth regulators were not used. It could be that there is a chance to shorten the flowering stems. On the other hand, there is already a breeding of these species with a shorter habit in process.

4.1.4 *Scabiosa japonica var. alpina* 'Ritz Blue' and 'Blue Diamond' (*Dipsacaceae*)

This species with light violet colour is not uninteresting for the early spring sale. The disadvantage is that supplementary light is necessary for blooming until week 10.
There was a high percentage in flowering with bigger plugs (12 cm pot) and with supplementary light. The date of flowering was given with one opening flower per pot. There were plants with one flower in week 4 but the shelf life has shown that the amount of light was not enough to open following buds. From week 8 onwards, more plants began to bloom. Because of the necessary of a high daily amount of light it is no crop for Valentine's day.

Duration of crop (weeks from the beginning in week 50 to the flowering date)
The average of duration of crop shows no significant difference between supplementary and the photoperiodic light. But until week 10 a higher percentage of plants were flowering with supplementary light than with photoperiodic light. The 'Blue Diamond' had lower percentage in flowering until week 10 than 'Ritz Blue'. The plugs from 'Ritz Blue' were already well developed before potting.

Picture 6: Week 8; *Scabiosa japonica var. alpina* ‘Ritz Blue’ suppl. light;
12 cm and 10 cm pot size

Picture 7: Week 9 (2003); *Scabiosa japonica var. alpina* ‘Blue Diamond’, suppl. light

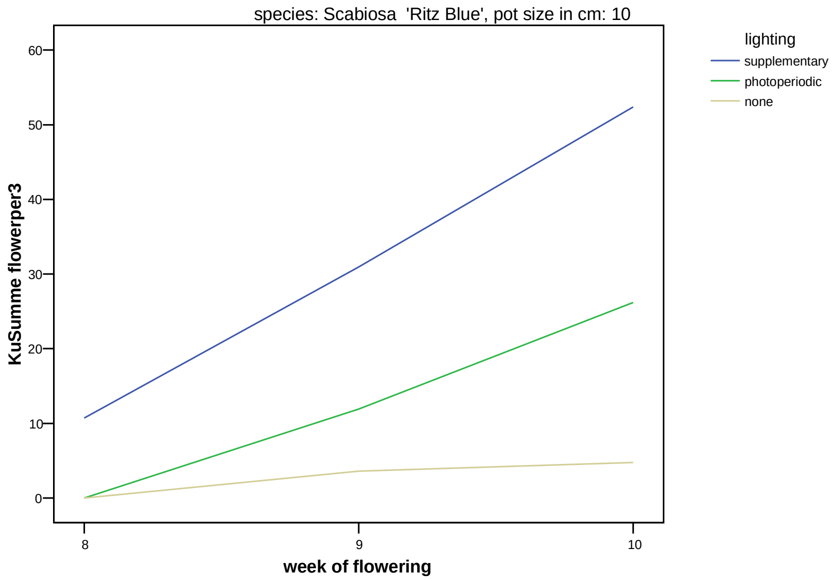

Diagram 7: Development of the percentage of flowering plants in dependence of different light treatments by *Scabiosa japonica var. alpina* 'Ritz Blue'; 10 cm pot size

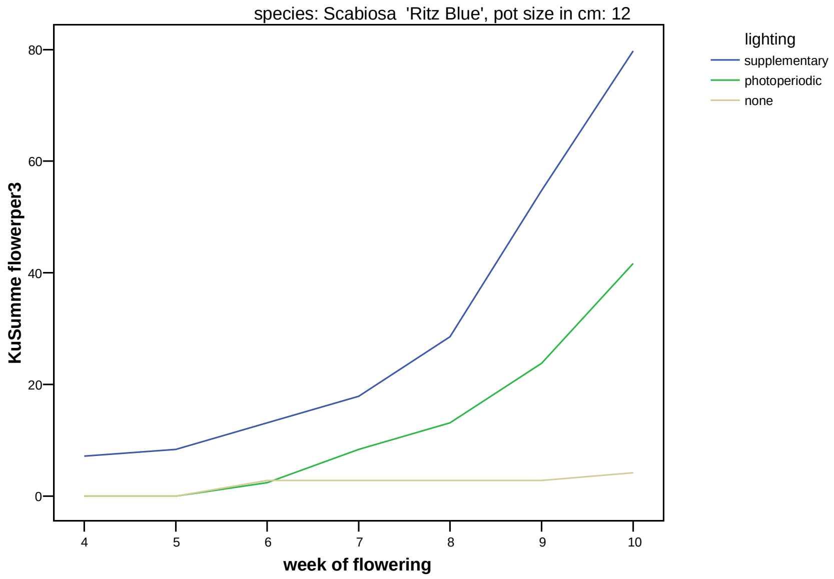

Diagram 8: Development of the percentage of flowering plants in dependence of different light treatments by *Scabiosa japonica var. alpina* 'Ritz Blue'; 12 cm pot size

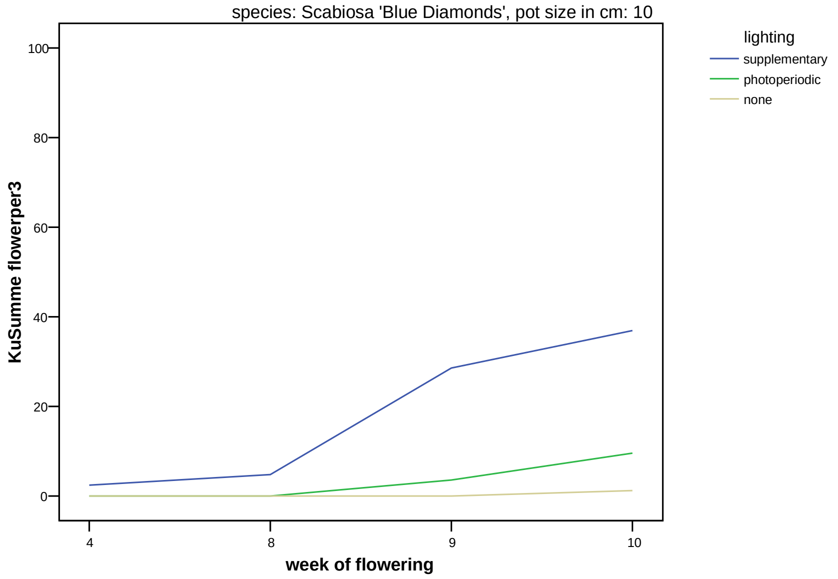

Diagram 9: Development of the percentage of flowering plants in dependence of different light treatments by *Scabiosa japonica var. alpina* ‘Blue Diamond’, 10 cm pot size

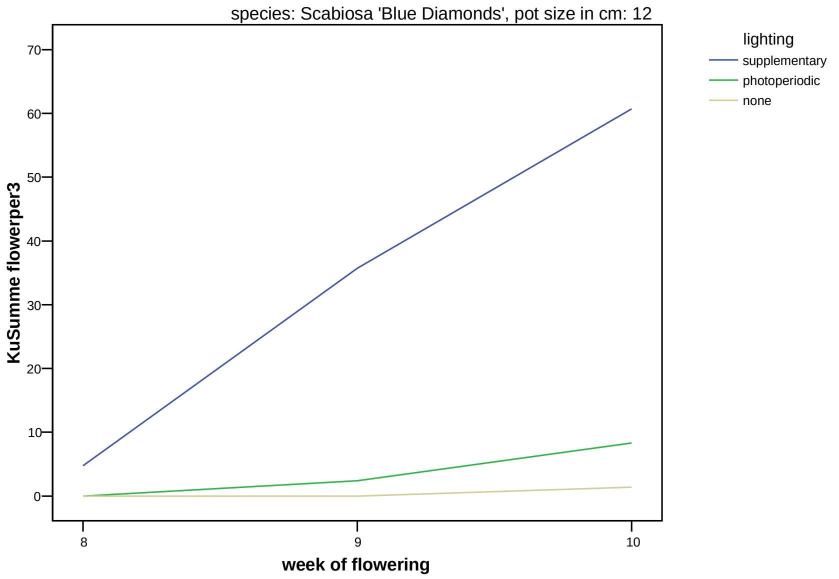

Diagram 10: Development of the percentage of flowering plants in dependence of different light treatments by *Scabiosa japonica var. alpina* ‘Blue Diamond’,12 cm pot size

Height of leaves, height of flowers, diameter and fresh weight, number of buds
The plants in 12 cm pots were heavier and developed more fresh weight and buds than plants in the 10 cm pots (plug size). All plants with supplementary light had a higher flowering rate, the fresh weight was higher. More buds were developed than on plants with photoperiodic lighting. There were first pots with a sitting flower with ambient daylight in week 10. The reason for that could be the short phase of cooling and the probably compensation of this lack by the treatments with the higher light level.

General value
The plants of 'Ritz Blue' in 12 cm pots got better marks than plants in the 10 cm pots. The average was about 6 compared to 4 to 5. The light treatments had no influence on the general value. The 'Blue Diamond' had a bad average value of 4.

Shelf life test
The shelf life under living room conditions was different but long. The shortest time was 11 days while the longest time was 23 days. It was depended on the number of buds per plant that was still opened in the beginning. Plants which came into shelf life test in January and early February did not open the following buds. The plants from week 9 opened up more buds and lasted longer.

Recommendation for *Scabiosa japonica var. alpina* 'Ritz Blue' and 'Blue Diamond'
Start with potting earlier (week 35) to develop more leaves and more flowers. The pot size should be 10 to 11 cm. The cold storage should be from week 40 to week 50 in polytunnel or cold greenhouse (h: 4℃, v: 6℃). Supplementary lig ht is necessary for successful crops in the weeks 9 to 10.

4.1.5 *Arenaria montana* (*Caryophyllaceae*)
The white flowers of *Arenaria* are attractive in spring arrangements. The shelf life is not that high, the flower keeps longer at a cooler place. The plants in 10 cm pots came almost 100 % into flowering; the smaller pot size was almost finished until week 10. The plants with supplementary light did not have such a good habit. The leaves were stretched and these were hanging down. The plants in 8 cm pots with ambient daylight looked the best. The date of flowering was given with 3 to 4 open flowers per pot.

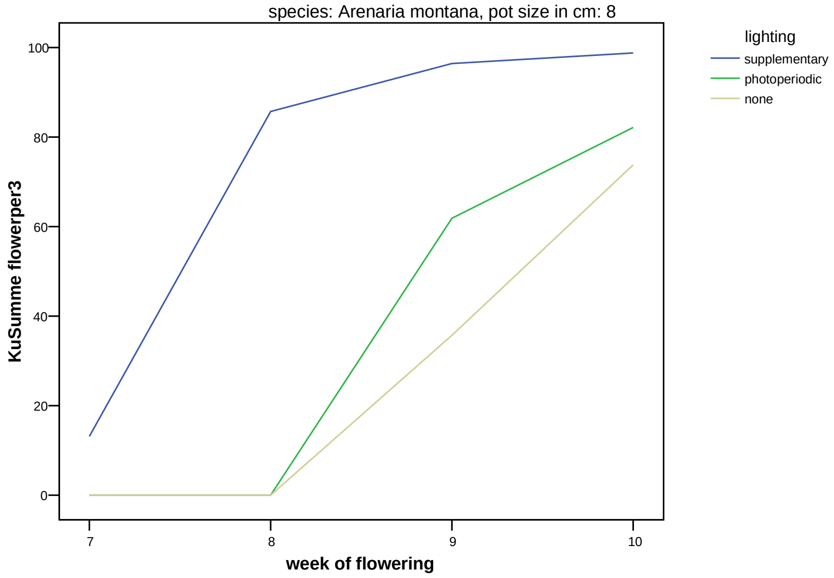

Diagram 11: Development of the percentage of flowering plants in dependence of different light treatments by *Arenaria montana*; 8 cm pot

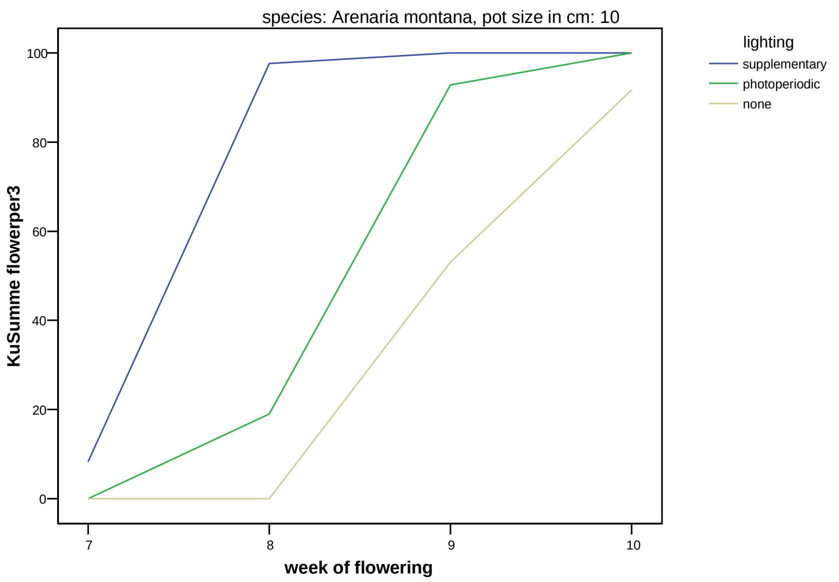

Diagram 12: Development of the percentage of flowering plants in dependence of different light treatments by *Arenaria montana*; 10 cm pot size

Duration of crop (weeks from the beginning in week 50 to the flowering date)
There was no difference between pot sizes. Plants with supplementary light were 6 to 11 days earlier than plants with photoperiodic and ambient daylight. The light is not so important for *Arenaria* than the sum of temperatures and even the quality is better with ambient daylight. With forcing from week 50 on the Valentine's day was not possible. With an earlier start of forcing or a slightly higher temperature the crop might be earlier.

Height of leaves = height of flowers, diameter and fresh weight
Plants in 10 cm pots were higher, wider (slacker growth) and heavier then plants in 8 cm pots. The plants in 10 cm pots with supplementary and photoperiodic light were higher than plants with ambient daylight. Plants in 8 cm pots were only somewhat higher and wider with supplementary light. Like the picture indicates from 10 cm length on the branches grew down and did not look so good anymore.

Picture 8: Week 8; *Arenaria montana*; 8 cm pot;
supplementary, photoperiodic and ambient daylight

General value
Because of the slacker growth the crop got bad marks. The 8 cm pots got the best general value with ambient daylight. There was a small additional test with pinched plants (week 51) and with supplementary light. Plants stretched in the same way and there were not flowered until week 10. It is possible that application of growth regulators could result in more upright plants.

Shelf life test
The shelf life under living room conditions was not tremendous. The white flowers folded up after 7 to 9 days. It is better to keep them in a cooler place.

Recommendation for *Arenaria montana*
Arenaria could be a small accessory crop, grown for spring arrangements outside. They could stay on a terrace or in a cooler place. Start potting from week 40 in 8 to 9 cm pots and let plants root higher temperatures (14℃) for 2 weeks. Keep them in a cold greenhouse for storage and start at least in week 50 with forcing. *Arenaria* reacts on the amount of temperature so, if possible, expose the plants for a couple of days with higher temperatures. With ambient daylight, the plants will flower from week 9 to 10.

4.1.6 *Saxifraga x arendsii* 'Carpet Purple' (*Saxifragaceae*)
Saxifraga is already a common early spring plant but not often grown for Valentine's day. There are different species with pink, red or white flowers. The lot of flowers above the rosettes look very attractive. These species are pretty as a single plant or as a colour spot in spring arrangements. The variety 'Carpet Purple' was not that clear in colour in this trial (colour splitting from seeds). 100 percent of plants came into flowering with supplementary and photoperiodic light. The plants with ambient daylight had the half in flowering in week 9 and the other half of plants showed colour during this time. The date of flowering was given with 3 to 4 open flowers per pot.

Picture 9: Week 5; *Saxifraga x arendsii* 'Carpet Purple', suppl. Light

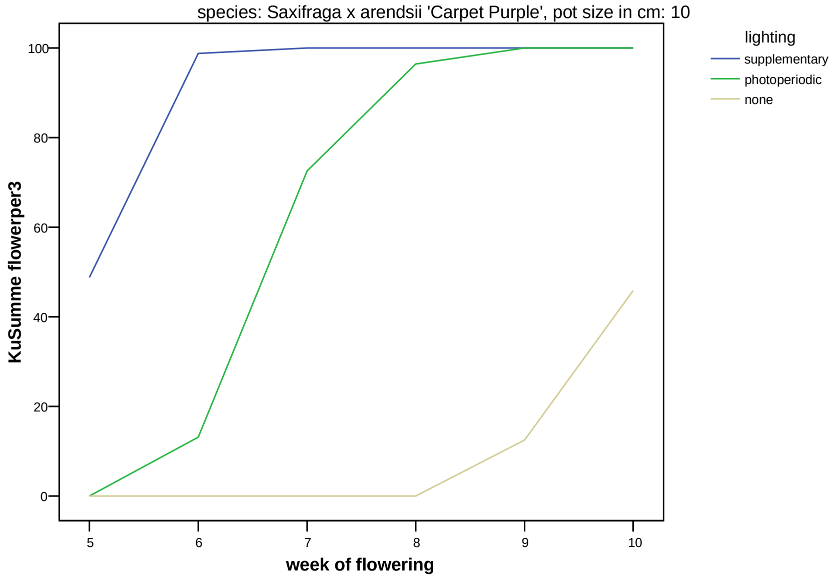

Diagram 13: Development of the percentage of flowering plants in dependence of different light treatments by *Saxifraga x arendsii* 'Carpet Purple'

Duration of crop (weeks from the beginning in week 50 to the flowering date)
Plants with supplementary light were one and a half weeks earlier than plants with supplementary light and almost 3 weeks earlier than plants with ambient daylight. Supplementary or photoperiodic light were necessary to reach the Valentine's day.

Height of leaves, height of flowers, diameter and fresh weight
The height of leaves and flowers were higher with supplementary light than with photoperiodic one and with photoperiodic light higher than with ambient daylight only. The plants were heavier with supplementary light than with photoperiodic and ambient daylight. The habit with supplementary and photoperiodic light was too slack. Flowering stems turned to the side.

General value
Because of the slack growth the plants with supplementary and photoperiodic light have got marks between 3 and 5. The plants with the best general value were from the ambient daylight and from polytunnel. The plants from polytunnel had more flowers (not documented) than plants from cold greenhouse. The duration of storage was too short to point that out. But *Saxifraga* needs definitely a period of cooling to initiate enough flowers.

Shelf life test
Saxifraga behaved well with living room conditions. The colours of flowers decoloured a little bit and the leaves looked still good after an average of 20 days. The shortest time was 16 days and the longest time recorded was 21 days.

Recommendation for *Saxifraga x arendsii*
In former trials the variety 'Peter Pan' grown from cuttings was really successful because it stayed compact and the flower stems did not stretch too much above the leaves.
Plants from cuttings need a little longer to fill the pot with rosettes. That is why start potting week 31 and grow them outdoors or in cold greenhouses is recommended. With plugs from seeds the potting is sufficient at week 35. Pot sizes from 9 to 12 cm are possible. The storage can take place in polytunnels or cold greenhouses from week 40 to week 50. Start forcing in week 50. The Valentine's day is possible with supplementary light and photoperiodic light and with temperatures between 10℃ to 12 ℃. Too avoid the slack growth it is possible to grow with 4℃ and supplementary light and get the flower ing in week 7 to 8. Plants which were

grown with 4℃ and with ambient daylight got the flower in week 11 to 12. With ambient daylight and 10 ℃ the flower will be in week 8 to 10.

4.1.7 *Delphinium Cultivars* 'Guardian Blue' (*Ranuculaceae*)

The dark blue colour of this species was just gorgeous in early week 9. Up to that time only the plants with supplementary light came into flowering. Plants with photoperiodic light showed light blue buds and plants with ambient daylight showed hardly closed buds in week 9. Their dates of flowering could not be recorded cause of the end of the trial. Very important is that the plants had already an initiated flower in all plants at the beginning of forcing. A disadvantage was that plants were about 100 cm high with supplementary light. That is why the low general value was to be given. There was one stretched flowering stem per pot. That makes them interesting as a cut flower. The vase life was 7 to 11 days. The flowers trickled down. For pot production would it be better to choose a more compact species of Delphinium. With an earlier start of crop the growth would be better in branching in autumn and later there would be more flowers per plant.

Picture 10: Week 9; *Delphinium Cultivars* 'Guardian Blue', suppl. light

4.1.8 *Heuchera purpurea* 'Ruby Bells' (*Saxifragaceae*)

The dark red colour of this species would be very welcome in early spring. The disadvantage is the high flowering stem. The 12 cm pot was suitable. Plants with supplementary light were flowering from weeks 8 to 10 with 80 to 90 % and plants with photoperiodic light with 30 to 40 %. Plants with ambient daylight had already coloured buds and looked more compact in week 10. Plants from polytunnel had more flowers and buds. A reason for lack of flowers in a part of the plants could be the different in growth in pre-cultivation and so they were not able to initiate flowers in autumn. The crop should start week 35 to get the better growth before storage. For more flowering initiation *Heuchera* needs a period of cooling. The storage is possible in polytunnel or cold greenhouse. The polytunnel has the risk that strong frost can damage the leaves to much. It could be, there is already a breeding of these species with a shorter habit in process (fits better for pot production). The shelf life under living room conditions depended on the buds per plants which were still opening up. First flowers trickled after 14 days and plants with more buds kept until 23 days.

Pictures 11 and 12: Week 8; *Heuchera purpurea* ‘Ruby Bells’
supplementary, photoperiodic and ambient daylight

4.1.9 *Digitalis purpurea* ‘Camelot Cream’ (*Scrophulariaceae*)

This species was fascinating in flowering and shelf life test. The big cream white flowers with dark pattern are an eye-catcher. The first two pots flowered in week 10 with supplementary light and the other plants showed coloured buds. The shelf life was amazing with 4 weeks. This species is too high for pot production. It could be there is a compacter breeding. Plants with photoperiodic and ambient daylight had buds in week 10 as well but they were more closed.

Picture 13: Week 8; *Digitalis purpurea* ‘Camelot Cream’
supplementary, photoperiodic and ambient daylight

Pictures 14,15 and 16: Week 13, *Digitalis purpurea* 'Camelot Cream'
photoperiodic light 12 cm pots
12 cm, 10 cm, 10 cm+ CCC suppl., photoperiodic, ambient

4.1.10 Other varieties

***Delphinium grandiflorum* 'Summer Stars White'**

This species was white-cream flowering. With supplementary light 60 to 70 percent of the plants were flowering in week 9. The flower was almost 60 cm high and was hold from a woody stick. That's why the general value was low. Plants with photoperiodic light had coloured buds and plants with ambient daylight hardly closed buds. The habit was more compact with ambient daylight but the plot was not uniform. The shelf life test was not too bad with 16 to 18 days and the flowers were not trickling as much as flowers from *Delphinium* 'Guardian Blue'.

***Lupinus nanus* 'Gallery Blue' (*Fabaceae*)**

This species is not recommendable for early spring sale. Only with supplementary light the plants developed flowers in both pot sizes. From week 8 to week 10 the 12 cm pots were 70% and 10 cm pots 20 % in flowering. All plants from photoperiodic and ambient daylight did not show a bud until week 14. It seems that only the amount of light is responsible for the initiation of flowers. The hight of the leaves was about 40 cm and the hight of flowers about 50 to 60 cm. This makes them not suitable as a pot plant. There were not enough leaves and the general value was low. In shelf life test the flowers trickled down after 10 to 14 days. The leaves were still looking attractive, only some snapped off. Because of the bulky growing plants there was always the risk of damaging the leaves during transport.

***Chaenarhinum origanifolium* 'Blue'**

At this blue-violet flowering species the date of flowering was given with 3 to 4 open flowers per plant. In week 8 or 9 about 12 to 20 percent of the plants were flowering only with supplementary light. This is not really attractive at that time and because of that the general value was low. *Chaenarhinum* is a late crop and reminds more of a bedding plant than of an early spring pot plant. Plants with photoperiodic and ambient daylight showed coloured buds in week 9. There was more influence of the temperature than of the light. Plants in 10 cm pots had almost the double fresh weight than plants in 8 cm pots and they were better in shape than plants in 8 cm pots. Shelf life was tested with *Chaenarhinum* from Kieft Seeds and showed 14 to 16 days. The blue colour turned to white under low light conditions very quickly.

***Geranium sanguineum* ‘Light Pink’**
This species was flowering with one pink flower per plant and after a while the next flower was opened. Only with supplementary light plants in 8 and 10 cm pots 40 to 50 % were flowering until week 10 and with photoperiodic light just about 10 % in week 10. This species depends on amount of light and long days. The plants in 10 cm pot developed the double of fresh weight but were not looking better. The stretched branches and little flowers gave them the low general value.

***Lobelia speciosa* ‘F1 Fan Scarlet’**
***Echinacea purpurea* ‘Primadonna Deep Rose’**
***Dianthus deltoides* ‘Confetti Carmine Rose’**
***Penstemon heterophyllus* ‘Electric Blue’, *Penstemon digitalis* ‘Mystica’**
***Leucanthemum x superbum* ‘Crazy Daisy’**
***Coreopsis grandiflora* ‘Baby Sun’**
These 7 species were not successful in this early spring trial. The crops missed the amount of light. All species showed no flowers until week 10 in all three greenhouse compartments. Same plants were kept a little longer with ambient daylight and were flowering in late week 14. Pictures are to be seen in the photo album on DVD in annex. *Lobelia speciosa* was not uniform in growth and leaves were deformed. The reason for that was not definable.

4.2 Results fertilisation trial

The white/green leafed *Ajuga reptans* ‘Variegata’ (*Lamiaceae*) will not be mentioned in detail because the crop was too late. There were no flowers until week 10. This species reacted very sensible on higher amounts of depot fertiliser. There was a lot of losses during cultivation especially with the fertiliser treatments 2 and 3.
For the fertilisation treatments the following codes are used:

1 = approx. 200 mg N per plant (1,5 g MannaCote Mini 4 M 19-6-11)
2 = approx. 700 mg N per plant (3,5 g MannaCote Mini 4 M 19-6-11)
3 = approx. 1200 mg N per plant (6 g MannaCote Mini 4 M 19-6-11)

4.2.1 *Ajuga reptans* ‘Rosea’ (*Lamiaceae*)

This species is an interesting pink flowering plant. The disadvantages are the twines around the pot. Therefore, the general value is low for the single plant. For the creation of arrangements this crop could be still interesting.

Picture 17: Week 6; *Ajuga reptans* ‘Rosea’, supplementary light

Picture 18: Arrangement with *Ajuga* 'Rosea' (right in background)

Picture 19: Week 36; *Ajuga reptans* 'Rosea'

Picture 20: Week 49; *Ajuga reptans* 'Rosea', polytunnel

All plots had 12 plants (3 replications= 36 plants). About 80 percent of plants came into flower only. Some plants developed already flowers in autumn. These flowers were not recorded. There were big differences between the single plants how long they did need to come into bloom. The start of the flowering was stretched over more than 8 weeks. The supplementary light could better force the development of buds and new flowers. The date of flowering was given with three open flowers on a flowering stem.

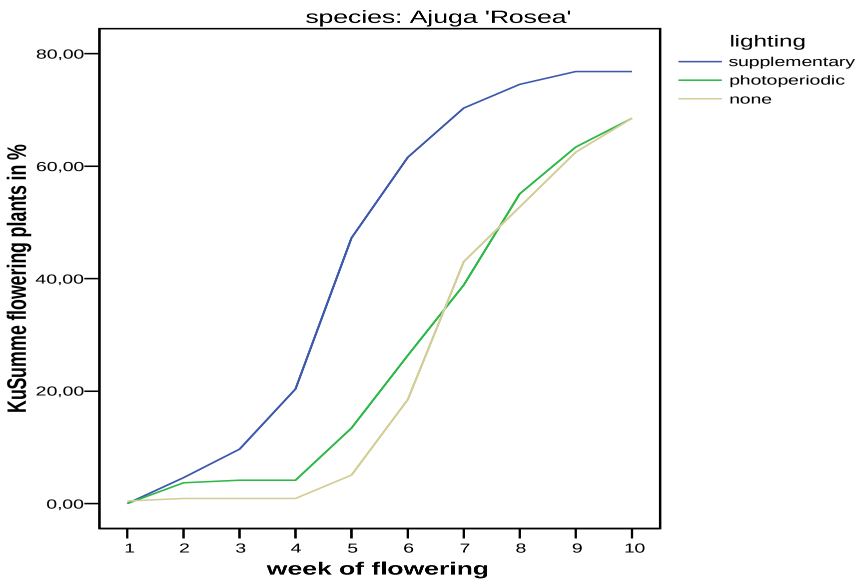

Diagram 14: Development of the percentage of flowering plants in dependence of different light treatments by *Ajuga reptans* 'Rosea'

Influences of the factors light, fertiliser and storage on the variable parameters:

Duration of crop (weeks from the beginning in week 50 to the flowering date)
Plants from polytunnel reacted with a longer duration of crop on the higher amounts of fertiliser. Plants from cold greenhouse made opposite: Plants with fertiliser 3 came as early as

plants with fertiliser 1. The reason for that could be that the plants had more stress with the higher fertiliser at the greenhouse and made an early stress flower. The difference in duration of crop was one week between the fertiliser 1 to 2 and fertiliser 2 to 3.
The light treatment had the influence that plants from polytunnel with supplementary light were 2 weeks earlier to photoperiodic light and 3 weeks earlier to ambient daylight. Plants from the cold greenhouse with supplementary light were 2 weeks earlier to photoperiodic and ambient daylight. There was no influence from photoperiodic light. The plants from the cold greenhouse were earlier than plants from polytunnel. Supplementary light is necessary for Valentine's day the day of sale. Photoperiodic and ambient daylight treated plants were still in flower before week 9.

Height of leaves, height of flowers, diameter and fresh weight
The fertiliser had influence on all four parameters. Plants with higher amount of fertiliser had higher leaves, flowers, diameter and fresh weight than fertiliser level 1, exception again plants from cold greenhouse with fertiliser 3 were smaller and had less weight, grown backwards (stress reaction).
The light had influence on the height of flowers and fresh weight. Supplementary light made higher flowering stems but developed less fresh weight than photoperiodic and ambient daylight because of shorter duration of crop.

Shelf life test
Ajuga reptans 'Rosea' had a good shelf life under living room conditions. The pink colour was a little decolourised, the leaves were good looking. Flowers did not trickle. The shelf life was influenced by fertiliser. Plants with higher amount of fertiliser showed shorter shelf life.

Table 8: Influence of the fertilisation and storage on the shelf life by *Ajuga reptans* 'Rosea'

	Shelf life in days					
treatment	Polytunnel			Cold greenhouse		
	mid	min	max	mid	min	max
Fertiliser 1	23	20	26	21	17	25
Fertiliser 2	19	14	26	16	11	21
Fertiliser 3	17	13	23	15	11	23

Recommendation for *Ajuga reptans* 'Rosea'
The crop can start later than week 28 (cuttings) to avoid the flowers in autumn. Let them grow in a cold greenhouse. The demand of fertiliser should be between 200 and 700 mg N per plant to catch the early flower, the bigger plant and a long enough shelf life. Supplementary light is necessary for selling date Valentine's day.

4.2.2 *Ajuga reptans* 'Mini Mahagoni' (Lamiaceae)

This species could have a great future. The species stays compact, no disturbing twines and the blue colour of flowers is very pretty. The single plant could be a nice present to Valentine's day and in arrangements the blue colour makes a good contrast.

Picture 21: Week 7; *Ajuga reptans* 'Mini Mahagoni'

Picture 22: Week 36; *Ajuga reptans* 'Mini Mahagoni', fertiliser level 2

Picture 23: Week 49; *Ajuga reptans* ‘Mini Mahagoni’, fertiliser level 2

All plots received 12 plants (3 replications= 36 plants). 100 percent of the plants came into flower. Just with ambient daylight a couple of plants were not finished to the 6th of March. The date of flowering was given with three open flowers on a flowering stem.

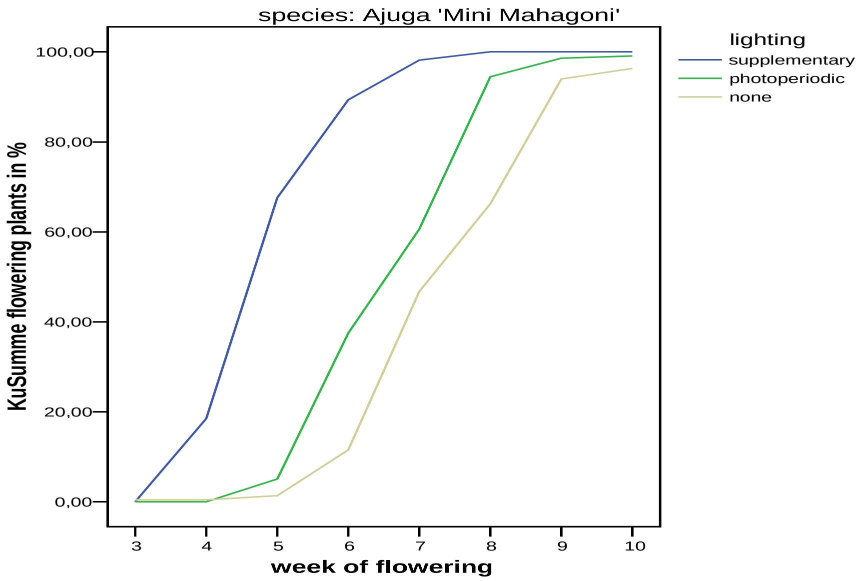

Diagram 15: Development of the percentage of flowering plants in dependence of different light treatments by *Ajuga reptans* ‘Mini Mahagoni’

Influences of the factors light, fertiliser and storage on the variable parameters:

Duration of crop (weeks from the beginning in week 50 to the flowering date)
The plants with fertiliser treatment 2 were half a week later than plants with treatment 1 and 3 so that the fertiliser had not a mentionable influence on duration of crop. The storage showed no correlation to fertiliser.
With supplementary light the plants from polytunnel were 2 weeks earlier compared to photoperiodic light and almost 3 weeks earlier compared to ambient daylight. Plants from the

cold greenhouse reacted with not such a big difference, supplementary light was a little over one week earlier than photoperiodic and 2 weeks earlier than ambient daylight.
Plants from the cold greenhouse were about 1 week earlier than plants from the polytunnel.

Height of leaves, height of flowers, diameter and fresh weight
Fertiliser and storage had influence on height of leaves, diameter and fresh weight. Plants from polytunnel were higher and wider compared to plants from cold greenhouse. Plants from the polytunnel had a better growth with fertilisation 2 and 3 than plants with treatment 1. Plants from the cold greenhouse reacted in a different way to the fertilisation differences. The plants with the highest level were lower and smaller than the plants with fertilisation levels 1 and 2. The light treatments had no influence. The parameter height of flower was influenced from storage, fertiliser and light. The plants from polytunnel had a higher flower with fertilisers 2 and 3 compared to fertiliser 1. The light did not have a big influence. Only plants with supplementary light and fertiliser 3 had higher flowering stems. In contrast the plants from cold greenhouses had higher flowering stems with lower fertilisers 1 and 2 compared to plants with fertiliser 3.
The plants got lower in flowering stems from supplementary to ambient daylight.
The reaction of plants from the polytunnel and plants from cold greenhouse to the fertiliser levels was different. Plants from the polytunnel were more successful with higher fertiliser levels than plants from greenhouse. Reasons could be the washout by watering over head and the lower temperature in the polytunnel. In coated depot fertilizers like MannaCote the release of the nutrients is strongly dependent from the temperature. In the greenhouse the water came over flow and ebb system. This and the higher average temperature probably resulted in accumulation of nutrients up to salt stress.

General value
Because of the different reaction of the plant size to the combinations of the factors it is interesting what the general value did in correlation. The plants from polytunnel had better marks than plants from cold greenhouse, but only at the higher fertiliser levels 2 and 3. Plants from cold greenhouse were all in the marks between 6 and 7.5. The significant best marks with an average of 8.5 got the plants from the cold polytunnel at the highest fertiliser level 3.

Picture 24: Week 4; *Ajuga reptans* ‘Mini Mahagoni’, greenhouse, suppl. light
Fertiliser level 1, 2 and 3

Picture 25: Week 4; *Ajuga reptans* ‘Mini Mahagoni’, polytunnel, suppl. light
Fertiliser level 1, 2 and 3

Shelf life test
Ajuga reptans ‘Mini Mahagoni’ is really suitable for living room conditions. Between the light treatments a strong influence was not to be seen. It is a fact that increasing fertiliser levels resulted in decreasing shelf life duration. The flowers were opened from bottom to top. The blue colour was a little decolourised. After some days they do wilt but not trickle. The leaves were still all right.

Table 9:
Influence of the fertilisation and storage on the shelf life by *Ajuga reptans* ‘Mini Mahagoni’

	Shelf life in days					
treatment	Polytunnel			Cold greenhouse		
	mid	min	max	mid	min	max
Fertiliser 1	18	17	21	16	14	18
Fertiliser 2	16	14	17	14	11	16
Fertiliser 3	13	11	16	13	13	14

Recommendation for *Ajuga reptans* ‘Mini Mahagoni’
Start with cuttings in week 28. The potting follows in week 33. The fertilisation should be in the higher level of 500 - 700 mg N per plant but better with fluid than depot fertiliser. Both storages are possible in polytunnel or frost free glasshouse. The selling date Valentine’s day is surely possible with supplementary light. Plants from polytunnel reached the Valentine’s day also with photoperiodic and ambient daylight in forcing period. This year trial started forcing in week 51. Start one or two weeks earlier and there should be a real chance to finish the crop before Valentine’s day with only ambient daylight too.

4.2.3 *Androsace septentrionalis* ‘Star Dust’ (*Primulacea*)
These lovely white flowering plants were always successful in former trials but there was no experience with different fertiliser levels before. *Androsace* has a high value for spring arrangements.

Pictures 26, 27, 28: Arrangements with *Androsace septentrionalis* ‘Star Dust’

Due to losses during precultivation and storage not all plots received 12 plants at the beginning of forcing. The plants came 100 percent to flowering. Just with ambient daylight a couple of plants were not finished until 6th of March. The date of flowering was given with three open flowers on a flower stem.

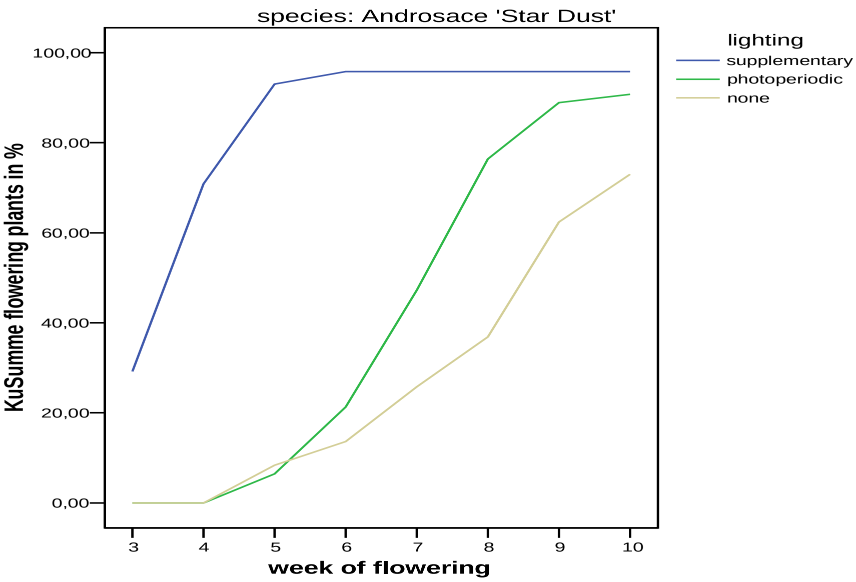

Diagram 16: Development of the percentage of flowering plants in dependence of different light treatments by *Androsace septentrionalis* ‘Star Dust’

Duration of crop (weeks from the beginning in week 50 to the flowering date)
All factors had an influence on duration of crop. In the plants from polytunnel fertilisation level 1 was two weeks earlier than levels 2 and 3. In the plants from greenhouse fetiliser level 1 was again two weeks earliere than level 2 but level 3 was about so early like level 1 (probably due to the salt stress).
Plants from polytunnel were nn average one week earlier than plants from cold greenhouse. Plants with supplementary light were 3 to 4 weeks earlier than from forcing under photoperiodic and ambient daylight. The flowering started in week 3 compared to week 7 and 8. Photoperiodic light resulted in just some day earlier flowering than ambient daylight. With photoperiodic and ambient daylight plants from polytunnel were a little earlier than plants from cold greenhouse. With supplementary light the plants were blooming at the same time. In this case the way of storage had no influence.

Picture 29: Week 4; *Androsace septentrionalis* ‘Star Dust’, polytunnel, suppl. light
Fertiliser level 1, 2 and 3

Picture 30: Week 4; *Androsace septentrionalis* ‘Star Dust’, cold greenhouse, suppl. light
Fertiliser level 1, 2 and 3

Height of leaves, height of flowers, diameter and fresh weight

All plants with fertilisers 1 and 2 were higher in leaves and flowers than plants with fertiliser 3. The fresh weight was different between plants from the polytunnel which were heavier than plants from the cold greenhouse. The diameter and fresh weight of plants from the cold greenhouse with fertiliser 3 were a lot worse than plants with fertiliser 1 and 2.
The light treatments did not have a mentionable influence. Plants under supplementary and photoperiodic light stretched their flowering stems more than plants under ambient daylight.

General value

All plants with the fertiliser levels 1 and 2 reached better marks than level 3.
The best development (especially the higher number of flower stems) got plants with supplementary light. Plants were uniform in stretching and maturity (general value 8 - 9)
The plants with low fertiliser level 1 looked the best.

Picture 31: Week 36; *Androsace septentrionalis* ‘Star Dust’

Picture 32: Week 49; *Androsace septentrionalis* ‘Star Dust’, polytunnel;

Picture 33: Week 4; *Androsace septentrionalis* ‘Star Dust’, fertiliser 1; suppl. light storage cold greenhouse, polytunnel;

Shelf life test
The shelf life of *Androsace* under living room conditions is a little over 14 days.
Most of the buds are developed to complete flowers. The flowers reshaped to seeds and the wilting of leaves went along with this. The most plants with fertiliser 3 and even with fertiliser 2 collapsed after a short time. The leaves wilted and the flower stems were hanging down. The reason for this is probably the high output of nutrient salts from the depot fertiliser under the higher temperatures in the shelf life test.

Table 10: Influence of the fertilisation and storage on the shelf life by *Androsace septentrionalis* ‘Star Dust’

	Shelf life in days					
treatment	Polytunnel			Cold greenhouse		
	mid	min	max	mid	min	max
Fertiliser 1	16	14	18	15	13	19
Fertiliser 2	13	10	16	11	7	16
Fertiliser 3	8	5	16	4	2	7

Recommendation for *Androsace septentrionals* ‘Star Dust’
Sowing in week 31 and potting in week 33 matches the demands. For best results the fertiliser should be in a low level and not above 200 mg N per plant. It is recommended to use liquid fertilisers that could be better controlled in their dosage at the different plant stages. It is possible to have flowering plants before Valentine’s day with ambient daylight but crop is not so uniform like plants from supplementary light. Supplementary light is definitely earlier than ambient daylight. Plants grown in polytunnel will grow more compact and will be earlier with flowering.

4.2.4 *Lithodora diffusa* 'Heavenly Blue' (*Boraginaceae*)

The colour of flowers from these species is really heavenly. The blue colour is welcome in colourless early spring months. In arrangements it could be a nice alternative.

Picture 34: The terrific blue colour of *Lithodora diffusa* 'Heavenly Blue'

The crop started with cuttings from stock plants were kept from former trials and with cuttings delivered from AGREXCO. The behaviour was almost similar, that's why the results are in the same chapter. The *Lithodora* reacted very sensitively on higher amounts of depot fertiliser. There was a big loss of plants especially in the fertiliser treatments 2 and 3 still in the pre-cultivation. This continued in the period of forcing. The following diagrams show the flowering behaviour under the different light treatments only of the surviving plants. 100 % of the plants under supplementary light were in flower until 6th of March. The plants with ambient daylight were not finished to this date but showed already coloured buds.

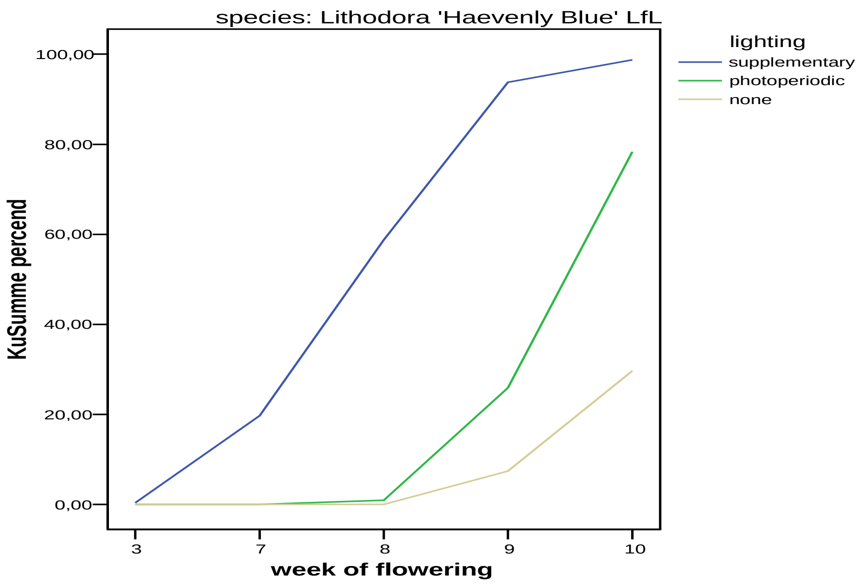

Diagram 17: Development of the percentage of flowering plants in dependence of different light treatments by *Lithodora diffusa* 'Heavenly Blue'; LfL

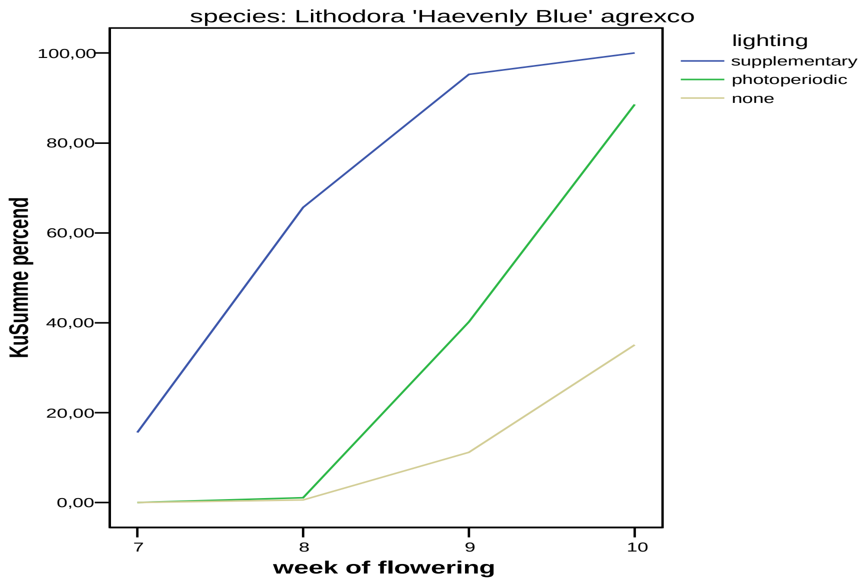

Diagram 18: Development of the percentage of flowering plants in dependence of different light treatments by *Lithodora diffusa* 'Heavenly Blue'; AGREXCO

Duration of crop (weeks from the beginning in week 50 to the flowering date)
The duration of crop was not influenced from fertiliser.
The plants with supplementary light were one and a half week earlier in average than plants with photoperiodic or ambient daylight. The reason for that could be the little higher under supplementary light (heat radiation of lamps). *Lithodora* reacts on temperature. The date of flowering was given with 3-4 open flowers on a plant.

Picture 35: Week 9; *Lithodora diffusa* 'Heavenly Blue', fertiliser 1, cold greenhouse supplementary, photoperiodic and ambient daylight

Height of flowers, diameter and fresh weight
The flowers of *Lithodora* are located at the end of a branch in direct neighbourhood of leaves. That is why only one height was measured. Storage and fertiliser had no influence on height and diameter. Plants with supplementary light were higher and wider than plants with photoperiodic and ambient daylight. The plants from polytunnel were wider than plants from cold greenhouse. The plants from polytunnel developed more branches.
Fertilisation and storage influenced the fresh weight. Plants from polytunnel were heavier than plants from cold greenhouse. Within the plants from polytunnel the higher fertilisation levels showed higher fresh weight. This differentiation was not to be found in the plants from the glasshouse probably due to the lower light level or the salt stress induced by the depot

fertiliser under the higher temperatures. Plants developed more fresh weight under supplementary light compared to other light treatments.

General value

Storage and lighting influenced the general value. Plants from polytunnel and with ambient daylight got better marks than plants from cold greenhouse and other light treatments. Plants from AGREXCO point out that plants from polytunnel and with ambient daylight and fertiliser 1 were the best in general value.

Picture 36: Week 36; *Lithodora diffusa* 'Heavenly Blue'

Picture 37: Week 49; *Lithodora diffusa* 'Heavenly Blue', fertiliser 1, polytunnel

Shelf life test

The shelf life of *Lithodora* under living room conditions is sufficient with about 14 days. The colour decoloured under the high temperatures and the low light level. Plants from ambient daylight came not into shelf life test. Plants from supplementary and photoperiodic light showed nearly the same shelf life.

Plants from own propagation were in average one to two days longer in shelf life than plants from AGREXCO that's why first data chosen in following table. Plants with fertiliser level 1 kept longer than plants from levels 2 and 3.

Table 11: Influence of the fertilisation and storage on the shelf life by *Lithodora diffusa* 'Heavenly Blue'

treatment	Shelf life in days					
	Polytunnel			Cold greenhouse		
	mid	min	max	mid	min	max
Fertiliser 1	15	12	18	14	13	14
Fertiliser 2	12	10	14	12	11	16
Fertiliser 3	10	8	11	11	10	14

Recommendation for *Lithodora diffusa* 'Heavenly Blue'
Lithodora reacts very sensitively on high amounts of depot fertiliser especially during storage and forcing. The fertilisation should not above 200 mg N per plant. The potting of plants was late in week 35 and it was surprising that plants still made such a growth under outdoor conditions, especially plants stored in polytunnel. With one plant in a pot, the pot size would be better 9 to 10 cm. In former trials the recommendation was even three plants in a 12 cm pot. Three plants in a pot create a better shape, there are more flowers at the beginning and costumers get better quality as a decorative gift. One plant in a pot could be interesting for mixture palettes and in arrangements. The potting should be 5 to 7 weeks earlier to get a maximum of growth before storage. The crop branches more in the polytunnel. The temperatures should not be under - 5℃. To reach th e flowering until Valentine's day with ambient daylight, the forcing has to start in week 50 and temperatures should be for one week higher (approx. 20 ℃). *Lithodora* needs a time of cold storage to initiate flowers and reacts on temperature during forcing. The sum of temperature is still not known. With forcing temperatures near 10 to 12 ℃ the crop is still ear ly in week 9 to 10. There has to be a plant protection against Botrytis with common fungicides. Former trials had sometimes lack of iron which was eliminated with special iron fertiliser (Fetrilon 1 g/ 10 l water). *Lithodora* is susceptible against calcium and should be potted in a substrate with lower pH of about 4.5 to 5.5.

4.3 Results additional assortment Kieft Seeds

This chapter will mention only these species which could be interesting for early spring pot plant production. There are pictures from all species in the ULEAD PhotoImpact album on DVD in the annex.

***Anacyclus pyrethrum var. depressus* 'Spring Carpet'**
The flowers of this species are pretty because of the white colour on top side and purple colour underside of crown leaves. This makes it attractive as a single plant or in arrangements. 75 % of the plants were in flower until Valentine's day and 25 % until the end of week 8. The date of flowering was given with three open flowers per pot. The habit was different. There were more plants with long stretched branches than upright and compact growing plants. That is why the general value was in the lower range. In former years the variety of *Anacyclus* 'Silberkissen' from Jelitto was more successful with its compact growing. With supplementary light and one week higher temperatures in the beginning of the forcing the plants flowered in week 8, without higher temperatures in week 9 and with ambient daylight in week 11. Start potting week 27 to 30 to develop enough leaves until storage. From

the week 40 to the week 50 the storage is possible in polytunnel or cold greenhouse. Higher temperatures and supplementary light have influence on earlier flower.
The shelf life was with 4 weeks really good.

Picture 38: Week 7; *Anacyclus pyrethrum var. depressus* ‘Spring Carpet’, suppl. light

Picture 39: Week 8 (2003); *Anacyclus pyrethrum var. depressus* ‘Silberkissen’, suppl. light

Aquilegia vulgaris **(‘Clementine’ series)**
The pretty filled flowers of these species were with 40 to 50 cm a little too high. All varieties of colours started with sowing in week 32. The week of potting was different in week 36 and week 37. It is interesting that only plants which were potted in week 36 and stored in cold greenhouse initiated a flower. The flowering started week 6 to 7 before Valentine’s day. All the other plants did not reach the needed adultness in autumn. There has to be a definite amount of leaves to initiate a flower. The shelf life was longer compared to *Aquilegia* F1 Spring Magic. The filled flower trickled down after 8 days and then a lot of buds opened up on the flowering stem and the plants kept 19 days in shelf life room.

Picture 40: Week 7; *Aquilegia vulgaris* 'Clementine Rose', suppl. Light

***Barbarea rupicola* 'Sunnyola'**

This crop is interesting because of the yellow flower above dark green well shaped leaves. The supplementary light made them flowering in week 5 to 6. The plants from the polytunnel stretched the flowering stems a little over the leaves. Plants from cold greenhouse had a sitting flower. That points out that the phase of cooling was not enough for *Barbarea rupicola*. The shelf life under living room conditions was 10 days.

Picture 41: Week 5; *Barbarea rupicola* 'Sunnyola', suppl. light

***Calceolaria biflora* 'Coldcap'**

Yellow tender flowers stand over a nice rosette of leaves. This species is not as bright as the common Calceolaria on market and could be just a little niche. Plants from polytunnel were earlier in week 7 than plants from cold greenhouse in week 8. But plants from cold greenhouse developed a bigger rosette of leaves. The shelf life depended on the buds which were still opening up and was in average 15 days.

Picture 42: Week 7; *Calceolaria biflora* ‘Coldcap’; suppl. light

***Erysimum perovskiskianum* ‘Goldrush’**

This species was early in flowering. A lot of yellow flowers stand over a rosette of leaves and makes it interesting as a colour spot in spring arrangements. Plants potted in week 34. Plants which stored in cold greenhouse started flowering already in week 51 and plants stored in polytunnel in week 1. A later beginning of period of forcing for blooming until Valentine’s day is possible. Plants stored in the cold greenhouse got one stretched flower stem whilst plants stored in the polytunnel got about 5 flowering stems and a better general value. That indicates the influence of the period of cooling. The shelf life under living room conditions was 14 to 16 days.

Picture 43: Week 7; *Erysimum perovskiskianum* ‘Goldrush’; suppl. light

***Cheanorhinum origanifolium* ‘Summer Skies’**

This blue-violet flowering crop was pretty late in flowering in week 9 to 10. The hanging shape is not so attractive for early season pot production and reminds more of a bedding plant. This crop (variety ‘Blue’) has already been mentioned in the chapter above. Shelf life under living room conditions was 14 to 16 days. The blue colour turned to white very quickly.

Erigeron karvinskianus **‘Stallone’**
A lot of white flowers make this species only interesting for spring arrangements. With supplementary light the plants from polytunnel were earlier in flowering on average (week 6 to 7) than plants from cold greenhouse (week 7 to 8). But plants from cold greenhouse were better in habit. The growth with supplementary light was too slack and the general value was low. The shelf life was amazing with 21 to 31 days. All buds opened up in shelf life room.

Mimulus x hybridus **(Bounty series)**
There were four nice colours in trial. All were potted in the same week 35. The yellow variety was first in flower in week 5-6 followed by pink and orange in week 6-7 and red in week 7-8. The shelf life was not satisfying with 4 to 8 days under living room conditions. Flowers snapped and buds did not open. *Mimulus* is plant which should be used as a bedding plant.

All other species tested in additional trial will not be mentioned because of late flowering, unattractive habit or their short shelf life. Data and pictures are included in the ULEAD PhotoImpact album on DVD in the annex.

5 Conclusions

Assortment from UK

From the 21 tested varieties involved in the UK trial the following are suitable directly as pot plants for early season sale at Valentine's day. A couple of these varieties will need some little changes in their cultivation schedule to realise a sure production with an attractive result. Start of pre-cultivation, duration of cold storage and lighting should be optimised for each variety.

Aquilegia 'Spring Magic Blue & White'
Geum coccineum 'Cooky'
Arenaria montana
Saxifraga x arendsii 'Carpet Purple'

Some more efforts are necessary to make the following varieties suitable as pot plants for early season sales, but there are really good chances for an improvement. The application of plant growth regulators, usage of larger pots and search for other breedings could be important steps.

Delphinum Cultivars 'Guardian Blue'
Digitalis purpurea 'Camelot Cream'
Heuchera purpurea 'Ruby Bells'
Papaver nudicaule 'Garden Gnome'
Scabiosa japonica var. alpine 'Ritz Blue' or better 'Diamond Blue'

Not each of those varieties which are suitable directly or in principle are attractive enough to be sold as a single plant. The best chances in marketing will be to offer mixed palettes ore ready mixed plantations. For this use further research is essential in order to:

- synchronise exactly the cultivation of different plants
- develop best selling combinations
- include further varieties

Crops which will be produced for Valentine's day and for living rooms should be in smaller pot sizes. The taller crops in bigger pot sizes could be a product for the early March selling for cooler places or terraces even if there will be the danger of frost.

Fertilisation trial

The fertilisation trial was done by a depot fertiliser to realise a simple handling in the pre-cultivation of the plants outside. Another aim was to find out the limit for an overfertilisation. The involved 5 varieties reacted in a very different way: *Androsace septentrionalis*, *Ajuga* 'Variegata' and *Lithodora diffusa* 'Haevenly Blue' were very sensitive at the high level of 1200 mg N per pot. The optimum for these varieties will be in the range of 200 to 300 mg N per plant. *Ajuga* 'Rosea' and 'Mini Mahagoni' are not so sensitive concerning over-fertilisation. At the lowest fertilisation level they actually showed slight symptoms of lack. The optimum for these varieties will be in the range between 500 and 700 mg N per plant.
The complete nutrition by help of the depot fertilizer caused problems by the way that the release of the nutrients is directly associated with temperature. Higher temperature during the storage of plants at the glasshouse and during forcing period may result in higher release up to over-fertilisation and salt stress. In future it will be better to apply a basic fertilisation for the pre-cultivation outside by depot fertiliser in combination with controlled liquid fertilisation for optimising the growth after that.
All varieties involved in this trial except for Ajuga 'Variegata' are benificial for early season sales at Valentine's day as single pots or in combinations:

Ajuga reptans 'Mini Mahagoni'
Ajuga reptans 'Rosea'
Androsace septentrionalis 'Stardust'
Lithodora diffusa 'Haevenly Blue'

Additional assortment Kieft Seeds
28 varieties from Kieft seeds were tested and out of these the following ones are suitable or hopeful for the very special use of early forcing for Valentine's day:

Anacyclus depressus ' Spring Carpet' or better 'Silberkissen'
Barbarea rupicola 'Sunnyola'
Calceolaria biflora 'Coldcap'
Erysimum perovskianum 'Goldrush'
Chaenorhinum origanifolium 'Summer Skies'
Erigeron karvinskianus 'Stallone'
Mimulus x hybridus 'Bounty' series

Despite of the late beginning of the project a lot of valuable results were obtained, in detail concerning the assortment, fertilisation, lighting and other information for a successful production of new pot plants for early season sales.

A proposal for a following project in season 2006/07 was just prepared and sent to the Horticultural Development Council and to the Sächsische Landesanstalt fuer Landwirtschaft

6 Annex

Contents of the annex on DVD

data files	sheets	Contents
UKdata.xls	assortment	list of the assortment
	01 …21	datas of the single varieties
	all data	combined data of all varieties
	shelflife	datas of shelf life test from UK trial
AnnexUK.ppt		tables and diagrams for each single variety in UK trial
UKpresentation.ppt		transparencies of the presentation at the meeting in Arundel on 4/14/06 from Ute Hoffman
UKpics.exe		selfextracting and browser readable photo album of the UK trial
Fertdata.xls	treatments	code for assortment, potsize, fertiliser and storage treatments
	data	datas of fertilisation trial
	shelflife	datas of shelf life test from Fertilisation trial
AnnexFert.ppt		tables and diagrams for each single variety and treatment in fertilisation trial
Fertpics.exe		selfextracting and browser readable photo album of the Fertilisation trial
Kieftdata.xls	assortment	Assortment and additional information of pre-cultivation
	data and shelf life	datas of fertilisation trial including datas od shelf life test
Kieftpics.exe		selfextracting and browser readable photo album of the additional assortment Kieft Seeds
Valentine 2006.ab3		ULEAD PhotoImpact album of all picture with the option of automatic search (needs special ULEAD software)
Report.pdf		this technical report as pdf file