Project title:	Narcissus: the use of herbicides, singly and in combination, for the control of volunteer narcissus in winter wheat
Project number:	BOF 47
Project leader:	Mr J B Briggs ADAS, Park Farm, Ditton, Aylesford, Kent, ME20 6PE
Annual Report:	Year 1 annual report, December 2000
Previous reports and dates:	None
Key worker: (author of report)	Ms J Fitzpatrick ADAS Arthur Rickwood, Mepal, Ely, Cambs, CB6 2BA
Location of project:	ADAS Arthur Rickwood (address as above)
Project co-ordinators:	Mr D G Wilson Lingarden Ltd Weston, Spalding Lincs PE12 6HP Mr D Almond Lords Ground Ltd Lords Ground Farm Swaffam Prior Fen Cambridge CB5 0LG
Date project commenced:	1 August 1999
Date completion due:	31 December 2001
Keywords:	Narcissus, cultivars Cheerfulness, Hollywood, Ice Follies, winter wheat, herbicides, Starane 2, Dowshield, Ally Express, Harmony M, Lorate, Eagle, MSS Mircam Plus

The results and conclusions in this report are based on an investigation conducted over one year. The conditions under which the experiment was carried out and the results obtained have been reported with detail and accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results especially if they are used as a basis for commercial produce recommendations.

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PRACTICAL SECTION FOR GROWERS

COMMERCIAL BENEFITS OF THE PROJECT

The project will provide the following benefits:

- Practical recommendations for the control of narcissus volunteers in cereals, widely-grown in the rotation following narcissus.

- Potential reduction in pest pressure with the elimination of narcissus volunteers and host reservoirs.

- Greater flexibility in land-use with the efficient removal of volunteer narcissus within the farm rotation.

BACKGROUND AND OBJECTIVES

Stem nematode and large narcissus fly are the two most economically important bulb pests. Cultural/chemical strategies directed solely at the control of these two pests within the two-year crop production cycle are insufficient. Furthermore, existing bulb lifting equipment cannot achieve full recovery of bulbs at lifting, especially of those narcissus cultivars which produce small bulbs which can fall through the equipment. The competing demands for good quality agricultural land suitable for large-scale production of a wider range of agricultural/horticultural crops with similar soil requirements to narcissus, has placed considerable rotational pressures on narcissus production.

It is of concern that increased infestations of stem nematode, the most destructive and persistent pest of narcissus, have been reported in the last three seasons and in 1998 and 2000 the atrociously wet weather and waterlogged conditions have aided field spread enormously.

Large narcissus fly is near its geographic limits in the UK, and although the recent cool early summers have not favoured breeding and expansion of populations, the present position should not lull the industry into a false sense of security. Only one or two years in which early summer weather conditions are more favourable could change the situation dramatically. Limitations to chemical control mean greater emphasis has to be placed on non-chemical control measures in the overall strategy, namely:

* Crops to be grown for no more than two years.
* Use of wide rotation/isolation between crops in areas known to be at risk from attack.
* Elimination of host reservoirs both in succeeding crops and field margins.

It is therefore essential to achieve safe and efficient control of volunteer narcissus bulbs in succeeding crops to eliminate host reservoirs.

The problem of volunteer narcissus bulbs is no less pressing than volunteer potatoes, (BOF 46), and some of the same factors apply, especially the competing demand for good quality agricultural land. Volunteer narcissus create a situation of continuous cropping and this provides ideal conditions for the two most economically important pests of narcissus, stem nematode and large narcissus fly, to flourish.

Control of narcissus volunteers or host reservoirs is the only practical way of breaking the cycle.

The best method to control narcissus is to spray them with paraquat or paraquat + diquat herbicides immediately post-flowering. This however, is only a practical option in a fallow situation or in field margins/hedgerows. Where the land cannot be left fallow winter wheat often follows narcissus.

The project aims to identify herbicides, used singly or in combination, applied post-flowering of volunteer narcissus and within the optimum growth stage for winter wheat - a crop often sown in the autumn after narcissus have been lifted.

SUMMARY OF RESULTS AND CONCLUSIONS

A range of herbicides were selected, all with label recommendations for use in cereals, and applied at the recommended rate. Treatments were applied on 27 April 2000, timing being based on the permitted growth stage (GS) range for each herbicide (average GS 31). This was between one and seven weeks after narcissus full flower date, depending on cultivar.

Three narcissus cultivars, Cheerfulness, Hollywood and Ice Follies were tested to determine cultivar response, if any, to the herbicides.

Phytotoxicity scores were used to measure the ability of the herbicides to control narcissus foliage/growth in the first growing season. Differences in cultivar response were recorded. In Cheerfulness and Hollywood, Starane 2 caused statistically significant severe damage. In Ice Follies, however, there were no statistically significant differences between the herbicide treatments.

Overall, Dow Shield caused the least amount of statistically significant damage.

Wheat yields were not statistically different in any of the herbicide-treated plots. This was to be expected given that each of the herbicides had a label recommendation for use in wheat, and it was applied at the correct growth stage for the crop and rate/ha.

Only when the project is completed in December 2001 will it be possible to make recommendations on the most effective treatment to control volunteer narcissus in winter wheat.

ACTION POINTS FOR GROWERS

Until the project is completed in December 2001 conclusions cannot be drawn.

ANTICIPATED PRACTICAL AND FINANCIAL BENEFITS

In the UK the total saleable output of bulbs is estimated as approximately 30,000 tonnes/year. If 60% (18,000 tonnes) is entered for PHSI Plant Passporting/Export Certification, of which 2% fails due to stem nematode infestation, 360 tonnes would be rejected. This does not take account of bulb stocks known to be infested with stem nematode and therefore not entered for inspection.

Costed at a nominal price of £50/tonne as against a farm-gate price of £350/tonne for healthy stock, this represents a cost to the industry of £108,000 per year in lost sales. Increased production costs and lost bulb yield due to early hot water treatment, and reduced export potential, would also result in further economic loss to the industry.

SCIENCE SECTION

INTRODUCTION

Current bulb lifting equipment cannot recover all bulb sizes at lifting, leading to narcissus volunteers commonly being left in the ground. These can serve as host reservoirs for both stem nematode and large narcissus fly. These are both commercially important pests, and stem nematode is subject to PHSI quarantine regulations.

The work aims to identify herbicides, used singly or in combination, applied immediately post-flowering of narcissus, and within the optimum growth stage for the winter wheat, for the control of volunteer narcissus. Assessments will determine the effectiveness of herbicide control including evaluation of the following parameters:

- Effectiveness of control of volunteer narcissus
- Phytotoxic effects in narcissus during the first and second growing seasons
- Populations of narcissus at the end of the project
- Determination of narcissus cultivar sensitivity to treatment
- Record of wheat plant counts over winter
- Wheat yield

R & D at ADAS' Kirton Experimental Horticulture Station, Kirton, Boston, Lincs, in 1978-79 compared the effectiveness of four chemical roguing agents applied immediately post-flowering. Paraquat was a much more effective roguing agent than glyphosate; neither of the other two chemicals was effective. (Miller 1978)

Clearly, as paraquat is a most effective non-selective, non-residual contact bipyridillium herbicide it can only be used if the land is left fallow until late spring of the year following lifting of narcissus. It therefore has limited use for the control of volunteer narcissus.

MATERIALS AND METHODS

Trial location

The trial site was at ADAS Arthur Rickwood on soil with 25% organic matter content. The site was free of sulfonyl urea residues.

Trial design

The trial was laid out as a fully randomised block split-plot design with four replicates. Each plots measured 2m by 10m. The main plots are the cultivars, and the split-plots are the herbicides. The three cultivars were planted in ridges, in separate rows, at two different depths, at a rate of 2.0t/ha. The grade used was 8-10 cm bulbs. This was done to simulate a volunteer population of narcissus in the wheat. The cultivars chosen were Hollywood, Ice Follies and Cheerfulness, and represented early, middle and late flowering cultivars.

Planting, emergence and treatment dates

The bulbs were planted on 8 October 1999. There were two rows of each cultivar in each plot.

The ridges were then flattened with a Dutch harrow, and the wheat was drilled over the trial area. The cereal was winter wheat c.v. Consort, drilled at the usual farm rate of 150kg/ha. The wheat began to emerge on 9 December 1999.

The bulbs began to emerge in early February. On 15 February 2000, Hollywood and Ice Follies were well emerged, and Cheerfulness was beginning to emerge. The Hollywood reached full flower on 9 March 2000, and the Ice Follies was at full flower on 20 March 2000. The later cultivar, Cheerfulness, was in full flower on 18 April 2000. The herbicide treatments were applied on 27 April 2000. At this time, Hollywood and Ice Follies were at the flower dieback stage, but Cheerfulness was still in flower.

Wheat harvest date

The wheat was harvested on 23 August 2000, and the yields were calculated.

Treatments

Table 1. List of treatments, 2000.

Treatment No.	Product	Active ingredient	Rate of product/ha
1.	No narcissus volunteers, standard cereal herbicide programme	-	-
2.	No herbicide application	-	-
3.	Starane 2	fluroxypyr 200g/l	21
4	Dow Shield	clopyralid 200g/l	0.351
5	Ally Express	carfentrazone-ethyl+metsulfuron-methyl 40:10%w/w	50g
6	Harmony M	metsulfuron-methyl+thifensulfuron-methyl 7:68 w/w	75g
7	Lorate	metsulfuron-methyl 20%w/w	30g
8	Eagle	amidosulfuron 75% w/w	40g
9	MSS Mircam Plus	dicamba+MCPA+ mecoprop-P 19.5:245:43.3g/l	51

* Note: Treatments 2-9 all contain narcissus volunteers

Treatment application

The treatments were applied according to the growth stage of the wheat on 27 April 2000, using an Oxford Precision sprayer, with a 2m boom, using Lurmark F110 002 nozzles. All treatments were applied in 450l water/ha at a pressure of 2 bar.

Assessments

Assessments were carried out on the wheat plant stand, narcissus plant counts and phytotoxicity 28 days after treatment application.

The wheat plant stand was assessed by counting five, 0.5m lengths of row. The total count was then divided by the mean row width to give a value of number of plants per m^2. All of the narcissus were counted per plot.

The phytotoxicity assessments for the narcissus were done using a score for each plant. The scores represented levels of damage to the plant as shown in Table 2 and an index was calculated.

Table 2. Scoring system for assessing phytotoxicity in narcissus.

Score	Symptom
0	No damage
1	Slight twisting/yellowing
2	Moderate twisting/yellowing
3	Severe twisting/yellowing
4	Dead

Data analysis

The data was analysed using analysis of variance (ANOVA). Where the ANOVA showed statistical significance, Duncan's Multiple Range test was used to assess pairwise differences between treatments. In this test, treatment means are calculated for each treatment and these are ordered in ascending order together with their standard error. Duncan's test then systematically makes a pair-wise comparison of these ordered means and places treatments in the same (assigned the same suffix letter) or different (different suffix letter) group depending on whether the treatment pair is adjudged not to be statistically significantly different or otherwise respectively. This test can be regarded as a 'batting order' for treatment effects but a real assessment of any two treatments can only properly be assessed using a trial designed for this purpose.

Score data is not appropriate for ANOVA, and was analysed using Friedman's test, a non-parametric ANOVA-style test. In this test, where score data rather than continuous data are available, treatment effects are ranked relative to each other rather than in each block and ranks are then summed or averaged over blocks. Where the Friedman's test showed statistical difference, a multiple range test for non-parametric data was performed. Using pair-wise treatment comparisons of say the sum of ranks, it can be assessed whether a particular pair of treatments is significantly different (Siegel and Castellan 1988).

RESULTS AND DISCUSSION

Table 3. Mean plant counts for winter wheat stand (plants/m^2), and narcissus emergence counts (plants per plot) prior to treatment application

Treatment	Mean wheat plant stand	Mean narcissus emergence count
1. No narcissus volunteers, standard cereal herbicide programme	267.8	0.0
2. No herbicide application	280.8	70.3
3. Starane 2	278.6	73.8
4. Dow Shield	284.4	70.9
5. Ally Express	270.6	65.1
6. Harmony M	275.0	71.1
7. Lorate	271.4	67.3
8. Eagle	282.5	67.7
9. MSS Mircam Plus	283.9	70.1
SED (72df)	13.18	3.727
p-value	NS	<0.001
Hollywood	272.5	57.1
Ice Follies	284.0	60.8
Cheerfulness	275.2	67.5
SED (6df)	5.49	1.820
p-value	NS	<0.01

Wheat plant stand counts showed no statistical differences between the treatments. There were, however, statistical differences between both the treatments and the cultivars for the narcissus counts. The differences for the herbicide treatment can be attributed to Treatment 1 where no narcissus volunteers were planted. When the data was re-analysed omitting treatment 1, there were no statistical differences between treatment ie. cereal herbicide application (treatment 3-9) did not reduce mean narcissus emergence, compared with no cereal herbicides (treatment 2). The differences between cultivars were attributed to the fact that the cultivars had different sized bulbs, and the plots were planted by weight of bulbs and not by numbers.

Table 4. Mean number of bulbs emerged, by cultivar prior to treatment application

Treatment	Hollywood	Ice Follies	Cheerfulness
1. No narcissus volunteers, standard cereal herbicide programme	0.0	0.0	0.0
2. No herbicide application	69.7	69.2	71.7
3. Starane 2	66.2	70.5	84.7
4. Dow Shield	69.5	63.2	80.0
5. Ally Express	59.5	63.2	72.5
6. Harmony M	64.2	71.0	78.0
7. Lorate	62.5	70.7	68.7
8. Eagle	66.2	65.5	71.2
9. MSS Mircam Plus	56.0	73.5	80.7
SED (72df)	6.352	6.352	6.352
p-value	<0.001	<0.001	<0.001

The number of bulbs emerged was similar for each cultivar across all the treatment plots. As already referred to, Cheerfulness had a higher population than Hollywood, due to smaller bulb size. The counts were significant, but this was caused by the difference between the control treatment (no bulbs planted) and the other treatments. If treatment 1 is omitted from the analysis, there are no significant differences between treatments.

Table 5. Phytotoxicity effects on narcissus, expressed as a percentage of the total number of plants. Assessment conducted 28 days after treatment application on 27 April 2000.

Treatment	No symptoms	Slight twisting/ yellowing	Moderate twisting/ yellowing	Severe twisting/ yellowing	Dead	Phytotoxicity score (0 to 4)
1. No narcissus volunteers, standard cereal herbicide programme	0.0 (a)	0.0 (a)	0.0	0.0 (a)	0.0	0.0 (a)
2. No herbicide application	100.0 (d)	0.0 (a)	0.0	0.0 (a)	0.0	0.0 (a)
3. Starane 2	33.5 (b)	24.8 (ab)	16.4	25.0 (b)	0.3	1.3 (c)
4. Dow Shield	59.7 (c)	39.8 (b)	0.1	0.0 (a)	0.4	0.4 (ab)
5. Ally Express	33.1 (b)	44.7 (b)	11.4	1.5 (a)	1.0	0.8 (b)
6. Harmony M	50.1 (bc)	47.2 (b)	2.3	0.0 (a)	0.5	0.5 (b)
7. Lorate	56.7 (bc)	42.0 (b)	0.5	0.1 (a)	0.6	0.5 (ab)
8. Eagle	47.4 (bc)	47.6 (b)	4.3	0.4 (a)	0.4	0.6 (b)
9. MSS Mircam Plus	41.2 (bc)	43.6 (b)	14.5	0.0 (a)	0.7	0.8 (b)
SED (72df)	9.65	11.25	7.71	5.14	0.65	0.19
p-value	<0.001	<0.001	NS	<0.001	NS	<0.001
Hollywood	43.0	32.7	6.8	5.8	0.7	0.7
Ice Follies	47.1	33.1	5.2	0.4	0.3	0.5
Cheerfulness	50.5	30.8	4.4	2.9	0.3	0.5
SED (6df)	4.21	2.64	2.51	1.95	0.26	0.07
p-value	NS	NS	NS	NS	NS	NS

Note: Values within the same column followed by a common letter do not differ significantly at $p<0.05$ (Duncan's multiple range tests).

Phytotoxicity scores ranged from 0 to 4 where 0 = no damage symptoms and 4 = dead plants.

Starane 2 (treatment 3) had the most phytotoxic symptoms whilst Dow Shield (treatment 4) caused the least amount of phytoxicity.

Comparison of cultivar data indicated Hollywood to be slightly more vulnerable to herbicide damage than the other 2 cultivars. Differences were not statistically significant, however.

Table 6. Analysis of the phytotoxicity scores for cv Hollywood, using Friedman's Test. Figures presented are mean scores, where assessments were conducted 28 days after treatment application on 27 April 2000.

Treatment	No symptoms	Slight twisting/ yellowing	Moderate twisting/ yellowing	Severe twisting/ yellowing	Dead	Total number of plants with Phytotoxic symptoms
1. No narcissus volunteers, standard cereal herbicide programme	0.0	0.0	0.0	0.0	0.0	0.0
2. No herbicide application	69.7	0.0	0.0	0.0	0.0	0.0
3. Starane 2	21.3	3.2	9.5	32.0	0.2	45.0
4. Dow Shield	33.7	35.5	0.0	0.0	0.2	35.7
5. Ally Express	22.0	26.2	7.2	3.0	1.0	37.5
6. Harmony M	28.8	32.0	3.5	0.0	0.0	35.5
7. Lorate	31.5	29.7	0.0	0.25	1.0	31.0
8. Eagle	30.3	28.0	7.5	0.0	0.5	36.0
9. MSS Mircam Plus	16.3	30.5	8.5	0.0	0.7	39.7
p-value	<0.01	<0.001	<0.05	<0.001	NS	0.05
p-value (T1+T2 omitted) (df=8, n=4)	NS	<0.05	NS	<0.01	NS	NS

For tables 6,7 and 8, Friedman's test was applied to all treatments, and then repeated, omitting Treatments 1 and 2. This allowed comparisons to be made between the actual herbicide treatments, and treatments plus controls.

In Hollywood, there were statistical differences between the treatments. Starane 2 (treatment 3) caused more severe phytotoxic symptoms than the other herbicides. MSS Mircam Plus (treatment 9) had the lowest number of plants with no symptoms. There were also significant statistical differences between the herbicide treatments in the slight and severe categories.

Table 7. Analysis of the phytotoxicity scores for cv Ice Follies, using Friedman's Test. Figures presented are mean scores, where assessments were conducted 28 days after treatment application on 27 April 2000.

Treatment	No symptoms	Slight twisting/ yellowing	Moderate twisting/ Yellowing	Severe twisting/ yellowing	Dead	Total number of plants with Phytotoxic symptoms
1. No narcissus volunteers, standard cereal herbicide programme	0.0	0.0	0.0	0.0	0.0	0
2. No herbicide application	69.3	0.0	0.0	0.0	0.0	0.0
3. Starane 2	17.0	35.7	15.7	1.8	0.2	53.5
4. Dow Shield	42.0	21.0	0.0	0.0	0.2	21.3
5. Ally Express	15.8	32.2	5.2	0.0	0.7	32.5
6. Harmony M	39.3	31.3	0.0	0.0	0.5	31.8
7. Lorate	39.5	31.3	0.0	0.0	0.0	31.3
8. Eagle	37.7	27.0	0.0	0.7	0.0	27.8
9. MSS Mircam Plus	37.2	25.8	10.5	0.0	0.0	36.2
p-value	<0.01	<0.05	NS	NS	NS	<0.01
p-value (T1+T2 omitted) (df=8, n=4)	NS	NS	NS	NS	NS	NS

For Ice Follies, there were no statistical differences between the herbicide treatments (ie. when treatment 1 and 2 are omitted). The pattern of damage was similar to that of Hollywood, Starane 2 (treatment 3) appeared to cause more severe damage than the other treatments, and Dow Shield had the least amount of damage.

Table 8. Analysis of the phytotoxicity scores for cv Cheerfulness, using Friedman's Test. Figures presented are mean scores, where assessments were conducted 28 days after treatment application on 27 April 2000.

Treatment	No symptoms	Slight twisting/ yellowing	Moderate twisting/ yellowing	Severe twisting/ yellowing	Dead	Total number of plants with Phytotoxic symptoms
1. No narcissus volunteers, standard cereal herbicide programme	0.0	0.0	0.0	0.0	0.0	0
2. No herbicide application	71.7	0.0	0.0	0.0	0.0	0.0
3. Starane 2	37.0	15.3	11.0	21.5	0.0	47.7
4. Dow Shield	57.5	22.0	0.2	0.0	0.2	22.5
5. Ally Express	27.8	35.5	9.0	0.0	0.2	44.7
6. Harmony M	40.5	36.5	0.5	0.0	0.5	37.5
7. Lorate	44.7	22.8	1.0	0.0	0.2	24.0
8. Eagle	29.0	41.2	0.8	0.0	0.2	42.2
9. MSS Mircam Plus	36.0	34.2	9.7	0.0	0.7	44.7
p-value	<0.05	<0.01	NS	<0.01	NS	<0.01
p-value (T1+T2 omitted) (df=8, n=4)	NS	NS	NS	<0.01	NS	NS

In Cheerfulness as with the other two cultivars, Starane 2 (treatment 3) caused severe damage statistically greater than other treatments. Ally Express (treatment 5) and Eagle (treatment 8) had a large number of plants with slight phytotoxicity symptoms.

Table 9. Winter wheat yields, 2000.

Treatment	Specific Weight (at 85% moisture)	Yield (t/ha) at 85% moisture
1. No narcissus volunteers, standard cereal herbicide programme	72.92	6.93
2. No herbicide application	74.26	6.34
3. Starane 2	74.46	7.00
4. Dow Shield	74.26	6.65
5. Ally Express	73.63	6.50
6. Harmony M	73.27	6.85
7. Lorate	74.58	6.74
8. Eagle	73.74	6.58
9. MSS Mircam Plus	73.86	6.53
SED	0.519	0.238
(72df) - p-value	NS	NS
Hollywood	74.04	6.73
Ice Follies	73.62	6.67
Cheerfulness	74.00	6.64
SED		
(6df)	0.441	0.103
p-value	NS	NS

There were no significant differences in wheat yields between either the herbicide treatments or cultivars.

CONCLUSIONS

Evaluation of the efficiency of the herbicides to kill narcissus volunteers will only be completed in 2001 when the treatments are assessed for re-growth, and bulb kill at lifting in July.

Three cultivars were tested, Cheerfulness, Hollywood and Ice Follies, with a spread of flowering and growth characteristics, to determine cultivar response. Phytotoxicity scores were used to determine a herbicide's effectiveness in controlling narcissus first year growth.

- In Cheerfulness and Hollywood Starane 2 caused statistically significant severe damage.
- In Ice Follies there were no statistically significant differences between herbicide treatments.
- Overall, Dow Shield had the least amount of statistically significant damage.

- There were no significant differences in wheat yields between either the herbicide treatments or cultivars. This was to be expected given that each of the herbicides had a label recommendation for use in wheat, and was applied at the correct growth stage and rates/ha.

TECHNOLOGY TRANSFER

1. Growers' walk held at ADAS Arthur Rickwood on 24 May 2000
2. Preliminary results presented at HDC bulb seminar on 21 November 2000

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Appendix 1: Plan of the field trial

	REP1			REP2			REP3			REP 4		
	cv3	cv1	cv2	cv2	cv1	cv3	cv2	cv3	cv1	cv3	cv2	cv1
10m	P1 **T9**	P10 **T9**	P19 **T5**	P28 **T8**	P37 **T3**	P46 **T9**	P55 **T1**	P64 **T2**	P73 **T7**	P82 **T6**	P91 **T5**	P100 **T6**
	P2 **T3**	P11 **T5**	P20 **T1**	P29 **T9**	P38 **T4**	P47 **T4**	P56 **T5**	P65 **T4**	P74 **T9**	P83 **T8**	P92 **T8**	P101 **T9**
	P3 **T7**	P12 **T7**	P21 **T8**	P30 **T2**	P39 **T9**	P48 **T6**	P57 **T2**	P66 **T5**	P75 **T4**	P84 **T2**	P93 **T3**	P102 **T7**
	P4 **T8**	P13 **T6**	P22 **T3**	P31 **T5**	P40 **T5**	P49 **T1**	P58 **T8**	P67 **T1**	P76 **T8**	P85 **T4**	P94 **T7**	P103 **T2**
	P5 **T1**	P14 **T3**	P23 **T7**	P32 **T7**	P41 **T1**	P50 **T7**	P59 **T3**	P68 **T9**	P77 **T2**	P86 **T9**	P95 **T2**	P104 **T4**
	P6 **T2**	P15 **T2**	P24 **T6**	P33 **T6**	P42 **T8**	P51 **T2**	P60 **T4**	P69 **T7**	P78 **T5**	P87 **T7**	P96 **T9**	P105 **T5**
	P7 **T4**	P16 **T4**	P25 **T4**	P34 **T4**	P43 **T6**	P52 **T3**	P61 **T6**	P70 **T3**	P79 **T3**	P88 **T5**	P97 **T4**	P106 **T8**
	P8 **T6**	P17 **T1**	P26 **T9**	P35 **T1**	P44 **T2**	P53 **T8**	P62 **T9**	P71 **T8**	P80 **T1**	P89 **T1**	P98 **T6**	P107 **T1**
	P9 **T5**	P18 **T8**	P27 **T2**	P36 **T3**	P45 **T7**	P54 **T5**	P63 **T7**	P72 **T6**	P81 **T6**	P90 **T3**	P99 **T1**	P108 **T3**

GUARD 2M

2m

2 ROWS OF EACH CULTIVAR PER PLOT.

HOLLYWOOD
Cultivar 1

ICE FOLLIES
Cultivar 2

CHEERFULNESS
Cultivar 3

Appendix 2: Trial diary

Date	Trial Operation
16.09.1999	Trial area subsided and ploughed
05.10.1999	Plot area power harrowed and ridged
08.10.1999	Trial planted 700g/10m ridge, 1/2 on ridge bottom, 1/2 shallow depth
14.10.1999	Ridges flattened prior to drilling
17.11.1999	Cereal drilled. Cultivar Consort at 150kg/ha
09.12.1999	Trial observation; Wheat emerged
21.01.2000	Trial observation; No narcissus emergence observed
10.02.2000	Trial observation; Narcissus emerged, clear rows evident
14.02.2000	Trial observation; Some narcissus in bud, wheat at GS 12-13
15.02.2000	Plant stand assessment carried out on wheat.
	Narcissus cultivar 1 and 2 emerged , cultivar 3 beginning to emerge
21.02.2000	Plant counts carried out on narcissus cultivar 1
28.02.2000	Plant counts carried out on narcissus cultivars 1 and 2
06.03.2000	Trial observation; Wheat at GS 21-22
	Narcissus cultivar 1 in flower, cultivar 2 in bud, cultivar 3 emerging
09.03.2000	Trial observation; Narcissus cultivar 1 in full flower.
16.03.2000	Emergence counts carried out on narcissus cultivars 1 and 2
	Trial observation; Wheat at GS 22
20.03.2000	Trail observation; Narcissus cultivar 2 in full flower
21.03.2000	Paths between plots rotavated to form discrete plots
24.03.2000	Trail observation; Wheat at GS 23
31.03.2000	Plant counts carried out on narcissus cultivar 3
03.04.2000	Trial observation; Narcissus cultivar 1 and 2 deteriorating
12.04.2000	Trial observation; Wheat Average GS 28,17
	Narcissus cultivar 3 still in flower, cultivars 1 and 2 at flower dieback
27.04.2000	Applied spray treatments to all plots at wheat GS 31.
22.05.2000	Phytotoxicity assessment completed
23.08.2000	Wheat harvested

