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PRACTICAL SECTION FOR GROWERS

1. Volunteer oilseed rape control - vining peas

Objectives and Background

A survey has shown that 25% of vining pea crops are infested with oilseed rape volunteers. This can cause substantial financial penalty to the grower if there are payment deductions for peas contaminated with rape stem, pod or leaf. In contrast with combining peas, low populations of oilseed rape are unlikely to cause harvesting problems. In the past there were no options for control with a pre-emergence herbicide, but Reflex T, a new product was registered for use in 1995 and looked promising. Reduced dose rates of post-emergence herbicides applied early to small rape may result in more economic control than full doses applied at normal timing.

The objectives of the experiments were to:

A. Assess Reflex T alone or in programmes with post-emergence herbicides, some at reduced doseage and early timing for oilseed rape control and to test double rates for crop tolerance, in 1995 and 1996.

B. To screen commercially grown and new varieties of vining peas in 1995, 96 and 97 for sensitivity to Pulsar + Fortrol applied early at half dose rates, compared with other herbicides.

Summary of Results

A. Reflex T gave good control (85.7%) of oilseed rape when applied to a fine rolled seedbed and followed by rain. Results were poor, only 52.3% control under dry conditions.

Post-emergence tank-mixes were applied at reduced doses earlier than label recommendations. The most effective was Pulsar + Fortrol (2.0 + 0.2)l/ha applied when peas were at the 2 node growth stage, when rape is small (cotyledon - 1 true leaf stage), and it was also safe to the crop at overlap rate. There is now a label recommendation for the half-dose rate of Pulsar + Fortrol applied early.

Another promising treatment, registered in France is not yet approved in the UK, was with Stomp + Basagran (2.0 + 1.56)l/ha applied very early at 1-2 node stage. It gave excellent control.

If treatment cannot be applied early MCPB applied at 4 node stage of peas was also a cost-effective treatment. A programme with Reflex T pre-emergence followed by a post-emergence treatment gave 100% control of volunteer oilseed rape.

Where oilseed rape is anticipated, the most effective treatment is with a programme of Reflex T followed by a reduced dose of Pulsar + Fortrol (2.0 + 0.2)l/ha applied early when peas are at 2 node stage to small rape. This will remove weed competition early and as quality standards regarding weedy contaminants become more stringent, should avoid problems with pieces of oilseed rape.

If no pre-emergence herbicide is applied, or for oilseed rape at 3-4 leaf stage, the full dose will be needed to control these and higher populations of some broad-leaved species.

B. The half dose rate (2.0 + 0.2) l/ha of Pulsar + Fortrol applied early to peas at 2 node stage appeared safer to most vining pea varieties than the full dose applied at 3 nodes (except where frosts followed in 1997).

Sensitivity of vining pea varieties based on 2 years data for Stomp + Basagran (2.0 + 1.56) l/ha applied very early when peas were at 1-2 nodes was similar to the normal dose and timing of Pulsar + Fortrol. It was safe to most varieties.

Tests will continue at PGRO in 1998 and final classifications will be given on Information Sheet No. 144.

2. Volunteer oilseed rape and broad-leaved weed control in broad beans

Objectives & background

The same survey showed that most broad bean crops grown for processing were infested with oilseed rape and there are payment deductions for weed contaminants in the product. The herbicides containing 'hormones' which are used to control rape volunteers in peas are very damaging to broad beans. The new pre-emergence herbicide, Reflex T, was also approved for use in broad beans in 1995. The only post-emergence option is Basagran but efficacy is weather dependent, and the addition of oil is not recommended to improve control because of the possibility of damage. A more effective post-emergence herbicide was sought.

The objective of the investigation were:

A. To assess oilseed rape and broad-leaved weed control with Reflex T pre-emergence, Basagran and post-emergence tank-mixes. In 1997 Basagran + Stomp at a range of dose rates and two timings and crop tolerance to double rates was evaluated at three sites.

B. To screen commercially grown and newer varieties of broad beans for sensitivity to two tank mixes: Skirmish + Basagran in1996, and Stomp + Basagran in 1997.

Summary of results

A. Where there was adequate moisture after application of residual herbicide Reflex T 72.8%, 78% and 88.9% control of volunteer rape was achieved in the three years of trial. Results for Basagran at full dose 3.0 l/ha were variable 78%, 93.4% and 57.8% control; a split dose (1995) performed only slightly better, and the addition of Actipron oil 2 l/ha improved control (1996) but was too damaging to the crop. Efficacy of these approved products Reflex T and Basagran is very weather dependent and control of oilseed rape and broad-leaved weeds may be inadequate if populations are high, or if germination occurs over a long period.

Another post-emergence option was sought with products not approved for use in broad beans. Skirmish + Basagran (0.75 + 1.0)l/ha gave excellent control (98% in 1995) of oilseed rape and other broad-leaved weeds, and was safe to the crop when applied very early at 1-2 leaf pair stage. It caused more leaf blackening where the leaf area was larger, at more advanced growth stages. Further work with different rates was undertaken and variety screens suggested there was no particular varietal sensitivity. In 1997, the company announced that Skirmish would no longer be manufactured.

Another post-emergence tank-mix, Stomp 400 + Basagran, which looked promising in the 1996 trial was evaluated further for crop tolerance and weed control at three sites in 1997. A range of dose rates, single and overlap were applied very early post-emergence before 2 leaf pairs and later. Control of oilseed rape and broad-leaved weeds was superior to Basagran, and where a second flush of weeds emerged after application, the weeds remained stunted due to the residual effect of Stomp. Although the single doses were safe to the crop when applied early, there was more damage as stunting from Stomp from the later applications. The overlap rates caused severe stunting and crop safety margin was insufficient except for the lowest dose rate. It is possible that a safer option could be a lower split dose applied before 2 leaf pairs and a follow up. However, Stomp is not registered for post-emergence use in broad (or field) beans and residue data would need to be generated for a specific Off-label Approval.

The withdrawal of Skirmish, and the lack of crop safety margins of Stomp post-emergence was disappointing.

At present the best option for volunteer oilseed rape and broad-leaved weed control is to apply Reflex T pre-emergence and to follow up with Basagran at full or split dose application post-emergence. If conditions are optimum, i.e. if there is adequate moisture for residual activity and the weather is warm when Basagran is applied, efficacy will be good.

However, because optimum conditions seldom occur, there is still a need for a more effective post emergence herbicide.

B. All broad bean varieties tested were highly tolerant of Reflex T. Skirmish will no longer be manufactured after 1997 and work was discontinued.

Stomp + Basagran has only been evaluated in varietal sensitivity tests for one year. All varieties were severely stunted at the rates used and there did not appear to be varietal differences.

SCIENCE SECTION

1. VOLUNTEER OILSEED RAPE CONTROL - VINING PEAS

General Introduction

A recent survey showed 25% of vining pea crops were infested with oilseed rape volunteers. This can cause substantial financial penalty to the grower if there are deductions where the crop is contaminated with rape stem, pod or leaf. In contrast with combining peas, low populations are unlikely to cause harvesting problems so 100% control may not be necessary. In the past there were no options for control with a pre-emergence herbicide but Reflex T, a new product was registered for use in 1995. Post emergence tank-mixes of Pulsar + Fortrol applied at an earlier stage than the label recommends have proved effective in combining peas and may be safe to use in vining peas. In 1996 new tank-mixes of Stomp 400 + Basagran at different rates of Skirmish + Basagran were evaluated either alone post-emergence or in a programme with Reflex T.

Stomp + Basagran may be registered for post-emergence use in vining and combining peas in the future.

In the 1995 trial a reduced dose of MCPB applied early, was inadequate and not safe to the crop and is not included.

The objectives of the experiments were to:

a) Assess the new pre-emergence herbicide Reflex T in vining peas, alone or in programmes with Skirmish + Basagran, MCPB, Stomp 400 + Basagran and reduced doses of Pulsar + Fortrol at early timing for oilseed rape control. Double rates were also tested for crop tolerance.

b) Screen currently grown and new varieties of vining peas for sensitivity to Pulsar + Fortrol applied early at half dose rate. Varietal sensitivity tests were also undertaken at PGRO for the other herbicides in this trial.

A. <u>Herbicide Efficacy and Crop Tolerance - 1995 and 1996</u>

Materials and methods

Normal husbandry for the pea crop was carried out. Vining peas, cv. Span, were sown with a Nordsten drill in March to achieve a population of 90 plants/m^2, on 15 cm rows and at 6 cm depth. Oilseed rape was drilled at the same depth on 30 cm rows between the rows of peas. After rolling the seed was covered by about 4 cm of settled soil.

Growth stages of rape and peas and results of pea leaf wax tests with crystal violet dye were recorded at the time of each application. Numbers of oilseed rape were counted, in 3 random 0.5 m per plot at appropriate intervals after herbicide treatments.

Site: Sacrewell Farm, Thornhaugh; light soil, sandy loam.

Layout: Randomised block, 3 replications; 2 untreated plots per replicate; Plot size 2 m x 5 m. Total 23 x 3 = 69 plots in 1995, 22 x 3 = 66 plots in 1996.

Materials: Herbicides and dose rates are shown in results. The following products (active ingredients) were used: Reflex T (fomesafen/terbutryn); Tropotox (MCPB); Skirmish (isoxaben/terbuthylazine); Basagran (bentazone); Pulsar (bentazone/MCPB); Fortrol (cyanazine); Stomp 400 (pendimethalin); Trifolex-Tra (MCPB/MCPA).

Application data 1995:

Application date	Weather (seedbed)	Growth Stage Peas	Growth Stage OSR
<u>Pre-em</u> 3 April	(dry, cloddy)	003 3 cm radicle 0.5 cm plumule	radicle, cot leaves just below surface
<u><2 node</u> 13 April	14°C 39RH, sunny, 0% cloud (dry)	101 nearly 102	cot
<u>2 node</u> 23 April	16°C 36RH, hazy sun, high thin cloud (moist (rain 22/4))	102 good wax	1TL slight frost damage
<u>3 node</u> 28 April	6°C (11° later) 34RH, 100% cloud cover (dry)	103 good wax	2TL a few 1TL
<u>4 node</u> 4 May	15°C (24° later) 30RH, sunny 0% cloud (dry)	104 good wax	50% at 3TL 50% at 4TL

cot = cotyledon; TL = true leaf

Application data 1996:

Application date	Weather (seedbed)	Growth Stage Peas	OSR
Pre-em 31 March	3°C 36RH, dry (only .2 mm rain after application)/ fine rolled	000	dry seed
1-2 node 25 April 2,3,4,7,8, 10,11,12, 15,16,17	14°C 48RH, sunny, 20% cloud cover/dry	101-102, 2 node mod leaf wax*	cot
2 node 29 April 9 a.m. 5,13,6,14, 18,19	7°C (12°C later), 48RH, hazy sun/dry	102, 2 node, severe pea thrip damage, mod/poor leaf wax	cot-1TL
3-4 node 5 May 9,20 & 17 follow-up	11°C 32RH, sunny, 30% cloud	103-104, most at 3 node a few at 4 node	1-2TL a few cot. Other weeds: Black bindweed 1TL. Fat hen, Fig-leaved goosefoot 2TL

cot = cotyledon; TL = true leaf; *crystal violet leaf wax test

All applications were made with an Azo precision plot sprayer delivering 200 l/ha water volume at 2 bar pressure, using flat fan nozzles 02F110.

Results

1995 (Table 1)

The population of rape was very high, 103 plants/m^2 on untreated plots. Conditions were dry and a few may have emerged after the first flush.

Pre-emergence herbicides

There was no rain for several days after application thus the activity of these residual herbicides was reduced. Reflex T (treatment 1) only achieved 52.3% control of volunteer oilseed rape. Oilseed rape is not susceptible to Opogard (8) which gave only 25.5% control.

Pre- and Post emergence herbicide programmes

There were no statistically significant differences between programmes of Reflex T (2-7) or Opogard (9-14) with the same post-emergence herbicides for control of oilseed rape.

Tropotox (MCPB): control with the ½N dose of 2.1 l/ha Tropotox (2 & 9) was significantly worse than the full dose and most of the other treatments. Tropotox affected the growing point but the leaves remained green for a long time before plants eventually died. Any rape remaining however, was stunted and below crop height until the peas lodged. Tropotox was applied at an earlier stage (peas, 2 nodes) than the 4 nodes recommended on the product label and caused temporary distortion of the peas which was severe at the 4.2 l/ha dose. Thus the early timing has insufficient crop safety margin.

Skirmish + Basagran at the rate of (0.5 + 0.5) l/ha (4 & 11) was less effective than (0.75 + 1.0) l/ha (5 & 12). These treatments did not cause any crop effects and in a separate trial, a range of varieties of vining peas were tolerant of a high dose rates of 3 x (0.75 + 1.0) l/ha of Skirmish + Basagran.

Pulsar + Fortrol tank-mix was applied early, when peas were at the 2 node stage but the pea leaves were well waxed (the label recommendation is for 3 node stage) and rape had 1TL. There was little crop damage for the ½N dose (2.0 + 2.0) l/ha (6 & 13) and there was only slight chlorosis and distortion from (4.0 + 0.4) l/ha (7 & 14) at this timing. The ½N dose gave very good control and the N dose almost complete control of 'volunteer' oilseed rape.

Post-emergence herbicides alone

Skirmish + Basagran (0.75 + 1.0) l/ha (15) alone, applied before 2 node stage was slightly less effective than the programmes but the differences were not statistically significant.

Pulsar + Fortrol (2.0 + 0.2) l/ha (16) applied early, was very effective on oilseed rape and similar to the programme. The (4.0 + 0.4) l/ha (17) rate at the label timing of 3 nodes, applied to larger oilseed rape at 2TL was excellent.

Tropotox (MCPB) at 4.2 l/ha (19) applied at normal timing, peas at 4 nodes, to rape at 3TL gave good control but plants were very slow to die.

Fortrol + Trifolex-Tra at normal dose (2.0 + 2.0) l/ha and normal timing was inadequate; some rape recovered after treatment.

Conf A (20) gave very poor control at the 2.0 l/ha rate and was not safe to the crop at the double rate, causing scorch, necrosis of leaf margins, followed by stunting.

Table 1. 1995 Experiment. Vining pea crop scores (10 = no damage, 7 = acceptable damage, 0 = complete kill); numbers of oilseed rape/m² and percentage control of oilseed rape.

	Product & Rate l/ha	Timing post-em number nodes	Crop Score Date: 13/4	23/4	1/5	9/5	No. OSR/m² 27/6	% control OSR 27/6
	Pre-em & Post-em							
1.	Reflex T 2.5	-	10	10	10	10	49.3	52.3
2.	Reflex T 2.5 & Tropotox 2.1	2#	10	-	8.8	10	17.3	83.2
3.	Reflex T 2.5 & Tropotox 4.2	2#	-	-	7.2	9.5	4.3	95.8
4.	Reflex T 2.5 & Skirmish + Basagran 0.5 + 0.5	<2	-	10	-	10	5.7	94.5
5.	Reflex T 2.5 & Skirmish + Basagran 0.75 + 1.0	<2	-	10	-	10	4.3	95.8
6.	Reflex T 2.5 & Pulsar + Fortrol 2.0 + 0.2	2#	-	-	9	10	4.3	95.8
7.	Reflex T 2.5 & Pulsar + Fortrol 4.0 + 0.4	2#	-	-	7.8	8.5	1.3	98.7
8.	Opogard 2.3		10	10	10	10	77	25.5
9.	Opogard 2.3 & Tropotox 2.1	2#	-	-	9	10	15.3	85.2
10.	Opogard 2.3 & Tropotox 4.2	2#	-	-	7.2	9.5	8.3	91.9
11.	Opogard 2.3 & Skirmish + Basagran 0.5 + 0.5	<2	-	10	-	10	11.3	89.0
12.	Opogard 2.3 & Skirmish + Basagran 0.75 + 1.0	<2	-	10	-	10	3.7	96.4
13.	Opogard 2.3 & Pulsar + Fortrol 2.0 + 0.2	2#	-	-	9	10	5.3	94.8
14.	Opogard 2.3 & Pulsar + Fortrol 4.0 + 0.4	2#	-	-	8	9	5	95.2
15.	Skirmish + Basagran 0.75 + 1.0	<2	-	10	-	10	9.7	90.6
16.	Pulsar + Fortrol 2.0 + 0.2	2#	-	-	9	10	5	95.2
17.	Pulsar + Fortrol 4.0 + 0.4	3	-	-	-	7.3	1	99.0
18.	Fortrol + Trifolex-Tra 2.0 + 2.0	4	-	-	-	8.5	16.7	83.9
19.	Tropotox 4.2	4	-	-	-	8	5.3	94.8
20.	Conf A* 2.0	2	-	-	9	8.3	30.7	70.3
21.	Conf A* 4.0	2	-	-	7	7.2	3	97.1
0	Untreated		10	10	10	10	103.3	0
	Significance @ P=0.05							SD
	LSD @ P=0.05							8.44
	CV%							6.2

Key:
* no label recommendation; # no label recommendation at this earlier timing. Rates 3 & 7 and 10 & 14 to evaluate crop safety at the early timing

1996 (Table 2)

Results for percentage oilseed rape control and scores for crop damage from herbicides are shown in Table 2. The rape population was 104 plants/m² on untreated plots. As in the 1995 trial, conditions were dry and a few may have emerged after the first flush. The growth of the drought stressed rape was poor and the low numbers on treated plots would not have caused harvesting difficulties at vining pea harvest stage 7 July. Rape on untreated plots could have caused problems with pieces of pod and leaves in produce.

Pre-emergence herbicides

Reflex T. There was only 0.2 mm rain for the two days following applications of Reflex T and then only 24 mm for the remainder of April. In spite of this Reflex T (treatment **1**) gave good control (86%) of the high numbers of rape. The seedbed was fine and rolled and Reflex T appears to work better in such conditions than on the more cloddy seedbed in 1995, or for the 1996 broad bean trial. Reflex T had persistent residual activity and there was no late germinating rape on these plots.

Reflex T was very safe to the pea crop.

Post emergence herbicides

These all performed better than Reflex T alone, otherwise differences in numbers of rape between treatments were not statistically significant.

Skirmish + Basagran. The tank-mix achieved a rapid kill and the (0.75 + 1.0) l/ha dose with the highest rate of Basagran (treatment **12**) gave 100% kill, the 1.5 plants/m² remaining emerged after application. Where the lower dose of 0.75 l/ha Basagran was used with Skirmish, the mixture was less effective. There was little difference in control between Skirmish at 0.5 or 0.75 l/ha + 0.75 l/ha Basagran. A few oilseed rape volunteers still remained on these treatments (**10** & **11**), but control was probably adequate for vining peas.

Although the leaf wax was not good at the time of application there was little damage except for slight temporary chlorosis.

Pulsar + Fortrol. Pulsar + Fortrol at (2.0 + 0.2) or (4.0 + 0.4) l/ha (**13** & **14**) achieved a quick, complete 100% kill within 6 days. This tank-mix does not have a label recommendation for the reduced dose of (2.0 + 0.2) l/ha at the early timing of 2 nodes. It was therefore tested (at double dose) for tolerance of the sensitive variety Span, when leaf wax was only moderate/poor. The peas suffered only slight damage from the (2.0 + 0.2) l/ha rate, at the double dose (4.0 + 0.4) l/ha chlorosis and distortion were more severe and persistent but at an acceptable level.

Stomp + Basagran. Stomp + Basagran was tested at a range of rates and timings and as a split dose. The 'Normal' dose (as used in France as Vulkan T) was (2.0 + 1.56) l/ha.

The lowest dose (1.0 + 0.78) l/ha applied very early (**17**) had little effect on the crop. On 5 May 15.5 pl/m² rape remained and control might have been adequate for vining peas and was at the same level as Reflex T. A follow- up dose gave complete control.

At the same timing, 1-2 node, Stomp + Basagran (1.33 + 1.04) l/ha, a two thirds N dose, gave 97.2% control of oilseed rape, and possibly did not control one or two which emerged late. However, the higher dose (2.66 + 2.08) l/ha which appeared to have more residual effect (from Stomp) achieved 100% control. There was more chlorosis stunting of the peas from this treatment although they recovered quickly.

Stomp + Basagran applied at the 2 node timing at dose rates of (2.0 + 1.56) l/ha gave 100% control. The peas suffered more, but acceptable, damage.

MCPB. Applied at the late timing of 3-4 nodes cause temporary distortion of the peas. The growing point of the rape plants was affected, but the leaves remained green for some time. MCPB achieved 100% control.

Programmes

Programmes with Reflex T followed by Skirmish + Basagran, Pulsar + Fortrol or Stomp + Basagran all achieved 100% oilseed rape control.

Table 2. 1996 Experiment Vining pea crop scores (10 = no damage, 7 = acceptable damage, 0 = complete kill); numbers of oilseed rape/m² and percentage control of oilseed rape.

	Herbicide Treatment	Rate product l/ha	Application GS peas (nodes)	OSR	Crop Score Date: 5/5	12/5	19/5	29/5	Oilseed Rape No./m² 5/5	19/5	% control 19/5
0	untreated	-	-	-	10		10	10		103.7	0
1	Reflex T	2.5	pre-	-	10		10	10		14.8	85.7
2	Reflex T & Skirmish + Basagran	2.5 & 0.5 + 0.75	pre- & 1-2	cot	10		9.3	10		0	100
3	Reflex T & Skirmish + Basagran	2.5 & 0.75 + 0.75	pre- & 1-2	cot	10		9.2	10		0	100
4	Reflex T & Skirmish + Basagran	2.5 & 0.75 + 1.0	pre- & 1-2	cot	9.2		8.3	9.2		0	100
5	Reflex T & *Pulsar + Fortrol	2.5 & 2.0 + 0.2	pre- & 2	cot-1TL	8.3		8	9		0	100
6	Reflex T & *Pulsar + Fortrol	2.5 & 4.0 + 0.4	pre- & 2	cot-1TL	7.5		7.7	8		0	100
7	Reflex T & Stomp 400# + Basagran	2.5 & 1.0 + 0.78	pre- & 1-2	cot	9		9.5	10		0	100
8	Reflex T & Stomp 400# + Basagran	2.5 & 1.33 + 1.04	pre- & 1-2	cot	8.5		9	10		0	100
9	Reflex T & Tropotox	2.5 & 4.2	pre- & 3-4	1-2TL	-	8	9	9.5		0	100
10	Skirmish + Basagran	0.5 + 0.75	1-2	cot	10		9.2	10		7.4	92.9
11	Skirmish + Basagran	0.75 + 0.75	1-2	cot	10		9.2	10		6.7	93.6
12	Skirmish + Basagran	0.75 + 1.0	1-2	cot	9.2		8.3	9.3		1.5	98.6
13	Pulsar + Fortrol	2.0 + 0.2	2	cot-1TL	8.3		8	9		0	100
14	Pulsar + Fortrol	4.0 + 0.4	2	cot-1TL	7.5		7.7	8		0	100
15	Stomp 400# + Basagran	1.33 + 1.04	1-2	cot	8.5		9	10		2.9	97.2
16	Stomp 400# + Basagran	2.66 + 2.08	1-2	cot	7.5		8.5	9.7		0	100
17	Stomp 400# + Basagran (split)	1.0 + 0.78 & 1.0 + 0.78	1-2 & 3-4	cot & 1-2TL	(9)		7.8	8.8	(15.5)	0	100
18	Stomp 400# + Basagran	2.0 + 1.56	2	cot-1TL	8.5		9	10		0	100
19	Stomp 400# + Basagran	4.0 + 3.12	2	cot-1TL	7.3		7.8	8.8		0	100
20	Tropotox	4.2	3-4	1-2TL	-	8	9	9.5		0	100
Significance @ P = 0.05										SD	SD
LSD @ P = 0.05										7.68	7.41
CV%										71.4	4.8

Key:
* = as yet no label recommendation at this early timing; # = not approved for vining peas

B. **Varietal Sensitivity of Peas to Herbicides**

Materials and methods 1997

Varieties

i. 28 new varieties plus 5 standards
ii. 29 commercially grown varieties plus 5 standards
Sown on 17 March 1997.

Herbicides

Herbicide products (active ingredients) were as follows: Stomp 400 (pendimethalin 400 g/l); Basagran (bentazone 480 g/l); Pulsar (bentazone/MCPB 200/200 g/l); Fortrol (cyanazine 500 g/l).

i. Stomp + Basagran @ (2.0 + 1.56 l/ha) x 3 at GS 101-102 (1-2 node) applied on 10 April, peas most 1½ node growth stage GS 101 - 102, pea leaf wax excellent in spite of frosts.
Weather: 14°C, RH 45, sunny no cloud, soil very dry.

ii. Pulsar + Fortrol @ (2.0 + 0.2)l/ha x 3 at GS 102 (2 node) applied 15 April 10am, peas 2 node growth stage GS 102, pea leaf wax good.
Weather: 12°C, RH 44, 50% cloud cover. Frost in the evening, air temp -0.5°C, and on 20 April -3.5°C.

(c) Pulsar + Fortrol @ (4.0 + 0.4)l/ha x 3 at GS 103 (3 node) applied 22 April, peas most 3 node growth stage GS 103, a few 4 node GS 104. Good leaf wax.
Weather: 13°C, 33 RH, 80% cloud cover, some sun.

Applied with an Azo precision plot sprayer in 200 l/ha water volume, 2 bar pressure, using Lurmark flat fan nozzles 02F110 to give fine spray quality.

Layout. 2 rows of each variety. Sprayed width 2 m and untreated areas for comparison. Not randomised, 2 replications.

Site: Sacrewell Field, Sacrewell Farm, Thornhaugh. Sandy loam soil.

Results

Table 3. Assessments for varietal sensitivity 1997.

	Stomp + Basagran early post-em 1 - 2 node	Pulsar + Fortrol (2.0 + 0.2) l/ha early post-em 2 node	Pulsar + Fortrol (4.0 + 0.4) l/ha post-em 3 node
i. **New Varieties**			
Standards			
Vedette	(2.5)	3	3.5
Avola	(2.5)	(3.5)	3
Scout	2	2	2
Carouby de Mausanne	2.5	2.5	3
Maro	1	1	1
Vining peas			
CO 4554	(3)	(3)	3
Jaguar	2	2	2
Balmoral	2	2	2
Alfold	(3)	(3)	3
Remus	2	2.5	2
Calibra	2	2.5	3
Paso (XPF 319)	2	2	2.5
Style	(2.5)	2.5	2.5
Finess	2.5	3	2.5
Purser	1.5	2	2
Favorit	2.5	(3.5)	2
Gemini	2	2	2
Saturn	1.5	2	2
Griffin	(3)	(3.5)	2.5
Premium	(2.5)	(3)	3
Costa	2	2.5	2.5
Colana	2	2	2
Quest (FR 51)	1.5	2	1.5
Legacy	2	2	2
Samish (CMG 293)	2	2	2
Snake (CMG 228)	1.5	1.5	2
90251-19	2	2	1.5
90214-05	2.5	2.5	2
CMG 297	1.5	1.5	2
CMG 308	1.5	1.5	2
Salsado	(3)	(3)	2
Oasis (SIS 1213-2)	2	2	1.5
Temptation (SIS 1276-2)	1.5	2	1.5

	Stomp + Basagran early post-em 1 - 2 node	Pulsar + Fortrol (2.0 + 0.2) l/ha early post-em 2 node

ii. **Commercially Grown Varieties**

<u>Standards</u>		
Vedette	(2.5)	(3)
Avola	(2.5)	(3.5)
Scout	2	2
Carouby de Mausanne	2.5	2.5
Maro	1	1
<u>Vining peas</u>		
Waverex	2	2
Cobalt	2.5	2.5
Darfon	(3)	(3)
Lynx	2	2
Sigra	1.5	2
Polo	1.5	2
Skinado	(2.5)	(2.5)
Markado	(2.5	(2.5)
Coral	(3)	2.5
Misty	2.5	2.5
Span	2.5	2.5
Markana	2	2
Vada	2	2
Puget	2	2
Winner	(2.5)	(3)
Renard	(3)	(3.5)
Daybreak	(3.5)	(4)
Bastion	2	2
Sancho	1.5	2
Tacoma	1.5	1.5
Cabree	(3)	(3.5)
Point	2	2
Pacha	1.5	2
Zamira	(3.5)	(4)
Barle	1	1.5
Bikini	1	1.5
Tristar	2	2
Pennine	1.5	2
Holiday	1.5	2

Key: Score for sensitivity
1 = Highly tolerant
2 = Tolerant
3 = Slightly sensitive
4 = Moderately sensitive
5 = Highly sensitive

( )frost damage

1997 Conclusions

Frosts in April exacerbated herbicide damage, particularly treatments (i) and (ii). Some varieties were more sensitive to frost than others and results for these are marked in parentheses.

Assessments for Stomp + Basagran @ (2.0 + 1.56)l/ha x 3 made on 24 April (Table 3) showed the following were sensitive Darfon, Coral, Renard, Daybreak, Cabree, Zamira, CO 4554, Alfold, Griffin, Salsado. They suffered chlorosis and stunting and in adjacent untreated plots these were all also affected by frost. Most made a good recovery by assessment date 31 May.

Damage from Pulsar + Fortrol (2.0 + 0.2)l/ha x 3, assessed 24 April was more severe - there was a frost in the evening. Vedette and vining peas Darfon, Winner, Finess, CO 4554, Alfold were slightly sensitive; Avola, Reynard, Salsado, Cabree, Favorit, Griffin, Premium were slightly/moderately sensitive. Most varieties recovered by 31 May, however, Alfold and Finess did not.

The following new varieties were slightly sensitive to Pulsar + Fortrol (4.0 + 0.4)l/ha x 3: vining peas CO 4554, Alfold, Calibra, Premium.

Table 4. Final classification of vining pea varietal sensitivity: Pulsar + Fortrol early post-emergence; Pulsar + Fortrol standard post-emergence; Stomp + Basagran. Varieties () 2 years data. Varieties with only 1 years data not included.

	Pulsar + Fortrol (2.0 + 0.2) l/ha early post-em peas 2 node	Pulsar + Fortrol (4.0 + 0.4) l/ha post-em peas 3 node	Stomp + Basagran (2.0 + 1.56) l/ha early post-em peas 1 - 2 node
Standards			
Vedette	2.5	3.5	3
Avola	2.5	3	3
Scout	2	2	2
Carouby de Mausanne	2.5	3	3
Maro	1	1	1
New vining peas			
CO 4554	2.5	3	(2.5)
Jaguar	2	2	(2)
Balmoral	2	2	(2)
Remus	2	2	(2)
Calibra	2.5	3	(2.5)
Paso (XPF 319)	(2.5)	3	(2.5)
Finess	(2.5)	(3)	(2.5)
Purser	2	2	(2)
Favorit	(2.5)	2.5	(2)
Gemini	2	2	(2)
Saturn	2	2	(2)
Griffin	(2.5)	2	(2.5)
Premium	(2.5)	2.5	(2.5)
Costa	2	2	2
Colana	2	2	2
Quest (FR 51)	2	2	2
Samish (CMG 293)	2	2	2
Snake (CMG 228)	1.5	2	2
90251-19	2	2	2
90214-05	2	2	2

	Pulsar + Fortrol (2.0 + 0.2) l/ha early post-em peas 2 node	Pulsar + Fortrol (4.0 + 0.4) l/ha post-em peas 3 node	Stomp + Basagran (2.0 + 1.56) l/ha early post-em peas 1 - 2 node
Commercially grown vining peas			
Waverex	2	2.5	(2.5)
Cobalt	2.5	3	(3)
Darfon	2.5	3.5	(3.5)
Lynx	2	2.5	(2.5)
Sigra	2	2	(2)
Polo	2	2	(2)
Skinado	2	2	(2)
Markado	2	2	(2.5)
Coral	2.5	2.5	(2.5)
Misty	2.5	3	(2.5)
Span	2.5	3	(2.5)
Markana	1.5	2	(1.5)
Vada	2	2	(2)
Puget	2	2	(2)
Winner	3	(3)	(2.5)
Renard (CO 400)	3	3	(3)
Daybreak	3	3	(3)
Bastion	2	2	(2)
Sancho	2	2	(2)
Tacoma (XPF 266)	(1.5)	2	(1.5)
Cabree (XPF 290)	(2.5)	3	(3)
Point	2	2	(2)
Pacha (XPF 274)	2	2	(2)
Zamira	2.5	2.5	(2.5)
Barle	(1.5)	1.5	(1.5)
Bikini	1.5	1.5	(1.5)
Novella	(1.5)	1.5	(1.5)
Tristar	2	2	(2)
Sprite	(2)	(2.5)	(2.5)
Alfold	2.5	3	(2.5)
Atop	(2)	(2)	(2)
Minado	(3)	(3.5)	(3.5)
Trek	(1.5)	(2)	(1.5)

Key: Score for sensitivity

1 = Highly tolerant
2 = Tolerant
3 = Slightly sensitive
4 = Moderately sensitive
5 = Highly sensitive

Overall Conclusions

The half dose rate (2.0 + 0.2) l/ha of Pulsar + Fortrol applied early when peas were at 2 node stage appeared safer to most vining pea varieties than the full dose applied at 3 node stage (Table 4); except when followed by frost as in 1997 (Table 3).

Sensitivity of vining pea varieties based on 2 years data for Stomp + Basagran (2.0 + 1.56) l/ha applied very early when peas were at 1-2 nodes was similar to the full dose of Pulsar + Fortrol applied later.

Tests will continue at PGRO in 1998 and final classifications will be given on Information Sheet No. 144.

2. VOLUNTEER OILSEED RAPE AND BROAD-LEAVED WEED CONTROL - BROAD BEANS

Introduction

A recent survey showed that most broad bean crops grown for processing were infested with oilseed rape. Herbicides containing 'hormones' which are used in peas are very damaging to broad beans. In 1995 and 96, control of oilseed rape was evaluated with a new product Reflex T, which was registered in 1995. The only post-emergence option is Basagran, but efficacy is weather dependent and oil cannot be added to improve control because it is damaging to the broad bean crop. A tank-mix of Skirmish + Basagran was tested in 1996. It was not registered for use in broad or field beans, but early applications looked promising. However, Skirmish will no longer be manufactured. In 1997 further work was undertaken with Stomp + Basagran.

The objectives of the investigation were:

a. To assess control of oilseed rape volunteers and broad-leaved weeds with a tank-mixture of Stomp + Basagran at a range of rates applied early post-emergence before the broad beans were a 2 leaf pair stage, or later than 2 leaf stage compared with the standard Basagran.

To assess double rates for crop safety.

b. To assess sensitivity of new and commercially grown varieties of broad beans to these herbicides.

A. HERBICIDE EFFICACY & CROP TOLERANCE: BROAD BEANS 1997

Materials and method

Normal crop husbandry was carried out. Broad beans were sown to achieve target populations of 18 plants/m^2 on 30 cm row width. At site 3, Thornhaugh, oilseed rape was sown at the same depth as the beans, to simulate volunteers emerging from depth. At site 1, oilseed rape volunteers were the main weed.

Growth stages of broad beans and oilseed rape and broad-leaved weeds were recorded at each application timing. Counts of numbers of weeds species in 3 random quadrats of 0.33m^2 per plot, and at site 3 counts of oilseed rape in 3 random 0.5 m drill runs were made. Weed control scores were recorded.

Crop damage was recorded at appropriate intervals after each application.

Weather data: April was a dry month and rainfall was negligible until the last week. May was cooler and wetter than the long-term (30 year) average. Rainfall in June at Thornhaugh (site 3) was 306% of the long-term average and July and August were also wet. Temperatures from mid-June until the second week in July were lower than normal, but from then on there were some very high temperatures over the harvest period.

Sites and soil type:

1. Ludborough, Nr. Louth, Lincs: silt loam
2. Ewerby, Nr. Sleaford, Lincs: loam
3. Sacrewell Field, Sacrewell Farm, Thornhaugh, Cambs: light sandy loam

Layout: Randomised block, 3 replications sites 1 and 2, total 48 plots; 4 replications site 3. Total 72 plots. Plot size 2 m x 5 m.

Varieties and sowing dates:

Site 1 - Danko; 25 March
Site 2 - Danko; 8 April
Site 3 - Talia; 9 April

Herbicides and dose rates are shown in the Tables 1, 2 and 3. The following products (active ingredients) were used: Reflex T (fomesafen/terbutryn 80/400 g/l); Stomp 400 (pendimethalin 400 g/l); Basagran (bentazone 480 g/l).

Only Reflex T and Basagran are approved for use in broad beans.

All applications were made with an Azo precision plot sprayer delivering 200 l/ha water volume at a pressure of 2 bar using flat fan nozzles Lurmark 02F110 to give fine spray quality.

Application data

Application date	Weather/seedbed	Growth stage broad beans	weeds
Site 1. Ludborough			
T_o 7 April	13°C/surface dry, moist below	(003) radicle 3 cm, plumule	none
T_1 30 April 8 a.m.	14°C 64RH, sunny, no cloud (19°C later)	(102) 2 leaf pairs	none
T_2 12 May 8 a.m.	14°C 66RH sunny, 10% cloud cover	(103) 3-4 leaf pairs	a few cot OSR
T_3 25 May second tr5	10°C 68RH, overcast (17°C later	(301) green flower bud	cot-2TL rape
Site 2 - Ewerby			
T_o 15 April	14°C/fine rolled very dry	(003) radicle 2 cm, plumule beginning	none
T_1 14 May 3 p.m.	21°C 39RH, sunny, 30% cloud cover	(103) 3 leaf pairs unfolded soft growth	OSR cot-2TL knotgrass) b. bindweed) cot-1TL redshank)
T_2 22 May 11 a.m.	19°C 43RH, sunny, 80% cloud cover	(104) 4 leaf pairs unfolded & 1 folded soft growth	b. bindweed 1-2TL redshank 2-3TL OSR 3-4TL
Site 3 - Thornhaugh			
T_o 15 April tr 1	12°C/ very dry fine rolled	(003) radicle 2 cm, plumule beginning	none
T_1 14 May 10 a.m.. tr 2,3,4,5	18°C 52RH, sunny, no cloud/moist	(102) 2-3 leaf pairs	OSR cot b. bindweed cot fat hen cot chickweed 2-4TL cleavers cot-1 whorl
T_2 23 May 8 a.m. Tr 6,7,8,9	12°C 56RH sunny, 50% cloud cover/ moist	(104) 4 leaf pairs open	OSR cot -3TL-4TL b. bindweed cot-2TL fat hen 2-4TL speedwell 2TL chickweed small plant
T_3 4 June Tr9	14°C (21°C later) 62RH, sunny, 100% cloud cover/ dry	203 green flower buds	only OSR (dying) no other weeds

cot = cotyledon; TL = true leaf

Results

Results for volunteer oilseed rape, broad-leaved weed control and scores for crop damage for the three sites are shown in Tables 5,6 and 7.

At all sites rainfall was negligible after sowing in April until the end of the month. Hence weed and rape germinated over a long period.

Site 1 - Ludborough (Table 5)

There were very few weeds at this site, mainly oilseed rape volunteers and these emerged over a long period under dry conditions. The soil capped after heavy rain at the end of April and a few emerged after the 12 May treatments were applied.

Thus control of weeds was poor, but they were rapidly suppressed by a vigorous crop. The pre-emergence residual herbicide Reflex T was an exception and was the most effective treatment giving acceptable control and causing no crop damage.

Basagran + Stomp

The Basagran component of the tank-mix caused slight leaf blackening to a few broad-bean plants soon after application. Basagran + Stomp sprayed early at 2 leaf pairs caused negligible crop damage at the single dose rates, but effects from the overlap dose rates in the form of slight chlorosis and distortion of the growing point followed by stunting (due to the Stomp) became progressively more severe and unacceptable except for the (1.0 + 1.2) l/ha overlap rate. Time of flowering was unaffected and there was some recovery before harvest stage. The damaged beans also appeared to suffer more from chocolate spot infection. The later sprays at 4 leaf pair stage had a more severe effect with reduction in plant height.

Basagran

Applied at 4 leaf pairs caused few effect of leaf blackening even at double dose rates.

Site 2 - Ewerby (Table 6)

At this site there was a high weed population predominantly black bindweed and also redshank, field speedwell and field pansy. A few black bindweed emerged after the 14 May application. There was also an infestation of black-grass which was not controlled by any treatment.

Reflex T

Pre-emergence gave good weed control initially, but it failed to control hemp nettle and the few black bindweed remaining grew vigorously in the wet weather so that control was unacceptable by harvest stage 28 July. A follow-up with another post-emergence herbicide would have been needed. There was no crop damage from Reflex T.

Basagran + Stomp

All Basagran + Stomp treatments performed better than Reflex T or Basagran. Excellent control of numbers of most weed species was achieved by all treatments. The best treatments were Basagran + Stomp at (1.56 + 2.0) l/ha and (1.33 + 1.66) l/ha. The later applications killed the late emerging black bindweed and some large oilseed rape volunteers, but were less effective on knotgrass although numbers were very low and are not shown in Table 6. There were few crop effects from the lower dose rates, but where higher rates of Stomp were used the overlap doses (treatment **3**x2, **4**x2, **7**x2 and **8**x2) caused distortion of the growing point and later, severe stunting of the crop which was at an unacceptable level. These effects were slightly worse for the later applications. At this site the (1.5 + 1.5) l/ha and (1.0 + 1.2) l/ha rates were safe to the crop but only the former gave acceptable weed control by harvest. Flowering on 5 June (GS 202) however, was not affected by any treatment.

Basagran

Basagran did not control field pansy, field speedwell or annual meadow-grass. It gave good control of black bindweed, but was not quite as effective at the Basagran + Stomp treatments.

The weather was warm and sunny on the day of application and Basagran caused blackening of the soft leaves. The initial effects, although more severe than usual, were only temporary and the new growth was not affected.

Site 3 - Thornhaugh (Table 7)

In addition to the oilseed rape which was sown, there was a high population of broad-leaved weeds, mainly black bindweed, fat hen, field speedwell, chickweed and black nightshade.

Reflex T

Gave good control of oilseed rape and black bindweed, but these which escaped control ere vigorous. Control overall was not quite acceptable by harvest. The broad beans were very tolerant of this pre-emergence herbicide.

Basagran + Stomp

All early Basagran + Stomp treatments applied on 14 May gave excellent control of all species, except the small numbers of oilseed rape and black bindweed which emerged after application. The later applications on 23 May performed better on black bindweed, but some of the rape at 3 leaf stage were too large to control. However, rape remaining on any of the Basagran + Stomp treatments remained very stunted. All Basagran + Stomp treatments caused occasional leaf blackening followed by severe stunting from double dose rates. The broad beans treated early 14 May had made a good recovery by harvest stage, the later ones although not quite as damaging in this trial, had less time to recover particularly treatment **9**x2. The split dose (0.78 + 1.0) and (0.78 + 1.0) l/ha was very effective but caused stunting at a late crop stage and earlier applications would probably have performed better.

Basagran

Basagran at 3.0 l/ha caused leaf blackening on sensitive variety Talia and damage was very severe from the double dose rate. It did not control field speedwell, annual meadow-grass or fumitory, and was less effective on fat hen than the Basagran + Stomp tank-mixes. Several large oilseed rape were not killed or stunted and became competitive.

Table 5. Site 1 - Ludborough. Crop and weed scores and numbers of weed species/m^2

					Crop Score					No. weed species/m^2 on 25/5					
	Material	Rate l/ha	Timing	Date:	12/5	25/5	5/6	5/7	25/7	OSR	Charlock	Cleavers	Chickweed	TOTAL	Weed Score 25/7
0	Untreated	-	-		10	10	10	10	10	29	1	2	1	33	0
1	Reflex T	2.5	T_0		10	10	10	10	10	2	0	1	0	3	7.5
2	Basagran + Stomp	1.5 + 1.5	T_1		9.5	10	10	10	10	24	0	0	0	24	4.5
2x2					8.3	8.3	8	8	7.7						
3	Basagran + Stomp	1.33 + 1.66	T_1		9.6	10	10	10	10	35	0	0	0	35	4.5
3x2					8.5	7.3	7.5	6.3	6.7						
4	Basagran + Stomp	1.56 + 2.0	T_1		9	10	10	10	10	22	0	0	0	22	6.5
4x2					7.7	6.7	5	4.3	6						
5	Basagran + Stomp (split)	1.0 + 1.2 & 1.0 + 1.2	T_1 & T_3		10	10	10	10	10	(32)	0	0	0	(32)	7
5x2					9	9	9	8.3	9.7						
6	Basagran	3.0	T_2		-	10	10	10	10	23	0	0	0	23	5
6x2					-	9.3	10	10	10						
7	Basagran + Stomp	1.33 + 1.66	T_2		-	10	9.7	8	8.7	10	0	0	0	10	7.2
7x2					-	8	5.7	3	4.3						
8	Basagran + Stomp	1.56 + 2.0	T_2		-	9.7	9.7	7.3	8	8	0	1	0	8	7.5
8x2						7.7	5	2	3.7						

Key: () only assessed after first T_1 application
T_0 = pre-emergence
T_1 = 2 leaf pairs broad beans
T_2 = 4 leaf pairs broad beans
T_3 = green bud broad beans

Weed score: 10 = complete control
7 = acceptable control
0 = no control

Crop score: 10 = no damage
7 = acceptable damage
0 = complete kill

Table 6. Site 2 - Ewerby. Crop & weed scores and numbers of weed species/m^2

				Crop Score 1st flower open					No weed species/m^2												Weed Score		
	Material	Rate l/ha	Timing	Date: 22/5	28/5	5/6*	4/7	28/7	Vol OSR	Hemp nettle	F. pansy	B. Bindweed	Redshank	Chickweed	Annual Meadowgrass	F. Speedwell	Pale Persicaria	Groundsel	Fat-hen	TOTAL	28/5	4/7	28/7
0	Untreated			10	10	10	10	10	7	3	8	73	12	5	6	12	6	3	4	140	0	0	0
1	Reflex T	2.5	T_0	10	10	10	10	10	0	3	1	4	1	1	2	0	0	0	0	11	9.3	7.3	6
2	Basagran + Stomp	1.5 + 1.5	T_1	10	10	10	10	10	1	1	1	2	0	0	2	1	0	0	0	5	10	9	8
2x2				9.7	9.5	8	9.7	10															
3	Basagran + Stomp	1.33 + 1.66	T_1	10	10	9.7	10	10	0	1	2	1	0	0	1	1	0	0	0	5	10	9	8
3x2				9.6	8.8	6.8	9	9.7															
4	Basagran + Stomp	1.56 + 2.0	T_1	10	9.2	9.3	10	10	0	1	0	1	0	0	1	2	0	0	0	3	10	9.3	9
4x2				9.5	7	5.7	7.3	9															
5	Basagran + Stomp	1.0 + 1.2	T_1	10	10	10	10	10	1	1	1	2	0	0	3	0	0	0	0	8	10	8.3	6.5
5x2				10	9.8	9	9.7	10													Date 5/6		
6	Basagran	3.0	T_2	-	6	7	9.8	10	0	1	4	4	0	0	3	5	0	0	0	17	9.7	8	6
6x2				-	4.7	4.7	8	9.7															
7	Basagran + Stomp	1.33 + 1.66	T_2	-	8	8	8.7	9	0	1	1	0	0	0	2	0	0	0	0	4	10	9	8
7x2				-	6.3	5.7	4.7	6.3															
8	Basagran + Stomp	1.56 + 2.0	T_2	-	7.3	7.7	7.7	8.3	0	1	1	0	0	0	1	0	0	0	0	4	10	9.5	9
8x2				-	5.3	5	4.3	6.3															

* First flower open no difference in flowering between treatments

No treatment controlled blackgrass

T_0 = pre-emergence broad beans

T_1 = 3 leaf pairs unfolded

T_2 = 4 leaf pairs unfolded and 1 folded

Weed score: 10 = complete control
7 = acceptable control
0 = no control

Crop score: 10 = no damage
7 = acceptable damage
0 = complete kill

Table 7. Site 3 - Thornhaugh. Crop & weed score; % oilseed rape control and numbers of weed species/m^2

				Crop Score				No. weeds/m^2 on 29/5												Weed Score	
	Material	Rate l/ha	Timing	Date: 21/5	29/5	1/7	19/8	OSR % control	B. bindweed	B. nightshade	Chickweed	Cleavers	Shepherds Purse	Fools parsley	Fat-hen	F. speedwell	Dock spp.	Annual meadowgrass	Fumitory	TOTAL	29/5	19/8
0	Untreated			10	10	10	10	0	55	11	16	5	6	4	37	23	4	8	3	172	0	0
1	Reflex T	2.5	T_0	10	10	10	10	88.9	3	0	1	1	0	0	1	0	0	0	0	5	9.8	6
2	Basagran + Stomp	1.5 + 1.5	T_1	10	9	10	10	93.9	9	0	0	0	0	0	0	0	0	2	0	11	10	6.5
2x2				8.9	6	9.4	10															
3	Basagran + Stomp	1.33 + 1.66	T_1	10	9	10	10	92.0	13	0	0	0	0	0	0	0	0	1	0	14	9.9	8
3x2				9.5	5.5	8.9	10															
4	Basagran + Stomp	1.56 + 2.0	T_1	10	8.5	10	10	94.9	8	0	0	0	0	0	0	0	0	2	0	10	10	8.5
4x2				8.8	5	7.8	10															
5	Basagran + Stomp	1.0 + 1.2	T_1	10	9.8	10	10	82.3	13	0	0	0	0	0	0	0	0	2	0	15	9.1	7
5x2				9.8	8	9.5	10															
6	Basagran	3.0	T_2		7	9	10	57.8	5	0	0	0	0	0	4	9	0	5	2	25	9.2	3.2
6x2					5	7.5	10															
7	Basagran + Stomp	1.33 + 1.66	T_2		8.8	10	10	69.0	6	0	0	0	0	0	0	0	0	3	0	9	9.8	6.8
7x2					6.8	8.5	9.5															
8	Basagran + Stomp	1.56 + 2.0	T_2		7.8	10	10	64.6	6	0	0	0	0	0	0	0	0	4	0	10	9.9	7.8
8x2					6	7.8	9															
9	Basagran + Stomp	0.78 +1 & 0.78 + 1	T_2 & T_3		(8.5)	9	9.2	82.9	(7)	0	0	1	0	0	0	0	0	3	0	(13)	(9.4)	9
9x2																						
No. OSR/m drill run								126.5														

Key: () 1st Application

T_0 = pre-emergence

T_1 = 2 leaf pairs broad beans

T_2 = 4 leaf pairs broad beans

T_3 = green bud broad beans

Weed score: 10 = complete control
7 = acceptable control
0 = no control

Crop score: 10 = no damage
7 = acceptable damage
0 = complete kill

Conclusions - 1997

There were very few weeds at Site 1, but at Sites 2 and 3 Basagran + Stomp at (1.33 + 1.66) or (1.56 + 2.0) l/ha were the most effective herbicides controlling high populations of black bindweed, fat hen, speedwell and black nightshade and they were also effective on 'volunteer' oilseed rape. Some rape and black bindweed emerging after applications remained stunted due to the residual effect of Stomp. Early applications were more effective than the later ones when weeds were larger and they were also safer to the crop. The split dose (0.78 + 1.0) followed by (0.78 + 1.0) l/ha (at Site 3) was the most effective treatment, but earlier treatment might have been less damaging.

Although the single dose rates cause negligible (early treatments) or acceptable crop effects, the overlap rates of the higher doses caused severe stunting due to Stomp and the later treated broad beans, where recovery was poor, are likely to have suffered yield loss at all sites.

The stunting damage caused by high doses of Basagran + Stomp applied in the varietal sensitivity trials was even more severe.

Safer options, not tested in these trials, could be: Split doses, the first applied before 2 leaf pairs of (0.67 + 0..83) l/ha x 2 or (0.75 + 0.75) l/ha x 2, but further work would be needed. In addition Stomp is not registered for post-emergence use in broad beans and residues data would need to be generated for a Specific Off-Label Approval application .

B. Varietal sensitivity of broad beans to herbicides

Materials and method

Herbicide products (active ingredients) were as follows:

Stomp 400 (pendimethalin 400 g/l); Basagran (bentazone 480 g/l); Basagran SG (new formulation of bentazone 870 g/kg)

Varieties

15 commercially grown and new varieties of broad beans.
Sown 11 March 1997

Herbicides

i. Basagran SG @ 1.65 kg/ha x 2 standard timing > 2 leaf pair
applied 22 April; beans at 3 leaf pair stage; weather 13°C RH 33, some sun, 80% cloud cover.

ii. Stomp + Basagran @ (1.66 + 1.33)l/ha x 2 timing @ 2 leaf. pr.
applied on 15 April; beans at 2 leaf pair stage; weather 12°C RH 45, sunny 50% cloud cover, frost -0.55°C the night of 15 April.

iii. Stomp + Basagran @ (2.0 + 1.56)l/ha x 2 timing > 2 leaf. pr.
applied 22 April; beans at 3 leaf pair stage; weather 13°C RH 33, some sun, 80% cloud cover.

Application with an Azo precision plot sprayer using flat fan nozzles, Lurmark 02F110, delivering 200 l/ha at 2 bar pressure.

Layout: 2 rows of each variety. Spray width 2 m and untreated areas for comparison. Not randomised, 2 replications.

Site: Sacrewell Farm, Thornhaugh. Sandy loam soil.

Results 1997

Table 8. Varietal sensitivity of broad beans to herbicides 1997

	Basagran SG		Stomp+Basagran (1.66+1.33)l/ha x2 @ 2 lf. prs			Stomp+Basagran (2+1.56)l/ha x2 @ > 2 lf.prs		
	27/5	29/5	24/4	12/5	29/5	2/5	12/5	29/5
Listra	1	1	3	3.5	3.5	2	3.5	4
Statissa c	1	1	2	3.5	3.5	1	3.5	4
Bistro	1	1	2	3.5	3.5	1	3.5	4
Verdy	1	1	2	3.5	3.5	1	3.5	4
Greeny	1	1	3	3.5	3.5	2	3.5	4
Gold	1	1	2	3.5	3.5	2	3.5	4
Stereo	1	1	1.5	3.5	3.5	1	3.5	4
Diamant	1	1	2	3.5	3.5	1	3.5	4
Talia	1.5	1	2.5	3.5	3.5	2	3.5	4
Jade	1	1	1.5	3.5	3.5	1	3.5	4
Danko	1	1	2	3.5	3.5	1	3.5	4
Brandy	1	1	1.5	3.5	3.5	1	3.5	4
Optica	1.5	1	2	3.5	3.5	2	3.5	4
Medes	1	1	2	3.5	3.5	1	3.5	4
Metissa	1	1	2	3.5	3.5	1	3.5	4

Key: Score for sensitivity

1 = Highly tolerant
2 = Tolerant
3 = Slightly sensitive
4 = Moderately sensitive
5 = Highly sensitive

c = coloured flowered broad bean, the remainder are white flowered.

Conclusions - 1997

Temperatures and relative humidity were not high at either spray timing, but it is possible that a frost after application of Stomp + Basagran (ii) may have increased damage.

There was very little damage from Basagran SG to any broad bean variety, Talia and Optica exhibited only slight leaf blackening.

The damage from Stomp + Basagran (ii) was slow to appear. There was some slight leaf blackening initially, followed by stunting (12 May), so there was crop height reduction of about 40% compared with the untreated for all varieties. The beans began to recover in June. Beans treated with (iii), the higher dose rate at a slightly later timing, showed similar effects and in addition flowering was delayed. All varieties were sensitive to Stomp + Basagran at both timings and dose rates.

OVERALL DISCUSSION AND CONCLUSIONS

Vining peas

Reflex T gave good control (85.7%) of oilseed rape when applied to a fine rolled seedbed and followed by rain. Results were poor, only 52.3% control under dry conditions.

Post-emergence tank-mixes were applied at reduced doses earlier than label recommendations. The most effective was Pulsar + Fortrol (2.0 + 0.2)l/ha applied when peas were at the 2 node growth stage, when rape is small (cotyledon - 1 true leaf stage), and it was also safe to the crop at overlap rate. A range of varieties were tested and sensitivity was less than the recommended rate and later timing. There is now a label recommendation for the half-dose rate of Pulsar + Fortrol applied early.

Another promising treatment, registered in France is not yet approved in the UK, was with Stomp + Basagran (2.0 + 1.56)l/ha applied very early at 1-2 node stage. It gave excellent control and appeared safe to most varieties.

If treatment cannot be applied early MCPB applied at 4 node stage of peas was also a cost-effective treatment. A programme with Reflex T pre-emergence followed by a post-emergence treatment gave 100% control of volunteer oilseed rape.

Broad beans

A. Where there was adequate moisture after application of residual herbicide Reflex T 72.8%, 78% and 88.9% control of volunteer rape was achieved in the three years of trial. Results for Basagran at full dose 3.0 l/ha were variable 78%, 93.4% and 57.8% control; a split dose (1995) performed only slightly better, and the addition of Actipron oil 2 l/ha improved control (1996) but was too damaging to the crop. Efficacy of these approved products Reflex T and Basagran is very weather dependent and control of oilseed rape and broad-leaved weeds may be inadequate if populations are high, or if germination occurs over a long period.

Another post-emergence option was sought with products not approved for use in broad beans. Skirmish + Basagran (0.75 + 1.0)l/ha gave excellent control (98% in 1995) of oilseed rape and other broad-leaved weeds, and was safe to the crop when applied very early at 1-2 leaf pair stage. It caused more leaf blackening where the leaf area was larger, at more advanced growth stages. Further work with different rates was undertaken and variety screens suggested there was no particular varietal sensitivity. In 1997, the company announced that Skirmish would no longer be manufactured.

Another post-emergence tank-mix, Stomp 400 + Basagran, which looked promising in the 1996 trial was evaluated further for crop tolerance and weed control at three sites in 1997. A range of dose rates, single and overlap were applied very early post-emergence before 2 leaf pairs and later. Control of oilseed rape and broad-leaved weeds was superior to Basagran, and where a second flush of weeds emerged after application, the weeds remained stunted due to the residual effect of Stomp. Although the single doses were safe to the crop when applied early, there was more damage as stunting from Stomp from the later applications. The overlap rates caused severe stunting and crop safety margin was insufficient except for the lowest dose rate. It is possible that a safer option could be a lower split dose applied before 2 leaf pairs and a follow up. However, Stomp is not registered for post-emergence use in broad (or field) beans and residue data would need to be generated for a specific Off-label Approval.

B. All varieties tested were highly tolerant of Reflex T. Skirmish will no longer be manufactured after 1997 and development was therefore discontinued and no final classification was made.

Stomp + Basagran has only been evaluated in varietal sensitivity tests for one year. All varieties were severely stunted for the dose rates used and there did not appear to be varietal differences.

RECOMMENDATIONS

Vining peas

Where oilseed rape is anticipated, the most effective treatment is with a programme of Reflex T followed by a reduced dose of Pulsar + Fortrol (2.0 + 0.2)l/ha applied early, when peas are at 2 node stage, to small rape. This will remove weed competition early and as quality standards regarding weedy contaminants become more stringent, should avoid problems with pieces of oilseed rape.

If no pre-emergence herbicide is applied, or for oilseed rape at 3-4 leaf stage, the full dose will be needed, to control these and higher populations of some broad-leaved species.

Broad beans

The withdrawal of Skirmish, and the lack of crop safety margins of Stomp post-emergence was disappointing.

At present the best option for volunteer oilseed rape and broad-leaved weed control is to apply Reflex T pre-emergence and to follow up with Basagran at full or split dose application post-emergence. If conditions are optimum, i.e. if there is adequate moisture for residual activity and the weather is warm when Basagran is applied, efficacy will be good.

However, because conditions are not always optimum, there is still a need for a more effective post-emergence herbicide.