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RUNNER BEANS: DEVELOPMENT OF PRE-EMERGENCE HERBICIDE TREATMENTS

APPLICATION:

The aim of the investigation was to find a safe pre-emergence treatment based on herbicides with approval (Dacthal) or a specific off-label approval (Sovereign 400 and Croptex Chrome), or with a label extension of use from green to runner beans (Arresin). Reflex T was also included at the site. They were evaluated alone, and some in tank-mixes at single doses for weed control or double doses for crop tolerance, in runner beans grown under plastic film, under cloche or outside.

Reflex T alone, a pea herbicide was the most effective treatment. However, one of the active ingredients terbutryn is not approved for runner beans, and crop safety at the twice normal dose was only just acceptable.

All the other herbicides have weaknesses on certain weed species and a tank-mix will normally be needed. Sovereign 400 appears to be a good basis for a tank-mix at a maximum of 4.0 l/ha, Arresin (or Croptex Chrome) could be added where annual meadow grass is likely to be a problem.

Suggested two way tank-mixes are:

Arresin + Sovereign (2.8 + 3.3) l/ha or (2.8 + 4.0) l/ha medium soil
(2.0 + 3.3) l/ha or (2.0 + 4.0) l/ha light soil

Sovereign + Dacthal (2.5 l + 6.0 kg)/ha or (2.5 l + 9.0 kg)/ha

or a more reliable three-way mix could be

Arresin + Sovereign + Dacthal

(2.8 l medium soil + 3.0 l + 4.0 kg up to 7kg)/ha
(2.0 l light soil " ")/ha

or

(2.8 (medium) + 4.0 l + 3.0 kg up to 7kg)/ha
(2.0 (light) " ")/ha

RUNNER BEANS: DEVELOPMENT OF PRE-EMERGENCE HERBICIDE TREATMENTS

SUMMARY

OBJECTIVE:

The aim of the investigation was to find a safe pre-emergence treatment based on herbicides with approval (Dacthal) or a specific off-label approval (Sovereign 400 and Croptex Chrome), or with a label extension of use from green to runner beans (Arresin). Reflex T was also included at the site. They were evaluated alone, and some in tank-mixes at single doses for weed control or double doses for crop tolerance, in runner beans grown under plastic film, under cloche or outside.

RESULTS:

Irrigation and/or rainfall resulted in herbicide leaching and more damage effects than in the 1995 trial and these were greatest from Arresin at the double dose rates used. Dacthal was the safest treatment. Very shallow drilling increased herbicide damage effects.

The predominant weeds were black-nightshade (at two sites), pennycress, *Chenopdium* spp, black-bindweed and annual meadow-grass and small nettle. Herbicide tank-mixes were effective on these species, but fool's parsley was not controlled by any treatment (although Reflex T was not included at this site).

Reflex T (fomesafen/terbutryn) alone was the most effective treatment but terbutryn is not registered for green or runner beans. Crop safety for the twice normal rate was only just acceptable.

All the other herbicides have weaknesses on certain weed species. Sovereign 400 appears to be a good basis for a tank-mix and Arresin (or Croptex Chrome) is useful where annual meadow-grass is likely to be a problem. The most appropriate two-way tank-mix for the anticipated weed spectrum could be used Arresin (2.8 (medium) or 2.0 light soil + Sovereign 400 (3.3 or 4.0 l/ha) or Sovereign 400 + Dacthal (2.5 l + 9.0 kg)/ha or 2.5 + 6.0 kg)/ha. A three-way (Arresin + Sovereign + Dacthal) at 2.8 l medium (or 2.0 l light) + 3.0 l + 4.0 kg)/ha or (2.8 l (or 2.0 l) + 4.0 l + 3.0 kg)/ha should cover most situations and might be the most reliable treatment.

RUNNER BEANS: DEVELOPMENT OF PRE-EMERGENCE HERBICIDE TREATMENTS

INTRODUCTION:

A very high standard of weed control is required in runner beans to avoid competition and harvesting problems. Hand-weeding is costly thus a residual herbicide is needed to control weeds from sowing to harvest. Enide has been withdrawn by the manufacturer, Ivorin (dinoseb-acetate/monolinuron) was withdrawn many years ago. There is no longer a label recommendation for use of Croptex Chrome in runner beans, but a Specific Off-Label Approval was granted in 1996. Although products used in dwarf green beans can legally be used in runner beans the latter is a more herbicide sensitive crop.

The aim of the investigation was to find a safe, effective pre-emergence treatment for runner beans.

Herbicides used in this trial were based on products which are: already approved for runner beans, Dacthal (chlorthal-dimethyl); or have specific off-label approval Sovereign (pendimethalin); or have a label extension of use from green to runner beans, Arresin (monolinuron). Croptex Chrome was also included for comparison, and at one site Reflex T (fomesafen/terbutryn) was assessed. All these products have weaknesses in the weed spectrum and need a partner (with the exception of Reflex T which has very few). At the dose rates recommended on the product label, Dacthal is the most expensive.

The observation trials assessed weed control for a second year for a range of pre-emergence herbicide tank-mixes and runner bean crop tolerance for double dose rates. The single doses were no more, and most were less, than those registered for the product and doses used on medium soil for Arresin and Dacthal were higher than on light soils. They were tested on runner beans grown under cloche and trickle irrigated; or under plastic film, with cloche protection later with irrigation (4 cm) immediately after herbicide application. An additional trial on a light-very light sandy loam/loamy sand soil, sown late without protection was also conducted to test crop safety.

MATERIALS & METHOD:

Materials: Sovereign 400 (pendimethalin 400 g/l SC); Arresin (monolinuron 200 g/l EC); Dacthal W75 (chlorthal-dimethyl 75% w/w WP);Croptex Chrome (chlorpropham/fenuron 80/15 g/l EC); Reflex T(fomesafen/terbutryn 80/400 g/l SC).

Experimental design: Sites 1,2 and 3 randomised, 2 replications.

Plot Size:

Site 1 - 1 row x 8 m split for single and double dose.
Site 2 - 1 row x 6 m split for single and double dose
Site 3 - 1 row x 6 m split for single and double dose

Sites:

Site 1 - Hallow, Worcester; soil type light, sandy loam (high OM)
Site 2 - Bramling, Kent; soil type light, silt loam
Site 3 - Sacrewell Farm, Thornhaugh, Cambs.; soil type light-very light, sandy loam-loamy sand.

An extra trial at Site 3 was undertaken to obtain more crop tolerance data and to include extra treatments.

Site 1: Runner beans cv. Enorma were sown by hand on 3 April, 2 seeds every 22 cm so that they were covered by about 4 cm of settled soil. The seedbed was fine and rolled.

After the pre-emergence herbicide treatments were sprayed on 4 April, about 2.5 cm overhead irrigation was applied and the area was covered with clear plastic film. Polythene tunnels were later placed over the plastic to protect plants when they emerged (last week in April) through a hole which was cut through the film. Canes were placed to support the beans, and the tunnel was removed in mid June.

Site 2: Runner beans cv. White Emergo, were planted with a single row Stanhay Jumbo precision seeder on 11 April, 4 seeds per 30 cms of row. Planting depth was very shallow and the seed was barely covered by soil, less than 1 cm in some places. The herbicides were sprayed on 14 April to a dry slightly cloddy seedbed and trickle irrigation was applied later on the same day. The rows were then covered with cloche covered in frost-proof polythene.

Site 3: Runner beans cv. Enorma, were planted by hand on 13 May and they were covered by 3 cm of settled soil after rolling. The seedbed was very fine. There was 6.4 mm rain on 18 May and herbicides were sprayed on 19 May to a moist seedbed. There was 16.0 mm rainfall 21-26 May. The runner beans were not protected at this site.

At all sites crop tolerance and overall weed control was assessed at intervals and scores were recorded. Numbers of weed species were counted in 2 x $^1/_6$ m² random quadrats per plot at Site 1, and 2 x 0.25 m² at site 2 and 2 x $^1/_3$ m² at site 3.

APPLICATION DATA:

Application date	Weather/seedbed	Growth Stage	Crop	Weed
Site 1	4 April	8°C dry/ slightly cloddy dry (irrigation after)	dry seed,	none
Site 2	14 April	9°C, 38 RH hazy sun/ fine rolled (trickle irrigation after)	dry seed	none
Site 3	18 May	5°C, 67 RH/fine rolled moist, rainfall 16 mm 21-26 May	seed imbibed	none

All applications were made with an Azo precision plot sprayer pressurised with propane gas using flat fan nozzles, Lurmark 02F110 delivering 200 l/ha water volume at 2 bar pressure as fine spray quality.

WEATHER DATA: All sites received much lower than long-term average rainfall from sowing until harvest. However, irrigation was applied at Site 1 (overhead) and Site 2 (trickle) when necessary and the beans did not appear to suffer from drought stress. No irrigation was applied at site 3, but sowing conditions were excellent and growth was vigorous. April and May were generally cooler than average but there was a sudden rise in temperature at the end of May and temperatures were similar to the seasonal normal from then on.

RESULTS:

Site 1 - Hallow, Worcester. Runner beans under clear plastic film

Crop tolerance and weed control were assessed when runner beans were at simple leaf stage, on 1 May. The weeds had emerged on plots treated with Sovereign, but many were severely affected. Counts for weed species were made on 16 May when the beans were at 2 trifoliate leaf stage. A further assessment for crop tolerance and weed control was made on 12 June when the beans were at 1st flower open stage. Results are shown in Table 1.

Crop Tolerance

There were few visual crop effects at site 1. 'Single' dose rates were safe to the crop. At higher dose rates Arresin caused temporary chlorosis, Sovereign caused slight delayed emergence and stunting, Croptex Chrome caused some stunting and leaf crinkling. Damage was at an acceptable level with the exception of the highest dose of the three-way tank-mix (**16**).

Weed Control

There was a very high weed population, of species which are often difficult to control. There were small numbers of unevenly distributed perennial ryegrass.

All treatments controlled small nettle, (with the exception of Arresin) and shepherds purse. Pennycress was resistant to Dacthal and fumitory was resistant to Arresin or Dacthal, mayweeds were not controlled by Sovereign.

The predominant species, black nightshade was not controlled by Arresin, or Croptex Chrome, Dacthal was effective and Sovereign gave complete control. The other main species, fool's parsley was resistant to all herbicides used in this trial although some caused vigour reduction.

Thus the tank-mixes performed better and in most cases gave complete control of all species except fool's parsley, as did the growers treatment of 3½ pt Chrome + 8 lb Dacthal/ac. Only the double dose of Arresin + Sovereign + Dacthal (**16**) at (4.0 l + 8.0 l + 6.0 kg)/ha gave an acceptable level of weed control including fool's parsley. Hand weeding of fools parsley, which emerged with the runner beans through holes in the plastic film, was needed in all cases.

The plastic film had a beneficial effect on weed control by drawing up moisture and suppressing remaining weeds which were scorched when temperatures rose under the plastic.

Site 1. Hallow, Worcester: Crop tolerance, weed control and number of weed species.

Herbicide	Dose rate l(or kg)/ha	Crop Score			#Weeds/m² on 16/5								Weed Score	
		1/5	16/5	12/6	SOLNI	AETCY	UTUR	FUMOF	THLAR	MATss	CAPBU	TOTAL	16/5	12/6
0 untreated					184	117	36	41	88	27	49	542	0	0
1 Arresin	2	10	10	10	180	68	15	30	8	0	3	304	2.5	2
2 Arresin	4	8[c]	10	10	141	69	0	10.5	3	0	0	223.5	4	3
3 Dacthal	9 kg	10	10	10	9	93	0	19.5	109.5	2.7	7.5	241.2	1	1
4 Dacthal	18 kg	10	10	10	10	144	0	28.5	70.5	2.7	0	255.7	2	2
5 Sovereign 400	4	10	10	10	0	141	0	0	0	10	0	151	5	3
6 Sovereign 400	8	9[st]	9.5	10	0	49.5	0	0	0	7	0	56.5	8.5	5
7 Sovereign 400	12	9[st]	8.8	10	0	51	0	0	0	0	0	51	8.5	5.8
8 Arr + Sov	2 + 2.5	10	10	10	0	96	0	0	0	0	0	96	5	4
9 Arr + Sov	2 + 3.3	10	10	10	0	102	0	0	0	0	0	102	5	4.5
10 Arr + Sov	2 + 4	9.5[st]	10	10	0	117	0	0	0	0	0	117	5	4.5
11 Arr + Sov	4 + 8	8[st],[c]	10	10	0	55.5	0	0	0	0	0	55.5	7.5	6
12 Arr + Sov + Dac	2 + 2 + 4 kg	10	10	10	0	87	0	0	0	0	3.8	90.8	6	3
13 Arr + Sov + Dac	2 + 3 + 4 kg	10	10	10	0	54	0	0	0	0	0	54	6.5	4
14 Arr + Sov + Dac	4 + 6 + 8 kg	9[cl]	9	10	0	45	0	0	0	0	0	45	8.5	6
15 Arr + Sov + Dac	2 + 4 + 3 kg	10	10	10	0	39	0	0	0	0	0	39	7.5	5
16 Arr + Sov + Dac	4 + 8 + 6 kg	8[st],[c]	6.5[c]	10	0	15	0	0	0	0	0	15	9.5	8.5
17 Sov + Dac	2.5 + 4 kg	10	10	10	0	42	0	0	0	0	0	42	6.5	4.5
18 Sov + Dac	2.5 + 7 kg	10	10	10	0	58.5	0	0	0	0	0	58.5	7	5
19 Sov + Dac	5.0 + 14 kg	9.5	10	10	0	61.5	0	0	0	0	0	61.5	7.5	6
20 Croptex Chrome	11	10	10	10	170	70.5	0	28.5	0	1.3	0	270.3	2	1
21 Croptex Chrome	22	9[st]	9	10	161	66	0	13.5	3	0	0	243.5	5	3

Key: [c] = chlorosis; [st] = stunting

Weed Score: 0 = no control
7 = acceptable control
10 = complete kill

Crop Score: 10 = no effect
7 = acceptable change
0 = complete kill

[#] Bayer code

SOLNI = Black nightshade
AETCY = Fool's parsley
UTUR = Small nettle

FUMOF = Fumitory
THLAR = Pennycress
MATspp. = Mixed population pineapple mayweed and scentless mayweed
CAPBU = Shepherds Purse

Site 2. Bramling, Kent. Runner beans under cloche.

Crop tolerance was assessed when the runner beans were at simple leaf stage about 10 cm tall on 30 April, at 1½ trifoliate leaf stage on 14 May and later on 18 June during flowering. Weed species were counted in 2 random quadrats of 0.25 m² on 14 May. Results are shown in Table 2.

Crop tolerance

A combination of very shallow drilling of the beans, and irrigation, resulted in some severe herbicide damage from several treatments. The damage was variable between replicates possibly because of variation in soil cover or water applied.

The runner beans were very tolerant of Dacthal which caused negligible crop effects except chlorosis of leaf veins. Sovereign had little effect at 4.0 l/ha (**5**) but caused yellowing of leaf veins and margins on occasional plots at the 8 l/ha dose (**6**), and additional and unacceptable stunting and leaf crinkling from the 12.0 l/ha rate (**7**). The 22 l/ha dose of Croptex Chrome caused severe stunting and some leaf crinkling. Arresin at 2 l/ha (normal dose) appeared safe to runner beans but the 4 l/ha rate caused chlorosis followed by severe necrosis of the leaf margins and stunting. Tank-mixing with Arresin appeared to increase damage in the form of necrosis of the leaf margins and stunting - there was virtually complete kill from high dose rate treatments (**11**, **14**, **16**).

The Sovereign + Dacthal Tank mixes were very safe to the runner bean crop.

Weed control

There was a wide range of species at site 2, predominantly black nightshade. Adequate moisture for good residual herbicide activity and a fine rolled seedbed resulted in good weed control from several treatments.

All herbicide treatments completely controlled fat-hen (except Croptex Chrome), small nettle, redshank (except Arresin) and gallant soldier (except Dacthal) and low numbers of poppy. The distribution of pineapple mayweed was uneven, but it appeared to be controlled by all except Dacthal and Croptex Chrome treatment.

Black nightshade was resistant to Arresin, control with Croptex Chrome was poor, Dacthal was not completely effective at the dose rates used, and neither were lower dose rates (2.5 l) of Sovereign used in tank-mixes (treatment **8**). Sovereign at 4.0 l/ha gave 96% control of this weed.

Of the single herbicides at normal doses, Sovereign at 4.0 l/ha was the most effective and this was also safe to the crop at twice this dose, 8.0 l/ha. The Sovereign + Dacthal tank-mix (2.5 l + 4 kg)/ha achieved a similar level of control but was slightly safer to the crop.

The Arresin + Sovereign + Dacthal tank-mixes gave complete weed control. However, tank-mixes with Arresin (treatments **8** - **16**) gave excellent weed control but all were too damaging to the shallow-drilled crop.

Site 2. Bramling, Kent. Crop tolerance, weed control and numbers of weed species.

Herbicide	Dose rate l(or kg)/ha	Crop Score			#Weeds/m² on 16/5										Weed Control	
	Date:	30/4	14/5	18/6	MERAN	SOLNI	CHEAL	UTUR	MATsp	POLPE	CAPBU	GALPA	PAPRO	TOTAL	14/5	18/6
0 untreated		10			3	224	37	18	24	18	18	21	4	367	0	0
1 Arresin	2	10	9	10	0	112	0	1	0	5	0	2	1	121	3.5	3.5
2 Arresin	4	9.5[st,c]	5[n, st]	5.5	0	33	0	0	0	0	0	1	0	34	7.5	7.5
3 Dacthal	7kg	10	10	10	0	19	0	0	7	1	1	3	0	31	5.5	4
4 Dacthal	14kg	9.5[c]	9[c]	10	0	16	0	1	10	0	0	6	0	33	7	7.5
5 Sovereign 400	4	10	9[c]	10	3	9	0	0	0	0	0	0	0	12	9	9.5
6 Sovereign 400	8	8.5[de]	8.5[c]	10	0	0	0	0	0	0	0	0	0	0	10	10
7 Sovereign 400	12	7.5	6.5[c,st,c]	7.5	0	0	0	0	0	0	0	0	0	0	10	10
8 Arr + Sov	2 + 2.5	10	9[n]	7.8	0	13	0	0	0	0	0	0	0	13	9.2	9.5
9 Arr + Sov	2 + 3.3	10	6.5[n]	5	1	3	0	0	0	0	0	0	0	4	9.7	9.8
10 Arr + Sov	2 + 4	10	6.5[n,st]	3	0	0	0	0	0	0	0	0	0	0	10	10
11 Arr + Sov	4 + 8	9	5[st,n]	0.5	0	0	0	0	0	0	0	0	0	0	10	10
12 Arr + Sov + Dac	2 + 2 + 4kg	10	6[n]	3.5	0	0	0	0	0	0	0	0	0	0	10	10
13 Arr + Sov + Dac	2 + 3 + 4kg	9.5[st,c]	6[n]	3	0	0	0	0	0	0	0	0	0	0	10	10
14 Arr + Sov + Dac	4 + 6 + 8kg	9	3[n,st]	0.5	0	0	0	0	0	0	0	0	0	0	10	10
15 Arr + Sov + Dac	2 + 4 + 3kg	10	6[n,st]	2.5	0	0	0	0	0	0	0	0	0	0	10	10
16 Arr + Sov + Dac	4 + 8 +6kg	8.75[c]	5.5[n,st]	1	0	0	0	0	0	0	0	0	0	0	10	10
17 Sov + Dac	2.5 + 4kg	10	10	10	0	9	0	0	1	0	1	0	0	11	9.7	9.5
18 Sov + Dac	2.5 + 7kg	10	10	10	0	7	0	0	1	0	0	0	0	8	9.8	9.9
19 Sov + Dac	5.0 + 14kg	8[c]	9[c,st]	10	1	4	0	0	1	0	0	0	0	6	10	10
20 Chroptex Chrome	11	10	10	10	0	90	19	0	3	0	0	0	0	112	4	2.5
21 Chroptex Chrome	22	8[de]	9[cr,st]	7	2	19	2	0	4	0	0	1	0	28	8	6.5

Key: [st] = stunting; [c] = chlorosis; [n] = necrosis; [de] = delayed emergence; [cr] = leaf crinkling

Weed control: 0 = no control; 7 = acceptable control; 10 = complete kill

Crop Score: 10 = no effect; 7 = acceptable kill; 0 = complete kill

[#] = Bayer code

MERAN = Annual mercury; SOLNI = Black nightshade; CHEAL = Fat-hen; UTUR = Small nettle; MATsp = Pineapple mayweed; POLPE = Redshank; CAPBU = Shepherd's purse; GALPA = Gallant soldier; PAPRO = Common poppy

Site 3. Thornhaugh, Cambs. Runner beans unprotected.

The runner beans emerged on 2 June and were assessed for herbicide tolerance at simple leaf stage on 8 June, on 16 June and when more damage had occurred after rain during the first week in July. Results are shown in Table 3.

Crop tolerance

Three times 'normal' rates were tested at this site. On this light-very light soil there was rain after application which caused leaching and root uptake of some herbicides. Some treatments caused more crop damage than others.

Runner beans were highly tolerant of Dacthal even at 21 kg/ha (treatment **23**), and also of Croptex Chrome (**30**) and the tank-mixes, (**33**) caused only slight delay in emergence and leaf malformation. Sovereign 400 was safe to runner beans at 4.0 and 8.0 l/ha (**7** and **8**) but at 12.0 l/ha (**9**) it caused slight delay in emergence and occasional leaves became yellow later. Arresin was safe to the crop at 2.0 and 4.0 l/ha but unacceptable damage in the form of necrosis of leaf margins from 6.0 l/ha (treatment **6**, a 3 x normal dose), although subsequent growth was unaffected. Runner beans were very tolerant of Reflex T (fomesafen/terbutryn) at normal rate (**1**), but after rain the a.i. terbutryn leached and caused unacceptable damage as necrosis of large areas of the leaf from the double rate (**2**), and very severe damage from the treble rate (**3**).

Tank-mixes of Arresin + Sovereign were safe to the crop at single (**10** and **11**) and double (**12**) rates, but not at treble rates (**14**) where runner bean leaf margins were necrotic and the leaf area yellow.

The three-way tank-mix of Arresin + Sovereign + Dacthal were very safe to the crop at single dose rates (**15**, **16**, and **18**). The tank-mix (**20**) including the highest dose of Arresin was the most damaging, causing necrosis of leaf margins in July and there were slight effects of delayed emergence, crinkling and yellowing of leaves.

Sovereign + Dacthal tank-mixes caused no crop effects with the exception of the treble dose (7.5 l/ha + 21.0 kg/ha) (treatment **27**) where there was slight leaf yellowing later.

Weed control

There was a very high weed population on this site, predominantly *Chenopodium* species (fig-leaved goosefoot and fat-hen) and annual meadow-grass.

Of the single herbicide treatments Reflex T was the most effective and controlled all species except annual meadow-grass. Sovereign killed *Chenopodium* spp., stunted remaining black bindweed and gave poor control of annual meadow-grass. Croptex Chrome at 11 l/ha was inadequate on *Chenopodium* spp. and black bindweed but completely controlled annual meadow-grass. Arresin at 2.0 l/ha failed to control *Chenopodium* spp., black bindweed and small nettle but was better than other single treatments on annual meadow-grass. Dacthal at 7.0 kg/ha (**31**) was also poor on *Chenopodium* spp., and annual meadow-grass.

The tank-mix Croptex Chrome + Dacthal (**31**) gave poor control of tall competitive *Chenopodium* spp., at the rates used. Sovereign + Dacthal tank-mixes **24** and **25** did not contain sufficient Sovereign for good control, and neither did treatment **8** Arresin + Sovereign or three-way tank-mix **15**.

The most effective tank-mix treatments at this site were:-

Arresin + Sovereign at (2.0 + 3.3) l/ha (**11**) or (2.0 + 4.0) l/ha (**12**) and at double doses of the latter there was an acceptable margin of crop safety.

Arresin + Sovereign + Dacthal at (2.0 + 3.0 + 4.0) l/ha (**16**) which performed similarly to treatments **11** and **12**, or (2.0 + 4.0 + 3.0) l/ha **18** which was slightly better.

Site 3. Thornhaugh. Crop tolerance, weed control and numbers of weeds/m^2.

	Herbicide	Dose rate l(or kg)/ha	Crop Score			#Weeds/m² on 16/5											Weed Control	
		Date:	8/6	16/6	4/7	VERPE	CHEFI	ATRPA	CHEAL	UTUR	SOLNI	POAAN	BILCO	MATss	POLAV	TOTAL	16/6	10.7
0	untreated		10	10	10	5	109	5	52	9	7	52	15	5	3	257	0	0
1	Reflex T	2	10	10	9.8	0	2	0	0	0	0	0	0	0	0	15	8.8	9.6
2	Reflex T	4	10	9.5[c]	7	0	0	0	0	0	0	0	0	0	0	0	10	10
3	Reflex T	6	8.8[de]	5.5[c]	3.5[n]	0	0	0	0	0	0	0	0	0	0	0	10	10
4	Arresin	2	10	10	10	0	80	2	28	7	1	6	19	1	1	149	2	1.5
5	Arresin	4	10	9	9	0	40	2	10	0	1	0	15	0	2	70	3	4
6	Arresin	6	9.5	9.2[c]	6.2[n]	0	0	0	5	0	2	0	16	0	3	27	6	5
7	Sovereign 400	4	10	10	10	0	2	3	0	0	0	26	6	1	0	38	7	7
8	Sovereign 400	8	10	10	9	0	0	0	0	0	0	13	9	0	0	23	9.5	9.4
9	Sovereign 400	12	8.5[de]	9.5	8[c]	0	0	0	0	0	0	16	2	0	0	18	8	9.8
10	Arr + Sov	2 + 2.5	10	10	10	0	0	0	3	0	0	6	7	2	0	17	9	8.5
11	Arr + Sov	2 + 3.3	10	10	10	0	0	0	0	0	0	7	2	2	0	11	9.5	9.5
12	Arr + Sov	2 + 4	10	10	9.8	0	0	0	0	0	0	5	7	2	0	16	10	9.5
13	Arr + Sov	4 + 8	8.5	10	8.5	0	0	0	0	0	0	0	3	0	0	3	10	9.9
14	Arr + Sov	6 + 12	7.5[c]	9[c]	6.5[c]	0	0	0	0	0	0	0	3	0	0	3	9	9.9
15	Arr + Sov + Dac	2 + 2 + 4 kg	10	10	10	0	3	0	6	0	0	4	8	0	0	21	10	7
16	Arr + Sov + Dac	2 + 3 + 4 kg	10	10	10	0	1	0	3	0	0	5	4	0	0	13	10	9.5
17	Arr + Sov + Dac	4 + 6 + 8 kg	9[de]	10	9[n]	0	0	0	0	0	0	1	4	0	0	5	10	9.8
18	Arr + Sov + Dac	2 + 4 + 3 kg	10	10	10	0	0	0	0	0	0	4	2	0	0	6	10	9.8
19	Arr + Sov + Dac	4 + 8 + 6 kg	9[de]	9.8[c]	8[n]	0	1	0	0	0	0	0	2	0	0	10	10	9.8
20	Arr + Sov + Dac	6 + 12 + 9 kg	9.0[c,de]	9.2[c]	7.5[n]	0	0	0	0	0	0	0	1	0	0	1	10	10

cont……

Site 3 (continued). Thornhaugh. Crop tolerance, weed control and numbers of weeds/m^2.

Herbicide	Dose rate l(or) kg/ha	Crop Score														Weed Control	
	Date:	8/6	16/6	4/7	VERPE	CHEFI	ATRPA	CHEAL	UTUR	SOLNI	POAAN	BILCO	MATss	POLAV	TOTAL	16/6	10.7
21 Dacthal	7 kg	10	10	10	0	64	2	33	0	1	15	4	2	8	130	2	2
22 Dacthal	14 kg	10	10	10	0	31	1	23	0	0	6	0	2	1	64	4.5	4
23 Dacthal	21 kg	10	9.9[d]	9	0	3	1	10	0	1	5	3	1	1	26	6	5.5
24 Sov + Dac	2.5 + 4 kg	10	10	10	0	1	0	1	0	0	47	5	2	0	56	6.5	7
25 Sov + Dac	2.5 + 7 kg	10	10	10	0	0	0	0	0	0	35	4	2	0	41	8	8
26 Sov + Dac	5 + 14 kg	9.5	10	10	0	0	0	1	0	0	12	0	1	0	14	9.8	9.8
27 Sov + Dac	7.5 + 21 kg	8.5[de]	9.8	8.5[c]	0	0	0	0	0	0	4	0	0	0	6	10	10
28 Croptex Chrome	11	10	10	10	0	19	2	10	0	1	0	8	0	0	43	5	4
29 Croptex Chrome	22	9.5	10	10	0	12	2	18	0	1	0	2	0	1	37	6.5	5.5
30 Croptex Chrome	33	8[de cr]	9[cr]	10	0	4	2	8	0	1	0	2	0	0	17	9.2	8
31 Crop C + Dac	11 + 6 kg	10	10	10	0	14	2	15	0	8	0	0	0	4	43	5	4
32 Crop C + Dac	22 + 12 kg	9.5	10	10	0	4	4	9	0	1	0	2	0	0	20	7	6
33 Crop C + Dac	33 + 18 kg	8[de cr]	9[cr]	10	0	2	0	4	0	1	0	0	0	0	7	10	10

Key: st = stunting; c = chlorosis; n = necrosis; de = delayed emergence; cr = leaf crinkling

Weed control: 0 = no control; 7 = acceptable control; 10 = complete kill

Crop Score: 10 = no effect; 7 = acceptable kill; 0 = complete kill

Bayer code

VERPE = Field Speedwell; CHEFI = Fig-leaved goosefoot; ATRPA = Orache; CHEAL = Fat-hen; UTUR = Small nettle; SOLNI = Black-nightshade; POAAN = Annual meadowgrass; BILCO; = Black bindweed; MATss = mayweed scentless; POLAV = Kn

CONCLUSIONS: All sites were irrigated or there was rainfall after herbicide application, thus there was more information on crop tolerance from this seasons trials.

There were few crop effects from any treatment at site 1, Hallow. No treatment at 'normal' dose rate gave adequate control of fool's parsley (117 pl/m^2) which was resistant to all herbicides used at this site. (Reflex T might have performed better).

At Bramling, site 2, as a result of very shallow drilling there was damage from double doses of Arresin or Croptex Chrome, and severe and persistent damage from tank-mixes which included Arresin. Sovereign, which is less mobile through the soil profile, had a good margin for crop safety and Dacthal was very safe to the crop. With the exception of Arresin alone or Croptex Chrome alone, other treatments controlled the predominant species black-nightshade. The best weed control, with a high margin of crop safety at this site was with Sovereign alone at 4.0 l/ha, Sovereign + Dacthal (2.5 l + 6.0 kg)/ha or (2.5 l + 9.0 kg)/ha which was only slightly better.

At Thornhaugh, runner beans were most susceptible to Arresin and Reflex T but damage was acceptable at double doses. Reflex T (fomesafen/terbutryn) gave excellent weed control and was the most economical treatment. However, experiments in other crops suggest that it requires moisture and a fine level seedbed for optimum efficacy. Although fomesafen is registered for green beans, the other active ingredient is not. Tank-mixes of Arresin + Sovereign (2.0 l + 3.3 kg)/ha and Arresin + Sovereign + Dacthal (2.0 l + 3.0 l + 4.0 kg)/ha were effective and safe to the crop at twice this dose rate.

In trials so far Sovereign seems a good basis for a tank-mix, with Dacthal to improve black-nightshade control, or with Arresin or Croptex Chrome for control of annual meadow-grass. A three-way tank-mix should control many species - except fools parsley.

WITH THE EXCEPTION OF REFLEX T, ALL THESE COMBINATIONS AND SINGLE DOSES MAY LEGALLY BE USED ON RUNNER BEANS BUT THEY ARE NOT SUPPORTED BY THE AGROCHEMICAL MANUFACTURER.