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Protecting canola seedlings against Slugs and Isopods
Results of the 2007 trials

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Slugs are a major problem in crops in most countries where they occur, and the losses experienced with the establishment of canola seedlings in the Overberg are due to both slugs and isopods which are active at the same time.

From the weekly monitoring of 10 melthoid traps placed in a pasture at Roodebloem it was possible to show that there was a 17 fold increase in the number of slugs and a 1.5 fold increase in isopod numbers between April and May 2007 compared with the same period in 2006. This massive increase in the slug population was easily discernable to the farmers in the region and immediate action was taken to counter this increase by broadcasting slug pellets. Despite this, many fields had to be replanted – and even the replanted fields suffered severe losses in seedlings. Barley and wheat fields were also affected, and throughout the region slugs trails could be seen everywhere glistening in the sunlight. The efficacy of the slug pellets was questioned because they appeared to have little effect on the slug population judging from the losses of seedlings which continued unabated.

These exotic slugs which originate in countries around the Mediterranean Basin are mainly soil dwelling species which are highly adapted to winter rainfall and summer drought conditions. They mostly over-summer as adults and can be found a metre or more deep in the soil. It appears that the 'unseasonable' rains that fell in November/December 2006 were favourable to both the slugs and the isopods and many more survived the harsh summer months due to this. This was borne out in the data from the 160 melthoid traps set out in canola fields in 2007 where the slugs found under these traps were classified into four classes – tiny(2.5%), small (33.3%), medium (54.3%) and large (9.9%). The 'tiny' slugs represent those laid in autumn (April/May 2007) while the vast majority consisted presumably of juveniles and adults that had successfully survived the summer months. Based on this finding, it is quite likely that there will again be a massive increase in the slug population in 2008 following the heavy rains that fell in the Overberg in November/December 2007.

Yet despite this huge number of slugs, the majority of the losses were caused by isopods feeding mainly below the soil, either on the seed as it germinated, or as it grew towards the surface. Of the four experimental sites that were set out on the farms Heuningneskloof and Roodebloem in the Caledon district, the canola seedlings in three of the blocks were virtually completely destroyed. But the field that was the wettest of the four, and which had almost no isopods only lost about 10% of the seedlings – and this was to slugs whose numbers were significantly greater at this site. The recognizable bare patches, which expand as the slugs devour the seedlings as they move ever further from their communal holes in the ground, were found throughout this site. Once the seedlings have reached a size where there is enough foliage to feed on without destroying the entire canola plant, the bare patch expands no further. This is the reason why the slug pellets appeared to fail – the major losses to seedlings were caused by isopods feeding below the soil surface.

What transpired in 2007 was that the canola seedlings in most fields never even appeared on the surface. Both slugs and isopods are able to feed below the soil surface on seeds. Canola seeds were also broadcast on top of the surface between experimental plots at Roodebloem after the initial crop failure, but not a single plant appeared on the surface. The 2007 trial consisted of a split plot consisting of early and late planting, and four treatments viz. insecticide, slug pellets broadcast once, or twice, & controls. From the 2006 trial it had been shown that by delaying planting for about three weeks until the heavy winter rains had begun in earnest, much of the isopod damage could be circumvented. This was because the isopods fed of the water sacks at the base of the canola seedling during this period in order to prevent desiccation, thus killing the plants over a huge area almost overnight. But the erratic rainfall experienced during the early growing season in 2007 showed that this is not a viable option. Both early and late plantings were almost equally affected and there was no significant difference in the survival rate of seedlings. Piet Lombard has moreover determined that delaying planting also results in a 5% loss in production for every week delayed. In both trials the insecticide application at planting had no effect on the slugs but instead resulted in an increase in the number of isopods, presumably by killing their natural enemies.

Because of the concern over the efficacy of the slug pellets, an *ad hoc* trial was carried out at Roodebloem in conjunction with Johan Lusse and Carel le Roux of Overberg Agri. Three slug pellet formulations were tested by placing a standard amount of pellets under melthoid traps and counting the number of dead or alive slugs and other organisms under the traps after five days. The following results were obtained:

Treatment	**Slugs**		**Isopods**		**Insects**	
	Alive	**Dead**	**Alive**	**Dead**	**Alive**	**Dead**
Snailnail	3	7	21	178	3	7
Kombat	7	6	114	4	2	0
Mesurol	2	10	136	62	1	4
Control	3	0	156	0	3	0

- All three formulations of slug pellets were very effective in both attracting and killing slugs (the ‘alive’ slugs had ingested the poison and died later).
- Snailnail also killed isopods very effectively, while Mesurol was slightly less effective against isopods. The reason for this was that Snailnail consists of metaldehyde + carbaryl, and Mesurol contains metaldehyde + methiocarb, whereas Kombat only contains metaldehyde.
- However, carbaryl and methiocarb also killed insects belonging to several families, including beneficial natural enemies.

Isopods are indigenous and have an important part to play in the decomposition of stubble and are therefore an integral part of conservation farming. The 2006 trial showed that there were more isopods outside the canola fields (e.g. in pastures) than within them, and that any disturbance, as when planting, lowers their numbers further. The objective is then not to wipe out the isopod population but only to protect the seedlings during that crucial three week period after planting. Thus attempts will be made during the 2008 season to test whether it is possible to treat the seeds by coating them with carbaryl or Cruiser. Only isopods attempting to feed on germinating seeds would then be targeted.

Preliminary investigations into insect pests of canola

Cabbage aphid, *Brevicoryne brassicae*

Twenty four whole canola plants with stems packed with cabbage aphids were removed from the farms Heuningneskloof and Roodebloem and placed in insect-proof sleeves. Emerging parasites were collected each day, after which they were sorted into species and enumerated. Three parasitoid wasp species were collected of which *Diaeretiella rapae* (n=1203 or 53.5%) was the most numerous, followed by two possibly new species and have yet to be described, consisting of 1023 (45.5%) and 22 (1%) individuals respectively. *Diaeretiella rapae* has a cosmopolitan distribution and probably originates in Europe, whereas the two undescribed species are likely to be indigenous species that have swapped to an exotic host. There was almost 100% parasitization within the sleeves and this was mirrored in the canola fields where all signs of the aphid had disappeared within two weeks.

The European weed, *Sonchus asper* is found on road verges throughout the Overberg and frequently is packed with aphids. Plants were uprooted and placed in sleeves. It was found that there were two aphid species present (*Hyperomyzus lactucae* and *Uroleucon sonchi*) which are believed to be exotic, but no parasites were found. These results indicate that the weed does not harbour the cabbage aphid and is therefore not an infection source for canola. But neither are they a reservoir for the parasitoids of the cabbage aphid, although they did support generalist coccinellid (ladybird) predators of aphids.

Diamondback moth, *Plutella xylostella*

Twenty–four canola plants containing Diamondback moth (DBM) eggs and larvae were uprooted at Roodebloem and placed in insect-proof sleeves. They were monitored daily and emerging DBM and its parasitoids were removed, sorted into species and enumerated. Two of the parasitoid species that emerged were parasites of the cabbage aphid, indicating that there must have been some 'mummies' (parasitized aphids) on the plants that had not been detected. The overall rate of parasitism of the DBM was a reasonable 30.0%. There were four parasite species that emerged in the sleeves, with the wasp *Diadegma mollipla* being the most abundant species (92%). This parasitoid occurs only rarely in the canola fields on the Highveld, so 72 live individuals were posted to Pretoria where they were mass reared for release. The most effective parasitoid in the Highveld regions is the larval parasitoid *Cotesia plutellae* which has not yet been found in the Overberg and can possibly be introduced to augment the natural enemies already present. The parasitoid *Diadegma semiclausum* which originally came from Europe but has been introduced into many countries as a biological control agent against the DBM has also been imported into South Africa for initial release on the Highveld.

Cabbage stem weevil, *Ceutorhynchus pallidactylus*

This snout beetle originates from Europe and was first collected in Stellenbosch in 1982 on grapevines, and soon thereafter it appeared in Nelspruit. It has thus been in South Africa for almost 26 years but only became a pest of canola about two years ago. A survey carried out on the new oilseed crop Crambe at Roodebloem showed that every stem had been hollowed out by the larvae of the weevil (n=800). Crambe was far more attractive to the weevil when compared with canola where 68% of the stems were hollowed out. By analyzing the stubble after harvesting, it was clear that the beetles do not pupate or over-summer in the stubble. Pupation takes place in the soil at the base of the plant, and it appears that there is only one generation per year. The significance of this is that if the adult weevils lay only once in a season, and this period can be determined, then control measures perhaps using insecticide sprays can be implemented with some reasonable hope of success.

The steady increase in the numbers of this pest is worrying, and it appears that conservation farming where there is minimal working of the soil has allowed more beetles to survive. This increase in the survival rate may also be ascribed to the improved soil texture and the greater retention of moisture. Although canola plants may topple over due to the action of the weevils and translocation within the plant is curtailed, at present it is not possible to put a financial cost to the possible losses that may be experienced. Because Crambe is more attractive to the weevils and they infest them earlier, it may be worth considering using this as a trap crop (which is destroyed once the plants are full of weevils) to protect the canola plantings.

Unidentified beetle pest.

For the first time a small (about 3mm long) beetle was found feeding on the leaves of canola plants at Roodebloem on the 20 November 2007. The leaves become pitted where they feed and what is of concern are the huge numbers which were present. The plants (remnants of the variety trials) were attacked after most canola had already been harvested and thus at this stage do not pose a threat to the industry. However, should they become active earlier in the growing season and they escalate in numbers, they could become problematical. The beetle is being identified by the National Collection of Insects in Pretoria.

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BEMESTINGSRIGLYNE VIR CANOLA IN DIE WINTERREëNSTREEK

Saamgestel deur D Hanekom en H Agenbag

Optimum grondvereistes: pH van 5.0 – 7.0 (KCl) met maksimum suurversadiging van 10%
P ± 36 dpm (Sitroensuur) ± 24 dpm (Bray 1)
K > 60 dpm (sitroensuur- en Bray 1 metode).

Hierdie waardes verteenwoordig vlakke in die grond waar saadopbrengs nie beperk sal word nie indien slegs onderhoudsbemesting gegee word. Let wel: Om 'n sinvolle aanbeveling vir canola te doen, moet 'n volledige grondontleding wat beide die koolstof % en klipfraksie insluit verkry word.

Stikstof

Net soos by koring moet reënval, wisselbou, grondtekstuur, koolstofinhoud, plantdatum, vestigingsmetode en die opbrengsmikpunt in aanmerking geneem word by die bepaling van die stikstofbehoefte.

Tabel 1 Stikstof bemestingsriglyne vir canola.

Gebied en Reënval	Opbrengs Potensiaal	Kg N per ha vir canola na		
		Lusern*	Eenjarige peulgewas stelsel	Graan-stoppel***
SUIDKAAP (65% winterreëns)				
< 350 mm	1.25 t/ha	10	25 - 30	30 - 50
350 - 425mm	1.5 t/ha	10 - 20	30 - 35	50 - 70
425 - 500 mm	2.0 t/ha	20 - 30	40 - 45	60 - 90
> 500 mm	2.5 t/ha	40 – 50	50 - 55	80 - 110
SWARTLAND (83% winterreëns)				
< 325 mm	1.25 t/ha		50 - 70**	70 - 90
325 - 425 mm	1.75 t/ha		70 - 90	90 - 110
>425 mm	2.50 t/ha		90 - 110	110 - 130

* *Weiding waarin grasse beheer is.*
** *Hoër waarde van toepassing op ligter gronde.*
*** *Sluit minimum- en geenbewerking in.*

Stikstof met vestiging

- Gebruik verkieslik nitraatgebaseerde stikstof of ureum weg van saad geplaas
- Planter(gebandplaas by saad) – 20 kg N/ha met saai vir 25cm ry
  Skaal af na 15 – 18 kg N/ha vir wyer rye
- Breedwerpig – nie meer as 30 kg N/ha met saai waar reënval < 350 mm
  maximum van 40 kg N/ha met saai waar reënval > 350 mm

Stikstof bobemesting

Die verdeling van stikstofbemesting by canola moet spesiale aandag kry. Oor die algemeen word twee bobemestings aanbeveel. Die eerste bobemesting moet op 30 tot 40 dae na opkoms geskied. Op swaarder gronde word aanbeveel dat ten minste ± 65% van die bobemesting reeds op 30 dae na opkoms toegedien word. Op ligter gronde, wat geneig is om baie te loog, word twee gelyke bobemestings aanbeveel nl op 30 dae na opkoms en met die aanvang van stamverlenging. Indien daar bonormale reënval rondom 60 tot 70 dae na opkoms voorkom, moet die tweede bobemesting dienooreenkomstig verhoog word. Waar kuilvoercanola verbou word, word aanbeveel dat 40 kg N/ha breedewerpig uitgestrooi met saai en 50 tot 60 kg N/ha as bobemesting op 30 tot 40 dae na opkoms.

Canola onder besproeiing benodig ongeveer 150 kg N/ha wat as volg toegedien word:

30 kg/ha	-	met plant breedwerpig – 20 kg/ha indien gebandplaas
40 kg/ha	-	20 dae na opkoms
40 kg/ha	-	30 dae later
40 kg/ha	-	50% blomknopvorming

Fosfor

‘n Grondwaarde van 36mg/kg (sitroensuur) of 24 mg/kg (Bray1) word as vertrekpunt geneem. By laer of hoër grondontledings word aanpassings gemaak met inagneming van faktore wat opbrengspotensiaal bepaal (Tabel 2). ‘n Onderhoudsbemesting van 10 kg P/ha word aanbeveel. In graanwisselboustelsels kan toedienings in Tabel 2 met 30% afwaarts aangepas word.

Tabel 2 Fosfor bemestingsriglyne vir canola in ‘n peulgewas wisselboustelsel.

Fosfor status van die grond (mg/kg)		P bemesting
Sitroensuur	Bray 1 vir pH < 5.5	(kg P/ha)
10	6	30
20	14	24
30	20	18
40	28	15
50+	34+	10 (onderhoud)

Kalium

As riglyn word die kaliuminhoud van grond op ongeveer 80 mg/kg vir swaarder en 60 mg/kg vir liggetekstuurde grond gestel. Volgens hierdie riglyn sal kaliumbemesting selde nodig wees. By laer ontledings word kalium soos vir koring toegedien (Tabel 3). As kunsmis gebandplaas word, kan ‘n te hoë soutlading skade veroorsaak en word aanbeveel dat kalium breedwerpig uitgestrooi en ingewerk word.

Tabel 3 Kalium bemestingsriglyne volgens grondontleding (Sitroensuur of Bray 1, mg/kg)

Swaargetekstuurde Gronde		Liggetekstuurde Gronde	
Kalium (mg/kg)	K-bemesting kg/ha[#]	Kalium (mg/kg)	K-bemesting kg/ha
< 50	30	< 50	30
50 – 80	20	50 – 80	15
> 80	0 – 20	> 80	0

Swawel
Die swawelbehoefte van canola is ongeveer viermaal meer as dié van koring. Spesiale aandag sal dus aan die bemestingsprogram gegee moet word wat betref swawel. Daar word algemeen aanvaar dat die swawel behoefte van canola 15 tot 20 kg S/ha per ton opbrengs per jaar is. Vir swawel aanvulling by canola kan die riglyn van Tabel 4 gebruik word. Die tyd van monsterneming is belangrik (kort voor plant) aangesien die S-inhoud van gronde dikwels wissel gedurende die seisoen. Die koolstof inhoud gee 'n redelike goeie aanduiding van die swawelstatus van gronde met waardes < 1% wat dui op moontlike suboptimale vlakke.

Tabel 4 Riglyne vir swawel bemesting volgens swawelinhoud van gronde.

Sulfaat S mg/kg in grond	Interpretasie vir bemestings aanbeveling
<6	Gebrekkig: S toediening hoër as spesifieke gewasbehoefte(> 15-20 S/ha)
7-12	Voldoende: S toediening teen instandhoudingspeil(15kg S/ha)
>12	Meer as voldoende: S toediening minder as instandhoudingspeil (10 kg S/ha)

Swawel moet verkieslik in kombinasie met stikstof as bobemesting gedurende die groeiseisoen toegedien word. Laasgenoemde is veral belangrik by hooggeloogde gronde met 'n koolstofinhoud van < 1%. As alternatief kan daar op gronde, met 'n geskiedenis van gebrekkige swawel-inhoud, 'n toediening van 300kg/ha Gips (Ca_2SO_4) voorsaai, bo-op of net vlak ingewerk word, wat in die meeste gevalle voldoende sal wees. Dit is belangrik om te weet dat plante slegs swawel in die wateroplosbare ($SO_4^{=}$) vorm kan opneem.

Ander plantvoedingstowwe
Canola is gevoelig vir boor- en molibdeen tekorte, veral waar molibdeentekorte met 'n lae pH gepaardgaan. Tekorte kan opgehef word deur die toediening van natriummolibdaat (150 g/ha as blaarbespuitings) en solubor (1kg/ha as blaarbespuitings). Die praktyk van saadbehandeling met molibdeen word nie aanbeveel nie, aangesien daar dikwels nie genoegsame molibdeen met hierdie metode toegedien word nie Die toediening van boor as 'n grondtoediening in die canolajaar word nie aanbeveel nie aangesien dit die ontkieming van sade kan belemmer. Die koper, sink en mangaan behoeftes is hoër as vir koring.

Sekere faktore soos grondtekstuur, pH, bekalking, loging, hoë koolstofinhoud en grondkleur kan dikwels gebruik word as indikasie vir moontlike tekorte. By hoër potensiaal gronde word die groter syfers gebruik.

Ontledings moet beoordeel word in konteks van groeikragtigheid en moontlike spuitreste.
(Bron: "Interpretation of Plant Analysis", CSIRO Publishing, P.O. Box 1139, Collingwood, VIC3066, Australia)

Tabel 5 Die grondontledingsnorme vir spoorelemente wat tans vir canola gebruik word, is as volg (dpm of mg per kilogram, EDTA oplosbaar).

Element	Gebrekkig	Laag	Voldoende
Koper	0.3	0.3 – 0.5	0.5
Sink pH<5.5	<0.5	0.5 – 0.7	>0.7
pH>5.5	<0.7	0.7-1.0	>1.0
Mangaan pH<5.5	<5.0	5 – 10	25
pH>5.5	<10.0	10-20	
Boor (warm water)	0,2 – 0,3	0,3 - 0,5	0,5

Sekere faktore soos grondtekstuur, pH, bekalking, loging, hoë koolstofinhoud en grondkleur kan dikwels gebruik word as indikasie vir moontlike tekorte. By hoër potensiaal gronde word die groter syfers gebruik.

Blaarontledingsnorme vir canola

N	>	3.5%	Voldoende
K	>	2.2%	Voldoende
P	>	0.3-0.6%	Voldoende
Ca	>	1.4-3.0%	Voldoende
Mg	>	0.2-0.6%	Voldoende
Na	>	0.03-0.5%	Voldoende
S	>	0.5%	Marginaal
	>	0.5-0.8%	Voldoende
Cu	>	3-5 mg/kg	Voldoende
Zn	>	20 mg/kg	Voldoende
Mn	>	30-200 mg/kg	Normaal
B	>	20-50 mg/kg	Normaal
Mo	>	0.25-0.5 mg/kg	Voldoende

Aanvulling van spoorelemente

Spoorelement aanvulling is nodig wanneer grond "laag" of "gebrekkig" ontleed. Tekorte aan spoorelemente kan aangevul word deur blaarbespuitings of grondtoedienings. Grondtoedienings se nawerking is gewoonlik baie langer as die van blaarbespuitings. In kalkryke gronde met hoë pH, word mangaan in die grond ontoeganklik vir plante en sal dit as blaarbespuiting toegedien moet word. Belangrike aspekte wat in gedagte gehou moet word vir die suksesvolle aanvulling van spoorelemente is:

- Tekorte moet reg geïdentifiseer word.
- Plante moet aktief groei (nie onder vogstremming verkeer) en die blaaroppervlakte moet voldoende wees.
- Plante moet droog wees en dit moet nie baie warm wees tydens aanvulling nie
- Ten minste 2-3 uur tyd moet verloop na blaarbespuiting voor reën of besproeiing vir voldoende opname deur die plant.
- Kom spesifikasies van die vervaardigers deeglik na om sukses te verseker.
- Spoorelemente moet nie met onkruiddoders vermeng word nie.

- Waar mengsels van spoorelemente gebruik word moet die laer dosis van die verskillende elemente gebruik word ten einde 'n te hoë soutlading te voorkom wat blaarskroei kan veroorsaak.

- Behoorlike benatting van die plant is baie belangrik vir die beste resultate, m.a.w. gebruik die aanbevole hoeveelheid water indien moontlik.

Tabel 6 Spoorelement aanbevelings vir canola

Spoorelemente	**Blaarbespuiting 500 liter water per hektaar**	**Grondtoediening kg per hektaar**
Sink (Zn)	1-2 kg sinkoksied	3,5 – 7 kg sinkoksied
Mangaan (Mn)	2-4 kg mangaansulfaat	Ondoeltreffend
Boor (B)	2-4 kg boraks of 0,5 - 1,0 kg solubor	Word nie aanbeveel
Koper (Cu)	1 - 1,5 kg koperoksichloried	2,5 – 5,0 kg koperoksichloried (wees versigtig op sandgronde)
Molibdeen (Mo)	100 - 150 g natrium molibdaat of ammoniummolibdaat	250 - 500 g natrium of molibdaat ammoniummolibdaat

Hierdie riglyne vervang alle voorafgaande riglyne deur die PNS vrygestel

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