Annual technical report

Year: **2006**
Project number: **02020207/1**

Title: An investigation into the production dynamics of eight crop rotation systems including wheat, canola, lupins and pasture species in the Swartland

Project leader: **M B Hardy**
Co-worker: **S Laubscher**

Report compiled by M B Hardy and S Laubscher
Crop Development Section, Chief Directorate: Agriculture, P/Bag X1, Elsenburg 7607

The inputs of the Swartland Crop Rotation Technical Committee are appreciated and gratefully acknowledged.

Introduction

This report covers the period January 2006 to December 2006 for crop data, and from September 2005 to September 2006 for sheep data. Details of the respective treatments are presented in the 'Action Registration' and previous reports.

The main experiment was conducted as stipulated in the detailed project proposal. Details of all activities, inputs and outputs for the 2006 season are summarised in this report.

Project funding and planning

Continuation of the project was supported by the Department and the GSA Winter Rainfall Region's Research Committee. Working capital requirements for 2006 were provided by the Winter Cereal Trust (WCT) and the Protein Research Foundation (PRF). The Department of Agriculture, Western Cape, provided manpower and facilities. Application to the PRF and the Winter Cereal Trust (WCT) for continuation of funding for the 2007 production-season was successful.

Management requirements for each crop and treatment were re-evaluated by the Swartland Crop Rotation Technical Committee before the start of the season (on 13/02/06). The management guidelines (protocols) agreed on by the meeting are presented in Appendix 1.

Procedure

The protocols presented in Appendix 1 were followed as closely as possible but were adjusted as necessary as a function of climatic conditions and variable weed and disease control requirements. A copy of the 'plot-plan' for 2006 is appended (Appendix 2). As with previous years a record of all activities (i.e. implements used, time taken for a particular activity e.g. planting, amounts and types of herbicides applied etc) has been kept for each replicate of each treatment to facilitate the calculation of input costs to each crop rotation system. These records are maintained at Langgewens. A detailed daily diary of activities during 2006 is presented in Appendix 3.

Soil samples

Soil samples were taken in December 2005 to assess the fertility status as well as to determine the organic carbon content (%) of the soils in each camp. The samples were analysed using the routine techniques used by the Elsenburg soils laboratory. For soil fertility assessments, composite samples were made up of samples taken to a depth of approximately 150mm at the "top" and "bottom" ends of each camp. Samples were taken

from ridges only (samples "camp No./1" – "top" of camp & "camp No./2" "bottom" end of camp) i.e. two composite 'ridge' samples per camp/sub-camp (96 samples in all). Fertilisation recommendations for each camp for the 2006 season were based on these analyses.

Soil amelioration

Lime (either calcitic or dolomitic) and gypsum were applied as required in late March 2006 (see Appendices 3 & 4 for timing of application and amounts applied)

Fertilisation

Fertilisation recommendations were made in collaboration with technical staff from Kynoch/Yarah (J Bester). Recommendations were based on the results of analyses of samples taken in December 2005, the crop grown in 2005 and the crop to be grown in 2006, and are presented in Appendix 4. Total N application for canola after wheat was 66kgN/ha and after medics was 62 kgN/ha. Total N application to wheat after wheat and canola was 66 kgN/ha, and after medic pasture was 52 kgN/ha. Phosphorus was applied (band-placed to the lupin camps as MAP (100 kg/ha) i.e. 11kgN/ha was also applied to those camps.

Planting

All crops were planted with recommended (Appendix 4) levels of fertiliser.

Top dressing

Top dressings were applied as planned to the canola in early June (42 days after planting) and to the wheat on mid-June. After measuring chlorophyll levels in the leaves of wheat it was decided that further topdressings would not be necessary (readings above threshold level of 575).

Pastures

MAP was applied (broadcast) at 100kg/ha to all legume pastures.

Planting

Crops

The procedures used are presented in Table 1. Preglone was used as a pre-sowing herbicides on all wheat camps. All crops were planted with the newly acquired AUSPLOW planter (11 tines and 300mm tine spacing). Trifluraline was applied during planting of all wheat camps. Simazine was applied during planting of canola and lupin camps.

Table 1 Details of the crop (planting date & cultivar), actual seeding rate, and planting and soil preparation implements used in 2006

Crop (planting date)	Cultivar	Seeding rate $kgha^{-1}$	Planting Implement	** Soil prep. Implement (depth cm)	** No. of cultivations
Wheat (08 to 11/05)	SST027	65	AUSPLOW	No soil prep	Only during planting
Lupins (21/04)	Tanjil	90	AUSPLOW	No soil prep	Only during planting
Canola (20/04)	ATR Stuby	4.0	AUSPLOW	No soil prep	Only during planting

The 1000-kernel weights (TKW), germination %, required plant density, assumed establishment % and calculated seeding rate for each crop are presented in Table 2.

Table 2 Data used for calculating the seeding rate for each crop planted in 2006

Crop	TKW (g)	Germination %	Required (plants/m^{-2})	Assumed establishment (%)	Seeding rate ($kgha^{-1}$) – est.
Wheat	35.8	96	150	80	70
Lupins	146	96	45	70	98
Canola	3.8	86	60 -70	50	5.7

Pastures

The pastures were allowed to re-establish from the seed available in the soil seed bank. A mixture of 4 medics cultivars viz. Paraggio, Parabinga & Santiago was sown-in to camps 43, 44 & 60 at a rate (mixture) of 4kg seed/ha. These were all medic/clover pasture camps but the clovers (Balanse and Rose) were not available in the market when required.

Weed, insect and disease control – crops and pastures

The planned control measures as stipulated in the protocol were followed but adjusted according to climatic conditions encountered during the season. The actual chemical control measures used in the various crops during the report period are provided in the detailed records kept for each camp. As mentioned above these records are maintained at Langgewens. They are also reflected in the MICRO-COMBUD economic analysis 'budgets' that have been done for each camp and each production year.

Animal management

Animal management procedures followed those described in previous reports (see details in Appendix 5). Supplementary feeding, initially at a rate of 200g per ewe per day and then increased to 300g per ewe per day, was continued until 16 June 2006.

All the Ewes were shorn on 11/10/2006 (a wool sample from each ewe was sent to the wool-testing lab at Middelburg for analysis). Lambs were "weaned" on 14/09/2006 and marketed together with ewes that were to be replaced on the same date.

Data collection procedures

Sheep:

The animals were weighed at regular intervals without starvation to provide data for determining growth rates of lambs and mass change of ewes on pastures, crop residues and on additional grazing camps. Differences in livemass gains of lambs and mass change of ewes could not be attributed to differences among treatments. Average carcass mass and grading of the ewes and lambs were therefore used, together with wool production, for the COMBUB economic analyses of sheep production for each treatment.

Pastures:

- Medic and clover seedling counts were done on 06/06/2006 in 40 randomly located 0.05 m^2 quadrats for each of the pasture camps when it was judged that the maximum number of legumes seedlings had established in a particular treatment camp.
- Pod counts and pod mass determinations were done (at soil surface) in 40 randomly located 'cores', of 105mm diameter, from each of the pastures grazed during 2005 (i.e. camps 36, 37, 41, 47/1, 47/2, 51. 54, 56/1, 56/2 and 57) on 12/01/2006. These data provide estimates of the mass of pods available as forage during the dry season and the mass of pods that remain on the camp to be cropped in 2006.

Pod counts and pod mass determinations were also done from 40 soil 'core' samples to a depth of 80mm on camps which were to be allowed to re-establish to medic and medic/clover pastures during 2006 (i.e. camps 42/1, 42/2, 43, 44, 48, 55, 58/1, 58/2, 59 & 60) on 17/01/2006). These data provide estimates of the mass of pods in the soil that would potentially add seed to the seed-bank (seed mass comprises approximately 30% of the dry mass of these buried pods).

- Exclusion cages were again used to estimate herbage intake and herbage mass accumulation through the growing season. Ten exclusion cages were located in each of the pasture camps before animals were allocated to the camps. Herbage samples were cut at monthly intervals from 10 July to 05 October 2006 within each cage (quadrat size = 1.0m x 0.25m). A "paired" sample was also cut outside the cage where there was material to cut.

  Herbage samples were **not** separated into different pasture fractions e.g. medic & clover, broad-leaved weeds, grasses and dead material, as occurred in previous seasons. It is estimated that grass weeds comprised less than 20% of the herbage in any camp. Samples, therefore comprised pasture and grass weed fractions. Cut samples were dried and weighed, and dry matter production calculated for the sampled area. The cages were strategically placed in each camp so as to sample the variation in pasture production across each camp. Care was taken to include ridges, furrows and the sides of ridges in the areas sampled. After sampling the cages were moved to a new location within the top or bottom halves of each camp respectively. Four sampling dates were possible in 2006.

Seedbank study

The detailed seed bank studies of all camps (continuous cropping and crop/pasture systems) continued in 2006. Soil samples were collected at the end of March. Each sample was made up of a composite of 20 "cores" each 40mm in diameter. Soil "cores" were taken to a depth of 50mm. Two composite samples were taken per treatment camp, one from the "top" half of the camp and the other from the "bottom" half of the camp. Seedling trays were filled to just over half their depth with weed-free, treated nursery bark. Each composite soil sample was placed into a separate seedling tray, on top of the bark and to a depth of 20mm, directly after sampling. Seedling trays were kept moist under shade cloth. The number of seedlings that emerge in each tray was counted, by species, during the growing season. Once identified the seedling was removed from the tray. Data from each replicate were combined to give mean seedling numbers per treatment.

Crops:

Wheat

- Plant counts were done (on 6th June) in 20 quadrats for each replicate of each wheat treatment. A quadrat size of 0.25m^2 (1000mm x 250mm) was used. The quadrat is placed randomly but at each placement was moved to ensure that it covered 4 planted rows. The conversion factor of plants per quadrat to plants per square meter is 3.33 (300mm row width).
- The wheat was harvested using a combine harvester. The whole camp was harvested. Wheat was bagged and weighed. Two 3-kg composite samples were taken of the grain harvested in each camp. The samples were sent to i): the WPK Co-Op depo at Russtasie for protein, hectolitre mass and 'sifsels' determination; and ii) the Dept of Crops and pastures at Stellenbosch for protein, hectolitre mass, falling number and TSW determination. Crop residues were spread behind the harvester (but were not "chopped").

Canola

- Seedling counts were done on 06/06 in 20 quadrats (0.25m^2) for each camp planted to canola using the same procedure as described for wheat camps (conversion factor = 3.33). Crop residues were spread behind the harvester.

Lupins

- Seedling counts were done on 06/06in 20 quadrats (0.25m^2) for each camp planted to lupins using the same procedure as described for wheat camps (conversion factor = 3.33). Crop residues were spread behind the harvester.

Component trial areas:
No component trials were conducted during the 2006 season.

Economic analysis
As for the previous seasons' data sets each camp was treated as a separate economic entity. All data, required to develop income and expenditure budgets, are in the process of being captured using MICRO-COMBUD package for each of the 48 camps. The economist responsible for this component of the project resigned at the end of 2006 before finalizing and verifying the data sets captured on MICRO-COMBUD to date.

Summary of results

Rainfall

Rainfall data are presented in Figure 1. The year started with the normally expected hot and dry summer. No significant rainfall was recorded during February and March. The first significant rains fell on the 21st & 22nd of April (18mm). A total of 341mm fell between 1 April and the end of October made up of relatively consistent rainfall events (Figure 1). Moisture availability was therefore high for most of the growing season and, at times, plants may have been stressed due to excessive soil moisture. Maximum daily temperatures varied from about 15 to 25^{o}C for most of the growing season (Figure 1).

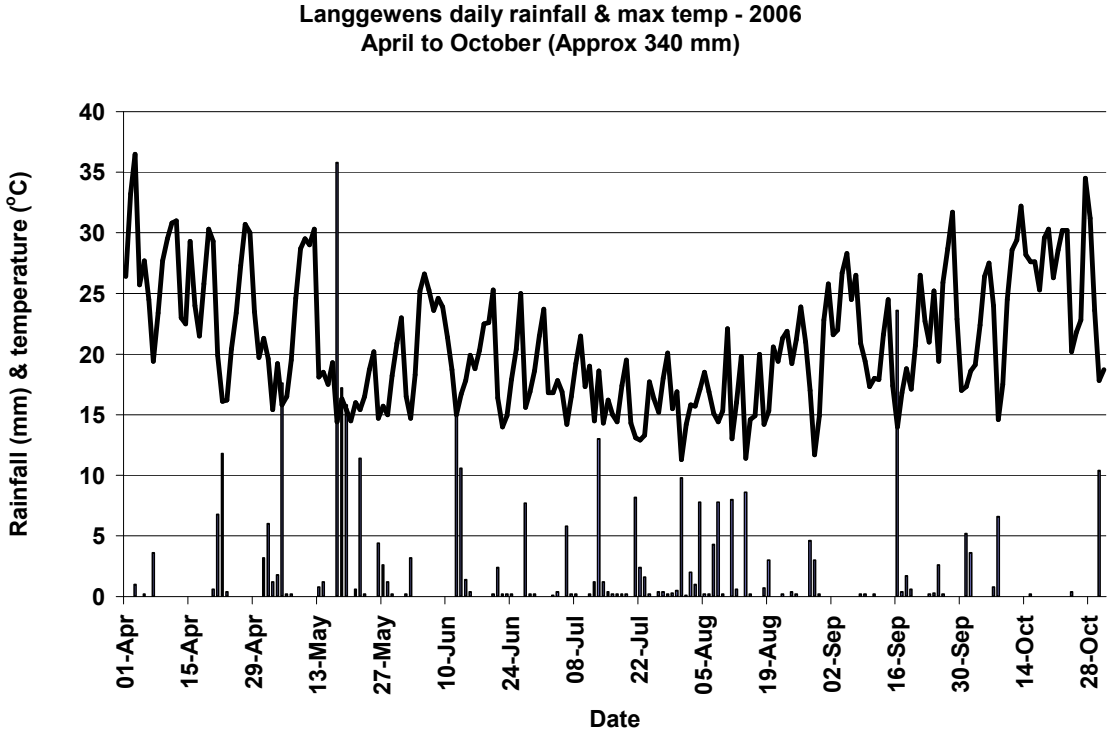


Figure 1: Daily rainfall and max daily temperature recorded for April to October 2006 at Langgewens

Sheep data

Ewe mass changes, from 21/09/2005 to 20/08/2006 are presented in Figures 2 & 3 for animals on the medic and medic/clover pastures respectively. Note that ewe and lamb numbers per group were balanced in mid-June 2006 to ensure similar grazing pressure among all treatments. Average mass change of lambs per group in each pasture type is presented in Figures 4 & 5.

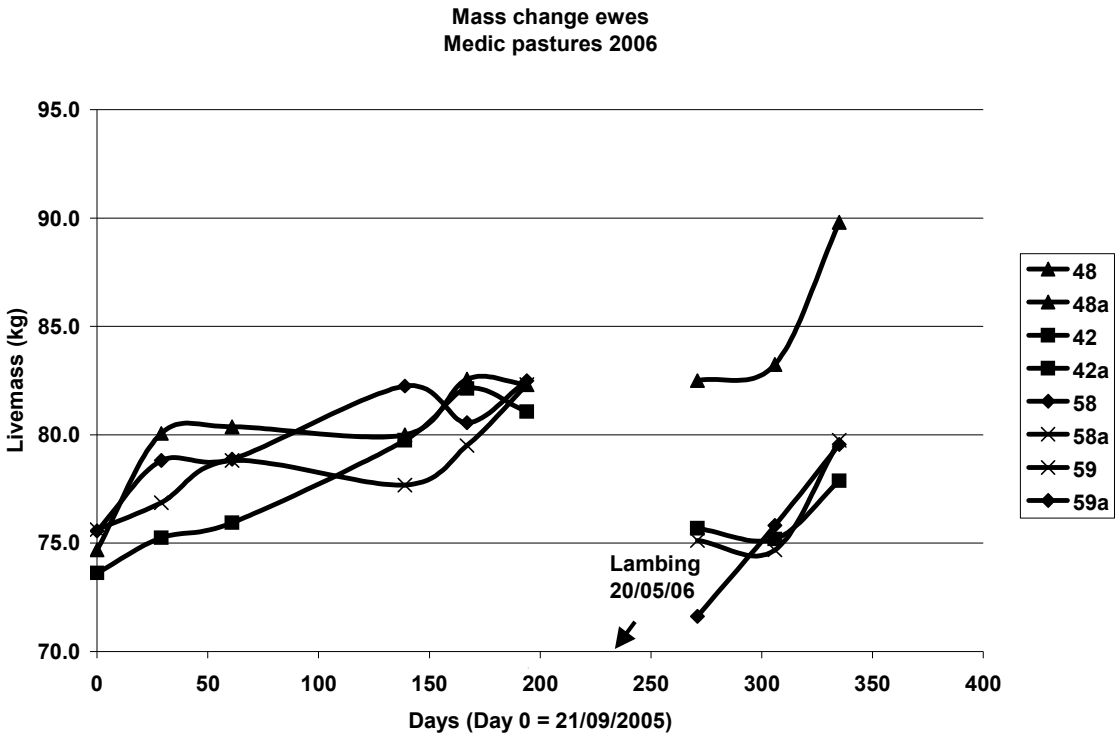


Figure 2: Mean mass change of ewes allocated to Medic pasture treatments

The ewes remained on camps cropped during 2005 until mid-March 2006 after which they were moved to the 2005 medic and medic/clover camps to utilize pasture residues (Appendix 5). In contrast to previous seasons additional fodder (e.g. lucerne or oats hay) was not provided to any groups of ewes during the 2005/2006 report period. All groups were moved to their respective pasture camps during June 2006 (Appendix 5). A supplement of 200 & 300g/ewe/day was provided to all animals 6 weeks prior to lambing and at lambing respectively.

Positive ewe mass gains during the summer months and prior to weaning indicated adequate quality and availability of fodder. The positive growth responses of both ewes and lambs in all pasture treatment camps after lambing reflects adequate pasture availability during the 2006 growing season. Refer to pasture production data in this regard.

Mean greasy wool yield per ewe was similar for all treatments (Table 3).

Soils data

Detailed records of the chemical status and % organic carbon content of soils (for both the ridges and furrows) of each camp are available on file. Fertilisation recommendations (Appendix 4) for 2006 were partially based on these data.

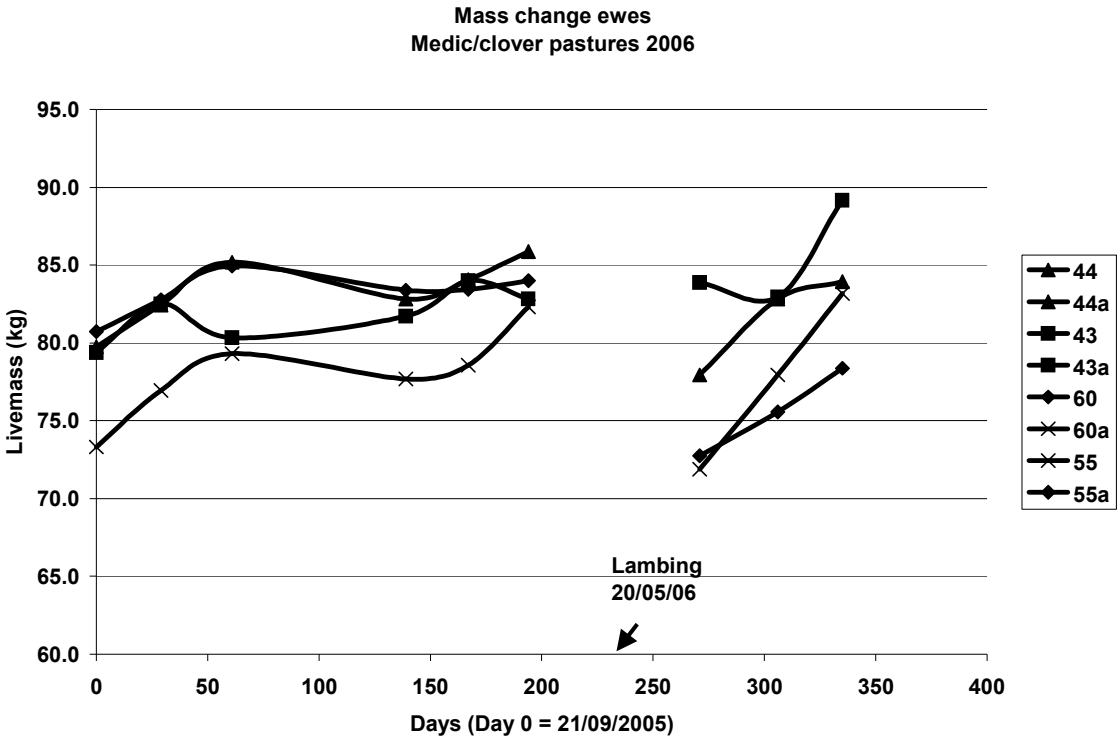


Figure 3: Mean mass change of ewes allocated to Medic/clover pasture treatments

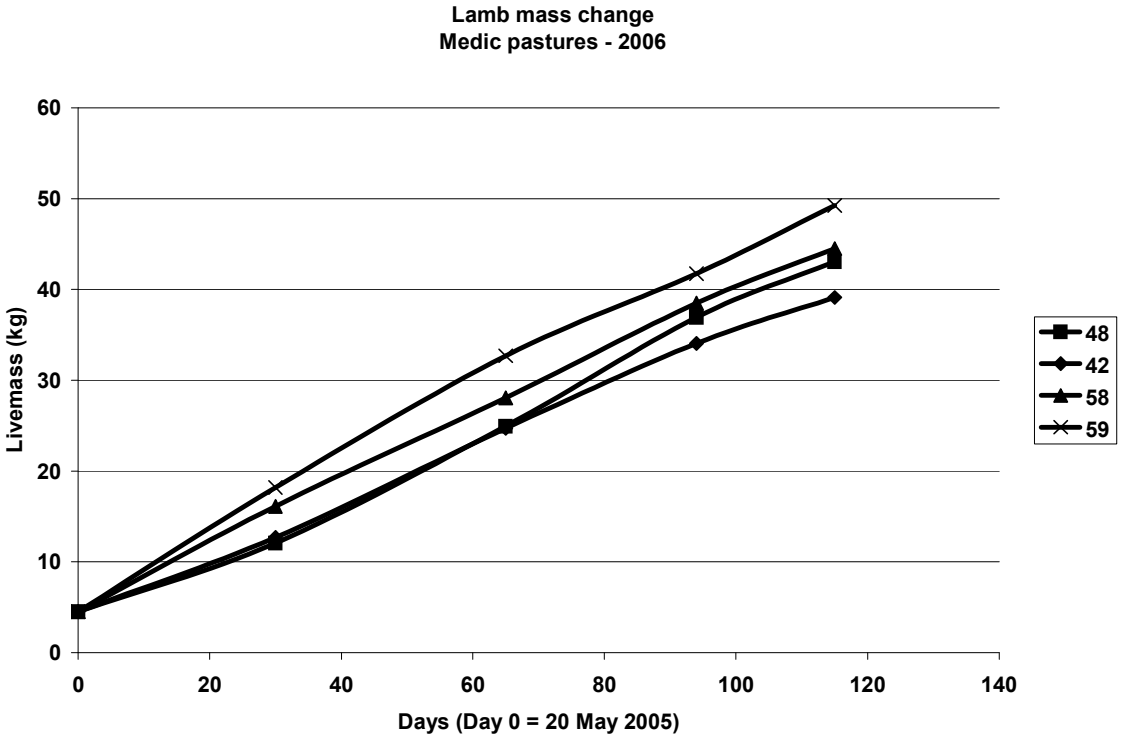


Figure 4: Mean mass change of lambs allocated to Medic pasture treatments

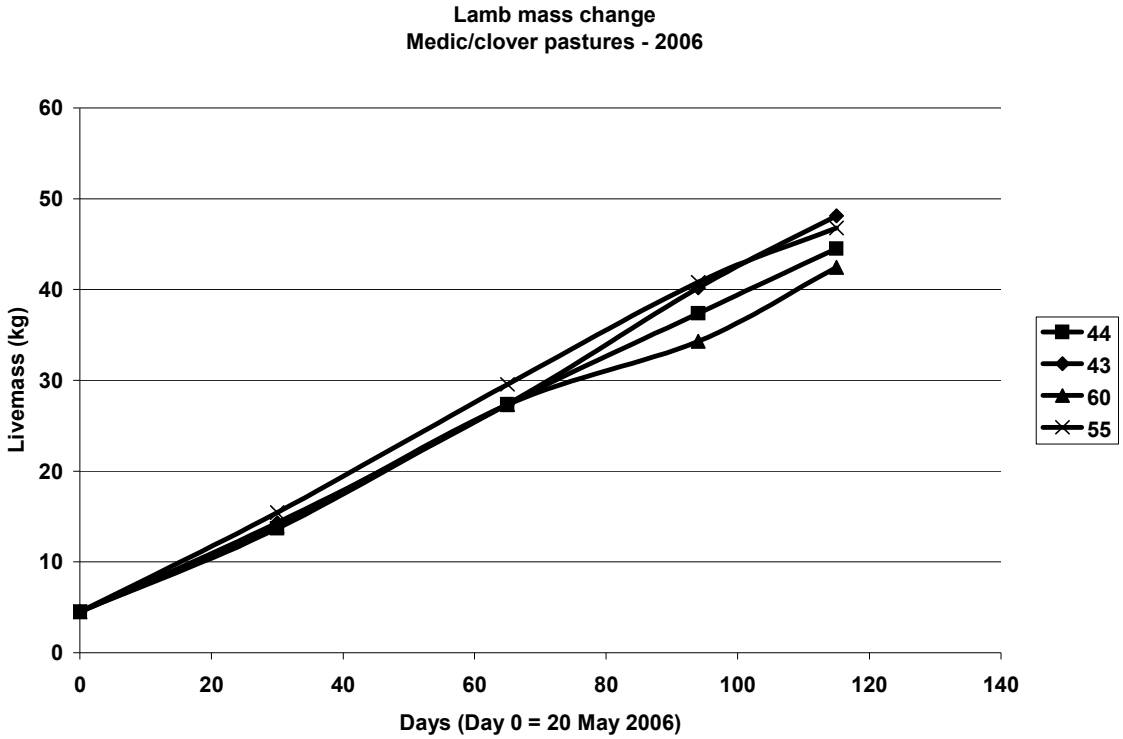


Figure 5: Mean mass change of lambs allocated to Medic/clover pasture treatments

Table 3 Summary of sheep numbers and wool data for 2006

System	Camp	Number Of Ewes	Number Of Lambs	Mean greasy wool yield per ewe (kg)
E	48	8	8	3.2
E	59	8	8	3.2
F	44	8	8	3.4
F	55	8	8	3.2
G	42	8	8	3.6
G	58	8	8	3.5
H	43	9	8	3.6
H	60	9	8	3.2

** E Medic/wheat rotation
F Medic-clover/wheat rotation
G Medic/wheat/medic/canola rotation
H As for F but including the use of a saltbush camp at the start of the lambing season (hence the higher stocking rate of ewes)

Soils data

Detailed records of the chemical status and % organic carbon content of soils (for both the ridges and furrows) of each camp are available on file. Fertilisation recommendations (Appendix 4) for 2006 were partially based on these data.

Pasture data

1 Seedling counts

Seedling counts for the medics and medic/clover pastures recorded in soil samples taken from the camps that were to be used for grazing in 2006 are presented together with data for each season from 2000 to 2005. These data indicate that seedling densities appear to be declining in most of the camps and are at levels that are potentially to low for optimum dry matter production (Appendix 6). It should be remembered that camps 43, 44 and 60 were re-seeded at the start of the 2006 growing-season and any seeds that germinated would have been included in the estimates. As stated in the previous report, seedling densities in excess of 400 plants per square meter are considered optimum for ensuring maximum dry matter production from the pastures in a particular season.

As reported in 2005 the summarised **weed seedling** density data derived from the **soil seed-bank study** indicate that the potential seedling density was far higher than that recorded in the field situation. These soil seed-bank data will continue to be collected and will be collated in a detailed report when a sufficient number of years of data become available.

This was the 2nd year that soil seed-bank studies have been conducted on all camps in the trial area (see the 2005 report for further information on this study). A summary of ryegrass densities as determined from the soil seed-bank study of all camps in the trial during 2006 is presented in Appendix 7. Note that the ryegrass densities in the MWMW treatment (Appendix 7 Fig 2) are higher than expected. Inspection of the raw data indicates an abnormally high ryegrass count in sub-sample 59/1 taken for that treatment. This monitoring action will continue for the duration of the trial in order to provide long-term data on the effects of rotation system, crop management and herbicide use on weed densities.

2 Dry matter production of pastures

Estimated dry matter production per hectare of pasture camps over four sampling dates are presented in Figures 6 and 7 for the medic and medic/clover pastures respectively. Note that the figures show total dry matter production and do not differentiate between medic and clover production. As mentioned in the procedure grass and broad-leaf weeds were not separated from legume content of the samples. The data provide estimates of total herbage dry matter on offer for each camp on the date of sampling (cages were moved to new site within the camp at each sampling date).

The mean herbage availability was estimated at the start of each month. Data in Figures 6 & 7 show that herbage availability was low until the beginning of August where after herbage availability increased dramatically. Lamb and ewe performance shown in Figures 2, 3, 4 & 5 reflect forage availability during the growing season. Ewes were growing and in good condition after weaning and forage availability on the pasture remained high. Pasture residues are likely to provide adequate roughage of a quality that should allow for maintenance of the ewes during the summer months.

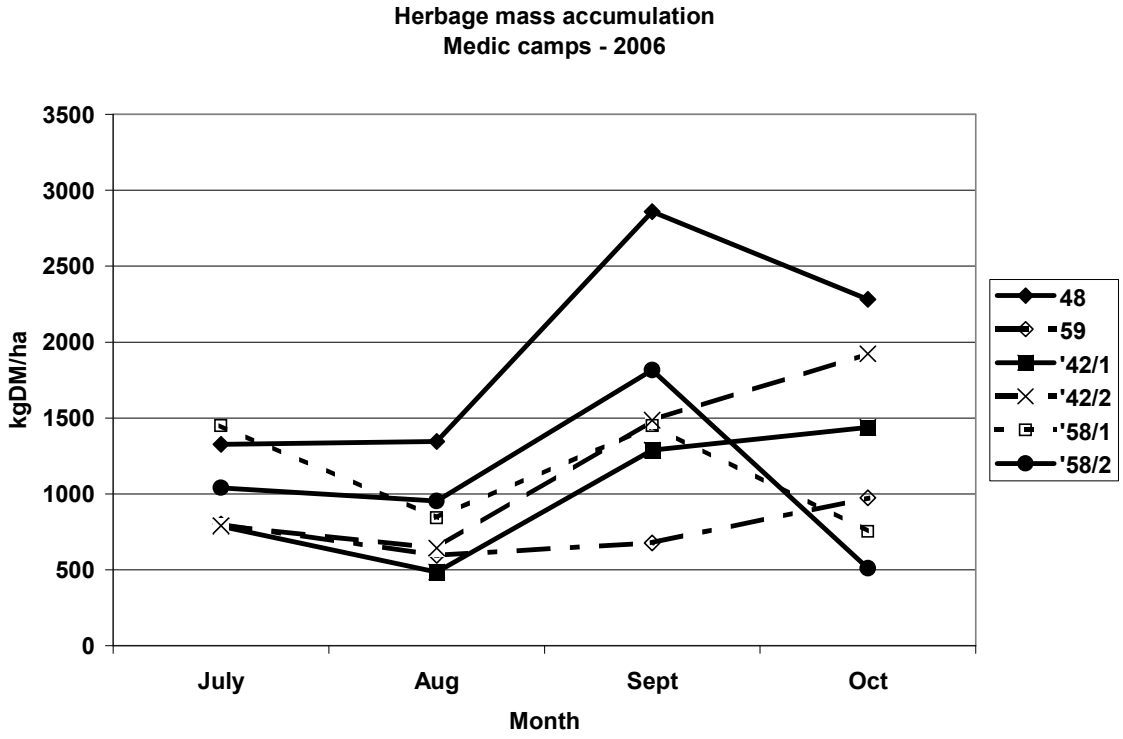


Figure 6 Dry matter accumulation of medic camps in 2006 – note that the herbage used by sheep and natural decay are not accounted for in these data

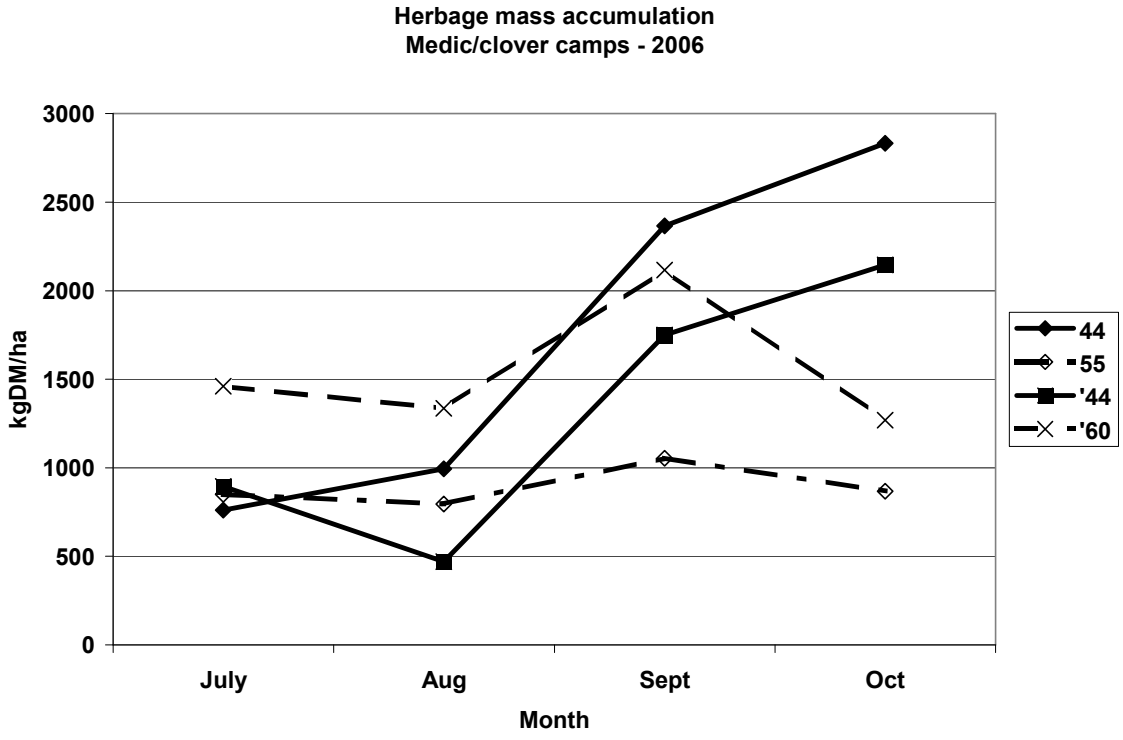


Figure 7 Dry matter accumulation of medic/clover camps in 2006 – note that the herbage used by sheep and natural decay are not accounted for in these data.

3 Pod mass

"Above- and below-ground" pod mass, and estimated seed mass, data are given in Figures 8 & 9 respectively. The mass of pods in camps to be cropped in 2006 (Figure 8) indicates that pasture production in the 2005 season was highly favourable for pod production providing far greater mass of pods than is required for sustainable medic pastures. Forage availability during the summer months on these camps was quite sufficient to provide dry pregnant ewes with a maintenance ration. While pod mass in camp 37 (a McW system) was significantly lower than the other camps it must be remembered that camp 37 also comprises clovers and an unknown amount of their seed would be present in the seed-bank. About 700 or more kg pods/ha is estimated to be required for maintenance of medic pastures.

As recorded in the 2005 report estimates of "below"-ground pod mass show that they are well below the required 750kg/ha in all camps. Since these camps had been cropped during 2005, their pod production in 2004 and pods would have been ingested during February to April 2005, low pod mass in the soil was expected. Low seedling densities (Appendix 6) partially reflect the low pod mass. However, much of the seed would have already been released from the pods during the winter of 2005 and through the ingestion process when being used as forage for sheep. "Below ground pod mass is therefore not necessarily a good reflection of medic seed availability at the start of a medic year.

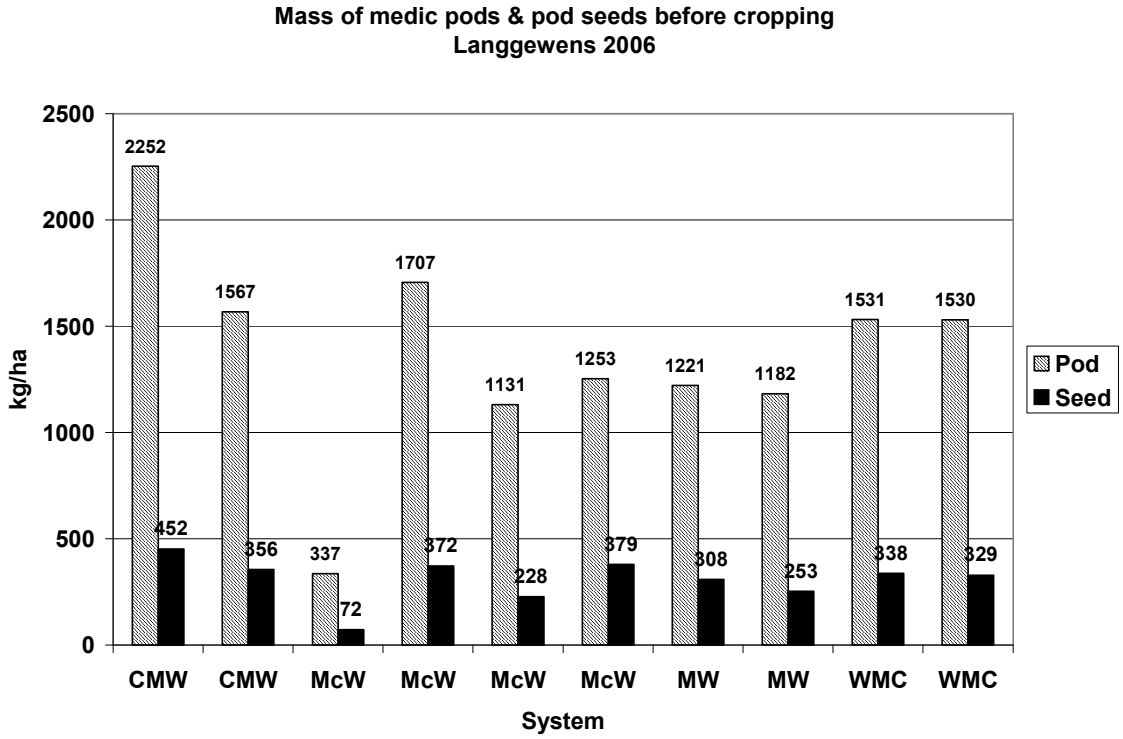


Figure 8 Estimated above ground pod mass (kgha^{-1}) in each treatment camp as measured in 12 January 2006 and estimated seed mass (calculated as 20% of pod mass (C = canola, W = wheat, M = medic & Mc = medic/clover)

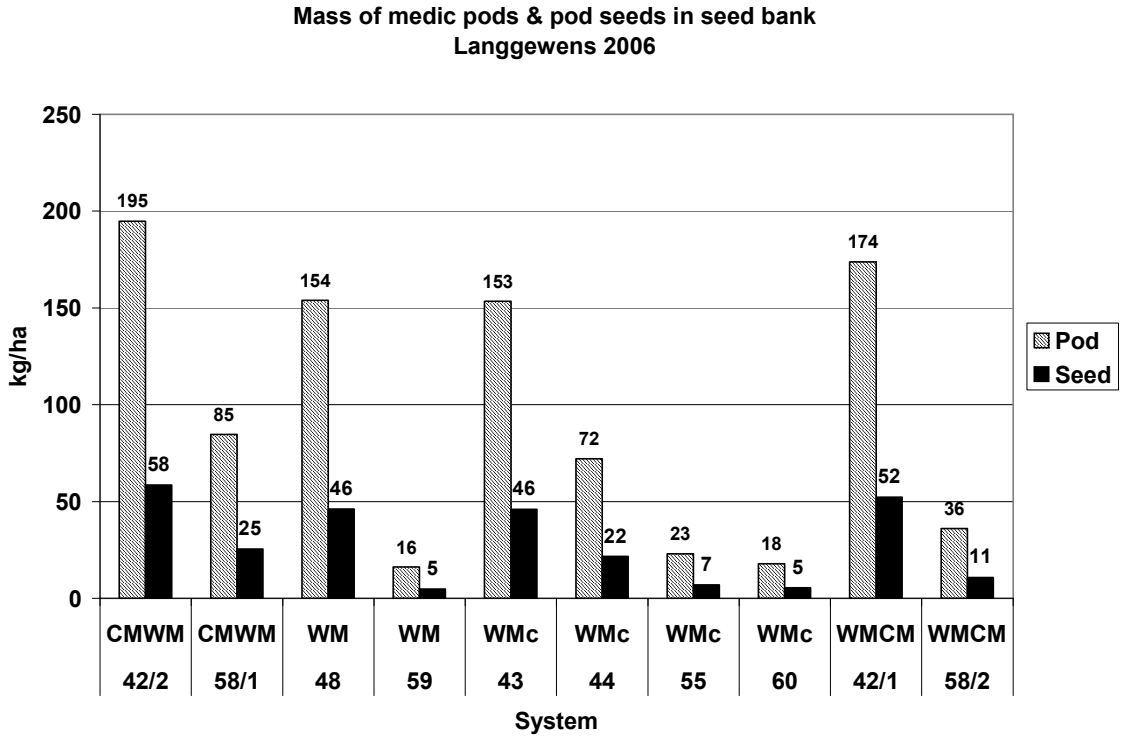


Figure 9 Estimated "below" ground pod mass (kgha^{-1}) in each pasture camp as measured in 12 January 2006 and estimated seed mass (calculated as 20% of pod mass (C = canola, W = wheat, M = medic & Mc = medic/clover)

Wheat, lupin and canola production data

Seedling densities

Seedling densities for wheat, canola and lupins indicate the successful establishment of those crops (Table 4). While lupin and canola densities were considerably higher than expected, wheat densities were considerably lower than expected (Table 2). Wheat densities could be lower due to the negative effects of Trifluraline falling into the planting row. The higher canola and lupin densities could be due to the superior planting mechanism of the AUSPLOW compared to the planter used in previous seasons.

Table 4 Average number (+ standard error of the sample mean - SEM) and range of plant densities per m^2 for each of the three crops in 2006.

CROP	AVERAGE NUMBER (m^{-2})	SEM	RANGE
WHEAT	110	1.7	94 - 132
LUPIN	61	2.7	54 - 67
CANOLA	88	4.5	70 - 104

Crop yields and quality

Total rainfall and the amount and frequency of rainfall events during the growing season provided soil moisture conditions that were highly favourable for crop production. Periods of warm and dry weather that often occur during June and August in the Swartland were not recorded (Figure 1). Wheat yields were higher than the wheat yields recorded for any of the previous 10 seasons for which production data are available.

Wheat production data

Yield

Mean wheat yield over all systems was 4329 kg/ha. As has been recorded over almost all seasons (2005 was an exception) there were clear differences in yield among the different crop sequences (Fig 10). Wheat yields following legume pasture and lupins were greater than wheat yields in all other systems (Fig 10). Wheat following canola also had greater yields than wheat following wheat. There was a consistent pattern of lower wheat yields with an increasing number of years of wheat as the preceding crop (Fig 10).

An analysis of average annual wheat yields over all reps per year for each treatment for the 6-year period from 2001 to 2006 clearly illustrates the effects of the different crop sequences on wheat yields at Langgewens (Fig 11). Summary data are presented with and without the yields for 2003 when no yield was recorded in the continuous cropping systems due to the severe drought experienced during that year combined with the poor weed control in the continuous cropping treatments.

Data collected to determine; number of ears per plant, ear density (ears m^{-2}), number of grains per ear; and TSW of grain in each treatment camp have not yet been analysed but are available on file.

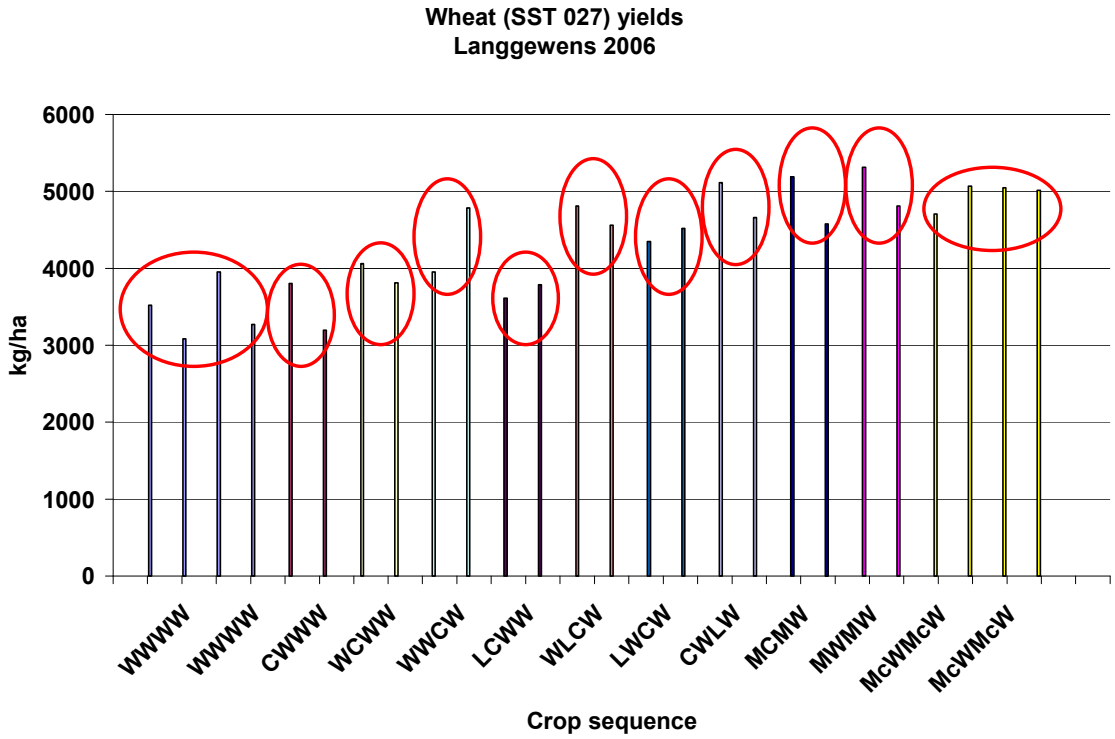


Figure 10 Average yields of wheat in each system in the 2006 season

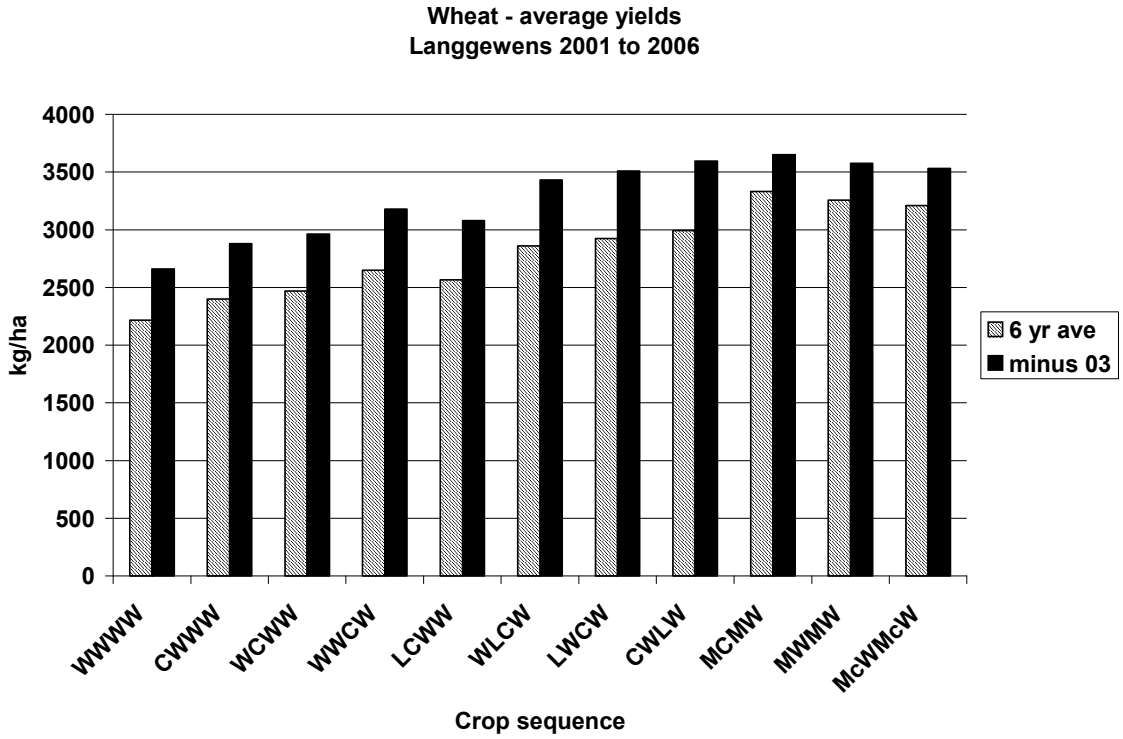


Figure 11 **Average annual wheat yields for each crop sequence over 6 years. Data shown with and without 2003 (drought year) data**

Grain quality

Grain quality as measured for each treatment plot at the RusStasie Silo showed that crude protein levels followed a similar pattern of response to the previous seasons crop (Fig 12).

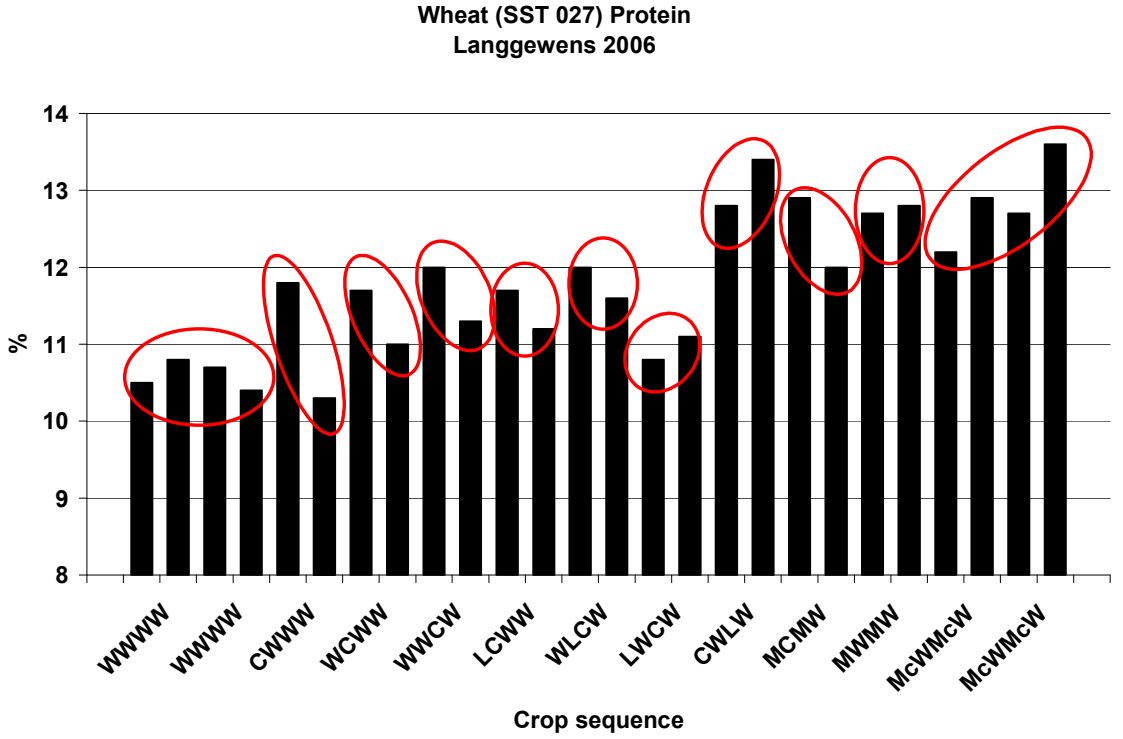


Figure 12 **Crude protein content of wheat for each crop sequence - 2006**

It would be expected that the high frequency and amount of rainfall experienced during the 2006 growing season would result in leaching of N from the soil profile. It would also be expected that %CP of the grain would be low due to dilution effects of high yields. These expectations were clearly realized with %CP in the wheat following wheat crop sequences having the lowest %CP content despite having had the highest N application rates (refer to fertilization of crops in the procedure above). Interestingly, and similar to past experience, %CP in grain following legume pasture was consistently higher than all other crop sequences (Fig 12). While much of the mineral-N applied during the first part of the season would have been taken up by plants, mineral N would also have been leached. In contrast, N made available to plants in pasture-based treatments during the late growing season (as soils are warming) through mineralization of organic matter derived from the previous season's legume crop, is less likely to have been leached from the system. So despite having had lower rates of N applied during the season the N made available through the mineralization process would explain the higher %CP levels in the wheat following legume pasture crop sequences.

Canola production data

The canola was harvested at the end of October. Since losses were bound to occur before and at harvest, estimates of potential yield were made at the stage of maturity when swathing would have been recommended (canola has always been harvested directly in the Langgewens trial).

The actual yields obtained during harvesting ("straight") ranged from 994 kg/ha to 1785 kg/ha (Fig. 13). On average, actual canola yield after medic pasture (1693 kg/ha) are higher yield than canola yields after wheat (1385 kg/ha). However, if one looks at the estimated yields for canola after medic (1490 kg/ha) against canola after wheat (1430 kg/ha) there is essentially no difference between these crop sequences. Furthermore there is, on average over all treatments, no difference between estimated and actual yields.

Reasons for the differences in actual and estimated yields can be ascribed to a combination of error and real differences. Of interest is that the low actual yields in two of the treatments viz. WLWC & WWLC (71 and 61% lower yield than the estimated yields respectively), are derived from camps with soils that have poor drainage, high clay content and are inherently high in salts, and are considered "problem" camps especially in low rainfall years (see previous reports in this regard). Could high salt up-take result in higher risk of pod shatter thus losses during harvest or due to wind damage just before harvest?

The average yield of canola over all plots was 1445 kg/ha. Given that the average yield of wheat over all wheat plots was 3993 kg/ha, canola yields were low viz. 33.3% of the wheat yield. Experience and the literature indicate that one should expect canola yields of between 50 and 70% of wheat yield under the same climatic conditions.

The average crude protein (%CP) and %oil contents of canola produced in 2006 range from 24 to 26% and 28 to 32% respectively. As noted in previous reports oil contents of the seed is low relative to normal expectations of 35% CP and above. It would appear that the TT cultivars ATR Hyden (used in previous seasons) and Stubby (used in 2006) both have inherently low oil contents.

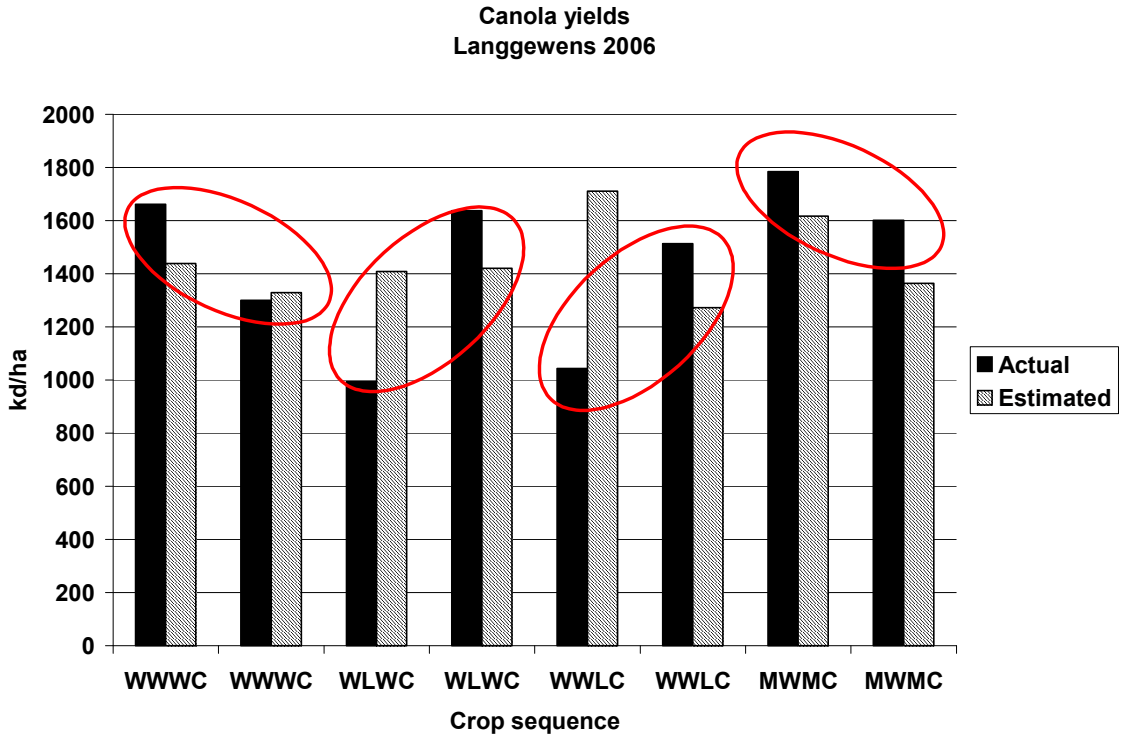


Figure 13 Actual and estimated yields of canola in each crop sequence - 2006

Lupin production data

Average lupin yield over all plots was 1560 kg/ha. There were no differences in yield among plots or crop sequences (Figure 14). Lupins yields were unexpectedly higher than canola yields (presented above) and are considered to be similar to the average commercial production for the area.

Average crude protein content of lupin seed was 28.1%, ranging from 25.6 to 30.1

Economic data

Economic analysis of data derived from this trial remains one of the most important constraints to providing added value from these data sets. Resignation of the various Economists involved over the years has resulted in this dilemma. Relevant input and output data have been captured to allow for detailed economic analyses but these data need to be verified (particularly the machinery costs) and then collated by a competent Agricultural Economist to ensure that accurate data are presented in reports and to producers. Summary gross margin data are presented in Appendix 8 and illustrate the effects of crop rotation treatments on variability of economic returns for given seasons and price structures for those particular seasons. The Department is in the process of motivating for an Economist to be employed within the Research and Technology Development Directorate in a post dedicate to adding value to research outputs such as those emanating from this trial.

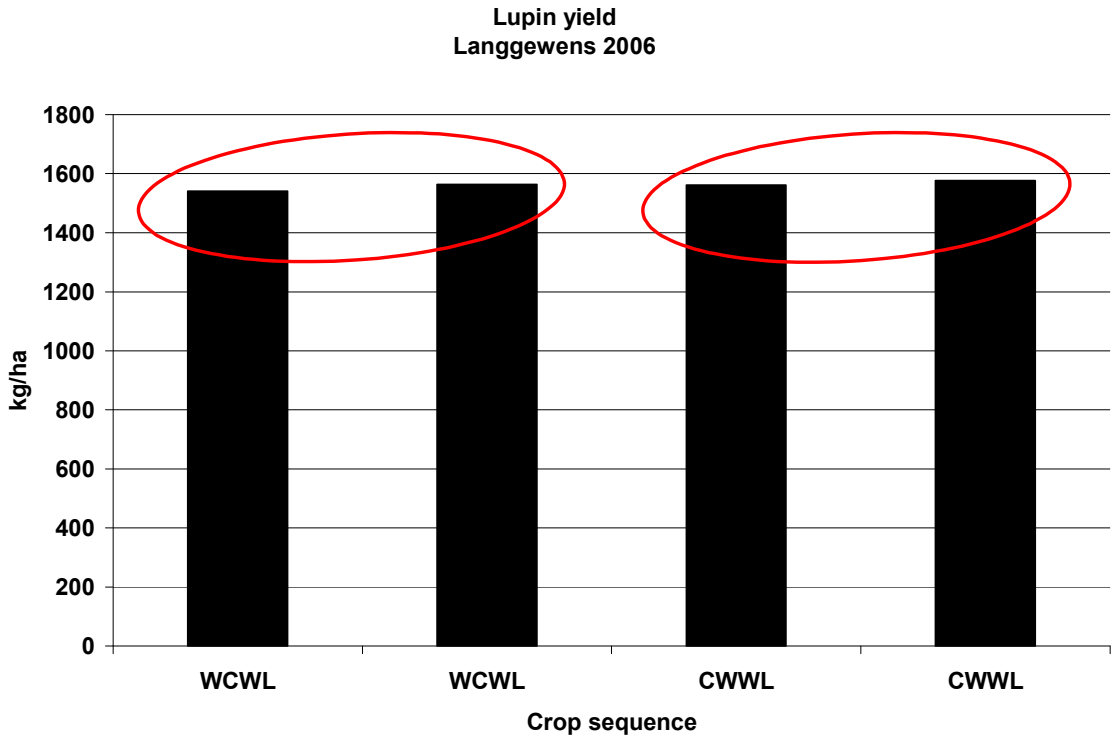


Figure 14 Yield of lupins in each cop sequence – Langgewens - 2006

Concluding remarks
The project is progressing according to the research proposal and protocols. Management and production data are regularly presented to the local farming community in popular publications and on occasions such as farmer's days. The information is also made available to technical advisors of the various Agri-businesses that operate in the area.

PRESENTATIONS AND PUBLICATIONS

The following section summarizes the presentations made and articles published during 2006. These publications and presentations were based on the crop rotation trials being conducted in both the Swartland and the southern Cape.

Scientific and semi-scientific articles
One scientific article and one semi-scientific article, both based on information gained from these trials, were published during the report period.

Lampbrecht SC, Marasas FO, Hardy MB & Calitz FJ 2006. Effect of crop rotation on crown rot and the incidence of *Fusarium pseudograminearum* in wheat in the Western Cape, South Africa. Australsian Plant Pathology, 2006, 35, 419 - 426

Hardy MB 2007. The Southern Cape crop rotation project: progress 2002 to 2005. Elsenburg Journal Vol 4 No. 1. 2-4.

Popular articles

Six popular articles, based on the trial data and experiences or that make reference to the trials, were published during the report period.

Hardy M, Langenhoven W, Badenhorst J & Joubert F 2006. Southern Cape crop rotation research in progress 2002 – 2005. Proceedings of Information day Outeniqua Experimental Farm 3 October 2006.

Hardy M, Langenhoven W, Joubert F & Badenhorst J 2006. Narrow leaf sweet lupins show their potential in Southern Cape crop rotation trials: seed yield. SA Grain 8 (7) pp 39 – 41

Hardy MB & Laubscher S 2006. Die langtermyn wisselbouproef te Langgewens: Produksiedata vir 2005 en gewasbestuursinsette vir 2006. Skog saamdragids 6 September 2006

Anon 2006. Graanprodusent van die jaar: En die finaliste is … Hendrik Willem de Waal. SA Grain 8 (9) pp 28

Malherbe B 2006. Boere maak 'n plan. SA Grain 8 (12) pp 14 - 15

Genis Amelia 2006. Boere bring navorsing plaas toe. Landbouweekblad No 1480. 8 December 2006. pp 8 – 19

Presentations

As in previous seasons several successful information days were held on the various trial sites during the report period. We were also invited to present and discuss the results of our trials on occasions such as: Study Group and Farmer Association meetings.

Talks/presentations at Farmer's days etc 2006

Hardy, M., Agenbag, A., Langenhoven, W. & Joubert,F., 2006. Seeding rates for wheat in the Western Cape: do we need to adjust our recommendations? Platform presentation. Combined Congress 2006 of the South African Society for Crop Production and the Soil Science Society of South Africa. 23 – 26 January, Durban.

Hardy,. M., 2006. Address 5 technical committees (Langgewens, Tygerhoek, Swellendam, Riversdale & Bredasdorp) on results of 2005 crop rotation research in the Western Cape. 13 to 28 Feb 2006. (35 people)

Hardy,.M. & Laubscher, S., 2006. Address Piketberg Farmer's Association on production dynamics and economy of crop and crop/pasture rotations in the Swartland. 14 February 2006. (14 people)

Hardy,. M., 2006. Address Riversdale "Bedryfskommittee" on results of the crop rotation research and seeding rate trials at the Riversdale site. 23 February 2006. (7 people)

Hardy,. M., 2006. Address Riversdale "vlaktes" farmer's Association meeting on results of the crop rotation research and seeding rate trials at the Riversdale site. 23 February 2006. (45 people)

Hardy, M., 2006. Basal fertilization requirements of kikuyu, perennial ryegrass and clover pastures. Outeniqua dairy study group meeting. George. 2 March 2006. (20 people)

Hardy, M.,. 2006. Seeding rates for wheat in the Riversdale "vlaktes". Overberg Agri Voorsaai dag. 7 March 2006. (70 people)

Hardy M & Langenhoven W 2006. Host New Zealand farmer on a "Walk & Talk" at the Tygerhoek trial site. 3 August 2006.

Hardy, M. 2006. Ekonomiese ontleding van wisselbouproewe by Swellendam. Swellendam Kleingraanstudiegroep 16 Augustus 2006. (15 people)

Hardy, M. 2006. Crop rotation for profit. In "Steek R100 000 ekstra in jou sak" – 'n werkswinkel vir landbou produsente. Agri Megaweek 30 Augustus 2006 (50 people) X 2 lectures

Laubscher S 2006. Walk & talk on Langgewens site for PNS tour group. 31 August 2006 (15 people)

Hardy, M. & Langenhoven W., 2006. Tygerhoek short rotation cropping systems – weed control walk and talk. Southern Cape crop rotation technical committee meeting 5 September 2006. (20 people)

Hardy M, Laubscher S & Hugo H 2006. Produksie en ekonomiese ontledings van langtermyn wisselbouproewe to Langgewens. SKOG Boeredag 6 September 2006 (130 people)

Hardy M & Laubscher S 2006. Crop management in Langgewens crop rotation trial (2006). SKOG Boeredag 6 September 2006 (130 people)

Hardy, M. & Laubscher S 2006. Langgewens crop rotation trial – weed control walk and talk. Swartland crop rotation technical committee meeting 9 September 2006. (18 people)

Hardy M 2006. Crop rotation systems in the Swartland. Report back to Trustees of the Winter Cereal Trust and "continuation of funding application" meeting. CSIR 11 September 2006.

Hardy M 2006. Crop rotation systems in the Southern Cape. Report back to Trustees of the Winter Cereal Trust and "continuation of funding application" meeting. CSIR 11 September 2006.

Hardy M 2006. The establishment and development of an on-farm cropping systems research site in the Protem area. New project funding application to Trustees of the Winter Cereal Trust. CSIR 11 September 2006.

Hardy M 2006. Sustainable crop production on shale soils. Report back to Trustees of the Winter Cereal Trust and "continuation of funding application" meeting. CSIR 11 September 2006.

Hardy M & Lombard P 2006. Cultivar evaluation of wheat in the Winter Rainfall Region. Report back to Trustees of the Winter Cereal Trust and "continuation of funding application" meeting. CSIR 11 September 2006.

Hardy M, Langenhoven W & Hugo H. Economic evaluation of the Riversdale crop rotation trial: 2002 to 2005. Riversdale Farmers Day – Uitkyk. 13 September 2006 (130 people)

Hardy M & Langenhoven W 2006. Management of crops in the Riversdale crop rotation trials – walk & talk. Riversdale Farmers Day – Uitkyk. 13 September 2006 (130 people)

Hardy M 2006. Crop rotation systems in the Swartland. Report back to Trustees of the Protein Research Trust and "continuation of funding application" meeting. Spier 14 September 2006.

Hardy M 2006. Crop rotation systems in the Southern Cape. Report back to Trustees of the Protein Research Trust and "continuation of funding application" meeting. Spier 14 September 2006.

Hardy M 2006. The establishment and development of an on-farm cropping systems research site in the Protem area. New project funding application to Trustees of the Protein Research Trust and "continuation of funding application" meeting. Spier 14 September 2006.

Hardy M 2006. Report back to Trustees of the Western Cape Animal Production Research Trust on projects funded through the Trust and managed by the Institute for Plant Production i.e Crop rotation, Cultivar evaluation, Shale soils, weed research. Knorhoek 21 September 2006.

Hardy M 2006. Produksie en ekonomie van wisselbou-stelselproewe in die Suid Kaap. Outeniqua Inligtingsdag 3 October 2006 (150 people)

Hardy M 2006. A re-evaluation of the "Sustainable crop production from shale soils" trial. Elsenburg 16 November 2006 (15 people)

Appendix 1

PROTOKOLS VAN DIE SWARTLAND WISSELBOU TEGNIESE KOMITEE VERGADERING GEHOU OP MAANDAG 13 FEBRUARIE 2006 OM 13:00 TE LANGGEWENS PROEFPLAAS

Teenwoordig: K van Heerden
D Hanekom
M Hardy (Voorsitter)
S Laubscher
F Potgieter
J Labuschagne
S Slabbert
M Ferreira
H van Zyl
A Haasbroek
G Conradie
M Kellerman

Verskonings: A Swanepoel
G Cooper
A Agenbag
H Agenbag

PROTOKOL VIR DIE VERBOUING VAN KORING – 2006

GRONDVOORBEREIDING
Geen stoppel word gebrand en geen voorafbewerking word gedoen nie.

PLANT
Raxil-behandelde SST 027 saad word gebruik vir aanplantings.
Bepaal eers die 1000 korrelmassa.
Doen ontkiemingstoetse onder gekontroleerde toestande.
Bepaal daarvolgens die saaidigtheid ($^{+}/_{-}$ 120-150 plante/m^2; kg/ha)
Gebruik die Ausplow vir die plant van die koring.

BEMESTING
Dien P + kalk + gips toe volgens aanbeveling.

- Koring na koring of canola: Maks. 86 N/ha — 26 N met plant gebandplaas; 40 N Kopbemesting; 20 N Opsioneel

- Koring na medics en lupiene: Maks. 52 N/ha - 22 N met plant gebandplaas; 30 N Kopbemesting

Daar moet gekyk word na die toedieningspeile (kopbemesting) van stikstof na weiding en lupiene. Die voordele wat peulplante bied, moet benut word.

Kopbemesting moet volgens reënval(grondvog) toegedien word, en kan aangepas word volgens die reënval.

Aanbevelings t.o.v spoorelementtekorte word gedoen, maar weefselontledings sal ook gedoen word. Weefselmonsters moet altyd van dieselfde ouderdom wees. Gebruik gewoonlik die jongste volwasse blaar. Ouderdom van koringplant, tussen 4 en 6 blaarstadium. Spoorelemente mag nooit saam met onkruiddoders toegedien word nie. Kontak Jannie Bester vir tweede kopbemesting.

ONKRUIDBEHEER
Spuit Preeglone as onkruid verskyn het na goeie vroeë reën.
Deeglike onkruidopnames van elke kamp afsonderlik, moet gedoen word. Gebruik Crew vir die beheer van raaigras met ‘n breëblaarmiddel later. Ally en Derby vir die beheer van breëblaaronkruide.
Vir afwisseling kan Bromoxynil (Buctril) as breëblaarmiddel gebruik word.

PLAAGBEHEER
Monitor gereeld vir insekplae, let veral op vir die teenwoordigheid van Russiese koringluis. Gebruik middels soos Dimetoaat of Mospilan saam met onkruid- en swamdoders teen sandmyte en luise. Monitor vir bolwurm. Vir die beheer van bolwurms – Methomyl

SWAMBEHEER
Indien dit ‘n vroeë koue jaar is moet die monokultuur koring asook alle kampe wat vir’n tweede of derde jaar koring dra vir oogvlek gespuit word met ‘n middel soos Opus, Follicur, Duet of Alto Ambel. Koring word op vier- tot ses-blaarstadium vir oogvlek gespuit. ‘n Goedkoper middel kan later gespuit word indien nodig. Die seisoen sal bepaal of dit nodig is vir die vlagblaarbespuiting.

STOPPELBESTUUR
Vanjaar se plantseisoen sal bepaal hoe ons die stoppel of strooi sal bestuur. As daar geen probleme met die plantaksie ondervind word nie, sal die strooi weer oopgestrooi word agter die stroper.

PROTOKOL VIR DIE VERBOUING VAN CANOLA – 2006

GRONDVOORBEREIDING
Geen stoppel word gebrand en geen voorafbewerking word gedoen nie.

PLANT
Kultivar wat gebruik sal word: ATR Stubby
Bepaal die 1000 korrelmassa.
Doen ontkiemingstoetse onder gekontroleerde toestande.
Bepaal daarvolgens die saaidigtheid. (50 – 70 plante/m^2; $^+$/-4kg/ha) Behandel die saad met Dimetoaat.

Gebruik die Ausplow vir die plant van canola.

BEMESTING
Dien P + S + kalk toe volgens aanbeveling.

- Canola na koring: Maks. 82 N/ha - 22 N met plant (gebandplaas)
  - 40 N Kopbemesting 30 dae na plant.
  20 N Tweede kopbemesting sal opsioneel wees voor stamverlenging.
- Canola na medics/lupien: Maks. 62 N/ha - 22 N met plant (gebandplaas)
  - 40 N Kopbemesting 30 dae na plant.

'n Boor-bespuiting (Solubor, 1kg/ha) op 'n laat stadium voor blom moet gedoen word. Dit kan gedoen word saam met die bespuiting vir die beheer van die ruitruglarwes. Aanbevelings t.o.v spoorelementtekorte word gedoen, maar weefselontledings sal ook gedoen word. Weefselmonsters moet altyd van dieselfde ouderdom wees. Gebruik gewoonlik die jongste volwasse blaar. Spoorelemente mag nooit saam met onkruiddoders toegedien word nie. Kopbemesting moet volgens reënval(grondvog) toegedien word, en kan aangepas word volgens die reënval. Kontak Jannie Bester vir tweede kopbemesting.

ONKRUIDBEHEER
Spuit Preeglone as onkruid verskyn het na goeie vroeë reën.
Deeglike onkruidopnames van elke kamp afsonderlik, moet gedoen word.
Spuit Simazine as vooropkoms onkruiddoder vir grasse en breëblaaronkruide tydens plant.

Spuit Aramo vir die beheer van grasse indien nodig.

PLAAGBEHEER
Monitor gereeld vir insekplae.
Gebruik middels soos Dimetoaat, Mospilan en Cypermethrin saam met onkruiddoders teen sandmyte en luise.
Monitor gereeld vir ruitruglarwe en bolwurm.
Vir die beheer van ruitruglarwes - Endosulfan
Vir die beheer van bolwurms – Methomyl

PROTOKOL VIR DIE VERBOUING VAN LUPIENE – 2006

GRONDVOORBEREIDING
Geen stoppel word gebrand en geen voorafbewerking word gedoen nie.

PLANT
Kultivar wat gebruik sal word: Tanjil.
Doen ontkiemingstoetse onder gekontroleerde toestande.
Bepaal die 1000 korrelmassa.
Bepaal daarvolgens die saaidigtheid. (40 – 45 plante/m^2; $^+$/- kg/ha)
Ent saad binne 24 uur voor plant. Gebruik die Ausplow vir die plant van die lupiene.

BEMESTING
Dien P + S + kalk toe volgens aanbeveling.

ONKRUIDBEHEER
Spuit Preeglone as onkruid verskyn het na goeie vroeë reën.
Deeglike onkruidopnames van elke kamp afsonderlik, moet gedoen word.
Spuit Simazine as vooropkoms onkruiddoder vir grasse en breëblaaronkruide tydens plant.
Spuit Aramo vir die beheer van grasse indien nodig.

PLAAGBEHEER
Monitor gereeld vir insekplae.
Gebruik middels soos Dimetoaat saam met onkruiddoders teen sandmyte en luise.
Monitor gereeld vir bolwurm.
Vir die beheer van bolwurms – Methomyl

SWAMBEHEER
Monitor gereeld vir witroes.
Vir die beheer van witroes - Bayleton EC of Topaz.

PROTOKOL VIR DIE BESTUUR VAN WEIDING – 2006

SAAI
As gevolg van die agteruitgang van die weidings, moet sekere kampe ingesaai word.Kultivars wat gebruik sal word: **Santiago en Parabinga in ‘n gelyke mengsel van 2 kg elk asook Balansa (1 kg/ha) Kampe wat vanjaar ingesaai word is:**?

Gebruik die Ausplow vir die plant van die weidings.

BEMESTING
Dien P en S toe volgens aanbeveling.
Spuit molibdeen saam met onkruiddoder indien nodig nadat weefselontledings gedoen is.

ONKRUIDBEHEER
Spuit Aramo vir die beheer van onkruid.

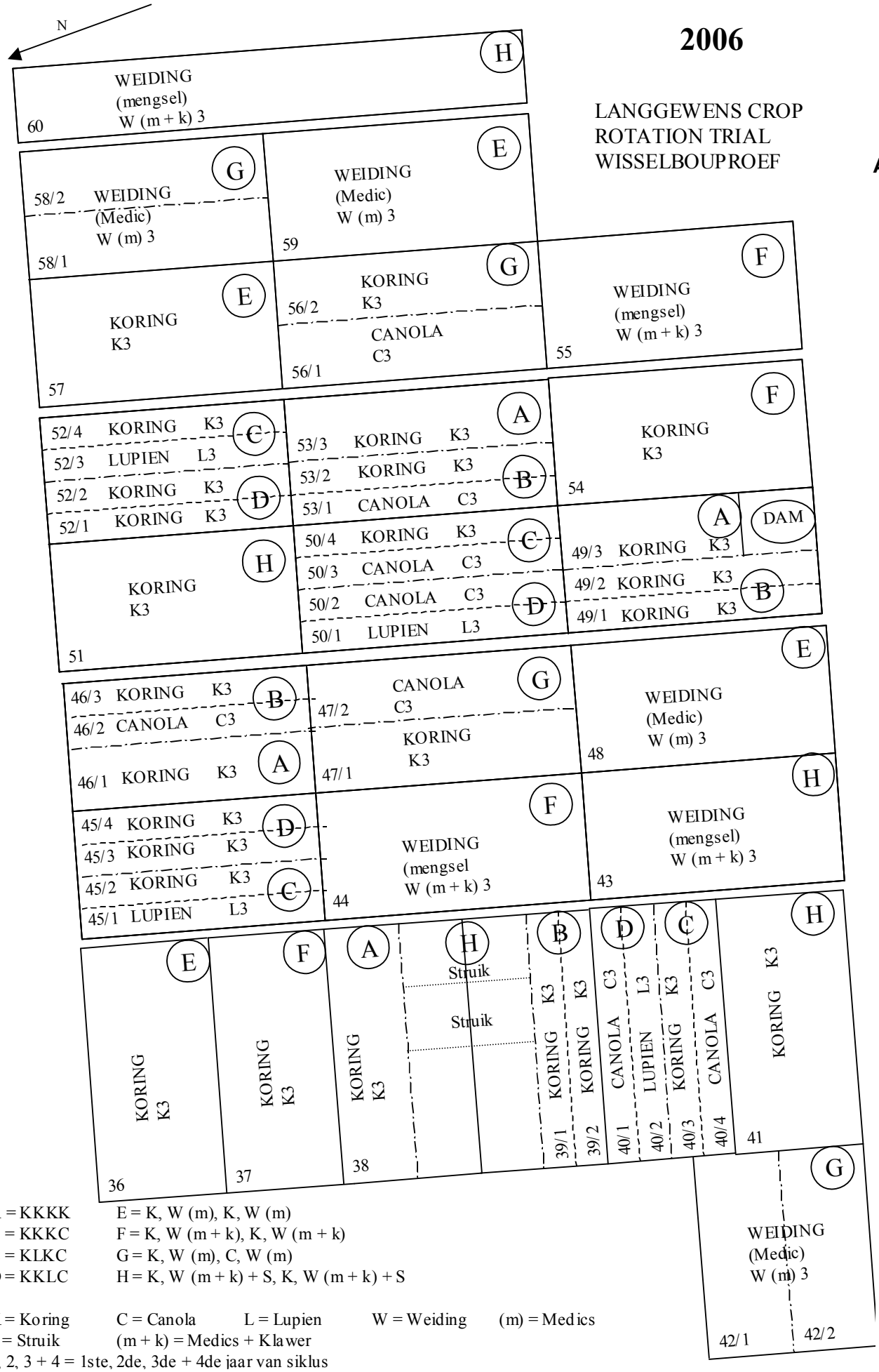
Spuit Broadstrike vir die beheer van breëblaaronkruid.

PLAAGBEHEER
Gebruik middels soos Dimetoaat en Mospilan saam met onkruiddoder teen sandmyte en luise.

2006

LANGGEWENS CROP ROTATION TRIAL
WISSELBOUPROEF

Appendix 2



A = KKKK
B = KKKC
C = KLKC
D = KKLC

E = K, W (m), K, W (m)
F = K, W (m + k), K, W (m + k)
G = K, W (m), C, W (m)
H = K, W (m + k) + S, K, W (m + k) + S

K = Koring C = Canola L = Lupien W = Weiding (m) = Medics
S = Struik (m + k) = Medics + Klawer
1, 2, 3 + 4 = 1ste, 2de, 3de + 4de jaar van siklus

Appendix 3

STELSELPROEF AKTIWITEITE – 2006

ONTKIEMINGSTOETSE

Canola (Stubby) – 86%

Lupiene (Tanjil) – 96%
Koring (SST 027) – 96%
Paraggio – 62%
Santiago – 50%
Parabinga – 50%

1000KORRELMASSA

3.836 gram

145.95 gram
35.8 gram

PLANTDIGTHEID (vlg. Formule)
Canola – 3.5 kg/ha
Lupiene – 85 kg/ha
Koring – 69 kg/ha

PLANTDIGTHEID (Werklike plantdigtheid)
Canola – 4 kg/ha
Lupiene – 90 kg/ha

Medics – 4 kg/ha
Koring – 65 kg/ha

KUNSMIS- & KALKPRYSE

Kalsitiese kalk – R 196.96/ton

Dolomitiese kalk – R 242.22/ton
Gips – R 321.27/ton
2.1.0 (29) – R 2508.80/ton
TurboPhos –R 2369.80/ton
1.0.0 (40) – R 2430.92/ton
MAP – R 3005.80/ton
K2SO4 – R 2808.80/ton
Spraybor – R 11.40/kg
Mangaansulfaat – R /kg

ONKRUID- INSEK- & SWAMDODERPRYSE

Preeglone – R 38.19/liter
Simasol – R 22.23/liter
Crew – R 71.25/liter
Foliwett – R 30.78/liter
Dimetoaat – R 25.26/liter
Mospilan – R 0.46/gram
Focus Ultra – R 185.82/liter
Opus – R 168.72/liter
LI 700 – R 43.78/liter
Methomex 900 – R 142.96/kg
UAP Glyfosate 360 – R 22.69/liter
Aramo – R 218.88/liter
Dash – R 27.36/liter
Logran – R 2.77/gram
Lontrel – R 79.80/liter
Broadstrike – R 4.86/gram
Derby – R 970.00/liter
Ally Express – R 2.20/gram
Triflurex – R 31.92/liter
Kerb – R 253.99/kg

Endosulfan - R55.86/liter
Duett – R 119.70/liter
Topaz – R 621.30 /liter
Bulldock – R324.90/liter
Lomex – R 2.64/gram
Brodal – R 246.20/liter
MCPA – R 21.09/liter
Buctril – R 44.18/liter
Bumper – R 111.72/liter

SAADPRYSE (R/kg)

Koring – R 3.03
Canola – R 29.95
Lupiene – R 2.95
Paraggio – R 32.72 (entstof ingesl.)
Santiago – R 32.72 (entstof ingesl.)
Parabinga – R 32.72 (entstof ingesl.)

Kalibrasie van kalkstrooier vir die strooi van gips. Groot sluis: 6 Ton – 86 mm
Kalibrasie van kalkstrooier vir die strooi van kalk. 3 Ton – 43 mm
1.5 Ton – 22 mm
Klein sluis: 0.25 Ton – 52 mm

23/03/2006	Sleep al die canolakampe, behalwe Kampe 42/1 en 58/2 waarop skape loop. Planter pak want canolastoppel is te lank.
27/03/2006	Strooi kalsitiese kalk
28/03/2006	Strooi dolomitiese kalk en gips.
05/04/2006	Behandel canolasaad met Dimetoaat. (280ml Dimet by 2lt water op 100kg saad)
11/04/2006	Gesels met Frik Potgieter. Besluit dat ons 'n bietjie moet wegbeweeg van die SU's. Hy beveel aan 'n mengsel van MCPA(0.5lt/ha) + Buctril(1.5lt/ha). Die MCPA word op sy eie teen 1.5lt/ha gespuit wat beslis gevaar inhou vir enige breëblaargewas langsaan, maar dat dit teen die verlaagde dosis nie soveel gevaar inhou nie.
20/04/2006	Strooi MAP en Kaliumsulfaat.
20/04/2006	Plant medics in op Kampe 43, 44, 60.
20/04/2006	Plant canola.
21/04/2006	Plant lupiene.
28/04/2006	Sleep stoppel, kampe 38, 39/2, 45/4, 46/1.
02/05/2006	Gesels met Frik oor lupiene in canola. Kan Lontrel gebruik teen 1.0liter/ha. Canola moet egter moet egter by die 3-blaarstadium of ouer wees. Gesels ook oor Simazine en Crew op baie stoppel. Simazine was af van die stoppel, maar is tog nie so doeltreffend soos op kaal grond nie. Crew word afgebreek deur ultraviolet. Sal nie werk nie. Hy beveel ook aan dat ons nie die Preeglone saam met die Crew spuit nie. Vermenging vind dadelik met die grond plaas en Preeglone neem ten minste 'n halfuur om opgeneem te word. Gesels ook oor Kerb. Sien aanwysings.
08/05/2006	Voorsaaibespuiting met Preeglone (2lt/ha). Kampe 36, 37, 41, 47/1, 51, 52/1, 52/2.
08/05/2006	Begin koring plant. Kampe 36, 37, 41.
09/05/2006	Voorsaaibespuiting met Preeglone (2lt/ha). Kampe 45/2, 45/3, 45/4, 46/1, 46/3, 49/1, 49/2, 49/3, 52/4, 54, 56/2, 57.
09/05/2006	Plant koring. Kampe 47/1, 51, 54, 56/2, 57.
10/05/2006	Voorsaaibespuiting met Preeglone (2lt/ha). Kampe 38, 39/1, 39/2, 40/3, 50/4, 53/2, 53/3.
10/05/2006	Plant koring. Kampe 38, 45/2, 45/3, 45/4, 46/1, 49/1, 49/2, 49/3, 50/4, 52/4. Sleep stoppel, kampe 49/1, 49/3.
11/05/2006	Sleep stoppel, kampe 46/3, 52/2, 53/2, 53/3. Plant koring. Kampe 39/1, 39/2, 40/3, 46/3, 52/1, 52/2, 53/2, 53/3.
15/05/2006	Spuit Lontrel (1.5lt/ha) op kampe 40/1 en 50/2. Lupiene in canola doodspuit.
16/05/2006	Spuit Broadstrike (50g/ha; breëblaar), LI – 700 (100ml/100lt water; benatter) en Dimetoaat (250ml/ha; insekte) op al die weidingskampe.
24/05/2006	Spuit Lomex (30g/ha; breëblaar) en LI – 700 (200ml/100lt water) op kamp 56/1 (turksnael).
29/05/2006	Gesels met Kobus Laubscher oor canola na medics. Is merkbaar swakker as die ander canola na koring en lupien. Vermoed eers dat dit bladmyner is, maar Kobus vermoed dat erdvlooi en rooibeen sandmyt ook betrokke is, en die simptome van die plante bevestig dit na inspeksie. Spuit al die canola- en lupienkampe Aramo (1lt/ha) en Dash (1lt/ha) vir grasonkruide, asook Dimetoaat (250ml/ha) vir insekte.
30/05/2006	Spuit al die weidingskampe Aramo (1lt/ha) en Dash (1lt/ha) vir grasonkruide.
01/06/2006	Kobus Laubscher besoek die proef en bevestig ook dat dit 'n kombinasie is van bogenoemde insekte.
01/06/2006	Bemes al die canolakampe met 1.0.0(40), 100 kg/ha, 42 dae na plant.
07/06/2006	Frik besoek proef. Besluit om eerder Derby te spuit vir breëblaaronkruid in die koring as 'n Buctril-MCPA mengsel. Bang vir wat die MCPA aan die canola en lupiene kan doen. Derby haal al die belangrike onkruide uit behalwe dubbeltjie. Dubbeltjie is egter nie 'n probleem nie. Derby se werking is soos

	die van die SU's, maar hy is nie 'n SU nie.
07/06/2006	Spuit al die lupienkampe Brodal (0.2lt/ha) vir breëblaar.
07/06/2006	Spuit kampe 42/1 en 58/2 Cysure (1.2lt/ha) en Imiboost (4.0lt/ha). Canola-opslag wou nie vrek van die Broadstrike.
08/06/2006	Begin spuit vir breëblaar in die koring. Gebruik Derby teen 50 ml/ha. Spuit kampe 39/1, 39/2, 40/3, 46/1, 47/1, 50/4, 52/1, 52/2.
09/06/2006	Spuit koringkampe 36, 37, 38, 41, 49/1, 49/2, 49/3, 54.
15/06/2006	Spuit koringkampe 51, 56/2, 57.
19/06/2006	Spuit koringkampe 45/3, 45/4, 52/4, 53/2, 53/3.
19/06/2006	Bemes al die koringkampe met 1.0.0(40), 40N na koring en canola en 30N na medics en lupiene.
10/07/2006	Spuit Duett (oogvlek) op kampe 38, 39/2, 45/4, 46/1, 46/3, 49/1, 49/3, 52/2, 53/2, 53/3.
11/07/2006	Spuit Spraybor (1.0kg/ha) en Endosulfan (0.3lt/ha, ruitrugmot) op al die canola kampe.
18/07/2006	Spuit Duett (witroes) op al die ander koringkampe.
19/07/2006	Spuit Duett (witroes) op al die ander koringkampe.
01/08/2006	Jannie Bester (Kynoch) besoek proef, nemm blaarlesings met N-toetser vir elke stelsel. Die standaardlesing wat die koring moet toets, is 575. Onder dit sal oorweeg word of ekstra N toegedien moet word. Elke stelsel het bo 575 getoets. K/M het getoets tussen 600 en 610. K/K het getoets tussen 575 en 590. Die res het tussen 590 en 610 getoets. Hy beveel aan dat ons nie ekstra N hoef te gee nie. Die luisgetalle begin vermeerder in die koring. Sal dit monitor. As ons weer vir swamme spuit, sal luisgif bygevoeg word, andersins sal daar vir luis op sy eie gespuit moet word.
10/08/2006	Frik Potgieter besoek proef. Die siektedruk is aanwesig. Aanbeveling: Koring – Alle koring moet 'n vlagblaar swambespuiting kry Bumper 0.5lt/ha. Voeg 'n insekdoder by vir luisbeheer, Mospilan 50g/ha + LI 700 (50ml/100lt water). Lupiene – Witroes bespuiting met Topaz 0.5lt/ha.
17/08/2006	Spuit Bumper (swamme) en Mospilan (luise) op die koringkampe.
21/08/2006	Spuit Bumper (swamme) en Mospilan (luise) op kampe 36, 37, 38, 39/1, 39/2 en 40/3.
21/08/2006	Spuit Topaz (witroes) op al die lupienkampe.
27/09/2006	Gesels met Kobus Laubscher, Frik Potgieter en Chris Cummings. Kry baie ruitrugmotlarwes in die canola. Sien nie veel bolwurmlarwes nie, maar almal is dit eens dat terwyl die vliegtuig die canola vir ruitruglarwes spuit, dit laat genoeg is om sommer vir bolwurm ook te spuit. Sit Decis by vir 'n bietjie van 'n nawerking. Een bespuiting behoort die koring deur te sien.
28/09/2006	Spuit al die koring, canola en lupiene vir bolwurm- en ruitruglarwes met Methomex (200ml/ha) en Decis (piretroïed 250ml/ha).
21/10/2006	Stroop canola, kampe 40/1, 40/4 en 56/1.
25/10/2006	Stroop lupiene, kampe 40/2 en 45/1.
26/10/2006	Stroop canola, kampe 46/2, 50/2 en 50/3.
26/10/2006	Stroop lupiene, kampe 50/1 en 52/3.
27/10/2006	Stroop canola, kampe 47/2 en 53/1.
27/10/2006	Stroop koring, kampe 39/1, 45/2, 45/3 en 45/4.
28/10/2006	Stroop koring, kampe 36, 37, 39/2, 40/3, 41 en 51.
01/11/2006	Stroop koring, kampe 54, 56/2 en 57.
07/11/2006	Stroop koring, kampe 47/1, 49/1, 49/2, 49/3 en 50/4.
08/11/2006	Stroop koring, kampe 38, 46/1, 46/3, 52/1, 52/2, 52/4, 53/2 en 53/3.
14/11/2006	Baal strooi, kampe 38, 46/1, 46/3, 49/1, 49/3, 53/2 en 53/3.
08/11/2006	Skakel Wynand Lambrecht/Cobus du Plessis vir koringpryse: 022-4828035

Gekontrakteerde prys vir Jaar 2006: R 1510 /ton = B1
Minus R 9,00 per ton vir WGT = R 1501/ton vir B1

31/10/2006 Skakel MKB vir gemiddelde canolapryse: 022-4333334
Gemiddelde prys vir 2006: R 2100 /ton
Gemiddelde lupienpryse vir 2005: R 1200 /ton

05/12/2006 Skakel Pieter Burger vir koringuitbetalings: 022-4828048
Bedrag inbetaal: R 228 783,95 BTW ingesl. Sluit Heinrich se koring in.
Bedrag inbetaal vir canola: R 17 343,00

Appendix 4

Fertilizer recommendations for 2006

LANGGEWENS WISSELBOUPROEF — BEMESTING - 2006

										Voor plant				Met plant								Bobemesting 1					Bobemesting 2					Blaarbespuiting			
Kamp	Opv	Stelsel	Gewas	Kal. kalk	Kal. kalk	Dol. kalk	Dol. kalk	Gips	Gips	K2SO4	K2SO4			2.1.0(29)	2.1.0(29)	Turbo	TurboPhos	MAP	MAP				Kor.+Can	1.0.0(40)				Kor.+Can	Kysan				Cu	Zn	Mn	B
	Ha			Ton/ha	benodig	Ton/ha	benodig	Ton/ha	benodig		benodig				benodig	Phos	benodig		benodig				1.0.0(40)	benodig				Kysan	benodig							
										Kg/ha	Kg	K	S	Kg/ha	Kg	Kg/ha	Kg	Kg/ha	Kg	N	P	K	Kg/ha	Kg	N	P	K	Kg/ha	Kg	N	P	K				
36	2	KMKM	Koring								0				0	200	400		0	22	22		75	150	30				0							
37	2	KMkKMk	Koring								0				0	200	400		0	22	22		75	150	30				0							
38	1	KKKK	Koring	1.6	0.8						0			135	135		0		0	26	13		100	100	40				0							
39/1	0.5	KCKK	Koring					5	1.75		0			135	67.5		0		0	26	13		100	50	40				0							
39/2	0.5	CKKK	Koring					3	0.75		0			135	67.5		0		0	26	13		100	50	40				0				Ja		Ja	
40/1	0.5	KLCK	Canola	1	0.25			4	1		0				0	200	100		0	22	22		100	50	40				0				Ja		Ja	
40/2	0.5	KKLC	Lupien	1.1	0.25				1	50	25	20	9		0		0	100	50	11	22			0					0				Ja		Ja	
40/3	0.5	KCKL	Koring						1		0			135	67.5		0		0	26	13		100	50	40				0				Ja			
40/4	0.5	LKCK	Canola							50	25	20	9		0	200	100		0	22	22		100	50	40				0							
41	2	KMkKMk	Koring	1.3	1.3	1.3	1.3				0				0	200	400		0	22	22		75	150	30				0							
42/1	1	MCMK	Medic								0				0		0	100	100	11	22			0					0							
42/2	1	MKMC	Medic								0				0		0	100	100	11	22			0					0							
43	2	MkKMkK	Med/Klaw								0				0		0	100	200	11	22			0					0							
44	2	MkKMkK	Med/Klaw								0				0		0	100	200	11	22			0					0							
45/1	0.5	CKLK	Lupien	1.4	0.35						0				0		0	100	50	11	22			0					0							
45/2	0.5	KLKC	Koring								0				0	200	100		0	22	22		75	37.5	30				0							
45/3	0.5	LCKK	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
45/4	0.5	CKKL	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
46/1	1	KKKK	Koring	1.2	0.3						0			135	135		0		0	26	13		100	100	40				0							
46/2	0.5	KKCK	Canola								0				0	200	100		0	22	22		100	50	40				0							
46/3	0.5	KKKC	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
47/1	1	CMKM	Koring								0				0	200	200		0	22	22		75	75	30				0							
47/2	1	KMCM	Canola								0				0	200	200		0	22	22		100	100	40				0							
48	2	MKMK	Medic	1.2	1.2						0				0		0	100	200	11	22			0					0							
49/1	0.5	CKKK	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
49/2	0.5	KCKK	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
49/3	1	KKKK	Koring			1	0.5			100	100	40	17	135	135		0		0	26	13		100	100	40				0							
50/1	0.5	KKLC	Lupien								0				0		0	100	50	11	22			0					0							
50/2	0.5	KLCK	Canola	1.5	0.4						0				0	200	100		0	22	22		100	50	40				0							
50/3	0.5	LKCK	Canola								0				0	200	100		0	22	22		100	50	40				0							
50/4	0.5	KCKL	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
51	2	KMkKMk	Koring								0				0	200	400		0	22	22		75	150	30				0							
52/1	0.5	LCKK	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
52/2	0.5	CKKL	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
52/3	0.5	CKLK	Lupien	1	0.25						0				0		0	100	50	11	22			0					0							
52/4	0.5	KLKC	Koring			2	0.5				0				0	200	100		0	22	22		75	37.5	30				0							
53/1	0.5	KKCK	Canola							50	25	20	9		0	200	100		0	22	22		100	50	40				0							
53/2	0.5	KKKC	Koring								0			135	67.5		0		0	26	13		100	50	40				0							
53/3	1	KKKK	Koring								0			135	135		0		0	26	13		100	100	40				0							
54	2	KMkKMk	Koring								0				0	200	400		0	22	22		75	150	30				0							
55	2	MkKMkK	Med/Klaw							50	100	20	9		0		0	100	200	11	22			0					0							
56/1	1	KMCM	Canola			1	0.5				0				0	200	200		0	22	22		100	100	40				0				Ja			
56/2	1	CMKM	Koring							50	50	20	9		0	200	200		0	22	22		75	75	30				0				Ja			
57	2	KMKM	Koring								0				0	200	400		0	22	22		75	150	30				0							
58/1	1	MKMC	Medic			1	0.5			100	100	40	17		0		0	100	100	11	22			0					0				Ja			
58/2	1	MCMK	Medic			1.2	0.6			100	100	40	17		0		0	100	100	11	22			0					0				Ja			
59	2	MKMK	Medic							100	200	40	17		0		0	100	200	11	22			0					0				Ja			
60	2	MkKMkK	Med/Klaw	1.3	1.3					100	200	40	17		0		0	100	200	11	22			0					0				Ja			
		Totaal benodig			6.4		3.9		5.5		925				1350		4000		1800					2625					0					0		0
		Kamp 19 A									800								320																
		Kamp 19 B																	340																
		Kamp 19 C			6.75		6												310																
		Kamp 20															1020							383											
		Totaal			13.15		9.9		5.5		1725				1350		5020		2770					3008					0							
		Bestel (50kg sakke)			13		10		6		34.5				27		100.4		55.4					60.16					0							
											40				31		110		60					65												

Opmerkings:

1. Die kaliumsulfaat word voor plant of reens uitgestrooi, dit sal ook van die laer swael aanspreek
2. Bobemesting soos aanbeveel dien slegs as riglyn en moet aangepas word volgens reenval, potensiaal en geskiedenis
3. Tweede bobemestingaanbeveling is opsioneel en sal na N testerlesings finaal oor besluit word.
4. Spoorelemente word op 4/5 blaar op graan gespuit en op canola sodra daar genoeg materiaal is om nat te kan spuit. Onthou 'n benatter veral op canola agv sy waslagie op blare wat afloop bevorder en dus opname beperk
   - Cu - Koperoksichloried
   - Mn - Mangaansulfaat

TurboPhos - 11% N, 11% P, 11%Ca, 9% S, 0.7% Mg, 0.5% Zn
K2SO4 - 40% K, 17% S
MAP - 11% N, 22% P
Kysan (KAN met swael) - 27% N, 3% S

Appendix 5

LANGTERMYN WISSELBOUPROEF **SKAAPREGISTER (2006)**

DATUM	KAMP NO								AKTIWITEIT
2005/11/21	48	44	43	42	60	55	58	59	Spons ooie. Sponskoste: (R 13.18/spons)
2005/12/05	48	44	43	42	60	55	58	59	Trek sponse, Spuit PMSG (300iu/ooi), Sit ramme by. PMSG-koste: (R 9.62/ooi)
2006/01/09	48	44	43	42	60	55	58	59	Onttrek ramme.
2006/02/07	48	44	43	42	60	55	58	59	Weeg ooie
2006/03/06	48	44	43	42	60	55	58	59	Begin met byvoeding. 200g/ooi/dag
2006/03/07	48	44	43	42	60	55	58	59	Weeg ooie
2006/03/13							56	57	Skuif ooie na medicstoppel.
2006/03/22						54			Skuif ooie na medicstoppel.
2006/03/31	36	37	41	47	51				Skuif ooie na medicstoppel.
2006/04/03	36	37	41	47	51	54	56	57	Weeg ooie
									Ent Multimin - 1ml binnespiers (R 185.50/100ml).
									Doseer Vetdose 3 - 30ml/ooi (R 185.20/5lt)
									Doseer Vit. A - 20ml/ooi (R 120.60/5lt). 100ml Vit. A meng met 5lt water.
									Ent ooie Multivax: R 525.70/250ml; 2ml/ooi.
2006/04/20				42			58		Skuif ooie na medicweiding.
2006/05/05	48	44	SB		SB	55		59	Skuif ooie na medicweiding. Skuif 2 kampe na Soutbos.
2006/05/06	48	44	SB	42	SB	55	58	59	Ooie begin lam. Skuif byvoeding op na 300g/ooi/dag.
2006/06/02			43		60				Skuif ooie na medicweiding.
2006/06/06						19A		19B	Skuif ooie na buitekamp medicweiding.
2006/06/13		19C							Skuif ooie na buitekamp medicweiding.
2006/06/14	48	19C	43	42	60	19A	58	19B	Deel ooie en lammers in volgens lamgetalle.
2006/06/16	48	19C	43	42	60	19A	58	19B	Stop byvoeding.
2006/06/19	48	19C	43	42	60	19A	58	19B	Weeg ooie en lammers.
2006/07/03						55		59	Skuif ooie terug na kampe.
2006/07/10		44							Skuif ooie terug na kamp.
2006/07/11	48	44	43	42	60	55	58	59	Ent lammers Bloednier Aluin (R 31.48/100ml)
									Doseer ooie en lammers Prodose Groen. Ooie-20ml; Lammers-6ml (R 73.29/lt)
2006/07/12			SB						Skuif ooie na Soutbos
2006/07/24	48	44	SB	42	60	55	58	59	Weeg ooie en lammers.
2006/08/01			43						Skuif ooie terug na medicweiding.
2006/08/22	48	44	43	42	60	55	58	59	Weeg ooie en lammers.
									Ent lammers Bloednier Aluin (R 31.48/100ml)
									Doseer lammers Lintex. 10ml/lam (R 408.99/2lt)
2006/09/12	48	44	43	42	60	55	58	59	Onttrek slaglammers en uitskotooie. Sit vervangingsooitjies by.
2006/09/14	48	44	43	42	60	55	58	59	Slag lammers en uitskotooie.
2006/09/26	48	44	43	42	60	55	58	59	Ent ooie Bloutong A - 1ml (R 189.90/100ml). Weeg ooie.
2006/10/11	48	44	43	42	60	55	58	59	Skeer skape
2006/10/17	48	44	43	42	60	55	58	59	Ent Multimin - 1ml binnespiers (R 172.00/100ml).
									Doseer Vetdose 3 - 30ml/ooi (R 49.54/lt)
									Doseer Vit. A - 20ml/ooi (R 120.60/5lt). 100ml Vit. A meng met 5lt water.
									Ent ooie Bloutong B
2006/11/07	48	44	43	42	60	55	58	59	Ent ooie Bloutong C
2006/11/14	36	37	41	47	51	54	56	57	Skuif ooie na koringstoppel. Weeg ooie.
2006/11/14	36	37	41	47	51	54	56	57	Spons ooie. Sponskoste: (R 11.74/spons)
2006/11/27	36	37	41	47	51	54	56	57	Trek sponse, Spuit PMSG binnespiers (300iu/ooi), Sit ramme by. PMSG-koste: (R 9.72/ooi)
									(Dra spons oor na 2007)
2007/01/03	36	37	41	47	51	54	56	57	Plaas ooie terug in kampe, en plaas 'n ram by elke troppie.

Appendix 6

Estimated total medic or medic + clover seedling numbers per m^2 at the start of the growing season (from soils samples taken at the end of March) recorded in the treatment camps used for grazing in 2000, 2001, 2002, 2003, 2004, 2005 and 2006.

Treatment	Year	Rotation system	Camp	Plants m^{-2}	Camp	Plants m^{-2}
E	2000	Wheat/medic	48	922	59	538
	2001		36	699	57	689
	2002		48	408	59	140
	2003		36	152	57	329
	2004		48	534	59	220
	2005		36	277	57	513
	2006		48	546	59	133
G	2000	Wheat/medic/	42/1	1429	42/2	1406
	2001	canola/medic	47/1	508	47/2	541
	2002		42/1	647	42/2	414
	2003		47/1	128	47/2	132
	2004		42/1	705	42/2	513
	2005		47/1	626	47/2	579
	2006		42/1	374	42/2	248
G	2000	Wheat/medic/	58/1	486	58/2	731
	2001	canola/medic	56/1	515	56/2	634
	2002		58/1	168	58/2	433
	2003		56/1	125	56/2	151
	2004		58/1	209	58/2	386
	2005		56/1	518	56/2	478
	2006		58/1	467	58/2	220
F	2000	Wheat/ medic-	44	811	55	396
	2001	clover	37	1030	54	748
	2002		44	321	55	190
	2003		37	150	54	109
	2004		44	224	55	202
	2005		37	436	54	283
	2006		44	149	55	187
H	2000	Wheat/ medic-	43	1424	60	687
	2001	clover + salt bush	41	744	51	1213
	2002		43	283	60	115
	2003		41	228	51	386
	2004		43	282	60	300
	2005		41	408	51	434
	2006		43	215	60	246

Appendix 7

THE LANGGEWENS CROP ROTATION TRIAL – RYEGRASS DENSITIES - 2006

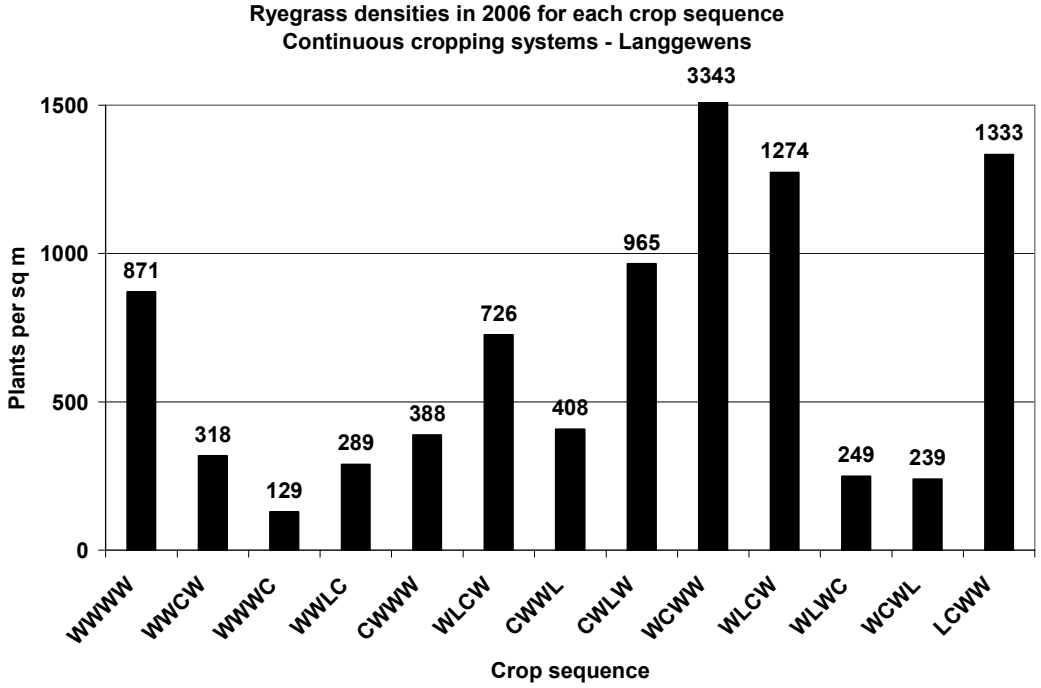


Figure 1 Ryegrass densities (plants m^{-2}) from soil samples collected during March in the continuous cropping treatments (last letter indicates previous season's crop – W = wheat; C = canola; L = lupin)

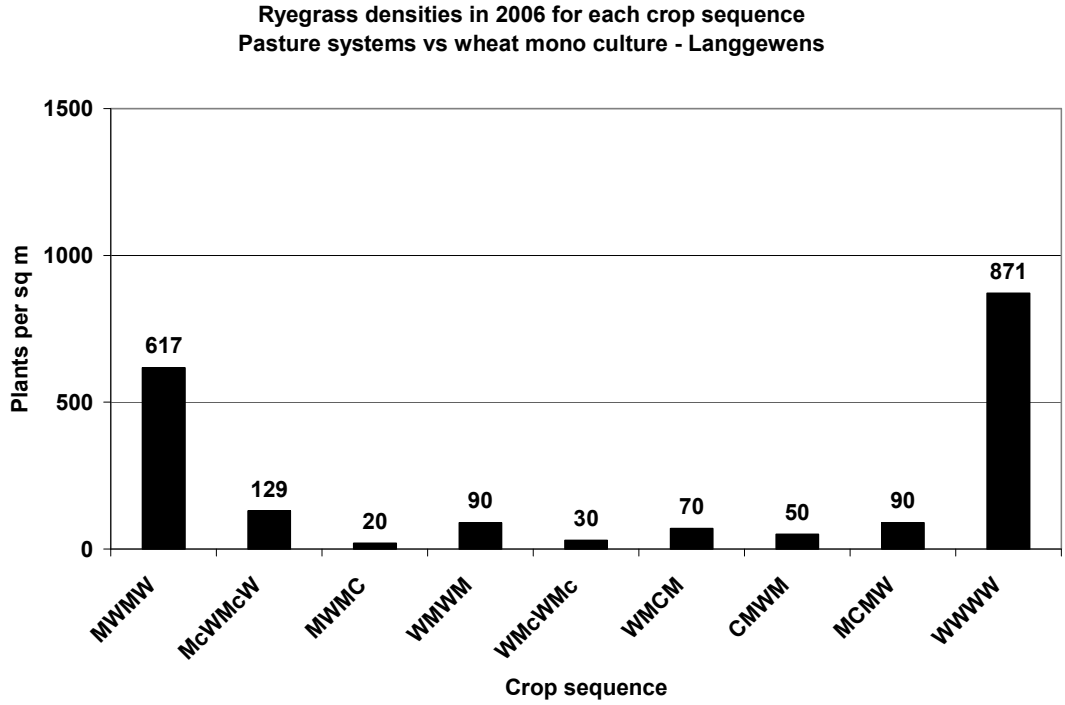


Figure 2 Ryegrass densities (plants m^{-2}) from soil samples collected during March in the crop/pasture treatments vs wheat mono-culture (last letter indicates previous season's crop – M = medic; Mc = medic/clover W = wheat; C = canola)

Appendix 8

Gross margin analyses of each crop and crop pasture system at Langgewens - 2004 and 2005