Western Cape Government
Agriculture

Economic sustainability of short- and long- rotation crop/pasture production systems in the southern Cape

Report on the 2012 production year

Report to

Winter Cereal Trust

by

JA Strauss

June 2013

Contents

INTERIM PROGRESS REPORT: January to June 2013

PROJECT TITLE: Economic sustainability of short- and long-rotation crop/pasture production systems in the southern Cape

PROJECT TEAM: JA Strauss & W Langenhoven, Directorate Plant Sciences, Western Cape Department of Agriculture

Aim

The aim of this study is to determine the short- and long-term effects of a number of the most feasible short- and long-rotation, crop and crop/pasture rotation systems identified for the southern Cape region on: crop yields, weed control, disease suppression, soil production potential, sheep production and the economically sustainable land-use in the southern Cape.

Project planning

Winter Cereal Trust (WCT) and the Western Cape Department of Agriculture provided the annual working capital required for 2013. The two technical committees associated with the southern Cape sites met during February to discuss the previous season's management of each site and to establish management protocols for the 2013 season. Note that since the start of 2012 Riversdale has been moved out of the Southern Cape crop rotation trial. It will for the following 12 years stand on its own feet as a separate trial.

Summary of progress

This interim report summarises progress for the 2013 production season to end June.

Soil moisture conditions were normal over the southern Cape. Swellendam was planted on the 26 and 27th of April and Tygerhoek during early May to mid-May. Tygerhoek received early good rains in April. All crops planted at the sites have emerged and looks promising. The Swellendam site has been moved to the original trial site, since the previous site has been re-established with lucerne following the 5 cash crop seasons. 2013 is this the second year in the 3rd cropping phase.

The planned amounts of fertilizer have been applied and adjusted according to the climatic conditions. No-till planters were used at all sites.

Canola, wheat and barley were planted at Swellendam.

Trial plots at the Riviersonderend (Tygerhoek) site were planted from the start to the middle of May.

The growth of the medic/clover pastures at Tygerhoek has been slow due te low soil temperatures.

Short-rotation systems (Tygerhoek experimental site)

1 Canola camps were planted to a conventional cultivar (HYOLA).
2 Lupin sub-camps were planted to the cultivar Mandelup.
3 Cereal crops planted were:
   - Wheat - SST 027
   - Barley - Erica
   - Oats – Pallinup
4 All medic/clover pastures and the 4 ha of lucerne were stocked with ewes and their lambs according to the trial protocols.

5 One composite soil sample was taken from each sub-camp (110 in all) in December 2012 and sent to the Elsenburg soils lab for (macro- and microelement, and organic carbon) analysis.

6 110 composite soil samples were taken in March 2013 (one composite sample per sub-camp), placed into seedling trays and are being monitored for weed seed banks in a shade cloth facility.

Long-rotation site (Swellendam)

1. Cereal crops planted were:
   - Wheat - SST 027
   - Barley – Erica

2 Canola -HYOLA

3 One composite soil sample was taken from each camp of each trial site (18 in all) in December 2012 and sent to the Elsenburg soils lab for (macro- and microelement, and organic carbon) analysis.

4 18 composite soil samples were taken in March 2013 (one from each camp at each of the trial sites), placed into seedling trays and are being monitored for weed seed banks in a shade cloth facility at Tygerhoek.

Technology transfer

(Includes information from both the southern Cape and Swartland rotation trials)
For the report period 4 presentations have been made at scientific conferences, technical meetings, farmer's association meetings, study group meetings and farmer's information days.

General

The project is running according to the protocols established during the technical committee meetings but inputs are adjusted according to changing climatic conditions.

LONG-TERM CROP ROTATION TRIAL – SOUTHERN CAPE

Executive summary: 2012

Title: Economic sustainability of short- and long-rotation crop/pasture production systems in the southern Cape

Aim: The aim of this study is to determine the short- and long-term effects of a number of the most feasible short- and long-rotation, crop and crop/pasture rotation systems identified for the southern Cape region on: crop yields, weed control, disease suppression, soil production potential, sheep production and economically sustainable land-use in the southern Cape.

Project team: JA Strauss, & W Langenhoven, Directorate Plant Sciences, Western Cape Department of Agriculture

Summary of results and outputs during the 2012 production year

2012 was the 11th year of production. The trial comprises two main components namely: **short-rotation systems** that are being tested at Tygerhoek experimental Farm at Riviersonderend and **long-rotation systems** that are being tested on farms in the Swellendam district respectively. 2012 was the 1st year of the 3rd 5-year cropping phase that is being tested at the Swellendam site.

All trial areas were planted and managed according to the planned protocols (including appropriate weed, disease and insect control measures).

The Swellendam site produced average yields following a dry latter part of the season.

At Tygerhoek soil moisture conditions were very favourable for dryland production received rainfall above the long-term average. All crops showed average to above-average yields.

Canola production – AGAMax was planted at Swellendam at 3.2kg seed/ha and AGAMax was planted at Tygerhoek. A seeding rate of 3.6 kg/ha was used and a total of 63 kg N/ha was applied to each plot (23kg N/ha at planting and 40kg N/ha top-dressings).

Canola yields at Swellendam averaged 1061 kg/ha, while the average yields over all plots at Tygerhoek realised 1580 kg/ha, which is high when compared to the region. The oil percentage of the canola ranged from 40% to 46%.

Wheat production – Wheat was planted at both sites (SST 027).

Grain harvested at the Swellendam site averaged 2291 kg/ha. This reflected the good rainfall received.

At Tygerhoek the average wheat yield was 4598 kg/ha^{-1} over both replicates.

Grain was classed as B3 at Swellendam and B1 following pastures and B2 following any other crop at the Tygerhoek site.

Barley production – At Tygerhoek Erica yields averaged 4343kg/ha.

Oats production – Oats (Pallinap) was planted only at Tygerhoek and SSG564 at Swellendam. Seed production averaged 1407kg/ha at Swellendam and 4224kg/ha at Tygerhoek.

Lupin production – Lupins (Mandelup) were only planted at Tygerhoek; yields averaged 1.4 tons/ha.

Economics – Crop production data from both sites have been captured using the newly developed, spreadsheet-based, gross margin analysis program. Detailed economic analyses of all rotation systems are given in the detailed annual report.

Component research – Various additional studies were done during 2012 including: 1) monitoring weed seed banks as affected by crop and crop/pasture rotation treatments in the southern Cape, 2) monitoring soil fertility status and soil organic carbon content as affected by crop and crop/pasture rotation treatments in the southern Cape trial, and 3) capturing of soil carbon sequestration data by n MSc student (Jacques Smith).

Technology transfer – The following summarises presentations, reports and publications based on the crop production trials being conducted in the southern Cape during 2012.

Presentations

- 1 Farmer's days
- 2 technical meetings and report sessions
- 1 conference and seminar presentations

Presentations

Scientific conference

An economic evaluation of short rotation crop and crop/pasture systems at Tygerhoek in the southern Cape, Johann Strauss and W Langenhoven Directorate: Plant Science Department of Agriculture: Western Cape, P/Bag 1, Elsenburg 7607

Farmer's Days and study group meetings

Walk and talk at Tygerhoek with overseas visitors

Annual progress reports

The following detailed technical reports and their summaries for the 2012 report year were prepared for the Department of Agriculture: Western Cape and the Winter Cereal Trust

Strauss JA & Langenhoven WR 2012. Economic sustainability of short- and long-rotation crop/pasture production systems in the southern Cape.

Financial report 2012 - WCT funded project

Researcher: **Dr JA Strauss**

Project Title: **Economic sustainability of short- and long- rotation crop/pasture production systems in the southern Cape**

Allocation: **Sien attached budget**

Expenditure: **See attached budget**

NOTE 1: **The running capital for this project was R193 014 and was made up as follows:**

A 60% CONTRIBUTION FROM THE WCT (R115 809)
A 40% CONTRIBUTION FROM THE WCDA (R77 205)

Expenditure is shown as total expenditure and includes the WCT and WCDA

Detailed budget of total working capital requirement for 2012

ITEMS	BUDGET	Expenses
Administration		
Subsistence	2 420	2 420
Air travel	4 000	4 000
Transport:		
(i)on farm	20 400	20 400
(ii)Researchers & off-farm personnel	23 400	23 400
Toll fees	520	520
Telephone	4 165	4 165
Equipment and Livestock		
Stationary	525	525
Seed,Chemicals & Fertilizers	75 495	75 495
Packaging material	2 625	2 625
Veterinary & supplements	5 040	5 040
Consumables	1 050	1 050
Professional services		
Farm services	24 000	24 000
Soil Analyses	17 584	17 584
Statistical advice	450	450
Miscellaneous		
Overtime (Livestock management)	11 340	11 340
	193 014	**193 014**

Annual technical report

Year: **2011**

Project No: **W.B.1**

Title: **Economic sustainability of short- and long-rotation crop/pasture production systems in the southern Cape**

Project leaders: **JA Strauss**
Co-worker: **W Langenhoven**

Report compiled by JA Strauss and W Langenhoven, Institute for Plant Production, Elsenburg, Private Bag X1, Elsenburg 7607

Aim

The aim of this study is to determine the short- and long-term effects of a number of the most feasible short- and long-rotation, crop and crop/pasture rotation systems identified for the southern Cape region on: crop yields, weed control, disease suppression, soil production potential, sheep production and the economic sustainability of land-use in the southern Cape.

Introduction

The project was initiated during 2001 at the request of the GSA Winter Rainfall Region Research Committee and is strongly supported by this committee. There are 2 trial sites viz. Tygerhoek Experimental Farm and Swellendam (on the farm of Mr Joos Badenhorst in the Napky district). The project was established during 2002. Funding for all production season's to date (2002 to 2011) was applied for and granted by the Winter Cereal Trust (WCT – 60% of working capital requirements) and the Protein Research Foundation (PNF – 40% of working capital requirements). Since 2012 the funding for the project was done by the WCT and the Western Cape Department of Agriculture since the PRF decided not to continue funding the long-term trial. The technical committees that were formed for each trial site met in three separate meetings (Tygerhoek, and Swellendam) during February 2009 to develop management protocols for the 2013 season based on the experimental design, production data from 2012 and the management inputs during 2012. The technical committees comprise Departmental, Agri Business (Co-Ops), ARC and University staff, as well as members in the grain production industry and co-operating farmers.

The management of each trial site and results obtained during 2012 are presented separately below. For the "long-rotation" crop sequences at Swellendam, 2012 was the 1st year of the third set of 5-year cropping-phase crop sequences, being tested on the site. Since management and input procedures remain much the same from year to year the reader will note that the descriptions and discussions that follow are similar to those given in previous reports. A separate report summarising the complete second set of 5-year cropping-phase at the Swellendam and Riversdale sites (2007 to 2011) has been prepared and were submitted along during the previous report period.

Swellendam – Napky (*Long-rotation* site)

Note that 2012 was the 1st year of a 5-year cropping phase on the new research site. The trial moved to the original site in 2012, where a 3rd 5-year cropping phase, following 5 years of lucerne pasture, started. Six cropping sequences were planted. All of the crop sequences are planted using a no-till planter, all systems was subjected to light scarification's of the soil prior to planting with a no-till planter since the lucerne had to be removed (see trail layout with cropping sequences in Appendix 1)

Site and crop management 2012

The normal approach to kill off established lucerne plants in the area is to rip or plough the land after spraying the lucerne (in full leaf) with a glyphosate + hormone herbicide mixture. Herbicide applications were done in January and then just before planting in May in an attempt to control the remaining lucerne as well as other weeds.

The main management activities (inputs) are presented in Table 1.

All seed was planted with the Tygerhoek AUSPLOW. All plots were inspected frequently to ensure that weed and insect control measures were completed timeously. The dry September hampered yields somewhat. All crops were swathed in October and harvested in November.

Table 1 Management of crops planted at the Swellendam site during 2011

Crop	Cultivar	Planting date	Seeding rate (kg/ha)	Fertilisation rate at planting (kg/ha)	Top dressing (kg/ha)	Crop protection Product
Wheat	SST027	May	51	25N + 8P + trace elements	Nil	Mamba 2l Mamba 2l Ravenger Logran Enhancer Dimet Epic
Canola	AGAMax	May	3.2	25N + 8P + trace elements	80 LAN/ha	Mamba 2l Mamba 2lGallant Scorp Dimet Alphatrin Metamidiphos
Oats	SSH405	May	61	20N + 8P + trace elements	Nil	Mamba 2l Mamba 2l Ravenger Logran Enhancer Dimet Epic

Data collection

Soil samples were collected from all camps in December 2011 and analysed to determine their nutrient status and carbon content.

Daily rainfall was recorded at the ARC's automatic rainfall station situated at the homestead 0.5 km away from the trial site.

Weed dynamics – Eighteen composite soil samples were taken during March 2012 (one composite sample from each of the 18 plots), placed into seedling trays and kept in a shade cloth germination facility at Tygerhoek. All seedlings that germinated in each tray were counted and identified. These data were used to estimate "start of treatment" weed seed banks for each plot.

Plant counts were done on all plots. Counting procedure was the same as presented in previous reports. Counts were done within plant rows at each of 20 randomly located 1.0m row lengths in each camp. Note that a systematic random sampling procedure was followed to ensure that the whole camp was sampled.

Yield and quality – The total harvest from each plot was weighed. Two grain-samples (each weighing approximately 3kg) were drawn from the yield of each plot. Wheat, triticale, barley and canola samples were sent to the SSK silo at Swellendam, and wheat, triticale and barley samples to Stellenbosch University (Agronomy Department), for quality analyses. Canola and lupin samples were sent to the feed laboratory at Elsenburg for protein and oil content determinations.

Results

Rainfall

The latter part of the summer was drier, but two showers at the end of April were adequate to make planting possible at the start of May (Figure 1).

A total of 213mm of rain was measured from April to September 2012, with a especially wet July and early August. A slightly wetter September would have made a difference in the final yield, but the results were respectable.

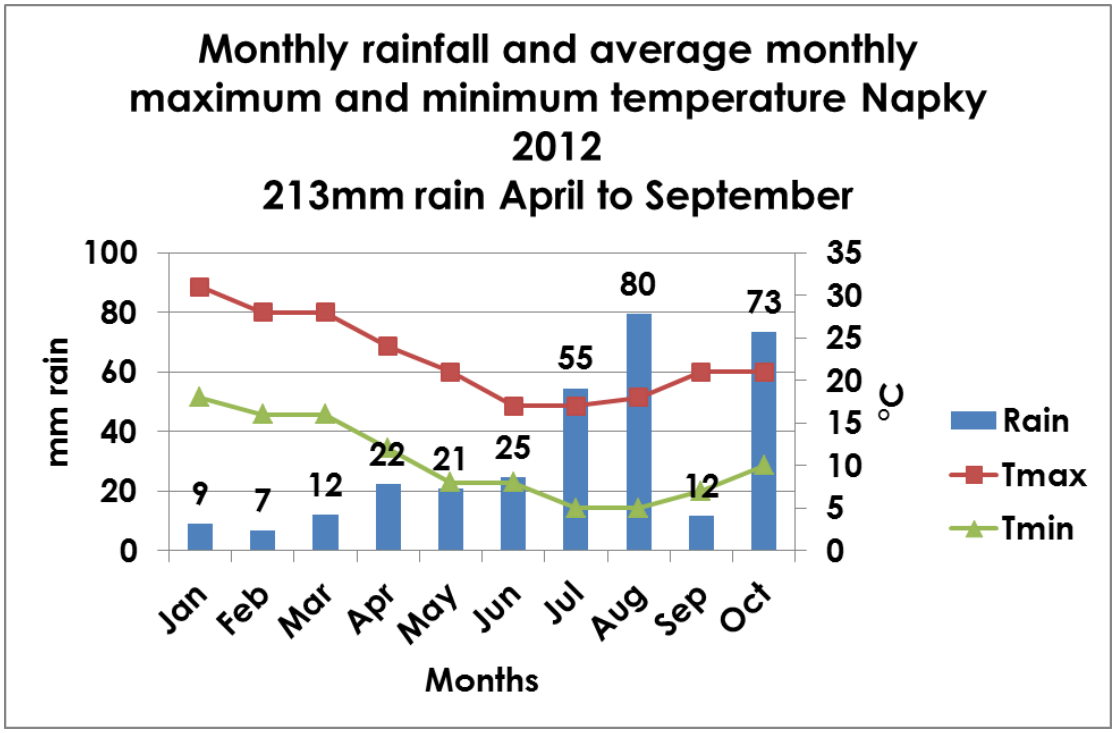


Figure 1 **Monthly rainfall and average maximum and minimum temperature for the period January 2012 to October 2012**

Plant counts

Canola - Estimated average plant density was 47 seedlings m^{-2}. For a seeding rate of 3.2 kg/ha.

Wheat - Estimated average plant density was 98 seedlings m^{-2}. For a seedig rate of 51 kg/ha.

Oats - Estimated average plant density was 120 seedlings m^{-2}. For a seeding rate of 61 kg/ha.

Crop yields

Harvested yields for all crops are summarised in Table 2. Wheat did exceptionally well. Canola yields were down from what was expected, but that was due to the ill-timed application of herbicide which affected the canola flower buds. Three of the barley plots could not be swathed in time and was subjected to strong wind that caused seed loss.

Wheat classification on average was B3 grade, mainly due to HLM and high "sifsels" content.

Table 2 **Average and range of all crops plantd in the 2011 season**

Crop in 2009	Average yield (kg/ha)	Range in yield (kg/ha)	Number of plots
Wheat	2291	1860 – 2621	9
Oats	1407	811 - 2054	6
Canola	1556	1023 – 1091	3

Weed seed-bank study

The weed seed-bank study data will be discussed once a full data set is available after the 5th year of study on this site.

Soil analyses

P was applied before planting through the application of lime following soil analysis of all plots.

Financial (Gross Margin) analysis of different rotations

The Gross Margin analysis for the 2012 season has been done. The average gross margin for wheat was R4130/ha, while canola averaged R1771/ha. Oat gross margin was very low following the problems at harvest and resulted in an average gross margin of only R869/ha. Fertilser again proved to be the highest contributor to input cost with an average 22% across all crops.

Tygerhoek – (Short-rotation experimental site)

The plot plan for the 2012 season is presented in Appendix 2.

Late summer was dry, but excellent showers in April resulted in planting the trial early to middle May. The months of April, June and August received rainfall above the longterm average for the site.

Late growing-season (September) rains was adequate which resulted in excellent grain yields. The high October rainfall delayed harvesting.

Crop and pasture management

Wheat, barley, oats, canola and lupins were sown in the report year. All medic/clover pasture camps were left to re-establish themselves from the soil seed bank. Detailed management inputs for each crop are available on file at Tygerhoek (hard copy and electronic). Note that the management inputs for each crop varied depending on the crop planted in the previous year and the specific requirements of each plot. A summary of management inputs follows.

All crops were planted with a knife-point DBS Ausplow planter (13 knife-points each 300mm apart). Fertilizer (N & P) was placed below the seed at planting. Nitrogen top dressings were applied as Nitrosul (26%N + 5%S).

Wheat (SST 027) was planted at a seeding rate of 63 kg/ha together with 20 kg N/ha, 15 kg P/ha and 10 kg S/ha. Refer to details on file for weed, pest and disease control measures. Fertiliser top dressings were applied as required. Wheat was also planted in all of the VAR treatment camps.

Barley (Erica) was planted at a seeding rate of 66 kg/ha together with of 60 of MAP/ha. Refer to details on file for weed, pest and disease control measures. Fertiliser top dressings were not applied to any of the barley plots.

Oats (Pallinup) was planted at a seeding rate of 55 kg/ha together with 20 kg N/ha, 15 kg P/ha and 10 kg S/ha. Refer to details on file for weed, pest and disease control measures. Fertiliser top dressings were applied as required. The oats was planted for seed production (hence Pallinup).

Canola (AGAMax) was planted at a seeding rate of 3.4 kg/ha together with 23 kg N/ha, 15 kg P/ha and 15 kg S/ha. One N top dressing was applied during the season using 155kg of Nitrosul in total. Snail bait (Sluggem – 7kg/ha) was applied to all plots the day after. Refer to details on file for weed, pest and disease control measures.

Lupins (Mandelup) were planted at a seeding rate of 106 kg/ha together with 67 kg of MAP. Refer to details on file for weed, pest and disease control measures.

Medic and clover seed were left to re-establish themselves except for three camps which was planted to a mixture of 9kg/ha. The tree camps showed a decline in re-establishment due to late seasonal starts for a period of three

years and it was decided to reshow. Refer to details on file for weed, pest and disease control measures.

Sheep remained in their respective treatments with access to both pasture and crop residues through the dry summer months. The sheep were moved to their respective wheat stubble camps during the mating season. Supplementary feed was supplied to the all sheep for much of the season. As in previous seasons a detailed record of the amount of supplement supplied to each group of sheep was maintained. A record of sheep grazing days per treatment area was also maintained.

Data collection

One composite **soil sample** was taken from each sub-camp in December 2011 and sent for (macro- and micro-elemental) analysis to the Elsenburg soils lab. The soils data were used when planning fertilisation requirements for each camp in 2012.

Plant counts were done on all crops by counting the seedlings in 20x1m rows on all plots. A systematic random sampling procedure was followed. The values were then converted to plants per square meter using a conversion factor of 3.33.

Daily rainfall was recorded at a position that is centrally located on the site and climate data are routinely recorded at other weather stations on Tygerhoek.

Weed dynamics - Soil weed seed banks were determined from 110 composite soil samples collected in March 2012: one composite sample from each treatment camp and two from each of the lucerne treatment areas. Each sample was made up of a composite of 20 "cores" each 40mm in diameter. Soil "cores" were taken to a depth of 50mm. 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. Seedling trays were kept moist under shade cloth. The number of seedlings to 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. Note that this is the same facility used for seed bank studies for the Swellendam site. The same sampling procedure was applied at all sites.

Yield & Quality

All crops were swathed at the start of November. All crops were harvested in November.

Yield estimates were also done for all canola camps at what was considered to be the ideal time for swathing (when between 40 and 60% of pods contained seeds that had begun to change colour and were firm enough not to be crushed when rolled between thumb and forefinger) in an attempt to determine the potential yield vs that obtained from swathing and harvesting at a later date.

Swathed rows of both the lupins and the canola were harvested in the evening or when there was the least chance of seed losses due to pod shatter and of pods breaking from stalks during the harvesting process. The total area (adjusted - see records on file) of each camp was harvested and weighed to determine yield per plot of each crop. Two x 3kg grain samples were drawn from the yield of each plot. Barley and wheat samples were sent to the Overberg Agri silos at Rietpoel and to Stellenbosch University (Agronomy Department) respectively for detailed quality analyses. Canola and lupin samples were analysed for % oil and %CP at Elsenburg.

Crop residues were estimated in summer after harvesting. Samples were collected from 20 randomly place 0.25 m^2 quadrants per treatment plot in November 2012.

Pastures
Detailed records of sheep numbers and the duration of grazing were maintained for each camp (see records in 2012 data files at Tygerhoek). 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 and crop residues.

Seasonal herbage mass production was monitored in alternate sub-camps of each replicate of the lucerne treatment. Estimates of herbage mass production were taken when the animals entered ("in") a sub-camp and again when they left the sub-camp ("out"). Samples were collected from 20 randomly place 0.25 m^2 quadrants per sub-camp on each sampling occasion.

Five exclusion cages were allocated per ha and located in each of the medic/clover pasture camps. Herbage samples were cut within ("in" samples) and adjacent to ("out" samples) each cage (quadrant size = 1.0m x 0.25m). The exclusion cages were randomly re-located within the same camp after each harvest and the procedure was repeated. All samples were separated into medic, clover, grasses and broad-leaf weeds, which were then dried and weighed.

Post harvest
Grain stubble, in those camps that were part of a pasture/crop rotation, was grazed by sheep during the summer after harvesting. Pasture residues including medic pods were also used by sheep during summer. Mass of medic pods was monitored during February 2012 in each camp that had been grazed during 2011. All pods in 40 randomly selected sampling positions per camp (using a circular quadrat of 110mm diameter) were collected, weighed and counted.

Results

Rainfall

Monthly rainfall is represented in Figure 2. Daily rainfall data was recorded at the manual rain gauge on the research site. Rainfall and temperature data were recorded at the ARC-ICSW automatic weather station located close to the trial area.

A total of approximately 76mm fell in April which left the soils moist at the start of May for planting. Total rainfall (approximately 311mm) for the period April to the end of September 2012 was higher than recorded for the same period in previous season. The most of the growing season saw well distributed rainfall events, with some larger events as well events of less than 5mm. The total rainfall from April to October 4was much higher than the long-term average of 305mm (April to October).

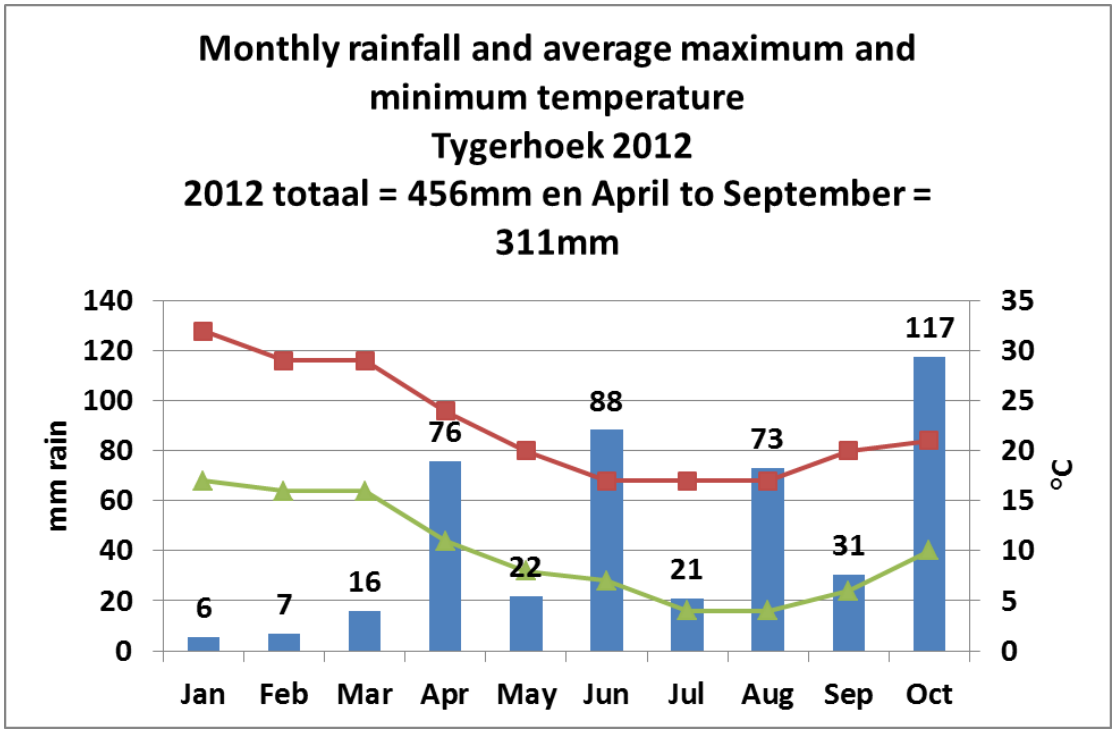


Figure 2. Monthly rainfall and average monthly maximum and minimum temperature for Tygerhoek in the 2012 season.

Plant counts

Plant counts illustrate the germination and emergence of all crops.

Seedling density for wheat was 89 seedlings m^{-2} on average. The expected seedling density was 120 seedlings m^{-2}.

Seedling density for barley was 67 seedlings m^{-2} on average. The expected seedling density was 100 seedlings m^{-2}.

Seedling density for oats was 96 seedlings m^{-2} on average. The expected seedling density was 100 seedlings m^{-2}.

Seedling density average for canola and lupins were 26 and 43 seedlings m^{-2}, respectively. The expected seedling densities for canola and lupin were 50 and 45 seedlings m^{-2} respectively.

Grain yields

Wheat
The average wheat yields across both replications for different crop sequences in the 2012 season are presented in Figure 3.

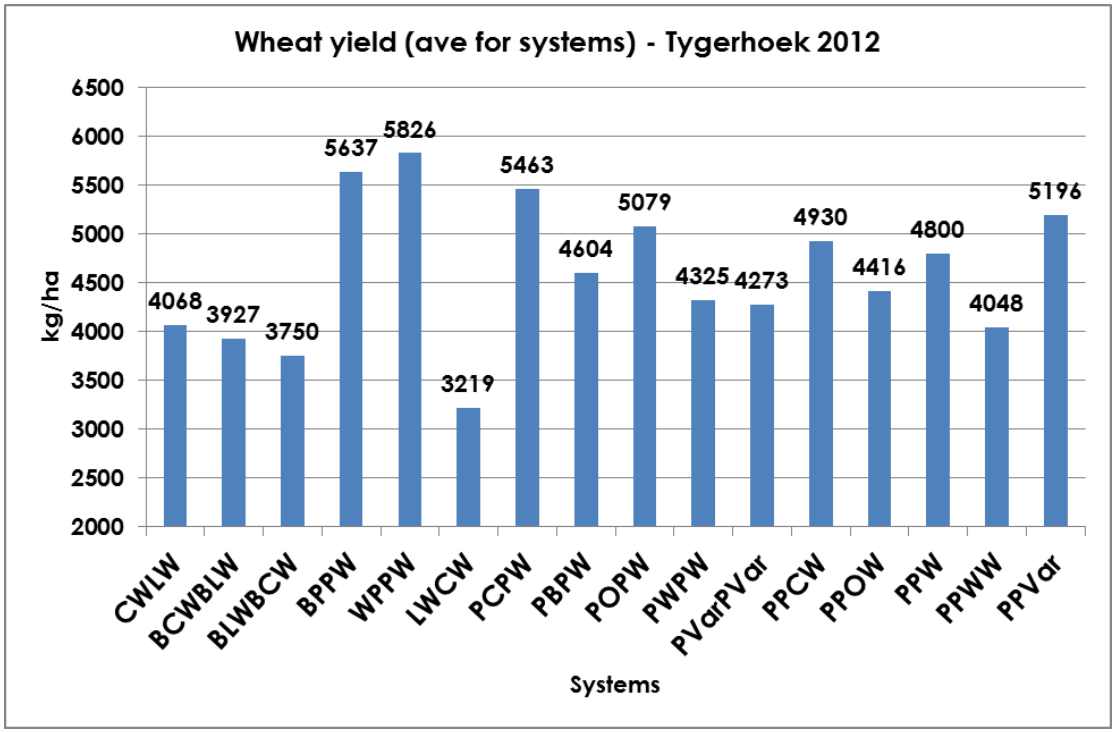


Figure 3 **Average wheat yields (recorded over both reps) for each crop sequence in 2012 (P = Pasture, L= Lupin, C = Canola, W = Wheat, B = Barley, O= Oats, Var = Wheat)**

This data shows the effect of an above average production season in the southern Cape, with the average yield of all wheat produced in all crop sequences were 4598 kg/ha.

The average wheat yield in crop sequences where wheat followed on a pasture were the highest, followed by wheat after oats (figure 4).

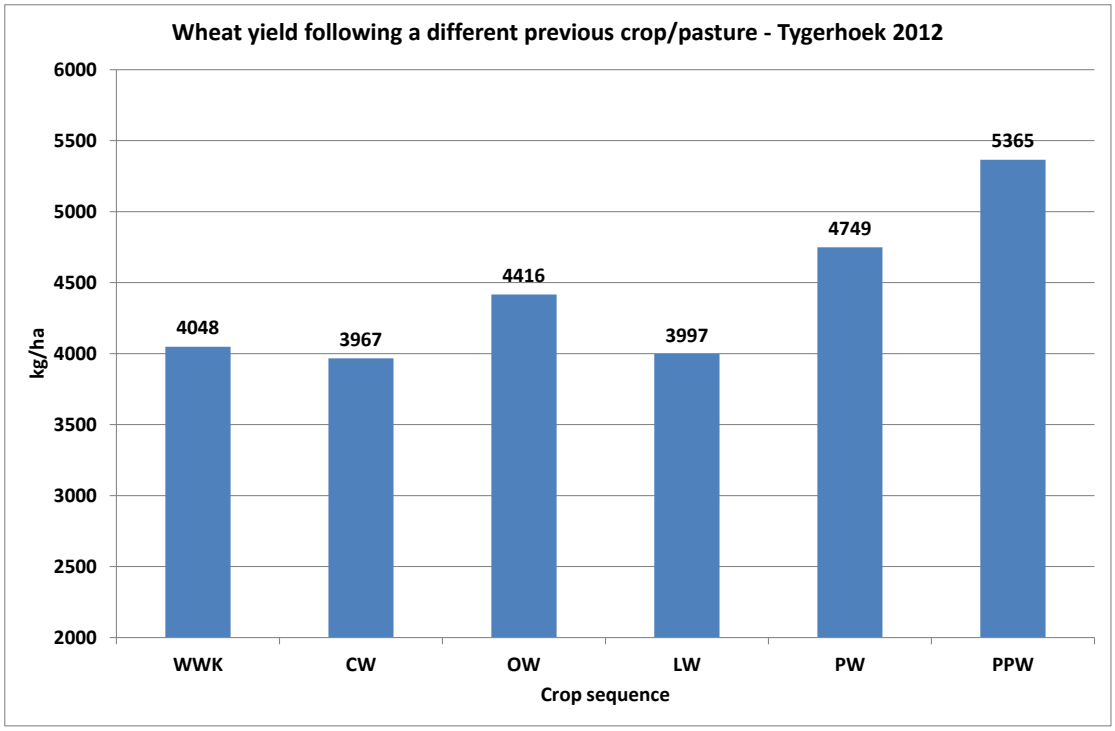


Figure 4 **Average wheat yields (recorded over both reps) following specific previous crop or pasture in 2012 (P = Pasture, L= Lupin, C = Canola, W = Wheat, O= Oats)**

Barley

Barley yields ranged from 3607 kg/ha to 4991 kg/ha (Figure 5). Average barley yield across all systems was 4343kg/ha. The yield of the 2012 season was lower than the 2011 season. The average % plumpness and N content over all systems were 91% therefore almost all barley produced in 2012 was classified as malt grade.

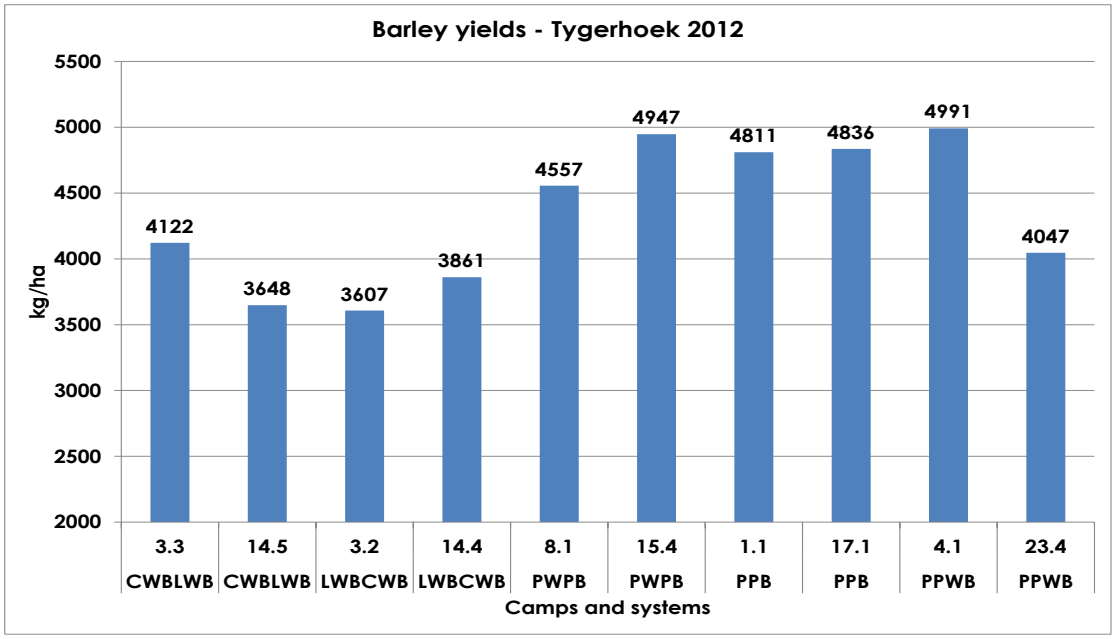


Figure 5 **Barley yields recorded in 2012 for all plots (P = Pasture, L= Lupin, C = Canola, W = Wheat)**

Oats
Seed production from the oats crop ranged from 3.8 to 4.5 tons ha^{-1}. The average yield for oats in 2012 was 4224kg/ha and was harvested as breakfast cereal (Figure 6)

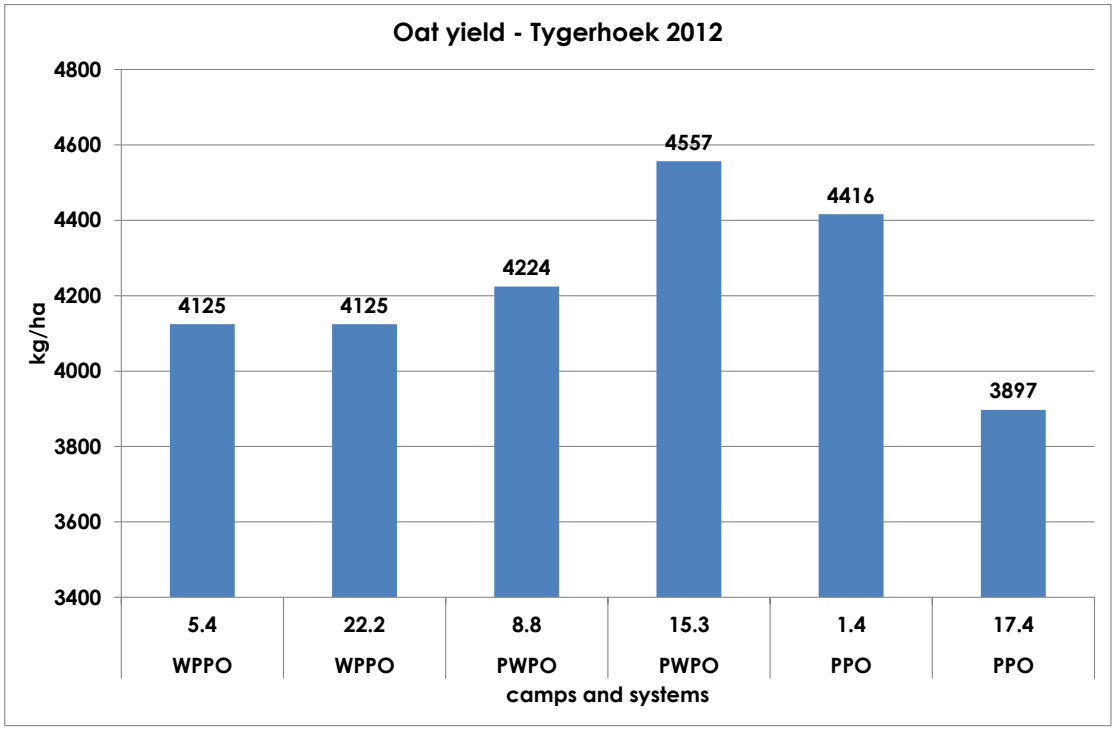


Figure 6 Oat yields recorded in 2012 for all plots (P = Pasture, W = Wheat)

Canola
Actual (harvested) canola yields ranged from 969 kg/ha to 2362 kg/ha. Average yield over all plots was 1580 kg/ha. The yield for canola following pastures was 2089 kg/ha, which was double that of canola following a cereal crop (1072 kg/ha).

Lupin
Lupin yields varied in the 2012 season with their yield ranging from 1064 to 1940 kg/ha.

Crop quality measures

Wheat
Per cent crude protein (%CP) of wheat samples (Rietpoel silo) reflect the rainfall conditions and average to above average grain yields. The %CP of the kernels was on average 11.8% for all systems. Hectolitre Mass ranged from 76 to 83 kg. Grain delivered to the silo ranged from B1 to B4, but all systems where wheat followed on a pasture the wheat was classified as B1.

Quality parameters of wheat samples, as determined by the University of Stellenbosch were similar to that of the silo.

Canola
Oil and crude protein (%CP) contents of samples from all canola camps, as determined at the Elsenburg laboratory were not available at the writing of the report. Oil content ranged from 41 to 46%.

Lupins
The crude protein content of the lupins was not available at the time of writing the report.

Pasture production data

Lucerne
Herbage availability was estimated in every alternate sub-camp of each lucerne replicate, when the animals entered a sub-camp and again when they left that sub-camp. The data represent a full year of grazing where the animals entered a sub-camp after 35 days (5 weeks) after the last grazing i.e. the grazing cycle for the sub-camp, and the other 5 sub-camps available to the group of sheep, was 7 days grazing ("in") and 35 days of rest ("out").

Herbage availability monitoring results (data not shown) quantified the amount of forage on offer to the animals through the season. The lucerne herbage was on the low side during a dry summer, but the excellent production season restored the pastures.

Medic/clover
Dry matter availability in the medic/clover pastures was monitored on one occasion during the season in August 2012). After a slow start to the season medic dry matter improved significantly following above average August rainfall. Dry matter production of well over 2.5 tons/ha was the norm for the medic/clover camps. The three camps that was sown during 2012 were not measured.

Animal performance
Ewes were in good condition in all treatments up to lambing in early May. The ewes in the medic/clover treatments increased weight after lambing which is an indication of the availability of sufficient pastures. There was however a dip in condition of the ewes on the medics in September although sufficient pasture were available. It might be attributed to the high water content of the pastures and the suckling lambs.

The average weight of a lam on the date of marketing them was 44kg over all pasture systems. Note that the weaning mass of the lambs would be used in economic evaluation of each system.

Economic data

The 2012 production season in the Southern Cape was excellent and that is reflected in the gross margins of crops produced at Tygerhoek as well as in the gross margins of the different rotation systems (Table 4).

Table 3 Average gross income, allocatable variable costs and gross margins per rotation system during the 2012 season (W = wheat, c = canola, O = oats, B = barley, L = lupin and P = pasture)

	1	2a	2b	2c	2d	3a	3b	3c	3d	3e
	Lucerne	PPW	PPO	PPB	PPVar	PWPW	PWPO	PWPB	PWPC	PVarPVar
Gross income:	4764	8286	5638	7851	8653	9360	8501	9710	9064	9481
Allocatable variable costs:	813	1740	1534	1611	1740	1955	1801	1882	2128	1955
Margin above directly allocatable costs:	3951	6685	4242	6379	7053	7614	6909	8037	7148	7735
Indirect allocatable costs:	0	139	139	139	139	208	208	208	212	208
Gross margin above all allocatale cocts:	3951	6546	4104	6240	6914	7406	6701	7828	6936	7527
	4a	4b	4c	4d	5a	5b				
	PPWW	PPOW	PPWB	PPCW	WCWL	WBCWBL				
Gross income:	10026	7761	9696	8729	8156	8068				
Allocatable variable costs:	1954	1800	1954	2145	2961	2845				
Margin above directly allocatable costs:	8280	6169	7950	6803	5649	5671				
Indirect allocatable costs:	208	208	208	218	454	447				
Gross margin above all allocatale cocts:	8072	5961	7742	6585	5195	5223				

The highest average gross income was obtained in the PPWW system with R10026/ha, while the same system also produced the highest average gross margin (R8072/ha). In 2012 the pure lucerne system showed the lowest average gross income of all systems and had the lowest average allocatable variable cost (R813/ha).

The 2012 season proved to be an excellent year for wheat and systems with higher wheat content within the system showed better margins than the pure cash crop systems.

CONCLUDING REMARKS

The experiment is proceeding according to the experimental protocols. The trial sites continue to be used in support of the cropping industry in the southern Cape.

PRESENTATIONS AND PUBLICATIONS

The following section summarizes the presentations, reports and articles for 2012. These publications, reports and presentations were based on the crop rotation trials being conducted in both the Swartland and the southern Cape.

Presentations

- 1 Farmer's days
- 2 technical meetings and report sessions
- 1 conference and seminar presentations

Presentations

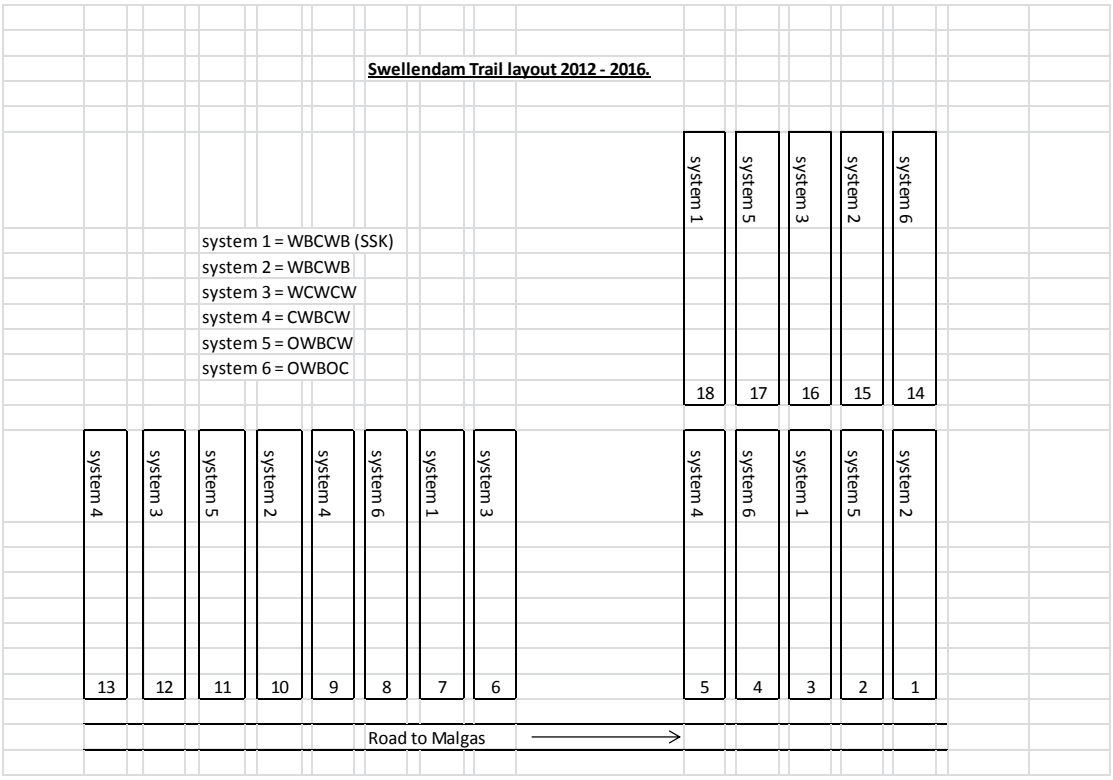
Scientific conference
An economic evaluation of short rotation crop and crop/pasture systems at Tygerhoek in the southern Cape, Johann Strauss and W Langenhoven
Directorate: Plant Science Department of Agriculture: Western Cape, P/Bag 1, Elsenburg 7607

Farmer's Days and study group meetings
Walk and talk at Tygerhoek with overseas visitors

Annual progress reports
The following detailed technical reports and their summaries for the 2012 report year were prepared for the Department of Agriculture: Western Cape and the Winter Cereal Trust

Strauss JA & Langenhoven WR 2012. Economic sustainability of short- and long-rotation crop/pasture production systems in the southern Cape.

Appendix 1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system 4 = CWBCW
system 5 = OWBCW
system 6 = OWBOC
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system 5
system 3
system 2
system 6
18
17
16
15
14
system 4
system 3
system 5
system 2
system 4
system 6
system 1
system 3
system 4
system 6
system 1
system 5
system 2
13
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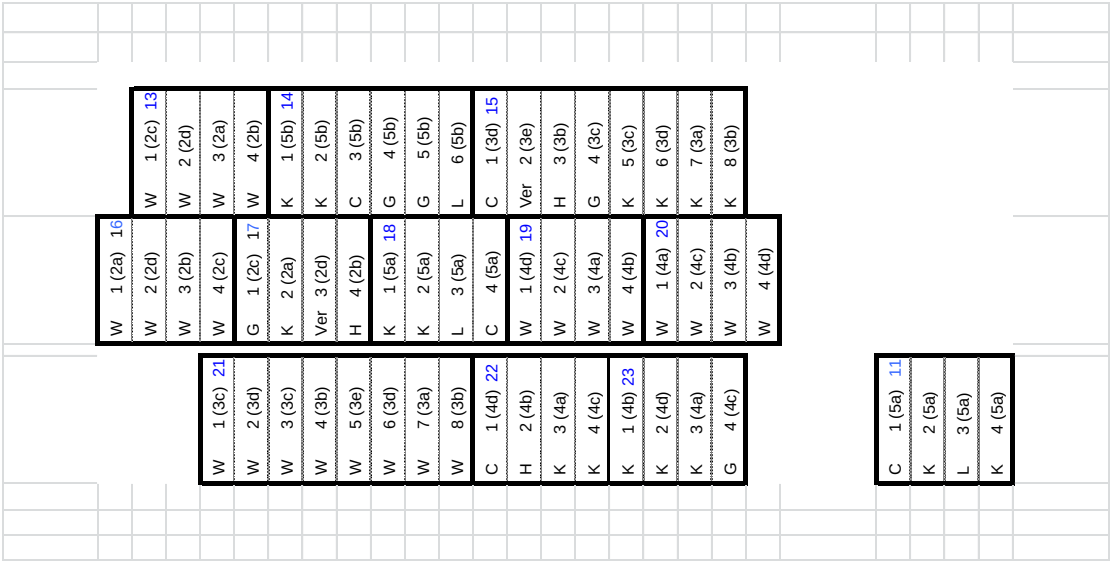
1
Road to Malgas

Appendix 2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H 3 (3b)
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K 6 (3d)
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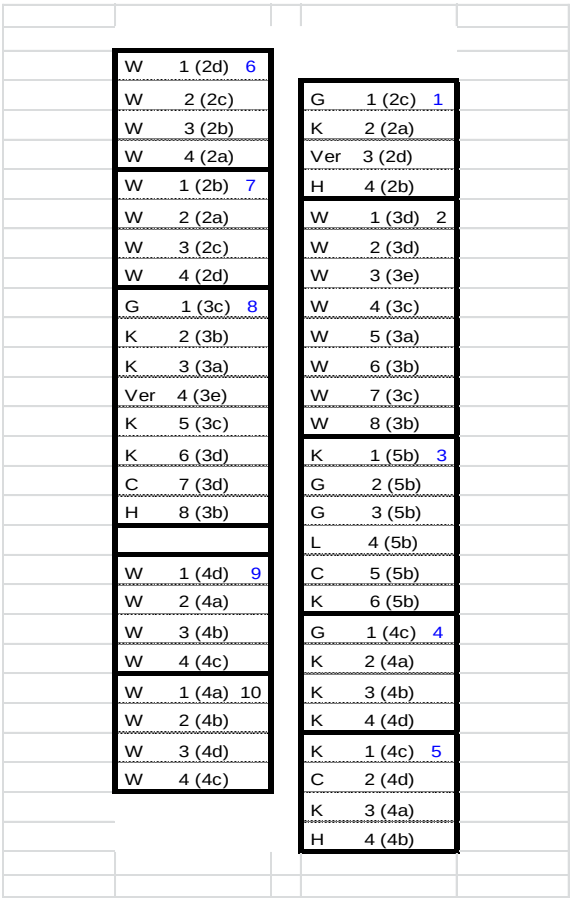
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