

# A mixed crop-livestock production financial analysis model

## Description and user manual

Developed under the  
Conservation Agriculture Farmer Innovation Programme

Implemented by:  
ASSET Research

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## Purpose of the model

This mixed Crop-Livestock Production Model (Version 1.1) is designed to provide farmers, researchers and decision-makers with a practical tool for analysing and assessing the financial performance and viability of mixed crop-livestock agricultural systems applied in the summer rainfall areas of South Africa.

## Structure of the model

The model (v1.1) comprises the following three main modules:

- The Crop Production Model
- The Livestock Production Model
- The Results (summary and comparison)

The **Crop Production Model** estimates production costs, income and net margins for maize, soybean and sunflower under a conventional tillage, no-tillage or conservation agriculture system in the various summer rainfall regions of South Africa. By using realistic costs for all the relevant inputs used in a grain crop production system, yield expectations of the specific crop and its farm-gate prices, comparative analyses across systems can be done, highlighting key cost drivers and supporting informed decision-making for improved profitability and resource efficiency.

The **Livestock Model** evaluates the integration of crop and livestock systems through the utilisation of crop biomass by animals, as well as by answering key questions such as: how many livestock days can be supported, how much meat are produced per hectare, what the associated costs and revenues are, and how much nitrogen, phosphorus, potassium and carbon are deposited back into the soil for the next season through manure and urine. Drawing on livestock, biomass, cost and sales variables, the model provides flexibility to run an almost limitless number of scenarios, making it a valuable planning and sustainability tool for mixed crop-livestock systems.

The **Results section** brings together the outputs of the Crop Production Model and the Livestock Model to provide an integrated view of farm performance across both crop and livestock systems.



## Crop Production Model user manual

### Model features and scope

This model supports three main crops: maize, soya and sunflower; and it accommodates three production systems: Conventional Tillage (CT), No-Tillage (NT) and Conservation/Regenerative Agriculture (CA/RA). The model includes various options for a cover crop system: summer cover crops (SCC), winter cover crop (WCC) and intercropping (IC), as well as a double cover crop (DCC) which represents a SCC followed by a WCC in the same season. It is built around a standard production-budget outline with inputs such as seed, fertiliser, fuel, reparation, herbicides, pesticides, fungicides, inoculants and bio-stimulants. Additional costs include input and crop insurance, grain hedging, interest on production and overheads. The model uses a combination of farmer specific values and default values, with the great majority being farmer specific data that is user-provided, making the model flexible. Key assumptions include a default cost-inflation rate of 8%, interest at 8% of direct costs and repairs set at 70% of fuel.

### Main data sources for default values

A set of default values were sourced to pre-fill the model with some unit prices for the ease and convenience of users. This was done for seed, fertiliser and fuel.

- **Seed:** A comprehensive list of seed cultivar options and prices were obtained from SA Grain Magazine (Link: [SO LYK SAADPRYSE in die nuwe seisoen - SA Grain](#)) and linked as options in the model under the seed cost line items. This provides the user with an opportunity to select their respective seed cultivar of choice. The model will produce its latest seed price. The unit price sheet is available in the model (last sheet).

MAIZE TYPE	COMPANIES	WM CULTIVARS	WHITE MAIZE	2021	2022	2023	DP/SAK		PER SEED		DP/SAK PER SEED	
							2024	2025	2024	2025	2024	2025
1. White maize	1.1. Agricol	IMP 52-11 R#	1.1. AgricolIMP 52-11 R#	R 3 050,0	0	0	0	0	0	0	0	0
1. White maize	1.1. Agricol	IMP 53-49 B#	1.1. AgricolIMP 53-49 B#	2830	0	0	0	0	0	0	0	0
1. White maize	1.1. Agricol	IMP 53-49 R#	1.1. AgricolIMP 53-49 R#	3550	3727	4180	4390	0,07316667	0	0	0	0
1. White maize	1.1. Agricol	IMP 53-49 BR#	1.1. AgricolIMP 53-49 BR#	3700	3888	4470	4695	0,07825	0	0	0	0
1. White maize	1.1. Agricol	VP 8405 R#	1.1. AgricolVP 8405 R#	3550	3800	4300	4600	0,07666667	0	0	0	0
1. White maize	1.1. Agricol	VP 8405 BR#	1.1. AgricolVP 8405 BR#	3700	3960	4600	4925	0,08208333	0	0	0	0
1. White maize	1.1. Agricol	SC 633 (25kg)	1.1. AgricolSC 633 (25kg)	0	2200	2200	0	0	0	0	0	0
1. White maize	1.3. Bayer	DKC76-71R	1.3. BayerDKC76-71R	0	4684	5875	6134	0,076675	0	0	0	0
1. White maize	1.3. Bayer	CRN 3505	1.3. BayerCRN 3505	3356	0	0	0	0	0	0	0	0
1. White maize	1.3. Bayer	DKC 63-53	1.3. BayerDKC 63-53	2397	0	0	0	0	0	0	0	0
1. White maize	1.3. Bayer	DKC 76-71	1.3. BayerDKC 76-71	4446	0	0	0	0	0	0	0	0
1. White maize	1.3. Bayer	DKC 78-27	1.3. BayerDKC 78-27	2850	0	0	0	0	0	0	0	0
1. White maize	1.3. Bayer	DKC76-73R	1.3. BayerDKC76-73R	4998	5251	6542	6812	0,08515	0	0	0	0
1. White maize	1.3. Bayer	DKC78-35R	1.3. BayerDKC78-35R	4090	4295	0	0	0	0	0	0	0

- **Fertilizer:** A list of latest prices for eight products: Ammonia (Middle East), Urea (46) (Eastern Europe), DAP (USA Gulf), KCL (CIS), LAN (28), Ureum (46), MAP and Kaliumchloried was obtained from the *Grain SA input reports* (<https://www.grainsa.co.za/pages/industry-reports/input-reports>). These prices were used to calculate the N, P and K component's costs in R/kg. The user will be allowed to add the amount of N, P and K (in kg/ha) at different application stages, which will automatically add the calculated cost in R/ha.

Fertilizer dropdown	2021	2022	2023	2024	2025
1. Ammonia (Middle East)	R 7 897,17	R 15 473,50	R 8 003,42	R 6 675,00	
2. Urea (46) (Eastern Europe)	R 7 269,92	R 9 270,25	R 5 535,42	R 6 124,17	
3. DAP (USA Gulf)	R 9 392,58	R 14 375,00	R 10 279,42	R 10 975,00	
4. KCL (CIS)	R 5 794,50	R 12 186,92	R 6 644,00	R 5 305,50	
5. LAN (28)	R 8 471,08	R 13 674,00	R 10 347,17	R 9 432,17	
6. Ureum(46)	R 10 688,33	R 17 257,67	R 11 107,33	R 10 332,08	
7. MAP	R 13 520,58	R 20 988,33	R 15 561,92	R 15 861,08	
8. Kaliumchloried	R 9 821,50	R 19 615,08	R 12 883,50	R 9 538,50	

- Fuel:** The latest diesel 0.05% prices were obtained from the Fuel Industry Association of South Africa (<https://fuelsindustry.org.za/publications/>) and used as the main rand per litre price in the model. Additionally, a comprehensive list of mechanisation farm or field actions and implements (such as planting with a no-till disc planter) with suggested fuel consumption (in litres per ha) were obtained from Grain SA, a few farmers and other research groups. With this, the user has an opportunity to select a sequence of actions and implements relevant for their crop production system (i.e. CT, NT or CA) and change the respective l/ha if it does not match their farm reality.

<b>FUEL CALCULATION</b>	
<b>NB: please insert <span style="color: red;">liters/ha</span></b>	
Action	L/ha
<b>Land preparation:</b>	
Moldboard Plow	21
Tandem rippper (skeurploeg) - 90cm	45
Tandem rippper (skeurploeg) - 75cm	35
Tandem rippper (skeurploeg) - 60cm	30
Tandem rippper (skeurploeg) - 45 cm	25
Boki inline ripper (45cm)	11,8
Rovic inline ripper (45 cm)	13,5
Rovic DLB ripper (45 cm)	16,4
Chisel Plough (ripper)	14
Offset disc	8
Discing or disc harrow (e.g. Lemken)	7
High-speed disc (Boki)	6,9
High-speed disc (Case Protill)	4,3

Crop model
Livestock model
Results
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- Overheads:** Similarly, a list of overhead costs was gathered from *SA Grain magazine* (<https://sagrainmag.co.za/sa-graan-grain-july-2025/>). These are integrated in the model as a guide but can be changed by the user to fit their farm reality.

Fixed cost/ha: 2024/25 season	Overheads: CT		Overheads: NT		Overheads: CA	
	Maize	Soya	Maize	Soya	Maize	Soya
Permanent labour: Salaries and wages	R390	R314	R390	R314	R390	R314
Electricity	R400	R400	R400	R400	R400	R400
Repairs: Fixed improvements	R44	R35	R44	R35	R44	R35
Fuel: Motor vehicles	R200	R200	R200	R200	R200	R200
Repairs: Motor vehicles	R20	R18	R20	R18	R20	R18
Bank charges	R34	R27	R34	R27	R34	R27
Auditors	R29	R23	R29	R23	R29	R23
Other expenses	R19	R15	R19	R15	R19	R15
Rent of land	R2 800	R2 800	R2 800	R2 800	R2 800	R2 800
Licences	R90	R90	R90	R90	R90	R90
Communication (telephone, internet, etc.)	R20	R16	R20	R16	R20	R16
Legal fees	R20	R16	R20	R16	R20	R16
General insurance	R182	R146	R182	R146	R182	R146
Living expenses	R286	R286	R286	R230	R286	R230
Personal insurance	R101	R101	R101	R81	R101	R81
Depreciation and medium term payments	R1 385	R1 385	R788	R783	R788	R847
Property rates and land taxes						
Long term loan payments	R353	R284	R353	R284	R353	R284
<b>Total fixed costs</b>	<b>R6 372</b>	<b>R6 156</b>	<b>R5 775</b>	<b>R5 477</b>	<b>R5 775</b>	<b>R5 542</b>

## Core assumptions and formulas

There are three main assumptions configured in the model: a default cost inflation multiplier of 8% per year that is applied to unit prices, a reparation cost of 70% of fuel cost, and an interest on production of 8% of direct costs (applied where interest carrying cost is required). These rates can be changed by the user.

There model calculates four key budget formulas:

1. **Total direct variable costs (R/ha)** = sum of all direct cost items (seed, fertiliser, chemicals, fuel, repairs, labour, etc.)
2. **Cost per ha before marketing costs (R/ha)** = Total direct variable costs + Overheads
3. **Income (R/ha)** = Farm-gate price (R/t) × Yield (t/ha)
4. **Net margin (R/ha)** = Income (R/ha) – Cost per ha before marketing costs (R/ha)

## How it works – user workflow

1. **Choose crop and production system:** Select crop (maize/soya/sunflower), system (CT/NT/CARA) and cover crops.

	Maize	Soya	Sunflower
CT	CT		
Seed			
Fertiliser			
Chemicals			
Labour			
Overheads			
Total			

2. **Select cultivar/product variant:** Choose from cultivar dropdown where pre-populated or enter own information under **yellow** spaces set at "other". Below is an example using maize seed cost.

		User provide	
Cost items	Select type	Select cultivar/type	Select cultivar type
Select yellow or white maize	2. Yellow Maize	1.4. Delta Saad DE 111	
Seed cash crop	2. If other please state product and insert price per unit to keep the same unit	1.4. Delta Saad DE 111 1.4. Delta Saad DE 303 1.4. Delta Saad DE 375 1.5. Capstone SeedsCAP 9299 1.5. Capstone SeedsCAP 9021 1.5. Capstone SeedsCAP 9-619 1.5. Capstone SeedsCAP 9001* 1.5. Capstone SeedsCAP 9503	
	2. Yellow Maize		
If type used is not available, specify type under other.		Other:	

3. **Select input unit:** Choose from the unit dropdown for either kg/ha, plant population/ha, or rand/litre; depending on the preferred unit prices to be used.

		User provide	User input in yellow cells
Select type	Select cultivar/type	Unit	
2. Yellow Maize	1.4. Delta Saad DE 111	plant population/ha	
2. If other please state product and insert price per unit to keep the same unit	Retained seeds:	kg/ha plant population/ha	
2. Yellow Maize	1.3. BayerDKC76-76BR	plant population/ha	R
	Other: DKC7726BR	kg/ha	R
	Other:	kg/ha	

4. **Select unit prices:** Either accept default sourced prices or provide own unit prices in a series of **yellow** highlighted fields that allow for user-provided values.

		User provide	User input in yellow cells
Select type	Select cultivar/type	Unit	Unit price (R/unit)
2. Yellow Maize	1.1. AgricolIMP 52-12 R#		R 4,30
2. If other please state product and insert price per unit to keep the same unit	Retained seeds:	If selected cultivar from dropdown options, unit price is automatically linked.	
2. Yellow Maize	1.3. BayerDKC76-76BR	plant population/ha	R -
	Other: DKC7726BR		R 0,08
	Other:	kg/ha	



5. **Specify cost inflation rate:** Enter a cost inflation rate to get an estimated final unit price for next season (this price will be auto-calculated). Default rate in the model is 8%, however, this can be changed.

User provide	User input in yellow cells		Auto-Calc	
Select cultivar/type	Unit	Unit price (R/unit)	%change in unit price	Final price (R/unit)
1.4. Delta Saad DE 111	plant population/ha	R -	8%	R -
Retained seeds:	plant population/ha			R -
1.3. BayerDKC76-76BR	plant population/ha	R -	8%	R -
Other: DKC7726BR	kg/ha	R 0,08	↓	
Other:	kg/ha		Apply where price is expected to change.	

6. **Specify usage quantities:** Enter quantity per ha (units used).

User provide	User input in yellow cells		Auto-Calc		User provide
Select cultivar/type	Unit	Unit price (R/unit)	%change in unit price	Final price (R/unit)	Quantity (/ha)
1.4. Delta Saad DE 111	kg/ha	R -	8%		Number of kgs
Retained seeds:	plant population/ha			R -	
1.3. BayerDKC76-76BR	plant population/ha	R -	8%	R -	
Other: DKC7726BR	plant population/ha	R			50000
Other:	kg/ha			R -	

This will depend on the unit specified as it is linked to unit price.

7. **Derive an estimated input cost:** The model will auto-calculate an estimated input cost for the next season which multiplies final unit price x quantity.

User input in yellow cells		Auto-Calc		User provide	Auto-Calc
Unit	Unit price (R/unit)	%change in unit price	Final price (R/unit)	Quantity (/ha)	Estimate (R/ha)
plant population/ha	R -	8%	R -		R -
plant population/ha			R -		R -
plant population/ha	R -	8%	R -		
kg/ha	R 0,08		R 0,08	50000	4 000,00
kg/ha			R -		R -
Total seed					R 4 000,00

Cost estimate = final price x quantity

8. **Repeat process for all cost items on the production budget.**

9. **Fertiliser costs:** Provision has been made in the model for different application stages: pre-plant, basal and total top dress for N, P and K.

Fertiliser cash crop and cover crop	N, P, K	N: pre-plant	kg/ha
		N: basal	kg/ha
		N: top dress total	kg/ha
		Other (N): foliar spray	
		Other (N):	
		P: pre-plant	kg/ha
		P: basal	kg/ha
		P: top dress total	kg/ha
		Other (P):	
		Other (P):	
		K: pre-plant	kg/ha
		K: basal	kg/ha
		K: top dress total	kg/ha
		Other (K):	
		Other (K):	
If other please state product and insert price per kg to keep the same unit	Other:	kg/ha	
	Other:	kg/ha	
Total fertiliser			

If there are other applications, please specify here.

This is the total estimated cost of fertiliser which is the sum of all applications.

10. **Fuel cost:** The same process applies; however, users can also engage the mechanisation table at the bottom (B373–C428) to change the litres/ha suggested for specific actions and implements to suit their farm reality (see **yellow** highlights). Total fuel costs will be the total l/ha multiplied accordingly.

Select activity (this is linked to mechanisation table)	Chisel Plough (ripper)	R	20,58	8%	R	22,22	15,00	
	High-speed disc (Bo)	R	20,58	8%	R	22,22	6,90	
	Offset disc	R	20,58	8%	R	22,22	10,00	
	Plant (conventional)	Rand/lit	R	20,58	8%	R	22,22	4,00
	Boom spray	Rand/lit	R	20,58	8%	R	22,22	3,00
	Spread fertilizer	Rand/lit	R	20,58	8%	R	22,22	1,00
	Boom spray	Rand/lit	R	20,58	8%	R	22,22	3,00
	Harvest combine (maize)						15,00	
	Transport grain truck						7,00	
	tapkar/ load grain (hand harvest)						1,50	
	Soil erosion ctrl/ filling ruts **						6,00	
	Spread (lime)	Rand/lit	R	20,58	8%	R	22,22	3,40
	Boom spray	Rand/lit	R	20,58	8%	R	22,22	3,00
	Other: water aamry	R	20,58	8%	R	22,22	0,00	
	Other:	R	20,58	8%	R	22,22	0,00	
Total fuel:		101,43						

Model uses the latest diesel prices.

Once activity is selected, the model will auto-produce a l/ha (this can be changed in the table below).

If there are other options not listed in the table, please specify here.

This is the total fuel used which is the sum of l/ha for all actions.

11. **Reparation cost:** This will be auto calculated per above assumption (70% of fuel). User has an option to change this 70% to one suitable for their farm.

Reparation / Maintenance	70%
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Overhead cost R/ha

For this, please go to the overheads sheet as this is linked to the total there.

R 6 372,30



13. **Model simulation:** Model calculates TDAV costs R/ha and cost/ha.

Total direct allocated variable cost (R/ha) Change so that this is for crops only				Sum of all costs.	→	R	20 162,57
Overhead cost R/ha	Include Electricity, labour, replacement, depreciation, admin, life costs for owner	Rand/ha	R	6 372,30		R	6 372,30
Cost per ha before marketing cost R/ha				Sum of all costs + overheads.	→	R	26 534,86

14. **To calculate income:** User will provide their farm gate selling price and yield (t/ha) which the model will multiply together to calculate income, net margin and per-tonne economics. Output includes summary table and charts.

User provide	User provide	Calc
Farm gate price	Yield (t/ha)	Income
R 3 700,00	7,5	R 27 750,00

15. Similar process applies for all crops (maize, soya, sunflower and cover crops) and systems (CT, NT, and CA/RA).



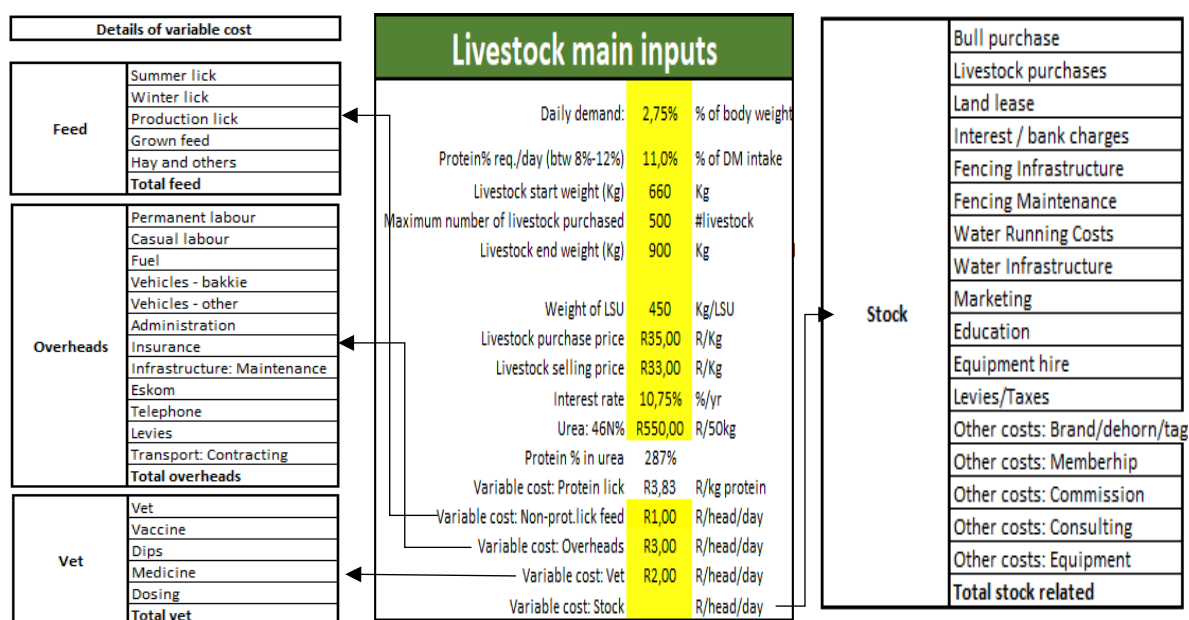
## Livestock Production Model user manual

### Model feature and scope

The primary driver or input of this model is the **biomass production** from the crop production model, namely from the three cash crops (maize, soya, sunflower) and from the cover crop systems (SCC, WCC, IC and DCC). It is done for the three production systems, namely Conventional Tillage (CT), No-Tillage (NT) or Conservation/Regenerative Agriculture (CA/RA). The model calculates livestock-days from available biomass, and estimates costs, revenue, net margin and nutrient deposition (N, P, K, C) deposited back into the soil.

### Main input data and assumptions

The model uses a set of main inputs to calculate biomass (in dry matter), costs and net margin. These are shown in the figure below. Likewise, all **yellow** fields are variables that can be changed by users to fit own farm reality.



The nutrient deposition (N, P, K, C) leans on the following additional data, all of which are used provided.

Portion of manure to soil	45%	%
N% in manure	1,8%	%
P% in manure	1,0%	%
K% in manure	1,5%	%
C% in manure	45%	%
Unit price: N	R27,90	R/Kg
Unit price: P	R68,00	R/Kg
Unit price: K	R18,00	R/Kg
Unit price: C	R0,135	R/Kg
% N retained for next season	50%	%
% C mineralization/soil respiration	30%	%
Daily water requirement relative to DM	3,20	Lit / day / KgDM
Portion of urine to drinking water	35%	%
g N / lit. urine	10	gram
%N volatilization	40%	%

Success rate: Number of years out of 5	
- Cash crop	4,50
- Intercrop	4,00
- Winter cover crop	3,50
- Summer cover crop	4,50

## Production statistics

After completing the inputs and assumptions above, there are various user input requirements necessary to calculate the conversion of dry matter to kg meat per ha. This is done by adjusting the various **yellow** fields below to reflect the farm's reality. The following is an example using maize.

Calculation of d				
Provides an option to include or exclude livestock based on farmer's practice.		Maize		
		Conv. Till	No Till	Conserv. & Regen
	Model yield: t/ha	7,5	Linked to yields specified in crop model.	
	Include livestock component: Yes or no	1 Yes		
	Buy livestock in: Yes or no (no=use own livestock)	1 Yes	Provides option for buying or using own livestock.	
	User yield override: t/ha If > 0; then user overrides model yield			
	Harvest index	0,52		
	tDM/ha (crop residues)	8,1	8,1	8,1
	Kg DM/ha	8 125	8 125	8 125
	Utilisation rate	50%	50%	50%
	Supply Kg DM/ha	4 063	4 063	4 063
	Protein % of DM	7,0%	Yellow = user provided  White = model calculations and links	
	Feed conv.: Kg fodder: Kg meat	25		
	Digestibility %	40%		
	Kg meat/ha	162,5	162,5	162,5

Provision is also made for the crop system where applicable.

Intercrop ; Intercrop ; Intercrop ; In			
- Kg dry matter / ha			1 500
Protein % of DM			13%
- Utilisation rate (%)			70%
- Feed conv.: Kg fodder: Kg meat			6,5
- Digestibility %			65%
- Kg meat/ha	0,0	0,0	161,5

Winter cover crop after cash & intercrop			
- Kg dry matter / ha			0
Protein % of DM			13%
- Utilisation rate (%)			60%
- Feed conv.: Kg fodder: Kg meat			6,5
- Digestibility %			65%
- Kg meat/ha	0,0	0,0	0,0

Using the above inputs, the model calculates these key formulas:

- ## How it works – user workflow

After all input data is provided by user, below is a demonstration of how the model works using maize as an example.

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	Maize		
	Conv. Till	No Till	Conserv. & Regen
Protein demand: g	402 188	402 188	494 588
Protein supply: g	284 375	284 375	420 875
Protein over (under) supply/day/head	-691	-691	-352
Protein over (under) supply: Kg	-118	-118	-74
Variable cost: Lick	R1,8	R1,8	R1,8
Variable cost: Non-prot.lick feed	R1,0	R1,0	R1,0
Variable cost: Overheads	R3,0	R3,0	R3,0
Variable cost: Vet	R2,0	R2,0	R2,0
Variable cost: Stock	R0,0	R0,0	R0,0
R/LSU/day	R7,8	R7,8	R7,8
Number of LSU equiv.	1,17	1,17	2,34
R/ha	R2 303	R2 303	R2 841

	Maize		
	Conv. Till	No Till	Conserv. & Regen
Portion of manure to soil	45%	45%	45%
N% in manure	1,8%	1,8%	1,8%
P% in manure	1,0%	1,0%	1,0%
K% in manure	1,5%	1,5%	1,5%
C% in manure	45,0%	45,0%	45,0%
R/Kg N	R27,90	R27,90	R27,90
R/Kg P	R68,00	R68,00	R68,00
R/Kg K	R18,00	R18,00	R18,00
R/Kg C	R0,135	R0,135	R0,135
Kg N/ha	17,8	17,8	20,2
% N retained for next season	50%	50%	50%
Retained Kg N/ha	8,9	8,9	10,1
Kg P/ha	9,9	9,9	11,2
Kg K/ha	14,8	14,8	16,8
Kg C/ha	444,2	444,2	503,8
% C mineralization/soil respiration	30%	30%	30%
Retained Kg C/ha	311,0	311,0	352,6
R/ha N	R248	R496	R562
R/ha P	R671	R671	R761
R/ha K	R267	R267	R302
R/ha C	R42	R60	R68
Total R/ha manure fert.	R1 228	R1 494	R1 694

	Maize		
	Conv. Till	No Till	Conserv. & Regen
Avg. livestock weight	780	780	780
Livestock DM consumpt. per day: %	2,75%	2,75%	2,75%
Livestock DM consumpt. per day: Kg DM	21,45	21,45	21,45
Daily water requirement relative to DM	3,20	3,20	3,20
Daily water requirement: Lit/livestock/day	68,64	68,64	68,64
Portion of urine to drinking water	35%	35%	35%
Lit. urine/livestock/day	24	24	24
Number of livestock equiv./ha	0,7	0,7	1,4
Grazing days	252	252	155
Lit of urine produced	4 095	4 095	5 036
g N / lit. urine	10	10	10
%N volatilization	40%	40%	40%
Kg N/ha	24,6	24,6	30,2
% N retained for next season	50%	50%	50%
Retained Kg N/ha	12,3	12,3	15,1
R/Kg N	R27,90	R27,90	R27,90
Total R/ha urine fert.	R343	R343	R421

These calculations, together with those in the crop model feed the results section that follows.





## Model Results

### Scope

The combined results module brings together the outputs of the Crop Production and the Livestock models to provide an integrated view of farm performance with contributions from different crop and livestock systems. The results module shows the financial net margins of maize, soya and sunflower under different tillage systems, but also quantifies how much crop biomass can support livestock, the associated feeding costs and revenues, and the nutrient value (N, P, K and C) returned to fields (soil) available to crops in the following season. The integration of both models enables farmers, researchers and policymakers to evaluate and compare profitability, resource-use efficiency, and impact of the integration of cover crops and livestock with different crops and tillage systems in a holistic way, highlighting complementary effects and trade-offs.

### How it is outlined

The results sheet shows the crop model results first (see figure below). The top section specifies total cropland area and how it is divided into different land-use options (that can be altered by user) between the three cash crops (maize, soya and sunflower), and non-cash crops such as cover crops. This allows for comparison of different crops, land allocations and systems. For each crop under each system, it takes into considerations the *yields* and *income from crops* from the crop model to show the revenue potential of each system. It then provides a breakdown of production cost items (as outlined in the crop model) with sub-components where relevant. At the bottom the direct costs, overheads and total crop costs are calculated as explained in the crop model section. Two additional calculations include:

1. **The net margin for crops = income on crops - total crop costs**
2. **The net crop margin % to crop income = net margin for crops / income from crops**

% area allocated to the land use options.										
Total cropland area	10%	40%	10%	40%						
1 000										100% yes
Rand/ha										
	1 Maize			2 Soy			3 Sunflower			Non-cash crop areas
	CT	NT	CA/RA	CT	NT	CA/RA	CT	NT	CA/RA	Double cover crop system
Yield	5,20	5,00	4,80	1,80	1,80	1,80	2,00	2,00	1,80	
Income from crops	R17 992	R17 300	R16 608	R12 060	R12 060	R12 060	R17 400	R17 400	R15 660	
Seed	R2 419	R2 240	R3 100	R1 706	R1 704	R2 254	R1 037	R1 037	R2 037	R1 950
Fertilizer	R4 213	R4 670	R3 849	R779	R779	R779	R3 274	R3 274	R2 522	R2 175
- Purchased N	85	85	75	0	0	0	55	55	45	50
- Purchased P	20	20	18	10	10	10	15	15	12	0
- Purchased K	22	22	9	30	30	30	9	9	8	0
Lime	R750	R750	R750	R470	R470	R470	R0	R0	R0	R0
- Purchased lime (kg)	0	0	0	1	1	1	0	0	0	0
Biostimulant	R0	R0	R1 000	R0	R0	R1 200	R0	R0	R1 000	R1 288
- Purchased biostimulant (lit)	0	0	27	0	0	28	0	0	27	30
Inoculant	R0	R0	R0	R520	R520	R260	R0	R0	R0	R0
- Purchased inoculant (lit)	0	0	0	2	2	1	0	0	0	0
Fuel	R1 676	R800	R903	R1 645	R689	R1 002	R1 311	R600	R681	R289
- Purchased diesel (lit)	75	36	41	74	31	45	59	27	31	13
Reparation	R1 173	R560	R632	R1 151	R482	R701	R918	R420	R477	R202
Herbicide	R1 000	R1 500	R960	R866	R1 300	R1 300	R520	R810	R508	R738
Pest control	R158	R170	R165	R65	R65	R65	R65	R65	R65	R65
Fungicides	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0
Input insurance	R1 500	R1 500	R1 500	R0	R0	R0	R0	R0	R0	R0
Grain hedging	R0	R0	R0	R0	R0	R0	R575	R575	R575	R0
Crop insurance	R570	R570	R570	R1 139	R1 250	R1 250	R435	R435	R435	R0
Interest on production	R1 077	R1 021	R1 006	R667	R581	R699	R651	R577	R584	R375
Direct costs	R14 536	R13 781	R14 435	R9 008	R7 840	R9 980	R8 785	R7 793	R8 882	R7 017
Overheads	R3 381	R2 997	R3 032	R2 942	R2 558	R2 594	R2 942	R2 558	R2 594	R1 200
Total crop costs	R17 917	R16 778	R17 468	R11 950	R10 399	R12 574	R11 728	R10 351	R11 476	R8 217
Net margin for crops	R75	R522	-R860	R110	R1 661	-R514	R5 672	R7 049	R4 184	-R8 217
Net crop margin% to crop income	0%	3%	-5%	1%	14%	-4%	33%	41%	27%	

User can select the % of cropland used.

Cover crop will have a negative income in the crop model.



The livestock results are also displayed as shown below. The income from livestock, total livestock costs and variable costs are taken from the livestock model. Fertiliser value or manure and urine, available N:kg, P:kg, K:kg, C:kg and C:N ratio are also drawn from the livestock model calculation sheet.

**Net margin from livestock** = income from livestock and total livestock costs.

Income from livestock	R6 478	R6 229	R10 934	R1 115	R1 115	R4 299	R1 238	R1 238	R8 545	R28 308
Livestock stock cost	R0	R0	R0	R0	R0	R0	R0	R0	R0	R0
Variable cost	R957	R914	R961	R142	R142	R237	R158	R158	R402	R2 011
Total livestock costs	R957	R914	R961	R142	R142	R237	R158	R158	R402	R2 011
Net margin from livestock	R5 522	R5 315	R9 973	R972	R972	R4 063	R1 080	R1 080	R8 143	R26 297

Fert. value of manure	R847	R996	R1 089	R178	R178	R253	R198	R198	R378	R1 701
Fert. value of urine	R238	R229	R272	R41	R41	R70	R45	R45	R120	R598
Total fertiliser. value	R1 085	R1 224	R1 361	R219	R219	R324	R243	R243	R498	R2 299
Available N: Kg	15	14	16	3	3	4	3	3	7	32
Available P: Kg	7	7	7	1	1	2	1	1	3	11
Available K: Kg	10	10	11	2	2	3	2	2	4	17
Available C: Kg	185	178	194	32	32	45	35	35	68	304
C:N Ratio	13	13	12	13	13	11	13	13	10	10

Impact from cover crops comes in under the livestock model.

For integrated crop-livestock results, the following are calculated:

1. **Total net margin** = total net margin for crops + total net margin for livestock
2. **Net livestock margin% to livestock income** = net margin from livestock / income from livestock
3. **Total net margin % to total cost** = total net margin / (total crop cost + total livestock costs)

Total net margin	R5 597	R5 837	R9 113	R1 082	R2 634	R3 549	R6 752	R8 129	R12 327	R18 080
								WCC share in DCC		R9 736
Net livestock margin% to livestock income	85%	85%	91%	87%	87%	94%	87%	87%	95%	93%
Total net margin% to total cost	30%	33%	49%	9%	25%	28%	57%	77%	104%	177%

## Conclusion

The Crop Production, Livestock and Integrated Results Models provide a comprehensive planning and decision-support framework for farming systems. The Crop Model highlights the financial viability of different tillage and management practices, in helping to identify cost drivers and profit margins across maize, soybean and sunflower production. The Livestock Model translates crop biomass into practical livestock feeding potential, meat production, associated costs and revenues, and quantifies the nutrient value from livestock dung and urine returned to soils. The results sections add the benefit of showing and comparing the profitability across all crops and tillage systems, but also the sustainability trade-offs between income, livestock utilisation and soil fertility enhancement. Together, these models can help equip farmers, researchers and policymakers with a practical toolset for farming scenario planning and long-term sustainability. Moreover, they have an added value in supporting evidence-based decisions that improve profitability today while safeguarding productivity and soil health for the future.