2023 Update

SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE

MECHANISATION REPORT No. 2

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SYSTEMS AND COSTS OF LAND PREPARATION, PLANTING AND RATOON MANAGEMENT

The costs given in the following tables are based on replanting 20 hectares per year and using new equipment with 60 kW 2WD tractor costs based on an annual usage of 1000 hours. Expensive implements are under-utilised and this results in high implement costs. The larger the area to replant, the greater the utilisation of the implement and hence its cost per unit of area will be reduced. The examples merely serve as a guide and growers should carefully compare the operations included and adjust these to suit their systems, if necessary. Growers are referred to the table on the last page for costs of individual operations.

LAND PREPARATION

Operations involving land smoothing, drainage and conservation structures are considered to be part of soil and water conservation and will therefore not be considered in this exercise on land preparation.

The main objectives in land preparation are assumed to be:

- to effectively destroy the old crop
- to prepare a seedbed for planting.

The two categories of soil to be considered in this exercise are:

i) heavier soils (loams and clays)
ii) lighter soils (loamy sands and sands).

The operations listed in the tables that follow may be considered to be the basic minimum, the number of harrowings for example being dependent on factors such as the presence or absence of grass weeds, soil moisture content, season of operation and volunteers. If a lime application operation is required, please refer to the table on the last page for individual operation costs.

1. **Traditional system:**

TRADITIONAL SYSTEM: **Operations:**	FUEL: (l/ha)	COST: (R/ha)
Deep plough (2f rev disc)	30	1339
Disc Harrow	16	751
Plough (2f rev disc)	30	1339
Disc Harrow	16	751
Disc Harrow	16	751
Ridger only	10	792
TOTAL:	**118**	**5723**

2. **Conventional tillage system (heavier soils):**

CONVENTIONAL SYSTEM: (HEAVY SOILS) **Operations:**	FUEL: (l/ha)	COST: (R/ha)
Shallow (100mm) 2f m/b 1way (May)	20	1181
Disc harrow (June)	16	751
Plough (200-250mm) 2f m/b 1way (Aug)	25	1321
Disc harrow (150mm) (Aug)	16	751
Ridger only	10	792
TOTAL:	**87**	**4796**

3. **Conventional tillage system (sandy soils):**

CONVENTIONAL SYSTEM: (LIGHT SOILS) **Operations:**	FUEL: (l/ha)	COST: (R/ha)
Shallow (100mm) rotary hoe (May)	25	1468
Disc harrow (100mm) (June)	8	517
Disc harrow (100mm) (Aug)	8	517
Ridger only	10	792
TOTAL:	**51**	**3294**

4. **Minimum tillage system, chemical (heavier soils) - Option 1:**

MINIMUM TILLAGE SYSTEM (SANDY SOILS) **Operations:**	FUEL: (l/ha)	COST: (R/ha)
Full cover spray Glyphosate 360gm/l @ 8l/ha (1 labour-day)	0	229
from Oct to Mar onwards (8l/ha)	0	1200
Min tiller (2r rotary hoe+ridgers+fert appl in interrow (Oct-Mar)	15	1473
TOTAL:	**15**	**2902**
Add stool plough- improved efficacy	12	685

Note: The efficacy of chemical stool eradication in heavier soils is improved if the stools are undercut (±100 mm) by using a stool plough one week after spraying. This will increase the costs as indicated in the table above.

5. **No-tillage system, chemical (sandy soils):**

NO TILLAGE SYSTEM (SANDY SOILS) **Operations:**	FUEL: (l/ha)	COST: (R/ha)
Full cover spray Glyphosate (1 labour-day)	0	229
from Oct to Mar onwards @ 8l/ha	0	1200
Ridger only	10	792
TOTAL:	**10**	**2221**

6. **Reduced tillage system, manual (sandy soils) – Option 2:**

REDUCED TILLAGE SYSTEM - MANUAL (SANDY SOILS) **Operations:**	FUEL: (l/ha)	Mech Cost: (R/ha)	Labour-days per ha	Labour cost (R/ha)	Operation cost (R/ha)
Chipping (May) @ 40 labour days/ha	0	0	40	9151	9151
Ridger only	10	792	0	0	792
TOTAL:	**10**	**792**	**40**	**9151**	**9943**

Note: Irrespective of the system of crop eradication used, the cost of hand labour for roguing must be added to the above costs.

PLANTING

In comparing the various planting methods, the following assumptions are made:

- flat culture is desirable;
- some fertiliser is required in the planting furrow;
- plant cane warrants one pre- and one post-emergent application of herbicide for weed control;
- the cost of materials is the same for all systems and is excluded from these comparisons;
- one labourer costs R**228,78** per day (9 hours);
- Glyphosate (360 g/l) costs R150,00 per litre (assumed retail price)

1. Machine planting

MACHINE PLANTING	Fuel (l/ha)	Mech Cost: (R/ha)	Labour-days per ha	Labour cost (R/ha)	Operation cost (R/ha)
Machine planting (at 1ha/day)	22	2716	6	1373	4089
Pre-emergent herbicide	3	187	1	229	416
Top dress fertilizer	3	225	1	229	454
Post-emergent herbicide	3	187	1	229	416
Hand-hoeing grasses	0	0	10	2288	2288
Spot spray	0	0	1	229	229
TOTAL:	**31**	**3315**	**20**	**4576**	**7891**

* This value can range typically from 6 to 10 labour days per hectare depending on labour productivity.

2. Semi-mechanical planting

SEMI MECHANICAL PLANTING	Fuel (l/ha)	Mech Cost: (R/ha)	Labour-days per ha	Labour cost (R/ha)	Operation cost (R/ha)
Ridging and Fert applic (2 row)	5	537	1	229	766
Planting	0	0	20	4576	4576
Covering	12	891	0	0	891
Pre-emergent herbicide	3	187	1	229	416
Top dress fertiliser	3	225	1	229	454
Post-emergent herbicide	3	187	1	229	416
Hand-hoe	0	0	10	2288	2288
Spot spray	0	0	1	229	229
TOTAL:	**25**	**2027**	**35**	**8007**	**10034**

3. Manual planting

MANUAL PLANTING	Fuel (l/ha)	Mech Cost: (R/ha)	Labour-days per ha	Labour cost (R/ha)	Operation cost (R/ha)
Ridging only	10	792	0	0	792
Fertiliser application	0	0	1	229	229
Planting	0	0	20	4576	4576
Covering	0	0	5	1144	1144
Pre-emergent herbicide	0	0	1	229	229
Top dress fertiliser	0	0	1	229	229
Post-emergent herbicide	0	0	1	229	229
Hand-hoe	0	0	10	2288	2288
Spot spray	0	0	1	229	229
TOTAL:	**10**	**792**	**40**	**9151**	**9943**

Operations such as the application of nematicides and filtercake and seed-dipping, are excluded as they are specific to soil types and season. Costs of materials were excluded in the planting costs.

RATOON MANAGEMENT

Within the industry there are three common situations which require different management.
Relatively few operations are required in the management of ratoon crops but weed control is the most difficult to cost as there is no best procedure. The type and number of operations depends on factors such as time of harvest, soil type and the spectrum and density of weeds that occur.
Operations such as subsoiling, stool pruning, furrow-forming and nematicide application are not included as they are not generally necessary.

1. **Cane burnt and tops windrowed**

CANE BURNT & TOPS WINDROWED	Fuel (l/ha)	Mech Cost: (R/ha)	Labour-days per ha	Labour cost (R/ha)	Operation cost (R/ha)
Raking tops	4	250	0	0	250
Topdress fertiliser	3	225	1	229	454
Post-emergent herbicide (long term)	3	187	1	229	416
Hand weed	0	0	10	2288	2288
TOTAL:	**10**	**662**	**12**	**2745**	**3407**

2. **Cane burnt and tops left scattered**

CANE BURNT & TOPS LEFT SCATTERED	Fuel (l/ha)	Mech Cost: (R/ha)	Labour-days per ha	Labour cost (R/ha)	Operation cost (R/ha)
Spread tops and clean up	0	0	3	686	686
Topdress fertiliser	3	225	1	229	454
Post-emergent herbicide (long term)	3	187	1	229	416
Hand weed	0	0	8	1830	1830
TOTAL:	**6**	**412**	**13**	**2974**	**3386**

3. **Mulch blanket**

MULCH BLANKET	Fuel (l/ha)	Mech Cost: (R/ha)	Labour-days per ha	Labour cost (R/ha)	Operation cost (R/ha)
Spread residue & tidy field	0	0	3	686	686
Topdress fertiliser	0	0	1	229	229
Spot spray, twice	0	0	2	458	458
Hand weed	0	0	4	915	915
TOTAL:	**0**	**0**	**10**	**2288**	**2288**

For all systems:

- material costs are excluded
- add verge control:

  Assume 10% of total area will be slashed 4 times annually i.e) 10% of 200 ha = 20 ha

  Cost per slashing = R631 per ha x 20 ha = R 12614

  Cost for slashing = R 12614 x 4 = R 50455

  Cost per hectare under cane = R 50455 ÷ 200 ha = **R 252,28 /ha**

PERFORMANCE STANDARDS AND COSTS FOR MECHANICAL SUGARCANE PRODUCTION SYSTEMS: 200HA CANE FARM REPLANTING 20HA/YR

Costs are based on a 60 kW 2wd tractor: R 316.22 /hour + implement cost NB: The operational costs per hectare shown below are for 1 pass only; For steep or poorly laid out fields these figures below must be inflated

Machinery and equipment	Cost price (Rand)	Work-ing width (m)	Effic-iency (%)	No. of passes (no.)	Lighter soils						Heavier soils					
					Speed (km/h)	Work-rate (h/ha)	Annual utilis-ation (hours)	Imple-ment cost (R/h)	Opera-tion cost (R/ha)	Fuel (l/ha)	Speed (km/h)	Work-rate (h/ha)	Annual utilis-ation (hours)	Imple-ment cost (R/h)	Opera-tion cost (R/ha)	Fuel (l/ha)
Subsoil: single tine	28000	1.2	90	1	4.0	2.31	46	78.91	915	15	3.0	3.09	62	60.35	1162	20
Ripper : 3 tine	54000	1.5	90	1	4.0	1.85	37	185.91	930	20	3.0	2.47	49	143.68	1136	25
Plough : 2f rev mb-shallow	100000	0.8	85	2*	4.5	3.27	131	114.18	1407	16	4.5	3.27	131	114.18	1407	20
2f rev mb	100000	0.8	85	2	4.5	3.27	131	114.18	1407	20	4.0	3.68	147	104.36	1546	25
2f mb beam-shallow	22000	0.8	80	2*	4.5	3.47	139	23.98	1181	16	4.5	3.47	139	23.98	1181	20
2f mb	22000	0.8	80	2	4.5	3.47	139	23.98	1181	20	4.0	3.91	156	21.94	1321	25
2f-3f disc plough	46000	0.8	85	2	4.5	3.27	131	52.52	1205	25	4.0	3.68	147	48.01	1339	30
3f rev mb	135000	1.2	85	2	4.5	2.18	87	215.70	1159	28	4.0	2.45	98	195.12	1253	32
chisel plow -5 tine	130000	2.0	90	4**	5.0	1.11	89	211.54	586	15	4.5	1.23	99	194.11	630	18
Disc harrow: light, <150mm	65000	1.8	80	3	6.0	1.16	69	130.78	517	8	5.0	1.39	83	112.01	595	10
heavy, >150mm	135000	2.0	80	3	5.0	1.25	75	245.03	702	12	4.5	1.39	83	224.53	751	16
Stool plough:	24000	1.2	90	1	-	-	-	-	-	-	5.5	1.68	34	90.58	685	12
Weeding: 2 row cultivator	25000	2.4	85	2	6.0	0.82	33	96.98	338	4						
Rotary hoe: very fine tilth	110000	2.0	85	1	2.6	2.26	45	332.76	1468	25						
normal tilth	110000	2.0	85	1	3.5	1.68	34	426.18	1248	18						
Min. tiller: rotary + ridger/bedformers	125000	2.4	80	1	2.6	2.00	40	419.15	1473	15						
Lime box: 3m wide	72000	3.0	50	1	6.0	1.11	22	408.19	805	4						
Fert. spreader: (2 row) 500kg mounted	28000	2.0	50	1	4.5	2.22	400	22.34	752	8						
Fert. spreader: (pendulum) 500L mounted	48000	4.0	50	1	4.5	1.11	200	49.95	407	4						
Fert. spreader: (1D broadcast) 500L	13000	6.0	50	1	5.0	0.67	120	16.70	222	3						
Fert. spreader: (2D broadcast) 1000L	77000	6.0	65	1	5.0	0.51	92	121.97	225	3						
Herbicide applicator: (boom) 4-600L	36000	6.0	70	2	4.5	0.53	212	36.57	187	3						
Herbicide applicator: (boom) 800L	63000	10.0	70	2	4.5	0.32	127	77.50	125	3						
Mist blower (300-500L mounted)	95000	18.0	70	1	3.5	0.23	41	302.21	140	2						
1 furrow ridger	22000	1.2	90	1	4.5	2.06	41	68.89	792	10						
2 furrow ridger + 2 fert applicators	35000	2.4	90	1	4.5	1.03	21	205.61	537	5						
3 furrow ridger + 3 fert applicators	45000	3.6	90	1	4.5	0.69	14	390.96	485	3						
Coverer: (one row per pass)	31000	1.2	85	1	4.5	2.18	44	92.53	891	12						
Planter: 1 row	125000	1.2	45	1	3.0	6.17	123	157.55	2925	22						
Planter: 2 row min till	220000	1.8	60	1	2.5	3.70	74	417.19	2716	22						
Planter: seed drill/planter	115000	1.8	60	1	4.0	2.31	46	329.80	1495	14						
Rake or windrow tops:	17500	2.5	90	1	6.0	0.74	133	20.79	250	4						
Grader-land plane:	38000	2.0	80	3	4.5	1.39	83	65.48	530	15						
Verge control: M/D (slash 10% total area)	40000	1.5	80	4	4.0	2.08	167	47.92	759	11						
Verge control: H/D (slash 10% total area)	65000	2.0	80	4	4.0	1.56	125	87.42	631	12						

* Same plough used for shallow ploughing and conventional ploughing

Mar-23 ** Used for stool eradication (2 passes) + two passes for seedbed preparation