GUIDELINES FOR MECHANISATION AND LABOUR PLANNING

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Mechanisation and labour costs have increased gradually over the past couple of years. The modern cash crop farming business cannot afford it anymore to have access labour or machinery on the farm. Machinery costs contribute to approximately 25% of total farming costs and approximately 15% of total gross production value. Labour costs contribute to approximately 15% of total farming costs and approximately 9% of total gross production value. Together, they contribute to approximately 40% of total farming costs. Thorough planning of these expenses is therefore essential to contribute to sustainable farming success.

The following guidelines will help the farmer to do mechanisation and labour planning for his farming business.

PLANNING OF ACTIVITIES

Step 1

Envisage and determine the planned area for a specific crop.

Step 2

Make a list of the planned cultivation activities, starting with the first cultivation of the specific crop production season, for example maize – chopping of stalks in July.

Step 3

Write down the months in which the cultivation will take place next to each cultivation activity. Where an activity takes up more than one month, the specific activity must be written twice underneath each other. There must also be a column for each size of tractor used in the same month (see Table 1 for an example).

Step 4

Determine the working tempo (hectare per hour) for each cultivation activity listed. There are different methods to determine working tempo which are available from dealers in mechanical equipment, from research (Nell, M.Sc. dissertation) as well as measurements by farmers themselves. The following formula is one of the methods that can be used to determine the working tempo:

$$Working\ tempo (ha\ per\ hour) = \frac{m^2\ per\ hour}{m^2\ per\ hectare}$$

$$= \left[\frac{Working\ width\ (m) \times \left[Speed\ (km / hour) \times 1\,000 \right] \times Field\ efficiency}{10\,000} \right]$$

Where:

Working width	=	the width of the implement in metre
Speed	=	the speed by which the tractor moves per minute
Field efficiency	=	the relation between the actual time that an implement does the work and the total time that the implement is on the field.

If 20% of the time that is spend on planting, is spend to fill the planter and clean the drill discs, then the field efficiency will be 80%.

Step 5

Determine the number of labourers who will be busy in the cultivation activity, whether they will be actively working or not.

LABOUR AND KILOWATT DISTRIBUTION

Step 6

Make a list of the months for each crop production season, starting with the month in which the first cultivation will begin (Table 2). Count the number of working days available in each month (Column "Available days"). Remember that Saturdays is counted as half a day when the farmer works on Saturdays. Depending on the situation of the farm, a certain percentage must be deducted to make provision for days lost because of rain (for example in November, December and January). as well as for leave. This step is the same for LABOUR and MECHANISATION.

Step 7

Determine **the number of permanent labourer**s available, as well as the number of kilowatt available for the cultivation activities in crop production.

Step 8

Determine the **total labour hours available.**

Number of labourers × hours available per day × number of days per month – percentage lost due to rain (where applicable)

The **total kilowatt hours available** must be determined by using the same formula:

Number or kilowatt × available hours per day × days per month – percentage lost due to rain (where applicable)

Step 9

The **total labour hours needed** in each month are determined by using the following formula when only Determine the **total labour hours available.**

Number of labourers × hours available per day × number of days per month – percentage lost due to rain (where applicable)

The **total kilowatt hours available** must be determined by using the same formula:

Number or kilowatt × available hours per day × days per month – percentage lost due to rain (where applicable)

The **total labour hours needed** in each month are determined by using the following formula when only ***one tractor*** is used:

$$\text{Labour hours needed for each month} = \frac{\text{Hectare}}{\text{Tempo (ha / hour)}} \times \text{number of labours needed.}$$

When ***more than one tractor*** is used, then the following formula must be used:

$$\text{Labour hours needed} = \left[\frac{\text{Hectare}}{\left[\text{Tempo Tr1 (ha / hour)} \times \textit{Number Tr1}\right] + \left[\text{Tempo Tr2 (ha / hour)} \times \textit{Number Tr2}\right]}\right] \times \text{Total number of labourers}$$

NB: If labourers are needed for a specific activity, but they are not directly involved in the physical activity itself (e.g. carting of fertiliser and seed during planting), then the number of hours spent during planting must be multiplied with the total number of labourers involved in this activity. Thus: labourers involved in carting of fertiliser and seed + labourers directly involved in planting = total labour hours. The same accounts for spraying or other similar situations, for example:

$$\left(\frac{600\ ha}{\left(7\ tractors \times 0{,}65\ ha\ /\ hour\right)}\right) \times \left(18\ labourers\right) = 2\ 374\ labour\ hours$$

To determine the **total kilowatt hours**, it will be necessary to determine the kW hours needed to cultivate one hectare. If ***one size tractor*** is used, then the following formula is used:

$$\text{Kilowatt } \textit{hours needed} = \frac{\text{kW Tractor}}{\text{Tempo (ha / hour)}} \times \text{ha}$$

When ***two tractors of different sizes*** are used in the same month, then the formula to determine the kilowatt hours needed will be the following:

$$\text{Kilowatt-hours needed} = \left[\frac{\frac{\text{kW Tr1}}{\text{Tempo Tr1}} \times \textit{Number Tr1} + \frac{\text{kW Tr2}}{\text{Tempo Tr2}} \times \textit{Number Tr2}}{\text{Number Tr1} + \text{Number Tr2}}\right] \times \text{ha}$$

This calculation must be done for each month as well as for each crop.

Step 10

The labour hours needed for each crop in a specific month must be added together to determine the **total labour needed for each month**. The same must be done for kilowatt hours.

Step 11

The **total labour hours available** *minus* **the total labour hours needed,** will then give the surplus/shortfall of the labour hours for every month. This figure can be used to determine for a shortfall of the labour hours for every month and to plan ahead. Will the farmer need seasonal labourers or will he increase the working hours per day?

The same must be done with kilowatt hours.

Table 1
PLANNING OF ACTIVITIES (Maize – 600 ha)

Activity	Month	Number of tractors	Tractor kW	Tempo ha/hour/ tractor	Number of labourers
Chopping of stalks	June	3	57	2,0	3
Chisel ploughing	July	2	90	0,75	2
Moalboard ploughing	August	2	90	0,68	2
Moalboard ploughing	August	7	57	0,5	9
Disc	September	2	90	0,8	3
Hoeing (cultivate)	September	7	57	1,5	9
Hoeing (cultivate)	October	7	57	1,5	9
Planting	November	7	57	0,65	14
Fertiliser & seed transport	November	2	35	0,65	4
Spraying	December	3	57	1,6	3
Water transport	December	2	35	1,6	2
Hand cultivation	January			2,0	20
Spraying	February	3	57	1,6	3
Water transport	February	2	35	1,6	2
Harvesting	May	5	57	0,85	10
Crop residue catchup	May	2	57	0,85	2
Baling of fodder	May	1	90	0,85	2
Fodder transport	May	2	35	0,85	5
Maize transport	May	1	90	0,85	3

Table 2:
LABOUR AND KILOWATT DISTRIBUTION

Resource	Available days	Overtime	Tempo-rary labour	Total available	Total labour/kW hours needed	Maize	Surplus/ Shortfall (Labour/hour)
Labourers*							
January	24,0			6 912	6 000	6 000	912
February	23,0			8 280	625	625	7 655
March	22,5			8 100	0	0	8 100
April	21,5			7 740	0	0	7 740
May	24,0			8 640	1 412	1 412	7 228
June	22,5			8 100	300	300	7 200
July	25,0			9 000	800	800	8 200
August	23,5			8 460	1 358	1 358	7 102
September	22,0			7 920	595	595	7 325
October	25,0			9 000	514	514	8 486
November	23,5			6 768	2 374	2 374	4 394
December	21,0			6 048	625	625	5 423
kW-hour**							
January	24,0			99 686	0	0	99 686
February	23,0			119 416	18 075	18 075	101 341
March	22,5			116 820	0	0	116 820
April	21,5			111 628	0	0	111 628
May	24,0			124 608	41 647	41 647	82 961
June	22,5			116 820	17 100	17 100	99 720
July	25,0			129 800	72 000	72 000	57 800
August	23,5			122 012	70 847	70 847	51 165
September	22,0			114 224	32 733	32 733	81 491
October	25,0			129 800	22 800	22 800	107 000
November	23,5			97 610	48 103	48 103	49 507
December	21,0			87 226	18 075	18 075	69 151

* 45 labourers @ 8 hour per day. Loss of 20% in November, December and January due to rain.
** 649 kW @ 8 hour per day. Loss of 20% in November, December and January due to rain.