Determining the potential for Mechanical Harvesting

As in many developing countries, South Africa is experiencing a shortage of manual labour in the sugar industry, especially during the harvesting periods. A recent project undertaken by SASRI was the first step towards exploring the feasibility of full or semi-mechanised harvesting in the sugar industry. The three factors that are deemed unsuitable for mechanical harvesting are steep slopes, wet weather and odd-shaped fields. Geographic Information Systems (GIS) was used to map the slopes, the number of days that a machine can be operated in a month and the fields that have a suitable shape for mechanisation.

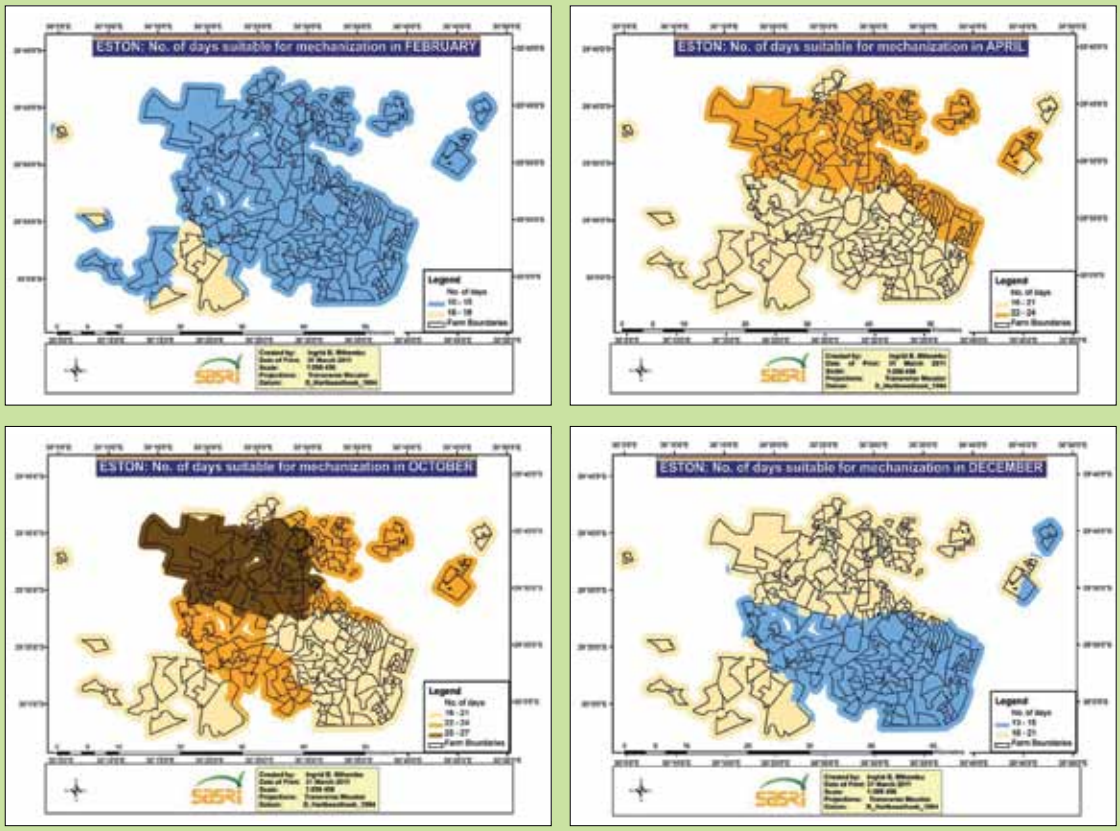
SLOPE MAPS

Slope maps were created using the 20 m contours for all mill areas. These maps were reclassified to suit the capabilities of three different methods of mechanical harvesting and manual labour. A whole-stalk harvester is able to operate on slopes of up to 10%, a chopper harvester with a trailer is able to operate on slopes of up to 15%, and a thumper is able to operate on slopes of up to 20%. Manual harvesting is done on slopes of up to 40%. The results are shown in the table below.

TABLE SHOWING PERCENTAGE AREA THAT CAN BE HARVESTED USING DIFFERENT METHODS

	% AREA THAT CAN BE HARVESTED			
MILL AREA	WHOLE-STALK HARVESTER (0 – 10% SLOPE	CHOPPER HARVESTER (0 – 15% SLOPE)	THUMPER (0 – 20% SLOPE)	MANUAL LABOUR (0 – 40% SLOPE)
MPUMALANGA	88	92	94	98
UPHONGOLO	80	85	90	96
UMFOLOZI	95	98	99	100
FELIXTON	76	87	93	99
AMATIKULU	68	77	89	97
DARNAL	61	75	91	98
GLEDHOW	36	49	61	90
MAIDSTONE	44	57	78	93
NOODSBERG and UCL	54	72	88	96
ESTON	39	57	70	92
SEZELA	40	54	77	94
UMZIMKHULU	56	69	85	95
INDUSTRY AVERAGE	**61**	**73**	**85**	**96**

The results show that, on average, 73% of area under cane in Mpumalanga and KwaZulu-Natal can be harvested mechanically using a chopper harvester. The chopper harvester has been a machine of choice in the Midlands because of its efficiency.



AN EXAMPLE OF THE MAPS FOR ESTON FOR THE SELECTED FOUR MONTHS

SOIL MOISTURE

Soil moisture maps were created for each month for all mill areas using data from 1950 to 1999. These maps show the number of days that are suitable for mechanisation. It was found that, on average, it is suitable to mechanise between April and October in most mill areas. The maps provide an indication of the number of days a specific area can be mechanised in each month as shown below in the maps for Eston. A booklet of these maps is being compiled for each mill area and will be available on request from SASRI.

SHAPE INDEX

The Fragstats system was used to calculate the shape index of each field/panel in the Midlands and in Mpumalanga. A field/panel shape with an index of 1.00 is the most suitable for harvesting mechanically. Results from these areas show that almost all the panels are close to the index of 1.00, with + 95% of the panels suitable for mechanisation. The shape of fields or panels is therefore not a significant limiting factor for mechanical harvesting.

CONCLUSION

Slope and weather patterns seem to be the most limiting factors for mechanical harvesting. However this study established that, on average, 73% of the land under cane can use a chopper harvester. Climate data that was used might not be entirely relevant in the future as this does not account for the possible impacts of climate change. Therefore, another study investigating the soil moisture patterns using climate change data will be useful. Field sizes and shapes are easy to modify.

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