THE COST BENEFIT OF TECHNOLOGY TRANSFER REGARDING KNOWLEDGE OF SOIL TYPE AND HERBICIDE SELECTION TO COMMERCIALIZE SMALL SCALE SUGARCANE GROWERS

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INTRODUCTION

A successful extension methodology implemented in KwaZulu-Natal (KZN) for small scale sugarcane growers has enabled them to achieve commercial-level yields and supply their crop to the international market through the local Illovo Mill. The extension effort has led to the development of economically successful sugarcane growers. However, a gap in knowledge still exists in terms of accurate herbicide application rates and calibration techniques specifically linked to soil form. The practical calculation of ratios, percentages and area over which herbicides need to be applied, remains an enigma to many. Soil properties must inform agronomic decisions and form the basis of this element of technology transfer.


Figure 1: Deep humic Inanda soil form

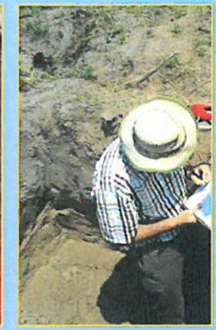
Figure 2: Restricted sandy Wasbank soil form


Figure 3: Assessing land potential

Table 1: Soil properties linked to agronomic choices

Soil form	Clay %	Organic Matter %	Effective Rooting depth (mm)	Herbicide choice (example)	Yield (tons/ha)	Income (R/ha)
Wasbank	6	0.9	1000	Velpar + Diuron 0.3kg + 1l	75	R38 133
Inanda	24	5.1	1200	Velpar + Diuron 1kg + 700ml At half the rate	120 96	R61 013 R48 810 (R17 287 loss)
Sweetwater	26	8.7	2000	Velpar + Diuron 1kg + 1l At half the rate	170 136	R86 435 R69 148 (R12 203 loss)

METHOD

Small scale grower plots were only planted once soil type, clay and organic matter percentage had been established for all fields. The fields were classified to soil form by digging a 1m x 1m x 1.5 – 2m soil pit, ascertaining topsoil clay and organic matter percentages, amongst other properties. Soil samples were analysed to confirm in-field estimations. Soil form was linked to herbicide selection, application rates and weed spectrum. A simplified step-wise procedure for herbicide selection and application rates, using standard-sized plastic or metal drums and developed calculation tables that adjust for clay content and knapsack nozzle output, was demonstrated and tested. The efficacy of herbicides over hand-hoeing was demonstrated, with the rate of adoption amongst farmers and the resulting yields compared. The cost benefit between herbicide use and hand-hoeing was measured. The importance of knowing soil form before selecting and applying herbicides was evaluated on various soil forms in the area.

RESULTS AND DISCUSSION

Weed control costs (hand-hoeing vs herbicides):
The importance of effective weed control on small-grower yield has been well-documented. The use of herbicides is considered more sustainable and effective than hand-hoeing). All small scale growers in this project have transitioned from hand-hoeing (a non-sustainable practice due to erosion risk and soil disturbance) to using appropriate herbicides. The cost saving of using this technology, aside from improved efficacy of weed control and reduced soil loss risk, is almost 50% lower at R2974/ha (herbicides) vs R6400/ha (hand-hoeing - 50 labour days at R128 per day). This saving is over and above the increased income generated from improved yields due to better weed control by using herbicides.

Herbicide selection based on soil form:
The selection of herbicides must be made only once soil form, topsoil clay and organic matter percentages have been established. Some commonly used herbicides are not suitable on soils with high clay and high organic matter %. If the soil clay and organic matter % is unknown, the incorrect herbicide could be used resulting in reduced weed control and yield losses. Poor weed control has resulted in yield losses of at least 50% in this area. A 1ha plot with a 20% reduction in yield would result in a loss of R13800 per hectare. Correct herbicide selection is reliant on soil type, weed spectrum and weed growth stage.

RESULTS AND DISCUSSION (Cont)

Herbicide application rate based on soil form:
Application rates are often calculated incorrectly. The application rate is highly dependent on the clay and organic matter content since both these factors reduce the bio-availability of the chemical. Organic matter plays an even more significant role than clay %. The majority of soils in this area are humic in nature, a significant factor when determining application rate (Table 1). When comparing herbicides recommended for soils with clay% below 6% with those above 35%, the herbicide application rate required was tripled. While this amounted to a relatively small increase (R400/ha) in input costs, it was well worth expending to achieve good weed control. The cost benefit of applying the correct herbicide at the correct rate, based on soil form, far outweighs the additional input cost due to increased yield (Table 1).

Drum calibration technique for herbicide application:
Training days were held with extension officers and growers, to transfer the simplified technology of calculating herbicide concentration, knapsack calibration and application rate. Trained extension staff demonstrate this to the growers annually. Weed control has significantly improved and has led to complete adoption and capitol investment in herbicides as standard practice replacing hand-hoeing.

The stepwise procedure is as follows: **Step 1**: Establish the area (frame 1). **Step 2**: Establish soil form, topsoil texture and organic matter % (frame 2). **Step 3**: Select the appropriate herbicide according to soil properties (frame 3). **Step 4**: Establish the knapsack nozzle application rate (secs) over 25m, and repeat spray to determine volume in the measuring jug (frame 4). **Step 5**: Refer to the table for row width and water volume to be added to the drum. **Step 6**: Mix in the correct amount of herbicide for each half hectare to be sprayed. **Step 7**: Use knapsack to apply herbicide. **Step 8**: Result - weed-free fields.


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CONCLUSION

By knowing the soil form, small scale growers have reached commercial yields and met the international standards for production through sustainable and improved agronomic practices. The transition from hand-hoeing to herbicides for weed control has been adopted. The knowledge of soil type and its effect on the selection and application of appropriate herbicides has been understood, and continuous training has led to more sustainable and cost-effective practices. Significantly increased income has been achieved, clearly reflecting the cost benefit of a sound knowledge of soil form, and its effect on the sustainable agronomy of sugarcane.

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