# Information Sheet

## 6.13 The pros and cons of mulching or burning at harvest

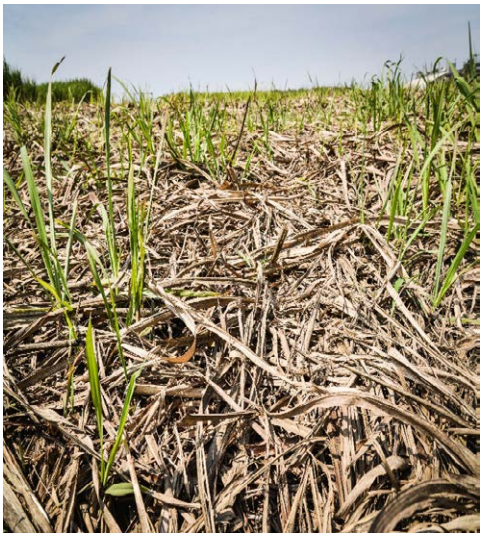
The practice of burning sugarcane before harvesting is widespread. The main reason for this is to improve harvesting, handling and milling efficiencies of the cane stalks. However, there are several disadvantages to burning, such as:

- degradation of soil due to lowering of organic matter,
- poor moisture conservation due to the absence of a surface cover,
- public nuisance caused by smoke and soot, and
- health hazards to cane cutters from manually harvesting burnt cane.

The decision whether to burn or mulch at harvest, therefore, demands careful assessment of the pros and cons in any particular situation. In South Africa, the negative environmental effects of burning have resulted in the formulation of industrial guidelines incorporating a code of practice (see SASRI Information Sheet No. 2.1). This suggests that fields in sensitive areas must be harvested without burning and that all other fields should be mapped for burning or mulching according to agronomic/economic factors. This Information Sheet discusses various factors influencing the occurrence and magnitude of any benefit from mulching.

## Crop yield

Effects of a mulch blanket on the crop include slower initial growth and tillering, and a lower peak population but taller and thicker stalks. The final population (at harvest) is not affected. Conversely, burning allows for faster ratooning and the development of a higher peak population of shorter and thinner stalks. Less lodging can therefore be expected from mulched cane but this has not been proven as yet.



**Responses to a mulch blanket**

These are influenced by factors such as rainfall received before and after canopy closure, season of harvest, variety, aspect, altitude and soil type. On the coastal lowlands, an average increase in yield of 11% or 9 tons cane/ha/a was measured over a wide range of conditions. These include the comparison between burning (and the removal of unburnt residues) and non-burning at harvest. These conditions simulate the field practices of burning at harvest, windrowing and re-burning any leftover residue resulting in a bare surface. The bare surface practice is now seldom followed in the sugar belt as results from the oldest cane trial in the world (BT1 at SASRI) indicated that a mulch blanket from unburnt cane will have a 2,4% or 2 tons cane/ha/annum benefit over burnt cane with singed tops left scattered.

**Responses to singed tops left scattered**

Where the crop residue (singed tops) are left as a mulch after burning at harvest, cane yields are on average improved by 7 tons cane/ha/annum compared to instances where all the residues were removed leaving a bare surface. In addition, soil capping (crust formation) and erosion were significantly reduced even under partially mulched conditions. All residues retained after burn at harvest could cover between 50% to 70% of the surface for a stalk yield of 70 tons/ha/annum. Surface cover might be as low as 10% for burnt fields during a drought. A cool burn early in the morning will also yield more residue to cover the surface. Table 1 summarises the response of burnt cane and either all residues removed or retained relative to green cane harvesting (no burning).
It is clear from Table 1, that the largest responses to a full mulch blanket will occur under dry conditions in summer and the worst under wet conditions in winter. The smaller difference in yield response between mulched and burnt cane with the tops retained compared to where all residues were removed (bare surface) is also shown.

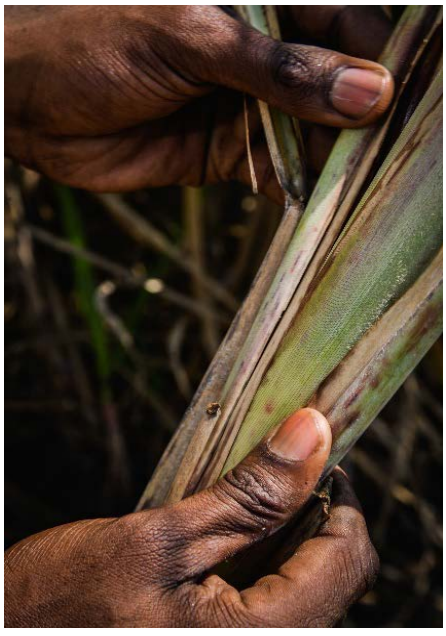
**Table 1: Yield response of cane mulched (M) relative to cane burnt (B) with all residues removed (to) or retained (t) at harvest.**

| Climatic condition | Spring and Summer | | Winter | |
|---|---|---|---|---|
| | M ÷ Bto | M ÷ Bt | M ÷ Bto | M ÷ Bt |
| Dry | 13% | 6% | - | - |
| Average | 10% | 5% | 4% | -1% |
| Wet | 1% | -1% | -15% | -13% |
| Bto = Burnt and tops removed Bt = Burnt and tops retained M = Mulched | | | | |

## Factors affecting burning and mulching

**Crop quality**

Unburnt cane stalks completely stripped of all dry leaves will result in a better cane quality as compared to burnt cane. However, if poorly stripped (as is often the case) the extraneous matter is likely to result in a higher fibre value for unburnt cane.



**Crop deterioration**

Deterioration of burnt cane left standing is faster than burnt cane cut immediately. Deterioration (loss of pol %) of burnt cane after cutting is faster as compared to unburnt cane and losses are more severe under hot summer conditions compared to a cool winter scenario. Under hot summer conditions the rate of pol loss per day for burnt cane (2,3% per day) is about 40% higher than for unburnt cane (1,6% per day). The rate of pol loss under cooler conditions is slower. Deterioration of billeted cane stalks (short pieces of stalk) is faster compared to whole cane stalks. Under conditions of high humidity the decline of juice pH is accelerated for billeted cane (1.3 pH units in 5 days). No differences in the rate of deterioration were recorded between varieties.

**Payloads**

Payloads from well-cleaned cane (all leaf material removed) are no different than those from burnt cane. However, poorly cleaned cane stalks can reduce payloads by up to 33%, and this may be a decisive economic factor. This applies to both field-to-zone and zone-to-mill transport.

**Harvesting costs**

These may be increased by as much as 45% by harvesting unburnt cane as opposed to burning. This has to be offset against the expected increase of 2 to 9% in stalk yield. Management plays a crucial role in both harvesting rates and payloads that are achieved.

**Conservation**

Residue conservation reduces erosion and water losses (evaporation and runoff) from cane fields, particularly on steep slopes. Crusting reduces water infiltration and gas exchange, but increases erosion, loss of soil organic matter and biological activity. Most soils in the sugar industry are susceptible to crusting and are more associated with burnt rather than mulched fields. Quantifying the effects is difficult. However, on a Longlands duplex soil form with a 11% slope that is extremely susceptible to crusting, a mulch layer prevented 90% of the water loss from rainfall and >60% of soil loss that occurred on a bare soil over a six month period.

**Weed control**

A good mulch blanket can suppress weed growth completely. With time, the weed spectrum might shift to vines which need to be treated with herbicide. Costs may vary from 0 to 100% of those on burnt fields, but would usually be about 45% of the costs of weed control under burnt conditions.

**Ratoon chlorosis**

Ratoon chlorosis commonly occurs on alkaline sandy soils (pH > 7.5) and can be severely aggravated by a mulch blanket. Treatment with a 10% ferrous sulphate solution alleviates the problem without affecting yields. However, in untreated areas, yield reductions of as much as 20% can occur.

**Eldana**

Burning is recommended where new outbreaks of eldana have occurred or where heavy infestations occur in severely droughted cane. Ensure good field hygiene by not leaving any material in the field which the pest can continue to live in. Ensure cane stalks are cut at the soil surface at harvest and remove all cane stalks from the field after harvest.

**Mulch (trash) caterpillars**

This pest is more likely to occur in a mulch blanket, but may also occur in burnt fields. Yield effects have been simulated and reductions of up to 10% recorded. Normally yield loss due to this pest is not significant.

**Wind**

Wind makes it difficult to control cane fires. It also is a nuisance due to sugarcane residues being blown into unwanted areas (i.e. houses, fences) leaving bare patches in the field.

**Power lines**

Cane fires under power lines cause flashovers leading to problems in the national electrical distribution network. Good communication with electricity suppliers, early notification of intended cane fires and flattening of cane before burning under power lines will avoid this.

**Factory criteria**

Work at two specific mills has shown that 1% increase in fibre(dry cane leaves) in cane delivered to the mill will:

· reduce extraction by 0,44%.
· reduce purity by 0,33%.
· increase clear juice colour by 3,6%.
· increase clear juice turbidity by 4,2%.
· reduce crushing rate by 2,2 to 3,0%.

# Summary

Rainfall and the crop harvesting season, are two factors in a potentially long list that determines the response of sugarcane to post-harvest residue retention. Crops harvested in winter and followed by an above normal rainfall are likely to produce less cane than cane burnt at harvest and all residues removed. On the other hand, cane harvested in summer followed by below normal rainfall (especially during the first six months after harvest, i.e. before canopy closure) is likely to show the highest yield response where mulching is practised. This coincides with the period before canopy closure where the difference (in terms of soil water content and temperature) between uncovered and covered (mulched) soil surfaces is likely to be the largest. Mulch covered fields will outperform others when a dry spell is encountered in this period.

**Burning**

- Cutter output may be increased by an estimated 0 to 80%, depending on the state of the crop, method of handling and standard of management.
- Payloads can increase by an estimated 0 to 33%, depending on the state of the crop, method of handling and standard of management.
- Damage due to mulch (trash) caterpillar can be reduced.
- Burning is a necessity where eldana infestation is heavy.
- The manufacturing of sugar and its quality is generally better.

**Mulching**

- Yields are improved, especially in dry years.
- Deterioration losses due to delays between burning and harvesting, and long delays between harvesting and crushing, can be reduced.
- Chemical, manual and mechanical weed control costs can be significantly reduced or avoided.
- Damage to power lines is avoided.
- Soil and water conservation are improved.
- Pollution due to smoke, smut and herbicides can be reduced and, in some cases, totally eliminated.

# References for further reading

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