AGRONOMIC, INDUSTRIAL AND ECONOMIC IMPACT OF SUGARCANE CHEMICAL RIPENING

By

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Abstract

The purpose of this study was to analyse the effects caused by chemical ripening on sugarcane and the agronomic, manufacturing and economic impact of its use. The application of a rational chemical ripening schedule facilitates the starting of the harvesting season and maximises sugar recovery. Stalk sucrose content is increased and stabilised with no deleterious effects on cane yield after application and in the following cycle. Besides, ripener application improves the harvest efficiency due to: early foliage desiccation, higher height of topping (which increases the cane yield), improvement in cane cleaning following mechanical harvest, and decrease in trash. All these effects, combined with the low spraying costs, make it possible to raise revenue in the sugar industry because of higher sugar recovery, and the reduction in harvesting, transportation and sugar manufacturing costs.

Introduction

Recoverable sugar levels show high variability during the harvesting season and from season to season, as a result of some limitations affecting its development and the varying ripening environmental conditions, a situation which is made worse by frosts in some subtropical areas.

Therefore, it is of fundamental importance to develop strategies in order to improve and stabilise sucrose recovery and sugar industry profitability. Chemical ripening is a useful practice to achieve this objective.

This paper examines both the main and additional benefits caused by ripeners and the agronomic, manufacturing and economic impact of this technology on the sugar industry.

Effects of ripeners on cane quality

Studies concerning ripeners were initiated by the Obispo Colombres Experiment Station (EEAOC, Tucumán, Argentina) in 1994. Up to the present, more than seven potentially useful ripeners have been tested. Only glyphosate and Fluazifop p-butyl were selected to be commercially recommended, based on results obtained from more than 300 field experiments and several commercial applications. Support from cane growers has been an important factor in the success of the technology.

These ripeners, which are widely used in sugarcane-growing areas of the world, are characterised by low costs and by the magnitude of the sugar increases which are found to be consistent in most situations (Romero et al., 2000 a,b,c).

The factors controlling sugarcane response to ripeners (i.e. environmental conditions, cultivars, application times and rates, crop growing conditions, and spraying systems) have been studied in order to quantify the interactions between them and the selected ripeners with the purpose of enhancing their effectiveness.

Due to its complementary features, it is quite feasible to increase the sucrose content and to crush, earlier, the available early and intermediate maturity cultivars, accounting for 86% of the Tucumán sugarcane area. This material has usually been crushed during the early and mid harvesting season.

The highest increases were achieved by spraying sugarcane at the end of the main growing period (from mid-March to mid-April). Even though the extent of the responses in later applications decreased, it is still found to be a profitable practice.

Figure 1 shows both the main and additional benefits resulting from chemical ripening and their impact on the agronomic, industrial and economic issues.

The main chemical ripening effect is the gain in sugar per tonne of cane, provided that cane yield is not affected to a great extent and that there are no noticeable modifications of other quality parameters, which can affect the milling process.

Furthermore, chemical ripening induces additional effects on sprayed sugarcane (vegetative composition variation, less trash to be cleaned, and no severe topping). The combination of the main and additional ripener effects generate important improvements in agronomic aspects (i.e. higher working capacity of combine harvesters, more efficient burning and cane cleaning processes, improved mechanical topping, and more efficient transportation), and in manufacturing processes (i.e. lower trash content, avoidance of frost effects on sugarcane quality, and especially, higher rates of sugar recovery per tonne of cane).

The analysis of the impact of chemical ripening demonstrates its high profitability. The ripener spraying costs (i.e. product and airplane spraying costs), expressed in terms of sugar (US$0.30/kg),
represent between 30 and 45 kg/ha. Efficient management of this practice produces at least 300 extra kg of sugar per hectare, with a return that widely exceeds the treatment cost in a short period of time (6–12 weeks), with a return rate higher than 7. Moreover, some other benefits, such as the reduction in harvesting, transportation and milling costs, were generated, though their economic impact is not easy to quantify.

Sugarcane chemical ripening, apart from being a highly profitable practice, allows the implementation of the following changes in the harvesting season:

1. Earlier starting: chemical ripening makes it possible to raise sugar recovery levels during the early phase of the harvesting season, since there is an increased stalk sucrose content, smaller immature stalk sections and a reduction in trash. Moreover, it produces better cane quality when frosts occur. The start of the milling season can thus be anticipated in 15–30 days in sugarcane grown in frost-affected areas.

2. Earlier finish: this modification would prevent the severe cane deterioration occurring in the late harvesting season caused by increasing rainfall and higher temperatures. Sugar mill stoppages could be reduced during the whole harvesting season. A suitable harvesting time will allow better and well-planned field management. Hence, crop productivity in the following cycle can be optimised.

3. Extended duration: rational scheduling would result in a longer, more effective crushing season, taking place under adequate weather conditions, and in a significant increase in the utilisation of the existing plant and equipment.

4. Improvement of its schedule and orderly execution: ripener use demands a coordinated schedule between cane growers and mills. It is necessary to know the area cropped with each available cultivar and its optimal spraying and harvesting dates. The most effective and profitable sequence of crushing should be determined in order to ensure maximum sugar recovery. Eventual alterations due to weather conditions, or other factors, in the initial scheduling should also be foreseen. In this way, it is possible to take advantage of the benefits of chemical ripening.
L'IMPACT AGRONOMIQUE, INDUSTRIEL ET ECONOMIQUE DU MURISSEMENT DE LA CANNE A SUCRE PAR PRODUIT CHIMIQUE

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Résumé
Cette étude se rapporte à l’analyse des effets du mûrissement chimique de la canne à sucre sur son agronomie sur la fabrication de sucre et sur les retombées économiques de l’utilisation de mûrisseur. Une utilisation judicieuse et planifiée du mûrisseur permet d’avancer la coupe et de maximiser la quantité de sucre récupéré. L’application du mûrisseur amène une teneur en saccharose des tiges plus élevée et stable sans pour autant affecter le rendement en canne suivant son application ou du cycle suivant. Par ailleurs, l’utilisation du mûrisseur améliore l’efficience de la récolte qui est due à une déshydratation précoce des feuilles, un étirement plus élevé des tiges (donc un meilleur rendement en canne), une amélioration du nettoyage de la canne issue de la récolte mécanique et une baisse dans les pailles. Tous ces effets associés au faible coût de l’épandage permettent d’augmenter les recettes de l’industrie sucrière de par une récupération accrue de sucre et une baisse dans les coûts de récolte, du transport et de la fabrication de sucre.

Mots clés: mûrisseur, récolte, programme de gestion, sucre récupéré.

IMPACTO DE LA MADURACION QUIMICA DE LA CAÑA DE AZUCAR EN ASPECTOS AGRONOMICOS, FABRILES Y ECONOMICOS

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Resumen
Se analizan los efectos principales y adicionales derivados de la maduración química de la caña de azúcar y su impacto en aspectos agronómicos, fabriles y económicos del cultivo.

La implementación de un programa racional de manejo de los maduradores, permite anticipar la fecha de inicio de la zafra, elevar y estabilizar la recuperación de azúcar de los cañaverales procesados en la etapa inicial de cosecha, sin que la aplicación afecte la producción actual de caña, como tampoco la del ciclo siguiente. Además, esta práctica mejora la eficiencia de la cosecha al inducir un desecamiento temprano del follaje, permitir un despuntado menos severo y posibilitar mejoras en la limpieza neumática, reduciendo el trash que llega a fábrica.

La maduración química constituye una práctica altamente rentable, asociada con el bajo costo de los maduradores y de la aplicación, con la recuperación de una cantidad adicional significativa de azúcar por tonelada de caña y por las reducciones de los costos de cosecha, transporte y fabricación de azúcar que su empleo genera.