QUALITY CANE AND EXTRANEOUS MATTER

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ABSTRACT

It is an accepted fact within cane sugar production industries throughout the world, more particularly in those industries engaged in the export of raw sugar — that a clean, fresh cane supply to mills is required to promote production of raw sugar of suitable quality to satisfy the rigid and varying requirements of refiners in an increasingly competitive world marketplace. There is also an acute awareness by responsible people in the industry of the need for both the manufacturing and the cane producing sections of the industry to minimize capital expenditure and to cut operating and running costs in all sections, in order to maintain viability in the industry as a whole. It must therefore be expected that, because of the growing shortage of and the ever increasing costs of manual canefield labor, the percentage of mechanically harvested cane will increase.

While there has been a vast improvement in inbuilt technology and performance of mechanical cane harvesting equipment since initial introduction, particularly in the area of cane cleaning, it is not practical to expect that machines are capable of producing exactly the same standard of cane supply in adverse conditions as can be produced by manual cane cutters — at least not with present machine configuration. This fact must be recognized and concerted cooperative efforts made by all sections of the industry to maintain maximum efficiency within the industry with available facilities and at the same time, to strive for development of improved methods and techniques.

INTRODUCTION

Extraneous matter is the material in a cane supply other than millable cane such as tops (green leaf and vegetative growth sections), green and dried leaf, partly burned leaf material, roots, soil, etc. Depending on the quantity and type of extraneous matter in a cane supply, the detrimental effect on performance of milling equipment, sugar recovery and sugar quality may be quite dramatic. It is therefore understandable that with the incidence of the introduction of large scale mechanical chopper harvesting in many cane sugar producing countries, industry
management are looking very critically at the efficiency of cane cleaning systems incorporated in mechanical cane harvesters.

In the Australian sugar industry which is dependent on the export of high quality raw sugar for disposal of approximately 65% of annual production and in which there is virtually 100% mechanical harvesting, there is an acute awareness by all sections of the industry of the problems associated with delivery of inferior quality cane supply. This awareness has led to insistent demands by industry management on harvester manufacturers of improved efficiency of the cleaning systems incorporated in mechanical harvesters.

In an effort to overcome the extraneous matter problem, Australian harvester manufacturers are in constant liaison with responsible sugar industry management and industry bodies through the Sugar Liaison Meetings and day to day liaison with responsible sugar mill personnel and harvester owner/operators. This liaison provides for transmission of information on the effectiveness of existing technology and provides the opportunity for discussion and suggestions for introduction and testing of new technology in mechanical cane harvesters.

OBSERVATIONS AND DISCUSSIONS

Cane Cleaning System

In general, the cane cleaning system in presently available cane harvesters consists of three distinct functions:

1. Topping (usually by the action of rotating disc-mounted blades).

2. Removal of the less dense vegetative material and dust by extractor fan air displacement and/or blower fan air displacement as the cane passes through the cane harvester in conveyance toward the transport vehicle.

3. Downward disposal of denser material such as soil or stones by motion of the cane in conveyance over an ‘open-roller’ system and/or perforated or slatted elevators.

All functions of the cane cleaning system are interdependent. The overall efficiency of the system is very relative to operator efficiency, crop conditions and efficient maintenance of all sections of the system. For example, in badly lodged crop conditions where the mechanical topper cannot be used effectively resulting in a greater intake of top material, there is an added volume of extraneous matter placed before the other cleaning functions. If the chopper blades are allowed to become dull and do not perform the function of chopping up the tops and leaf matter, the efficiency of the function of extractor fans is reduced considerably. If the size of the extractor fan blades is reduced as a result of wear resulting in reduced air displacement, the efficiency of the extractor fan is reduced consider-
ably. If the basecutter is operated below ground level, soil intake is increased considerably.

Because of the fact that extractor fans run at a predetermined and set speed, it necessarily follows that the quality of cane sample produced must be directly relative to the volume of material, placed before the extraction system in a given time and the percentage content of extraneous matter in that volume of material. Therefore, in extreme dense crop and lodged cane conditions where the topper cannot be used effectively, or in unburnt cane conditions, it is necessary to reduce the ground speed of the harvester as compared to operation in light density, upright and well burnt crop conditions in order to maintain a similar level of extraneous matter in the cane supply.

Extraction

The function of extractors is to draw an up-draft of air through the body of chopped cane. The up-draft is most effective where the body of material is suspended. So, it is desirable to position the extractors at the top of the elevators where the cane falls either from the primary elevator into the secondary elevator or from the secondary elevator into the transport unity.

Air flow rates in the extractor system are commonly in the vicinity of 30,000 cubic feet per minute or 14 cubic meters per second with discharge velocity of approximately 30 meters per second at nominal fan speed of 2500 rpm. The extractor fans are hydraulically powered with an input engine power requirement of approximately 26 hp or 19.5 kws for each extractor. This means that for two extractors there would be an input requirements of approximately 52 hp or 39 kws. In terms of fuel consumption, approximately 11.3 liters per hour.

Looking at it from a total cost and power usage, the extraction system uses approximately 25% of total engine power output and represents approximately 25% of total capital cost of a standard type mechanical cane harvester. Cane clearing results and loss of millable cane through extractors have been the subject of many technical papers.

Common assumptions are that in a crop of unburnt cane, extraneous matter would account for approximately 26% of total material. Depending on effectiveness of pre-harvest burning off, the quantity of extraneous matter in a cane crop may be as low as 8% or as high as 25% of total material. Cane variety, weather and crop conditions influence this figure to a large degree. But generally speaking, the extraneous matter content in burnt cane is much less than in green or unburnt cane although the added bulk in green cane is predominantly light weight leaf material.

Efforts by harvester manufacturers to improve the efficiency of extractor systems by increasing the air flow velocity, have produced an unacceptable
level of cane loss by millable cane passing out through the extractors. Tests have shown losses as high as 15 tons per hectare with only a small reduction in extraneous matter level in the cane sample. Generally, total cane losses with mechanical harvesters in most crop conditions total approximately 3%. Manufacturers pre-set extractors at what is believed to be the best compromise between engine power input, extraneous matter level and cane loss level.

**The Cane Top and the Topper**

A high percentage of the gross weight of extraneous vegetative material (approximately 70%) is the growth section of the plant between the last node of millable cane and the “fan” where the leaves join the growth section in mass. This section may be up to 600 mm in length and when stripped clean of leaf sheath is almost identical to a billet of millable cane in form and density. Vegetative material of this nature is commonly called cane cabbage (Fig. 1). In mechanically harvested cane, approximately 80% of extraneous matter remaining in a cane supply is cabbage. This is so because if the extractor air flow velocity is set to extract this material, it will also extract millable cane.

![Cabbage of sugarcane](image)

**FIGURE 1.** Cabbage of sugarcane

The cane topper on a mechanical cane harvester as an integral part of the cane cleaning system (Fig. 2) is regarded as the most effective means of removal of the cane top and cabbage material. However, in the light of statistics of erect cane compared to recumbent cane, the effectiveness of the topper is very much in question. This matter is presently being researched in depth by one cane harvester manufacturer in Australia.

Previous to the introduction of chopper type cane harvesters which harvest
recumbent cane successfully, sugar industries directed concentrated efforts to breeding “erect” cane varieties. But since the introduction of the chopper harvesters, this concept of cane breeding appears to be given less priority. Because of this and for other reasons such as increased crop density as a result of improved technology and techniques of cane growing, the percentage of erect cane in relation to total crop is reducing each year in the Australian sugar industry.

For most efficient results, the cane should be topped at the last node of cane or within approximately 4 inches or 100 cm above the last node of cane on the cane stalk. Of course, if harvester operators endeavor to top the cane in this exact spot, there is little margin for error before cane loss occurs. Therefore, there is a general tendency to top the cane at a point considerably above the ideal point.

FIGURE 2. Cane cleaning system (1) topper, (2) primary extractor, (3) secondary extractor

CONCLUSION

It is unlikely that the present system of cane cleaning incorporated in mechanical harvesters will produce a greatly improved cane sample for reasons outlined above. However, a great deal of research is being directed to improving the economy of the system by improved technology resulting in reduced power input requirement and reduced capital cost. For example, the aims of one harvester manufacturer are to achieve at least the existing standard of cane cleaning with engine power input requirement reduced to 10% of total engine power output and to reduce capital cost of the system to 10% of total machine cost.
CALIDAD DE CAÑA Y MATERIA EXTRANJA

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RESUMEN

Es en hecho aceptado en las industrias productoras de caña de azúcar a través del mundo, muy particularmente en las industrias exportadoras de azúcar cruda, que existe la necesidad de suplir caña limpia y fresca a los molinos con el fin de obtener una producción de azúcar cruda de calidad adecuada para satisfacer las demandas estrictas y variables de las refinerías en un mercado progresivamente competitivo en el mundo entero. Además personas responsables en la industria están muy concientes de que tanto la sección manufacturer a como la sección de productoras de caña, tienen necesidad de reducir los costos de operación y de funcionamiento en todas las secciones con el fin de mantener viabilidad en toda la industria. Por lo tanto, es de esperarse que, debido a la continua escasez de mano de obra y el aumento continuo en salarios de esta, el porcentaje de caña cosechada mecanicamente aumentará.

Aunque ha habido un gran progreso en la tecnología interna y en el funcionamiento de equipo mecanico para cosecha de caña desde su introducción inicial, particularmente en el área de limpieza de caña, no es practico esperar que las máquinas sean capaces de producir exactamente las mismas normas de abastecimiento en condiciones adversas que podría la labor manual, por lo menos no con la configuración actual de maquinaria. Este hecho debe ser reconocido y todas las secciones de la industria deben concertar sus esfuerzos en forma cooperativa para mantener eficiencia maxima dentro de la industria con las facilidades disponibles y al mismo tiempo, esforzarse en desarrollar mejores métodos y técnicas.