

CHANGES IN THE TRADITIONAL LOUISIANA SUGARCANE HARVEST SYSTEM: REPLACING SOLDIER HARVESTERS WITH 'CUT-CROP' COMBINE HARVESTERS

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Introduction

Louisiana, a 200 year old sugarcane producing area, has harvested its entire crop mechanically since the 1950s with the use of soldier harvesters and grab loaders. Harvesters have been improved since the 1940s, especially with the advent of hydraulic systems and later with the two-row harvester design. Modern grab loaders straddle two rows of cane and have mechanical piling devices to reduce field soil in cane deliveries. This system has been shown to be one of the least expensive among the world's industries, with harvesting costs averaging between \$2,25 and \$3,00 (US) per ton cane. However, the soldier system has its faults. As a result of these shortcomings, alternative harvest systems have been evaluated many times during the past 50 years. Primary reasons why cut-chop systems were not used commercially until 1992 include Louisiana's light tonnage (a 10 year average of 60 tons/hectare due to its short growing season), inexpensive soldier harvesting costs, and higher unaccounted losses in combine harvesters. Beside these factors, Louisiana's harvest system is further complicated because each grower owns his own harvesting and loading equipment. During the 1990s, improved combine designs, higher yielding cane, public concerns on cane burning and transport spillage, a decreased labour supply and other factors have attracted several growers to commercial use of combines. In 1995, 4% of the industry's cane supply was cut with combines and the number of growers using these cut-chop harvesters will more than double in 1996. As a result of this renewed interest in combines, comparison tests between harvest systems were conducted over the past three years and observations from growers were summarised on proficiency aspects of combine harvesting.

Test results and grower opinions

Between 1992 and 1995, six side-by-side comparisons between the traditional Louisiana soldier system and combine harvesters were conducted. Pre-harvest yields were determined by weighing plots harvested within each field for gross tons of cane per hectare. Per cent trash on cane was measured by stripping all leaves from stalk samples taken in the plots. Net tons of cane per hectare were calculated from these measurements. Hand cut samples, topped at the uppermost hard joint, were stripped and delivered to the sugar factory for analysis at the core laboratory. Theoretical yield of sugar per net ton of cane was determined for each sample. These values were then used to calculate the predicted yield of sugar per hectare in each experiment.

Test fields were then harvested mechanically using the two systems in their assigned areas. The area from which each wagon load of cane was cut/loaded was mapped and measured to determine field area for each wagon. Combine-cut cane (green in some experiments, burnt in others) was delivered immediately to the sugar factory. In the whole stalk har-

vested area, heaps were burned (normal practice) before delivery to the factory. All delivered cane was weighed at the factory scale and sampled at the core sampler. From these measurements, delivered tons of cane per hectare and commercially recoverable sugar per ton of cane were calculated. Scrap measurements (ground losses) were sampled within the fields to determine tons of cane per hectare left following each harvesting system. The delivered yield of sugar per hectare was then compared with the predicted yield of sugar per hectare and losses were assigned to contributing factors.

The combine system outperformed the conventional soldier system in only two of the six experiments (statistically significant difference in delivered sugar per hectare). These two experiments had high field tonnages and the cane was badly lodged. Other experiments had low to moderate tonnages with erect cane and demonstrated that the two systems performed equally well. Traditionally, the Louisiana industry produces low to moderate tonnage, especially in older stubble. Results of these experiments indicated that, for growers to achieve maximum benefits from the combine system, high tonnage yields are necessary. The newly released variety, LCP 85-384, has shown the greatest potential in this regard. Fields of this variety have often been so badly lodged that some growers have been reluctant to expand the area planted to this variety, for fear of the soldier system's inability to harvest the cane or of leaving too much scrap (field losses). Combine harvesters have allowed growers to harvest these fields with a minimum of scrap. The area planted to LCP 85-384 will expand rapidly on farms that have switched to the combine system.

While three of the six experiments and grower observations indicate higher delivered tonnage with the combine system, sugar per ton of cane was normally lower than in comparable soldier system delivered cane. This offset in yield is probably due to the higher trash percentage in delivered cane with the combine system (especially in unburnt cane), the presence of more tops in the delivered cane supply, and approximately the same proportion of field soil as in cane loaded with the conventional system. There are also lingering questions concerning the accuracy of the core sampling system in delivered cane from the two systems.

Tests conducted on burnt and unburnt cane have not yet produced sufficient results to demonstrate that cane can be economically harvested without burning in Louisiana. Additional tests are required to compare not only green and burnt cane but also the difference in air quality from cane (with tops removed) burnt on the heap as compared with cane burnt standing in the field. The transport methods used in Louisiana vary greatly, although all have generally led to reduced cane spillage on state and federal highways. Reduction in spillage will certainly improve the relationship of growers with the non-farming public. Most growers report that labour requirements with the combine system are reduced, especially since

field workers are not required to pick up cane stalks not properly laid on the heap following harvesting and prior to loading.

Based on these results and observations, interest in combine harvesters continues to expand. Cultural practices may need to be altered for more efficient use of the harvesters. The impact of these changes on drainage and production will need to be examined, as will the effect of trash blankets on cane shoot survival during the cold and wet winters. The need for more than one high yielding variety is also a necessity if combine harvesting is to be a continued success. Because 75% of

the growers in Louisiana operate from a small area (less than 23 000 tons delivered per season), the future of contract harvesting, mill owned harvesters, or other arrangements needs to be considered. Accurate combine harvesting costs have not yet been determined because of the small number of growers involved and the various transport methods used. Combine costs are estimated to be higher than for the soldier system. Additional growers would like to switch to combine harvesters in order to achieve the aspects listed in this paper, but are concerned about the many questions that are still unanswered, most important of which is profitability.