Burley Harvest and Stripping Mechanization

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Burley tobacco production is very labor intensive, with the biggest part of the labor requirements being harvesting and stripping. Considerable effort has been put into mechanizing harvesting and stripping operations over the years, but as labor remains available at reasonable rates, it is less costly to manually harvest and strip the tobacco than to invest in available mechanization. Accordingly, adoption of new mechanization concepts and devices by producers has been sporadic and short-lived; however, increased difficulties with the availability and cost of labor may spark renewed interest in mechanization.

Harvesting

The automated burley harvesters manufactured by GCH International were used to harvest large amounts of tobacco on farms in both Illinois and Kentucky from 2006 to 2009. These machines can drastically reduce the labor requirements for harvesting tobacco, but the system is very expensive. Only one of the units originally manufactured is still in use in the United States. That unit has been used to harvest approximately 80 acres annually on a farm in Henry County, Kentucky. Meanwhile, a tobacco growers' cooperative in France purchased a new unit of the harvester from GCH and used it to harvest approximately 60 acres in 2011. Subsequently, they purchased a second unit and used both to harvest approximately 165 acres in 2012 (Wells et al., 2012). The quality of the cured leaf using the automated harvester system has been judged to be equivalent or superior to that from conventional harvesting in France, and efforts are continuing there to reduce system cost and improve reliability.

Three-point hitch mounted plant-notching harvesters manufactured by MarCo Manufacturing Company and Kirpy generated considerable interest from growers following their demonstrations at field days in 2005-2007, and a few of them were purchased and used by growers in Kentucky, North Carolina, and Indiana. In the past few years, however, many growers who own the machines have quit using them. There are many reasons for the waning interest in these notching harvesters. While they do speed up cutting operations, the labor savings are largely offset by increased labor requirements for hanging the notched plants one by one on wire, compared to hanging sticks of 5 to 6 stalks of tobacco on a stick. Also, use of the machines imposes some constraints on managing harvest labor. Wagons filled with fresh-cut loose plants cannot be left for more than a few hours before hanging. Stick-cut tobacco can be left in the field for a few days or on a wagon overnight before hanging. Large labor crews may not be able to work largely unsupervised as they can with traditional stick harvesting operations. Another severe limitation is the difficulties these and other harvesting machines have with handling wind-blown, crooked tobacco stalks, as are concerns about excessive losses due to leaf breakage (Wilhoit and Duncan, 2012).

A harvesting concept that partially mechanizes tobacco hanging operations was developed in the Department of Biosystems and Agricultural Engineering at the University of Kentucky during 2013 to 2015. With this concept, traditional stick-harvested tobacco is loaded onto loose wooden rails carried through the field on a rail wagon, and then these rails are picked up from the rail wagons and set in place on field curing structures using a large set of forks on a tractor front-end loader. The loads of approximately 50 sticks each can be transported to field structures using the tractor with front-end loader provided the distance to the structure is not too far (approximately 600 ft or less). Trials were conducted in 2014 evaluating the use of larger unit loads transported longer distances by tractor to permanent field curing structures. With this configuration of the system, the loader tractor stays at the structure, while multiple transport units (tractors pulling trains of rail wagons) cycle between the tobacco field and the field curing structures. The results of these trials with the larger unit load configuration were encouraging. A benefit of this configuration is that it can be adapted to increasingly larger scale operations by adding additional tractor/rail wagon trains. As with other outside field curing structure systems, the wooden rail harvesting system eliminates hazardous hanging work high off the ground and significantly reduces hanging labor requirements, compared to hanging in traditional tobacco barns.

Stripping and Market Preparation

A mechanical leaf-removing stripping machine developed by Carolina Tobacco Services that was introduced at tobacco field days and trade shows in 2006-2007 initially received considerable interest from the tobacco industry. The CTS stripping machine uses "sticker" type chains to hold the tip end of plants hanging vertically downward, conveying them past angled wiper bars that strip off leaves as the plants move through a length of 14 to 16 feet. Different leaf grades fall into boxes below the plants along that length. Tips must be stripped by hand before loading the plants into the machine. Evaluations conducted both by the University of Kentucky and the University of Tennessee have shown that this machine can significantly improve labor efficiency over typical manual stripping. In one study, a crew of seven workers could strip around 70 pounds per worker-hr., or about 35 worker-hr./A for a 2,500-pound per acre crop (compared to 50 to 75 worker-hr./A for conventional stripping) (Wilhoit and Duncan, 2013). This technology was not widely adopted by growers.

An automated stripping concept has been under development and evaluation in the Department of Biosystems and Agricultural Engineering at the University of Kentucky for several years. A very high capacity mechanical stripping system has been developed that segments the tobacco plant into sections of stalk with leaf attached (for each grade), and then separates the leaf pieces from the stalk pieces (Day et al., 2012). This system has been field tested for the past three or four seasons for efficiency and industry acceptance. Given the expected costs and complexity of the machine, this concept would likely involve growers bringing bulked tobacco to a central location for custom stripping.

The changeover to big bale packaging for burley production and the accompanying opportunity for putting non-oriented leaf into the bales, led to an initial flurry of interest in various stripping aids that moved the stalks past the workers allowing them to use both hands to more rapidly remove the leaves. Such aids include the stripping wheel and various types of straight-line conveyors. Of these stripping aids, the dual chain conveyor, which moves sticks of tobacco hanging vertically downward past the workers, has gained widespread use, especially in dark tobacco. In one study, the dual chain conveyor had a reported labor productivity of 57-pound per worker-hr for 10.8 workers, meaning an overall capacity of over 600 pounds per hour, quite high for a relatively simple and inexpensive mechanism (Wilhoit and Duncan, 2013). As the size of tobacco operations has increased since the end of the federal quota system, timeliness in getting a crop processed has become more important, meaning high capacity may be a more critical factor for producers than actual labor efficiency when it comes to mechanization innovations.

Interest in these stripping aids seems to have leveled off as growers have tried different ways of incorporating big balers into their stripping system to improve labor efficiency. Some of the things growers are doing include pulling wagonloads of tobacco directly into large stripping rooms, taking portable balers to the barns and stripping on wagons in the barn driveway, using various multi-chambered balers that have become available, powering two balers off a single hydraulic power source, and even stripping directly into the balers. Some growers consider stripping aids to fit well into their systems, while others feel that they are obtaining good efficiency with the setup they are using for organizing the workers and relaying the tobacco stalks.

There continues to be interest in using stalk choppers with the larger-scale stripping operations that are becoming more common. Many farmers have converted forage choppers, powering them electrically, to make tobacco stalk choppers. Several units of a purpose-built tobacco stalk chopper developed in the Department of Biosystems and Agricultural Engineering at the University of Kentucky have also been used on Kentucky farms in the last several years. Stalk choppers that incorporate conveyers, so that they are fed continuously as workers strip the tobacco, offer the best gains in efficiency for stripping operations. These systems eliminate the need for accumulating bare stalks and carrying them out of the stripping room and manually loading them on wagons or in manure spreaders. Labor requirements for spreading chopped stalks are considerably reduced compared to having to throw whole stalks off a wagon manually. Uniformity is much better than if whole stalks are spread with a manure spreader.

References

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