Mallee harvester: from concept to reality

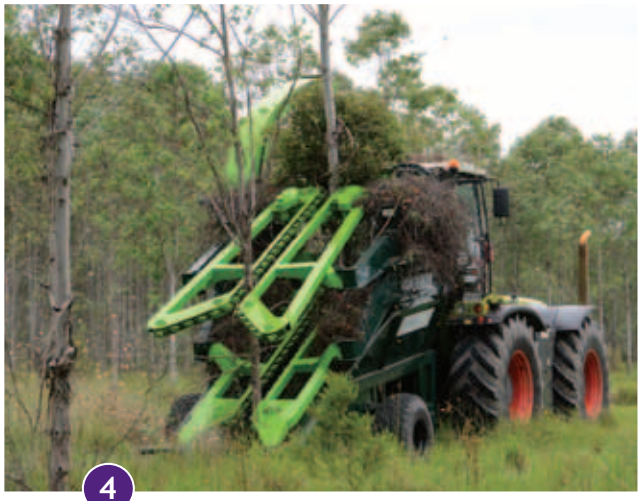
By Janet Paterson

The mallee harvester works! The prototype harvester, developed by Richard Sulman, Biosystems Engineering, with ongoing support and advice from Future Farm Industries CRC Project Leader Rick Giles, has now met all its milestones and work on developing a commercial model has begun. This is a huge boon for the embryonic mallee industry as a harvester is an essential component of an integrated supply chain for woody crops. In this article, we review the challenging road that has taken the harvester from concept to reality.

1 *The development of a harvester for the Australian mallee industry started 15 years ago with several years of work by Harley Pederick of Dumbleyung Engineering and the CRC's Rick Giles, leading to a concept harvester (above). The next challenge, which would take most of the next decade, was to develop a harvester that could cut and chip mallees at a commercially viable rate (left).*

2 *The mallee's form and size requires a unique harvester design. Mallees are not a conventional single-stem forest plantation tree, nor are they a forage crop. Therefore, developing a mallee harvester needed to draw on both agricultural and forestry harvesting principles.*

3 *To be commercially viable, the harvester needs to be able to harvest and chip the mallee stems continuously at a rate of at least 50 green tonnes per hour. This requires the harvester to operate on the move and trees have to be harvested and fed into the chipper while standing up. In conventional forestry systems, individual stems are felled then stockpiled for later processing.*



4 *Designing a system to cut, queue and carry vertical stems along a conveyor to the chipper was a huge engineering challenge, especially given that mallees are multi-stemmed, irregular and have very dense wood.*

5 *The greatest difficulty was engineering the transfer of the vertical tree stems from the elevator to the rollers that feed the trees into the chipper. This required the moving trees to change direction from moving up the incline to dropping vertically down into the chipper. It is imperative the tree stems are not left uncontrolled for even a split second during this process or they may fall from the machine.*

6 *Optimising the strength and weight of the saw disc ensured it cut the mallee stems with the greatest possible efficiency. The momentum of the spinning disc is set so it cuts each stem without wasting energy in needless spinning. Improving the operational efficiency of each of the harvester's components was critical because there is limited power to drive each harvesting process.*

7 *Initially augers (left) were used to grab and transport the stems but these were replaced by chain elevators (right), as they proved more aggressive and effective. Richard Sulman, Biosystems Engineering, (right) designed the successful mallee harvester.*

8 *Chipping the mallee stems requires considerable energy and minimising the power used by the chipper has been a major consideration during the harvester's development.*

9 *After extensive investigations, a chipper was developed that uses 45 per cent less energy than its predecessors.*

The early-commercial harvester currently being developed will have about 600 kW of power with most of this going through the chipper. The current harvester (pictured above) is based on a 280 kW tractor.

During 2012, the prototype mallee harvester successfully met its final milestone — to harvest at least 20 tonnes per hour for at least an hour. In fact, it achieved a harvest rate of 38 tonnes per hour for 74 minutes. The harvester trials also provided valuable information on the bulk density of the chipped material, which will underpin the design of future transport systems for the mallee industry.

The next step is to develop an early commercial harvester to produce the first commercial volumes of biomass and promote the technology to commercial manufacturers.

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