ADVANCED EQUIPMENT IN SHEEP MEAT PROCESSING

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Introduction

Over the last ten years the pressure for the meat industry to adapt or develop new technology has increased markedly. Intense international competition between species, and from alternative protein sources, has forced an unprecedented need for cost reduction and efficiency in the processing sector. High volume production on chain systems and increased further processing (boning/cutting) have accentuated issues of job description, task specialisation and occupational safety and health. Increasingly stringent hygiene requirements favour reduction in manual handling where possible. One way to address these issues is by the use of mechanisation where significant advantages can be gained in the areas of direct labour cost, indirect labour cost and yield. Increased ease of processing pre-rigor and hygiene improvements may also be important. Other issues obviously enter decision making and the emphasis given all factors will vary markedly according to company policy, circumstances, the particular process and the technology available.

Background

The above factors have led to the development of many processing aids, particularly in the last twenty years. In the slaughter area inverted dressing systems are now common and many processing aids associated with inverted dressing are installed. Developments continue in this area, with the emergence of new equipment from Europe and the recent manufacture in New Zealand of the first of a new generation of automation, a robotic y-cut machine.

Research into the mechanisation of sheep boning operations is relatively recent. Some pork boning machines have been marketed with varying degrees of success over the last thirty years, with the Prince ham deboner, Langen U-series boning machines and Protecon machines notable. A common feature of these machines has been the tissue damage inflicted by the operation and the unsuitability of the machines to be adapted to sheepmeat. One successful adaptation is the use of the Protecon shoulder boners in lamb processing by a New Zealand company. More recently MIRINZ has developed some boning machines, most notable being their loin boner which is in relatively common use in NZ and Australia and their chine boner. A number of others are being or have been developed and are nearing commercialisation. These include machines for trunk, rack, leg and pelvis boning.

Slaughter/Dressing

Inverted dressing (NZ)

In the mid to late 1970's a New Zealand industry funded development project brought together and coordinated efforts that were independently developing different concepts at three sites. It was this project that spawned the inverted sheep dressing system in common use today. The initial result of the development was a large rotary dressing machine which removed the pelt in one operation from the shoulder to the rear hocks. Resistance to the size and cost of this large piece of equipment led to the development of a series of smaller devices to replace or complement the operations for which it was developed. This suite of machines is relatively well established in the market and comprises: automatic stunning, neck-break, wide to narrow transfer, hock removal, shoulder puller and final puller.

Inverted dressing (Norway)

A recent addition to the inverted dressing scene is a Norwegian system whose major component is a single machine to pull the whole pelt from the shoulder down and off the legs. The standard system is designed to operate at modest production rates but it is claimed to produce a very good standard of dressing with minimal pelt damage.

Robotic Y-cut

A more recent development from New Zealand heralds a new generation of automation in the meat industry. A New Zealand industry funded project has developed a robotic Y-cut machine which differs from previous developments in that the machine incorporates all the properties of a "classic" robot. The machine has on board intelligence and adapts its responses and path according to feedback from sensors. The machine is completely re-progammable to direct an end effecter in any desired path within the envelope its four-degree-of-freedom probe encompasses.

Two production SRV Y-cut machines have been sold and are undergoing production commissioning at the time of writing. Because of the flexible nature of the robot and the fact that the cutter developed will likely serve other opening up tasks with little alteration, it is likely that continuing development will rapidly spawn robotic alternatives to a number of slaughter operations and boning, cutting and packaging applications.

Boning

MACPRO Trunk boner

A prototype trunk boning machine has been proven in production trials in Australia. The machine removes the meat from the skeletal frame of mutton trunks, leaving the foreleg bones intact in the soft trunk side. Production machines will run at 6 trunks per minute with one operator loading the machine and prior workup being performed by two men. Yield, particularly of the high-value backstrap (longissimus dorsi,) is excellent.

MACPRO pelvis boner

A prototype pelvis boning machine has proven concepts that have been developed to remove the legs from a chump-on hindquarter pair. The device is manually loaded, however an automatic loading option is planned. Production rate is about 6 per minute, removing the legs with high standards of yield, minimal tissue damage and minimal preparation.

MACPRO leg boner

The MACPRO leg boning machine has been proven in concept in workshop trials and a production prototype machine has been built for

industry trials commencing May 1997. The machine is compact and will tunnel bone legs at the rate of about 6 per minute. One operator will be able to load 2 machines. Yields are better than most manual boning operations and preparation is minimal, involving only the removal of the knuckle tips and the patella, if necessary.

MACPRO rack processing machine

MACPRO Engineering is developing a rack processing machine which is designed to produce French or plain racks from a full saddle The machine will occupy a space of about lm x 2m and be capable of boning about 6 saddles per minute with one operator. No preparation of the saddle will be necessary past the transverse cuts to break the primal from the carcass. In the one machine the ribs will be cut to form the rack, the chine removed and the rack frenched, to form uniformly sized and shaped product, with minimal tissue damage and excellent yields

MIRINZ loin boners

The MIRINZ loin and saddle boner is a well established machine with about 25 having been sold in New Zealand and Australia. The device removes the longissimus dorsi from racks or saddles. Production rate varies from 6 to 9 pieces per minute depending on whether one operator or two are employed. Yield is claimed to increase by 10% compared to manual boning

MIRINZ chine boner

This machine removes the vertebrae from a rack saddle by means of a blade set to clear the meat from the vertebrae followed by a saw cut through the ribs adjacent the spine. The operating rate is 9 per minute with one operator. The increase in yield is claimed to be 8% over average manual techniques for the same operations.

Motivating factors for the adoption of such technology

The obvious major factors for the uptake of these technologies are those of labour cost and yield increase. The priority accorded these factors will vary from plant to plant and it is probably fair to say that the initial justification for many automation installations is based on labour cost. In some instances, though, the gains available from yield increase may well exceed the gains from direct labour cost reduction and may in fact be the major contributor to overall productivity gains. With the rising levels of OHS related costs many of the devices discussed here can contribute to profitability significantly by eliminating tasks which are high risk in terms of OHS costs. This is particularly so where the number of repetitive, high (physical) stress tasks can be reduced by the introduction of mechanisation. Increasingly stringent hygiene requirements favour reduction in manual handling where possible. Generally standards of hygiene on slaughter boards have been increased by the use of mechanised and inverted systems reflecting the original motivation for the early pelting developments in New Zealand in the mid seventies.

Conclusions

A large number of technical developments have emerged to assist in improving productivity and quality in sheepmeat processing. To date most equipment available has been for use in the slaughter area, and developments continue in this area. In the boning/cutting area a few existing machines will be joined shortly by others to provide the potential to significantly impact on the operation of boning rooms in terms of productivity and quality.

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