

## Rapid Drying of Lucerne Hay by Maceration

Drying is of major importance in haymaking. The dry matter loss associated with drying is about 25% for fine weather conditions and can exceed 40% when rain occurs. This loss can be minimized by using more efficient conditioning techniques that increase the drying rate and thus reduce the time interval between cutting and baling.

Studies in Australia and overseas have shown that hay drying rates can be increased by using mechanical and chemical conditioning techniques. However, typical field drying time still remains 2 or 3 days in summer and 4 to 8 days in winter. Hay maceration is a new technology which has the potential to further improve the drying rate. Maceration is achieved by passing the plant material through a set of grooved rolls rotating at different peripheral speeds. Maceration hastens drying because it ruptures the epidermis and inner tissue of leaves and stems allowing greater moisture loss.

Using a two roll laboratory maceration unit, experiments were conducted under southeast Queensland weather conditions to identify the factors affecting dry matter losses and drying rate. Upper roll speed and pressure did not affect the drying rate of macerated hay but significantly affected the dry matter loss. Upper roll pressure of "zero" in combination with a speed of 600 rpm yielded the lowest dry matter loss with no significant difference in the drying time compared with other maceration treatments. Further experiments comparing the drying rates of the unconditioned, mower-conditioned and macerated hay revealed that the drying time of macerated hay was 21% shorter than the mower-conditioned and 48% shorter than the unconditioned hay.

Because corrugated cylindrical steel for the macerating roll is very expensive, other material for the macerating roll surface was assessed. The two corrugated steel rolls were modified by glueing a softer rubberised belting material to them. Experiments were done to evaluate the effect of the rubberised macerating rolls on drying rate and dry matter loss of macerated hay. The drying rate of the macerated hay was significantly higher than the unconditioned hay but a further experiment comparing the mower-conditioned and the macerated hay showed no significant difference between them. In the latter experiment, the drying rate of the macerated hay was faster only during the early stages of drying.

An identical two roll laboratory macerator was fabricated using a harder type rubberised belting material. A series of loss and drying experiments were conducted in January and February 2000 using four treatments; unconditioned lucerne hay, mower-conditioned lucerne hay and macerated (rubberised-rolls) lucerne hay. The January drying experiment showed that both macerated (steel-rolls and rubberised-rolls) hay dried to a safe storage level after 8 hours of drying while the mower-conditioned and unconditioned hay dried on the second drying day. A similar trend was also observed in the February experiment. Drying rate of macerated (rubberised-rolls) hay was significantly faster than the macerated (steel-rolls), mower-conditioned and unconditioned hay. However, dry matter losses were significantly higher than for the other treatments. The improved maceration on the crop was attributed to the configuration of the upper and lower rolls' corrugations which formed a 16° angle between them. This caused the lucerne crop to be rolled over as it was fed into the macerating rolls resulting in more uniform maceration.

Crude protein and dry matter digestibility experiments comparing the four treatments revealed that mechanical conditioning treatment and/or reduced drying time did not affect the crude protein content of hay. However, the dry matter digestibility of mower-conditioned and macerated hay but macerated (rubberised-rolls) hay gave the highest R<sup>2</sup> value of 94% indicating higher consistency of dry matter digestibility.

Overall results of the study showed a good potential for maceration technology in Australia. Although the dry matter loss associated with it is comparably higher than the traditional mower-conditioning treatment, the shortened drying time of macerated hay could be its major benefit especially under the unpredictable weather conditions in Queensland.