FIELD DRYING OF HAY USING A RANGE OF MOWERS AND CONDITIONERS

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SUMMARY

Cereal and pasture hay crops were cut with a sickle-bar, a disc or a drum mower and the resulting swaths left to dry or subsequently conditioned. These treatments were also compared to crops cut with a mower-conditioner. The cereal and pasture crops were cut at flowering and also when the cereal was at the milk stage and when the medic pods in the pasture were descending. The swaths were sampled twice daily until herbage dry matter was above 75%. Swath type did not affect drying rate in cereals but swaths produced by the disc mower in pasture dried quicker than those cut with a sickle-bar or drum mower. Conditioning had a more marked affect on the drying rate of pasture than cereal, resulting in herbage being ready for baling up to 54 hours earlier than some unconditioned treatments. The mower-conditioner produced swaths that dried marginally slower than herbage cut and subsequently conditioned.

Digestible dry matter percentage decreased between cutting and baling in the cereal swaths but not in the pasture swaths. Crude protein percentage decreased in the pasture between cutting and baling due to leaf loss. No changes in crude protein were recorded in cereal hay. It is concluded that in cereals mower design had little effect on the drying rate, but in pasture disc mowers were more effective than the other mower designs. Conditioning was more effective in pasture than cereal crops.

INTRODUCTION

Until recent years sickle-bar mowers have been used in cutting herbage for hay. These mowers cut poorly, block in high yielding crops (Klinner and Shepperson 1975), are susceptible to stone damage and require frequent maintenance. Multiple disc and drum mowers do not have these shortcomings and are replacing sickle-bar mowers despite their high cost and high power requirements (Klinner and Shepperson 1975). Disc mowers produce a swath similar to sickle-bar mowers whereas drum mowers produce a swath of herbage standing upright in a loose windrow of reduced width which manufacturers claim dry faster and avoid leaf and nutrient losses associated with swaths cut by sickle-bar mowers. Mower-conditioners, which have a wider cutting width than most mowers, are also gaining acceptance by farmers. Manufacturers claim these machines produce fast drying windrows, allowing earlier baling and reduced plant nutrient losses.

Hay made in southern Australia usually is cut when the grass species start to flower and for up to four to six weeks later. Stage of maturity may have different effects on the drying rates of cereal or pasture.

This paper describes an experiment in which cereal and pasture herbage were cut at two maturity stages with a sickle-bar mower, disc mower or drum mower with and without conditioning, or a mower-conditioner. Changes in dry matter, digestible dry matter (DDM) and crude protein (CP) were recorded during the field drying period.

MATERIALS AND METHODS

Oats (Avena sativa cv. Avon) and a 95% legume based pasture consisting of

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subterranean clover (Trifolium subterraneum), annual medics (Medicago scutellata) and annual ryegrass (Lolium rigidum) were cut at the Northfield Research Centre on October 21, 1979 and October 27, 1979. The cutting dates in cereal coincided with the flowering of the ryegrass and medics and the descent of the medic pods. Herbage was cut with a Massey Ferguson Model 22 sickle-bar mower, a Vicon CM 165 disc mower, a PZ cyclomower model 165 drum mower and a Hesston Model 1070 mower-conditioner. Herbage was cut with the mowers or cut and subsequently conditioned immediately after mowing using a New Holland 404 conditioner.

Treatments were replicated six times at random in the experimental block. Each replicate, a swath 50 metres long, was sampled in five places at 0900 and 1500 hours during the drying period using a swath sampler (Tullberg and Minson 1978) and the five samples bulked. Samples were collected at mowing, raking (60% dry matter) and baling (75% dry matter) were dried at 100°C for 12 hours, ground through a 1 mm screen and analysed for DDM (Tilley and Terry 1963) and CP by Kjeldahl nitrogen. Data were analysed by analysis of variance.

RESULTS

At mowing the mean contents of dry matter were 27.2% and 31.2% for cereal cut at the flowering and milk stages and 16.2% and 17.4% for the pasture cut at the flowering and seed pods descended stages respectively. Dry matter yields were 10 111 kg/ha and 9 100 kg/ha at the two cutting dates in the cereal and 5 659 kg/ha and 7 441 kg/ha in pasture. Conditioning of the cereal hay cut at flowering (Fig. 1) resulted in the dry matter content for baling (75%) being reached six to 24 hours before the unconditioned hay.

The conditioned treatments of pasture herbage cut at the flowering stage with the sickle-bar, disc and drum mowers were ready for baling 48 hours before herbage cut with the drum or sickle-bar mower, while herbage cut with the mower-conditioner and disc mowers was ready for baling 42 hours earlier.

Conditioned treatments of cereal (Fig. 2) cut at the milk stage were ready for baling 24 hours before herbage cut with the sickle-bar, disc and drum mowers, while the mower-conditioned herbage was ready 18 hours earlier. Conditioning of herbage in pasture cut at the descent of the medic seed pod stage allowed baling 48 to 54 hours earlier than herbage cut with a sickle-bar mower or drum mower, while herbage cut with the disc mower allowed baling 24 hours earlier than these two mowers.

Cereal herbage had DDM and CP contents of 59.5% and 8.0% and 58.2% and 7.0% when cut at the flowering and milk stages respectively, while pasture had DDM and CP contents of 66.2% and 21.4% and 65.5% and 20.2% at the flowering and when seed pods were descending respectively. Between cutting and baling there were some significant differences in DDM in the cereal herbage, but no consistent trends were observed between the conditioned or unconditioned herbage. No significant differences were recorded in DDM in the pasture at the two growth stages, although significant (P < 0.05) declines in CP % between cutting and baling were recorded. Cereal hay cut at the flowering and milk stages declined to an average DDM of 55.0% and 57.2% at baling, while the average CP in the pasture cut at flowering and descent of the seed pods were 19.6% and 18.5% at baling respectively.

DISCUSSION

There were few differences in the drying rates of cereal herbage cut at both
FIG. 1 Field drying of cereal and pasture herbage cut at the flowering stage.

FIG. 2 Field drying of cereal cut at the milk stage and pasture cut when the medic seed pods were descending.
stages of maturity with the sickle-bar, disc or drum mowers. However, in the pasture, herbage cut at flowering and the descent of seed pods with the disc mower dried 42 hours and 24 hours earlier than that cut with a sickle-bar or drum mower respectively. Clothier and Taylor (1980) found energy for evaporation comes mainly from radiation and wide open swaths which intercept a large amount of the incident radiation from the sun and dry most rapidly and uniformly. They also found that swaths cut with a disc mower dried quicker than swaths cut with a drum mower. They found swaths produced by the disc mower were shallower and not as compact or as high in bulk density as those produced by the drum mower. The swaths produced by the disc mower in our experiment were shallower and wider than the higher and narrower swaths produced by the drum mower. Swaths produced by the sickle-bar mower in the pasture at both cutting dates were uneven and lumpy due to the blocking of the mower in the high yielding medic pasture. This would explain why the swaths dried at the same rate as those produced by the drum mower.

Conditioning improved the rate of drying, as has been recorded by Greenhill (1959). Conditioned cereal hay was ready for baling six to 24 hours earlier than the unconditioned herbage when cut at the flowering and milk stages, whereas, conditioned pasture hay was able to be baled up to 54 hours earlier than pasture cut with a drum or sickle-bar mower and not conditioned. This was most likely due to the conditioner crushing the stems and allowing them to dry at a similar rate to the leaves resulting in an improved drying rate. Both cereal and pasture herbage cut with the mower-conditioner did not dry at the same rate as that cut with the three mowers and conditioned separately. This was most likely due to the design of the mower-conditioner in which the rollers crimped and did not crush the herbage. Herbage cut at the later stage of maturity dried quicker, which could be attributed to its higher dry matter percentage at the time of cutting and the increasing mean daily temperature later in the hay making season.

Although there were significant changes in DDM between cutting and baling in cereals in some of the treatments there were no consistent declines between the conditioned or the unconditioned treatments. The declines in CP in the pasture treatments between cutting and baling may be associated with leaf loss either at the time of raking or during sampling as the herbage became drier and the leaves more brittle.

It is concluded that in cereal herbage in a Mediterranean environment mower design has little effect on the swath drying rate but in pasture disc mowers result in faster drying of the swath than sickle-bar or drum mowers. In cereals, conditioning results in only marginally quicker drying of the swath, but in medic and subterranean clover based pasture they improve the drying rate by allowing the herbage to be baled up to 54 hours earlier than unconditioned hay.

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REFERENCES