Fodder Conservation

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SUMMARY

THIS paper deals with many aspects of fodder conservation. Hay-making with modern equipment is discussed. Silage is given pride of place as the type of conserved fodder that best retains the original feed nutrients. of using conserved fodder to secure maximum benefits are dealt with. Ways paper concludes with notes on fodder protection.

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National development, permanent agriculture, and prosperity in Australia depend largely on the conservation of adequate fodder, not only in the narrow definition of feed preservation by haying or silage making, but also in the wider concept of conservation, embracing as it does all the principles and practices of sound husbandry.

Hay-making is probably the oldest form of fodder conservation, and, until recent years, the process was of necessity slow and laborious. The needs of housed livestock, in many overseas countries, have made this form of conservation an essential part of farm management. However, in Australia, where there is not this need, the making of hay has been limited largely to meet some of the needs of drought feeding. The picture is one in which the total tonnage conserved is quite inadequate to meet overall requirements.

The establishment of improved pastures in the better rainfall areas and the introduction of the automatic baler have brought about a changed outlook, resulting in a greater volume of feed being conserved as hay. Where this fodder has been used to tide over the irregularities of pasture volume and quality that occur every year great improvement in the production from livestock has resulted.

Surplus pasture growth, lucerne, and other special crops may be conserved as hay, but the quality varies over wide limits, depending on species, stage of maturity, weather conditions, and the technique employed in harvesting and storage.

Lucerne and cereal crops are frequently specifically grown for haying, and the stage of maturity usually coincides with suitable hay-making weather. However, in the case of pasture hay, the pasture must be managed in such a manner that maturity is delayed until weather conditions are likely to be suitable.

As it requires less labour, the pick-up baler has solved many problems associated with the rapid handling of large tonnages, but it has also brought other problems that have not yet been completely solved. Such problems are the ancillary equipment and organisation in mowing, raking and cartage to storage, needed to deal with the large output of a unit. Furthermore, from economic considerations fodder conservation programmes must be sufficiently large, and the hay-making prospects from season to season reasonably reliable, to justify the large capital investment in plant.

The development of hay-making techniques and the proper use of established reserves will only be solved by experience, and the casting-off of some old shibboleths that are misleading not only to the novice but also to farmers with low powers of observation.

For example, the view is widely held that hay baled with a high moisture content, left in the field, or carried to storage and stacked with sufficient inter-bale spaces to allow free air movement, will dry out to a safe moisture level. This idea is completely fallacious. Since hay is a very poor conductor even under favourable conditions, drying extends only several inches below the surface creating an illusion of general dryness. The centre of the bale, however, retains its high moisture content with resultant heating, moulding and loss of nutrients.

Baled hay of high moisture content is difficult to dry under conditions of forced air circulation, so that when weather conditions are doubtful and hay moisture content too high, it is better to risk spoilage in the field than to bale and ensure it.

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Mowing the crop with a high-set cutter bar to leave a good stubble, keeps the swath off the ground, allowing circulation of air below the hay and eliminating contact with the ground. This not only assists curing, but also makes it possible to rake cleanly with a higher rake setting that avoids pick-up of stones and clods, and prevents contamination of the hay with dust, an inevitable result when rake teeth are set low and strike the ground.

Careful raking is vital and to a considerable extent it determines the ultimate quality of the hay. Too early raking results in a tight, hard windrow that will not dry readily, late raking shatters leaves and causes a direct loss of this most valuable part of the hay. Fast, careless raking does not form the even continuous windrows that cure evenly and make for easy non-stop operation of the baler.

In turning hay with the rake care is necessary to ensure that the windrows remain unbroken and are turned over completely, so that the bleached top of the windrow remains on top. The stirring so accomplished opens up the windrow, places it on drier ground, and reduces bleaching to a minimum.

The recent introduction of the "Hay Conditioner" which passes fresh cut hay between spring loaded rollers to crack the stems (but not express plant juices) affords a means of more rapidly drying heavy crops, with greatly improved leaf retention. This method of "hay conditioning" must be used with care if rainy conditions are imminent. The crushed material has a greater capacity to absorb water (as well as lose it) so that spoilage can be more rapid than is the case with ordinary material.

Shed-curing (or barn-curing as it is known in U.SA.), is not yet a common practice in Australia. In this method hay is carried to the shed within 48 hours of mowing, and is subsequently dried by blowing air through it. The resultant product has a higher nutrient content, particularly protein, and retains a better colour than hay made in the usual manner.

However, in areas of high rainfall, where field curing is too often upset by rain, there is growing interest being shown in this method. Barn-curing is so firmly and widely established in the United States, that it seems likely that further experience in this country will see its adoption as a common practice.

SILAGE MAKING is not popular in Australia. This is possibly due to a lack of knowledge of the methods of making it and to the evil-smelling result that frequently accompanied earlier attempts, attempts that were costly in terms of labour, not only in the making but also in the feeding-out of the resultant product.

Properly made silage retains a higher percentage of harvested nutrients than the products from any other form of conservation and the buck rake and forage harvester have made it possible to harvest large quantities with relatively few man-hours of labour.

While silage can be made from practically any green feedstuff, and can be stored in a number of ways, one thing is essential in all methods, fermentation must be controlled if a good product is to result. Furthermore, the moisture content of the material to be ensiled has a very important bearing on the quality and the cost of the silage produced. For instance, ten tons of material containing 80 per cent. moisture will yield 2 tons of dry matter fodder, whereas a similar weight of material containing 70 per cent. moisture will yield 3 tons of dry matter. This represents an increase of 50 per cent. in dry matter content with no increase in effort or cost.

Losses (from enzyme action and respiration) in the practice of wilting are more than offset by the greater economy and ease of handling, and the superior feeding properties of the lower-moisture silage.

The temperature of the ensiled mass has an important influence on the quality of the product. Activity within the plant cells causes an initial rise in temperature while bacterial activity gives a further rise, the amount of heating depending on the nature of fodder, the method of filling the silo and the type of silo. Generally, slow filling, relatively dry material and poor compaction give higher temperatures; rapid filling, moist material and exclusion of air result in lower temperatures.

Silage which has been subjected to high temperatures has a brown, charred appearance, is unpalatable and has lost digestible protein. Such silage is commonly seen on the outside of stacks. Low temperatures are associated with

the ensiling of material that is too wet. The product in this case is "sour", dark brown in colour and rank in smell, due to the presence of butyric acid.

Good quality "acid" silage is made by rapid filling of an air-tight container with fodder in the right physical condition, air being quickly exhausted. Only moderate temperatures (100-110" F.) are developed in this material.

On Belabula Farms, where silage making is a regular practice, it has been our experience that additives and covering with soil results in a silage of good feeding quality. Without adequate covering and weighting, spoilage is considerable and continues throughout the period of storage, whereas a cover of 9 in. of soil (representing approximately 1/- per ton in a pit silo of 100 tons capacity) results in negligible spoilage and the silage can be stored indefinitely.

Although its use is reported to give the highest retention of carotene, we do not favour molasses as an additive. It is messy to use, has a great attraction for flies and must be diluted with water, giving a greater overall moisture content to the silage. Dry additives, on the other hand, are easy to use, make a direct contribution to the dry matter and provide a vehicle for carrying essential minerals. Where the techniques employed in making the silage are sound, waste is reduced to a minimum so that the additives lose little of their value by the time the silage is fed out.

Finely-ground grain meals, or industrial carbohydrate wastes are suitable materials. The quantities added depend on several factors, but the main consideration is whether the silage is to be used soon after it is made or whether it is to be kept for a considerable period.

When it is anticipated that the silage will be stored for a long period, it is necessary to use only small amounts of additive — say, 20 lb. per ton of silage. On short-term storage when, e.g., spring-made silage is to be used in the following summer, autumn or winter, the value of the additive is not tied up for long periods, larger quantities may be used. Benefits that accrue are a higher dry matter content and a higher energy value of a normally high-protein feedstuff.

The use of additives largely prevents the loss of carbohydrates from the plant material by bacterial action, with the result that the silage will keep better on exposure at feeding time and larger faces can be opened for working. A sample of first cut-lucerne-barley grass silage put up in 1947 with 50 lb. of carbohydrate meal per ton was analysed in 1948 and showed a protein content of 22 per cent. (dry matter basis), six weeks later portion of the same sample kept in a non-airtight jar was found to be free of mould, and showed 20 per cent. protein.

Sodium metabisulphite is at present receiving considerable attention overseas as an additive. The powdered chemical is mixed with the greenstuff frequently by the use of metering feeders on the chopper or blower, at the rate of 8-10 lb. per ton. While there is no direct contribution to the feed value, in the presence of moisture and heat, sulphur dioxide gas is evolved which, on permeating the mass, inhibits microbial action, thus suppressing temperature rises, and obviating the need for the usual careful packing and consolidation. The aroma of the silage is said to be that of freshly cut grass. The chemical residue in the silage is glauber salts.

At present it seems that the cost of the chemical in Australia would be not less than 16/- per ton of silage (over 50/- per ton on a dry matter basis). Until local experimentation determines the advantages of this additive, the cost represents a high premium to pay for the social graduation of silage.

STRIP GRAZING is now a well known conservation practice, which has been adopted particularly in dairying areas. Close rationing of stock, a high conversion of grown nutrients, and good pasture control, are the main advantages. While twice or thrice daily shifting of the electric fence is an added refinement for maximum results on larger holdings, the technique is frequently modified to give better grazing control by reducing selective grazing, and to avoid excessive soiling and trampling.

This modification is growing in popularity for feeding of supplementary crops **in situ.** This permits the degree of defoliation to be controlled, and the frequent changing of stock to fresh areas reduces the incidence of internal parasites.

ROTATIONAL GRAZING is sound utilisation practice, as it enables the best use to be made of paddock sites. Pastures can be controlled and new establishments can be given the care that is essential for their sound development.

With rotational grazing the larger concentrations of stock are less selective, pastures can be allowed to grow to the right stage of maturity, the degree of defoliation can be controlled, permitting good root development with a consequent quick recovery after grazing.

Unfortunately, even in terms of existing facilities, rotational grazing is not as widely used as it could be, for it is a common experience to see all farm stock simultaneously grazing several paddocks, or even the whole holding. Renovation of fences and gates, together with the provision of suitable water supplies would, in many cases, permit the advantages of rotational grazing to be gained at a very small outlay.

With grazing control, accumulation of leaves, stems, dung, etc., forms a covering mat that absorbs rain, protects the soil from sun, wind and rain, and assures a soil climate favourable to plant growth, as well as playing a major part in erosion and weed control.

PASTURE IMPROVEMENT is another major conservation measure that may be well illustrated by the situation in the Canowindra district. Here the natural cover is barley grass, medics, ball clover, spear grasses and weeds. All are annuals that germinate in autumn and make some growth before frost depresses growth for the winter. In spring there is a heavy growth for 8-10 weeks, the barley grass then seeds and the feed thereafter is only suitable for mature shorn sheep or cattle. By midsummer any growth that has not been consumed has dried up and is gone. For a period of some weeks before the autumn germination starts the cycle again, the only feed provided with good rains is weed growth, for there is practically a complete absence of summer growing species. Top dressing with superphosphate stimulates clover growth, giving better holding into winter and a more sustained peak in spring, but there is the same poverty of summer feed.

By sowing lucerne (3 lb.), rye grass (1 lb.) and subterranean clover (1 lb.) in autumn and topdressing with superphosphate, the position is radically changed. After establishment rye grass and clover germinate each autumn while lucerne makes sound growth. Good autumn rains give a sound sward which carries into winter and which is suitable for autumn-winter saving. The rye sub-clover combination will make some growth except under the most severe conditions of frost and dry weather, and the spring growth comes away earlier and rises to a high and well sustained peak.

After the spring growth is cut for silage or hay, or is grazed, the lucerne growth contributes the bulk of pasturage for several months. If the spring growth is neither cut nor grazed its heavy bulk hays-off on the ground, but its decline in quality is offset by the lucerne growth through the dry pasture, with the result that there is good feed available well into the summer.

Summer storms ensure a stand of lucerne that provides for heavy grazing and/or cutting, and under sound management the soil is covered by the residues of earlier grazing that render the area resistant to erosion, a condition that is not common where grazing lucerne is the sole sown species.

AUTUMN SAVING of pasture is the cheapest and easiest form of fodder conservation when conditions are suitable, as it results in large volumes of high-quality matured feed being available for use at one of the most critical periods of the year. In this technique suitable areas of pasture are shut up and allowed to grow from mid-autumn into the winter. With conditions of good rainfall the pasture grows strongly in late autumn and early winter and with colder conditions the large leaf area already developed takes advantage of whatever sunshine there is and growth continues slowly through the winter. Although the growing period is long, the cold conditions prevent the deterioration near ground level that always occurs with lush mature pastures in other seasons of the year. Thus cold-stored growth can be used in the late winter-early spring period and the advantages of a good supply of mature feed at this period cannot be overstressed.

A further advantage of this practice is that stock pressure on other areas is eased. When autumn-saved areas are shut up after grazing in early spring, the wide-spreading and vigorous root system of the pasture, and the benefits of heavy dunging results in a rapid regrowth, which can be used for hay or further grazing. When cut for hay this later spring regrowth matures at a later, and more suitable, hay-making period.

PASTURE CONSERVATION by supplementary feeding on pasture means increased production from pastures and effective use of stored fodder. The

close relationship between growing and stored fodder is very important in securing optimum nutritional levels for livestock throughout the year.

With new growth after autumn rains it is common practice to extensively graze the holding, so that the short growth will give keep to livestock until sufficient volume builds up and allows the use of smaller areas. The alternative is to confine stock to small areas and supplement the pasture by feeding hay or silage. After several weeks, a change of paddocks will give a larger volume of grazing, and as a progressive policy, the supplement is cut down as pastures build up and are more capable of providing total requirements.

Intensive stocking of the areas first used may damage the sward beyond recovery without re-seeding, so it is well to use areas in poor heart for this purpose; the large fertility increment conferred by this intensive feeding can rapidly build up poorer areas of the farm. The later-stocked areas, because of increased fertility, will respond rapidly and the saved areas will give yields that could not otherwise be achieved. A quick grazing of portion of this latter area, followed by shutting up for autumn saving is the natural sequence at this time.

WINTER PASTURES supplemented with hay, will contribute more grazing than is possible without supplementation and, except in unfavourable seasons, it is possible to stretch the grazing in this way to bridge the winter gap where it would frequently be necessary to feed 100 per cent. on stored fodder for some weeks if optimum thrift in livestock is to be achieved.

In spring, or any other season, when pastures are lush, a small hay ration extends pasture use and gives a more balanced diet. The high moisture content of lush pasture can prevent the ingestion of adequate quantities of dry matter, but hay makes a direct contribution to dry matter intake and slows down the tide of soft wet material passing through the animal, reduces scouring and ensures better assimilation of the pasture. Under these conditions low quality roughage will be readily consumed, and it is a good plan to use the poorest hay on the best pastures, as the high protein content of the pasture ensures the best utilisation of the hay, and better quality hay can then be used when pasture is scant or when animals must be fully hand fed to prevent loss of condition. On the other hand,' when pastures are dry, silage or a concentrate supplement, will secure good utilisation of standing roughage.

Low quality roughage needs to be supplemented with a highly digestible ration having high energy value, an adequate protein level, Vitamin A and minerals. These needs can be supplied daily by 8-10 lb. of silage or 3 lb. of a suitable concentrate for cattle, and 2 lb. of silage or 2-4 ounces of concentrate for sheep. Stock are better able to digest the roughage, retain good appetite and clean up poor quality feed that would, at best, barely maintain them over a difficult period.

In dry spells, or severe winter conditions, the same principles of supplementation of roughage applies. Without it, physical waste of fodder by rejection is very high, there is further waste by low conversion, and, as a result, loss of body weight is high.

During periods of low pasture production the higher digestibility of the grazed pasture which results from supplementation has a strong bearing on the economics of fodder conservation programmes.

FEEDING METHODS have an important place in fodder conservation, for it is quite obvious that a given quantity of fodder properly fed will give better results than a far larger reserve wastefully fed. Where animals are rationed too freely, or in such a manner that the fodder is trampled and fouled, physical waste can run to 50 per cent. or more.

Simple wire and pole racks to hold hay, adequate feeding space to prevent jostling, feeding out on a new site preferably grassed each time, and the correct rationing of feed, are all means whereby waste can be reduced to a minimum. A 200 lb. spring balance is a positive approach to better rationing.

Wheeled feeders, or hay racks, that can be towed to the hay shed for loading, and then left in the paddock for free choice feeding, can frequently be quite cheaply made, and save considerable labour and waste.

ADEQUATE LIVESTOCK NUTRITION is the object of all fodder conservation programmes. The way the animals are fed and the effective use that is made of their feed are the factors that determine the profit margin in returns for their products. Growing stock should always be well fed, and

market stock should be fed on a plane of nutrition that ensures a steady rise in bodyweight. Any period of marking time, or declining weight, inevitably means that the total weight of fodder consumed in reaching market condition is much higher than is the case with the full-fed animal. Pregnant stock, and dry stock, should be fed at nutritional levels aimed at sustaining health and vigour. A rise and fall in bodyweight, within controlled limits, is consistent with animal thrift and feeding economy. Over-fatness or poverty are extremes that result in depression of production and wasteful use of feed supplies.

Full-feeding can readily be achieved by timing the lamb or calf drop to take full advantage of seasonal peaks of growth, so that maximum demand coincides with maximum pasture output. This factor is important not only in terms of volume of production, but also in the effect of providing conditions where young animals graze soft pastures at an early age and progressively become accustomed to mature material.

PROTECTION OF FODDER from weather, stock, pests and absorption of ground moisture results in more nutrients being available at feeding time.

The application of all forms of conservation, within the limits imposed by local circumstances and economy, offers a method of livestock husbandry that will result in increasing yields and improvement in quality of wool, meat and milk, at an economic level that will assist in the establishment and maintenance of a sound export trade.

DISCUSSION

Mr. BLOMFIELD: Could Mr. Sergeant outline his methods of determining moisture content of material to be ensiled?

ANS.: It is rather difficult to determine, but spring growth had approximately 80 per cent. moisture. Material wilted for several hours had 70 per cent. moisture.

Mr. VASEY: Does Mr. Sergeant agree that lucerne may be baled at a higher moisture content than it can be carted loose from the windrow and stacked?

ANS.: No.

Mr. De VEAN: Do you consider that the hay conditioner is the answer to the problem of reducing moisture content of material in the minimum time? Does the breaking of the stalk give an inferior sample?

ANS.: Stems are merely crushed to allow moisture to leave. This speeds up drying. With showery weather the crushed stems tend to absorb moisture.

Dr. MOODIE: Would Mr. Sergeant recommend feeding out weekly supplies of sorghum silage under drought feeding conditions? This would be both labour saving and might lead to greater utilisation of the stemmy portions of the silage.

ANS.: It would depend on the moisture content and the daily requirements of the animals. A lot of the silage would be soiled, dried out and blown away.

Mr. STRUTT: What experience has the speaker in the mechanics of feeding silage?

ANS.: Silage cut with a forage harvester and mechanically handled facilitates the feeding out. I favour the above-ground clamp where it can be forked out. I propose to try self-feeding silos.

Mr. LENAGHAN: It seems to me that the mechanical difficulties of making lucerne hay must so frequently lower its ultimate nutritional value that it might be preferable to pay greater attention to clover hay making. Has any work been done to ascertain the extent of nutritional loss due to mechanical handling in making the various hays?

ANS.: Hay makers must be aware of losses and handling to avoid leaf losses. No figures are available.