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Fig. 1.—Using a tractor-mounted buckrake to top off a silage pit.

MODERN SILAGE MAKING
By H. G. ELLIOTT, Assistant Superintendent of Dairying.

DURING recent years there have been phenomenal advances in grassland production in many parts of the world, and the conserving of much of the surplus spring growth of pastures and fodder crops in the form of silage is becoming increasingly popular. Silage-making is recognised as a sound farming practice which not only improves the stock-carrying capacity of a property but also increases the production of the individual animals.

More and more dairymen are realising that they must conserve silage to balance the big seasonal variation in pasture growth, and for use during dry periods or when adequate green grazing is not available. To maintain a reasonable level of production there is a constant demand for nutritious feed by livestock through the year.

In Australia it has been estimated that to maintain a dairy cow in good production at least two tons of hay and two to four tons of silage should be conserved each year; for beef cattle about half of this quantity; and for sheep about two to three cwt. of hay and five to seven cwt. of silage. It is considered that these quantities conserved in good years may lead to the accumulation of a reserve which could be utilised in years when full conservation is not practicable.

A few years ago, the making and feeding out of silage entailed much heavy manual labour which was costly in time and money.

Today there are many mechanical aids available which have reduced these costs to an amazing extent.

Silage has many advantages. Many types of vegetation—including weedy crops and pastures—may be safely and economically ensiled, with an assured aftermath of regrowth for late spring or early summer grazing.

Silage-making may be carried out under weather conditions that would prevent or delay haymaking. Neither the labour nor the machinery used for silage-making are likely to be simultaneously needed on other urgent jobs, as grass and cereal silage, which is normally made in the spring, is conserved much earlier than hay.

Any additional machinery or equipment that may be needed is relatively cheap; a minimum of labour is required; storage
methods are simple and cost little or nothing, and finally, the product is fire and vermin proof.

It is recommended that farmers should always make silage in the paddock from where the material is harvested, as it reduces the cost of making and feeding out. Apart from that, it is essential that silage should be fed back on to the paddock from which the material was cut, as a 5 to 6-ton crop would remove about £2. 10s. worth of fertiliser elements in nitrogen, phosphate and potash, without taking into consideration the minor constituents.

When fed out in the summer and autumn months in Australia, silage provides a good substitute for green pasture or green feed, but weight for weight it contains about one-third less feed value than good quality hay owing to its higher moisture content.

The selection and preparation of the paddocks for harvesting is most important. These should be top-dressed early and lightly cultivated to level off. During early August they should be closed up from stock, after light grazing in the winter months, harrowed to spread cow pats and all sticks and stones removed and any obstructions marked so that they can be seen during mowing and harvesting.

Prior to harvest time it is advisable to go over all machinery which will be used to see that it is in good working order and will not cause delays in operations.

**TIME OF CUTTING**

When considering this most important point it is worth remembering the following points:

1. For a good quality product it is necessary to cut the green material as early as possible, and by doing this the maximum regrowth of pasture will take place.
2. The ideal stage for cutting is just before the bulk of the material to be harvested is commencing to flower.
3. It is essential to see that there is the maximum leafiness of material for ensiling.
4. With haymaking the correct time to cut is later when the bulk of the material to be harvested is in flower.

**METHOD**

Silage is preserved green fodder which is succulent and nutritious. The preservation is generally produced by lactic bacteria from sugars contained in the plant. Therefore conservation depends on the fermentation of sugars in the silage.

Fig. 2.—Tractor-mounted buckrake attached to the hydraulic lift system of a light tractor.
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to produce acids which “pickle”, or pre­
serve, the fodder from further decomposi­
tion.

For best results the green material
should be high in sugar content for this
fermentation process; if not, it may be
necessary to add molasses to assist this
action.

Grasses, maize, millet, sorghum, green
cereals, all make excellent silage as do
mixed swards of clover and grass. Lucerne and pure clover swards which
contain high protein do not make the best
silage unless molasses is added at the rate
of 40 lb. diluted with water for each ton
of material made.

When making the silage the cells of the
green material ensiled, breathe as long as
air is available, and while this breathing
continues heat is produced. At tempera­
tures between 70 to 103°F. the lactic bacte­
eria multiply rapidly and, when this acid
is at a concentration of approximately 2%,
preserve the fodder as silage indefinitely,
provided all air is excluded.

Temperature control is most essential
for making good silage and the ideal
temperature is about 110°F. If the
material does not heat up properly,
fermentation cannot take place and the
silage deteriorates, but if it gets too hot it
will char. Overheating can be reduced by
rolling to consolidate and exclude the air.

Lush pasture heats slowly, so it is neces­
sary to wilt the material before carting,
raking or baling. Ripe and partly dry
material can overheat very rapidly.

Very lush unwilted green material can
be used to seal off the stack by thorough
rolling. This will form a tight seal over
the top and herringbone rolling with the
tractor is recommended.

Overseas the mechanisation of this form
of fodder conservation has made rapid
strides in the last six or seven years, and
it can be said that this form of conserva­
tion is becoming increasingly popular with
the farming community and has gained
much headway due to the innovations of
many mechanical contrivances and the
modifications in making and feeding out.

It was said after the war that owing to
increasing labour costs and shortage of
manpower, silage was a stock food of the
past unless a new approach to the problem
of storage and handling both in and out
was evolved.

The need for reducing construction
costs of silos, and the man-hours required
to fill and empty them, was felt in all
countries and it was not long before
such innovations such as the buckrake,
horizontal silos, stacks, baling, muckrakes,
mechanised knives and self-feeding were
introduced and adopted. Most of these
new ideas are now being put into practice
in Australia.

In the United Kingdom and on the Con­
tinent it is a common sight to see silos,
silage clamps, stacks and pits, but it is
obvious that the long narrow low wedge­
shaped stacks and horizontal silos, either
uncovered or topped with earth or lime­
stone, with or without a first protective
cover, have come to stay.
One of the main challenges today is to find ways and means of reducing the amount of spoilage, which is usually 5% to 10%, with methods other than the overhead silo; to perfect self-feeding methods; to devise mechanism for removal of silage; to convert rapidly large surpluses of grass into silage and to find simple economical methods of storing the material. This challenge has been taken up in the U.K. and U.S.A. and many new methods have been introduced.

Mechanical methods for handling the green material for conserving are divided into three sections:

A. The buckrake.
B. The hay baler.
C. The silator or mower-chopper combination such as the forage harvester.

The Buckrake
Most farmers in this State are now familiar with the buckrake which is attached to the tractor and used for picking up the green material and carrying it to the storage site—either a pit or a horizontal silo such as a clamp or wedge-shaped stack. It has been estimated in Western Australia that this method of conserving costs between £1 1s. 6d. and £1 5s. per ton. When filling pits or making wedge-shaped, horizontal silos or clamps, the tractor is used for rolling to give compression, and the top sealing can be done by using very lush green material on top which has been rolled until full consolidation has taken place.

The Hay Baler
Baled green grass for silage making is rapidly gaining in popularity with pickup baler owners, as the modification on the metering wheel, whereby the bales are made half the length and weigh 60 to 70 lbs., has reduced heavy work and labour costs. In England it is stated that it can cost up to £2 per ton to make silage by this method, and that about 33% of this cost is for baling and twine. In Western Australia baler twine would cost about 7s 6d. per ton or 24d. per bale, but much less if binder twine is used. The time taken to cut and bale in the field naturally depends on the type of bulk of the crop being handled, but will range from 1½ to 1¾ hours per acre for a 6-ton crop. For a farmer who owns a baler, an average cost of silage making by this method, including labour, tractor depreciation and repairs, would be in the vicinity of 25s. per ton.

At Wagga in New South Wales, making 50 to 60 tons per day, four men with two tractors, haybaler, rake, mower and trailers, worked their costs out at £1 1s. 6d. per ton. This figure was made up as follows: Labour 4s. 3d. per ton, twine 7s. 6d. per ton, tractors 7s. 6d. per ton, and machines at 2s. 3d. per ton.

It must be pointed out, however, that by baling there is a reduction in the amount of consolidation necessary when making, and rolling is generally only necessary in the final stages of building and particularly just before finishing off. Although only limited information is as yet available of the operation in this State, it is claimed elsewhere that rolling should not be carried out until 24 hours have elapsed, as by then the baled material has had time to settle in the stack.

When making baled silage a thermometer is considered essential, for once the heat in the bottom layers reaches between 110-115°F. the completion of the building must be done as rapidly as possible in order to make the best quality silage.

Bonding the bales in the pit or clamp is not recommended as it makes the task of removing harder. The twine should be on top and at right angles to the line of rolling.

There are a number of points in favour of baled silage, and these can be enumerated as follows:

1) In the clamp or pit the baling twine does not rot, consequently the material is easy to remove by the strings.
2) The bales of silage are easy to carry and handle which is an advantage over handling loose material.
3) As the bales are reasonably uniform in weight it is easy to work out the amount of silage to put out for the stock at each feeding.
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(4) By baling it is easy to calculate the yield from fields and, if counted in, the tonnage made in the pit or clamp.

There are, however, some disadvantages, in that, if loose bales are put in they are hard to remove and, if bales are not stacked well, air pockets are formed which cause moulding and charring of the material in that area. Probably the main disadvantage may be the cost of making silage this way over the buckrake method, but if a farmer has a baler the cost may not be much greater, although more saving would be made in feeding out by bales than with the loose material.

Forage Harvesters

During recent years machinery firms have designed combination mower-chopper-blower machines for handling green material and self-unloading trailers for putting this chopped material into silos, pits, clamps and horizontal silos. One man can do the whole job with this modern machinery, but apart from self-feeding, usually special machinery is required to handle out this type of material, and feeders are required, otherwise wastage can be high. South Australian and Queensland results indicate that the cost of making silage with a forage harvester is in the vicinity of 19s. to 24s. per ton.

ADDITIVES

The use of additives for silage, such as salt, molasses, solrose, sodium bisulphite, etc., is carried out in many places, but it is generally considered that with proprietary lines they are too costly, and in any case if the material ensiled is of high quality, cut and handled at the right time and efficiently, these additives are not needed.

Because sodium meta bi-sulphite costs about 1s. 6d. a lb. and 8-10 lb. have to be used per ton of material, it is considered by many farmers to be too costly. It is a powder which when added and in contact with moisture, releases sulphur dioxide, thereby using up large quantities of oxygen and thus eliminating the heat in the silage. By this method it is stated that the silage retains more green colour, carotene, and the fresh grass odour and flavour.

FEEDING OUT

Apart from reductions in the cost of making silage, the problem of how to remove the chopped or loose material from the stack or pit for feeding out to stock has been given much thought. Various methods of mechanical removal, self-feeding and motorised cutters are in use.

Mechanical removal such as by using the muck loader on the front of the tractor is common, but this has one major disadvantage in that the material is removed from the top of the pit or stack, which tends to expose to the air too great a surface for drying and spoilage. Its advantage, however, is in ease of handling, loading or spreading, and the saving of man labour.

Self-Feeding. It is evident overseas that horizontal silos, wedge-shaped stacks, pits and clamps, together with self-feeding,
have many possibilities for increasing efficiency and economy of labour operations, and the use of this method of feeding out is increasing considerably by using gates, poles or by electric fences. Very little difficulty is experienced in adopting self-feeding, but the following points which have been raised by overseas users of this method are of interest:

(a) Ample feeding space must be provided.
(b) There is a tendency for “boss cows” to monopolise the feeding area to the detriment of timid cows.
(c) Free access by cows to silage with self-feeding may reduce their intake of other feeds such as hay or dry grass.
(d) It is hard to ration silage when self-feeding is adopted.
(e) Self-feeding saves handling costs, and this is important for, without mechanised equipment, silage is generally handled twice in feeding out to the stock.

It may be said that self-feeding by any system has great possibilities from the point of efficiency and economy, as it appears feasible to let the animals balance their own diets if pasture, hay or silage is available, and hand labour can be eliminated entirely without additional expense for mechanical equipment for feeding out.

Motorised cutting aids such as the “Silo-aid” are now available and reduce the labour involved of hand-cutting out. This machine weighs about 40 lbs. and will cut a run 12 feet long and 8 inches deep in one minute. Other types of mechanical aids are now being designed to reduce labour in cutting out silage from above-ground stacks clamps and trench silos.

STACK AND TRENCH METHODS FAVOURED

It can now be said that, after two generations, stack and trench silos have come back into favour. Tower silos were popular because of the high percentage of wastage in stacks and the inconvenience of handling material in and out of underground silos, but with the modern equipment these older forms of stacks, clamps, pits and trenches can now meet present needs for forage preservation.

Horizontal silos are those in which the length or diameter of the finished product is greater than the height. The available machinery for harvesting, placing, compacting and removing of this crop is making the horizontal silo popular.

Horizontal silos may be in the form of excavated trenches; dike silos made on rising ground or hillsides, box or clamp silos where the floor and sides are above ground, as well as the many forms of the free pile or stack silo. These may be of the low, wide, wedge-shaped form, the loaf centre pole type or the bun type.
Some stacks are left unprotected, others are enclosed in a wire and mesh shell with walls of sisal paper or plastic material.

Each type of silo fits the needs of some farmers better than others, but, in general, it will be found that a horizontal stack of suitable size is a good economical method of silage-making.

There are upper and lower limits to the economical sizes of any type of silo, and horizontal silos are often built too small to be satisfactory. The percentage of waste material is necessarily higher in a small stack, but in many cases the low yields of good silage in these stacks resulted from the mistaken belief that crops in any condition, put into a heap, will preserve themselves.

Good silage is only obtained when suitable green material that is not too mature, is ensiled properly with due attention paid to the compacting of the material and effective sealing of the surface layer.

It is anticipated that with the mechanising of silage-making and feeding out, much more of this valuable conserved fodder will be made in the South-West of this State.

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