

SB
195
G36

With the compliments of the Writer

GATHERER

UC-NRLF



SB 70 587

ENSILAGE . . .



Being

Some Notes on the
Construction and . .
Management of the
different kinds of . .
Silos, together with
Observations on . .
the value of Silage
for Farm Stock. . .



By

John F. W. Gatherer.

SB 195 G36

YC 60652



LIBRARY
OF THE
UNIVERSITY
OF

CALIFORNIA

ENSILAGE.

ENSILAGE

BEING

Some Notes on the
Construction and Management
of the
different kinds of Silos,
together with Observations on the
Value of Silage for Farm Stock.

BY

JOHN F. W. GATHERER.

J. C. JUTA & CO.,

CAPE TOWN, JOHANNESBURG, PORT ELIZABETH, EAST LONDON
GRAHAMSTOWN, STELLENBOSCH, DURBAN (NATAL).

1904.

CONTENTS.

	PAGE.
Introduction - - - - -	7
Ensilage - - - - -	9
The Essentials - - - - -	11
Pit Silos - - - - -	14
Filling the Silo - - - - -	16
Stack Silos - - - - -	20
Above-ground Built Silos - - - - -	23
Feeding of Silage—	
To Dairy Stock - - - - -	30
,, Beef Stock - - - - -	31
,, Horses - - - - -	32
,, Sheep - - - - -	32
,, Ostriches and Poultry - - - - -	32

TO THE READER.

The following notes have grown somewhat out of lectures delivered in October last at the Government School of Agriculture, Elsenburg. When, as an afterthought, it occurred to me that a wider use might be made of the observations they contain, I consulted with those in a position to judge, and, meeting with encouragement, resolved to publish them.

In general design the pamphlet retains the character of the original lectures, which were, in accordance to the presumed expectations of a young and progressive audience, an attempt to display the importance of, and necessity for, the general introduction of a more advanced agricultural method.

To prevent any misunderstanding, perhaps I should say that the writer does not claim any of that praise which belongs to those who suggest an altogether new and improved plan for the mitigation of the many difficulties which beset the South African farmer, but he does hope that the intelligible and handy form of this little book will bring the subject to the notice of many who will, he trusts, profit by its perusal.

JOHN F. W. GATHERER.

Government School of Agriculture,
Elsenburg, April, 1904.

INTRODUCTION.

Every few years some part of South Africa is visited by prolonged periods of drought which bring with them severe consequences to the farmer. Those who remember the terrible results of droughts such as occurred in 1890 and 1897, not to mention the great drought we have just experienced, will understand the extent to which we are dependent on seasonable rains for any measure of agricultural prosperity. Of course the natural remedy for our untoward conditions in regard to uneven distribution, throughout the years, of a scanty rainfall, is the storing of water; and it is good to have the testimony of competent men that the possibilities of engineering systems of irrigation in our sub-continent are great. But the construction of reservoirs, canals and the boring of holes, with the passing of the necessary legislation, must needs take a long time, and we would be the last to hurry unnecessarily those on whom it falls to perfect those future sources of wealth, for we agree that such schemes require thorough inquiry and deliberation before they are put into execution. In addition to these periodical droughts, the South African farmer has much to deter him in making that progression of which we have heard so much lately from the lips and pens of those, who, are only armed with a limited knowledge of the many untoward conditions, such as the great prevalence of animal and plant diseases, the difficulty in obtaining labour, etc., under which we struggle. Personally, we have long since come to the conclusion that the systems of farming pursued in the different parts of the Colony are the best under the circumstances, for they have been evolved by a shrewd, observant race of men during generations of varied experiences. It would require, then, a bold man who would come forward and propose any great departure from the old custom, if the conditions under which the old ways had grown up had remained the same, or had shown no sign of changing. But, fortunately—or shall we be tempted to say with some un-

fortunately—those conditions under which we had a contented peasantry, caring little for wealth, and living on an income which was so small that a bad year made little or no effect on that income, those conditions are certain to change ; in fact, sufficient evidence is already forthcoming that the change will come about sooner than was ever expected—if it has not already begun.

That being the case we hope it does not require much boldness to suggest to the consideration of farmers a system which has been proved, in similarly circumstanced countries, good, and which has in this Colony been shown, both by Government and private experiment, to be a very likely source of increased profit.

If the green fodder, which at some period of most years grows naturally or can be easily reared, could be saved over in its green state to that season of the year when green food is impossible or scarce, stock could be kept in a uniform condition throughout the whole year ; also dairy cattle could be kept in a full flow of milk from January to December. Again, if in years of plenty, green stuff could be cut and stored, the losses attending years of drought would not need to be feared.

A method of storing food stuffs has been known from the earliest times, but it is probably only within the last few decades that a method of preserving green food began to be looked into and experimented upon. During the last few years the system has been received with so much favour by farmers in the more advanced agricultural countries, that the benefits to be derived may safely be taken as considerable.

Although much investigation and experiment is yet necessary in the Colony to determine particulars, as for instance the best crops to grow for preserving, and the cheapest and best building in which to store those crops, the general principles which underly the process are well known.

The method is known as Ensilage : the place in which the material is stored is termed the Silo ; the resulting preserved material is called Silage.

The making of silage then has passed through the experimental stages, and, we think, can be confidently recommended to the farmers of South Africa, as a very practical method of making provision in a time of plenty against a season of want.

ENSILAGE.

Ensilage is simply the name given to the process by which feeding stuffs may be stored during the rainy or growing season against the scarcity which is likely to attend the dry or dormant season.

In Britain it was the custom to convert green forage plants into hay for use as a feed, as here we are in the custom of doing with our oat crops. But in certain districts at Home, particularly in the West of the Isles, the rainfall is such as to render the making of hay precarious, and often, indeed, is the crop entirely lost, and oftener it suffers loss in quality. Then it was proposed that, instead of endeavouring to make hay, and run the risk of losing the whole crop by its being spoiled by rain and unsuitable weather, the crop should be cut and preserved in a silo in its succulent green stage. In many instances this plan was followed, and although at first clumsy methods were only known and many disappointments befel the pioneers, the general report was one of enthusiastic praise, and silage gradually became more popular.

It will be seen that the necessity for making silage in Britain is different from that prevailing here.

In those parts where the winter rains fall, there is a plentiful growth of veldt grasses, and it is warm enough for grain crops and also for numerous other fodder crops to grow. In the summer, with a scanty rainfall, the veldt is burned up and much less natural green feed is to be had. The result is that at one season, or another, the farmer is either understocked or overstocked. If understocked at one season he is losing; if overstocked at another he has either to trek with his stock to a part where nature is more kind, or else be under the painful necessity of seeing his cattle go down in condition.

The same sort of thing happens where summer rains fall. Luxuriant grass comes up, or green food can be easily reared and the cattle come into excellent condition; but

then the season of cold, drought—and we are sorry to have to add—insufficient comfort and protection arrives, and the stock lose flesh, and how often do they succumb !

The valuable veldt grasses on many large farms grow at a quicker rate than the stock can eat them off. It seeds and becomes hard, and is usually burned off. This superabundance should be mown while still green and made into silage, to be fed when other food is scarce.

It appears, then, that South Africa, with its year nearly equally divided between periods of rain and drought, should have been one of the first countries to take up Ensilage largely, for it would be difficult to find another country where such a great necessity exists or where such national benefits could be derived from its more general introduction.

THE ESSENTIALS.

If a quantity of green material is cut and made up into a small heap, it is common knowledge that under ordinary conditions as to temperature it will rot, and instead of the feeding value of the resulting material being increased, it is on the contrary strongly repulsive to stock.

It is known that rotting or putrefaction is a process by which organic matter, and particularly the nitrogenous compounds in the cut parts of the plant, are decomposed into simpler substances such as nitrogen, hydrogen, carbon dioxide, ammonia, sulphuretted hydrogen, and other similar gases, and it is the evil-smelling properties of some of these gases which give to a rotting mass its unpleasant odour.

The cause of this decomposition, which is termed putrefaction, is the action of various species of minute organisms or bacteria, and it is the nature of the bacteria engaged on which depends the amount and kind of the rotting. It is not then simply exposure to air which causes rotting. Both fermentation and putrefaction can only take place when certain living organisms are present, and the conditions are suitable to their action. At a temperature below freezing point the activity of the bacteria, which under more favourable conditions would cause meat to go bad, is suspended. On this fact the successful traffic in frozen meat is carried on.

So also do the products of fermentation vary in amount and kind according to the conditions of temperature present.

We all know that milk is more apt to develop a sour taste in warm weather than in cold. The reason for this is that the activity of the bacteria which produce the lactic acid is greatest at a temperature of from 30 to 35 degrees centigrade. We also know that if, immediately after milking, we cool down the milk and keep it at a low temperature, the injurious results of bacterial activity will be delayed.

If subjected on the other hand for some time to a temperature of, say, 60 degrees centigrade, the lactic acid producing bacteria are killed. If the milk was then allowed to cool and kept free from further infection, it would not undergo a lactic fermentation, although in time it might spoil by the action of other bacteria which had not been killed by a temperature of 60 degrees centigrade.

Thus we see that different species of bacteria are suited to different temperatures, so that if matter rises in temperature over certain points, one set is rendered inactive, if not killed, and another species, which before did not

increase owing to a too low temperature and the presence of a more numerous and active competitor, comes into a more favourable temperature for development, activity and multiplication.

We know, then, some of the influences of temperature.

Now some bacteria can only live when they have plenty of air—plenty of free oxygen, and in this respect they do not differ from other living things. They are termed Aerobic bacteria. Anaerobic bacteria, on the other hand, can live only in the absence of free oxygen—not that they can entirely dispense with this life-sustaining element, but because they have the power of obtaining oxygen by breaking up organic matter, which contains a certain proportion of oxygen. Then there are bacteria known as Facultative Aerobic bacteria and Facultative Anaerobic bacteria, so called because they appear to possess the faculty of adapting themselves to any condition between the two extremes of when there is a plentiful supply of oxygen present and when there is a complete absence of free oxygen.

We therefore find that bacteria are the cause of fermentation and putrefaction ; that certain temperatures render some bacteria inactive ; and that the amount of oxygen to them obtainable regulates the amount and kind of fermentation which is likely to take place.

When fermentation is taking place heat is evolved, as, for instance, when a heap of stable manure is first made up. The rise in temperature is due to chemical changes which are taking place in the mass, owing to the presence and action of bacteria. The chief action observable is one of oxidation. If oxidation is going on at a great rate, and that is when air is being freely admitted, the temperature will be higher than when oxidation is limited. In fact, if air were totally excluded, the rise in temperature would be very slight.

We have mentioned roughly, and of necessity simply, the fundamental principles applicable to the successful making of silage.

Having learned something of the nature of bacteria, let us see what happens when green fodder is heaped up in large quantities.

The microscopic organisms which are found on all vegetation now find the conditions favourable to their attack. The fodder, now lifeless, can no longer resist the attack, and the tissues become food for these germs. Different kinds are always present. Yeast-like ones convert the starchy and sweet matter into alcoholic compounds, others, taking up the work, convert the alcohol into vinegar. Some produce lactic, others butyric acid. Other bacteria convert the albuminoid constituents into complex nitro-

genous matter, producing putrefaction, and therefore substances of little or no feeding value. Those are some of the changes which are liable to occur. Now, our endeavour is to preserve green fodder without allowing it to undergo any change. That, at least, would be an ideal state of things, and the nearer we can approach that state the better, for all and any chemical changes which do occur are of a destructive and degenerative rather than a formative and elaborative kind.

In practice, however, it will be seen that it is impossible for us to check action at the very beginning. But we can prevent it going beyond a certain distance.

We know that bacteria require water, a temperature within certain degrees, and air. The moisture contained in the fodder we cannot take away without converting the stuff into hay and thereby defeating our object. We cannot control the temperature by the methods used in the preservation of milk and meat, for instance, as they would be too expensive, but we can control to a certain extent the amount of oxygen present, by pressing out more or less of the air from the heap, and preventing the entrance of more. We have said that it is impossible to check the action at the very beginning, and the reason is clear, for a certain amount of air is always contained in the interstices of the mass. On this supply fermentation goes on of an alcoholic and lactic nature till it can no longer be supported. The temperature will have risen, acids will have been produced, and the interstices will have been filled with a product of fermentation, carbonic acid gas, and if no more air is admitted no further action will take place. The mass will keep for a number of years. The keeping of silage is due principally to the large amount of volatile acids and carbonic acid gas produced, which effectively prevents the further growth of bacteria, and to the sterilization which it has undergone during the warmer stages of the fermentation.

We will now go on to the consideration of the different systems in use for the manufacture of silage.

CONSTRUCTION OF A PIT SILO.

A built silo is not a thing that can be constructed carelessly and prove satisfactory. It is a building which will well repay the care which is taken in its planning and construction. A badly-built receptacle will be a source of annoyance, whereas a good one will, if intelligently worked, be a source of both pleasure and profit. Those who have not had practical experience with silos, or who have never seen silage at all, cannot be expected to go straight away to a considerable expense in constructing the most approved style of silo. And, as we presume novices constitute the majority of our readers, we propose to deal first with the more inexpensive, but quite practical systems, by which good stuff may be made, by the working of which experience may be gained, and which will no doubt tend to create a greater interest.

The first is termed the Pit Silo. The choice of a suitable site is important; it should not be far from where the stock are housed and fed, but at the same time it should not be near to the dairy or place where milk is stored, as when the silage is being taken out, there is sometimes an unpleasant permeating smell. The pit may be dug under an old outhouse, if the foundations are still intact. The side of a slope has its advantages, but, whatever the site chosen, the soil should be of sufficient depth to permit of a free excavation to the depth of at least ten feet. The dimensions of a pit, of course, depend upon the quantity of silage required, or on the quantity of green stuff obtainable. The weight of good silage which a full grown cow consumes per day may be reckoned at 40 lbs. Suppose we are to feed artificially 180 days per annum; each cow will have to be provided with 7,200 lbs. of silage. A herd of ten cows will require 72,000 lbs. Now, the average weight per cubic foot of mealie silage in a silo 20 feet deep with no weights on top may be taken at 33 lbs. We therefore require a pit having a capacity of 2,182 feet. The dimensions for such a pit should be, if possible, 20 by 11 by 10, or if it is impossible to excavate as deep as 20 feet, and 10 feet is the most, then as there will be less pressure on the lower layers by those lying above, the average weight per cubic foot of silage will be less, unless weights are applied. The average weight per cubic foot in this instance will be about 26 lbs., so that to hold 72,000 lbs. a pit having a capacity of 2,770 cubic feet will be required. Measurements for which may be 10 feet deep by 17 by 17, or 10 by 35 by 8. In nearly every case the nature of the soil and subsoil will be such that,

unless the proper precautions mentioned below are taken, during the process of filling-in the fodder, or of emptying the silage, if not during the actual excavating, the sides are liable to fall in. Should this happen when the silo is in use, the presence of soil would greatly reduce the value of the silage. To prevent this happening, it is necessary to line the sides, and for this purpose smooth-faced wooden planks, running vertically so as to lessen the friction during filling, are recommended. Bricks lined with good cement will answer better where they can be afforded. The chief precaution to be taken is to have the walls as perpendicular and smooth as possible, so that during filling the whole may settle down easily and evenly. The bottom may be bricked or cemented. The mouth of the pit, if exposed, should be protected from rain and surface water, and if a shelter is not built over it a rough tarpaulin will be found handy when heavy rain falls. It must be said that we have seen on several occasions silage made in an ordinary hole, with sides sloping so that the bottom is smaller than the mouth, in cases where it was practically impossible, or economically disadvantageous, to have a properly built one. But the silage round the sides and bottom of these has invariably been rotten or dirty, and we have been told that the filling was difficult.

FILLING THE SILO.

There is no doubt that much material of a hard and fibrous nature, such as rank and hard grasses, are rendered more palatable and digestible by fermentation in a silo, but to make silage entirely or largely composed of such innutritious herbage would not give the best results. It should be borne in mind that to make good silage, good green stuff is required, and the fallacy, which is popularly believed, that any weeds or old stuff is good enough for the silo, cannot be too severely criticised. Morgen upon morgen of good veldt is annually burned in these colonies, and although the custom seems to be justified by some reasons, we feel that it will yet be the custom to cut down that herbage and to turn it into silage. Grasses should be cut when they begin to flower. It should be stated here that care should be taken that none of the poisonous weeds, such as "tulp" (*Homeria collina*) and "giftbol" (*Buphane disticha*) are included, lest the animals be unable to discriminate between them, in their altered state, and the healthy material.

The most suitable crop for silage in this country we know of is mealies, for heavy yields at comparatively little cost can be got, and it makes particularly good silage. For this purpose it should be sown broadcast, and cut after it has come into ear, but before it has become hard and woody. Those varieties should be grown which produce the greatest weight of green forage per acre. The cereals wheat, oats, barley, and rye should be cut while they are still in the milky stage. Lucerne and the other allied forage plants make excellent silage. Whatever is used, however, care should be taken that no immature or over-ripe stuff is used.

All crops cut for silage should be conveyed to the silo as soon as convenient, and it may even be well to harvest so that the fodder may not have to lie out exposed to the sun or drying effects of wind. As the silage will be fed in conjunction with some other food-stuff, it is customary to put the fodder through a chaff-cutter before putting it in, as afterwards the operation would be less easily accomplished. When chopped it is also found that it can be more uniformly packed. Should the crop be drier than it ought, some water may be poured over it in the silo. The crop may be cut while still wet from rain or dew, and put in at once without any ill effects. As a quantity of soluble nitrogenous and other matter is always formed in a silo, and as they

generally run down to the bottom, we deem it a good plan to cover the bottom of the silo to the depth of a foot with chaff or some other absorbing food, which can be used afterwards, and so a loss is prevented. If a silo is filled all at one time with green stuff, after a few days it will be found to have sunk down to about half its former height. It may be found more convenient to fill in so much at certain intervals. Those intervals should never be so long as to allow the top of the last layer to become mouldy. If two to four feet of stuff is added and well packed down either by boys, roller, or even by lowering down and walking about a horse, and a day or two allowed to intervene before next filling, a good silage will result. Special care should be paid to the packing round the sides, else the outside edges are liable to be spoilt. Much experience and judgment are necessary to be able to heap up the fodder the right distance above the silo, so that when the shrinking has ceased the pit will be exactly full. The top should be protected by a layer six to twelve inches thick of rough material, as weeds, straw, etc. Sufficient planks, cut two inches shorter than breadth of silo, to cover the silo, but leaving an inch between each plank for ventilation, should be placed on the top and weights put on the top of them. If the pit has been gradually filled and carefully packed, it will require less weighting. Stones, bags of earth, loose earth or anything handy may be used, but a small hole should be left in the centre for the purpose of taking the temperature.

We should have mentioned before that in filling a deep silo there is some little danger attached to entering, for, during heating, quantities of carbonic acid gas—a poison—is given off. It has been found that the resulting silage is not always of the same nature, even although the material used was the same and harvested and filled in the same condition. Sometimes the bottom layers differ from the upper. It may be a brownish substance with a peculiar sweetish smell, to which stock are very partial, or it may be a yellowish green substance with a sharp odour, of which stock are also fond. The former is known as "sweet silage," and is very useful for fattening stock; the latter is specially serviceable in increasing the flow of milk when fed to dairy stock. The difference between the two sorts is due to the fact that two different kinds of fermentations have taken place. The nature of both fermentations is known, and either can be induced or controlled at will.

If after rapid filling the silo is weighted down and a large portion of the air in the interstices driven out, the spontaneous heating is unlikely to result in a higher temperature than 35 degrees centigrade = 95 degrees F., and butyric and lactic bacteria, as well as a number of highly divergent fermentative organisms are active. After a time

the fermentation ceases, the oxygen having been used up and the interstices becoming charged with carbonic acid gas, further action is suppressed, the mass gradually cools, and when opened will be found to contain "sour silage."

If, on the other hand, the silo is filled gradually and weighted less, considerably more air will be present and a higher spontaneous heating will occur, 50 degrees C. to 70 degrees C = 122 degrees F. to 160 degrees F. At this temperature the lactic acid bacteria are in a more suitable temperature for their growth than are the others mentioned as taking place in the production of "sour silage." They, therefore, so to say, outstrip their competitors in the struggle for existence, and, becoming supreme, only lactic acid is produced to any extent. Such silage is almost free from volatile acids, and possesses a somewhat sweetish smell and an aromatic sweet flavour. The name "sweet silage" is given to this kind. Misleading, for it contains only about half per cent. of lactic acid.

If the temperature of the heap rises immoderately—over 70 degrees C. = 160 degrees F.—the fodder is burned, and the silage loses its value, either altogether as a food, or the palatability and digestibility is lowered. Should it be observed that the temperature is rising rapidly near to this degree, the pressure should be increased and the activity of the heat-producing germs is consequently diminished. (Water may be poured on in urgent cases.) The temperature is lowered or raised by respectively increasing or lessening the amount of pressure. The temperature should be that most favourable to the lactic acid bacteria if "sweet silage" is desired, lower if "sour." It must be understood that silage cannot be prepared by either of these ways without certain losses occurring, which, to our present knowledge, are inseparable from the process. The increased temperature, the evolution of carbonic acid gas, and the formation of acids, are caused by the decomposition of the carbohydrates in the fodder; so, also, the acid-forming organisms consume a quantity of albuminoids, breaking them up into substances of a low nutritive value. But, although this sacrifice of some constituents appears to be necessary for the preservation of the rest, it should be our endeavour to reduce that loss to its very minimum.

Special instruments are sold for taking the temperature of silos. One of those not being procurable, a piece of piping long enough to reach to the bottom of the silo is stopped up at one end and a spike fixed on. It is driven down through the silage, and a thermometer, registering up to at least 160 degrees F., is lowered down the inside of the tube by means of a string. It is allowed to stand for some time, and then pulled up and read at once.

The following record of an actual experiment will give an idea of the temperatures which may be expected.

DATE.	WEIGHT OF FODDER ADDED.	PRESSURE APPLIED.	TEMPERATURE.
Sept. 1	8 Tons	None	—
2		"	120° F.
3	4 "	"	140°
5		"	150°
6	6½ "	"	160°
8		Slight	160°
11		"	160°
12	12 "	"	160°
14		100lbs persq foot	140°
21		125 " " " "	140°
Oct. 2		125 " " " "	110°

After October 2nd silage gradually fell to ordinary temperatures.

So long as a pressure is kept on the silage will keep. It may be opened when cool or may be left over for years.

STACK SILOS.

It will have been observed by those who have followed us thus far that the whole secret of success in silage-making consists in preventing the entrance of air into the silo. In the pit silo the green stuff, closely packed to the walls and corners, keeps as well as that in the centre of the mass. The initial expense of constructing a pit silo is sometimes considerable. A method of preserving green crops without any excavating or building was in use over twenty years ago in Britain, and in several parts of the Colony it is being practised with success. It is a method which has several advantages, and in our opinion bids fair to be the one which will be most employed in these colonies for a good time to come.

It is termed the Stack Silo system, and consists of simply building the cut forage into the form of an ordinary stack, and by means of ropes, chains and levers, or by dead weights, bringing a pressure to bear on the mass. This stack should be built as near as convenient to the place where the silage is to be fed, and it may sometimes, when occasion arises, be constructed on the field where the crop has grown. The site chosen, however, should be one sheltered in the direction of expected strong winds. It should be fenced or otherwise completely protected from the excursions of stock, else once they find the silage out and obtain a liking for it, it is only with the greatest trouble that they can be persuaded to leave the neighbourhood. It might be as well to mention here, lest it be overlooked by the novice, that a stand should be chosen where there will be no chance of the surface water causing damage. It is nearly always advisable to dig a trench round where it is intended to erect the stack.

There is a rough method of simply laying the first layer of fodder on the ground and adding thereto, trampling the while until a fair height is attained, after which a covering may be put on, and the heap left to look after itself. The chances of anything like success year after year are against such a reckless-course. The surface of the ground should at least be cleaned and levelled down, and some worthless or less valuable material than the crop spread two or three inches deep. The bottom of stack silos generally go bad; by doing as advised loss is prevented. Cutting the sides in, keeping them neat and firm—the shavings may be thrown into the stack—as the building proceeds, is strongly recommended. Fodder chopped into small pieces does not balance in a stack, so that this silo is filled with whole materials.

Mealies and the larger crops stand best. Where high winds are to be expected, this species of silo should not be built very high. The precautions mentioned in dealing with the filling of pit silos are applicable to this system also.

When the stack is completed it should be peak-shaped. Over the stack, at a distance of every three or four feet, is thrown a piece of ordinary plain fencing wire, to each end of which, some distance from the ground, weights are attached. Large stones, bags or tins filled with earth, stones, etc., are used. On the top, above the wires, a thatching of some kind should be made.

Some farmers practise building a forage stack upon the top of the silo stack.

A method which appeals to one on account of its simplicity and efficiency consists of building the stack on lengths of wood 6 feet by 6 ins., sunk into the ground every three or four feet apart along the length of stack, so that both ends project two feet on either side. Then, instead of weighting the wires as previously recommended, one end of a wire is attached to one of the beams, thrown over the stack and the wire tightened through the other projecting end of the same beam, in the same way as is done in tightening a fence. We have seen a Spanish windlass used, but there are many ways of getting the wires tight.

We have seen at Home splendid stuff produced by means of a patent Stack Press. The principle is somewhat the same as in the preceding kind, with this difference, that at both ends of each projecting beam is fixed a ratchet drum through which, by means of levers, the wire ropes, which pass over the stack, are tightened. To prevent those beams from being pulled up into the silage, it is advised that some pieces of wood should be placed across the framework of beams. Those appliances are sold in Britain at a reasonable price, but in so far as our knowledge goes no agency exists as yet in South Africa for their sale. This is a pity, for of all the methods used for the making of stack silage those employing special mechanical appliances are the most easily handled and, therefore, are most likely to give best results.

In using the silage from a stack, one wire or rope should be removed nearest to an end, and the silage cut down as required the full breadth, so that none is left behind which will be without pressure.

The general advantages and disadvantages of stack siloing are :—

The advantages :

- (1) No building is necessary and the framework and contrivances are easily obtainable and inexpensive.

- (2) If properly looked after it is a very efficient and economical method of making silage.
- (3) The stack may be built at any convenient place.
- (4) The pressure can be added or taken off with the least labour.
- (5) They are easily built and are most handy to feed from.

The disadvantages :

- (1) The decay round sides of stack is sometimes considerable.
- (2) There is greater loss in weight by evaporation than there is in built silos.
- (3) Unless well thatched liable to harm from rain.
- (4) Open to vermin attack.
- (5) In heavy gales apt to be blown over.

ABOVE-GROUND BUILT SILOS.

Hitherto we have described methods of making silage which have been practised for many years and at present are to be found in countries not very far advanced in the arts of large and economical production. The methods already given require the outlay of only a small amount of capital for their construction. But the time cannot be very far distant when, the advantages of ensiling having been generally accepted, and the special necessity for it recognised, it will be the desire of the more enlightened and moneyed farmers amongst us to adopt methods of preserving green fodder which, although requiring a considerably larger outlay of capital at first, will in the long run prove much more handy and thrifty. The Americans have led the way in finding out such methods, and from the records of their enterprise in this direction we propose to take a few hints as to the lines which would appear to be best suited for our South African conditions. In doing so it may be mentioned that in Australia, a country to which we all look—and we think rightly—for evidence, where hitherto the pit and stack silo have been in use, several improved silos on the principle which we will now describe have lately been constructed, and are being highly spoken of.

It will be remembered that, when dealing with pit silos, it was said that the depth of the silo was a most important consideration, for the reason that a silo 10 feet deep will hold more than twice as much silage by weight as a silo the same length and breadth only five feet deep, because the weight of the upper layers exerts a very considerable pressure on the lower, thereby consolidating them. Also the lateral pressure is increased, and the mass is pressed firmly against the walls, so that air is totally excluded and there is no spoiling of the sides.

But it is inconvenient and expensive to make very deep excavations into the ground, also, during the process of

emptying the silage, it is not handy to bring it up from such depths.

To build a structure above ground to a convenient height is the natural way out of the difficulty. To-day we find thousands of such buildings in use throughout Canada and the United States, and as we have said they are now being introduced into Australia.

They are generally built of wood, stone, brick or of combinations of these.

One factor, which is apt to be overlooked or underestimated, in the erecting of those silos is the surprising amount of outward pressure which occurs when the silo, especially if it is a high one, is full.

An ordinary built shed or old stable or mill will not as a rule bear conversion into a silo, as the walls are almost certain to bulge out, and either collapse altogether or become worthless for the purpose of an airtight structure. Square or rectangular buildings are much less liable to withstand this strain than circular ones having walls of the same thickness. Circular block-house-like buildings have, therefore, generally superseded those of other shapes. The site to choose is of great importance. In the case of a dairy farm where the cattle are fed in byres, this kind of silo should be as near as possible, in fact, it might with advantage form part of the same building.

As to the size of the silo, depth and diameter, these will naturally depend on the quantity of silage which it is required to make. From the table below and our previous remarks on quantities generally fed per animal, the height and diameter may be reckoned.

A point which here demands attention is this. In the emptying of a silo 20 feet deep, of, say, a diameter of 25 feet to feed 18 cows, one requires 720 lbs. silage per day, allowing 40 lbs. per head. Suppose we are just opening it. We require 40 cubic feet, reckoning 18 lbs. to a cubic foot. It is better to empty by taking off layers horizontally with a fork without making holes here and there. Forty cubic feet equals 69,120 cubic inches; the area of the surface of the silage would in this case be 70,560 sq. inches. That would mean that for the first few days silage would be removed to the depth of approximately one inch, at which rate moulding would very likely set in. So that it would be advisable to decrease the horizontal feeding area by having the inside diameter 23 feet instead

of 25 feet. So arrange it, if practicable, that nearly two inches will be removed from the surface every day after the silo is opened. The following table may prove useful :—

Table showing inside measurements of silo 24 feet deep, assuming 40 lbs. to be fed per cow per day for, say, 180 days, so that silage to the depth of 1 to 3-5 inches is removed per day.

NO. OF COWS.	TONS REQUIRED.	INSIDE DIAMETER.
10	36	10ft. 4in.
20	72	14ft. 7in.
30	108	17ft. 10in.
40	144	20ft. 8in.
50	180	23ft. 1in.

BRICK BUILT SILO.

Although costly buildings, as we have endeavoured to show in previous pages, are by no means necessary for silage making, nevertheless where silage is to be gone in for on a large scale and the process is to become a permanent institution, to our mind the brick built silo recommends itself. (fig. 1.). If good bricks can be made or purchased cheap, an excellent silo can be made at a reasonable cost. The foundation for such a silo may, if the material is procurable, be made of stone. The greatest outward pressure is on the lower walls, so that it is to the substantial construction of this part that we must pay most attention. By allowing the silo to extend down for some feet beneath the ground level, the lower walls or foundations have the support of the soil on the outside. Wherever possible, therefore, the bottom of this sort of silo should be as deep down as possible without causing the operation of emptying the silage to be inconvenient. Six feet is not too much. The underground walls should be two feet thick, and are best made of stone. Boulders and cement is not nearly so good as quarried rock. If only the former are obtainable, however, some method of strengthening, by rods, for instance, must be resorted to. This wall and higher wall have to be thoroughly solid so as to prevent the entrance of air. In some formations it may be found necessary to lay a drain to protect this foundation. Sometimes a concrete wall is found as a foundation. A floor of concrete is recommended. If proposed silo be 24 feet deep, 18 feet will be above ground and this 18 feet wall may be made of brick 14 inches thick ; towards the top less will suffice. The greater the diameter the thicker must be the walls.

Doors, through which to fill and empty silo, should be made in the wall every 5-8 feet apart. If there is no necessity that all the doors should face one way, as is the case when the silo is built adjoining the stables, this source of weakness in the walls is avoided by having the doors on opposite sides of the silo. However arranged it is imperative that they should be well fitted, otherwise air gets in and silage is harmed. Even then, they are a source of weakness, so that it is usual to have the rods imbedded in the wall, anchored at both ends between each door.

The frame for those doors should be of 4 x 8 inch wood, rabbited two inches deep in the inside, against which the door, made of 1 x 6 inch tongued and grooved boards, screwed together with a layer of waterproof or tarred paper between the two, lies. On the outside of this framework

a groove should be made, into which a tongue, projecting, say, two inches all round into the mortar, is fixed.

To make the door perfectly air-tight, it is well to put something, either a strip of rubber or some puddled clay will answer well, between the door and the jamb. The doors open inwards and are removed one after another as the operation of emptying proceeds downwards. Strong screws or, better, quarter-inch bolts, are used for drawing doors tight against jambs. If the framework of the doors is flush with the sides of the silo, then they (the doors) being straight, their centres will be an inch or two inside. This disadvantage cannot very well be avoided. So that as little resistance as possible will be offered to the sinking silage, the crevice should be filled with cement, with a gentle slope up and down to the wall. The roof may take the form of a cone. Less material is required for this shape, but, perhaps, more skill is required for its construction than with the method shown in figure I. The roof has a built-out framework for the last filling and first feeding door. The inside should now be plastered with a coat of good cement and sand (1 to 2), and trowelled as smooth as possible. Whitewashing annually will be found to protect the plaster from the dissolvent action of the silage. At the apex of the cone, or in the centre of the roof, some arrangement for ventilation, either simply by a pipe, protected from rain, or by square cupola, fitted with loose boards, will have to be provided. As regards the filling of this kind of silo our remarks contained on page 17 will apply. The filling, however, from its height above ground, in this case is not so simply performed as is the case with the sunk or pit silo. If the fodder is being cut by steam or horse-power, it will be easy to work an elevator to the top door. The elevator should be so made that fodder is deposited into the middle of the silo. From there it can be easily distributed evenly to all points, trampled down and well packed at the sides.

Should the crop for any reason have been left till it has lost some of its succulency, it is well to add some water to it in the silo. Where silage is fed all the year round the top layers are sometimes removed again for feeding with as soon as the last lot has been added, and thus without the use of weights of any kind, the loss of the top exposed materials is saved. If the feeding is not to commence immediately, however, it is better to pack well, and then cover with some worthless matter or straw.

Of course, where good building stone is plentiful, a silo may be made of that, and it would undoubtedly prove, if intelligently built, stronger than a brick one. The plans would be practically the same as those given for the brick-built silo already described. Hooped wooden silos have also been much used. They go by the name of "Stave Silos."

We do not think, however, that they as yet recommend themselves to our South African conditions, where, as a rule, either brick or stone is the more ready at hand.

WARNING.—Some days after filling there is likely to accumulate above the silage a gas called carbonic acid gas, to breathe which causes suffocation. Care should therefore be taken that no one should descend into the silo to spread or trample the arriving fodder till the air-currents have been set agoing for some time by the opening of the doors and the falling in of the green stuff.

FEEDING OF SILAGE.

The value of food is determined by two factors. They are composition and digestibility. By composition is meant amounts of what might be described as flesh-forming, heat and force producing, and bone-forming ingredients present in the food. They are termed by the chemist albuminoids, fats, carbohydrates and fibre and ash respectively. All foods also contain a greater or less amount of water in their composition. Some foods are known to contain more flesh-forming material than others, as the analysis of oats and wheat straw when compared will show :—

	Water.	Albumi- noids.	Fats.	Sol. Carbo- hydrates.	Ash
OATS	13	10·4	5·4	57·3	3
WHEAT STRAW	13·6	3·0	1·3	39·4	5·3

It is seen that oats contain over three times the quantity of the flesh-forming constituent (albuminoids) that wheat straw does. Also in heat and force producing ingredients they contain about half as much again as wheat straw.

But in various foods those various ingredients are present in somewhat different forms, so that in passing through the digestive tract they are not all equally digested. Again, a ruminant, such as a cow, may digest and assimilate more of an ingredient than would, for instance, a horse.

Table showing amounts digested per 100 lbs. of each constituent in oats supplied.

	Albuminoids.	Fats.	Soluble Carbohydrates.
HORSE	86	71	74
COW	78	83	77

Knowing both the composition (from analysis) and the degree of digestibility (from the results of experiments), we can compare the feeding value of most foods.

	Water.	Albumi- noids.	Fats.	Sol. Carbo- hydrates.	Fibre.	Ash.
MEALIE SILAGE	79·1	1·7	·8	11	6	1·4
RED CLOVER SILAGE ...	72·0	4·2	1·2	11·6	8·4	2·6

Let us compare this with green mealies and red clover :—

	Water.	Albumi- noids.	Fats.	Sol. Carbo- hydrates.	Fibre.	Ash.
GREEN MEALIES	79·3	1·8	·5	12·2	·5	1·2
RED CLOVER	70·8	4·4	1·1	13·5	8·1	2·1

It will be observed that the little loss which occurs during the conversion into silage falls chiefly and almost entirely upon the carbohydrates. As far as digestibility goes, it appears that there is a slight falling off in the amount of albuminoid matter and soluble carbohydrates digested when green mealies are converted into silage ; on the other hand mealies made into silage are more digestible than if they were converted into dry forage.

DAIRY CATTLE.—The chief use of silage is for the feeding of dairy cattle. They, at first, often do not take readily to silage, but in a few days they become very fond of it. The best way to commence feeding is to give small quantities. If large quantities be given at once there is a probability that the milk may suffer a little in flavour, and, again, if the cattle have been having a dry feed for some time previously there is a chance that excessive purging may ensue.

It must be remembered that silage is not altogether adapted for feeding alone, but forms a most valuable addition in a ration of dry or concentrated foods.

As milk which lies in close proximity to loose silage is apt to absorb the peculiar flavour, it is well to guard against any carelessness in this direction. This may be done by feeding the silage after milking is over and all the milk has been taken away. After handling silage the person should wash thoroughly before milking or otherwise working with the milk. A disregard for these rules has often gained for silage-feeding a bad name, for it has been thought by some that it was the feed which was having the effect within the cow of tainting the milk.

The milk flow is increased when ensilage takes the place of dry forage, and the animal is kept in better condition. The milk may, however, be slightly poorer in fats, that is, if an equal weight of silage takes the place of an equal weight of dry stuff. But if we reckon on a more practical basis and compare the quantity of milk and butter fat produced by feeding the produce of equal areas of green meadows, one converted into silage and the other made into dry forage, we find that there is an increase of 8 per cent. in the quantity of milk and of 3 per cent. in the quantity of butter fat produced per acre.

Of course the main advantages of ensilage are that it supplies a cheap, palatable, digestible, succulent food for cattle all the year round, by the use of which, without increasing the number of the herd, without calling in the aid of expensive artificials, the daily supply of milk can be kept up during the dry or dormant season.

The quantities which may be used depend on the nature of the other food the cattle are receiving. If silage be the only succulent food, up to 40 or 50 lbs. may be given per day with advantage. Silage is often fed combined with lucerne or oat hay, corn, or the concentrated food stuffs.

Silage also compares very favourably with other foods in the fattening of stock. It has been proved in one instance by experiment that animals can be fattened as well on silage as on roots.

Silage should prove a very effective means of bringing stabled animals up to good show condition.

It must be remembered, in considering what foods are suited for horses and which are not, that their digestive

organs differ essentially from those of the cow. The horse cannot digest the bulky and rougher foods which a cow is adapted for doing. He requires at work a more concentrated ration, therefore silage does not take a prominent place amongst horse foods. We have heard it stated that in more than one instance in this country even fatal results have followed the feeding of silage to horses. That good, sweet silage, fed in limited quantities, along with other foods, produces no ill effects, has been proved conclusively by the continued health of hundreds of working teams. We would, therefore, in those unfortunate instances referred to, choose to blame either the quality of the silage, the too sudden change from a harder feed, or to the fault of the manager in allowing too large quantities per diem. However, it must be said that unless sufficient care is to be exercised in using silage to horses it had, perhaps, better be left out of their reach altogether. On the other hand, if small quantities are begun with and the horse gradually accustomed to not more than, say, ten pounds per diem, replacing a quantity of the hay usually given, and with some concentrated food in addition, no harm need ensue; on the contrary, it will be found a satisfactory and economical feed. It is even claimed that it is an excellent appetizer and has a beneficial effect on the coat.

We have heard of some local instances of mules dying after eating silage, but we have no doubt if our previous hints as to the cause of alleged similar fatalities with horses had been made the lines of an inquiry, bad management would have been found to have been the cause.

The same precautions appear therefore to be necessary in feeding silage to mules.

Silage from the leguminous crops, such as lucerne and clover, with a narrower nutritive ratio, is better adapted to horses than mealie grass silage with a ratio of 1:11 or 1:12.

A horse standing in stable may be allowed most and a horse at hard work least.

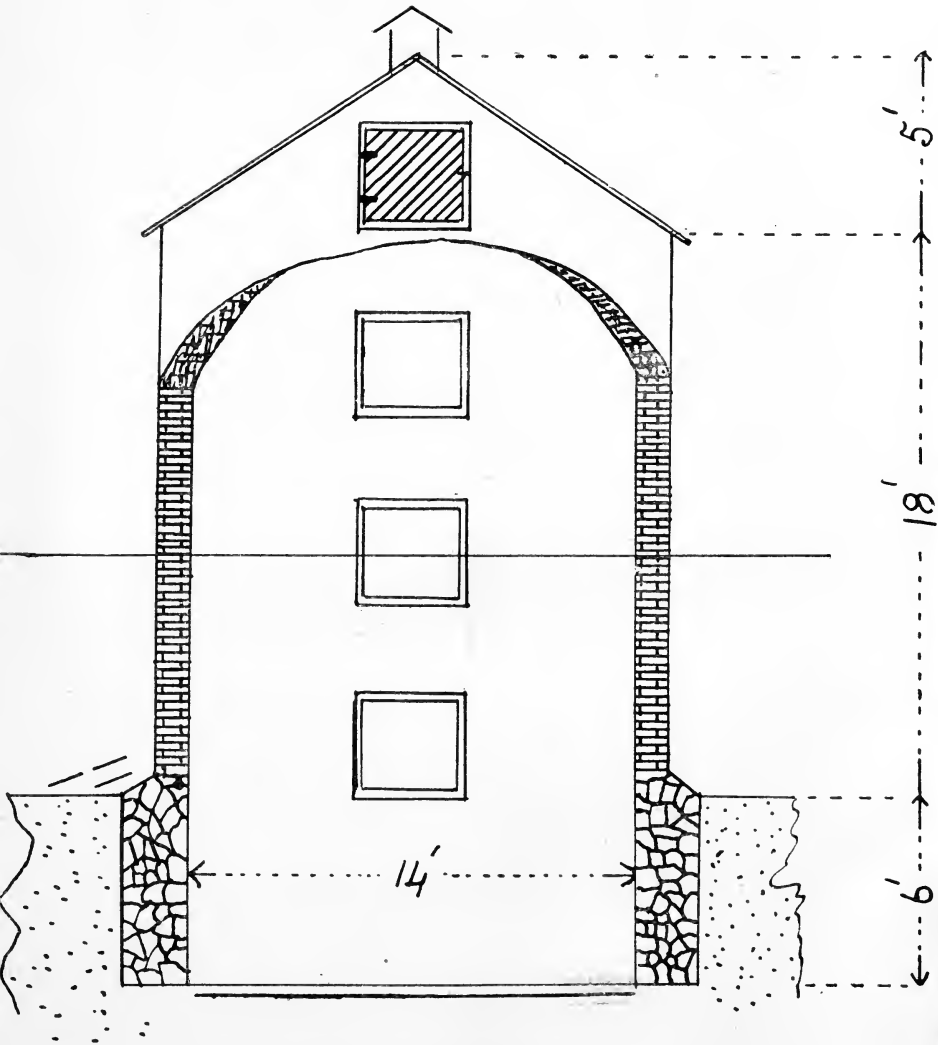
Sheep like ensilage, and very satisfactory results have been obtained from feeding them on it. In a season of drought it should prove invaluable, and from the fact that it is a cheaper food to produce than roots, we have no doubt but that it will soon be the general custom to have a silo wherever sheep are kept.

Ostriches and poultry profit from a picking of this succulent food when green stuff is scarce.

We have now dealt shortly with the principles on which the making of silage rests, the construction of silos and the general results to be expected from a use of the system; and when our stock farmers realise that for the more successful prosecution of their calling they must make every provision for emergencies, we think they will find in the system recommended in this treatise, a very practical way of setting at defiance their most persistent enemy—drought.



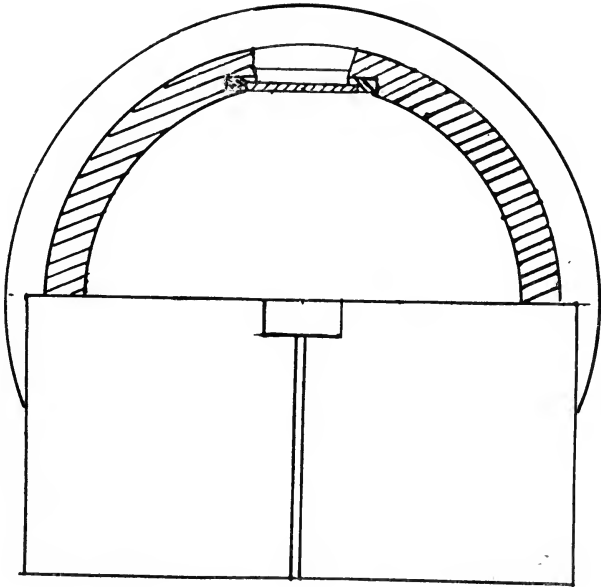
CONSTRUCTION OF A



Sectional Elevation.

BRICK-BUILT SILO.

Scale 1/6 in. to a foot.



Half Sectional Plan on A B.

M322228

