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JOURNAL OF THE

# IRISH GRASSLAND ASSOCIATION

(Animal Production Society)

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# contents




*Our sincere thanks are due to the contributors of articles in this book, and to the Irish Farmers' Journal for use of photographs from its files.*

Results of experiences and trials of the technique of silage making and fodder conservation in the Federal Republic of Germany with outlooks on the conditions in the Republic of Ireland.

# PRINCIPLES OF FODDER CONSERVATION

by Professor Dr. Alfred Könekamp
Institute of Grassland Husbandry
Fodder Production and Fodder Conservation
Braunschweig—Völkenrode.

## THE GENERAL ECONOMICAL BASIS OF FODDER CONSERVATION IN WEST GERMANY

In the **Federal Republic of Germany,** i.e. the area west of the "Iron Curtain" in Northern and Western Germany, we find mostly family farms without hired labour with a comparatively heavy stock. The proportion of unalterable permanent grassland is about 40% of the agricultural area, varying from 30—100%.

Under the given climatic conditions the stockkeeper has to provide for **winterfood** as a rule for half a year, for young cattle for 150 days, for dairy cows 180-200 days.

For a rationable stockkeeping therefore the following considerations have to be made:

1. In which **form** shall we offer the conserved food to the animals ?
2. How can we obtain the best qualities of same ?
3. By which methods of food conservations can we have the lowest cost of production ?

### Cost of starch unit

Regarding the last and perhaps important question we can prove by numerous investigations and calculations that we can count in the average with the following **costs of production:**

| | Cost of 1 KStE (2.2 lbs. St. Eq.) | |
|---|---|---|
| Method of food-stuff | Cents of German Mark | Pence |
| Grazing | 16—22 | $3\frac{1}{4}$—$4\frac{1}{2}$ |
| Silage | 21—27 | $4\frac{1}{4}$—$5\frac{1}{2}$ |
| Hay | 34—44 | $6\frac{3}{4}$—$8\frac{3}{4}$ |
| Bought concentrates | 50—60 | 10—12 |

The average value for farm-produced food can be calculated at a cost of 5½—6 Pence corresponding to an output of 3500—5500 lb. of Starch Eq./ac.

Using these figures we have to take into consideration the influence of the **output of area** and **fodder-quality** within the different methods of utilization and conservation. These connections result from the following table 1 and **diagram Nr. 1** shown below. The "losses of conservation" mentioned hereby form the most important criterium for the quality of a certain silage.

Table 1

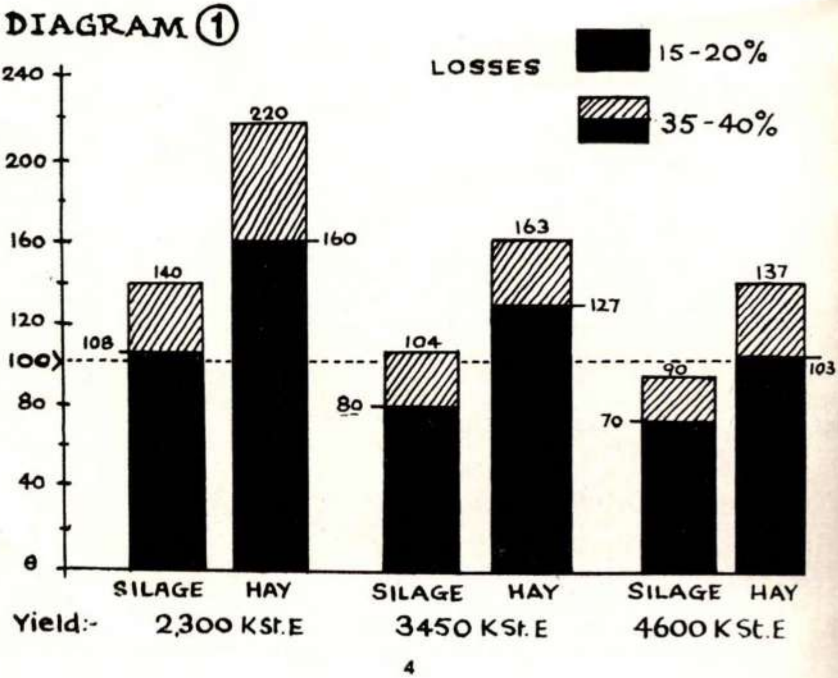
**Cost of production for 1 KStE in grass silage and hay in connection with output of area and losses of conservation**

Relative: 0,30 DM (6 d)/KStE/100.

**Relative costs of production in connection with area-output**

| | 2300 lb. StE/ac. | 3450 lb. StE/ac. | 4600 lb. StE/ac |
|---|---|---|---|
| **Silage** | | | |
| loss 15—20% ......... | 108 | 80 | 70 |
| ,, 35—40% ......... | 140 | 104 | 90 |
| **Hay** | | | |
| loss 15—20% ......... | 163 | 127 | 103 |
| loss 35—40% ......... | 220 | 163 | 137 |

DIAGRAM ①



The **tendency** resulting thereupon for the practical farmer is clearly to be made out:

| | | |
|---|---|---|
| Rising output per acre | — | Falling costs |
| Less losses | — | Falling costs |
| Less hay and more silage | — | Falling costs |

**The harvesting methods influence the feeding value.**

The degree to which the different methods of harvesting, e.g. in **hay making,** influence the **digestability** and the **nutrition value** of food is shown by the latest trials of digestibility with sheep by K. Richter and H. J. Oslage (2) compiled in **Table 2:**

Table 2

(after K. Richter and H. J. Oslage)

| | Method of hay making: | | |
|---|---|---|---|
| | on the ground | Swedish fence | Hot air ventilation |
| **Digestibility** | % | % | % |
| Organic matter... | 56.1 | 62.9 | 66.3 |
| Crude protein ... | 58.9 | 66.1 | 74.0 |
| Fibre ............... | 60.9 | 63.2 | 60.9 |
| Crude Fat ...... | 27,7 | 61.9 | 55.8 |
| N-free extractives | 53.0 | 62.9 | 67.3 |
| **Nutrition value** | g | g | g |
| 1 kg contains: | | | |
| Dry matter ...... | 856 | 878 | 884 |
| Digestible protein | 67 (100) | 74 (110) | 92 (137) |
| Starch equivalents | 282 (100) | 371 (132) | 405 (144) |

This is the first time, as far as I know, that the economical advantage of better methods of hay conservation has been proved by exact digestive experiments on the animal. First of all a higher yield in harvesting is gained by using racks for hay drying and better still by aeration and ventilation of wilted grass in the barn since the losses by crumbling away of leaves and stalks are avoided. Moreover such hay being dried carefully has a higher digestibility by higher concentration of nutrients in the fodder unit. It is due to these facts and the lesser weather risk joint to them—which always means a diminution of labour —that the cost of production decreases. We will see further below that similar tendencies are found in silage making.

**The content of nutrients determines the output of milk.**

The importance of **better qualities of farm produced fodder** for the practical keeping of stock and the rent of animal husbandry altogether is shown in simple figures in Table 3 and the respective **diagram Nr. 2:**

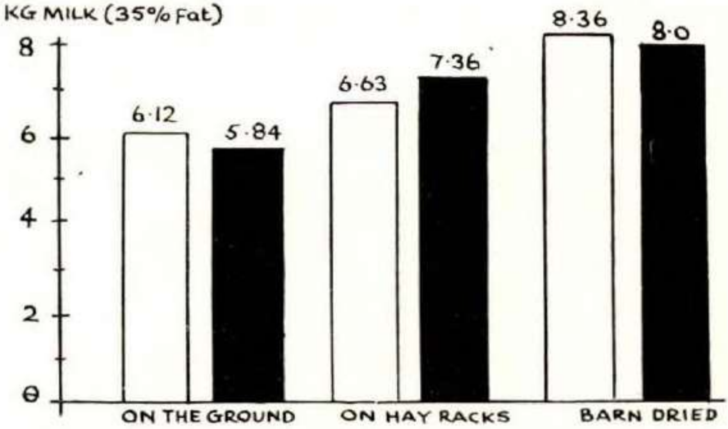



DIAGRAM ②

Table 3
5 lbs. of hay from a good ley contains nutrients for ...... lbs. of milk (3.5% Fat)

| Method of Hay Making | in digestible protein | in starch units |
|---|---|---|
| dried on the ground ...... | 6.12 | 5.34 |
| dried on racks ........... | 6.63 | 7.36 |
| dried in the barn by air | 8.36 | 8.00 |

I want to point out that the hay of the best method (Barn drying) is at the same time the best equalized in protein and starch units.

### Rough figures of the losses according to type of silo

In **making silage** very similar connections can be shown as regards the different methods, their losses and the quality obtainable, i.e. the units of valency.

The **losses of crude protein and starch units** occurring during the process of conservation can be classified on the base of balanced investigations and experiences under practical conditions on the whole as follows:

| | |
|---|---|
| **Improvised methods** .......................... (Trench silo without concrete walls, Dutch free stack) | 35—40% |
| **Concrete trench silos** (More than 125 c.yds.) .......................... (Carefully stored and covered) | 25—40% |
| **Silos of medium height** .......................... (Carefully pressed and covered) | 20—30% |
| **Tower silos** .......................... (according to dry matter content) | 15—25% |

### How much is left of fresh grass for the animal ?

To give a more plastic picture I propose to put the question as follows: What will remain of the most important nutritive values of fresh grass grown on an acre of grassland after being processed for conservation? I take as base a yield of 8 tons of paddock grass (incl. a proportion of 10% of clovers and 5% of good herbs), cut before shooting to ear. This amount of grass will contain in the average 620 lbs. digestible crude protein and 2,400 lbs. of StE, being yield, as said before, of one acre.

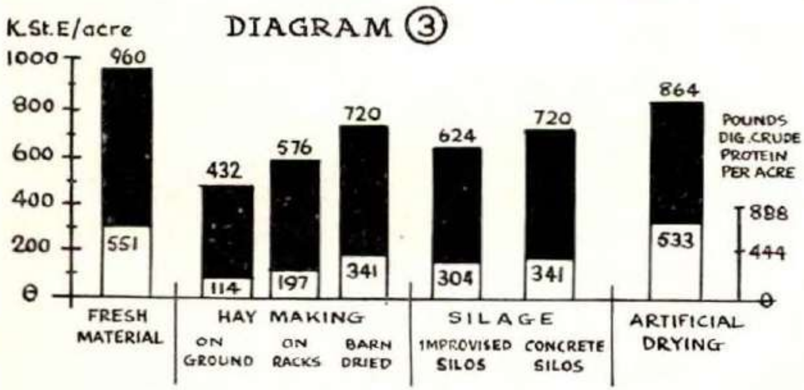
See Table 4 and **diagram Nr. 3** for the figures:

Table 4

**Yields of digestible crude protein and starch units/ac permanent grassland**

(Base: 8 t/ac of grass before shooting)
8 tons grass contain:
(a) immediately after cutting
(b) after conservation

| | digestible crude protein | StE |
|---|---|---|
| a) **after cutting** ...... | 620 | 2,400 |
| b) **after conservation** | | |
| **Hay making** | | |
| on the ground ... | 128 | 1,080 |
| on racks ........... | 222 | 1,440 |
| hot air barn drying .............. | 384 | 1,800 |
| **Silage** | | |
| improvised methods ... | 342 | 1,560 |
| in concrete silos... | 384 | 1,800 |
| **Artificial drying** | 588 | 2,160 |



### The price of labour increases continually !

At a period where especially in German Agriculture (free part of Germany) numerous farm hands migrate over to the industry the problem of **cost of labour** for the different method of conservation is of decisive importance.

This question was investigated by E. Zimmer in a special study on the utilization of the different shapes of containers envisaged from the point of view of labour cost (3). See the following **Table 5:**

Table 5

**Space of time needed for silage making using different types of silos and different intensity of mechanisation**

Need of time for 1 ton of silage expressed in number of labour/minutes

(Research work at the Agricultural Centre of Völkenrode and the Max-Planck-Institute-Kreuznach, 1957-1960)

| Types of silos Kind of fodder | Use of manual work Grade of mechanising Kind of covering . . . when | | | Labour/ min. per ton silage | Relative |
|---|---|---|---|---|---|
| | Loading | Covering | Unloading | | |
| **Medium height** & moveable rim | Hand | Soil | Hand | 95 | 100 |
| **Tower silo** | Chopper | Immersion -lid | Hand | 68 | 72 |
| | Chopper | Immersion -lid | Grab | 40 | 42 |
| | Grab | Immersion -lid | Grab | 40 | 42 |
| **Flat—and Trench silo** | | | | | |
| Wilted silage | Hand | Foil | Hand | 67 | 71 |
| | Hand | Foil | Front-loader | 47 | 50 |
| Sugarbeet-tops | Hand | Foil | Hand | 41 | 43 |
| | Hand | Foil | Front-loader | 27 | 28 |
| | Elevator-loader | | Grab | 22 | 23 |

I restricted myself on the values which can be calculated and measured during silage work proper, loading and unloading and feeding. The expenditure for cutting, processing on the field and transport to the silo may be neglected since they are about the same with all the methods mentioned.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II.

## Weather conditions for farming in West Germany

To give the Irish silo experts and farmers a better understanding for the climatic conditions under which we have to work in the Federal Republic, which are the fundamental bases of our knowledge and which are the principles of our advisory work to practical farmers, I would like to give some special evidence. For only thus will my audience and the reader of this paper be able to modify my statements according to Irish conditions and to judge them.

To begin with follows now Table 6 with the most important climatic facts, which are furthermore represented on the diagram **Nr. 4.** The knowledge of these conditions is especially important for the problems of fodder conservation.

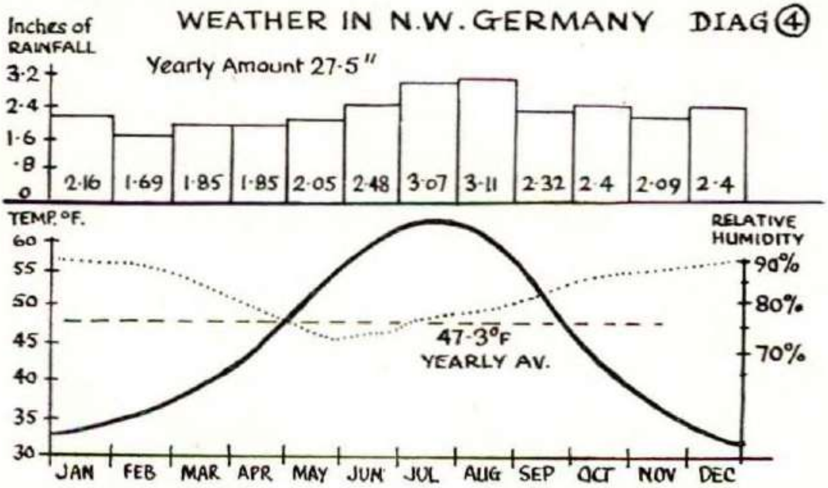
Table 6

### Weather in North-West Germany

(Average values of the districts of Oldenburg, Bremen, Emden, Quakenbrück)

| Month | **Rainfall** Sum of the month Inches | Relative moisture of air monthly average % | Average daily temperature in month Fahrenheit |
|---|---|---|---|
| January | 2.16 | **89** | 33.4 |
| February | 1.69 | **88** | 34.7 |
| March | 1.85 | 82 | 38.6 |
| April | 1.85 | 77 | 45.0 |
| May | 2.05 | 74 | 53.8 |
| June | **2.48** | 75 | **59.0** |
| July | **3.07** | 78 | **62.2** |
| August | **3.11** | 80 | **60.8** |
| September | 2.32 | **82** | **55.9** |
| October | 2.40 | 87 | 48.1 |
| November | 2.09 | **88** | 40.1 |
| December | 2.40 | **90** | 35.4 |
| | 27.47 | | |

The highest rainfall is therefore in the months of June, July and August, during which the biggest part of grass harvesting takes place. Those three months have accordingly the highest daily temperatures. The relative air moisture is then also the lowest, but we realize typical maritime climate zones. On the whole the conditions for hay making in the old style, i.e. on the ground are not favourable. And this we have to take in account in our plans and research work.




**Lactic acid bacteria are favourized by anaerobic conditions and sugars**

In the following I quote some of the results I presented already at the 8th International Grassland Congress 1960 at Reading (England) as far as they belong to our subject 4.

The fundaments of the **fermentation techniques** for silage making are generally known. It has to be our aim from the start to prevent quickly the **respiration of the cells**, to avoid the **decomposition of protein** and to restrict the further retrenchment of carbohydrates. This is brought about by all measures leading to a rapid formation of acidity, therefore lowering the pH-value. We found as optimum limit values for wet and humid silages a pH of 3.5—4.2, for wilted silages with high dry matter content a pH of 4.5—4.8.

In practical farming there are first of all 2 measures leading to a quick lowering of the pH and to a vigorous formation of lactic acid:

1) Easily soluble sugar-stuffs have to be provided as food for the bacteria, at least 2% sugar.
2) It is essential to create anaerobic conditions in the fodder stack.

The lactic acid bacteria secure a sparing conservation, i.e. there are only little losses of nutrients and other important stuffs. The fodder becomes palatible and the conserve remains stable.

**The time of cutting has decisive influence**

The process of ensiling includes to some extent the previous cultural measures and starts already at cutting the grass. The

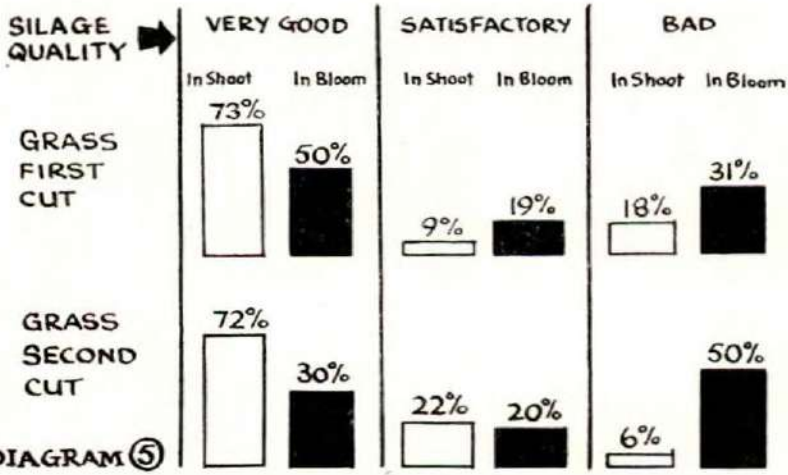


DIAGRAM 5

cut at the **right** time has great influence. We can see that clearly by investigations carried through to a great extent in practice.

In Table 7 and **Diagram Nr. 5** it is shown which influence has the harvesting in the state of shooting and flowering of the grass on the quality of silage.

Table 7

**Influence of time of cutting on silage quality**

| Time of cutting | (Proportion of the various grades i %) Percentage of silage on the grades | | |
|---|---|---|---|
| | Very good 61—100 Flieg points | Satisfactory 41—60 Flieg points | Bad less than 40 Flieg points |
| **1. cut** | | | |
| Shooting | 73 | 9 | 18 |
| Flowering | 50 | 19 | 31 |
| **2. cut** | | | |
| Shooting | 72 | 22 | 6 |
| Flowering | 30 | 20 | 50 |

We can clearly see the tendency: we have the biggest chance to get a highly valuable silage if we succeed to cut before the state of shooting of the grasses is passed.

### The fermentability depends on the sugar-content

The **faculty of fermentation** of plants depends to a high degree on their content of fermentable sugar. The species of fodder plants and naturally also their selected seeds differ very much in this regard.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I want to mention just shortly that even the hour of the day at which the cutting is executed has a clear influence on the fermentability of the green crop. Length and intensity of insolation influence the content of assimiliates. Silage cut in the afternoon contains frequently 15—20% more fermentable sugar than grass cut in the morning.

The Swedish scientists **Kivimäe** and **Wylam** have fixed the sugar content for 3 important fodder plants on the following average:

Red clover (Trifolium pratense) 2.2% in fresh matter
Timothy (Phleum pratense) 4.2% in fresh matter
Corn for silage (Zea mais) 5.6% in fresh matter

This corresponds also with our practical experiences in silage making. The rising sugar content improves also the fermentability.

The same investigators have also worked out the connections between the state of development at the moment of cutting and the sugar content and had the following results:

**Content of fermentable sugar (%) in fresh matter**

after Kivimäe and Wylam

| | | | | | |
|---|---|---|---|---|---|
| a) | Before budding | Begin budd | Full buds | Begin flower | Full flower |
| b) | Before shoot | Begin shoot | Shooting | Full shot | Begin flower |
| a) Red clover | 1.74 | 1.98 | 2.21 | 2.46 | 2.71 |
| b) Timothy | 3.9 | 4.02 | 4.12 | 4.34 | 5.12 |

## All factors have to be in the optimum

As we know by experience it is much easier to ensile Timothy grass than red clover. And this depends not only on the different content of protein, as we see now, but at the same time on the sugar content. We can see that the latter increases in the progress of development resp. of ripening and culminates in the case of red clover in full bloom and in that of Timothy in the beginning of flowering. But this fact again should not induce us to choose the time for cutting **only** from this point of view. Doing so other valuable qualities of the plants like content of protein and fibre and digestability would be injured. As in all biological proceedings the point is rather to catch the **optimum** of **all** valuable qualities. Besides I believe that a sugar content of about 2% onward will satisfy the demands of fermentation with regard to lactic acid and stabilisation of the food.

In choosing the best moment of cutting other factors play an important part. So amongst others the physical nature of the silage. Unwieldy fodder getting too old contains in the stalks many spaces and impedes us in our struggle to **densify the stack.**

The practical farmer should therefore never miss the right moment of cutting! This has come when the clovers are in full buddings and the grasses in shoot. This will agree well with the previous results of our experiments as regards the sugar content. The evaluation of numerous series of investigation on grass silage gives us determined proves.

### The dry matter content acts on the quality

In causative connection with the sugar content of silage is also the content of **dry matter.** The higher the dry matter when ensiling the more concentrated is the natural solution of sugar. Our aim is therefore to reduce the water in the green fodder before filling in by prewilting vigorously. The optimum would be to reach a dry matter content on the field of 30—35% but this measure will only answer to the purpose if we succeed to reach this state in **not more than 48 hours** by mechanical methods like tedding, turning, eventually also by crushing.

It is astonishing indeed that these favourable reciprocal effects between dry matter, sugar content and fermentability have been discovered only in recent years.

Again I will show you in Table 8 and diagram 6 some practical results compiled out of many investigations of the last years.

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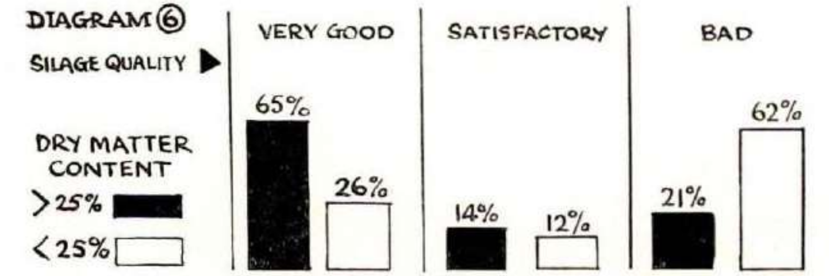
Table 8

**Influence of the dry matter content on silage quality**

(Proportion of the various grades in %)

| Dry matter content | Percentage of silages in the grades: Very good 61—100 Flieg points | satisfying 41—60 Flieg points | Bad less than 40 Flieg points |
|---|---|---|---|
| >25% | 65 | 14 | 21 |
| >25% | 26 | 12 | 62 |




In this diagram divergence of percentage of the 3 grades in 2 groups with higher or lower dry matter content appears more clearly still.

## What can we do in case of bad weather ?

But what will happen **when weather conditions do not allow prewilting,** e.g. in the case of a permanent, obstinate "Scotch mist" what can the practical farmer do then ? Suchlike situations are frequent in the grassland areas of the Federal Republic, especially in the rainy hill areas with normally 23-28 inches of yearly precipitation. Unfavourable weather conditions will injure—and I have to stress this—in the first line the farms which are not yet or not sufficiently mechanised, whereas a farm manager with a technical good outfit will in most cases succeed in prewilting sufficiently by making use of transitory fine weather periods.

## Also from humid forage we can obtain good silages

The harvesting of forage ripe for ensilage must not be delayed in any way, it is essential to level the "grass hill" existing in the intensive grazing farms in May and June somehow, but in proper time. The silage maker is therefore forced to employ appropriate evading methods which enable him to get a good silage even from wet material with a dry matter content of less than 25%. In such situations we have to take refuge in

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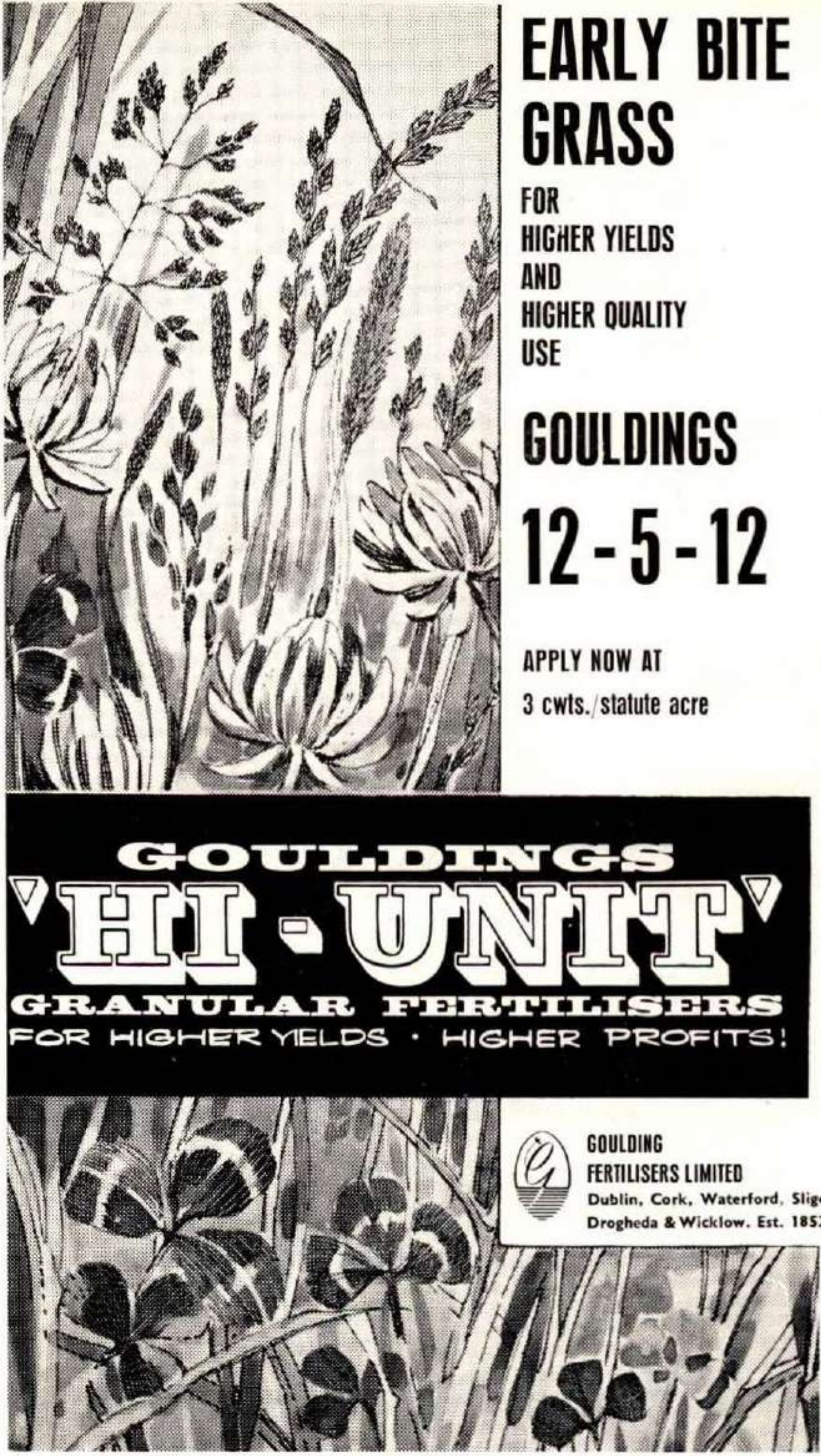
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additives. For this purpose we made investigations on the utility of different additives and their effect. Without going into details we compare the results of a series of practical cases. They are meant to inform the farming community on reliable figures.

In Table 9 and **diagram Nr. 7** three big groups are presented: without additives, chemical additives and molasses.

Table 9

**Effect of molasses and chemical additives on the quality of grass silages**

(Percentages of the different grades)

| | very good | satisfactory | bad |
|---|---|---|---|
| Flieg points | 100—61 | 60—41 | 40—60 |
| Without additives ............ | 21 | 19 | 60 |
| Chemical additives ......... | 38 | 15 | 47 |
| Molasses ....................... | 76 | 10 | 14 |

### Molasses are the best additive

If we compare the 2 extreme grades "very good" and "bad" we can easily see which effect we can expect from the right employment of the additives.

The best success will come from the **molasses** with an addition of 4% of the green stuff. We can again see the favourable effect of the sugar on the fermentation.

This is especially gratifying for animal nutrition as we have here a **healthy natural product** and the cost for this additive decreases by the fact that we find again about 50% of the sugar content of the molasses as nutrient in the fodder ration.

### Only mineral acids can help in the case of wet fodder

In very unfavourable cases, when the forage is very wet (dry matter content of less than 18—20%), but has to be brought

in anyhow by reasons of farm management, or if the material is soiled and infested by bacteria of putrefication or if the grass shows already the beginning of butyric acid formation by laying a longer period in swath on the field, even the molasses can not help any more. In such a situation the farmer has to take on more massive methods and to add solutions of **mineral acids.** Doing so we can without any fear employ the recipes of **A. I. Virtanen**—Helsinki. The Finns have proved on a great scale that it is possible to get valuable grass—clover silages by the AIV method even under their generally unfavourable conditions.

The principle of this method should be to make the shocks of acids vigorous enough to lower the pH-value down to 3.5. The calculation of the equivalents of acidity is based on the prescriptions of A. J. Virtanen. We could take them over in the whole unchanged and recommend our farmers after a special study trip to Finland to work accordingly. (5) But we employ in the Federal Republic also solutions of formic acid. A handy means is Amasil—salt which has about the same effect.

### If the silage is free of butyric acid we will also have good silo-milk

When feeding silages treated with dissoluted mineral acids we have to take certain precautions against acidoses. This is effectuated by restricting the ration of silage on about 66 pounds per cow and day and adding 5-6 lbs. of good hay. We state therefore that under German conditions this method may be employed only in certain cases of exception. We believe that the AIV-method will be justified in areas of hard-cheese production where silage feeding is forbidden up to now because it is possible to obtain with security grass-silages free of butyric acid even under disfavourable conditions.

### The practical farmer needs simple prescriptions

Our **prescriptions** for the use of the different methods are in brief the following:

**(1) Normal case**

Cut, if possible, in the afternoon because of the higher sugar-content. Thereby higher concentration of the cell-sap and augmentation of the sugar-content by 50-100%. Duration of prewilting 1-2 days. The losses by prewilting are at the average 2-4% of dry matter.

(2) If prewilting is impossible (dry matter remains under 25%), use **additives with sugar.**

Suchlike **humid silages receive:**

0.5—1% of feeding sugar or
0.8—1.5% of dried sugarbeet pulp (fully valued) or
2.0—4.0% of molasses or
3.0—5.0% of molasses-pulp.

The same treatment is applied to all forage plants originally hard to ferment like lucerne, vetches, beans, pure clover,

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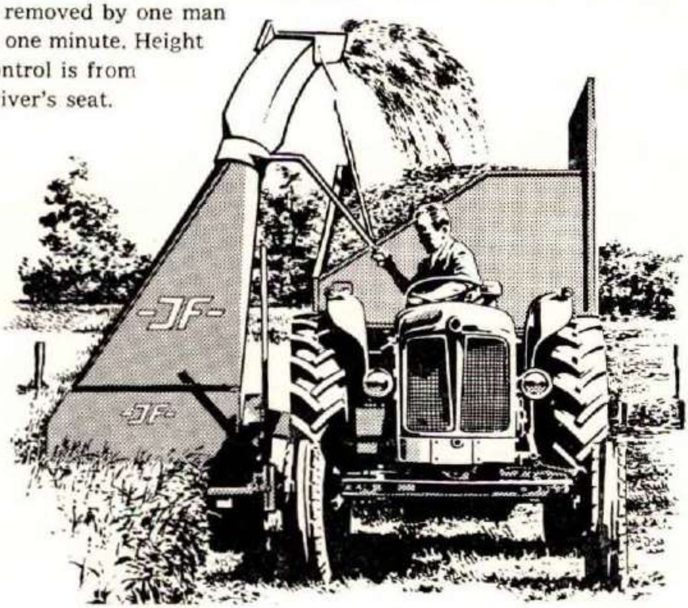


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etc., the natural sugar content of which is under 1.5%. As regards the cost of feeding sugar one can count pratically with the reappearance of the sugar nutrients in the lactic acid of about 50%.

In Germany groats of corn or cereals are not used as additives by economical reasons.

(3) In the case of fully **wet silages,** rain stricken forage, grass from sewage fields or of soiled material we have to use **mineral acids.** We recommend to keep mineral acids or salts in stock for these exceptions.

With one of these 3 variances the farmer will always be successful.

### The "best type of silo" can only be determined from the farm organization

"Which is the best silo?", this question is asked again and again by the practical farmer emphatically! But science can only make fundamental statements:

(a) A silo has to be **gastight.**
(b) It must allow a **high density** of the fodder stack or by spontaneous pressure or by mechanical pressing, and
(c) It should have an arrangement to **drain off the effluents** impeding the access of air from outside.

All types of silos fulfilling this demand really can pass as the "best" from the point of view of fermentation.

I am not dogmatical in this regard, but feel obliged to inform the silo-farmer where one type of silo fits in and the other not. On the condition of an unobjectionable structure this question has to be decided according **to the economical structure of each farm separately.**

The second question is then—I always have German conditions in view—how far is the farm **mechanised and which is the technical outfit.** We have also to take into account if the pen-barn system and self-feeding can be recommended.

Anyhow a deliberate **planning of the whole fodder-chain** from the stem to the crib is to be made of which the silo is the most important link.

### The plan of work is to be carried out with sequence.

Only thus it is possible for the advisor to give **general directions** for the correct way to choose. The points have to be shifted properly, but then the course once started has to be continued consequently:

(a) For **small holdings** of 25-35 acres generally only the "long-fodder chain" is applicable. Needed for that is a "Loader" operated by a tractor of about 25 h.p. In this case we need also a chopper-blower if we have to fill a tower silo or an arrangement to unload if the unchopped forage is discharged into a trenchsilo. Also a tractor rolling down the forage in the trench should be at disposal, but this will be possible in a small holding only by neighbourly help.

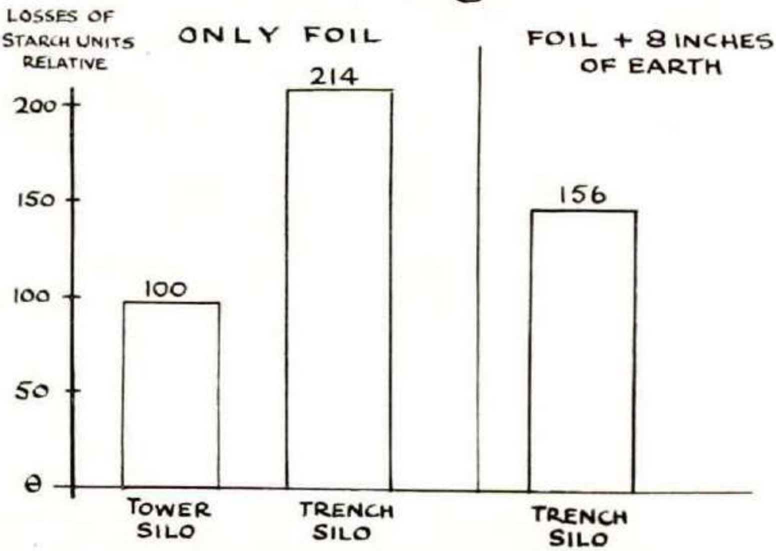
(b) For **bigger farms** above 75-125 acres the " chopping-chain " with **chopper-blower** is adequate which guarantees an exact short chopping of 0.8 inch. The charge of the silo can then be executed either by the **hay grab** or by the **pneumatic conveyor.** Using the latter we need also a **special trailer for chopped forage** unloading continually **to the forepart** over a transversal conveyor.

**General directions for West-German grassland farms.**

For German conditions we decided in the following way **on the choice of the type of silo:**

(1) The **" Trench-silo "** is the prototype for all farms going in mainly for root-crops (sugarbeet) with a great output of sugarbeet-tops, or cultivating silo-corn, leys or catch-crops. We call these farms " enterprises with root-crops—forage and cereals." Generally they have a great technical power.

## DIAGRAM 8




Another characteristic trace of them is the appearance of **great amounts of forage in a comparatively short time,** and this is just the basis to make real good silage in a trenchsilo. It is essential to bring home the forage for the silo in 3-4 days and complete the covering! Furthermore we need quantities for the filling of **at least** 100m³.

(2) For intensive **grassland farms** (we have in Germany 40% of the arable area as unalterable **permanent** grassland) the "best silo" is the **tower silo.** Why?—Practising a good fertilizing (176 pounds of N/acre) and a severe grazing management a good deal of the forage, even of heavily stocked pastures, has to be harvested **early by** cutting the young grass and ensiling it. This happens two or three times in the first half of the grazing season. Repeated fillings can **only** be executed in **tower silos,** if the farmer is interested to obtain the **very best quality** and to economise the **cost of labour.**

**The tower silo is the prototype for grassland farms**

This is the reason why we can only recommend the tower silo in the case of farms with a high proportion of grassland. All improvised methods like trench silos and stacks above ground, even if covered by foil or earth will **always** be conected with **big losses!** Quality of these silages is rarely good, butyric acid fermentation and high losses on the outside can simply not be avoided even with the greatest care. Our results are briefly compiled in Table 10 and Diagram **Nr. 8.**

Table 10

**Losses of nutrients** with the different types of silos and effect of covering
(Balance experiments Völkenrode 1957-1960, prewilted 24-26% DM)

| Type of silo and Covering | Relative losses of nutrients Percentage of St.Eq. |
|---|---|
| Tower silo | 100 |
| Trench silo with foil | 214 |
| Trench silo with foil + 8 inches earth | 156 |

The composition of a great investigation material out of balance experiments made in the years 1957-1960 with **pasture grass** gives the result presented in Table 11 (average values).

The **diagram below** has only in the left part interest for the Irish farmer since this climate will permit in the best case only a slight prewilting.

Table 11

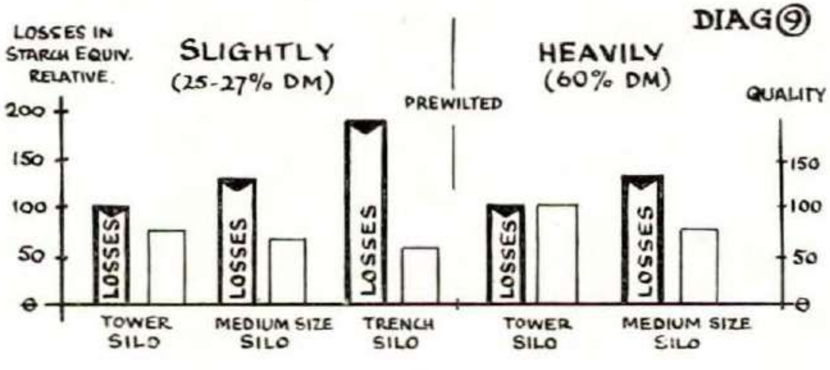
**Losses of nutrients and silage quality**

with different types of silos and 25-27% DM
Material: **pasture grass**
(relative values)

| | Tower silos | Silos of medium height | Trench silos |
|---|---|---|---|
| Losses of Starch units | 100 | 130 | 183 |
| Flieg Points | 78 | 70 | 60 |

The results were obtained by exact **balance experiments,** they are therefore to a great extent reliable since the whole matter ensiled was weighed coming in and going out and the nutrient content analysed chemically.

DIAG 9



## III

## Characterization of Irish Family Holdings

If I am trying now to apply the West-German principles to the conditions of the **Republic of Eire** I start from the facts communicated to me by Mr. T. Raftery for this purpose.

(1) In Eire in most **cases very small farms** are concerned with a cultivable area of 35 to 50 acres ((=15−20 ha).
(2) Having a long growing season the **period of winter keep** is very short; to my estimate 120 days average.
(3) Only a **very small number of farmers** makes silage up to now.
(4) Wilting for silage will be possible only in rare cases under the Irish weather conditions.
(5) Silage is made to-day almost exclusively in **Trench Silos.**
(6) Generally the surface of the fodder-stack in the trench silo remains **uncovered.**
(7) When brought in the silo good forage has generally a **Dry Matter content of only 18-20%.**
(8) The stored forage **heats up quickly,** a cold fermentation is therefore rare.
(9 Ensilages show a **very low quality.**
(10) The whole winter keep is composed of **rather poor fodder qualities.**
(11) **Additives** for silage are only applied in cases of exception.
(12) If there are any so generally **molasses** in a solution of 1.5%.

### A comparison of Irish and German conditions is interesting

These conditions in Eire can be compared the nearest to the small holdings in the rainy hills of the German Federal Republic. The differences are not as big as one would believe at first sight. Also in our country we have as yet only one third of the necessary silo capacity, only every fifth farm has a silo at all. Insufficient silage methods are frequent, and wilting is—though possible in many cases—rare. The technical equipment of the "fodder-chain" is still imperfect in these small farms; the same happens with pressing and covering.

In the grassland areas of the plains with bigger farms of about 75-125 acres (30-50 ha) and a proportion of grassland of 70-100% silage is generally made—if pasture grass is ensiled at all—in trench silos or open stacks as we find them in Holland. In these cases the losses are between 35 and 50%, the qualities are seldom good, mostly only satisfactory, if not decidedly poor or bad.

We find a fundamental difference to Irish conditions in the fact that these farms have to provide for a winter keep of 180-200 days or else they need manifold the silage capacity of Eire!

Counting only 120 days of winter keep in Eire the **requirement of silage capacity** is therefore only two-third of ours. This is a great advantage, for feeding on pasture is cheapest.

**The aim is the hayless fodder ration.**

Hay of good quality will always be more difficult to make in England and Eire than good silage. Already by this reason and further because the unit of nutrients is much cheaper as in hay, **silage should occupy with the Irish farmer the first place.**

To my opinion hay should be fed only to calves and only **occasionally** to dairy cows and fattening cattle. The matter arrives therefore more than with us to a **hayless ration.** Doing so we have, however, to presuppose that we obtain **real good qualities of silage.** We have the same aim in West Germany and take it as a fundamental principle in **reorganizing the fodder producing farms.** The leading principle has to be in future: " much silage—little hay " or more radical: " Only silage—no hay." Thus we feed in the cheapest way.

**Requirement of labour is lower in silage making than in hay.**

We have two reasons for it:

(1) Because the **requirement of labour** of the different methods of fodder conservation is the lowest by making silage. We can see that by **table 12** and diagram 10.

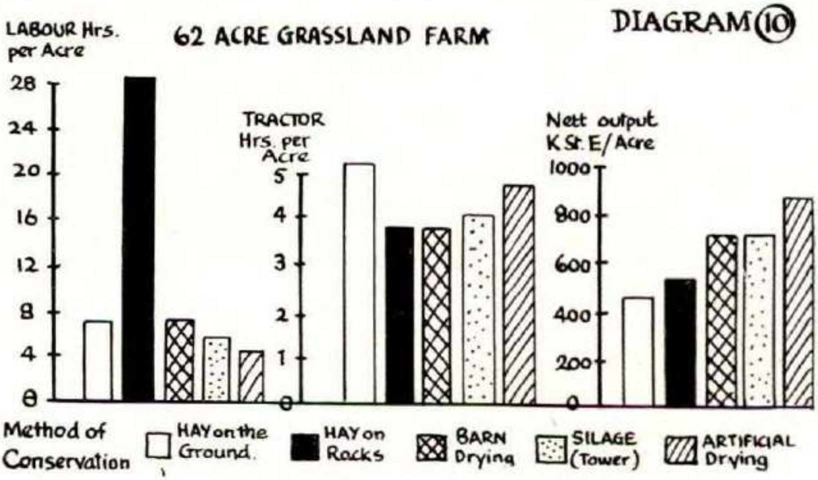
Table 12

**Requirement of labour of the different methods of fodder conservation**

(according to A. Markus (6).

Calculation for a 62 acre grassland farm, fully mechanized, yield of green matter 8 t/acre.

| Method of conservation | Labour hours per acre | Tractor hours per acre | Netto output lbs. st/eq. |
|---|---|---|---|
| Hay on the ground ...... | 7.76 | 5.68 | 1080 |
| Hay on racks .............. | 28.48 | 3.80 | 1440 |
| Barn drying .............. | 7.80 | 3.80 | 1800 |
| Silage (tower silo) ...... | 6.20 | 4.08 | 1800 |
| Artificial drying ............ | 5.44 | 4.84 | 2160 |



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The expenditure of human labour and of machine work is the lowest in silage making—the same as in artificial drying.

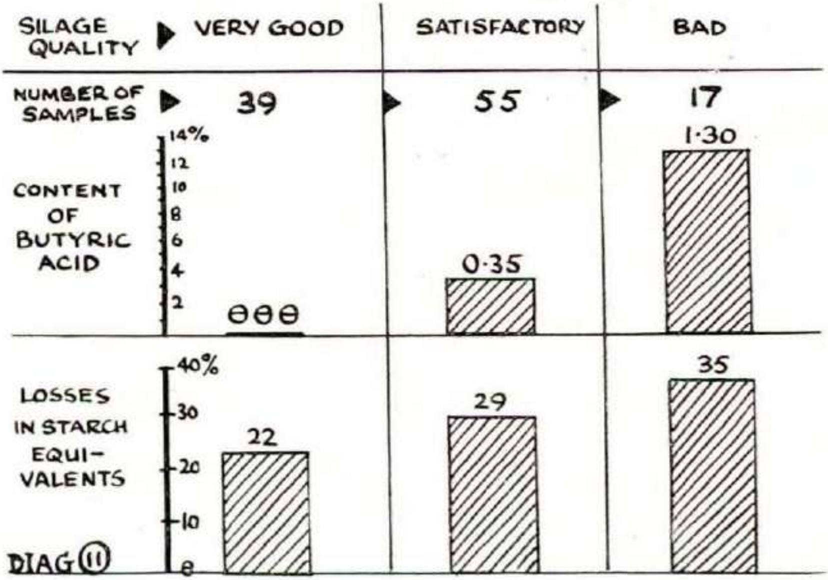
(2) Because the **losses of nutrients are** much lower in making silage than making hay. We can see that in Table 13 and **diagram 11.**

Table 13

**Relations between quality and losses of nutrients making silage**

(Percentages in the various grades)

| Silage quality | very good | satisfactory | bad |
|---|---|---|---|
| Number of samples ...... | 39 | 55 | 17 |
| Flieg Points ............ | 100—61 | 60—41 | 40—00 |
| Content of butyric acid | 0.00 | 0.35 | 1.30 |
| **Losses** of starch units... | 22 (100) | 29 (132) | 35 (158) |




DIAG (11)

With the increase of the butyric acid content — a reliable standard for the "quality" of a silage—the losses of starch units increase by leaps to 132% and 158%! It is astonishing indeed that the farmer does not pay any regard to these loss-figures in his production. This is the heavy mortgage of the processing husbandry basing preferably on farm produced fodder.

## Scheme of organisation of silage making in an Irish farm of medium size

Planing the **silo-capacity requirement** for a farm it is necessary to make up the calculation in relation with the mechanical equipment and the "fodder-chain." The expenditure of this kind can only be economical, if the necessary emphasis is laid from the beginning on the silage husbandry.

The three **main points** should be to my opinion:

(1) **High and well secured grass-yields** from the pastures in order to get enough silo grass besides the forage for the grazing animal (high "grass-mountain").
(2) The feeding indoors is to be organized after the principle: "Much silage—little or no hay."
(3) **Best quality** of silage.

I should like to venture according to these principles a proposal for the planning of silage making for a farm of medium size in Eire:

The holding has 50 acres (20 ha) and 100% of grassland (permanent pastures). The rate of stock is 1.5 "cattle unit"/ha or 30 cattle units on the 50 acres. (1 cattle unit=1100 pounds liveweight). The period of winter feeding is 120 days, daily ration of silage is fixed on 77 pounds per head (=35 kg).

The farm requires therefore:

30 (cattle units) X 120 (days) X 35 (silage ration) kg of silage=126,000 kg=126 tons of silage during the winter
**=18m³ silage capacity netto.**

Supposing a medium rate of losses of 20% during fermentation the yield of green material should be therefore:

$$126 + \frac{126 \times 20}{100} = 126 + 26 = 152 \text{ tons}$$

Basing on a yield of 15 t/ha or 6 t/acre we would have to **cut** altogether an area of 25 acres or 50% of the total area. This corresponds to the output of a grassland farm of a middling intensity. This output of mowing can be distributed on various areas of about 4 acres during the rotation of grazing in a period of 6-8 weeks. This work can be done without any difficulty on a farm equipped with tractor, tedder, loader and chopper-blower.

In the above mentioned instance we come to a requirement of silo-capacity (netto) of 180m³. If we chop the grass, obtain a good compact storing and refill the silo twice we can count with an utilization of the silo space of 90%, that means a planing of a **total volume of 200 m³ silo capacity.** One cattle unit demands therefore a **silage capacity of 7 m³** (We in West Germany have to base our planings on 10 m³ per cattle unit!).

### In a pure grassland farm of small to medium size we choose the tower silo.

Now come the most **important decision for the farmer:**

“ Which is the best silo for my farm ? ”—This question is put very often to us, especially in critical cases like the one in discussion. You will remember our previous statement that we **decline in West Germany trench silos of less than 100 m³ capacity** because the losses in smaller trench silos are too high. If we were concerned in our case with a farm producing sugar beet/and ensiling chiefly sugarbeet-tops we could perhaps concede a trench silo. But our case is concerned with a **pure grassland farm**, and therefore we have to take in account the following fact: When we follow the rotational system of grazing the grass wanted for the silo does not come in altogether at once, but is spread in various cuts of young grass executed in the month of May and June. It is therefore only possible to fill the silo **piecemeal,** in a period of several weeks. Consequently we have to use a type of silo enabling us to **various refillings without a great expenditure of labour and as well without considerable losses.**

Under these circumstances the refilling in the trench silo gets impossible without saying. We can therefore equip our model-farm only with a type of silo having a small surface in proportion to its capacity: and that is just the **tower silo.** It would be then suitable to divide the whole silo space into 4 units of $50 m^3$ in order to meet the limited labour power of a suchlike farm. The filling of a $50\ m^3$ silo in **2 turns** requires each time an amount of fresh material of $50 \times 0.7 = 17.5$ tons, that is the yield of about 3 acres. At these periods the cuts of grass may be also expected in a good grassland farm.

**A practical Key for the calculation of silo capacity**

Table 14

**Rate of Stock, Silo Capacity and—Types** (in rough figures)

| Area of farm acres (ha) | Rate of stock (cattle units) | Capacity $m^3$ | Type of silo: Units (Number of silos) | Type of silo: Size per unit $m^3$ | Type of silo: Diameter feet | Type of silo: Height feet |
|---|---|---|---|---|---|---|
| (1) 12 (5) | 7 | 50 | 2 | 25 | | |
| (2) 25 (10) | 14 | 100 | 4 | 25 | 9 | 15 |
| (3) 40 (15) | 21 | 150 | 6 | 25 | | |
| (4) 50 (20) | 28 | 200 | 4 | 50 | | |
| (5) 75 (30) | 42 | 300 | 6 | 50 | 10 | 20 |
| (6) 100 (40) | 56 | 400 | 6 | 65 | | |
| (7) 125 (50) | 70 | 500 | 8 | 65 | 12 | 22 |

In the cases 1-3 we come therefore to silos of “medium hight,” in 4-7 to tower silos if one dares to term them thus already.

In both groups **chopped** grass is filled in. In smaller holdings

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1. If there is enough lime in your soil, use 3 to 4 cwt. superphosphate per acre.
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3. If your soil needs potash, use 1 cwt. of Muriate of Potash also.
4. Dress lime deficient soils with Ground Limestone.
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where the use of a field chopper would not pay—unless by the insertion of a machine community—the wilted (if possible) and windrowed grass is taken up with the "Loader" and chopped **at the silo** with a **chopper-blower** and then filled into the silo. For the above mentioned silo-hights a simple ensilage harvester is sufficient, which requires about 15 HP on the motor.

### How to retain the C $o_2$-gases in the container ?

**Another problem** now appears at once: How can we cover the fodder stack on the top to secure an **anaerobic fermentation** and how can we avoid the **rain** penetrating ? The latter appears to me very important in the rainy Irish climate.

I will try now to show you the methods by which we believe to solve this problem in our West German grassland farms. I would like to make first some preliminary remarks.

As long as the plant is still breathing after cutting the **consumption of oxygen (0)** and the **production of carbonic acid** ($CO_2$) continue. This process goes on for a considerable time after the filling in of the grass in the silo. The quicker and more intensively the $CO_2$ concentration rises the earlier the cell-respiration will cease. The plant is drowned—so to speak—in the $CO_2$ atmosphere produced by itself and fades away at last. This passes within a few days after filling, if we succeed to **keep the $CO_{\frac{1}{2}}$-gases in the container !**

On the death of the cell, the plasmolysis, sets in, the cell sap breaks out and the fodder stack goes down quickly. In silos about 15-20 feet high their **own pressure** produces a vigorous compression which can not be distinguished in the final state from a compression caused by continual treading, encumbering by weights or mechanical pressing equipment (high pressure mechanism).

**The temperatures remain low,** they should not surpass 86°F. The outbreaking **cellsap** liberates **sugar stuffs,** a welcome nutrient for the bacteria.

Now we can understand better that **the production of natural carbonic acid** and its **conservation in the silo** is a deciding factor in fodder conservation. Hereupon is founded the "CARBONIC ACID METHOD."

This method can only operate, however, if the technical outfit of the silo is beyond any objection. The first condition is **gastightness** of the walls of the **container.** Neither dare the **hatchways** and **sap sink valves** allow any gas exchange. Furthermore it is necessary to exclude the top of the silo from the outside air in such a manner that the carbonic acid produced within the cointainer can not evade spontaneously over the edges of the walls. **The gas exchange is to be kept under control.**

### The gas pump works continually !

Even the practical farmer should not overlook the fact that the **main losses** of silage making are caused in the whole by two processes: the **flow off of the cell sap and the exchange of gases.**

The **ever working gas pump** during fermentation causes most of the losses above all. It is the continual mutual exchange of carbonic acid and oxygen which can come to an extraordinary extent according to the differences of temperature from inside to the outside and frequently also from the outside to the inside.

We have investigated the function of the fermentation gases in balance trials in a special arrangement (7). The results are compiled in Table 15.

Table 15

| | Gas content in volume % according to time in | | | | |
|---|---|---|---|---|---|
| | 6 hours | 12 hours | 24 hours | 48 hours | 120 hours |
| Sugar beet tops $O_2$ | 12.2 | 1.2 | 0.0 | 0.2 | 0.2 |
| chopped $CO_2$ | 1.4 | 11.3 | 17.9 | 31.8 | 64.2 |
| Silage corn $O_2$ | 7.4 | 4.3 | 1.1 | 0.2 | 0.2 |
| chopped $CO_2$ | 9.4 | 23.0 | 30.8 | 43.8 | 57.8 |
| Grass/clover $O_2$ | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 |
| chopped $CO_2$ | 26.0 | 34.1 | 45.4 | 57.4 | 74.6 |

The production of $CO_2$ rose in all three cases very quickly quickly and vigorously. The content of $O_2$ decreases quickly. Even in the third case (grass/clover) where we succeeded to lead the fermentation under absolutely anaerobic conditions we could state a very vigorous development of $CO_{\frac{1}{2}}$-gases.

It is evident that these gas-exchanges can only be possible in a silo if it possesses the necessary **constructive** qualities. The gas-tightness of the walls—already a high requirement—is not sufficient in most cases; certain arrangements are to be added permitting an ingenious **closure at the top.** This purpose serves the "**immersing lid**" with the necessary additions like **groove** and **barring liquid.** The physical function of the arrangement can be best explained in the **picture.** The immersing ring of the lid entrenches into the groove. The liquid—glycerine, molasses or oil—flows round the immersing ring from both sides. But the effect of barring is limited to a certain hight of the barring liquid, i.e. 2 inches. According to the amount of $C_2$ production and to the actual difference of temperature from the inside to the outside or vice-versa a certain **difference of pressure** is formed. More often than one would suppose there are also **underpressures** (partial vacuum) in the container. It is self-evident that the whole arrangment should be carefully mounted and controlled. I can not go into details by lack of time, but I would be pleased to put sketches and plans at your disposal.

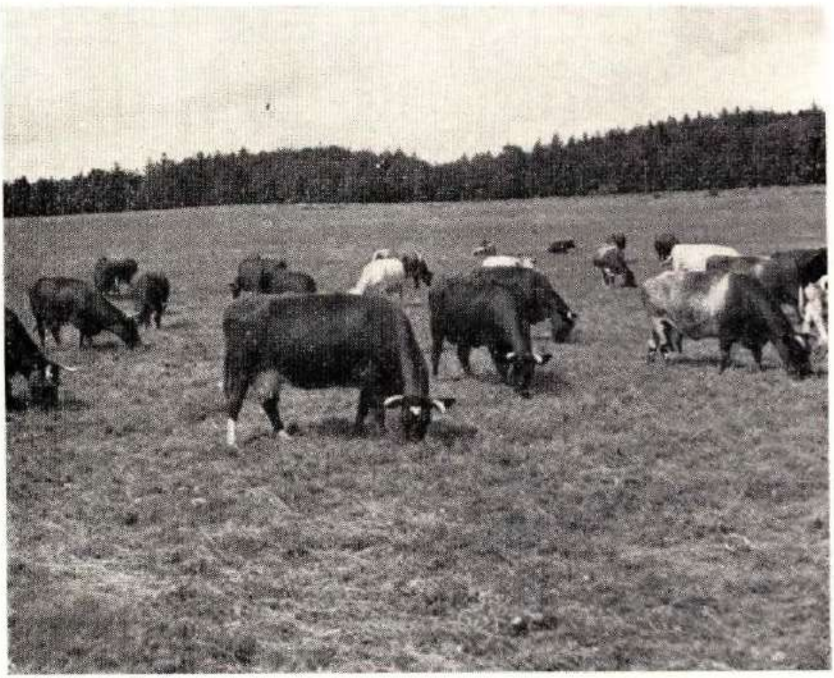
We call that to-day the "German method." It will spread more and more according to the speed of acknowledgement of the conception of quality in silage making, in feeding our cattle and in the requirements of milk and dairy products, butter and cheese.

**The silo with immersion lid was invented 30 years ago.**

The carbonic acid method is already fairly old; **thirty years ago** Tiemann and Rehm founded the experimental bases at Tschechnitz near Breslau (Silesia), induced by the Czech, "Moravia method." The modern technicians have opened the door for the application of the immersion lid also on the tower-silo. The electric grab, operated by one man, enables us already to-day to fill the silo automatically and unload it on the same way. Thus an important link of the "fodder-chain" is closed and the mechanization from the stem to the crib is reached!

## The people of animal nutrition still do not believe in the high nutritive value of grass!

Before I come to the end I would like to mention just one subject which I believe is of greatest interest especially for the Irish stock breeder and dealer, that is the question if grazing alone is sufficient to fatten cattle on good pastures. You will see that permanent grassland intensively managed gets an ever increasing importance for modern cattle fattening!



According to older conceptions of animal nutrition—unfortunately sometimes valuable until our days—the requirements of young growing cattle can **not** be met by pasture alone. This opinion is based on the old dogma that the content of dry matter and that of crude fibre be always too high. But people pretending this started from the experiences of the old undivided permanent pastures and extensively managed paddocks.

L. Krüger-Giessen (8) has established for the fattening of young cattle the following principle: "From the 5th month of life the supply of starch units is always secured, if 2.2 lbs. starch Equiv. are combined with **less** than 4.5-5 pounds of dry matter and **less** than 1-1.1 pounds of crude fibre." Krüger believes even that good hay, older green forage and the silage made out of it will not satisfy this demand, because these foodstuffs contain **more** than 4.5 pounds D.M. and **more than** 1.1 pound of crude fibre in 2.2 lbs. starch.

But we are able to prove for good **rotational** pastures that the grass, cut **before shooting,** highly satisfies the a/m demands. This appears on Table 16 of a 3 years' grazing trial on the lower Weser by **A. Dörrie (9).**

Table 16

**Content of nutrients in pasture grass**

(Völkenrode experiment at Geversdorf 1952-1954)

| | Average | min. | max. |
|---|---|---|---|
| Dry matter % | 18.3 | 15.0 | 22.6 |
| Crude protein in % DM | 19.3 | 13.8 | 23.7 |
| Crude fat in % DM | 22.3 | 20.4 | 24.4 |
| Starch units in 2.2 pounds DM | 657 | 603 | 715 |

**The animal gets thus with 2.2 lbs. starch:**

| | | | |
|---|---|---|---|
| Dry matter pounds | 3.4 | 3.1 | 3.7 |
| Crude fibre pounds | 0.75 | 0.69 | 0.82 |

The area in question was a permanent pasture which can be botanically described as lolietum cynosuretum tyricum and which yielded 3,500-3,900 lbs. S.E./acre.

We can therefore take for proved that **good permanent pastures** provide a full nutrition of young fattening cattle even with the highest demand for beef quality.

**Conclusion**

The grassland farms are the most delicate children of agriculture in the whole world. The processing of green forage into animal products has its own difficult problems. The first condition to make grassland farms pay is the art to produce a **high output per unit of area** by rational management.

We do not hesitate to pretend — and we can prove it by practical instances—**that permanent grassland can bring the same caloric output and the same rent as** the intensive arable system! Grass is a crop equal to sugar beet and wheat! It is only essential to treat it the same way! By intensive management of the grassland, especially fertilizing and best grazing methods, an optimum utilization of the grown forage by productive and healthy animals can be secured. Making use of the full yielding potential of the permanent grassland **the modern fodder conservation is assigned** a special heavy task.

This paper was read to the Irish Grassland Association on July 15, 1961.

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Walsh, Dr. T., Agricultural Institute, Merrion Road, Ballsbridge, Dublin.

Ward, Ml. J., Nuttstown, Clonee, Co. Meath.

Ward, Raymond, Ballintry, Clonee, Co. Meath.

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Ward, Sean, Department of Agriculture, Athenry Agricultural College, Athenry, Co. Galway.

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## Factors affecting

# YIELD AND QUALITY OF IRISH WOOLS

by V. VIAL, M.Sc.

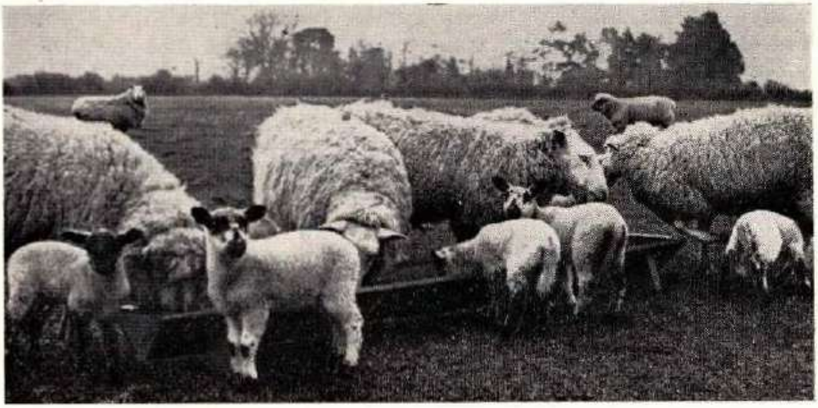
Of all the farm commodities sold in Ireland, none is so ill-prepared for sale, so heterogeneous or sold with such misgivings as the wool clip. Despite years of official advice against tar-stained wool, dead wool mixed with fleece wool, fleeces tied with binder twine—all these faults are still very much apparent in the consignments to the merchants. When so little care and attention is paid to the clip, it would seem that the average farmer just does not realise the potential cash value from quality wools nor has he stopped to reflect on what should be the relative incomes from wool and from lamb and mutton.

The hill farmer is getting equal returns from both sheep and wool, despite the fact that his primary aim is quality wool production* On the other hand, the specialised £1 farmer gets approximately 5 times his income from sheep sales as from wool. Individual farmers will alter these ratios depending on what form of conscious selection towards wool or meat is exercised.

This paper has been prepared to focus attention on those wool traits which will respond to selection. Wool improvement appears to be a breeding problem rather than a nutritional one.

*a. Fleece Weight*

Profitability from wool is primarily determined by the weight of clean wool shorn from each sheep. Improved feeding of the flock tends to increase fibre diameters and coarsen the clip and has very little effect on the actual weight of wool. A higher plane of nutrition also tends to increase the quantity of grease and suint in the fleece thereby lowering the yield of clean wool. On the other hand, the heritability of wool weight is fairly high and repeatability of fleece weight is also high. Repeatability is a measure of the extent to which superiority of fleece weight is maintained throughout the lifetime of the animal, despite environmental changes from year to year. If, for example, we take a flock of sheep and



weigh the fleeces at shearing, we may find that the five best fleeces are 1.4 lb. heavier than the flock average. Next year these same five ewes may be 1 lb. heavier than average, i.e. their superiority in the second year is 1.0/1.4 x 100 = 70%. We express this relationship by saying that "the repeatability for fleece weight is 0.70". In practical terms, if we selected hoggets which had a fleece weight at the two-tooth stage 1 lb. above average, they would have a fleece weight of 0.7 lb. above flock average at subsequent shearings. A measure of repeatability is the basis for improvement of fleece weight in the current flock: it is temporary and must be established for succeeding generations, i.e. *woolrecording must be continuous* if continuous gains are to be made by selection.

If the gains made in any one generation by selection are to be added to the gains made in the preceding generation, then we must know something of the heritability of fleece weight. Heritability measures that part of the current improvement brought about by selection which will be handed on from parents to offspring. Estimates of heritability are obtained from a knowledge of daughter and dam production characteristics or from the relationship which exists between the character measured in the rams and further recorded in their immediate offspring. This takes a long time to obtain and at present we do not know estimates of heritability for Irish wool characters. In the case of fleece weight we will need to have hogget fleece weights for at least 200 daughter-dam pairs in our main wool-producing breeds. Taking work done elsewhere, we can consider the heritability of fleece weight to be 0.4 which is fairly high. Again talking in practical terms, if a ram with a fleece weight of 1 lb. better than his contemporaries is mated to ewes which also have a superiority of 1 lb., their progeny will have, on average, 0.4 lb. of fleece above the average of the whole, unclassed flock. In other words, the next generation will have inherited an additional 0.4 lb. of wool as a direct result of our selection programme. But since it takes on average 4 years, and not one year, to replace one generation of sheep by the next, the annual genetic gain will be 0.1 lb. and not 0.4 lb.

From a farmer's point of view, it is therefore apparent that a worthwhile increase in fleece weight could be obtained by flock recording: in fact, it should be considered essential for pedigree and self-maintaining flocks if they are to keep their general level of production above that of the flocks to which they sell the breeding and crossing rams. Greasy fleece weight is one of the few economic characters of farm animals which is more likely to respond to a selection programme than to changes in the level of the nutrition of the flock.

*b. Wool Colour*

In most wool-producing countries, downgrading wool for colour usually means rejecting individual fleeces for bacterial rot, excess yolk or some obscure coloration associated with abnormal weather conditions. In Irish wools all these conditions are also found but their relative importance to the trade is completely overshadowed by the problem of black fibres in white wools. In the present-day market, light grey and grey fleeces are worth at least 10d. per lb. less than white wools. Only recently the public press carried a statement by the President of the Irish Wool Federation wherein he expressed a wish to see all the blackfaced ewes roaming Kerry, Connemara and Donegal done away with. No doubt, as a merchant, he has ample justification for this sweeping statement in that 43% of the wools going through Irish stores are downgraded greys. The situation is further aggravated by the presence in the national ewe clip of Suffolk-cross fleeces coming in from those farmers who retain Suffolk-cross ewe lambs for subsequent breeding. As in the case of fleece weight, the problem of black fibres in wool is more a breeding problem than a nutritional one. We don't know the heritability of black fibres because the problem does not arise in those countries where active wool research is carried out: the Hill Farming Research Organisation at Edinburgh are engaged on the problem and our own Wool Research Laboratory is evaluating our research flocks for the character. A selection differential exists for the Institute was able, in 1959, to select Blackface ewes in Kerry which graded only 13.9% light greys in 160 fleeces. It will take at least 3 years to gather sufficient data from this flock to estimate the heritability of black fibres: in the absence of this data we can safely recommend that culling be practised for the repeatability of the trait must be very high: those hoggets with black wool will certainly still have black wool at the subsequent shearing. The black fleeces from Suffolk crosses is a very different problem: basically, it stems from our absence of a planned sheep economy. The Suffolk is primarily a fat lamb sire combining excellent conformation with rapid maturity but its breeders have never intended that it confer on a cross the attributes of a fat lamb ewe—namely, mothering ability, high fertility and wool fitted for the worsted trade (pick and super quality). These qualities are, in other sheep-producing countries, achieved by recognised crosses such as the Cheviot x B.L., Blackface x B.L. or Merino x English longwool breed. Here we have every year a proportion of Suffolk x ewe lambs which fail to fatten retained for breeding back to the Suffolk and their wool included in the ewe clip. From a National point of view, it is not sound practice and is a principal reason why so much of our clip is fit only for the mattress, upholstery and inferior carpet trades.

*c. Staple Length and Fibre Diameter*

These two characters, together with an assessment of colour, determine largely the ultimate utilisation of a particular wool type. Wool for the paper felt and worsted trades must be long-stapled with a well-defined number of crimps per inch and no break or tenderness such as is found in the wool of poorly-fed lactating ewes. Staple length has a greater influence on greasy fleece weight than has diameter and length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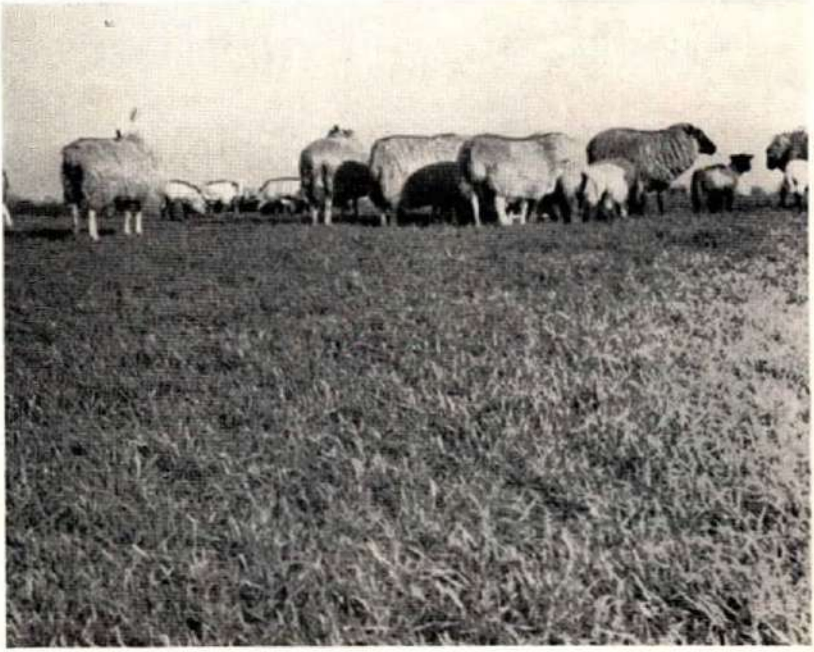
will respond to a selection programme more readily than diameter. Length has approximately the same repeatability as fleece weight (0.7) and a heritability of the same order (0.3—0.6). Less is known of fibre diameter and its heritability is though to be about half that of staple length and fleece weight. In our own work with Galway wools the lack of a correlation between staple length and fibre diameter suggests that it should be possible by selection to increase staple length without lowering the count (increasing the diameter of the fibres): Galway wool is generally too coarse in relation to its length thereby downgrading the clip for use in the less profitable woollen trade.

*d. Hairy Wools*

Wool grows in units known as follicle groups, each group consisting essentially of a primary follicle surrounded by 14 or 15 times as many secondary follicles plus assorted sweat glands. The primaries give rise to fibres with hollow centres which, when they are still growing, are known as medullated fibres: if they are detached and shed into the fleece they are known as kemps. The secondary follicles give rise to the true wool fibres. As far as we know, the ratio of secondaries to primaries is fixed at birth so that we again have a breeding problem if we desire to alter that ratio. Hairy fibres are undesirable except in carpet wools and kemps, which will not dye, are even less desirable. Not all breeds have kempy wool and in Ireland it is a problem only in Blackfaces and Cheviots.



# THE IRISH GRASSLAND ASSOCIATION

The Irish Grassland Association was formed at a meeting, held during the R.D.S. Spring Show in May 1946. The O'Morchoe was elected president and the council was composed of Professor Michael Caffrey, Professor E. J. Sheehy, Professor Michael Gorman, Messrs. H. M. Fitzpatrick, W. Bland, J. Litton, R. Bryan, Capt. Redmond, Col. Doherty, Dr. Kennedy and Dr. Spain. The first honorary secretary was Mr. R. I. McCulloch.

This was a period when the quality of grassland in Ireland was at a very low ebb. Fertility was depleted after the war years, fertilisers were extremely scarce and ground limestone was, as yet, unavailable. Still, there was a lively interest in grassland improvement among a limited group. In particular, a number of farmers were impressed by the wartime grassland production efforts in Britain; the views of Sir George Stapleton had stimulated many and there was keen interest in assessing under Irish conditions new pasture strains, direct reseeding, grazing managing methods and the effects of treating grass as a crop, rather than as something which just grew.

At the first meeting of the council, an expert committee, comprising Professor Sheehy, Professor Caffrey, Professor Gorman, Mr. Robert McCulloch, Dr. Spain and Mr. A. A. McGuckian, was appointed, and this committee was asked to "advise on all matters relating to grass seed mixtures, fertilisers, nutrition of grazing animals and strains of grass and clover". The committee reported to the first technical meeting of the Association, held during the Horse Show in 1946. About twenty members attended and papers were given by Mr. A. A. McGuckian, Professor Gorman and Professor Caffrey.

Membership quickly grew and in September of that year Dr. Spain called a meeting at Limerick Show, where the Golden Vale branch of the Association was established and this local branch thrived for many years, helped by Dr. Spain, Mr. Owen Binchy and Mr. T. Ryan. By 1947, membership had outgrown the capacity of the honorary secretary to deal personally with details and the lively personality, Mr. R. R. Yates-Hale, became associated in a secretarial capacity with the Association.

By 1948, the secretary reported membership had increased to 161, "fully paid up". The activities gradually extended to farm walks, a Spring Show dinner and one dinner and evening meeting during the winter months.

In those early years a most interesting meeting of the Association heard Mr. George Holmes develop on grassland management in general and the improvement of Irish pastures in particular. Mr. Holmes, a New Zealander, had been asked by the Government to report "on the present state and methods for improvement of Irish grassland".

In May 1949 the present Rules and Constitution of the Association were adopted. Under these Rules, the president would retire annually, to be succeeded by the vice-president and that year The O'Morchoe, who held the chair since 1946, was succeeded by Lord Carew.

In 1951, Mr. R. I. McCulloch, who had been honorary secretary to the Association since its inception, intimated that he wished to retire and he was succeeded by Mr. P. O'Keeffe.

In 1951 the activities of the Association extended to a full week-end meeting, which was held in Jury's Hotel in early December of that year.

By 1953 two week-end meetings were held, one in the early winter, and the other in early spring and this practice has continued. The subjects discussed have extended outside the direct subject of grassland and grassland management. For this reason the Annual General Meeting of the Association in 1961 decided that the sub-title " Animal Production " should be added to the name of the Association.

# IMPROVEMENT IN SHEEP BREEDING

**By OSCAR COLBURN**

Many people talk as though the problem of the pedigree breeder and the problem of the commercial sheep farmer were two entirely different things.

Progress in animal breeding is extremely slow, and it is very necessary for breeders to make an accurate assessment of what the commercial man is likely to want if suitable sheep are to be available in ten, fifteen or twenty years time.

The United Kingdom provides the largest market for lamb and mutton in the world. Consumption here is of the order to twenty-three pounds per head of the population. Of this total, British farmers produce about 40%, and about 60% is imported mainly from New Zealand. Consumption of lamb and mutton is increasing very slowly.

**Increase**

Since 1950, however, breeding ewes in Britain have increased their numbers by roughly 3% per annum and there is no sign that this rate of increase is slowing down to any appreciable extent.

The dry year of 1959 showed the fine balance between supply and demand, and it seems obvious that farmers here can only continue to increase output by capturing part of the market that is now supplied by New Zealand.

**New Zealand**

This is not as easy as it sounds. Ewe numbers in New Zealand are also rising, even though the average return to New Zealand producers last year was 1/8d., making the price per lamb about 48/- and, including wool, an output of some £4 per ewe.

The New Zealand Meat Producers Board has built up large reserve funds adequate if necessary to finance low prices on Smithfield for three or four years.

**Two Ways**

There are two ways to meet a fall in gross returns per ewe, and both are of some urgency to the sheep farmer. First of all it seems likely that some of the newer intensive methods of keeping sheep will step up returns per acre. Secondly, there is a great necessity for our sheep breeders to produce new strains or indeed new breeds of sheep that are more productive than those available now.

If sheep are thought of in terms of functions rather than in terms of breeds, objectives can be immensely simplified.

The functions that are performed by sheep are five in number and are as follows:

(1) Hill sheep
(2) The sire of the crossbred ewe
(3) Self-contained fat lamb producers
(4) Mutton sires
(5) Out of season lambing.

**Examination**

Let us examine the characteristics required by each of the categories of sheep that have been described. Hill sheep require hardiness, prolificacy and as heavy a fleece as possible. Those breeds producing the sires of crossbred ewes must be able to transmit prolificacy, milking capacity and growth rate.

Self-contained fat lamb producers must be prolific and heavy milking with high growth rate and a carcase of acceptable quality.

Those breeds producing fat lamb sires to be used on ewes of other breeds must be capable of passing on first of all a high growth rate and secondly good carcase quality. Mutton sires on the other hand must develop carcase quality first and growth rate in this case is a secondary consideration. Those breeds suitable for frequent or out of season lambing must obviously be able to take the ram throughout the year and in addition must be reasonably prolific and milk well.

It would be unrealistic not to appreciate that few breeders are likely to accept the complications of full scale progeny testing for these characters.

But provided that a sufficient nucleus of top quality flocks are able to undertake this work, the results of it can be spread rapidly by ram multiplying flocks which in practice will be the main body of pedigree breeders. I visualise a three-tiered structure in each breed which would operate as follows.

**Key Flocks**

The nucleus ram breeding flocks would be the key flocks for the improvement of the characteristics required for the fulfilment of each function. Full-scale progeny testing and individual ewe recording would be carried out, the actual breeding system to depend on flock objectives.

It would obviously be necessary to identify all lambs at birth. In addition I would hope that a general mark for animals bred in nucleus ram breeding flocks could be agreed on.

For this purpose possibly a tattoo mark at the base of the tail would be effective. I would also like to see some form of recognition of nucleus flocks made either by the Ministry or by breed societies and accommpanied by a certificate or licence. Regular veterinary examination would be highly desirable in this type of flock.

**Recording**

In a ram multiplying flock of any breed, the complications of progeny testing with all that implies in record keeping and record analysis could be dispensed with. Individual ewe recording for the required characteristics, however, wouid still be necessary, but this is not such an arduous task.

The system here would be to use rams that were bred in nucleus flocks of the breed of ewes that, after recording, had proved themselves capable of performing efficiently over several lactations. In this way not much genetic improvement can be expected, but the work done in the necessarily few nucleus flocks would be made available to the breed as a whole.

To sum up—

(1) Management in all its aspects can have far greater effect on flock productivity than improved breeding can.

(2) Even with correct management, however, there is still a great need for improved sheep.

(3) In order to stand any chance of making worthwhile breeding improvement, objectives must be severely limited.

(4) There is therefore great need to re-examine breeding objectives and to do this in the light of the **functions** of sheep rather than on old fashioned lines of breed type.

(5) Functional stratification can simply breeding objectives and make progress possible.

(6) Improvement of the essential economic characteristics (proficiency, milking capacity, growth rate, carcase quality, and weight and quality of fleece) will necessitate more accurate breeding methods than those in use today.

(7) Full-scale progeny testing and individual ewe recording will be required in the key flocks of every breed, and the results of this can be spread fairly rapidly by widespread use of animals bred in these flocks.

This Paper was read at the Irish Grassland Association meeting 3rd-4th March 1961.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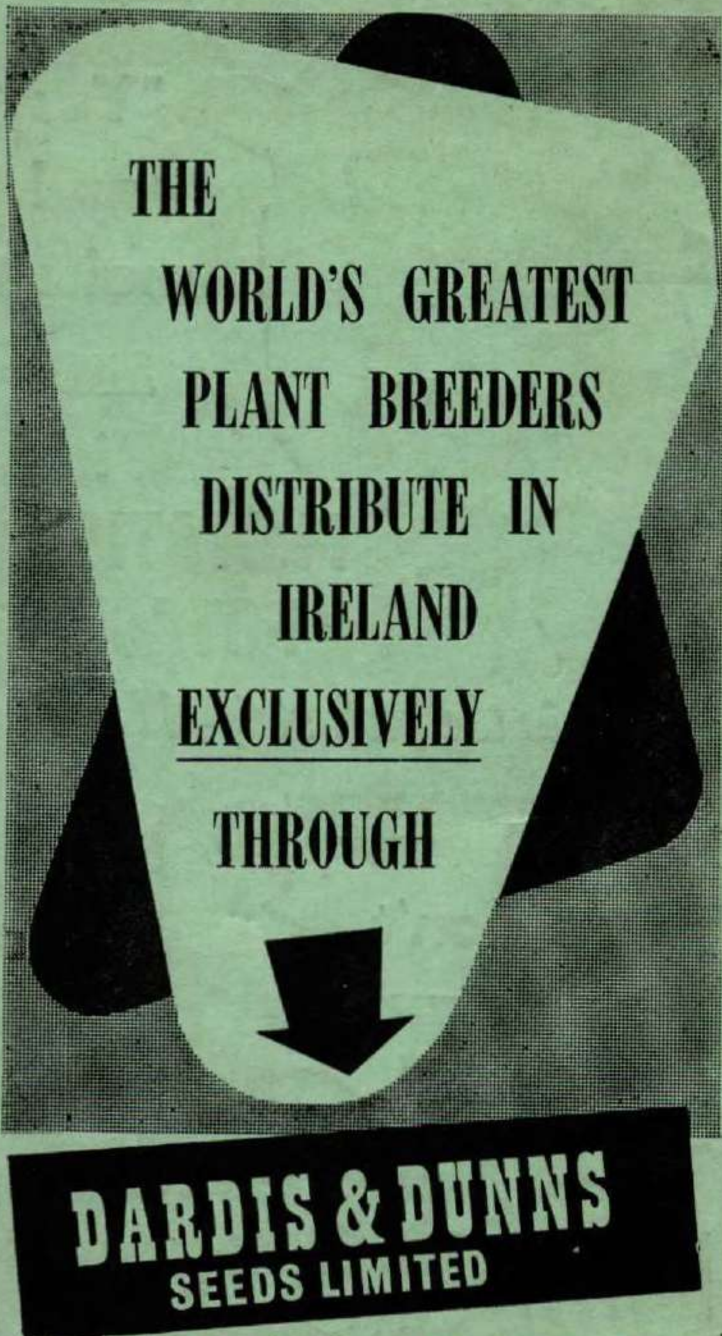


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