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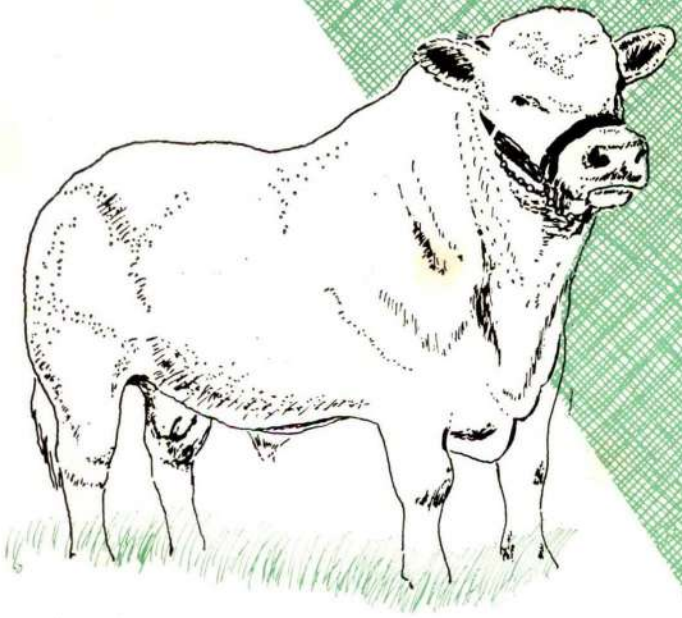

Second Edward Richards Orpen Memorial Lecture

Fifteen Years of Development in Fodder Conservation and Feeding

by

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EDWARD RICHARDS ORPEN MEMORIAL LECTURE

The family of the late Edward Richards Orpen has established a Trust in his memory. It is intended that the Trust Fund should be used to sponsor an annual lecture from a prominent worker in the field of agricultural research. The Trust will select the lecturer on the merit of his work and its relevance to Irish farm practice. In recognition of the lecturer's contribution to Irish farming, the Trustees will award an honorarium to the invited speaker.

The following have kindly consented to act as Trustees along with Captain Orpen's son, John Richards Orpen, and his daughter, Mrs. E. P. Hill: R. Ivan Allen, Stan Brophy, John G. Litton and Patrick O'Keeffe.

The first lecture was by Dr. Tom Walsh, Director, An Foras Taluntais, on "RESEARCH IN FARMING" and was delivered at the Winter meeting of the Irish Grassland and Animal Production Association on Friday, 29th November, 1968, in the South County Hotel, Dublin.

This second Richards Orpen Memorial Lecture by Dr. McCarrick was given at the Grassland Association's Spring Meeting in the Sunset Ridge Motel, Cork on February 18th, 1970.

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EDWARD RICHARDS ORPEN

1884—1967

Born 20th Oct., 1884, Edward Richards Orpen was educated at St. Paul's School, London, and at Trinity College, Cambridge, where he studied mathematics.

After leaving Cambridge he farmed at Monksgrange which had been in the possession of his mother's family (Richards) for five generations. He took an active interest in the Co-operative Movement as a member of the Committee of the Enniscorthy Co-operative Society, and was also active in the Farmers' Union. He took part with Loftus Bryan and Mrs. Lett in the discussions which led to the foundation in Bree of the United Irishwomen, now the Irish Countrywomen's Association.

He served in the British Army in the 1914-18 war in which he variously ran a school for the care and maintenance of motor vehicles and a mobile workshop for the repair of lorries in the field. After the war, he took his family to England in 1921. There he worked for a while for the Rural Industries Bureau on the revival of rural crafts in the West of England and Wales.

He returned to Ireland in 1926 and shortly afterwards started a small furniture industry at Monksgrange with 2 carpenters and 2 assistants. The worldwide trade depression closed this venture in 1931. Later he turned to tourist development and ran Monksgrange as a guest house in conjunction with a New York travel agency until the outbreak of war in 1939.

His participation in politics started in 1932 with the formation of the Centre Party. He became an active member of the agricultural committee of that party and subsequently of Fine Gael. In 1947 the then Taoiseach, Mr. Costello, appointed him a member of the Senate. His political work led him to read widely on technical and economic developments in agriculture in other countries and he set down his views in agricultural articles for the Irish Independant. These aroused considerable interest at a time when agricultural journalism in this country was at a low ebb.

He was a founder member of the Irish Grassland Association and its President in 1951/52. He died on the 14th November, 1967.

Roger McCarrick grew up on a farm at Coolaney, Co. Sligo. He attended University College, Dublin where he was awarded his B. Agr. Sc. degree in 1956, and his first job was in the Grassland Research Unit at Johnstown Castle, from November 1956 to February 1959. His work was mainly concerned with research on silage and haymaking and their quality at farm level, and he was responsible for developing a silage analysis service for farmers. In February 1959, he was appointed to the staff of the newly formed Agricultural Institute farm at Grange where he continued research on grass conservation and developed winter feeding research.

He was awarded M.Sc. and Ph.D. degrees at University College, Cork in 1962 and 1965 respectively. He went to Iowa State University, Ames, Iowa, U.S.A. in 1965 to spend one year on a Post Doctoral Fellowship. After his return from the U.S.A. he became involved in research on housing accommodation for cattle which resulted in the development of sawdust pads and topless cubicles.

He has published more than 40 research papers and has written extensively in the farming press. He was a member of the Royal Dublin Society panel of specialist lecturers for four years. He has lectured to farming groups throughout Ireland and by invitation to several groups in England and Wales. He lectured also at several International Congresses and was invited to chair two sessions at the Second World Congress on Animal Production in Maryland, U.S.A. in 1968.

He was Hon. Secretary of the Irish Grassland and Animal Production Association for two years and is currently its President-Elect. He is also a Council member of the Irish Agricultural Economics Society. He has frequently broadcast on radio and television and in 1969 he prepared and presented a series of seven television programmes on beef farming.

His research has given rise to a number of developments of direct interest to farmers. Among them were cold silage-making, which opened the way to large scale contracting; the use of polythene for sealing silos thus eliminating waste; bun silage which reduced the capital involvement in silage-making, and additive research which put into perspective the importance of additives and their relative merits.

He left the Agricultural Institute to Join International Meat Packers as Field Service Manager in November 1969. In his new post he is responsible for developing communications with 28,000 shareholders of the Company and for developing a team of specialist beef advisors to service producers.

FIFTEEN YEARS OF DEVELOPMENT IN FODDER CONSERVATION AND FEEDING

BY R. B. McCARRICK

Mr. Chairman, Ladies and Gentlemen, I felt very honoured and also very surprised when I received a letter inviting me on behalf of the trustees to deliver the second Edward Richards Orpen Memorial lecture. Tonight I feel no less honoured to have been chosen. I know that in selecting me for this job, the trustees intended that I should represent the various people working on grassland conservation within the Agricultural Institute.

In this talk I will start by reviewing progress made in the field of grass conservation and feeding during the past fifteen years. Fifteen years ago silage was almost a rarity on Irish farms and there was little research in progress in the area.

Dr. Neenan who headed the new Grassland Department in Johnstown Castle revived research on silage in 1955. Prior to that little research had been conducted for almost 15 years. In the 20's and 30's some very excellent research work had been conducted by such people as Professor Drew, Professor Sheehy, and Dr. Deasy at U.C.D. and by Professor C. Boyle and Dr. Ryan in U.C.C. When these people moved out of research, a void was created and it was this that Dr. Neenan attempted to fill when he initiated silage research in 1955. I joined Dr. Neenan's section at the end of 1956 and we both worked in this area for the next two years.

Silage surveys

In 1958 Dr. Neenan and I with the co-operation of the Agricultural Advisory Services conducted a survey of silage throughout the country. The results of this survey showed that less than 2% of all farmers in Ireland made silage and that only 160,000 tons of silage was made, which was less than 2% of the total conserved feed in the country.

The remaining 95% was hay. At that time a great majority of the silage was made in two areas in the Cork-Tipperary and the Kildare-Meath-Dublin-Wicklow area. Throughout the rest of the country silage was so rare that most farmers had never seen any. Silage-making in the late 30's and early 40's was even lower than in 1958.

From 1958 onwards silage-making increased dramatically. Surveys conducted by the Department of Agriculture and the County Advisory Services has shown that since 1964 silage has become very popular indeed. (figure 1).

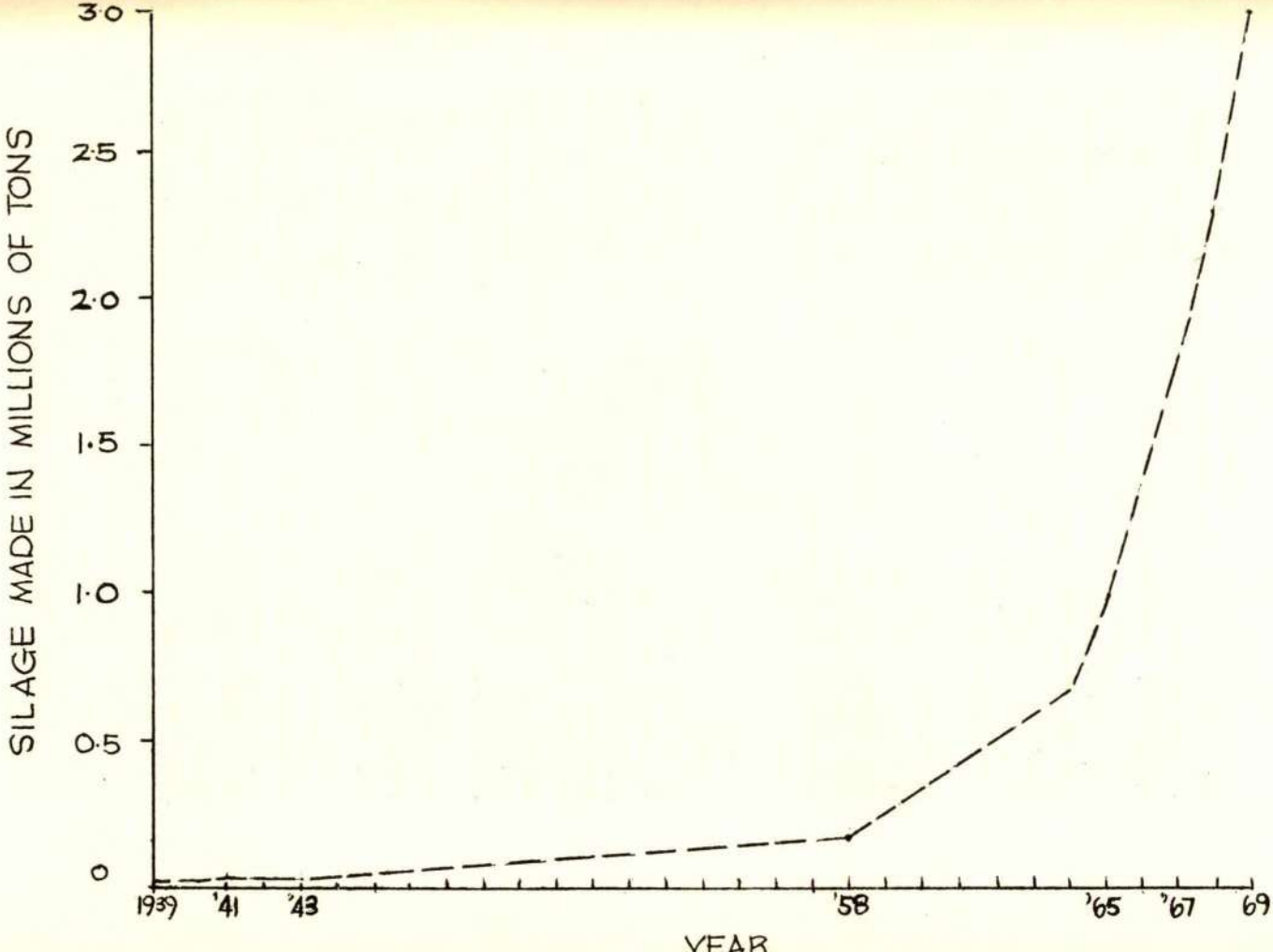
SILAGE MADE IN MILLIONS OF TONS
3·0
2·5
2·0
1·5
1·0
0·5
0
1939
'41
'43
'58
'65
'67
69
YEAR

Figure 1

Between 1958 and 1964 the amount of the silage made increased from 160,000 tons to 658,000; it had reached almost one million tons per annum in 1965, 1.3 million in 1966, 1.8 million in 1967, 2.3 million in 1968, and last year it passed the three millions mark. At the same time the number of farmers making silage have increased from about 2,000 in 1958 to 16,591 in 1969. To-day silage represents 20% of all conserved fodder. We are now making more silage on percentage basis than in England. Silage-making in England has not increased very much in the last decade. The importance of silage to Ireland is however, much greater than this figure would suggest because it is the progressive farmers who make it. It is difficult to find a farmer who makes a decent effort at intensification in any cattle enterprise without relying largely on silage to provide winter feed. Furthermore, the quality of the silage produced is likely to be somewhat better than that of the average hay.

Reasons for expansion in silage-making

What were the reasons for the rapid expansion in silage making? The first thing that can be said is that there is no single reason. However, a variety of labour saving techniques have been developed and these certainly played a major part in popularising silage. The first of these was the discovery of self-feed silage. This removed the drudgery of silage-feeding. Credit for the idea of self-feed silage must go to Mr. Sean O'Neill from Lurgan, Co. Armagh who is a very respected member of this Association and his neighbour Mr. Willie Hamill. Sean O'Neill started self-feeding silage in 1952 and it immediately aroused interest particularly amongst the bigger farmers who were hankering for a labour saving method of feeding. In the South of Ireland, the first self-feed silo was built in 1956 by Mr. Tom Lalor, of Kilbeggan, Co. Westmeath. When the Agricultural Institute was set up at Grange in 1959 the first winter feeding experiments conducted were designed to compare self-feed with trough-feed silage for pail-fed weanlings, suckled weanlings and store cattle. In three comparisons with each type of stock, self-feeding was found to be equal to trough-feeding.

The second factor which contributed largely to silage-making was the introduction of the Silorator in the late 50s and its successor the forage harvester. The forage harvester took the labour out of silage-making and perhaps, what was more important, it reduced the number of mechanical operations in silage-making by combining the cutting of grass and its collection. It brought other advantages also such as laceration of grass which improved the chances of a good fermentation, reduced labour in spreading silage in the pit and it speeded up output.

Development of cold silage

The discovery in the U.K. and Ireland that it was not necessary or indeed desirable to allow grass to heat in the silo opened the door for large scale silage contracting. Although the facts of cold silage were recognised in America and continental Europe for years, its practice didn't penetrate to England until 1960. That year, Dr. Murdoch, of N.I.R.D., read a paper at the International Grassland Congress in Reading in which he showed better fermentation in parts of the silo which weren't allowed heat than in areas which heated. This started a re-think of the whole subject. Prior to this we thought cold silage was only for acid additives and wilted herbages. Our own experiments, conducted at Grange and Johnstown Castle that year showed no advantage in favour of heating, either in terms of nutrient savings or feeding value. The following year we began to advocate cold silage. Initially, farmers were sceptical but good results in the folloiwng year lead to its widespread adoption. In England, the adoption of cold silage was much slower and even today, one can find advocates of the warm method. Cold silage opened the door for large scale contracting by allowing the contractor to complete a job of silage-making without waiting for the traditional heating-up period.

The introduction of polythene also had a major effect by obviating the necessity for daily rolling for several weeks after the silage was made. We first used polythene in 1957 on small silos at Johnstown Castle. We soon learned that a good seal could be made by covering with polythene and weighting with farmyard manure as soon as silage-making was completed. This kept air out and eliminated surface waste.

Apart from saving labour, the value of polythene in preventing waste of prime economic importance. A saving of 4″ of visible waste on the surface of the silage means the saving of 12″ of settled silage which is a saving of 24 tons of silage on a silo 60 ft. long and 21 ft. wide. In money terms this silage had a production value of £70 to £95. The classical work of Minson in New Zealand during the early 60's demonstrated the value of polythene in eliminating waste in out-door silos. However, I think we can say that we at Grange had advocated polythene covering before the New Zealand experiments had been initiated. Polythene also led to the introduction of the bun silo at Grange in 1965. The principle of the bun was that all sides of the silage heap were sloped at an angle of about 45°. The whole surface area was covered with polythene and weighted. Surface waste was thus avoided. Silage-making by this method became very popular almost immediately, amongst farmers with little capital and it brought silage within the reach of the small farm. In 1967, a

survey conducted by John Craig, Department of Agriculture, in conjunction with the Agricultural Advisory Services showed that there were 499 of these bun silos made in Ireland. This fact is, in my opinion, rejection of the commonly held view that farmers are conservative by nature and resist change. It proves that when an idea is suited to their requirements and properly presented that they are quick to catch on to its economic implications for themselves.

Unroofed silos

At about that time, the concept of the walled unroofed silo was re-introduced using polythene as a seal. The first major demonstration of this was at Mullinahone where Dan Browne of the Agricultural Institute had set up a number of dairy herds which were self-fed in walled unroofed silos. Again farmers showed their adaptability by building several hundred of these silos in 1967 even though they were not grant-aided. Between 1966 and 1967 less than 1,000 new roofed silos were built but 2,000 additional silos in the form of unroofed silos, buns and clamps were filled.

The movement towards increased silage-making was also aided by a number of other factors. Not the least of these was the explosion of a number of myths and prejudices which were inbuilt in our thinking a decade ago and which have as a result of research been exploded. For example, ten years ago any discussion on silage inevitably centred about which additives we should use and what was the best type of silo. We had a pre-occupation with such things as AIV silage and tower silos. The importance given to these two points has since been shown to be unwarranted. During the past 13 years we have conducted experiments to compare more than 20 silage additives. Most of these were shown to have no value whatever for preserving nutrients in silage or in improvement of silage quality from a fermentation viewpoint. Others were found to have some value as a nutrient preservative but were unsuitable for our feeding conditions because of unpalatability or physiological stresses on the animals. Only two types of additives have been found to give improved performances. These are additives based on sugars such as molasses, and additives based on organic acid such as formic acid. Even these additives have not invariably improved performance. They have only shown an advantage when ensiling conditions were extremely difficult such as occurs in late Autumn with wet grass. The case for additives as a general precaution has not yet been proved despite volumes of research papers written on this subject in every country of the developed world. The fact is that excellent quality silage with low inherent losses can be made under most

circumstances without additives, if the proper ensiling techniques are adopted.

Again our pre-occupation with tower silos was based on a misconception. Tower silos were and perhaps still are more efficient for preserving heavily wilted silage and in every country where they are widely used it is wilted silage that is made. It is wrong to transfer such a technique to a country like ours where unwilted silage is being made and to suggest that it is still best. Indeed American work on this subject has disproved theory. In recent years the concept of tower silos has been revived on big farms in the U.K. and elsewhere. Now they are serviced with automatic unloading devices. Although, it makes a little more sense when equipped with such mechanical aids, the cost is still prohibitive as has been shown by American research in their affluent farming situation.

Silage evaluation

The increase in our knowledge of silage-making during the past decade has had an effect on improving silage quality and eliminating the unpredictability of feeding value. The original work of Homb in Norway, Reid in U.S.A. and Minson, Raymond, Harris at Hurley, England, sparked off a new wave of research which has largely clarified the importance of cutting grass at the leafy stage before ear emergence, in order to ensure high quality. This area was also investigated at Grange by Dr. Wilson, and I, and the position for Ireland established. This combined with the usual rules for good silage-making, fast filling, avoidance of soil contamination, proper and immediate sealing has taken the chance out of silage-making. Armed with this information it is now possible to predict the practical outcome from silage in terms of animal performance. On this point, the work of Mr. Joe O'Shea at Dunsinea demands special mention. He has developed a chemical method called *in vitro* digestibility, for measuring the digestibility of silage. He has been working with Mr. Matt Barlow and Mr. John Craig of the Department of Agriculture on their farm recording of beef cattle and with Grange experiments. As a result of this work, he has gone a long way towards producing a technique which will predict the feeding value of silage at the start of the Winter. I don't need to emphasise the importance of this. It will enable the farmer to formulate the proper ration to supplement his silage in order to produce the required animal performance. It will also help him to decide the type of cattle to buy and the trade to pursue. *This work is indeed very important and its devleopment must continue.*

Feeding values of silage for animals of different classes

During the past decade we have learned a lot about silage feeding. Ten years ago it was commonly held that cattle should not be fed on silage as the sole diet because it was unbalanced or it hadn't enough fibre or some other reason. It was also believed that young cattle such as weanlings were physiologically incapable of digesting silage properly. It was recommended that some hay and/or meals should always be fed to supplement silage. I remember the day we started the first feeding experiment at Grange in November 1959. We were walking 40 weanlings to the feeding shed where they were being put on an experiment to compare self-feed and trough-feed silage. A colleague, who is a good cattleman, quipped to one of the men "There go 40 Kevin Barry's." The inference, of course, was that these animals were doomed to die during the winter. When I heard the remark, I was worried too, because I didn't know whether they would live or die. Well, the calves didn't die and we now know that such animals can put on a lot of weight on silage alone. But like most myths there is some element of truth involved. The fact is that weanlings won't grow as fast on silage as will older cattle. In our experiments, we found that store cattle will put on about 0.6 lb per day more when fed on silage than will weanlings fed the same silage. Both can, however, be self-fed without loss of performance.

TABLE 1: Growth Rates of Weanlings (400 lb. liveweight) and Store Cattle (800 lb. liveweight) when fed the same silage at Grange.

	Liveweight gain lb. per day		
	Weanlings	stores	mean difference
Experiment 1 (1959)	0.5	1.1	0.6
Experiment 2 (1960)	0.1	0.7	0.6
Experiment 3 (1961)	0.7	1.4	0.7

Recent research by Alder McLeod and Gibbs at Hurley confirm this relationship and show that with 4-month old calves weight gain per day are ½lb. lower than with weanlings. (Table 2).

TABLE 2: Liveweight (lb. per day) of cattle of different ages fed wilted silage (Alder, McLeod & Gibbs).

	age of cattle in months		
	4	10	16
Unwilted silage	0.3	0.8	1.4
Wilted silage	0.5	1.3	2.0

More recent work at Grange suggests that heavy cattle will gain about 0.25 lb./day more than light stores. As a result of this and other work we are now in a position to predict the likely performances of animals of different ages fed high quality unwilted silages. (Table 3). This prediction must be based on a good assessment of the silage quality such as by *in vitro* digestibility.

TABLE 3: Predicted growth rates of cattle of different ages when fed high quality silage (from results of experiments at Grange and elsewhere).

	liveweight gain/day, lb.	difference from previous category
Heavy stores (8½ cwt.)	1.8—2.0	
		0.2
Light stores (6—7 cwt.)	1.6—1.8	
		0.3
Yearlings (4½—5½ cwt.)	1.3—1.5	
		0.3
Weanlings (3—4 cwt)	1.0—1.2	
		0.7
4-month old calves (2—2½ cwt.)	0.3—0.5	

This type of relationship can be applied down the scale with medium and poor quality silages. It can be scaled up slightly for wilted silages. The increased advantages of wilted silage according to our figures and those of Alder *et al* amount to an additional 0.25—0.5 lb. liveweight gain per day depending on the degree of wilting. The question of whether wilting should be advocated is not yet very clear. There is no doubt that wilting increases intake of silage and reduces effluent as well as increasing animal performance. However, if the silage is being supplemented with concentrates the differences in intake between wilted and unwilted silage decreases as level of concentrate supplements increase. Thus the extra return for the additional trouble of wilting and sometimes higher nutrient losses may not be worthwhile.

Feeding concentrate supplements with silage

On the question of feeding barley supplements with silage, considerable information is now available from the work of M. Drennan, V. Flynn, A. Conway, F. J. Harte and myself at Grange in the case of beef cattle and from P. A. Gleeson's work at Moorepark on cows and dairy replacement heifers. Responses to barley feeding with silage or hay are greater with young cattle than with older animals. For example, if one wanted to put on an extra ½ liveweight gain/day above that obtained from good silage one needs to feed only 2 lb. barley/day to weanlings, 3 lb to yearlings and 4 lb to heavy stores (Table 4). However, one has consequential reduction of 10% in silage intake with all these animals. This means that 11 animals fed concentrates can be fed on the same amount of silage that is required for 10 animals, if no concentrates are fed. So the cattle numbers wintered is increased.

These figures refer to situations where silage quality is good. When silage quality is indifferent or poor responses to barley feeding are somewhat greater.

TABLE 4: Barley requirements of weanlings, yearlings and store cattle to support additional increasing increments of 0.5 and 1.0 lb per day above those obtained from good quality silage fed alone.

	barley, lb. required to produce extra—					
	0.5 lb	L. Wt.	gain/day	1.0 lb	L. Wt.	gain/day
Weanlings		2			4½	
Yearlings		3			7	
Stores		4			10	

How much barley does it pay to feed? This is a different question. It depends on what is intended for the cattle at the end of the winter, the price of barley, price rise and cost of capital. In the case of fattening cattle, it appears from our results that if barley costs £31 per ton it doesn't pay to feed any barley unless the carcase price exceeds 2/9d. per lb., or £8-10-0 per live cwt. It pays to feed 4 lb. barley if the carcase price exceeds 2/10½ per lb., or about £9 per live cwt. If the selling price is expected to be £11 per live cwt., feeding 6-7 lb. barley per day appears to be economically sound if the farmer has housing accommodation for 15% extra animals. This is unfortunately only a rough guide. We need a more scientific and accurate approach such as the one which Mr. Andrew Conway demonstrated to this Association at the winter meeting last year. Suffice it is to say at this stage that

there is a lot of physical data which could be processed in the way Mr. Conway demonstrated last year where barley price, purchase and sale price of cattle and interest on capital are taken into account. This processing is needed immediately. A ready-reckoner can be produced using a computor which can be used by farmers and advisors to determine optimum levels of concentrate feeding for each particular farm situation.

Hay versus silage for beef cattle

Comparisons between hay and silage feeding were studied in detail at Grange during the past 10 years both in terms of animal performance and composition of liveweight gain. We found that weanlings put on weight faster if fed on well-cured hay than on simultaneously harvested silage. On the other hand, liveweight gains of store cattle were the same when offered either hay or silage. Where the hay was not well-made (i.e. in rainy weather) then all animals, weanlings included, grew faster on the silage. Liveweight gain per acre was always as high or higher with silage than with hay. In conjunction with these experiments we looked at the composition of liveweight gains in terms of lean, fat, bone, non-carcase tissues and 'gut fill'. Very big differences were shown here. For example, animals fed hay have heavier 'gut fills' than their mates fed on silage (Table 5). We found that cattle weighing 4½ cwt. when slaughtered had 30 lb. more 'gut fill' when fed on hay than when fed on silage. Similarly 6 cwt. cattle had 33 lb. extra 'gut fill' when fed on hay and 8 cwt. cattle had 50 lb. extra 'gut fill' when fed hay than when fed silage cut the same day. Because of this extra 'gut fill' the killing out percent of cattle fed hay was lower than that of animals fed silage.

TABLE 5: 'Gut fill' and killing out % of cattle fed either hay or silage.

liveweight of cattle	'gut fill' lb		killing out %	
	hay	silage	hay	silage
4½ cwt	88	58		
6 „	115	82	50.0	52.8
8 „	167	117	51.4	56.6

The most important difference from an economic viewpoint was perhaps that 70% of the liveweight gain was carcase in silage-fed animals while only 50% was carcase in hay-fed animals. Carcase gains per acre were always greater from silage than from hay. It is clear from this information that this information that silage-fed animals are at a disadvantage when sold on the hoof relative to

hay-fed animals. On the other hand, the silage-fed animals can be expected to kill-out better than those fed hay. Killing out % of silage fed animals is also improved by barley feeding. Feeding 4 lb. barley per day to finishing cattle increases the killing out % by approximately 1 lb. carcase per live cwt. Feeding 8 lb. barley increases the killing out % by an additional 0.5 to 0.75 lb. extra carcase per live cwt.

Effect of season of cutting on silage feeding value

In 1968 we decided to investigate the relative feeding values of silages cut at different seasons of the year. Eighteen acres were closed up in Spring and cut at the end of May, mid-July and mid-September giving three silages. Each silage was fed 0, 4 and 8 lb. barley per day to 8½ cwt. cattle. The cattle were valued at the start of the experiment and again at the end by store buyers and factory buyers. Animals were then slaughtered and carcases were graded by five factory graders. We were thus able to calculate the increases in value of live and dead animals brought about by feeding each silage with and without barley.

Cattle fed May silage gained 2.1 lb. per day during the whole Winter. (Table 6). When 4 lb. barley was added, this increased to 2.6 lb. per day and with 8 lb. barley they gained 2.8 lb. per day. On July silage fed without grain, they gained 1.6 per day. With 4 lb. barley added this reached 2.0 lb. per day, and with 8 lb. barley it reached 2.3 lb. per day. September silage was made in wet weather and had a lower feeding value. When fed September silage only, the animals gained only 1.1 lb. per day. With 4 lb. barley added they gained 1.6 lb. per day and with 8 lb. of barley they gained 2.1 lb. per day. The net result of this was that May silage on its own had the same feeding value as July silage supplemented with 4 lb. barley per day or September silage supplemented with 8 lb. barley per day. Again, May silage supplemented with 4 lb. barley was as good as July silage supplemented with 8 lb. barley.

TABLE 6: Effect of season of cutting on feeding value of silage fed to 8½ cwt. Friesian bullocks and the value of barley supplements.

	Liveweight gain, lb. per day		
Barley fed, lb. per day	0	4	8
May silage	2.1	2.6	2.8
July silage	1.6	2.0	2.3
September silage	1.1	1.6	2.1
July silage following grazing	1.1		

On this experiment, we fed about 20 tons of silage per acre cut. This produced 6 cwt. liveweight gain per acre when fed on its own, 9 cwt. when fed with 4 lb. barley per day and almost 11 cwt. liveweight gain per acre when fed with 8lb. barley per day. (Table 7).

TABLE 7: Liveweight gain per acre and carrying capacity per acre for 4 months from 3 silage cuts, with different levels of barley supplements.

lb. barley fed	Liveweight gain/acre, lb.	No. of cattle/ acre for 4 month winter
0	678	$3\frac{3}{4}$
4	1,002	4
8	1,211	$4\frac{1}{4}$

The performances obtained from these silages and the output per acre obtained are very high indeed, much higher than any of us would have thought a few years ago. There is no reason why these cannot be equalled or surpassed at farm level. Indeed, the results of the Department of Agriculture's beef recording scheme has shown that farmers can and do equal these performances. There are records of farmers getting almost 2 lb./day on cattle fed silage alone and 2.5 lb./day on cattle fed silage and 4 lb. barley per day. These results were obtained on large groups of cattle up to 80 head per group. So there is no doubt that this type of performance can be repeated, on the farm. The question is why more farmers don't get such results? The usual answer is that silage quality isn't good enough.

Husbandry and management of cattle

I believe that poor husbandry and management is often responsible for reduced performance. During the past five to ten years numbers of cattle wintered have increased several fold on many farms. These increases usually brought about a complete change in animal management and feeding. Generally speaking, we didn't scale up the quality of animal husbandry to match the increase in numbers. We must pay much more attention to husbandry and management in future. Examples of poor husbandry include having the silage face too high or too tight for self-feeding, or the silage barrier not properly attended, resulting in cattle having to work very hard for their silage and usually ending hungry. *Animals treated this way cannot express the full potential of the silage.*

Again, one often sees the situation where the lying area in loose housing is not properly bedded or that cubicle sizes are too small for the animals. These factors result in cattle lounging around the yard instead of going back to lie down as soon as they have eaten. Proper parasite control is often neglected. Indeed, on many farms it is almost impossible to look after dosing and lice control because there are no handling facilities for cattle. I believe every farmer should have a decent cattle race, crush and yards with access to the race from both sides so that cattle may be sprayed properly for lice. While on this point, a good cattle scales is a must on large beef farms and the smaller farmers might well club together to purchase a mobile scales. Perhaps, some of the farming organisations like Macra na Feirme might involve themselves in this area. It is important to know how your cattle are doing during the winter so that you can adjust your feeding properly. The day of guessing is over.

Cattle housing

The most comfortable housing is not necessarily expensive. The work at Grange and Moorepark over the past four years has demonstrated this point beyond any reasonable doubt.

The first experiment to compare housed with outwintered cattle was conducted by Michael Walshe at Moorepark during the 1965-66 winter. As you probably remember that was an exceedingly wet winter. In that experiment, cattle fed outdoors grew as fast as similarly fed animals wintered indoors. The experiment was repeated the following year at Moorepark with similar results. At Grange, our methods were somewhat different to those used at Moorepark. We compared weanling cattle (3½ cwt.) wintered on sawdust pads with and without wind shelter, with similar animals wintered indoors. Half the animals on each treatment were fed on a high plane, and half on a low plane. These experiments were conducted during each of the winters 1966-'67, 1967-'68 and 1968-'69. In every experiment, weanlings wintered on sawdust pads grew as fast as the indoor wintered animals. In 1968, we introduced the "topless cubicle" concept into this country. We compared 4 cwt. cattle wintered in "topless cubicles" with similar animals in cubicles in a conventional house. Again there was no difference in performance between the two wintering environments. Again, you will remember that the winter of 1968-69 was very wet. The "topless cubicle" was first used by a New Zealand farmer with dairy cows and found to be very satisfactory. Prior to our experiment, no one had compared the performances of cattle wintered in topless cubicles with animals wintered elsewhere and bullocks had never been wintered in them before. Since 1968, several dozen

farmers have set up open silo-topless cubicle units with as many as eighty cattle per unit.

This development, together with other forms of cheap housing such as kennels, and cheap silage such as buns, has opened a new door for reducing costs in cattle wintering. The conventional Dutch Barn with silo and lean-to costs £33-£40 per head to erect. A walled unroofed silo with topless cubicles costs only about 25% of this figure. This means a net saving of £2.5 per bullock per annum in housing costs when repayments on buildings over 20 years, and interest, are taken into account. This in turn means an increase in profitability of £2.5 per animal wintered. This development was badly needed. It allows a new category of farmer into silage and intensive wintering, because for many farmers the capital cost of going into silage was previously prohibitive.

Farming systems arising from silage adoption

Of course, the facility to make silage allows for intensification of grazing also. During the past five to ten years, several new intensive cattle systems have become popular. Most of them involve either May silage or autumn silage or both. None of these systems would be possible were it not for silage. Indeed, some new systems such as spring-calving, once-calved heifer beef and all-silage systems involve cutting at three or four different periods during the year. Particularly, in the case of beef systems, the quality of the winter fodder needs to be high. Silage has made these systems possible.

Further objectives and research

Despite the obvious improvements which the introduction of silage has made on many farms, we must not delude ourselves that everything is perfect in this area. Indeed, the position is still far from satisfactory.

After all, silage represents no more than 20% of conserved fodder and this is concentrated on less than 15% of farms. The benefits of silage or other improved conservation techniques must be got across to the rest of the farmers. To achieve this, silage-making and utilisation must be made more efficient. Even now, its costs are too high, and its utilisation is inefficient. Improvements in these areas will increase the appeal of good conservation to many more farmers, and improve the profitability of those already using it. The question is, which areas should be improved? the simple answer is, all areas, I feel that researchers must be fully aware of the costs of each factor separately in order to see what economies are possible. Costs of wintering a store bullock might be broken down as follows:-

Purchase price 8 cwt. bullock @ £9 per cwt.	£72
4½ tons silage @ £1-13-0 per ton	7.9
Covered silo + lean-to @ £33/head repaid over 20 years	3.3
Straw bedding @ 1/6 per bale	3.0
Transport and marketing charges	2.0
Vet. medicines	1.0
Losses at ½%	0.8
Interest on capital in livestock @ 9% for 4 months ...	2.3
Labour at feeding	1.0
Miscellaneous	1.0
4 cwt. 3st. barley @ £1-11-0 per cwt.	6.16
TOTAL COSTS:-	£100
Returns:	
10¼ cwt. bullock @ £10-10-0 per cwt.	107.10
Net return per animal	7.10

Cost of silage-making

Researchers must look at the cost of silage. This cost of £1-13-0 per ton includes fertilisers, machinery, rent and rates and polythene. We must look at each of these factors. In fertliisers we need to know how much phosphate and potash is required, and also the limit to nitrogen response. None of these are clear at present. Since the machinery for cutting and handling was designed, output of silage at farm level has increased immensely, but the basic designs of the machines have not changed. We need harvesters with higher outputs to suit present day conditions. Furthermore, too much grass is lost during the cutting and blowing operation and this grass is the most digestible fraction. If we could make 5% more silage by eliminating or reducing losses it would decrease costs by 1/6 per ton which would mean 7/- extra net profit per animal. If we can increase output of machines it would reduce costs of making silage giving a further increase in net profit. Machinery for handling grass at the pit is also a bottleneck when high output cutting is attempted. We are still mostly using the buckrake for this purpose —a machine designed some 30 years ago by Rex Patterson at a time when the type of outputs we look for to-day weren't dreamt of. There is certainly room for improvement here. Again, the grass species which we sow today are basically the same as those sown 50 years ago, at a time when no more than 10-20% of the farm was cut in any year. To-day the most intensive beef systems require that the equivalent of the whole farm is cut two or three times.

It would be a major co-incidence if the species used for the basically extensive pastoral enterprise several decades ago are still the best for our new systems.

Yet we know nothing about this subject. The species needed now, are those which respond well to nitrogen fertiliser, have high digestibility and palatability and maintain leafiness over a protracted period. The work which Vincent Flynn is initiating at present in this area is of prime importance.

Management of grass for silage

Even with the grass species in use at the moment, we have a lot to learn. We don't know how to manage them to produce high quality silage following grazing. In one of our experiments, July silage taken from a pasture grazed until the end of May had a lower feeding value than one cut at the same time from an area which had been cut in May. We need studies of plant physiology to help sort out this problem. There are several other problems of this nature to which we have no answer.

Reducing surface waste in silage

Again silage cost is very increased by waste at the surface of the pit. We need research to develop efficient techniques for sealing unroofed silos. A foolproof method of sealing an unroofed pit is perhaps the most pressing need at the present time. At Grange, we obtained promising results from the use of bituminous paints for sticking polythene to the walls. This must be developed further.

Cattle housing is another priority for research. The development of better and perhaps cheaper methods of constructing topless cubicles and kennels is very important. Until the last two years this was virtually an untouched area. I have no doubt that big improvements can be made. Again, the construction of walled unroofed silos needs to be looked at. It might be possible to use pre-fabricated slabs of some sort slotted into a groove in the ground, and the junctions between slabs sealed. Anyway, we must ask ourselves whether materials other than concrete might not be used in silos.

Methods of easy feeding of cattle is becoming increasingly important. Particularly on beef farms, the number of cattle carried per farm is increasing rapidly. We must ask whether self-feeding is still the best method of feeding large numbers of cattle. We need to look at easy feeding methods. The design of cattle feeding units must be re-appraised to allow for such aspects as easy feeding and reduced labour feeding.

Future cattle systems

In cattle housing it is vital that we think ahead; in the near

future, I can visualise a situation where two categories of beef farmer emerge. One will be a producer rearer, the other a beef finisher. The producer rearer may be the small farmer. The finisher is likely to be the bigger land owner. He may turn out five cattle per acre outside the E.E.C. and up to 10 cattle per acre within access to the E.E.C. where the ratio of cencentrates to beef prices are more favourable. A 500 acre farmer would thus turn out up to 5,000 cattle a year and require accommodation for perhaps 2,000 at a time. We must re-think designs for housing and silage accommodation, and methods of feeding for this man. An integrated approach is needed. It is unlikely that present day concepts wil be suitable. Perhaps, something on the lines of topless slatted floors and mechanical feeding of silage, and concentrates from a very large silo is the answer. It deserves thought!

We must also consider whether silage is the optimum method of grass conservation for this man. If he is feeding 50% concentrates in the ration, the amount of fodder eaten will be very much reduced. It may well be that some form of artificially dried grass will be desirable within the E.E.C., particularly for the beef finisher who is likely to be feeding 12 to 15 month old bulls or fast growing heifers.

Improving silage intake

Research on methods of increasing silage intake is also important. If animals could be encouraged to eat more silage concentrate feeding could be reduced or eliminated. Recent results from Hurley suggest that neutralisation of the silage juice prior to feeding increases intake by 20%. This and other areas such as using additives like formic acid to reduce fermentation needs to be studied. The importance of this point is likely to decrease, if and when we enter the farming society within the E.E.C.

Reduction in the cost of concentrate feeding is another area which demands research. If we could reduce the cost of concentrates by £4 per ton it would increase the profit per bullock by £1. We must look at concentrates other than barley. Concentrates such as feeding wheats, which are reported to yield up to 3 tons per acre, and beet pulp are all sources of enregy which might be exploited.

Lastly, the beast of the future must be fed and husbanded with well defined objects in view. He must be fed for some particular trade. It is the duty of the trade to tell the farmer what they want and when they want it. Invariably, the emphasis must be on high quality, because that is the only area where premium prices will be obtained.

The days of keeping options open are fading. If one is to maxi-

mise profits, one must become committed to supply a specified article at a specific time. It won't be possible to play the market. However, before becoming committed, the farmer must be armed with reliable information on the trade. This will also mean a committment by the trade to the farmers.

Finally, I would like to acknowledge the contributions of the unsung heroes of Agricultural Research. I am referring to the technicians and men who look after experiments, keep records, feed the cattle and make the winter feed. The technicians in the Agricultural Institute are dedicated men. To provide proper service they willingly give up much of their leisure time to work in the evenings and at week-ends. These men and the workmen have always had a consuming interest in the work on hand and act well beyond the call of duty to see to it that everything is correct. When you visit the station you seldom see them or hear them, but the situation which you do see is largely of their making. The research conducted by the Institute would not be possible without the full co-operation of these people. I know that I am speaking not only on my own behalf but also on behalf of all of my colleagues in research in paying public tribute to them for their valuable services.

Again, I wish to thank the Edwards Richards Orpen Memorial trustees for their invitation to deliver this talk.

THE IRISH GRASSLAND ASSOCIATION was founded in 1947 with the aim of promoting the knowledge of grassland production.

In 1961, the name of the Association was modified, in recognition of the fact that good grassland husbandry is intimately associated with, and inseparable from, good livestock husbandry.

The Association provides an opportunity for those interested in modern grassland farming to gather and interchange views and ideas; it provides a platform for forward-looking farmers and scientists to expound their ideas; it fosters and encourages research into the production and utilisation of grassland, and it aims to co-operate with organisations which have in common the improvement of grassland farming.

If you or your organisation would like to join the Irish Grassland and Animal Production Association, the Secretary, 24 Earlsfort Terrace, Dublin 2, would be pleased to hear from you.