DRAYCOTT

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OF THE

SOUTH WEST

AND

CENTRAL SCOTLAND

GRASSLAND SOCIETIES

No. 8 SUMMER 1966

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Editorial

Little needs to be said that is not obvious to the reader of this journal.

Firstly, it appears in yet another form as a properly printed publication.

Secondly, we have been favoured by some (not many) original contributions of which the poem by Jack Edwards of the Central Scotland Grassland Society obviously sets a new standard and may stimulate a whole number (?) devoted to bothy ballads of grassland.

Dr Castle has summarised the results of Questionnaire No. 2 and draws some rather interesting conclusions.

John Frame and Sandy Robertson report on visits to the British Grassland Society's winter and summer meetings.

Finally, Ron Harkess presents us with reviews of some of the papers published in the latest numbers of the British Grassland Society's Journal. Copies of the British Grassland Society Journals are kept in the College Offices in Ayr, Dumfries, Castle Douglas and Stranraer and can be borrowed at any time by members of the S.W. Society. Central Society members can borrow copies through their Secretary Graham Berrie.

As previously, the bulk of this number is taken up by full reports of the Societies' meetings. With about ten a year there is plenty of material available to fill our journal twice a year. There is still room for farmers' own comments, articles, queries and views.

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Treasurer: Dr Malcolm E. Castle, Hannah Dairy Research Institute, Ayr. (Prestwick 77292).

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Ayrshire:	J. K. Henry, Kirkland, Kirkoswald.	1965.
	R. Reid, Diddup, Saltcoats.	1964.
Dumfriesshire:	W.. F. Maitland, Crichton Royal, Dumfries.	1965.
	T. Hamilton, Briery Hill, Lockerbie.	1964.
Kirkcudbrightshire:	D. M. Tough, Conniven, Kirkgunzeon.	1965.
	J. Finlay, Rainton, Gatehouse.	1964
Wigtownshire:	R. Lammie, Lowdrummore, Drummore, Stranraer.	1965.
	A. S. Jupp, Bailliewhirr, Whithorn.	1964.

Advisory Officers of the West of Scotland Agricultural College

Alistair Campbell, 20 Miller Road, Ayr. (Ayr 64627).

John Thorburn, 41a Castle Street, Dumfries. (Dumfries 4174).

Robert M. Patterson, 82 King Street, Castle Douglas. (Castle Douglas 2743).

S. A. Ross, National Commercial Bank Buildings, Bridge Street, Stranraer. (Stranraer 2200).

Co-opted

I. Jennings, Nether Cleugh, Dalry, Castle Douglas.

A. E. Parkinson, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow, C.2.

G. M. Berrie (Secretary: Central Scotland Grassland Society), 6 Blythswood Square, Glasgow, C.2.

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Farmer members

J. Gallatly, The Mains, Menstrie, Clackmannanshire. 1965/66.

W. Caldwell, Mid Gartlocharn Farm, by Alexandria, Dunbartonshire. 1965/66.

A. Pollock, Cashley Farm, Buchlyvie, Stirlingshire. 1965/66.

A. J. K. Laing, Pollock House, Glasgow, S.3, Renfrewshire. 1965/66.

A. D. Lyon, Linnhead, Lanark. 1966/67.

N. Simpson, Largievrechtan, Rothesay, Isle of Bute. 1966/67.

T. Paterson, Wemysshill Farm, Overtown, Lanarkshire. 1966/67.

W. Andrew, Crossflat, Kilbarchan, Renfrewshire. 1966/67.

College advisers

C. G. Watson, 8 St. Mirren Street, Paisley. (Paisley 9151).

A. G. Malcolm, Beechwood, Stirling. (Stirling 4731).

Co-opted

A. E. Parkinson, West of Scotland Agricultural College, 6 Blythswood Square, Glasgow, C.2.

I. V. Hunt, Grassland Husbandry Department, West of Scotland Agricultural College, Auchincruive, Ayr. (Secretary: South West Scotland Grassland Society and Journal Editor).

THE CATTLER'S TALE

Just Dave MacPhee and I were sitting there,
Close by the ingle neuk, athawing out,
For having done our daily chores, a well
Deserved warm was our entitlement.
Both Mirk and Floss, Dave's collie dogs,
Had made themselves at home,
For though they usually bedded in the byre,
For once, because the day'd been long and cold,
A fireside rug was their idea of bliss.
With all the cattle in the court and sheep in-by,
The wind could blow with all its wrath.

So Dave began his tale
About the cattle up at Balnagair.

Sam Christie was the farmer then, a canny lad
Who kent the type of beasts the lowland feeder need,
But though he'd been to Perth and bought the grandest bull,
Somehow the calves would never thrive
Upon the pastures, which he tended with great care;
For when he took them to the mart
T'was only twenty pounds apiece he got,
For coats were red instead of black.
And all the billies pulled Sam's leg, about the beasties
He had brought from off the hills at Balnagair.

So home Sam went to try again, and find
The cause of his predicament.
He got the vet. and college lads, who brought along
Their long haired pals, to ponder over all the facts.
But all that came of this was that the pastures
Seemed to lack the vital micro-nutrients.

He ploughed a part of one grass park and planted there
What was to be the finest crop of tatties ever seen.
But Sam was not a black land man,
His heart was with the beasts and grass.
So thumbing through the catalogue
He picked the mixture that the boffins said
Contained the finest grasses for his type of land.
But when they grew, Sam rued the day
For almost overnight the cattle went from black to red
So once again poor Sam was back where he'd begun.

One night as he was searching in his desk,
He came across a leaflet which extolled
The merits of some stuff called Basic Slag,
And as he turned the page, he saw a table
Showing what the stuff contained.
Along with phosphates and with lime there were
Things that they called Trace Elements.

Would this then be the panacea that would
Solve the problems of his grass, to make it better feed
And give him stock that he could sell at
Twice the price, when he did take them to the mart?
He had heard tell of this stuff slag, and that
It did the trick on other farms.
So straight away he phoned Jack Duff, who said
He could put on a half ton to the acre
On his park within the week.
And so the dirty deed was done, and lo within
A moon, the grass and clover fairly thrived,
The beasts, they ate their fill of lush green leaf
And put on weight that Sam could scarce believe.

And when he took the beasts for sale, t'was
Forty pounds apiece he made, the finest bunch
They'd ever seen, and Sam, fair tricked with the cash,
Swore blind that ne'er again would he attempt
To put his beasts on parks that had not had a dose
Of that Black Magic — Basic Slag.

JACK D. EDWARD

THE FEEDING AND MANAGEMENT OF DAIRY COWS IN THE 1964 GRAZING SEASON

Survey results

By M. E. CASTLE

The Hannah Dairy Research Institute, Ayr

In order to obtain information on the feeding and management of cows at grass in 1964 a brief questionnaire was circulated to members of the South West Scotland Grassland Society. Returns were obtained from 71 farms which were distributed as follows: Ayrshire 15, Wigtownshire 30, Kirkcudbrightshire 17 and Dumfriesshire 9. This response from members was most encouraging and the committee are grateful to the farmers who completed the form.

Fertilizer nitrogen

At the outset, it is useful to know the number of units of fertilizer nitrogen applied during the year to the grazed swards since this figure gives some measure of the intensity of the grassland management. As expected, the use of fertilizer nitrogen was widespread and on 27% of the farms over 100 units/acre were applied in 1964. On 35% of the farms 51-100 units N/acre were applied and on the remaining 38%, 50 units or less were used. On average there was a tendency for the highest amounts of nitrogen to be applied in Wigtownshire and for the lowest to be applied in Ayrshire. There was, however, no clearcut relationship between the total amount of fertilizer nitrogen applied to the pastures during the entire year and the date of the first grazing or the length of the grazing season. On average, where more than 100 units N/acre were used the first grazing was 8 days earlier than where 50 units or less were applied, but undoubtedly other factors influenced this relationship and it would be unwise to place too much stress on it.

System of grazing management

The answers on this subject indicated that on 56% of farms only one system was used whereas on the other 44% of farms two or even three systems were used during the course of the grazing season. At some period of the grazing season, strip-grazing was the system on 39% of the farms, paddock grazing was used on 33% and extensive grazing on the other 28%. No indication was given of how long each system was employed on the farms which used two or more systems and it can therefore be safely concluded that all three methods were used about equally and that there is not one universally proved system.

Supplementary feeding

This is probably the most important aspect of the survey results and, up to a point, gives a measure of the confidence or lack of confidence which the farmers had in their grassland. The feeding of roughage to the grazing cattle occurred only on a very few farms. In June, July and August only 3% of the herds were given straw and in May the figure was 14% which included some hay-feeding in addition. Concentrates were, however, much more widely and frequently given. This is shown in Table 1 which indicates the percentage of farms on which concentrates were given to cattle during the various months of the grazing season.

Table 1. Number of farms giving concentrates to the cows expressep as a % of all the farms.

April	*May*	*June*	*July*	*August*	*September*	*October*
94	56	31	37	55	85	89

From this table it can be seen that complete reliance on grazing on all the farms was far from being achieved. In April, September and October concentrates were being given on 89% of the farms which is not surprising, but in May which is the month in which the highest quality herbage is normally available, concentrates were still being used on 56% of the farms. Fewer farms used concentrates in June than in May, 31% of the total, but this was nearly a third of the group surveyed and would still seem to be a high proportion. There was a tendency for less supplementary feeding of cows in the period May-August inclusive on the farms which used the highest amounts of fertilizer nitrogen compared with those where the lowest amounts of nitrogen were applied. On the farms where less than 50 lb fertilizer nitrogen/acre were applied the ratio between the number of farms on which supplements were used to the number where supplements were not used for 10:11. When 51-100 lb N/acre were applied the ratio was 10:12, and at rates over 100 lb N/acre the ratio widened to 10:14. It would seem that as more fertilizer was applied, there was a growing awareness of the value of the grass and consequently less reliance was placed on feeding concentrates to cows at pasture. Exact details of the amount of concentrates per cow were not given on all the questionnaires but 51 results were supplied. These replies showed that from nil to 25 cwt/cow were used during the grazing season from the date the cows first went out to grass during the day until the cows were first indoors day and night. On average concentrates were given at the rate of 5.5 cwt/cow with only relatively small differences between the amounts used in the four different counties.

Two main types of concentrates predominated during the grazing season; a balanced concentrate for milk production was used on 52% of the farms and a grazing concentrate on 43%,

with the remaining 5% feeding a straight cereal. A high proportion of the concentrates was purchased and although no exact figure can be given, it was greater than 44% of the total amount used.

Dates of grazing

The average dates when the dairy cows first went to grass in the spring and when they were housed day and night in the autumn are shown in Table 2.

Table 2. Average dates of first and last grazing and length of the of the grazing season (days).

	Wigtown	Kirkcudbright	Dumfries	Ayr
First day-grazing	29 March	14 April	18 April	20 April
Last day-grazing	27 Nov.	22 Nov.	6 Nov.	31 Oct.
Length of grazing season between these dates	243	222	202	194
Total number of days of complete day and night grazing	219	197	179	173

These results have been given on a county basis because of the obvious differences between the counties. Ayrshire, for example, had a grazing season of 194 days whilst Wigtownshire had one of 243 days. Similar differences can be seen when the total number of days of complete day and night grazing are considered, with Ayrshire having only 173 days and Wigtownshire 219 days. On average 8 days were employed for the changeover from the date of the first grazing day until the cows were out day and night. The number of days in the autumn when only day-grazing was possible varied from a minimum of 11 on the Ayrshire farms to 19 on the farms in Kirkcudbrightshire.

No definite relationship was found between the date when the cows first went to grass in the spring and the height of the farm above sea level. This perhaps is not surprising because so few results were obtained from farms at high altitudes. Most of the farms in this survey were low-lying with 85% of the total number on or below 300 ft and 96% at or below 400 ft. Within the 15 farms in Ayrshire, the date of spring grazing was clearly later on the higher farms than on the lower farms but an overall relationship for the four counties was obscured by other factors which had a more marked effect than altitude.

There was a definite tendency for farms nearer the sea (or the Solway) to have earlier grazing than farms further inland, but this relationship must be considered in the light of the fact that most farms in the survey were in a fairly narrow coastal belt. For example, 50% of the total number of farms were 2 miles or less from the coast and only 6% were more than 10 miles inland. However, for every extra 1 mile from the sea the date of the first grazing was retarded by an average of 2 days.

Discussion

The results obtained from this first survey amongst our members have yielded limited but useful information. The rates of fertilizer nitrogen application to the pastures were on average higher than the rates found in the fertilizer surveys conducted in 1960-62 in selected areas of S.W. Scotland, and this is probably a reflection of the greater awareness on the part of members of the Society on the effect which nitrogen fertilizer has on herbage yields.

Strip-grazing was used on 39% of the farms in our survey and this is a figure similar to that for the proportion of farms using electric fences recorded in the 1960-62 fertilizer survey. The use of the electric fence, and hence the control of grazing which this equipment allows, is thus far from being a universal practice. Because of this, the system of grassland management on 28% of the farms was an extensive one, which, from evidence in New Zealand, is not the best system of grazing if stocking rates are to be increased. No information on the density of stocking of pastures was collected in our survey but it is well known that the stocking density on a dairy farm is a vital factor influencing milk production and the gross margin per acre, and can even be more important than yield per cow, concentrate cost per acre, fertilizer cost per acre and even the price received per gallon of milk.

With the large and conclusive weight of experimental evidence now available which shows that the feeding of supplementary concentrates to cows at pasture is uneconomic, it is difficult to understand why such a high proportion of cows are still given concentrates when grazing. A typical survey conducted in England and Wales showed that in every month in the period April to October, over 90% of the herds were being given supplementary concentrates. The results in our own survey were not as high as that figure but even in May and June, the best grass months, 44% of the herds were receiving supplementary concentrates and on half of the farms the concentrates was a balanced one for milk production. The feeding of a straight cereal, a relatively cheap food, was not a common practice and was only recorded on 5% of the farms surveyed. It would seem, therefore, that there is still scope for reducing concentrate usage during the grazing season and also for adopting a cheaper feed such as cereal. The economics of concentrate feeding at grass are clearly linked with the density of stocking and there is evidence that until one cow is kept on 0.5 acre for the entire grazing season with some herbage for conservation taken from the same 0.5 acre the use of concentrates is not economic. It is doubtful if many farms in the survey achieved such a high rate of stocking.

The average weight of concentrates fed per cow during the grazing season was 5.5 cwt. If the average milk production per

cow was 500 gallons in this same period, probably an over estimate, then 1.2 lb of concentrates were used per gallon of milk produced. This is certainly better than the rate of 1.9 lb/gallon for the summer months found in a recent survey of 54 farms in S.E. England but gives scope for improvement if a target figure of 0.5 lb/gallon is to be reached. The feeding of 0.5 lb/gallon or less during the summer 6-months period is now being achieved economically on many successful grassland farms where high quality grazing is produced and an efficient system of grassland management is in operation.

The dates of the first grazing in the year and also details of the length of the grazing season found in the survey confirm the fact that there is a wide variation between different parts of the area covered by our Grassland Society. Although most of the farms surveyed were in a fairly narrow coastal belt it was clearly apparent, for example, that the farms in Wigtownshire had 49 more days grazing per year than the farms in Ayrshire. The amount of herbage available when the cows first went to spring grazing would vary quite widely from farm to farm, but allowing for this fact there was a marked difference between counties in the length of the grazing season.

The committee thank the 71 farmers who kindly completed the questionnaire and thus made this first survey a success.

B.G.S. SUMMER TOUR 1965

By S. A. ROBERTSON, Auchafours, Cowal

The third day of the B.G.S. Summer Tour was spent in the Lake District visiting two sheep farms, but apart from the fact that both had sheep for their main enterprise, they had little else in common.

The first farm visited, after a long but very interesting drive from Carlisle through a wide variety of different types of farming, was Messrs Wilsons, Glencoyne Farm, Glenrideling. This farm, which stretched from the shores of Ullswater to 3,000 feet above sea level, was a real hill farm with little improveable land.

Mr Wilson gave us a brief description of how he ran his farm, many of his problems being common to hill sheep farmers everywhere, and followed this with a demonstration of the most common sheep breeds and crosses of Westmorland. These were the Swaledale, the Herdwick, the Rough Fell, on the high ground and the Teeswater, and various crosses on the better land. The Teeswater in fact performs many of the functions of the Border Leicester in Scotland. The Herdwick is the traditional breed of the Lake District and indeed many of the local tenancy agreements stipulate that a certain number of Herdwicks must be carried. To Scottish eyes they seem an anachronism being hornless, course boned and slow

maturing. The lambs when born are nearly black but become lighter as they grow older.

When questions were asked it was said that Scottish Blackface had been tried, but found too soft, something which the Scottish contingent found very hard to believe, as they were certainly superior in all other ways to the local breeds.

A new sheep handling unit and barn had been built at Glencoyne by Messrs Wilson's landlords, the National Trust. Great care was taken by the Trust not only to ensure an efficient unit was installed but also that the buildings blended into the surrounding countryside, and this was achieved by building in a traditional manner with local stone. Since our visit their set-up won first prize in a competition sponsored by the C.L.A. and the Farmers Weekly.

After a vote of thanks most ably proposed by Dr Kellie Brooke of Newton Stewart, the party embussed and drove through magnificent scenery, very reminiscent of the Highlands, to Lake Windermere, where lunch was enjoyed at the Royal Windermere Hotel.

After lunch the party drove a short distance to Major Hedley's Calgarte farm where the main, in fact the only enterprise was the intensive stocking of cross Suffolk lambs produced from grey faced ewes, mostly Swale or Rough Fell crossed with Hexham Leicester or Teeswater rams.

One sixteen acre field was carrying 160 ewes and 240 lambs and another 13 acre field was similarly stocked. As forward creep grazing was being carried out on these fields, the sheep and lambs were confined to a third of each and the density of sheep had to be seen to be believed. The rest of the farm was heavily set stocked. 900 ewes and 1400 lambs being kept on 137 acres of which 66 were shut up for silage for winter feeding.

We were assured that this left a margin of £20.1 per acre over variable costs. Many people felt this was scarcely sufficient to cover fixed costs and leave a profit, and certainly the lambs lacked bloom and appeared to suffer from hysteria. It seemed very doubtful if many of them would be sold fat.

This was followed by a discussion with a panel including Professor Cooper of King's College, Newcastle and Dr Spedding of the Grassland Research Institute, Hurley and topics ranged from forward creep grazing to vacuum silage.

The party then returned to Carlisle, calling on the way at Major Hedley's stud of magnificent Arab horses and then passing through some more beautiful and varied scenery.

A buffet supper provided generously by Shell concluded the day.

The organisation could not have been bettered with split second timing and no hitches. As our hosts said, after a day during which the sun shone continuously, the most difficult part had been arranging the weather.

On Tour

THE PLACE OF SOWN PASTURES

Report of the delegate of the S.W. Society of the 1965 Winter Meeting of the British Grassland Society

By JOHN FRAME
Grassland Husbandry Department
West of Scotland Agricultural College, Auchincruive, Ayr

Presidential address.

The outgoing president of the British Grassland Society, Professor P. T. Thomas, Director of the Welsh Plant Breeding Station at Aberystwyth took as his theme the impact of the plant breeder on grassland production. He criticised the general management conditions usually applied to bred varieties. A major fault in sowing was the use of a seed mixture with a wide range of constituents ostensibly as an insurance that something or other would grow. As a result, the production potential of bred varieties was swamped. He also stressed the importance of a really high level of mineral and biological fertility and of keeping a clean bottom on the sward since the effect of an accumulation of decayed herbage is to lower the photosynthetic efficiency of the sward. Repeated cutting or grazing at a late stage of growth development was also detrimental to yield and persistence. Experimentally under ideal conditions, he reported that free-tillering varieties such as S.23 perennial ryegrass could achieve 20000 lb/acre of dry matter (i.e. 4 times the normal production from a grass/clover sward). Since acceptibility, digestibility and voluntary intake were other important features apart from yield, the plant breeder looked to the animal nutritionist for guidance as to what feeding value properties it was desirable to incorporate into bred varieties. It has been noted that whereas high protein grass boosted by fertilizer nitrogen appeared to be eminently suitable for milk production, a clovery sward seemed to have advantages in meat production. At Aberystwyth they were attempting to breed a clover which could still efficiently fix nitrogen from the air even under high levels of fertilizer nitrogen. (At present, the application of fertilizer nitrogen to a grass/clover sward results in clover being shaded out and its nitrogen-fixing ability impaired). They were also trying to breed a clover mainly for its nutritional value as a companion to grass, able to thrive under fertilizer nitrogen and forget about its traditional nitrogen-fixing role. The other futuristic approach in grass breeding was to cross-breed species from various parts of Europe and elsewhere since derivatives sometimes showed combinations of desirable properties not present in the parental material. As examples, he cited crosses between British and North African tall fescues and crosses between tall fescue and Italian ryegrass. With the latter cross it was hoped to produce a perennial plant with the yield potential of tall fescue and the quick establishment and palatability of the Italian.

Breeding and blending

H. H. Rogers, Plant Breeding Institute, Cambridge, discussed the work and views of a plant breeder. When producing new herbage varieties, the breeder has to take into account the various factors which control sward production such as climate, soil, etc., but in particular he pays attention to the factors over which he has most control. These are plant type and management:

Plant	Management practices
Morphological characters	Cutting or Grazing: Intensity; frequency; time of year; method.
Physiological characteristics	± Companion grass.
Chemical composition	± Legume.
Digestibility : palatability	Duration of sward.
Response to fertilizer	Fertilizer applied.

He thus produces herbage varieties capable of achieving maximum production only under a specified set of conditions. So far the impact of bred varieties on grassland production has been small. Several reasons are apparent. Bred varieties form a low percentage of the herbage seed use in Britain and they are often blended with other varieties in so many combinations and permutations that their potential production is suppressed. This indiscriminate blending appears to be done mainly as a buffer against poor management since " shotgun " mixtures will usually give some grass even under gross mismanagement. When sown alone, the bred varieties are often managed under conditions totally different from those for which they were bred. He concluded that it was management rather than genetic potential which limited the production of bred varieties and in a pointer to the future, stated that new varieties will have even more clearly defined characteristics of growth and quality and optimum conditions of management than in the past. It will therefore behove the farmer to view individual varieties in the same way as individual varieties of cereals, i.e. grow and utilize them as special purpose crops be they for grazing or for conservation.

Formation and maintenance of pastures

Dr A. H. Charles, Welsh Plant Breeding Station, Aberystwyth, dealt with the dynamic nature of swards, dynamic in the sense that the proportions of herbage species and varieties making up the sward changed in response to the management conditions applied. Herbage plants compete with one another for moisture, light, air and nutrients and this competition is aggravated when sown under a cereal cover crop. In his experiments he noted that for every 100 seeds sown, only 25 established two months after sowing whilst eleven months after sowing only 10 were left. These 10 would be

the ones most suited to survive the particular soil conditions and management given during the establishment phase. If a different management was then applied, these 10 may not necessarily be the best types to have. He quoted experiments in which a ryegrass sward made up of S.22, S.23 and S.24 became 80%, S.22 Italian ryegrass after eleven months even although only 25% of the viable seed sown was Italian. Older swards proved to be equally dynamic. A sward with 80% Italian ryegrass at the start of the first harvest year was changed to one with 40% Italian by the third harvest year when sown with S.23 and S.24 perennial ryegrass, yet when sown alone it remained vigorous and was still in full production after five years. When the sward has frequently grazed, S.23 became dominant. Similar changes in established swards have been noted in the past, especially by Martin Jones. In a series of classical experiments he showed how the composition of a sward could be changed at will by a selected grazing management. By grazing heavily when a herbage species was making active growth, it could be checked whereas by grazing leniently it could be encouraged. For example, hard grazing in spring and lenient in summer checked grass growth but encouraged clovers whereas lenient grazing in spring and hard in summer encouraged grass growth and checked clovers. Charles postulated that poor soil conditions and bad management led to a plant population with a low yield potential since under such conditions the population left was one adapted for survival rather than production. Only if this low-yielding population is replaced and the growth environment made more favourable can production be maximised. The plant breeder is thus faced with the problem that if he breeds a variety for a particular set of conditions, the variety will be of little use unless these conditions are met. Thus varieties bred for specialized use such as high nitrogen fertility will be very susceptible to mismanagement. The alternative is to breed a variety suited to varying levels of management but this implies a lower ceiling of production.

The need of a fresh approach to the place and purpose of the ley

Dr E. K. Woodford, Director of the Grassland Research Institute for Britain aroused controversy with his paper in which he touched upon several futuristic aspects of grassland husbandry. He drew attention to the lack of precision in terms of grassland nomenclature. For example, the word " ley " was hitherto used as a pivotal grass sward meant for ploughing up before taking a cereal crop. It is now used loosely to mean a grass sward down for varying periods of time, e.g. short term, long term. He suggested that the use of " ley " be restricted to mean a system of arable husbandry and that grass swards be termed more definitely e.g. an S.24 ryegrass sward or an S.48 timothy sward. In this connection he also pleaded for single variety swards of bred varieties sown down for special purposes and managed accordingly.

He went on to discuss the biological efficiency of pastures, that is, the maximum use of environmental resources. Since grazing was essentially a biologically inefficient process, he predicted that grazing would eventually become restricted to the poorer non-arable land, whilst the arable land would be used for the relatively biologically efficient cereal cropping and grass conservation. With this change, cattle and sheep would be kept under intensive indoor systems. This concept was later challenged by the audience in the grounds of economic efficiency.

He also pointed out the need for research into the use of stoloniferous and rhizomatous grass species which were usually shy seeders. If the urge to produce seed was replaced by the urge to produce herbage, it would be worthwhile sowing out such types vegetatively rather than traditionally by seed. Vegetative propagation made an attractive sowing method, however, only if the grasses persisted for many years. There was thus need to establish what factors controlled the life span of a grass plant.

A farmer's view of the ley

A. S. Cray, Southdown Farm, Hampshire discussed the advantages and disadvantages of leys from a farmer's point of view and contrasted their characteristics with those of permanent pastures. He defined a ley in the words of Stapledon, *viz.* " a sward that was established as a crop with a special purpose in mind and is treated as a crop " whilst a permanent pasture was a sward at least 20 years old which was in equilibrium with its management and environment and whose constituents bore little relation to the original seed mixture. The main problem in choosing between these swards is whether or not to plough up the permanent pasture and establish a ley since this is easy relative to the long term project of allowing a ley to become a permanent pasture. Obviously the deciding factor is the level of productivity of the old pasture and this requires some form of grass recording to assess its output. If output is satisfactory, it should not be ploughed up unless it is desired to establish a particular special-purpose ley or as part of a cropping rotation. Apart from lime, fertilizers, drainage etc., the productivity of the old sward is governed by the proportions of productive species such as perennial ryegrasses in the sward. Soil type, class of stock to be carried and topography of land are other factors to be considered before assessing the value of ploughing up. Good permanent pasture could be as productive as a ley although production from the ley is more flexible in that it is usually spread over a longer period of the year.

He concluded by stressing the importance of biological and mineral fertility in maintaining productive leys and permanent pastures and noted that with levels of fertilizer nitrogen of 180-200 units/acre/year on his farm, the sown grasses persisted. At 60-80 units, they seemed to disappear after the third year.

Grassland problems in Chile

S. Campbell, a specialist Grassland Adviser with the National Agricultural Advisory Service at Reading, spoke of his experiences whilst on secondment to Chile — he was stationed in the southern temperate zone which was typically "ryegrass" land, although many of the swards requiring improvement were "bent grass" (Agrostis) swards sown out on burnt forest land. There were also problems of reversion of pasture to scrub, erosion because of continuous wheat cropping and the high cost of fertilizers. However, the main problem basic to the improvement of grassland was understocking with consequent under-utilization of the grass-growth and hence rapid botanical deterioration. The land/stock ratio was in the region of 4 acres per animal unit.

SOUTH WEST SCOTLAND GRASSLAND SOCIETY

Report of Proceedings of the 4th Annual General Meeting at the Hannah Dairy Research Institute, Ayr, on 9th November, 1965

1. Minutes

The Chairman, Mr D. B. Jamieson, opened the 4th Annual General Meeting of the Society.

1. **Minutes**

The minutes of the 3rd Annual General Meeting, as published in *Greensward* No. 6 were approved and signed.

2. **Matters Arising from Minutes**

None.

3. **Treasurer's Report**

Dr Castle referred to the audited statement of accounts for the last financial year, copies of which had been circulated to members. The balance on hand increased from £150 at the beginning of the year to £328 on 31st May, 1965. The surplus was not so great as it would appear because the statement included the income but not the expenditure for the 1965 summer tour. This tour to Northern Ireland resulted in a profit of £30. The committee decided not to refund this money to the members, but to put it in a "Tour Fund," which could cover possible losses on future summer tours.

The treasurer drew attention to the increase from £5 to £41 in the grants to members attending B.G.S. meetings. The committee considered this an important item of expenditure, since attendance

at these meetings allowed members to make valuable contacts and to bring back ideas.

On 9th November the balance on hand in the society's account was £311.

4. Secretary's Report

Mr Hunt reported that 18 new members had joined the society over the past year, and the membership now stood at about 275 after allowing for resignations and deaths. He announced that publication of the membership list of this society in the winter issue of the journal and that of the Central Scotland Grassland Society in the spring issue was being discontinued due to pressure of space.

The winter issue of the journal had been sent to the printers, but because of printing delays would not be available to members until about mid-December.

5. Chairman's Report

Mr Jamieson reported that the society had had an active and successful year. On both the financial side and the membership side the society was " in a good state of health," for which he gave credit to the secretary and treasurer.

In a tribute to the late Professor Hendrie, Mr Jamieson said that his death during the year had been a severe loss to the society, of which he was a founder member and one of the originators. During his term of office on the committee his contributions were much appreciated as were the facilities he made available to the society.

The problem of the poor attendance at some meetings of the society was the next subject dealt with by the chairman. He asked for members' views on the reasons for this, and for ideas to improve attendances.

The highlight of the society's activities during the year was the summer tour in Northern Ireland. This was a great success despite the poor weather. Mr Jamieson thanked Dr Lowe and other members of the Ulster Grassland Society who arranged the programme for this tour, and Mr Hunt and Dr Castle, who made the detailed arrangements.

Mr Jamieson proposed a vote of thanks to Mr Hunt and Dr Castle for their industrious and dedicated attention to the running of the society.

The adoption of the financial report was then proposed and seconded.

Mr Hannah asked why the membership subscription should continue at the present level when the balance in the society's accounts was accumulating at the rate of about £100 a year. He suggested that such a large reserve was unnecessary since the college and the Hannah Institute contributed largely to the running of the society both in time spent and facilities provided. The annual subscription could, in his opinion, be considerably reduced.

Dr Castle replied that when the society began the committee considered it sound policy to accumulate funds to the extent of the total annual income, and he agreed with this policy. A reserve was necessary to cover an unexpectedly large expenditure within any year, and also to cover increasing costs. For example, the committee had been discussing the possibility of printing the journal instead of photographing it as at present. This might increase journal costs from the present £75 to £150. Dr Castle then asked for suggestions as to ways in which the society could usefully spend more of its funds. He, as treasurer, did not think that the subscription should be reduced, and in this view he had the full support of the committee.

The chairman thanked Dr Castle and asked Mr Hannah if he wished to make a motion on the question of the subscription.

Mr Hannah replied that it was wrong that the committee should be in the position of having a lot of money and seeking ways of spending it. He did not make a formal motion, but asked the committee to look into the matter and to take action to prevent further accumulation of funds.

Mr Berrie agreed that it was wrong to accumulate a large reserve, but did not favour a reduction in the subscription. He suggested using the money to further the educational aims of the society, giving as an example the purchase of more publications similar to the one recently sent to members.

6. Election of Committee

The chairman announced that no nominations for new committee members had been received, and once again the committee had to take it upon themselves to approach people. He thought it much better for the administration of the society if nominations came from the members themselves, and asked them to remember this next year.

The four committee members retiring at this time were:—

Ayrshire — Mr W. Gray, Park Farm, Kirkoswald.

Dumfriesshire — Mr A. Smith, Gotterbie, Lockerbie.

Kirkcudbrightshire — Mr T. L. Howie, Cubbox, Balmaclellan, Castle Douglas.

Wigtownshire — Mr S. A. McColm, Cairngarroch,

The new members nominated by the committee and duly elected were:—

Ayrshire — Mr J. K. Henry, Kirkland, Kirkoswald.

Dumfriesshire — Mr W. F. Maitland, Crichton Royal, Dumfries.

Kirkcudbrightshire — Mr D. M. Tough, Conniven, Kirkgunzeon.

Wigtownshire — Mr R. Lammie, Lowdrummore, Drummore, Stranraer.

Mr Jamieson proposed Mr R. W. Montgomerie, the retiring vice-chairman, as chairman for 1965-66, and this was unanimously agreed. The committee's nominee for vice-chairman for 1965-66 — Mr J. Marshall, Hardgrove, Carrutherstown, Dumfries, was also elected.

Dr Castle and Mr Hunt were re-elected treasurer and secretary.

7. **Any other business**

Mr Jamieson, who remained in the chair in the absence of the new chairman, Mr Montgomerie, thanked Dr Smith, the director of the Hannah Institute, for granting the society the use of the hall for the meeting and also a room for the committee meeting earlier in the day.

Mr Finlay proposed that in future nominees for vice-chairman should be retiring committee members and not ordinary members of the society as at present. He considered that this would ensure a greater continuity in the committee. Mr Jamieson said that this suggestion would be noted for discussion at the next committee meeting.

Members were reminded by Mr Jamieson that the society subsidises the expenses of one member to attend the B.G.S. Winter meeting in London in December, and asked anyone interested to contact Dr Castle or Mr Hunt.

The meeting closed with a vote of thanks by Mr Berrie to Mr Jamieson for his excellent work as chairman of the society over the past two years.

PROFIT FROM GRASS

The guest speaker at the annual general meeting of the South West Scotland Grassland Society held at the Hannah Dairy Research Institute on 9th November, 1965, was Mr V. H. Beynon, Senior Lecturer in Agricultural Economics at the University of Exeter.

In his address, Mr Beynon discussed the present performance and future prospects of grass. Over the years, most agricultural economists have drawn attention to the low level of utilization from British grassland, and this has been confirmed by some agricultural scientists. However, the scientists are usually remarkably confident in the ability of grass and conserved grass products to make a major contribution to the feeding of ruminant stock.

Apart from the large acreage it occupies, grass has long held a pre-eminent position in British agriculture. This is evident from the resources lavished on it, e.g. a research institute devoted to grassland problems, specialist grassland advisors in the advisory service, etc. Mr Beynon listed a number of questions raised by the lavish attention to grass. The most important and urgent of the questions was—" Have farmers responded to the advice on grassland offered to them, and, if so, are they financially better off ? "

Grassland recording

The speaker believed that, apart from endless meetings and conferences, the only practical action which has been taken to interest farmers in grassland is grassland recording. The chief reason for this is probably the need to determine the contribution of grass to the feeding of ruminant livestock. If this is achieved it will help to dissipate the apathy shown by many farmers towards grass. However, many pitfalls must be investigated if recording is to be profitable.

Most methods of grassland recording involve the assessment of utilized starch equivalent (U.S.E.) and cow grazing day equivalents. These give reasonably consistent results when considering the entire grassland on a farm, but difficulties arise when comparing individual fields. Variations in management from field to field are the main cause of these difficulties.

Mr Beynon next discussed the evidence on whether or not a high performance, in terms of U.S.E. or cow-grazing days, is closely correlated with high farm profits. A study made some years ago showed a positive relationship between gross margin and U.S.E., but other factors detract from the U.S.E. method. For example, additional production of meat or milk often involves a proportionately higher intake of nutrients. However, the magnitude of the allowance to be made for this is difficult to determine, since each cow appears to have its own response curve. Thus, high yielding herds need not necessarily use more S.E. per gallon of milk

produced. Another drawback to the U.S.E. method is that two foods with the same energy value may have the same value for maintenance but different values for production.

Further weaknesses in most grassland recording methods arise from the fact that the results of converting pasture into livestock and livestock products depend on three important factors, namely:—

(1) The quantity and quality of grass available.

(2) The proportion of the crop which is harvested.

(3) The efficiency with which the livestock convert the grass into the end-product.

Considerable differences can be recorded between two identical fields because of variations in stocking density and conversion efficiency. The contribution of grass cannot be accurately measured unless the field is adequately stocked.

Because of these weaknesses, grassland records should be interpreted with care, and increasing reliance should be placed on financial as well as physical records.

Present output from grassland

In Mr Beynon's opinion livestock production from grass in Britain compares unfavourably with that in most western European countries. Even Norway with all its natural disadvantages derives more nutrients per acre from grassland than does Britain.

Many proponents of grass claim that farmers have improved grassland considerably, with a consequent increase in livestock production. Certainly, liquid milk consumption has increased by 75% since pre-war, and milk for manufacture by 70%. We have always been self-sufficient in liquid milk, but our self-sufficiency in dairy products is now 45% compared with 30% pre-war. Meat production in Britain has increased by over 86% in the same period, so that 67% of the meat consumed is home-produced compared with 47% previously.

Although noteworthy, these achievements have not been accomplished entirely from our own resources. British farmers appear to have been relying heavily on home-grown as well as imported concentrates, and also to have used a bigger grass acreage and applied more fertilizers. In addition, the livestock population has increased even more rapidly, so that the average stocking rate is now 1.63 acres of grass per cow equivalent compared with 1.85 acres 10 years ago. The present stocking rate is still low compared with the Netherlands figure of 1.15 acres, and the gap between the U.S.E. figures for the two countries—below 16 cwt/acre for Britain and over 26 cwt/acre for Holland—remains wide. Never-

theless, grassland contributes 50% of the nutrient requirements of all livestock in Britain, the figures ranging from 0 for pigs and poultry up to 90% for sheep, with dairy cows at over 50%. Milk production is therefore still very dependent on purchased concentrates.

The proportion of home-grown corn used in animal feed in Britain has been increasing so that 80% of our barley and 50% of our wheat is now used for this purpose. This has occurred at a time when the substitution of concentrates with the cheaper home-grown forage crops has been commonly advocated, despite the fact that the relationship of livestock prices to concentrate costs has not worsened over the past decade. With milk production this relationship has changed little, while beef prices have shown a marked improvement in relation to feed costs. Thus, although lower unit costs of production would be obtained on many farms by substituting grass and grass products for concentrates, a fall in output and profits might result. Dairy farmers realise that milk prices are sufficiently high to justify the purchase of certain quantities of concentrates, particularly since these enable expansion beyond the limits imposed by farm size. Another factor is that grass does not now have the same cost of production advantage. Grazing is still a cheap source of nutrients, but no longer the cheapest, while hay and silages have little production cost advantages over other crops. In the past ten years, barley has emerged alongside grazing as the cheapest source of starch, and barley production has increased 20% compared with only 1% and 7% for temporary and permanent grass respectively. Grassland experts have consistently claimed that grass can contribute twice as great a yield of nutrients per acre as barley. However, a recent investigation of milk costs in South-West England showed that grassland had the lowest yield of nutrients and kale and mangolds the highest over a range of crops. At the moment, barley has a marked advantage over grassland, especially as it is easy to store. A greater reliance on grassland, with its present comparatively low output per acre, must strictly limit the levels of livestock production and profit.

There is no evidence to suggest that the poor performance of grassland is due to a failure to adopt improved methods. On the contrary, the acreage of temporary grass has increased by 70% since pre-war, the tonnage of silage has increased, and the average dressings of the three main fertilizer nutrients have increased. The increase in fertilizer usage has enabled the stocking rate to be increased though it is still low compared with the Dutch figure. In Mr Beynon's opinion the wide disparity between the British and Dutch U.S.E. figures is directly attributable to under-stocking and, consequently, under-utilization of grass on British farms.

The high level of U.S.E. output from Dutch grasslands probably results from the heavier nitrogen usage and higher rates of stocking, but the question arises whether the adoption of these

Dutch practices would raise profits on British grassland. Mr Beynon described an investigation of the factors influencing gross margin, which was conducted on farms in the Exeter province. The results from this showed that 75% of the variation in profit was associated with five factors. These were, in order of importance, stocking rates, yields per cow, concentrates per acre, fertilizers per acre and milk price per gallon. Further analysis of the results showed that almost 50% of the variations in stocking rate was associated with yields per cow, concentrates per acre and fertilizers per acre together, and all three were equally important. However, of even greater importance was the fact that half of the variation was left unexplained. Mr Beynon suggested that this could be due to under-stocking on the farms investigated with a consequent under-utilization of grass, which he held to be common on many British farms.

The farmer is too often given advice on grass production, with particular stress on fertilizer usage, but the question of utilization is neglected. Although fertilizer applications contribute, on average, only about 6% of the cost of producing milk, excess fertilizer usage in isolation could reduce profits. Indiscriminate advice on fertilizers is wrong unless accompanied by advice on grass utilization.

Future prospects for grass

For some time Mr Beynon has held the belief that the skill required to produce and utilize grassland has been under-estimated, and that this is proved by the small number of successful grassland farmers in Britain. He has been criticised for this statement and assured that there are groups of such farmers all over the country. Why then has this not been reflected in a better U.S.E. figure for British grassland ?

Farmers appear recently to have acquired confidence in the ability of grazing to produce milk, and fewer now hand-feed during the summer months. However, many remain disappointed in the production obtained from conserved grass products, and have contemplated relying to a greater extent on cheap cereals for maintenance and production.

New developments in conservation may reinstate this grass crop. For example, Mr Beynon mentioned the experiences of a farmer in N. Devon who had 40 cows and followers on 40 acres and made vacuum silage for the first time in 1965. He made 800 tons of silage by this method, and the material from the first pack was giving maintenance plus 4 gallons in September. If this is the long-awaited breakthrough in conservation, we can look forward to a time when winter milk will be as cheap as summer milk. Otherwise barley will be substituted for hay and silage on an increasing scale, and conservation will be limited to small quantities of a high quality product such as dried grass.

Q 4: What would be the effect on the agricultural industry of Britain if the density of stocking advocated by the speaker was achieved ?

A 4: If higher stocking rates became generally applicable, the livestock population of this country would not necessarily be increased. The industry could make a major contribution to the balance of payments by expanding the acreage of barley so as to reduce the imports of coarse grains. Rather than increase the livestock population, the aim should be to achieve a greater measure of self-sufficiency for the existing livestock population.

Q 5: Is it not a fact that the U.S.E. output of grass is underestimated, because the calculation gives full value to the other feeds and attributes only the difference to grass ?

A 5: This is true, but whether the poor U.S.E. performance of grass is due to lack of production, to bad utilization, or the over-feeding of concentrates is immaterial. The U.S.E. figure for Britain is bad even if it is known to be due to over-feeding concentrates. The aim should be to prevent this, and allow grass to produce to its full capacity.

Q 6: What increase in stocking rate should be suggested to the average farmer seeking a reasonable profit without encountering all the difficulties inherent in intensive grassland farming ?

A 6: Considering the Dutch figure of 1.15 acres per cow equivalent, it is reasonable to set a target of 1.25 acres per cow equivalent for Britain. This would be a considerable improvement, and would contribute much to the achievement of the target for agriculture in the National Plan. To achieve this target requires a 30% improvement in the U.S.E. figure for Britain by 1970, i.e. an increase from the present 16 cwt U.S.E. per acre to over 21 cwt per acre in 5 years.

At this point in the discussion, support for Mr Beynon's remarks on the importance of stocking rate in determining grassland output, was given by Dr Castle, who quoted some results from a recent experiment at the Hannah Institute. In this experiment two rates of stocking were compared—6 cows on 5.6 acres of grass for the summer, and 6 cows on 3.5 acres for the same period—giving a 60% difference in stocking rate. The milk yield at the low

stocking rate was 530 gallons per acre, and at the high rate 700 gallons per acre. By simply altering stocking rate and nothing else, milk production per acre was increased by 32%.

Q 7: Is it right to grow more barley on grassland farms in the west, especially after the experiences of the last two harvests? Would it not be better to have more grass and more stock producing more milk or beef in the west, and leave barley growing to farmers in the drier eastern areas?

A 7: The westward spread of barley growing in Britain in the last few years has been caused by an imbalance taking place between cereal prices and livestock prices, which would eventually even out in a free market. Taking everything into consideration, far more regional specialization of the different crops is desirable and should be expected.

Q 8: Has Mr Beynon any figures to show the fantastic wastage arising from the over-feeding of concentrates and the consequent under-utilization of grass?

A 8: A considerable quantity of concentrates is undoubtedly wasted, but just how much is difficult to estimate. In a recent investigation records were kept for individual cows at grazing, and the results showed that the better performers were giving upwards of 5 gallons from grass alone in May, June and July. These results show clearly that the full potential of grazed grass has not yet been exploited.

Mr J. J. M. Hannah proposed a vote of thanks to Mr Beynon for addressing the Sociey.

Report by David Reid.

SYSTEMS OF FEEDING COWS

A. S. Foot

Deputy Director, *National Institute for Research in Dairying (N.I.R.D.), Shinfield, Reading*

Glenluce, 8th December, 1965.

Mr R. W. Montgomerie, chairman of the society, introduced the speaker as a member of one of the most important centres for research into the problems of the dairy farmer in Britain, who had travelled widely advising on the establishment of dairying in many parts of the world.

A. S. Foot

Before coming to speak to the society, I looked up that marvellous source of information about Scotland and Scottish farming, the Transactions of the Highland Society. This year is something of a centenary because in 1865, the first volume of the new series was published and a field experiments committee set up. Reading through that journal, a sense of excitement in Kirkcudbright and Wigtownshire was discernible. Steam ploughing was new; Rev. Patrick Bell was awarded £1000 for his discovery of the reaper; fertilizers were in the news.

Dr Anderson and his staff were busy analysing feeding stuffs with results expressed as percentage of water, oil, albuminoids, ash, etc., etc. The names are slightly different nowadays but the results, in the absence of any knowledge of their meaning, seemed just as useless then as they are nowadays. There is just the same sense of excitement nowadays as one looked into the future. The large unit seemed to be imminent especially in Kirkcudbright and Wigtownshire, both counties having consistently shown over the years higher numbers of cows/farm than other parts of Britain.

Over the last 30 years, milk prices have increased by 300% whilst milk costs as feed and labour have increased by up to 600%. How was the effect of this unfavourable balance to be met ? Two methods were obvious (a) Switch feeding from dear concentrates to cheaper grass products, (b) Increase cow numbers/man. Herd size throughout Britain was increasing at approximately one cow per man per year. The average herd size was now 26 in England and Wales but over 40 in South West Scotland. Three trends were to be seen in feed handling:—

(a) Return to the old idea of group instead of individual feeding.

(b) Tendency towards *ad lib* feeding of bulky feeds and in some instances even of concentrates.

(Ad lib. = the full term is *ad libitum* and means feeding without rationing or restriction, allowing stock to help themselves until their appetites are fully satisfied).

(c) Tendency to move away from strict rationing according to production. Dr Mackintosh, a former director of N.I.R.D. was one of the leaders in the movement towards strict rationing according to production (e.g. 3½ or 4 lb feed per gallon milk) and in his day did much to prevent the waste of concentrates. Now, we have newer knowledge which points to a need for varying the ration according to many circumstances.

At present the stress is on feeding according to the energy supply of the feeding stuff and the energy requirement of the cow.

The present use of nitrogenous fertilizer or high clover herbage seemed to ensure plenty of protein but a bottleneck in the amount of energy in the feed. This was affected in three stages:—

(a) The amount of feed which the cow would eat.

(b) The digestibility of the feed, i.e. the amount of the food eaten which the cow can absorb.

(c) The efficiency with which this digested food is converted into milk.

A recently concluded experiment will illustrate the problem. The results are shown below:—

Table 1.

Period of lactation in weeks	*Bulky feed/day*	*Group*	*lb/day conc. fed*	*Yield of milk* 1964	1965	*% Fat* 1964	1965	*% S.N.F.* 1964	1965
3rd–8th	10 hay + 20 lb. Brewers Grains	A	16	33	35	3.8	3.4	8.9	8.8
		B	10	30	33	3.4	3.5	8.5	8.6
Gain from 6 lb. concentrates			...	+3	+2	+0.4	—0.1	+0.4	+0.2
9th–20th	Alsike hay and silage	A	16	26	32	3.9	3.7	8.8	8.8
		B	6	22	26	3.7	3.4	8.6	8.6
Gain from 10 lb. concentrates			...	+4	+6	+0.2	+0.3	+0.2	+0.2

Notes on the conduct of the experiment

1. 40 first calf Friesian heifers were used in each group A and B. The experiment was repeated in 1965 with fresh batches of first calf Friesian heifers.

2. The objective was to compare a high concentrate diet (16 lb/head/day) with a low concentrate diet and get a figure for gallons/lb of concentrates or number of lbs concentrate/gallon milk.

3. The period of study was the 9th-20th week of the lactation when milk yields had passed their peak. The first period 3rd-8th week is a period of adjustment to the experiment proper.

4. *Ad lib* feeding of bulky feeds. This consisted of 2 hours feeding on silage each morning and 2 hours on hay in the evening.

Note on the results

1. During the 9th-20 weeks the extra 10 lb concentrates had increased milk yields by 4 or 6 lb milk. Thus, 4 lb of concentrates was not producing 1 gallon of milk but less than $\frac{1}{4}$ gallon milk. The extra concentrates resulted in higher B.F.% and S.N.F.%.

The extra 10 lb concentrate was apparently an uneconomic proposition.

Before drawing too general a conclusion, it was well to remember:—

(a) There might be an improvement later in the lactation.

(b) The animals in the groups were of varying potential as milk yielders. The low wielding ones were possibly overfed whilst those with a high yield potential were underfed by using a flat rate of 16 lb/head/day.

(c) The hay and silage were of good quality.

Close study of the experimental results provided some interesting information as shown below.

Effect of concentrate level on amount of hay and silage taken

1. On average, the cows given 16 lb concentrates per day were eating also 18 lb/hay dry matter as hay and/or silage whilst the cows given 6 lb/day concentrates took 21 lb/day of dry matter as hay and silage.

2. Frequency charts in which the cows were grouped according to how much silage and hay they took, showed that amongst those given the high concentrate feed, there were a few taking less than 18 lb/day down to 13 lb, a few taking more than 18 lb up to 25 lb/day/head, but about 80% of the cows were in the range 16-20 lb/day.

A similar chart for cows given 6 lb/hay showed a much wider range of feeding rates up to 27 lb/head/day with 80% of the cows taking from 18 lb to 24 lb/head/day with much higher percentages of very low and very high silage/hay feeders.

The 6 lb concentrate group were on average eating only 3 lb/day more silage/hay dry matter. Some of them were obviously not taking in enough dry matter under the system.

Preference of individual cows for hay or for silage

It was obvious that some were small hay eaters and large silage eaters and vice versa. It was also obvious from a scatter diagram constructed that silage was generally selected in preference to hay in 1965 rather more so than in 1964. Such peculiar diffences among individuals have to be reckoned with.

The conversion of energy into milk

Individual cows showed wide differences in the use to which additional energy was put. Comparisons between 10 cows all given 3 gallons milk/day in their 9th-14th week of lactation showed some using 100% energy for milk production and others only 80% for milk production and 20% for liveweight gain.

Possibly this liveweight gain ultimately goes to the pail at the end of lactation but this is not an efficient method of feeding for milk unless there are very special circumstances.

For example, where the cow uses cheap grass in the summer to put up liveweight gain which can be milked off later after the grass is finished.

Response to concentrates

It is difficult to make a general statement about this very important subject since 3 or 4 factors can influence the response.

(a) Stage of reproductive cycle.

(b) Level of feeding.

(c) Potential productivity of the animal.

A vast number of experiments have shown that if the level of concentrates is raised and then lowered in mid-lactation the response is not 4 lb/gallon but about 4 lb/$\frac{1}{4}$ gallon.

With a potentially high yielding cow or one that has received less than an adequate diet the response is higher than this.

The response seems to be less than this in later lactations.

Effects of feeding level before calving

Where 8 lb/day of feed was given as against no concentrates on poor pasture before calving, there was a lower milk yield by about $\frac{1}{2}$ gallon/head/day throughout the lactation even though the two groups were given 4 lb concentrates/gallon of milk produced. The milk composition also showed higher % B.F. and % S.N.F. following the extra steaming up.

The most interesting observation, however, was that the liveweight gain of the two groups behaved differently during lactation.

The steamed-up cows showed a higher liveweight than those not steamed up with hardly any change during the lactation.

The others had low weights and showed a steady rise in liveweight throughout the lactation. Some of the feed given for production was being diverted to liveweight gain as the cows strived to pick up what they had lost by previous underfeeding. It is this that results in the fall in milk yield of these heifers. The effort to produce compensatory growth depresses the milk yield.

These heifers gave a better response to extra concentrates averaging $\frac{1}{2}$ gallon milk/4 lb concentrates instead of $\frac{1}{4}$ gallon. This response may be economical especially if one considers the saving by underfeeding before calving.

It is obvious that if we are to use concentrates effectively, we must move away from the rigid 4 lb/gallon and try to produce a plan by which a farmer could assess the individual response of cows and feed accordingly. It might be possible to measure this by a plan such as the following:—

(a) Challenge individual potential with liberal feeding 3 weeks after calving.

(b) In 4th week, try raising the level of feed and then lower it to see the effect.

(c) Base subsequent feeding for production on the results shown in this test week.

An experiment was now running at N.I.R.D. which might demonstrate the feasibility of this idea. 50 heifers had been liberally steamed up and in the 4th week of lactation were given an extra 3 lb concentrates. The result by the end of the 4th week could be measured against the price made by the milk and the cost of the extra feed. If profitable, carry on, if unprofitable drop back but watch the effect of dropping back again measured by the cost of feed and price of milk. If the drop in feed was matched by too big a drop in milk then it should be restored.

This should be measured against a background of *ad lib* hay/silage of top quality, so that the utmost milk from bulky feed will be obtained. The results are not complete but will soon be available.

Discussion

Q 1: What yield could you have from your heifers given a flat rate of 16 lb/day/head of concentrates followed by a further 16 lb in the late period of the lactation ?

A 1: It should be made clear first that the flat rate of 16 lb or the lower one of 6 lb/head was set to measure the effect of the extra 10 lb/head on yield and also on the cows' behaviour towards hay and silage. If these concentrate levels had been varied according to the yield of the individual animals, it would have been difficult to pinpoint the precise effect of the extra 10 lb in the higher rate.

The yields of individual heifers varied widely, since the heifers were not our own rearing but represented stock bought under a special arrangement from many growers. This ensured that the heifers were not specially selected ones but properly represented the breed and class. As a matter of interest, we do it by approaching the co-operating farmer, put the names or numbers of all suitably aged stock into a hat and draw out the one or two needed for the experiment. We pay for the heifer and give the farmer the option of buying it back at the end of the season. On average, a batch of 50 calves purchased this way would contain 2-3 absolute duds and the rest have yields of 2 to 5 gallons/day.

In the trial comparing 16 and 6 lb of concentrates we had approximately half of our own bred stock and half of these specially bought stock. It was noticeable that at both levels of feeding our own stock gave more consistent yields with 3½ to 4 gallons at the high level, whilst the bought-in heifers showed a wider spread from duds with no milk at all up to 5 gallons.

Q 2: What happened to production the following year?

A 2: This is something which I would like to know myself. As mentioned above most of the stock are sold back after the season's experiment is over. It would be possible of course to make enquiries on their farms but the results wouldn't be strictly comparable because each farmer would treat them differently.

Q 3: I am interested in steaming-up. What was the ration which gave the best response?

A 3: 8 lb concentrates/day for 6 weeks before calving gave the best response. These animals were on good pasture as well. If a good response is wanted, it is necessary to start an animal on poor feed before steaming-up.

Q 4: Was the better silage intake noted in the second year of your experiment due to using beasts a year older?

A 4: No, after the first year, the stock were sold and a fresh lot of 1st calf heifers bought for the second year. The second batch of silage was just better quality. I forget the exact figures, but from memory I believe it had 16% crude protein, 27% crude fibre and a very good fermentation.

Q 5: Your reference to the value of the older Transactions of the Highland Society have made my day. They are a mine of information even for present day needs. I would like to make two or three comments.

i. When you talk about feeding 80 Friesians *ad lib* you mentioned that they were fed for 2 hours. This is not necessaritly *ad lib* as would be practised on a farm allowing cattle free 24 hour access to a silage face in a self feed system. It is important to make this distinction.

ii. You mentioned special circumstances where it was possible to show an advantage in feeding low quality roughage with high levels of concentrates. I would like you to enlarge on this.

iii. I have noticed in our observations of cow behaviour at Auchincruive that certain animals prefer hay and others prefer silage. The same animals show the same preferences year after year.

A 5: All interested in Wigtownshire should make a point of reading the Transactions for 1875 containing a 40 page article on the County.

Point I. It is, of course, necessary to define in detail what is meant by *ad lib* feeding. Our method was as follows:—Each half

week we examined the hay or silage ration set before the animals. If either or both were cleared we increased the bigger ration. Any left-overs were weighed and returned to the animals feeding trough together with its fresh lot of hay or silage. This system guarded against the possibility found under true *ad lib* feeding that selection of preferred bits of hay/silage would take place. The amounts then remaining in the troughs would measure not the feed intake but the preference of stock for part of the ration.

II. My main reason for suggesting a possible use for low bulky feeds plus high concentrates is a paper by Dr Blaxter and R. S. Wilson (This paper was reviewed in Greensward No. 3, page 65, Review No. 56), who worked with sheep and showed a higher output of store sheep per acre with a high yielding poor quality hay plus concentrate supplement where the quality of the hay would not be required by the class of stock being produced. Another circumstance coming to mind is the feeding of barley straw and additives with concentrates. This depends on a supply of cheap (valueless) straw in an area such as East Anglia. It would not be generally suitable for areas such as South West Scotland.

Q 6: I doubt if poor quality roughage can be compensated for by a supply of concentrates.

A 6: Much will depend on the reason for the low quality, whether due to bad silage making conditions. I agree that for milk production, low quality hay or silage cannot be compensated for by adding concentrates.

Q 7: We hear of silage giving M + 2 and even M + 4. What in your experience are the limits which can be attained from silage ?

A 7: This is the pivotal question. Why can we get M + 5 or 6 and more from grazed grass and be hard put to it to get M + 2 from the same material. Part of the answer is due to the loss of feeding value in fermentation but this is not the whole story. I would like to know more about it myself. One thing is important to remember, and that is that M + 4 or more may well be had with stock at peak lactation but the difficulty is to maintain this level through the lactation. I would be quite happy to be able to maintain just M + 2 through a lactation and yet M + 4 and more can be maintained whilst grazing on grass.

Q 8: A main difference between grazing and silage is that an animal can select during grazing a diet of far higher quality than is represented by the whole crop cut for silage which must generally be eaten without the same opportunity for selection. What information has the speaker on the amount of concentrate that can be saved by providing bulky feed of high dry matter % and thus encouraging higher intake.

A 8: The evidence is not very strong regarding the value of % dry matter as such. Silages with under 20% dry matter can influence intake but for ranges between 20 and 30% dry matter it is difficult

to show increased intake. For silages with high dry matter such as Haylage and for hay it is possible to demonstrate a relationship between intake and the digestibility of the grass product.

Q 9: I have read somewhere that the observations are consistent with the 'ruminality' of the fodders. Hay forms a fluffy mass in the stomach whilst silage generally forms a tightly bound dense mass.

A 9: It makes one think that the best plan might be to go back to dried grass with the physical chacteristics of hay and the possibility of harvesting grass in peak condition. Five or six years ago, dried grass seemed a dead issue, killed by fuel costs, but it may become economically useful given more efficient drying methods and changes in the cost structure of milk production.

Chairman: It seems mad to even think of going back to dried grass which went out of popularity when it cost £14-£20 per ton to dry. Our weather conditions are bound to make it a costly process. Fuel costs will tend to rise quicker than milk production costs and prices. My own experience shows that some of the benefits of steaming-up were always carried over into later lactations.

Q 10: I have been told by many lecturers that 95% of a cow's productions comes from feeding and only 5% from breeding. As an instance last spring two of my cows calved the same day, both gave 1200 gallons milk. One gave 3% butter fat and 11% total solids. The other gave 5% butter fat and 15% solids. These two extremes in cows of the same age, stage of lactation and fed in precisely the same way are evidence of the considerable effect of breed.

The economics of milk production seems to be based from food towards milk and not from the conditions of the cow back towards the feed. When can you expect the benefits from a given amount of concentrate as far as milk production, the same day or later ?

A 10: 'Breed or Feed' is the theme of many a discussion and we probably haven't time to go thoroughly into the question. Some 6 years ago, members of the National Agricultural Advisory Service (N.A.A.S.) in England and Wales tried to decide this question in a big country wide experiment. Farms were divided into those consistently showing under 8.4% S.N.F. and those with an average of 8.8%. Cows were selected from each of these groups and brought back to our research institute and observed under precisely the same management. Comparing the figures for these different animals under the same management and also these animals under their home farm management the conclusion was that 20% of the differences in results were due to breed and 80% to the management.

Q 11: What would be your main advice to our dairy farmers ?

A 11: Quite definitely, improve the quality of bulky feed whether hay or silage.

HIGH QUALITY WINTER FODDER

Discussion night at Castle Douglas, 15th February, 1966.

Openers : H. B. CHRISTIE, Silage Making
J. FINLAY, Feeding Silage
J. K. S. HALL, Cold Blow Barn Dried Hay
I. V. HUNT, Growing Grass for Fodder

Chairman : J. MARSHALL

Each of the openers was allowed 10-15 minutes to put forward some leading points after which a lively discussion took place. No full record of all that took place is available since the reporter was involved in defending his contention that there was a case to be made for deferring harvesting grass for silage.

The following were the main features put forward by the openers: —

H. B. Christie

The following eight maxims were set up.

1. Silage must be made from young grass to be any use. Start cutting at least one week before you believe it is ready.

2. Early starting is essential otherwise the speed of growth and rapidity of fall in feeding value will mean poor silage from the later cut herbage.

3. The first cut silage is so superior to other silage that it must be set aside for dairy cows.

4. Autumn or third cut silage although not as good as young first cut silage is much superior to old shot first cut grass.

5. Wilt for 24 hours or if wet for 48 hours to make better use of silage capacity.

6. Youthful grass is required and is more important than wilting. Cutting should not be delayed in the hope of better wilting weather.

7. Air must be kept out of silage. Sleeper walls are useless. Mr Christie has smooth concreted walls.

8. A top sheet should be used to cover silage each night whilst it is made and then used to cover the silage. Mr Christie has carried out this system of covering for many years and saw no reason to change to vacuum silage. Provided the top sheet was weighted down and closely in contact with the silage, no waste at all could be detected.

J. Finlay

Mr Finlay's contribution was a series of sketches and descriptions of gadgets which he had seen on farms in and around Kirkcudbrightshire which could ease the job of hay and silage making and feeding. Unfortunately, sketches of these gadgets would be costly to print but the following is an attempt at brief descriptions.

1. Mobile hecks and trailers to make for easier feeding outside.

2. Methods of controlling self feeding, including a mobile open shed incorporating a barrier which could be pushed against an outdoor vacuum silage pack.

J. K. S. Hall

The latest development in barndrying, namely drying with cold air has been in use at Auchincruive for three seasons. It is important to realise the differences between barndrying with heated air and with cold air which are as follows:—

1. Grass for heated air barn drying can be cut at any time of the year and need only be wilted to 45% moisture.

2. Where cold air is to be used, wilting is essential to at least 35% moisture (65% dry matter). The time for cutting needs to be chosen rather more carefully.

3. It is thus possible to make higher quality grass into barn dried hay by heated air.

4. The advantage of the cold air system is low cost and the ability to use it to dry hay in the barn where it is to be stored. Two bays under one roof each holding 50 tons of made hay are used at Auchincruive. The cold air is pushed by fan along a sunken channel and can be diverted to either bay. A chimney formed by a plug which can be hoisted as the stack is built allows the air to pass through the hay. Side ducts laid horizontally during building spread the air more evenly through the hay. The cost of drying by this method comes to 10/- per ton compared to 26/- for equivalent quality material by the heated air drier. Considerably higher costs are incurred if clovery herbage or very sappy herbage is dried by heated air.

5. An essential feature of the cold air system is that there must be a large volume of air passing through (the fan at Auchincruive delivers 30,000 cubic feet per minute). The air must be dry enough to pick up moisture as it passes through. For the first 10-12 days, continuous blowing should be allowed whilst thereafter blowing should be restricted to daytime and dry periods. A further 2-3 weeks may be necessary. Where heated air is used blowing should be completed in 6-7 days after which the dried batch (about 8 tons) needs to be moved to a storage barn to make room for the next batch.

I. V. Hunt

The theme was that with the increasing use of heavy dressings of fertilizer nitrogen, it was necessary to make certain that an economic response to applied nitrogen was obtained.

Exhortations to cut earlier were all right when applied to farms using 50/60 units or less nitrogen as a spring dressing who thought early cutting was sometime in June. There were, however, many farmers applying more; for instance at the College Farm, Auchincruive 80-100 units N were applied. If this sort of herbage is cut too early, the only result will be a vast increase in water and little or no increase in dry matter production.

Cutting such grass in early to mid May at Auchincruive produced a silage which was far too high in quality, was eaten too readily, was a poor return for the fertiliser applied and finally made inefficient use of the silo space available.

The ideal situation would be reached when it was possible to forecast by looking at the crop or by a simple test such as counting the number of ears per handful, that the crop had reached a satisfactory tonnage per acre and was still of adequate quality for the purpose in mind.

The discussion was heated, especially for the conflict between the early cutters irrespective and the traditional late cutters. Eventually a formula was reached which satisfied H. B. Christie's youthful grass and I. V. Hunt's request for consideration of older grass.

No attempt has been made to report the meeting fully but it was one of the most successful meetings we have had. The problems of "High Quality Winter Fodder" are probably the most important ones needing solution at present. The subject will no doubt be discussed at later meetings.

A number of very useful booklets on barn drying are available from the Electrical Development Association and the following are especially recommended.

1. Electricity for cheaper hay drying and storage.
2. Progress in farming with electricity.

The headquarters' address is as follows:—E.D.A., Trafalgar Buildings, 1 Charing Cross, London, S.W.I. Copies could also be obtained through our member:—R. M. T. Wilson, South of Scotland Electricity Board, Inverlair Avenue, Glasgow, S.4.

Spring Meeting: Station Hotel, Dumfries, 3/3/66.
Chairman : J. G. MARSHALL, Hardgrove, Carrutherstown, Dumfries

GOODBYE PLOUGHING

Dr H. P. ALLEN
Home Development and Technical Services of Plant Protection Ltd. I.C.I. Ltd., Jealotts Hill Research Station

Before he started on his talk, Dr Allen said that he preferred a title with less of an air of finality about it and proposed to confine his remarks to the use of the bipyridyls in grassland husbandry as part or complete replacements for cultivation. He would outline the history of their development and then demonstrate their action by slides and comments. Paraquat was discovered in 1957-8 at I.C.I. Laboratories and is marketed as Gramoxone W., containing 2 lb paraquat/gallon. Other bipyridyls (e.g. Diquat) were already proving of interest.

How paraquat acts

Paraquat is more effective than other bipyridyls against a wide range of grass. Its mode of action is as a contact herbicide. On hitting a green part of the plant it is absorbed into the leaf and is reduced and oxidised within the plant while photosynthesis is in progress, liberating a toxic principle and resulting in the death of the plant. The brighter the light, the more rapid is the reduction/oxidation process, the quicker the plants take on the scorched look typical after paraquat spraying. Under poorer light conditions, paraquat has time to move further through the plant without change. The scorch is slower in appearing but the resultant kill is often more uniform and more complete.

Paraquat on the soil

On reaching the soil, paraquat loses its toxicity. The paraquat (and all bipyridyls) become latched on to clay particles so tightly that they cannot be released (unless the soil is boiled with concentrated sulphuric acid). As far as the farmer is concerned, once paraquat has come into contact with a mineral soil, the paraquat is of no further consequence or interest, i.e. ordinary loams, silts, clays. On light sandy soils, there is a time-lag of 2-3 days because of the wider dispersion of clay particles which serve as absorption sites for paraquat.

Paraquat and species and varieties of grass

From about 1960, experiments were directed at testing paraquat against a whole range of grasses at various rates and times of application.

It was soon noted that the degree of kill was related to the amount of green shoot, etc. available for spraying. Couch grass (Quickens), for instance, takes several sprayings before it is

completely eradicated because of its extensive, non-green underground rhizome or stem. Among the most resistant grasses are couch, bent grass (Agrostis) and fescues. Among the easiest to kill are crested dogtail, the meadow grasses (Poa spp.) and timothy.

A particularly valuable discovery was that the effective spraying season was quite a long one. Grasses increase in susceptibility to a given dose of paraquat as the season progresses. Application is effective in autumn and even well into the winter, provided the grass is still green when sprayed. The fine leaved fescues have proved easier to kill when sprayed during the winter.

Using paraquat for renewing a sward

The earliest recommendation made whilst experimental work was in progress consisted of three steps:—

Before spraying: Apply lime, phosphate and graze sward down tightly to provide a good target of green growth and make seed-bed preparation easier.

Spray: 8 pts/acre, later reduced to 4 pts/acre, Gramoxone W. in about 20 gallons water.

Sowing seed: 14 days afterwards, the dead turf was torn up, buried and a tilth prepared with a rotary cultivator. Seed mixture sown. Seed-bed rolled firmly.

The technical possibilities were demonstrated widely but the rotary cultivator is not a common implement on grassland farms.

Intensive research was directed to seed-bed preparation and a number of machines based on cultivators and tined weeders examined. During application to arable cropping, direct drilling of cereals and other crops, e.g. kale, suggested that a drill might be developed for grass/clover leading to a relatively simple series of operations, viz. spray — fertilizer — direct drill.

Development of rotary cultivator and seeders

Some of the development work was undertaken by Plant Protection Ltd. machinery section at Fernhurst and by our regional development teams and also by firms who specialised in the kind of machinery which seemed suitable.

In our own efforts, machines based on discs and rotary cultivators were used but the depth control was weak. Two firms are particularly active, viz. 'Sisis' (Wm. Hargreaves of Macclesfield) and Howard Rotovators Ltd. Both have a rotary cultivator principle and have managed to build a drilling system on to it. The objective is to drill seeds directly into the soil, so limiting the disturbance of the fibrous mat which makes for a poor seed bed. Slides of the various machines shown are described below. This machinery will be on the market during the coming summer and will receive wide testing through a coming together of ourselves, farmers, machinery manufacturers and contractors.

Slides 1, 2, 3: Improvement of grassland was possible without complete destruction of the existing herbage in suitable instances, e.g. a buttercup infested pasture could be vastly improved by M.C.P.A. to kill the buttercups and other weeds and the application of 4 cwts/acre of compound such as 12 : 12 : 18. A poor rushy sward could be improved by lime, basic slag and spraying the rushes.

Slides 4-9: These showed the effect of paraquat followed by rotovation, rolling, fertilizer and seed. In these cases areas such as a low-lying water meadow with a sticky clayey sub-soil which could not be ploughed were improved.

Slides 10-40: The use was shown of Sisis Contravator, Howard Rotaseeder and Fernhurst prototype drill on a number of farms in Cheshire and other parts of Britain.
The present model of the Sisis Contravator consists of a relatively light rotor which turns in the opposite direction to that of the tractor wheels. The rotary tines produce narrow slits spaced at 4 inch intervals to a controllable depth. The seed box follows the cultivator and itself has a unique feed mechanism consisting of two soft rubber (or similar material) rollers which roll towards each other and grip and roll seed through to the guide strips in the same way that a clothes wringer carries clothes through without damage. A wide range of seed rates and seed sizes can be handled. Given the recommended treatments, it was evident that considerable improvement was possible on land which was unploughable. A number of examples were shown where improved establishment was obtained compared with ploughed areas.

Discussion

The discussion lasted from about 8.30 to 10.30 and was called to a halt with some difficulty. Many members put questions to Dr Allen and also to John Thorburn, I. V. Hunt and Vice-Chairman Marshall who formed a general panel on the subject. The following were the discussion points raised and questions put as noted by the reporter.

S. Harrison: What is the effect of Paraquat on heather ?

Dr H. P. Allen: Not much information is available except that Calluna (Ling) is easily killed by Paraquat whilst Erica (Bell heather) is resistant.

Dr Allen wondered if the Muirfad technique would not suffice on heather-covered areas. Although on many peaty soils the Muirfad method or similar non-spray surface treatment can bring about an initial improvement in the sward, the time is reached when the sward is composed not of open heather and bog myrtle but of grasses and needs to be improved a stage further.

J. Thorburn: The results at Muirfad were very impressive but the site was at sea level.

I. V. Hunt: Lime and basic slag were the most efficient methods of getting rid of heather (where that is necessary) and improving the feed value of the herbage.

Dr R. D. Harkess: Dr Allen's slides of the use of Paraquat on farms in Cheshire was impressive. Both I. V. Hunt and I had the privilege of visiting these farms last autumn and can confirm the improvements. What is there to show in Scotland ? Are there any special peculiarities of high land to consider ? It is noted that there is no residual effect of paraquat on clayey soil and a slight one on sandy soils. What is the position on organic or peaty soils ? There is some suggestion that livestock should not be given access to sprayed ground for some time after spraying. This can be a hindrance to the use of spray when grazing cattle are used as cultivators. Is the sprayed herbage harmful to animals and must the sprayed area be fenced ? Finally, has Dr Allen any costings of improvement using paraquat ?

Dr H. P. Allen: The fate of paraquat in soil and in herbage is a most interesting subject. The picture is by no means complete even yet.

Considering soil first, there is some variation in the speed and permanence of the attachment of paraquat to the soil particles. Peat absorbs paraquat in a manner different from that of a mineral soil. Each soil has its own limit to absorption. A mineral soil can take a very large quantity of paraquat/acre in the top inch of soil before the limit of irreversible absorption is reached. Peat soils may have a lower limit to such irreversible absorption but still far higher than the amounts of paraquat likely to be applied in practise.

In peatland, in New Zealand it has been found that seeds sown up to 18 days after spraying with paraquat suffered some retardation of germination but obviously peat soils differ in their ability to absorb paraquat and our knowledge about the fate of paraquat in such soils is not yet complete.

With regard to the need for fencing, I don't think it is necessary from the point of view of toxicity of paraquat but it may be desirable from the point of view of the improvement of the sward. Dr Swan, Head of the I.C.I. Industrial Hygiene Laboratories in Cheshire has studied the effects on livestock and has compared three treatments:—

(a) Heifers confined to small areas of sprayed herbage with no other source of feed.

(b) Heifers confined to area half sprayed and half unsprayed so that they can choose what they eat.

(c) Heifers confined to untreated herbage.
After some time, the heifers grazing the treated herbage only were slaughtered and complete post mortems carried out. No effects of paraquat were found. No weight loss. No accumulation of paraquat in any organ or tissues.

No complete costing are available since most improvements have been either experimental or so integrated into the farm that a separate assessment of the financial benefits was impossible.

Dr Kellie Brook: I have tried this herbicide and others as well in co-operation with I. V. Hunt and his colleagues at Auchincruive. In the tradition of the Muirfad technique, no mechanical treatments were used apart from the grazing animal. The results were quite satisfactory apart from the appearance in one area of **Docks.** How does one deal with such resistant weeds which come up after paraquat treatment ?

I would like to add to the replies to Mr Harrison's question about heather. As a neighbour of the late A. B. Allen, Muirfad, and also having visited the improvements undertaken on Lewis and Harris, I have seen how effectively the lime plus grazing gets the heather down and also the beneficial protection given by the heather whilst the young newly sown grasses are established.

Dr H. P. Allen: The tops of dock plants can be killed by paraquat but the underground parts survive. 24-D or M.C.P.A. applied annually is cheap and eventually effective. The new Dow weedkiller—Tordon, is said to be very effective against docks but kills out clover.

John Thorburn: I am not surprised that Dr Kellie Brook mentions docks. His farm is near the Wigtown border and to my mind no county can beat Wigtownshire for docks. M.C.P.A. applied every year at an annual cost of about 7/6d per acre is the most useful method.

Dr M. E. Castle: I visited Cornwall last December and saw many instances of the successful use of paraquat on steep slopes. The cost was high but no other method could have achieved the results obtained. A very important requirement seems to be plenty of nitrogen on the new sown seeds.

Dr H. P. Allen: There is evidence in New Zealand that paraquat in certain areas well endowed with rainfall without cultivations can lead to improvement. In New Zealand, swards with about 10% clover can be sprayed with a low rate of paraquat (2 pts/acre) and followed by surface sowing seeds and fertilizer superphosphate to give a very vigorous clover herbage. A condition of success here is that before spraying the swards are grazed tightly by sheep.

Angus Race: Concerning residual toxicity in herbage, what is the effect of treated herbage disced into soil on young seedlings? When should nitrogenous fertilizer be used? Will it not encourage the regrowth of natural grasses?

Dr H. P. Allen: I like to call the toxicity of paraquat to treated herbage 'trash toxicity' to make it quite clear what we are talking about. This is only important in direct drilling trials where cereals are sown into dense trash when three conditions are satisfied:—

(a) 8 pts/acre or more paraquat used.

(b) Cereal seed germinates and comes to the soil surface rapidly.

(c) Herbage or straw trash dense on surface of soil.

It is possible that for three weeks or so after spraying some paraquat may remain on the surface of trash which may be transferred to the seed leaves of emerging cereals or kale — this will only happen if the three above-mentioned conditions exist. Grass seed is usually slower germinating and it is most unlikely that it would suffer. It is advisable to reduce trash by hard grazing before spraying.

With regard to nitrogen, the problem of recovery of indigenous herbage has occasionally arisen where kale has been drilled into a killed sward. The heavy doses (100-150 units) of nitrogen/acre needed to give a good kale crop may induce regrowth of any clumps of indigenous herbage which may not have been killed completely by paraquat. The problem has not arisen with pasture work. A solution for kale may be to split the N dressings so that part of the dressing is given when the kale is part-grown and can compete with any regrowth of indigenous herbage.

D. Tough: I tried paraquat on high land. It was very effective, producing a bright orange patch within a day or so. When I attempted to prepare a seed bed with a rotovator I found myself in trouble with stones which the machine kept on lifting. Eventually I had to plough. Are the new machines able to tackle stony ground?

Dr H. P. Allen: The Sisis contravator can ride out of stony areas but can also kick stones along between the tines. The other machines would no doubt find large stones a problem.

J. Thorburn: In view of the high cost of the chemical, is there any reason why it should be used on ploughable areas? I can understand its value on rocky, steep or wet ground.

Dr H. P. Allen: We have had some interesting comparisons between ploughing with reseeding by traditional methods and pasture renewal with the aid of paraquat but without ploughing. Where you plough, perennial weeds are buried but you bring up a crop of annual weeds. Where you spray, annual weeds should be less of a problem but competition is removed and some domant perennials may be encouraged to grow in the seeding year.

S. Harrison: After a few years of continuous barley, Quickens (couch grass, Agropyron repens) seems to become a problem. What advice have you ?

J. Thorburn: Dalapon, T.C.A. and Amitrole have all three been effective especially the Amitrole. None of them eliminate the couch grass entirely. I have heard farmers in the arable districts of England say that the best policy is to keep down the couch grass by any means possible and accept the fact that it can't be eliminated completely.

Dr H. P. Allen: All three of these chemicals have been effective providing the rates are high enough but at rates sufficient to kill couch without any cultivation, costs would be excessive. Combinations of herbicides are being tried which may be useful, e.g. Amino triazole with Dalapon and Paraquat. A low dressing of Amino triazole at 1 lb/acre followed by Paraquat at 2 pts. per acre 10 days later is one promising combination which is being studied.

S. Harrison: Couch grass is a serious menace, one which justifies a special effort possibly on the part of our Grassland Society. Experiment should be undertaken and the results made known quickly.

M. Cessford: I tried drilling kale into sprayed pasture and found the exercise interesting and the crop useful.

(a) The method is easy.

(b) The job can be done very quickly which is useful when we are busy.

(c) The result was a very clean weed-free crop of kale.

(d) The sprayer left a few strips of untreated grass which was a nuisance but I will be more careful in future.

(e) The cows stood firmly to graze this kale without poaching even when the field was a really wet one.

My question is this: I noticed that the kale was rather slow germinating. Is this a result of the paraquat ? Should I have applied more nitrogen ? I used 4 cwt. of a high N compound (80 units N/acre) at sowing time with a further 80 units as a top dressing when the kale was up.

Dr H. P. Allen: The germination of kale can be affected by a sowing x nitrogen level interaction. At 0-25 lb N/acre, germination will be quicker in ploughed soil because such a low level of nitrogen barely satisfies the needs of the soil bacteria which must rot down the dead sprayed herbage. At around 100 units/acre of applied N, the bacteria may be satisfied and ploughed and drilled crops may be alike. By the time 150 units are applied the drilled crop is the better crop.

M. Cessford: But is the germination of the kale slower ?

Dr H. P. Allen: I have never noticed a difference.

P. T. Gordon-Duff-Pennington: Our Chairman's (J. Marshall) advice to me on couch grass in a young ley was that I should top dress with N fertilizer and graze it hard.

J. Marshall: I confirm that I can grow good twitch on my ground and when I have to sow a ley into such ground, the lot is grazed hard. The twitch (couch) is kept down or killed off since it has not been seen again during the life of the ley.

J. Gass: When a grass field is ploughed in, the buried turf has some manurial value. What about the manurial value of sprayed herbage ?

Dr H. P. Allen: The sprayed dead herbage will have a value as organic matter and also in accordance with its content of available nitrogen, potash and phosphate just as if it were a buried turf. There may well be a slight difference in the location of this added fertility. When a sward is ploughed, the tendency is to bury the turf deeply. When a spray is used, the manurial value of the turf is confined to the top inch or two. Estimates of this difference were made on a sward which had been (1) ploughed and (2) sprayed in preparation for winter wheat for 4 successive years. The amounts of organic matter in the top 6″ of soil were exactly the same but after spraying it was concentrated in the top 2″ whereas after ploughing it was distributed more evenly throughout the plough layer.

J. Gass: Then why is more nitrogen needed ?

Dr H. P. Allen: Bacteria need a supply of nitrogen as a nutrient if they are to rot down straw, trash, etc. Low levels of application of fertilzer nitrogen (up to 25 units/acre N) tend to be used entirely by the bacteria leaving none for the crop to grow with. The result is a temporary shortage of nitrogen for the crop. With 50 units of nitrogen or more the shortage is not so evident.

J. Thorburn: I have been told that a rotovator is as good a way of getting rid of couch grass as any, provided the rotovator is used often and the couch rhizomes are chopped finely. The trouble about couch grass and docks is that couch grass just looks like grass and is accepted but docks look like docks and nothing else.

S. Harrison: I had an experience with a rotovator which I borrowed. Part way through preparing land the owner required it leaving me with 4 acres to plough. Every weed in Galloway was showing on the rotovated area but the ploughed area was as clean as could be.

Dr M. E. Castle: One or two rotovations are not enough. The whole point of killing couch by rotovation is constant repetition until the rhizomes are so small that they exhaust themselves in producing a plant. Summer fallowing is a recognised method in the south of England but not suitable in our wet summers.

N. McWilliam: I am glad we have had the courage to drag this skeleton out of our cupboard and look at it. I have tried most remedies, Weedazole, Tecane, etc. If the couch is chopped to 4" lengths, any buds on the stems are likely to be killed. Trusting to fallowing is useless. The last dry summer we had was 1959. Our society should take the matter up seriously and see what they can dig out about the problem as it concerns us here. I have found rotovation quite effective before a root crop where later cultivation can keep the couch grass down.

J. G. Marshall: As Chairman I must say that this meeting has been one of our most successful. It could go on all night but many of these problems will still be with us tomorrow morning.

S. Harrison: Vote of thanks. I have thoroughly enjoyed the meeting and would like to thank Dr Allen and those who took part in the panel, the members who kept the discussion going, and our able Chairman for the night.

CENTRAL SCOTLAND GRASSLAND SOCIETY

MINUTE of THIRD ANNUAL GENERAL MEETING

held at Blane Valley Hotel, Blanefield, 25th November, 1965.

Minute of Previous Meeting

The Minute of the Second Annual General Meeting had appeared in "Greensward" the Society's Journal which was circulated to each member. Accordingly the Minute was deemed to have been read and was approved on the motion of Mr Elder, seconded by Mr Andrew.

Chairman's Report

The Chairman spoke of the great loss the Society had suffered by the untimely death of Professor D. S. Hendrie.

(a) The first winter meeting was held on 18th January, 1965 in the West of Scotland Agricultural College and was addressed by Mr I. V. Hunt, Head of the Grassland Husbandry Department, W.S.A.C. This meeting attracted an attendance of over 100 members.

(b) On 22nd February, Messrs D. B. Jamieson (South West Scotland Grassland Society), Robertson and Yuill (Central Scotland Grassland Society) gave short talks to members of the Society on their methods of farming. The meeting which was also held in the Agricultural College had an audience of some 60 members.

(c) On 13th May a tour of farms in Ayr was made and the following farms were visited:—

Messrs Montgomerie, Lessnessock;
Mr J. Hogarth, Glenduisk;
Mr J. J. M. Hannah, Girvan Mains.

The Chairman reported that this was a most successful tour and that the 80 members who had taken part found it most stimulating.

(d) The Edinburgh School of Agriculture farms were visited on 10th June and this again proved a most successful venture. Members were greatly impressed by the work that was being done at this centre and thanks were due to members of the East College who had taken such an interest in the visit. 90 members of the Society were present.

(e) On 25th November as part of the Annual General Meeting, two farms in Stirlingshire were visited — Mr A. Gilmour, Bankend, Denny and Mr A. Paterson, Woodend, Balfron. Over 90 members had taken part.

The Chairman wished to thank all speakers and farmers who had contributed to the Society's programme for the year.

(f) The Chairman reported that the Committee had met on three occasions and he wished to record his thanks to the office bearers and committee members for the diligent way they had carried out their duties.

(g) As part of the Society's programme, certain publications had been issued to all members and these were as follows: —

" Greensward," Journal of the Central and South West Scotland Societies.

" Herbivaria," The Local Societies' Journal.

D.A.F.S. Bulletin — " Intensive Grass for Grazing."

The Chairman's report was adopted unanimously.

Treasurer's Report

Membership : The Treasurer reported that at the end of the financial year the total number of members of the Society was 234 and at the time of the Annual General Meeting it was 235.

The Treasurer submitted a statement of income and expenditure for the year ended 30th September, 1965 and this statement should be read as part of the Minute. Members expressed satisfaction at the state of the finances of the Society and it was suggested that the Committee should investigate means by which some of the assets could be invested to give a return of interest. The statement of accounts was adopted on the proposal by Mr Howie, seconded by Mr Simpson.

Election of Committee

The Secretary reported that in accordance with the Constitution four members were due to retire and that six nominations for committee membership had been submitted to him in writing by 1st October. Accordingly a ballot was necessary. The retiring members were: —

A. P. Anderson, Kippenross Home Farm, Dunblane.

R. M. Yuill, jun., Walston Mansions, Dunsyre, Carnwath.
J. A. Minto, Coulterhaugh, Biggar.
A. Robertson, Auchafours, Toward, Dunoon.

and the nominations were as follows:—

Nominee	Proposer	Seconder
Andrew W. Lyon, Linnhead, Lanark.	James A. Minto.	Adam G. Semple.
Ninian Simpson, Largievrechan Farm, Rothesay, Isle of Bute.	Alexander Robertson.	Robert N. Gentles.
Thomas Paterson, Wemysshill Farm, Overtown, Lanarkshire.	George M. Gilmour.	A. J. Bankier.
John McGregor, Boghill, Lesmahagow, Lanarkshire.	Charles P. Kay.	Donald S. Robb.
A. D. MacFarlane, Little Kype, Strathaven, Lanarkshire.	J. M. Nisbet.	R. Hamilton.
W. Andrew, Crossflat, Kilbarchan, Renfrewshire.	William C. Carswell.	A. D. Ritchie.

The ballot resulted as follows:—	Votes
John McGregor, Boghill, Lesmahagow, Lanarkshire	30
Andrew W. Lyon, Linnhead, Lanark	58
Ninian Simpson, Largievrechan Farm, Rothesay, Isle of Bute	68
Thomas Paterson, Wemysshill Farm, Overtown, Lanarkshire	46
W. Andrew, Crossflat, Kilbarchan, Renfrewshire	72
A. D. MacFarlane, Little Kype, Strathaven, Lanarkshire	18

Accordingly Messrs Lyon, Simpson, Paterson and Andrew were declared duly elected for a period of two years.

Election of Office Bearers

The following office bearers were elected:—

Chairman—Mr Minto Argo.
Vice Chairman—Mr Robert Howie.
Secretary—Mr G. M. Berrie.
Treasurer—Mr J. Waddell.

Mr Argo expressed the thanks of the Society to the retiring Chairman Mr Gilmour for his excellent work during the first two years of the Society's existence. Mr Argo requested that Mr Gilmour should continue in the Chair for the remainder of the meeting.

Any Other Business

(1) Members of the Society expressed satisfaction with the Journal "Greensward" and wished to record their thanks to Mr Hunt for his excellent work as Editor. In acknowledgment Mr Hunt appealed to members for farmer contributions to the Journal.

(2) The suggestion was made that if at all possible some financial data should be available regarding the farms which the Society visited from time to time. The difficulty involved in this was realised but it was hoped that the committee might keep the idea in mind when arranging farm visits.

(3) The committee was asked to investigate the possibility and desirability of arranging visits at a greater distance than had been done in the past and it was agreed that members should be invited to express an opinion. It was emphasised however that the policy which had been carried out to date had been most successful and that the attendances at all the meetings were highly satisfactory.

The meeting closed with a vote of thanks to the Chairman.

Following the business meeting, Mr James Walker-Love, Head of the Animal Husbandry Department, W.S.A.C. was invited by the Chairman to open a general discussion on the systems of farming which had been seen during the afternoon. Following Mr Walker-Love's talk a full discussion took place and the meeting closed at 8.30 p.m.

6 Blythswood Square, Glasgow, C.2.
1st December, 1965.

AUTUMN FARM TOUR OF CENTRAL SCOTLAND

The Annual General Meeting of the Central Scotland Grassland Society as usual took the form of an afternoon visit to farms, followed by a high tea, the business meeting and a discussion based on the farm visits.

This year the subject of the visit was " Winter Housing and Feeding of Dairy Cattle " and a large number of members gathered on a freezing, cold day at Mr Alan Gilmour's farm, Bankend Farm, Denny, and then moved on to visit Mr Andrew Paterson at Woodend Farm, Balfron. Both visits were extremely interesting.

Vital Statistics

Bankend Farm, Denny (Alan Gilmour Esq).

Acreage :	376 acres Grassland, 61 acres Rough Grazing, no cropping.
Fertilising :	100 acres received 6,000 gallons poultry slurry per acre. 90 acres received 3,000 gallons cow slurry per acre + 2½-3 cwts Compound in spring + top dressings of Nitro-chalk giving every acre equivalent of 83 units Nitrogen.
"Seeds" Mixture :	Mainly Timothy/Fescue Mixtures for long duration.
Grass Silage :	1,540 tons made from 1 cut only from 220 acres. D.M. 16.3%; p.H. 4.60; S.E. 9.1%; D.C.P. 1.84%.
" Grass Yield " :	Approx. 1.5 acres per cow equivalent for grazing, silage and hay.
Dairy Stock :	120 cows in milk; 30 cows dry; 200 young dairy stock.
Rations :	Silage is self feed by all cows. Grassland is paddock grazed. 70 lbs. Silage 16 lbs. Distillers Draff 6 lbs. Bruised Barley This supplies maintenance + 2½ gallons. Above 2½ gallons per day, 3½ lbs. of a 16% P.E. Cake fed.
Milk Sold :	850 gallons per head (heifers included) per lactation. Mainly retailed as "Certified".

Labour connected with milk production : 3 men plus 1 woman doing feeding only.

Buildings : Cubicles, self-feed silos, extensive slatted area, milking parlour.

Noteworthy ideas

A : The whole of the slatting and slurry tank capacity had been designed and built by Mr Gilmour with the help of a retired engineer. The basis was a slat made from steel T section cut to Mr Gilmour's requirements at a local steel works. These were welded to cross pieces of strip iron in fours to provide easy units for lifting off the tank area below for cleaning and emptying. The laying of these slats had proved so easy that Mr Gilmour had slatted almost every open area within his covered buildings and had extended his covered buildings to take all his cattle young and old.

The cubicles were built by his own labour from purchased steel tubing. One interesting feature was that the cubicles were set on the same level as the slatted area. At present, grants seem to be available for schemes involving a step up from passage to cubicle. Although there are many official reasons for insisting on the step, Mr Gilmour had proceeded to extend his cubicle areas " on the flat." His cattle did not show any of the expected harmful effects of the absence of the step.

B : Most farmers are familiar with cubicles for dairy cows but Mr Gilmour had found it impossible to draw any line between cows and other stock. All beasts had cubicles right down to calves.

C : All slurry tanks connected and holding nearly $\frac{1}{4}$ million gallons. All slurry can be removed at any one point.

D : Milk tank holding and cooling. Bottle filling machine. Bottle washing and sterilising machine. Automatic steam raising unit.

Woodend Farm, Balfron (Andrew Paterson Esq.).

Acreage : 300 acres Grassland; 43 acres Crop; 420 acres Rough Grazing.

Fertilising : All grassland receives one or two applications of 3,000 gallons cow and/or pig slurry per acre + lime (according to soil analysis) + 2/3 cwts Nitro-Chalk per acre.

"Seeds" Mixture : Only long term mixtures used, Timothy, Fescues, etc.

Grass Silage : 1,000 tons made from 1 cut only from 120 acres. D.M. 21.8%; pH. 4.5; S.E. 9.9%; D.C.P. 1.36%.

"Grass Yield" : Approx. 1.8 acres per cow equivalent for grazing, silage and hay.
N.B. 45 L.W. x Landrace Sows are also grazed.

Dairy Stock : 70 cows in milk; 15 cows dry:
84 young dairy stock.

Rations : Silage is self-feed by cows in milk only.
Grassland is paddock grazed.

70 lbs. Silage
9 lbs. Good Quality Hay
7 lbs. Distillers Draff
7 lbs. Brock Potatoes
1½ lbs. Bruised Barley

This supplies maintenance + 3 gallons.
Over 3 gallons per day, 3½ lbs. of a 17% P.E. Cake Fed.

Milk Sold : 920 gallons sold per head per lactation (heifers included).

Labour connected with milk production : 1 son plus occasional assistance from another.

Buildings : Cubicles, self feed silo, feeding 2 faces, line abreast milking parlour.

Noteworthy ideas

A : Insulation of buildings. The district is cold and the sheds in their original form were draughty. Mr Paterson had lined them with 4" thick glass wool. The result was a considerable increase in insulation. The heat inside the shed, full of cattle and full of visitors seemed rather high and there was some condensation on the roof. The system was under review, however, as will be gathered from the discussion below.

B : Heater unit in calf house, powered by waste heat from refrigerator.

C : Method of milk and feed recording in parlour. Report on visit by I. V. Hunt.

DISCUSSION ON AUTUMN FARM TOUR

opened by

J. WALKER-LOVE
Animal Husbandry Department
West of Scotland Agricultural College
Auchincruive, Ayr

Bankend

I was impressed by what I saw for two reasons : (1) the basic planning has been good; (2) the money spent on converting buildings has been extremely effective. A general point — I am quite sure if we come back in two or three years' time we may find the cow numbers increased from the 120 being milked at present. This can be done quite easily without any alterations.

Cows. They appeared to be in good condition and also very quiet, as one would expect in a cubicle setup. They were very clean but I would criticise the means of identification. It is essential in a herd as large as this that the cows be adequately and easily identifiable.

Housing. (1) I did not like the lack of a kerb in one of the cubicle houses since it encourages animals to enter the cubicle backwards and also there is more tendency for disturbance when animals are in heat. Lack of a kerb also prevents the build-up of litter.

(2) According to my calculations, there were 139 cubicles for 120 cows. This is admirable since it means that the more timid cows have a choice of cubicles.

(3) I felt that the building was perhaps on the cold side, although there were more doors open than normal for the purpose of our visit.

Feeding. I estimate that at the very most the silage will last till March. I doubt, therefore, whether there is enough silage to see the cows through until the grass. However, the system at present lends itself to flexibility and hay could easily be fed should all the silage be consumed. I would like to point out that self-feeding and loose-housing do not necessarily require to be married.

Woodend

The setup here is compact and convenient although there is a definite limit of 70 cows at present.

Cows. They were in very good order but I did not like the cold branding.

Parlour. This line abreast setup was a contrast to Bankend and shows that a herring-bone is not essential.

Housing. There is no doubt that the insulation was too successful. I do not like the cubicle divisions because they do not lend themselves to training a cow to stand in the cubicle. The cubicle floor is of the dished type which is not desirable in every circumstance but is all right here because there is a front rail to prevent a cow from standing too far forward. According to my arithmetic, there are 70 cows to 62 cubicles — this could encourage cows to lie in the passage or at the silo face.

General. Silage analysis is a guide towards feeding but the condition of the dung and the cow are equally important. I still favour the addition of a little protein supplement to any cereal being fed.

Discussion

Q. 1 : The cubicles at Woodend were on the warm side. I have found that the butter fat is lower in a warm byre than in a cooler byre. Does Mr Paterson have any complaints ?

Mr Paterson : The lining in the roof at Woodend had only been installed this October so there was not sufficient time to say if it was having any deleterious effect on the butter fat. The cubicle house has not been so warm other days as it was today. 18°C was the highest temperature recorded.

Q. 2 : Could we have observations on the methods of silage-making at the two farms ?

Mr Paterson : At Woodend the crop was cut as early as possible with a double chop harvester. No wilting was carried out. Potatoes and draff were mixed in with the grass as it was being ensiled.

Mr Gilmour : At Bankend it was cut early and wilted but as the grass got stemmier, the wilting was discontinued.

Mr Walker-Love : This year at Auchincruive, it was cut with a Kidd forage harvester and lifted with the Lundell forage harvester, wilted between 6 and 24 hours, the result being 18% dry matter. Dry matter is a slightly over-rated subject. High starch equivalent, protein and digestibility are much more important.

Q. 3 : Can we afford to wilt in the West of Scotland ?

A.: Mr Baird, Floors, wilted for the first time this year because of an effluent problem. Last year the sump was emptied three times a day without wilting and this year it was only emptied once a day with wilting in spite of wet weather, so it would appear that even in wet weather wilting can be an advantage.

Q. 4 : It would appear that on both farms we visited today only one cut of grass had been taken.

Mr Gilmour : Part was cut twice and part once.

Mr Paterson : Cut once.

Q. 5 : Can you define good quality silage.

Mr Walker-Love : We must be practical about this. Growing season, staff and weather can all vary and it is impossible to get a uniform mass of silage. No matter what we aim at, we get a variation from beginning to end. Put your money on digestibility and start as early as possible. 14-16% D.C.P. (Digestible Crude Protein) is adequate. Mr Gilmour, Bankend, is now feeding for 2½ gallons in his basic ration and, at this, has a surplus of protein.

Q. 6 : I agree with previous questioner about wilting. In connection with the feeding at Bankend it seems to me that draff and barley is necessary for 2½ gallons. I suggest that it would be better to dispense with the draff and make better silage for 1½-2 gallons.

Mr Walker-Love : It is difficult to make the silage one desires since it is largely controlled by the weather.

Q. 7 : Are slats really necessary ?

A.: Slats are not essential and certainly cost more. However, if you do not have slats you must be able to cope with the slurry. If you have to store it in a tank, why not put the tank in passage and cover it with slats ? An added advantage is that the cows' feet tend to be drier on slats.

Q. 8 : I don't make silage. How much does it cost for wintering a cow on silage ?

Mr Paterson : It costs £40 per cow for silage at Bankend.

Mr Walker-Love : At Auchincruive we feed 70 lb. of silage and 8 lb. of hay per day per head. Silage costs just under £4 per ton to produce and the hay £10 per ton.

Q. 9 : The atmosphere in the cubicle house at Woodend was moisture-laden. Would it not be better to have some fans to prevent possible respiratory troubles ?

Mr Paterson : There is not as much moisture in the air now as before putting the lining in but a fan will be installed if found to be necessary.

Comment : Virus pneumonia seems to be on the increase. I hope that Mr Paterson will be watching out for it.

Mr Paterson : At Woodend, the cows did not seem to be eating as much as before the change and they are also lying down longer.

Q. 10 : My lower rail in my cubicles is 1'7" and I am still getting bruised ribs. What is your experience ?

Mr Gilmour : No trouble has been experienced at 1'5".

Mr Walker-Love : From our limited experience at Auchincruive it is necessary to take all the measurements into account. We have no evidence of bruising at 1'7".

Mr Paterson : We have never had bruised ribs during the past 5 years.

Q. 11 : Are any comparisons available on the costs of pits and towers.

Mr Gilmour : Pits are much cheaper.

Mr Paterson : You have an additional cost for equipment for loading and unloading the tower and this equipment is liable to break down.

Remark : I think the previous two speakers are biased. With a tower you can get a high dry matter (40%) and high digestibility (70%). You cannot achieve this in any other container. The cost per ton of dry matter stored in a tower is favourable with other types of silos and you get more milk from less grass.

Mr Gilmour : 40% dry matter is too high to achieve in the West of Scotland.

Additional Remark : Wilting must be achieved by handling the grass properly over 36 hours, e.g. crimpers, tedders, etc.

Mr Walker-Love : Traditional silage is extravagant from the loss point of view (it can be as much as 15%). Up to 80 cows the economic justification for sealed silos is doubtful. However, we cannot remain static. If rents and prices rise, the economics may change. The alternative need not be a sealed tower but could well be the vacuum silage which is now being tried out.

Remark : Our Grassland Society must look at the place of grass in the winter feeding programme. If we cannot improve grass silage, we must bring in barley. We are at the crossroads now and must make up our minds where to go. Grass is not doing its job properly.

Q. 12 : Have you any information on the use of barley straw and additives ?

Mr Walker-Love : Barley has the edge in terms of output per acre in certain districts. However, we cannot all go into barley in the West of Scotland and preliminary results would suggest that with very high levels of barley feeding to cows, there can be higher cow wastage.

The questioner has in mind, I think, the feeding of limited barley with straw and urea. Such a ration is possible but I am inclined to the view that it is more applicable to the arable areas than grassland areas such as our own. Urea is a possible substitute for protein but it must be remembered that such substitution will never give more milk and could give, through the toxicity factor, considerably less. It is a matter of economics and extreme care in use.

THE EFFICIENT USE OF GRASS

W. FRANK RAYMOND, Hurley

Mr Raymond opened his talk by discussing the three stages involved in animal output from grass and grassland products. Firstly the production of a good crop; secondly the management needed to utilise this crop and thirdly the use of highly efficient animals to convert grass into a saleable product.

The first stage has been successfully obtained by many farmers while improved utilisation is now receiving greater attention. However, the third stage, that of obtaining animals with a high food conversion rate has been largely overlooked and the speaker suggested that this part must receive further attention before endeavouring to push grass yields even higher. This point was illustrated by comparing animals grazing at 1, 2 and 3 lb liveweight gain per day.

M	M	M	M	Maintenance	
+	+	+	+		
	1	2	3	lb. gain per day.	
3.8	5.4	7.2	9.2	lb. S.E. per day	Feed
	5.4	3.6	3.1	S.E. per lb. gain	requirements.

The increasing efficiency in terms of S.E. required per lb. liveweight gain as daily gain improves is due to a spread of the maintenance allowance over higher growth rates. Animals which have this higher growth potential would be well worth selecting for in our breeding programme.

Mr Raymond considered that too much emphasis was being put on low cost per lb. of grass. Instead he suggested that cost per unit of animal production was of greater significance. A small increase in food cost in producing better quality grassland products would be well compensated for by improved productivity from our livestock.

In discussing why low animal production was obtained from grass, the speaker suggested that it was largely due to underfeeding either by way of low food intake or low feeding value, particularly digestibility. The seasonal fall in digestibility was illustrated by graphs, the fall being predictable from year to year with any given grass variety. It was therefore possible to predict quite accurately what the digestibility of a grass would be at any week through April, May and June. The possibility of spreading the season of

high digestibility was illustrated by comparing the early S.24 with the late S.23 perennial ryegrass. At Hurley S.24 had a yield of 5500 lb. dry matter and a digestibility of 73% on the 11th May but it was not until 31st May that S.23 produced similar figures. This 20 day time lag was claimed to be of great practical significance since most silage making activities extended over a three week period during which feeding value falls. The use of several varieties of grass each sown as separate swards would therefore improve the overall quality of silage since harvesting at a more desirable growth stage would be possible.

Mr Raymond illustrated the link between voluntary feed intake and digestibility and stressed the need for hay and silage of good feeding value in order to stimulate higher intakes of conserved products. Under grazing systems the speaker believed that availability rather than digestibility of herbage was responsible for limiting intake. Either too little herbage was on offer or there was a high degree of rejection due to contamination from dung and urine spots.

Rate of stocking was also shown to be vital for improved productivity on acreage basis. However, too high a stocking rate could reduce individual animal performance which may not be desirable. For example, Mr Raymond thought that if high stocking rate meant $2\frac{1}{2}$ years to finish a beef animal then clearly extra acres in the form of barley would be needed since under today's economic tensions beef cattle should be finished before 2 years of age.

On the subject of conservation, the value of complete evacuation of air in the vacuum silage process was questioned. The speaker suggested that rolling in conjunction with the use of a top sheet might be equally as effective. As air within a mass heats it rises and so draws cold air in and a convection current is set up in the silo. A top cover acts as a damper and stops this. Air trapped in the mass will quickly be turned into carbon dioxide and so aid the pickling process. Once the silo is filled a good seal is absolutely necessary. Mr Raymond mentioned the success of Mr Christie of Port William in making silage by this technique.

The use of a walled silo filled in layers and covered each night was more flexible than a tower since length can be added to a clamp but tower height is limited. Vacuum clamps without walls result in unevenly shaped heaps of silage which can be awkward to handle.

R. D. HARKESS

THE ESTABLISHMENT OF PRODUCTIVE PASTURES

28th February, 1966, in Agricultural College, Glasgow

J. LESLIE DAWSON
Scottish Agricultural Industries

Your Society has asked me to prompt thinking about grass seeds and about the sowing of them. I do not intend to give any lists of grass seeds mixtures but I do intend to raise one or two rather controversial points which I hope will stimulate thought.

During the last ten or fifteen years, great progress has been made in the quality of grass seed mixtures which are sown nationally. The new varieties which have been produced in this country and abroad have been imposed on the old prescriptions, on the " College " or " Cockle Park " type of prescription. These have produced flexible, easily managed mixtures and sowings which stand up to a fair degree of mismanagement. But is this the way to capitalise the advantages of the new varieties? Is this the way to take the full benefit of the work of breeders and seeds technologists who work to make farming more profitable? The breeders and pundits would say no — they want us to treat grass as a crop like barley and to use predictable performance seeds mixtures.

Mr Frank Raymond's talk to your Society last month dealt with new scientific knowledge and how this new knowledge could be made to bring more profit. The story he told was a fascinating one full of logic and sound practical sense and all of you must have tried to relate what you heard to your own farm. Personally, I believe that what we heard was very much the shape of things to come. Like Raymond, I believe that land values are so high and economic pressures so great that no longer can we afford to treat our grass as accommodation land. The land it occupies must be made to yield more profit. And in this context can I quote what J. J. Mechi said in the middle of the 19th century — " Any changes that take place in agriculture if unattended by profit are wrong and are not improvements."

But whether we use the " predictable performance " mixture or the more flexible more easily managed general purpose mixture, there are certain fundamentals which are often lost sight of. It is so easy to get the whole question of seeds and seeds mixtures out of perspective and ascribe more benefits to a particular kind of seed or brand of seeds mixture than these are capable of giving. Too often salesmen and advisers will give the impression that by sowing a particular mixture all grassland problems will be solved. This is quite wrong and quite misleading. Seeds are only one small part of the complex business of producing a good pasture. A good seeds mixture is the basis on which good husbandry practices should be founded. It is the starting point and if it is not right then there is very little you can do to correct it.

Grass in Scotland

Scottish farmers sow half a million acres of grass and clover seed mixtures each year and no farmers anywhere in the world sow as high a proportion of their cultivated land to grass as Scottish farmers. In New Zealand, leys are kept down from seven to twelve years whilst in Holland, farmers rely almost entirely on permanent grass. With such a high consumption of grass seed, our national grassland production is sensitive to the quality of the seeds that we sow and we should be able to capitalise the benefits of plant breeding and seeds technology more quickly and more completely than if our farming were based on a higher proportion of permanent grass. Despite the fact that we consume so much grass seed we are not a seed producing country. Apart from Scots timothy and the last remnants of Ayrshire ryegrass, Scotland does not produce grass seeds, it has to depend on imports from England and from overseas.

Taking perennial ryegrass, our most commonly sown species as example, our average annual consumption for the United Kingdom follows these lines:—

British Certified Seed	20%
Northern Ireland Certified Seed	3%
Northern Ireland Commercial Seed	35%
Eire Commercial Seed	4%
Danish Certified Seed	10%
Danish Uncertified Seed	10%
Dutch (Named Varieties)	3%
New Zealand (All Certified)	11%
U.K. Uncertified Seed	4%

Quality in Grass Seeds

To sow seeds of high quality has always been fundamental to the skills of farming which have grown up through the ages. From the beginning of time, no farmer would knowingly or willingly have sown anything but the "highest quality" seed. But what is high quality seed? How can a farmer assess it and how does he decide the kind of seed he wants to buy when he wishes to benefit from the latest modern knowledge.

Only a few years ago the quality of grass seeds was still being judged by the brightness and the boldness of the sample, by its freedom from obvious weed seeds and disease, by the smell of it, where it came from, and by a figure giving its germination percentage. "High quality" seed was related to these characteristics. Contracts to buy and sell were based on these terms but nowhere in these contracts was it possible to make provision for the useful-

ness or the worthlessness of the plants that grew from these seeds and were ultimately fed to livestock. Few people cared, the farmer who produced the seed crop wanted as big a yield of seed as he could get and his merchant wanted seed that he could describe in superlative qualities and then sell to make as big a profit as possible.

It was a big step forward when the farming industry realised that seeds on their own were quite valueless, that a sample of seed was worth nothing until it produced a plant. Only then was it possible to start measuring quality in terms of the usefulness of the plants that seeds produced.

The sequel to this step forward came when it was appreciated that grass seeds which looked identical were capable of producing vastly different plants in their usefulness. Take perennial ryegrass as example, ten or twelve years ago it was very common for farmers' invoices to contain the item " 18 lb. Perennial Ryegrass Finest." Now this is unknown and perennial ryegrass is described more specifically as perhaps " British Certified S.24 " or " Danish Hunsballe (O.E.C.D. Certified)." Plant breeders and plant improvers in this country and abroad have developed well over 150 different varieties of commercially available perennial ryegrass and while the seeds of all these varieties look exactly the same, the plants that grow from them are very different indeed; some are valuable, some are worthless, some are early, some late, some more suitable for short-term use and some very persistent. In the past, farmers used to think of their seeds mixtures in terms of the seeds themselves now more are thinking of their seeds mixtures in terms of the kinds of plants which these seeds will ultimately produce and the usefulness of these plants for their animals on their farms. This is as it should be and it represents another step forward in the thinking of seed quality specifications.

Certification

Progress followed with the development of certification schemes. These schemes are designed to help ensure that the buyer of seed receives what he has ordered. They aim to safeguard the buyer against admixture (both genetic and physical) with anything which will contaminate the seed which he wants and detract from its value. Certification schemes are available in all the major seed producing areas of the world from which Scotland imports seeds.

Seeds Legislation

It would not be possible to talk about the quality of seeds without referring to the Seeds Act and their Regulations. All trading in seed is governed by Seeds Regulations and every stock of seed that is sold to farmers must be tested and the results of that test declared to the buyer. Under the old Seeds Act of 1920, emphasis was placed on purity and germination figures but no provision was made for varietal purity or for the quality of the

plants that grew from the seeds that were tested. But new Seeds Regulations which came into force in 1961 and 1962, made provision for varietal purity. There is still provision for purity and germination figures but these are of a secondary importance to varietal purity, to certification schemes and to the many measures which ensure that farmers grow the kind of plants that they expected when they ordered their seeds.

A further important development for farmers in the new Seeds Regulations is the quantity of injurious weed seeds which can be sold to them without being declared. Under the 1920 Seeds Act, it was quite legal for a seeds merchant to supply seeds with up to 2% of couch grass without declaring it to the buyer. Under the new Regulations if there is more than one seed of each of five scheduled injurious weed seeds in the sample when it is tested then the merchant must declare this fact to the farmer. This is a very important step forward indeed. The injurious weeds which are serious in Scotland (as far as grass seeds are concerned) are the docks and couch grass. Why are so few farmers conscious of this source of contamination of their land ?

Establishment

Today, the most common cause of bad or disappointing grass is not seed variety or seed quality, it is inefficient sowing and the inefficient conversion of seeds into plants. Inefficient sowing of grass seeds nullifies all the benefits that the buying of good grass seeds mixture can bring and the efforts of plant breeders and results in weedy pastures incapable of producing profitably and responding efficiently to fertility and management treatments. A very high proportion indeed of the seeds which are sown never produce plants. The position is worsening as cover crops change from oats to barley and to the ever intensifying of the barley crop.

The following figures may serve to emphasise the point. A normal general purpose mixture of say 33 lbs. seed per acre will contain over 13 million seeds all capable of producing healthy plants if given the right conditions to do so. This, when sown evenly over a field, should result in over 300 seeds being sown on **every square foot of the field.** For every pound sown per acre there should be the following numbers of seeds per square foot.

Early perennial ryegrass	5
Late perennial ryegrass	5
Pasture perennial ryegrass	7
Italian ryegrass	5
Western Wolths ryegrass	3
Cocksfoot	10
Timothy	22
Red clover	5
White clover	16
Wild white clover	17

And how can all these seeds be turned into a higher proportion of plants ? How can the loss of plants be avoided ? First of all, we must ensure that adequate supplies of lime, phosphate, potash and nitrogen are present in the soil before the seeds are sown. If we consider our orthodox methods of sowing, we find that seed is broadcast on the surface and harrowed to cover the seeds. The result is that far from being covered the seed is merely being mixed with top soil. Some seed is being buried too deeply and some not covered at all. None of this seed will produce plants. It is only seed which is not too deeply covered which has a chance to produce plants. Considerable improvement is possible if the Cambridge roller is used to consolidate the ground before sowing, to draw out furrows for the seed to drop into and then for the seed to be covered by closing these furrows by a second rolling. The drilling of grass seeds is gaining popularity with the advent of more efficient machines.

The time of sowing grass seeds in relation to the time of the cereal crop is very important. The best results are obtained when grass is sown immediately after the cereal crop or at least within the same week. Grass and clover seeds which are sown into a well developed braird three or four inches high never have a chance to grow and develop. Not only does the cereal crop smother the young seedlings instead of protecting them but the already highly developed rooting systems of the young cereal seedlings create almost impossible competition for nutrients and for water.

Undoubtedly direct seeding is increasing in popularity and rightly so because it is the most efficient method of establishing good pasture. But it does not always fit into the farming pattern. Farmers are loath to adopt the principle because of the loss of the grain crop. However, with the present trend to grow massive yields of barley, under-sowing becomes extremely precarious and many farmers have adopted a method of direct seeding which allows a full year's crop from the grass. The normal grass seeds mixture is direct-seeded early in the spring with 15 lbs. of Commercial Western Wolths Ryegrass added to it, this mixture is manured with a compound fertiliser containing about 45 lbs. of nitrogen. The first growth is cut early for silage, the succeeding growth is then grazed as a good direct-seeded pasture.

Seed Treatment

It has been assumed in the past that there were no real disease problems in grassland in this country. There were certainly diseases in grass but these were regarded as being more of academic interest than of economic significance in national grassland production.

In cereals, the significance of seed-borne and soil-borne diseases is well known and the advantages of seed treatment with a fungicide is universally accepted but in grass — no, despite the

fact that grasses and cereals belong to the same natural order of plants. But there are disease problems which adversely influence the establishment of grass and have serious repercussions on production in subsequent years.

Disease in grass can be caused by organisms which are carried on the seed or by those which are present in the soil. The fungicidal treatment of grass seeds helps to combat those seed-borne and soil-borne diseases which attack, weaken and kill young developing seedlings. This treatment has no direct effect on the diseases which occur in established pastures.

Important Plant Characteristics in Pasture

Plant density is very important. The unit of production from grassland is the annual tiller. The more tillers there are in a pasture the more potentially productive that pasture will be. High plant density is the basis for high pasture production but it is important that density is due to the seeds that are sown and not to the weeds that have crept in. Greater plant density can be achieved by better sowing methods, by safeguarding against disease and by the use of high tillering varieties.

In the planning of seeds mixtures, persistence is an extremely important characteristic and the different species and different varieties of the same species have varying inherent abilities to die or to persist. Good management and well balanced fertility levels will help the persistence of sown grasses but only within certain limits.

Earliness is a growth characteristic of interest to most farmers. The main species which show ability to grow early are the Italian ryegrasses, the early cocksfoots and the tall fescues. The earliest commercially available varieties are perennial ryegrass, Italian ryegrass, meadow fescue and cocksfoot that at present come from Denmark.

The extreme winter of 1962/63 taught us a great deal about the survival of grass species and varieties under extreme winter conditions and highlighted the importance of winter-hardiness as a characteristic of plant growth.

Perennial ryegrass is not as winter-hardy as we should like, some varieties are in fact very prone to be killed in winter. In general, Italian ryegrasses and early perennials are very susceptible to winter-killing. The only varieties of early perennial ryegrass which are really resistant to severe winters are the tetraploids. Meadow fescue is more resistant to winter than perennial ryegrass and timothy varieties are very resistant.

Here again the origin of the seed has an important bearing on its growth characteristics. We find that the most winter-hardy varieties of ryegrass come from Holland where the winter conditions are much more severe on grass than are our own.

The ability to withstand drought conditions is important for many farmers. Cocksfoot, with its deeper rooting ability, is the classic species to use for drought conditions. But there are two other ways of combating drought. The tetraploid ryegrasses have prolific rooting systems and they also can withstand drought better than the diploids. Then again, by using high tillering grasses and producing extreme density it is possible to insulate the soil surface against the rays of the sun.

It is now well recognised that the feeding value of cocksfoot is inferior to that of perennial ryegrass or meadow fescue because of its poor digestibility. The work of Raymond and his colleagues has shown how important is the digestibility of grass. They have shown how digestibility is related to the maturity of the plant and can be predicted from knowledge of the variety sown and the stage of maturity the plant had reached when cut or consumed. There are many who believe that the work will lead to a new approach to grassland farming; an approach in which grass will be grown in a sophisticated manner and harvested or grazed to a programmed schedule.

Weeds will not respond to fertility neither native fertility nor fertilisers in the same way as do the sown agricultural grasses. Within species there are varieties which can give greater response to the same rates of fertiliser application. Perennial ryegrass, for example S.24 ryegrass, will produce some 50% more grass per unit of applied nitrogen than will commercial ryegrass even if this latter does persist.

Tetraploid ryegrasses deserve special mention, they were developed in Holland and appeared in this country about ten years ago as interesting plot samples. Now the seed consumption of these extraordinary grasses has developed to a remarkable extent. As far as yield is concerned, the tetraploids produce a large amount of lush green material. In terms of dry matter yield per acre, there is no significant difference between tetraploids and diploids. There is, however, very great difference in the quality of the dry matter which is produced. Tetraploid dry matter is consistently higher in soluble carbohydrate content and animals show a distinct preference for tetraploids in the field. The digestibility of tetraploids is slightly higher than that of diploids and they are certainly more resistant to frost. They are more drought resistant and they appear to have higher resistance to certain diseases.

There are however snags. Tetraploids have seeds which are almost twice the size of normal varieties and this means that there are only half the number of seeds per lb. Tetraploids are not tillering plants and tend to produce an open sole. If, however, tetraploid seed is mixed with diploid seed of an equivalent variety then it is possible to overcome some of the difficulties of having too open a sole.

Discussion

Q 1: If seed treatment was necessary surely it was up to the seedsman to carry it out. Against what kind of diseases were seed treatments effective ?

A 1: Seed-borne diseases and to a limited extent and for a short time, soil-borne diseases.

Q 2: Can you name some of the seed-borne diseases and give us some idea of their incidence on commercial stocks of seed ?

A 2: Pathogenic species of Helminthisporium are common. Some time ago we had occasion to check the seed-borne burden of certain of our stocks and found a surprisingly high incidence. Since then, an international survey has confirmed the existence of a surprisingly high burden of pathogens on grass and clover seed passing in commerce.

In Sweden, timothy is frequently treated as a condition of certification.

Q 3: Rolling before and after sowing seed is surely not advisable on all kinds of soil. Would it not produce a pan on heavy soils which would hinder germination ? Seed does quite well in our wet climate when left on the surface and just harrowed in without any rolling at all.

A 3: Seed is too expensive to waste by putting it either too deeply or not covering it at all. The only soil type where I have known the Cambridge roll to be unsatisfactory is on the very heavy clays. I do not think that grass seed can have too much rolling. Cereal seeds can but not grass seeds.

Q 4: Which is the more profiitable, short-term ley or long-term ley? I know the former has a higher yield potential but what I want to know is, does the extra production compensate for the extra cost of ploughing, sowing, seeds mixture and loss of subsidy ?

A 4: All that I can do is to state the position regarding productivity of dry matter. A short-term ley even when direct-seeded can give around 40 tons of fresh weight per acre. This kind of yield cannot be touched by any other type of seeding. Whether or not that 40 tons of green material is used profitably is a different matter altogther. The short-term leys will generally give much higher yields of digestible nutrients per acre.

Q 5: Is the amount of clover used in seeds mixtures falling ?

A 5: Red clovers are falling rapidly but white clovers are maintaining their position, probably replacing the red clovers.

Personally, I think it foolish to sow a ley without white clover. White clover has been shown to contribute to production even when heavy nitrogenous fertilizer dressings are used; furthermore, it is to be valued for its high magnesuim content and its high digestibility.

115.—A Comparison of Ryegrass Varieties for Early Bite Production

BAKER, H. K., CHARD, J. R. A., DAVIES, J. and ALDRICH, D. T.,
Hurley, N.A.A.S. and N.I.A.B.
J. BRIT, *Grassland Soc. Vol. 20, pp. 151-155.*

Plots were laid out at 32 centres ranging from southern to northern England. Italian, Westerwolth and hybrid ryegrasses were sown in three successive years and first cut yields recorded. Major differences in varietal earliness were similar at all centres and the following table gives the yield order from the main control at Hurley.

Yield order of early bite cuts.

Sowing date	April, 1960	April, 1961	August, 1961	August, 1962
Cutting date	March, 1961	April, 1962	April, 1962	April, 1963
Italians:				
Danish	1	1	4	1
Leda (Danish)	2	2	1	2
Tiara (Dutch)	4	3	5	4
Irish	5	5	6	5
N.Z. Cert. Mother ...	3	4	3	7
S.22	6	6	2	6
Tetila tetrone	–	7	7	3
Hybrids:				
Gartons perennialised	1	2	2	1
N.Z. short rotation ...	2	1	1	2

The Danish varieties proved to be the earliest and S.22 and Tetila the latest in producing early growth. A noticeable change in yield order occurred in 1963 when Tetila survived the hard winter very well but New Zealand and S.22 suffered badly.

The two hybrid ryegrasses were similar in yield but the report recommends Gartons for high or exposed sites. Their yield generally occupied an intermediate position in the Italian scale falling between Danish and S.22 at the early cut.

Of the Westerwold ryegrass varieties tested there was little to choose between Mommersteegs, Vertas, Sceempter, Barenza or Dutch. In order to ensure early bite from a twelve month old sward every effort has to be made to prevent flowering in the sowing year. Under farm conditions, this is difficult and the authors state that it is unwise to rely on year old Westerwold for early bite.

Plots sown in the spring of 1962 were wiped out by the frosts of early 1963 but the late 1962 sowings survived very well as can be seen from the table. Autumn sown swards (August/September) can therefore provide good early crops in the following spring.

On an annual yield basis the Danish varieties held their leading position, S.22 being the poorest. The hybrid ryegrasses generally out-yielded the Italian on an annual yield basis. Since swards were left down for one year only, no measure of variety survival for a second harvest year was possible. R. D. HARKESS.

116.—The Output of Swards on Commercial Farms in relation to Fertilizer and other Management Factors

BAKER, R. D. and BAKER, H. K., *Hurley.*

J. BRIT, *Grassland Soc., Vol. 20, pp. 182-187.*

Output data in terms of utilised starch equivalent (U.S.E.) were collected from 291 fields in 1961 and 309 fields in 1962. Dairy farming was the main enterprise on the farms surveyed. Leys yielded 5.36 lb. U.S.E. per lb. N applied. While output increased as N application became heavier, only 25% of the yield difference was accounted for by the applied N. Other factors such as time of N application, time of utilisation, general management and season all exerted a tremendous effect on productivity. Phosphate and potash accounted for only 1% of the total yield response. Type of sward had little effect on total yield although it did influence season of production.

Permanent pastures generally yielded less than leys although in the two years under consideration output per lb N was 5.99 lb U.S.E. Production from permanent swards was found to be directly linked to the presence of perennial ryegrass, higher outputs being from fields with higher proportions of ryegrass.

Direct sown leys in spring produced only 60% of the U.S.E. of an established ley. The authors suggest, however, that greater attention to seed bed preparation, earlier sowing and adequate fertilisation should enable an improvement to be made in the output of such swards.

R. D. HARKESS.

117.—The effect of a Paraquat-treated Grass Mulch on the Rate of Emergence and Growth of Barley, Rape and Perennial Ryegrass Seedlings

WARBOYS, I. B. and LEDSON, S., *Aberystwyth.*

J. BRIT, *Grassland Soc., Vol. 20, pp. 188-189.*

This article is an advanced research note and suggests caution when seeding after Paraquat spraying. Seeds were sown in pots in a glasshouse and covered by a $1\frac{1}{2}$ inch layer or herbage which had been sprayed 2, 7 and 14 days earlier.

Barley, rape or perennial ryegrass seedlings were all affected when sown within 2 days after spraying, damage becoming less severe as the time gap increased to 7 and 14 days. In ryegrass, 85% of seedlings were abnormal after the 2 day treatment and 10-20% were affected even after 14 days. Residual Paraquat within the decaying herbage was considered responsible for these effects and the authors were against a speedy sow out on Paraquat killed swards. Time should be given for Paraquat in the trash to become deactivated. They suggest that hasty seeding was

responsible for these effects and the authors were against a speedy sow out on Paraquat killed swards. Time should be given for Paraquat in the trash to become deactivated. They suggest that hasty seeding was responsible for many of the disappointing results associated with " chemical ploughing."

R. D. HARKESS.

118.—A Comparison of the Reaction of Different Grass Species to Fertilizer Nitrogen and to growth in association with White Clover

COWLING, D. W. and LOCKYER, D. R., *Hurley.*
J. BRIT, *Grassland Soc., Vol. 20, pp. 197-204.*

Seven grass varieties and one mixed sward were sown alone and with clover. Pure grass plots received O, 81.5, 163 and 326 lb N/acre/annum. Grass/clover plots received no N. From data presented the reviewer has compiled the following table.

Variety	*% clover in D.M. yield.*			*lb N to increase pure plot yield to equal grass/clover yield.*		
	1960	1961	1962	1960	1961	1962
S.24 ryegrass ...	30	70	56	50	290	170
S.23 ryegrass ...	35	77	56	50	305	205
Irish ryegrass ...	23	71	66	40	395	190
S.48 timothy ...	31	58	43	50	210	150
S.215 M. fescue ...	32	65	59	50	260	165
S.37 cocksfoot ...	19	58	44	30	210	165
Agrostis	66	74	60	125	265	210
S.24 + S.23 + S.37	20	65	47	20	220	150
Mean	32	67	54	52	268	176

The influence of clover content on dry matter production is illustrated by the amount of N required to boost the yield of pure grass plots to that of grass/clover plots. Hence in 1960, plots had a mean clover content of 32% and 52 lb N/ac. were required to stimulate pure grass swards to give a similar yield. In 1961, when clover content was of the order of 67% of the herbage dry matter, some 268 lb N/ac. was needed to equate yields. With the fall in clover in the third year so too fell the N requirement.

The authors noted that the presence of clover increases the proportion of total yield harvested in late summer and autumn. However, dependence on clover alone to boost production resulted in greater annual fluctuations in yield due to the uncertain growth of clover.

R. D. HARKESS.

Reviewer's Comment: The table serves to remind us that reasonable production from clover is only likely where a high proportion of the sward is clover. Over 80% of pastures in Britain have only 10% or less clover and many permanent leys receive no N either — no wonder our national grassland productivity is low. Likewise the intensive grassland user cannot wait until clover growth starts in late spring nor can he afford the variability in seasonal and annual productivity that reliance on clover N brings.

119.—Chemical Renewal of Lowland Pastures

DOUGLAS, G., *I.C.I., Jealotts Hill.*
J. BRIT, *Grassland Soc., Vol. 20, pp. 233-240.*

From several experiments on lowland swards, a list of plants susceptible to 4-8 pints of Gramoxone (Paraquat) per acre has been prepared and includes Yorkshire fog, timothy, annual meadow grass, rough stalked meadow grass and tufted hair grass. Couch, agrostis, meadow foxtail, cocksfoot, perennial ryegrass and red fescue are species with the ability to recover particularly in the absence of cultivation. Spray resistant species were found to be most effectively suppressed by rotary cultivation. Harrowing and discing were less successful.

The need for timely spraying was stressed especially for control of agrostis (bent). This grass does not produce its full leaf area until July and spraying before this date will not be effective. In order to expose all grasses present in a sward to the spray, top growth should be grazed or cut off before spraying.

The final paragraph lists practical recommendations and stresses that Paraquat is only one stage of a renewal process. Points which should receive attention are; use of selective weedkiller to reduce broad leaved weeds; reduce herbage before spraying; accurate and timely spraying with Paraquat; shallow rotary cultivation to incorporate dead vegetation into top soil, roll for compaction and moisture conservation; sow rapidly establishing grasses in order to smother any weeds; sound grazing management.

R. D. HARKESS.

Reviewer's Comment: Seems rather a lot of work to renew a lowland pasture and the technique would only be considered where ploughing was absolutely impossible.

120.—Survey of Productivity of New Zealand Dairy Farms, 1963-64

CASTLE, O. M. and CLIFFORD, H. J.

Agricultural Science (Journal of the N.Z. Institute of Agricultural Science), Vol. 1, No. 2, Sept. 1963, pp. 19-23.

It is always informative to have facts about farm productivity especially of farms in a country as favourably placed as New Zealand. Here are some of the facts which interested me.

1. The 14,583 farms in New Zealand derive all their income from dairying, average 123 acres carrying 76 cows yielding 277 lb butterfat/cow.

2. In 12,379 of these no feed at all was purchased.

3. In the most productive region, South Auckland, 4,741 farms averaged 118 acres carrying 86 cows per farm yielding 291 lb butterfat/cow.

4. The least productive farms were in East coast region with an average farm size of 91 acres carrying 41 cows yielding 218 lb butterfat/cow.

Reviewer's Comment: Most of this milk is produced on practically permanent grass given no nitrogenous fertilizer and usually just a light dressing of superphosphate every year.

These average figures include one or two stars such as T. H. Gibson, Manaia, Tarawaki, who milks 430 cows on 250 acres yielding 360 lb butterfat/cow and B. E. Murphy, Kaponga, with 400 cows on 400 acres referred to in No. 3 of the same volume of this new journal.

I. V. HUNT.

Erratum

Review 105 page 68-69 J.S.W. & C.S.G.S. No. 7, 1965. Reviewers comments line 15 should read — 1 lb per acre of paraquat is equivalent to 4 pints Gramoxone per acre.

From the College Librarian

Copies of any of the articles mentioned below can be obtained on request to the College Librarian. It is not necessary to quote the whole title but just to give the list number (8) and the number of the leaflet (1-23) as required.

1. BAINES, S. Some aspects of the disposal and utilization of farm waste. (In Journ. & Proceed. Institute of Sewage Purification. Part 6, 1964).
2. FRAME, JOHN. The assessment of utilized-starch-equivalent (U.S.E.) output from farm grassland by the farm-recording method. (In J. British Grass. Society, Vol. 20, No. 2, 1965)
3. FRAME, JOHN. Spring growth and hogg wintering. (In Scottish Agric., Autumn, 1965).
4. FRAME, JOHN. The effects of cutting and grazing techniques on productivity of grass/clover swards (9th Intern. Grass. Cong., Sao Paulo, Brazil, Session 17. Experimental techniques in pasture research).
5. FRAME, JOHN. The effect of winter grazing by sheep on spring and early summer pasture production. (West of Scotland Agricultural College, Grassland Husbandry Department, Experimental Record No. 8, 1965).
6. WEST OF SCOTLAND AGRICULTURAL COLLEGE, Grassland Husbandry Dept., Current Experimental Programme No. 8., May, 1965).
7. GRAINGER, JOHN. Disease and grass. (In *Farming Review* No. 29, Winter, 1965).
8. GRAINGER, JOHN. Economic and technical perspectives in crop protection. (In Pest Articles and News Summaries, Section B, Vol. II, 1965).
9. GRAINGER, JOHN. A possible mechanism for the action of floral stimuli in plants. (In Hort. Research, Vol. 4, No. 2, 1964).
10. HARKESS, RONALD D. The assessment of inter and intra specific competition by the wire grid technique. (9th Intern. Grass. Cong., Sao Paulo, Brazil, January, 1965. Session 3. Ecology and physiology of grasslands).

11. HUNT, I. V. Manuring for early bite, 1958. (West of Scotland Agricultural College, Grassland Husbandry Dept., Experimental Record No. 9, 1965).

12. HUNT, I. V. The technical and practical significance of chemical cultivation in West of Scotland hill land improvement. (In Proceed. 7th Weed control Conference, 1964).

13. HUNT, I. V. Herbage palatability. (In Scottish Agric., Spring, 1965).

14. HUNT, I. V. Manuring the sow-out. (In Scottish Agric. Autumn, 1965).

15. HUNT, I. V. It pays to plan your fertilizer programme carefully. (In Scottish Farmer, 30th January, 1965).

16. HUNT, I. V. Don't sow Italian alone. (In Dairy Farmer supplement, February, 1965).

17. HUNT, I. V. The effect of utilisation of herbage on the response to fertilizer nitrogen. (9th Intern. Grass Cong., Sao Paulo, Brazil, January, 1965: Session 13 Nitrogen cycle in pastures: the role of legume and nitrogen fertilisers).

18. MOON, F. E. Animal feed additives. (I.C.A.M. Conference: Developments in the Economic feeding of livestock, Edinburgh, June, 1965).

19. THOMSON, J. M. Slurry handling on the College Farm, Auchincruive. (In Scottish Agric., Summer, 1965).

20. THOMSON, J. M. and HALL, J. K. S. The introduction of cubicles, self-feeding and parlour milking at Auchincruive. (In Scottish Agric., Spring, 1964).

21. WAKERLEY, S. D. Weather and behaviour in carrot fly (*Psila rosae Fab. Dipt. Psilidae*), with particular reference to oviposition. In Ent. exp. and appl., Vol. 6, 1963).

22. WAKERLEY, S. B. The sensory behaviour of carrot fly (*Psila rosae Fab., Dipt. Psilidae*). (In Ent. exp. and appl., Vol. 7, 1964).

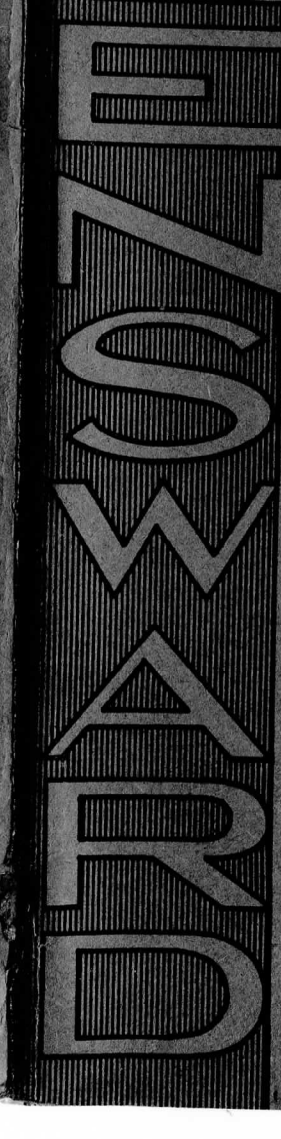
23. WATERSON, H. A. West of Scotland trials of potato herbicides, 1961–1964. (In Proceed. 7th British weed control conference, 1964).

SOUTH WEST SCOTLAND GRASSLAND SOCIETY

New Members

Since the list published in Journal No. 7 and up to 31st May, 1966.

Anderson, Andrew D., Newbyre Farm, Hurlford, Ayrshire.
Anderson, W. J., Grennan Farm, Dalry, Castle Douglas.
Brewis, Mrs. J., Ardwell, Stranraer, Wigtownshire.
Carson, R. & J., Conchieton, Twynholm, Kirkcudbrightshire.
Clark-Maxwell, N., Speddoch, by Dumfries.
Cummack, J., Killymingan, Kirkgunzeon, Dumfries.
Daniels, R. N., Tallowquhairn, by Dumfries.
Ferguson, A., Clochan, Terregles, Dumfries.
Finlayson, N. G., "Woodlands," Mauchline, Ayrshire.
Freeman, D. B., Clarencefield Farm, Dumfries.
Goudie, W., Dalricket Mill, New Cumnock, Ayrshire.
Halliday, W. J., Penfillan, Keir, Thornhill, Dumfries.
Hodge, H., Garfield, Mauchline, Ayrshire.
Kelly, K. A., Barncleugh, Irongray, Dumfries.
Kerr, V., Nether Murthat, Beattock, Moffat, Dumfriesshire.
Kingan, J., Lochhill, New Abbey, Dumfriesshire.
Mackay, C., Dept. Agriculture for Scotland, 29 Miller Road, Ayr.
Matthewson, J. M., Castlemilk Home Farm, Lockerbie, Dumfries-
Milne, J., Nether Clifton, Southwick, by Dumfries. [shire.
Mitchell, I., Commonside Farm, Annbank, Ayrshire.
Murray, L., S.A.I., Ltd., Heathall, Dumfries.
MacDougal, A., Bloomsbank, Auchincruive, by Ayr.
McKechnie, W., Schoolhouse, Whithorn, Wigtownshire.
McLean, J., Shiel, New Galloway, Kirkcudbrightshire.
MacMillan, I. A., Learig, Mauchline, Ayrshire.
McNaughton, N., Fulshawwood Farm, Ayr.
Phillips, C. R., College Office, Royal Bank Buildings, 104 King Street, Castle Douglas.
Rae, J., Boghead, Collin, Dumfriesshire.
Rennie, J. M. H., Brocklehill Farm, Annbank, Ayrshire.
Riddet, R., Burrance, Templand, Lockerbie, Dumfriesshire.
Shanks, W., Nutholm, Lockerbie, Dumfriesshire.
Smith, D., Muirhead, Twynholm, Kirkcudbrightshire.
Smith, J. E., Annanbank, Johnstonebridge, Lockerbie, Dumfriesshire
Smith, M., Mossblown Farm, Ayr.



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No. 8