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THE WEST OF SCOTLAND AGRICULTURAL COLLEGE



PROBLEM MARGINAL LAND IN THE SLAMANNAN AREA OF STIRLINGSHIRE

By

ROBERT M. PATTERSON

Agricultural Adviser, Stirling and Clackmannan

BLYTHSWOOD SQUARE,
GLASGOW, C.2.

Bulletin No. 147.

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There are many acres of poor wettish land in East Stirlingshire. Much of this land had at one time been ploughed, since riggs and furrows are commonly seen. Many of the older people in the locality speak of the old "government" drainage systems, which apparently were quite common throughout the area. Those field drains were laid considerably deeper than is now customary. The tiles were much smaller than our normal present-day ones, being only approximately 1 inch in diameter. Those old drains are now of little or no value. Much of the land in the area, however, has never been drained at all.

Prior to World War II., very little ploughing was done. The dominant herbage was moor-mat grass (*Nardus stricta*), and the grazing value poor. Those tough, wiry plants carried stock without severe poaching of the land. Limited numbers of well-grown cattle were summered on big acreages. Very young cattle did not do well on those grazings, since the feeding value was accepted as being inadequate to meet the needs of rapidly-growing stock.

During the war, land had to be ploughed, and winter stock-feeding produced. In most cases, drainage was not possible. The normal cropping was oats for one or two years and then seeds hay followed by grazing. While in "lea" oats, the underturned "mat" seemed to act temporarily as a kind of drainage system. Given a normal dressing of compound corn fertiliser, and a reasonably good harvest, a satisfactory oat crop could be expected. The succeeding, stubble, sow-out oats were usually limed and given a normal dressing of compound corn manure. The grass and clover seeds' mixtures sown were reasonably satisfactory. The oat crop was usually moderate. In a wet season, harvesting was difficult. The chances of the undersown seeds were often seriously prejudiced, because of the damage done by harvest "traffic." In addition, much harm was often done to the young grass by poaching with stock in its first autumn and winter, as well as irreparable damage done by wintering sheep. The following year, after a limited dressing of fertiliser, a moderate hay crop was taken; the hay being largely Italian and Perennial Ryegrass. From now on, the land quickly reverted to very inferior herbage, including a vigorous growth of rushes. The land had, by now, become very wet and was easily poached.

Ultimately, the grazing value was less than it had been prior to ploughing.

In conducting its advisory and investigational work, a soil survey of the area was undertaken by the College in 1944, when 204 soil samples from 35 farms were chemically analysed.

TABLE I.
SUMMARY OF ANALYTICAL DATA.

			Arable Soils.	Young Grassland Soils.	Old Grassland Soils.	Total.
Available Phosphate (P ₂ O ₅)	Low ...	...	96.9%	96.0%	100%	97.6%
	Medium ...	...	2.2%	2.0%	—	1.4%
	Satisfactory ...	...	1.0%	2.0%	—	1.0%
Available Potash (K ₂ O)	Low ...	...	52.5%	80.0%	43.6%	58.7%
	Medium ...	...	39.0%	12.0%	49.1%	33.4%
	Satisfactory ...	...	8.6%	8.0%	7.3%	8.0%
Acidity	Very Strong					
	pH 5.0 and below	...	15.0%	2.0%	16.4%	11.1%
	Strong					
	pH 5.1-5.5	...	40.0%	26.0%	45.4%	37.1%
	Moderate					
	pH 5.6-6.0	...	32.0%	54.0%	34.5%	40.2%
	Slight					
	pH over 6.0	...	13.0%	18.0%	3.6%	11.5%

From Table I, those soils can be taken as having an extreme phosphate deficiency, a low-medium potash content, and a moderate need for lime. Incidentally, the overall organic-matter status of the soils was normal.

It was now obvious, that to establish grass on this land, heavy dressings of phosphate must be applied.

After the War, the Slamannan area had become a definite problem, and in 1948 the College was approached on this matter by the Central Agricultural Executive Committee. This Committee enquired whether experiments could be conducted to demonstrate how this land could be improved.

During 1948, it was decided to experiment, if possible, in establishing grass. It was only possible to do this by the willing co-operation of R. McNee & Sons, Rottenstocks, Falkirk, on land occupied by them at Auchengean and Loanfoot. There were approximately 19½ acres in the unit. This land was generally accepted throughout the area as being typical (if not worse) problem land.

It had been ploughed out of old moor-mat grazing in 1942, limed, given approximately 4 cwts. grain manure per acre, and sown direct to grass that Summer, with a good and costly seeds' mixture. The initial take of grass was good, and in the Autumn of 1942 was eaten off with sheep. In 1943, a considerable number of animals were grazed. Rushes were, by now, beginning to appear, and very soon the whole unit had reverted to very poor herbage, including a vigorous growth of rushes.

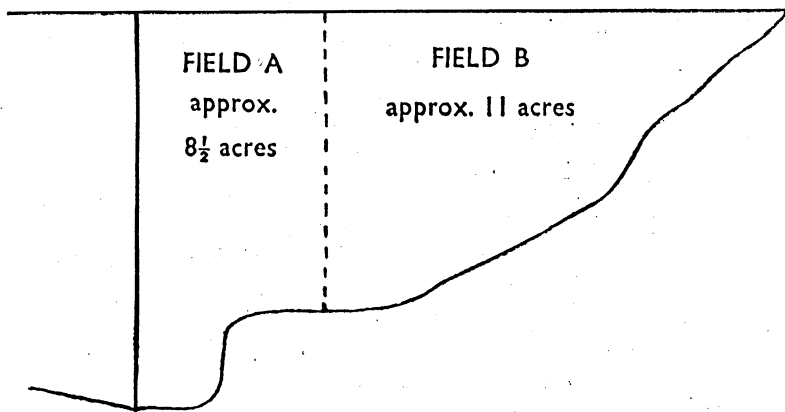
In 1948, those 19½ acres were unfit to graze, satisfactorily, 2 horses.

A botanical analysis of the herbage on this unit showed that the plants present were almost entirely undesirable types. It was therefore decided, that to attempt to establish pasture, ploughing was inevitable, and that new grasses and clovers must be sown. As a point of interest, a turf from a nearby unploughed moor-mat area was also examined.

BOTANICAL ANALYSES OF TURVES.

19½ ACRE UNIT.		Nearby Unploughed Moor-Mat Grass Area.	
Sample I.		Sample II.	Sample III.
Common Rush ... 40% (<i>Juncus communis</i>)		Sweet Vernal Grass 16% (<i>Anthoxanthum odoratum</i>)	Moor-Mat Grass 85% (<i>Nardus stricta</i>)
Buttercup ...		White Clover ... 4% (<i>Trifolium repens</i>)	Heath Bedstraw (<i>Gallium saxatile</i>)
(<i>Ranunculus repens</i>)	8%	Fiorin and Bents 62% (<i>Agrostis grasses</i>)	Woodrush ...
Lesser Spearwort (<i>Ranunculus flammula</i>)		Woodrush ...	(<i>Luzula campestris</i>)
Bents and Fiorin (<i>Agrostis grasses</i>)	30%	(<i>Luzula campestris</i>) } 2%	Sheep's Fescue ... 3% (<i>Festuca ovina</i>)
Moss ...	22%	Sedges (<i>Carex</i>)	Tormentil ...
Bare ground ...		Bare ground ... 6%	(<i>Potentilla erecta</i>)
		Moss ... 10%	Moss ... 5%
			Bare ground ... 7%
	<u>100%</u>	<u>100%</u>	<u>100%</u>

PLAN OF 19½ ACRE UNIT.



The 19½ acre unit can be divided into two areas which, incidentally, were not fenced separately. (See above plan.)

Field "A," of approximately 8½ acres, was to be seeded direct to grass with long ley seeds' mixtures, and was the actual College experiment. Part of the cost was borne by the farmer and part by the College.

Field "B," of approximately 11 acres, was to be seeded temporarily to Rape and Italian Ryegrass, and the entire cost was borne by the farmer. Four acres were tile-drained prior to ploughing.

During the winter of 1948, a crawler tractor and special ploughs were hired to do the ploughing. The land was wet, and the small amount of ploughing attempted was unsatisfactory. As a result, work was stopped. Fortunately, by the late Spring of 1949, when the land had become drier, the ploughing was satisfactorily done by the farm staff and the normal farm machinery. It was subsequently disced until a fine seed bed had been obtained.

CHEMICAL ANALYSES OF SOILS.

	FIELD "A."	FIELD "B."
Available Phosphate (P_2O_5)	Low (2 mgms./100 gms.)	Low (2 mgms./100 gms.)
Available Potash ... (K_2O)	Medium (7 mgms./100 gms.)	Medium (7 mgms./100 gms.)
Acidity ...	Strong (pH 5.40)	Strong (pH 5.35)
Organic Matter ...	Normal (10.3%)	Normal (10.4%)

For obvious reasons, it was decided to fertilise the land generously, and leave nothing to chance as far as plant foods were concerned. The following are details of lime and fertilisers applied.

MANURING PER ACRE.

FIELD "A."	FIELD "B."
3 tons ground lime.	2 tons ground lime.
14 cwts. basic slag (8%).	8 cwts. superphosphate.
8 cwts. superphosphate.	1½ cwts. sulphate of ammonia.
2 cwts. muriate of potash.	
2 cwts. nitro-chalk.	

The fertilisers were applied just prior to seeding.

FIELD "A."

In Field "A," it was decided to sow 3 different seeds' mixtures. One mixture was to have a proportion of Aberystwyth S. strains as well as commercial types, another commercial types only, and yet another was to contain a proportion of its grasses as Meadow Foxtail and Red Fescue. The Aberystwyth S. strains were thought to be more persistent and also later growing. The commercial types were accepted as being earlier. The first mixture was therefore intended to have the advantages of the Aberystwyth S. strains and commercial types dovetailing into each other. The second mixture was purely on established lines. The third mixture included Meadow Foxtail and Red Fescue, in the hope that those species might do better on this wet land.

In prescribing the actual mixtures other decisions were made. A generous seeding of 50 lbs. per acre was given in each case. Neither cocksfoot nor red clovers were sown, since their establishment was considered uncertain. Meadow Fescue was included as a substitute for Cocksfoot in each of the non-Meadow Foxtail/Red Fescue mixtures. Crested Dogstail was included in each mixture, because of its hardiness and likelihood of persisting in those difficult conditions.

SEEDS' MIXTURES IN FIELD "A."

	Commercial/ Aberystwyth Mixture.	Commercial Mixture.	Foxtail/ Red Fescue Mixture.
	lbs. per acre.	lbs. per acre.	lbs. per acre.
Italian ryegrass	8	8	8
Perennial ryegrass	10	12	16
S.23 perennial ryegrass	10	—	—
Scotch Timothy	2	6	4
S.48 Timothy	4	—	—
Meadow Foxtail	—	—	12
Meadow Fescue	8	14	—
Rough Stalked Meadow Grass	2	2	—
Crested Dogstail	3	5	2
Red Fescue	—	—	5
Alsike Clover	1½	1½	1½
New Zealand wild white clover	1	1	1
Kent wild white clover	½	½	½
	—	—	—
	50	50	50
	==	==	==

FIELD "B."

A straightforward mixture of Rape and Italian Ryegrass was sown in Field "B." There was too big a proportion of Rape included in the mixture. As a result, the Italian Ryegrass had not such a good chance as it might have had.

All the seeds were finally sown on 28th June, 1949. In August, there was an excellent growth of nutritious feeding available. It was decided to eat it off with sheep. Lambs were brought in, and by the end of the year close on 250 had been graded fat, direct off this land, without any additional feeding whatever. The established practice in the area was to purchase poor hill lambs, since bigger and quicker-maturing types did not "do." It is interesting to note that the only batch of cross lambs (B.F. x B.L.) left more profit per lamb than any of the other lots.

During 1950, the entire 19½ acres were grazed as one unit. No fertilisers of any kind were applied, except 2 cwts. of nitro-chalk on an area of just over 1 acre on Field "A." The numbers of stock carried were satisfactory, and the animals thrived well. While being grazed by the milking herd, approximately 70 gallons of milk were produced daily. Grazing commenced on 6th April and ended on 14th December.

SIMPLIFIED 1950 STOCK-GRAZING RECORD PER ACRE.

Field "A" + Field "B."

1 Cow	for	56.74 days.
1 Heifer	for	37.28 days.
1 Calf	for	2.46 days.
1 Sheep	for	322.10 days.

Details of the production from each of the long ley mixtures in Field "A" were obtained by caging. The cages were first placed on those mixtures in late summer, 1950. In addition, for comparative purposes, cages were placed on the nearby moor-mat grass area which had not been ploughed in recent years (and of which a typical botanical analysis has already been given).

ESTIMATED PRODUCTION BY CAGING—PER ACRE.

Period 2/8/50 - 12/9/50.

	Commercial/ Aberystwyth Mixture.	Commercial Mixture.	Foxtail/ Red Fescue Mixture.	Old Moor-Mat Grass Area.
Cwts. Green				
Matter ...	65.140	76.275	41.175	4.725
Cwts. Dry				
Matter ...	12.233	12.357	7.968	2.243
Cwts. Crude				
Protein ...	1.783	2.154	1.076	.266

The area caged was clipped bare when the cages were placed in position. The recorded production (from which the above records were prepared) was therefore the growth from a known area, within the period of caging. This initial clearing of the thick, wiry, moor-mat grass promoted fresh young shoots. The production, therefore, from the old unploughed area would in actual practice have been less than that recorded.

During the winter of 1950, Field "B," which, as already mentioned, was sown only to a temporary ley, was ploughed. It was dressed with 5 cwt. superphosphate plus 1 cwt. sulphate of ammonia per acre, and seeded with 6 bushels of oats per acre in the Spring of 1951. A very good crop of oats was grown. In the bad harvest of 1951, the land became very wet, and great difficulty was experienced in cutting and securing the crop. Certainly, had the crop been undersown with grass seeds, great damage would have been done during harvesting operations.

Since 1949, the 4 acres tile-drained in Field "B" produced the better crops.

Field "A" was now fenced separately and was again grazed during 1951. Since the production in 1950 had been good, a further dressing of fertiliser was justified, and 6 cwt. of superphosphate per acre were applied in the Spring of 1951. The numbers of stock carried during the season were again satisfactory, and again all the animals thrived well. Grazing commenced on 14th May and ended on 27th October.

SIMPLIFIED 1951 STOCK-GRAZING RECORD—PER ACRE.

Field "A."

1 Cow	for	50.12 days.
1 Heifer	for	55.06 days.
1 Calf	for	8.24 days.
1 Horse	for	5.53 days.
1 Sheep	for	91.76 days.

Cage records were also kept, and from those, estimated production was as follows:—

***ESTIMATED PRODUCTION BY CAGING—PER ACRE.**

Period 12/9/50 - 2/10/51.

	Commercial/ Aberystwyth Mixture.	Commercial Mixture.	Foxtail/ Red Fescue Mixture.	Old Moor-Mat Grass Area.
Cwts. Green				
Matter ...	262.238	276.751	248.063	18.113
Cwts. Dry				
Matter ...	47.347	50.851	45.221	6.305
Cwts. Crude				
Protein ...	7.714	8.518	7.752	7.68

* Fuller details of caging can be seen in Appendix I.

GENERAL SUMMARY.

The production from the pasture can be considered most satisfactory. There is still no immediate likelihood that rushes will become a serious problem. Any young rush plants that appear are grazed by the stock.

On this problem land, of which there is a very considerable acreage in East Stirlingshire, East Dunbartonshire, North Lanarkshire and West Lothian, the first need is drainage. Without drainage however, great improvements can be effected, as in the case of this experiment.

The first step is to plough. This can best be done in late Spring or early Summer when the land is drier. After generous manuring (particularly phosphate) and adequate cultivations, sow down to grass, using a suitable grass and clover seeds' mixture. Direct re-seeding is preferable to undersowing. Thereafter, when the sward is ready to graze, correct management is very important. Since the land is wet, it can be severely poached (with disastrous results to the sward) if overgrazed with stock in very wet weather. Great harm can also be done if grazed (or poached) with stock of any kind during Winter, when there is little or no "keep" available in any case. It is therefore of the greatest importance, that the much improved sward should be heavily grazed in better weather and "freed" if the land becomes seriously wet. At no time should it be overgrazed. If these rules are strictly observed, there is little doubt that much of the land will become considerably more productive.

A few years later, as a result of increased productivity and consequent profitability, it might be possible to tile-drain some of this problem land. Still better and more permanent results could then be expected. Incidentally, sub-soils from the area have been examined, and as a result of their physical "make-up," the cheaper system of mole-draining was considered impracticable.

ACKNOWLEDGMENTS.

The writer gratefully acknowledges the valuable guidance and encouragement given him in this work by Principal John Kirkwood.

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Botany Department—for botanical analyses of turves.

Chemistry Department—for soil and herbage analytical data.

Grassland and Agricultural Departments—for assistance with cage clippings and weighings.

APPENDIX I.

ESTIMATED PRODUCTION PER ACRE BY CAGING—FIELD "A."

12/9/50 - 2/10/51.

		Aberystwyth Commercial Mixture.	Commercial Mixture.	Mixture containing Meadow Foxtail and Red Fescue.	Nearby Unploughed Moor-Mat Area.	
II	Period 12/9/50-6/6/51	Cwts. Green Matter	62.775	78.975	49.950	5.738
		Cwts. Dry Matter	14.011	16.474	10.724	2.295
		Cwts. Crude Protein	1.551	2.035	1.272	.297
	Period 6/6/51-2/7/51	Cwts. Green Matter	54.675	53.663	64.800	7.425
		Cwts. Dry Matter	9.092	8.543	10.141	2.078
		Cwts. Crude Protein	1.462	1.516	1.743	.262
	Period 2/7/51-14/8/51	Cwts. Green Matter	112.050	107.325	91.800	4.950
		Cwts. Dry Matter	18.197	19.072	16.763	1.932
		Cwts. Crude Protein	3.266	3.418	2.967	.209
	Period 14/8/51-2/10/51	Cwts. Green Matter	32.738	36.788	41.513	Nothing to Cut.
		Cwts. Dry Matter	6.047	6.762	7.593	
		Cwts. Crude Protein	1.425	1.549	1.770	
	Period 12/9/50-2/10/51	Cwts. Green Matter	262.238	276.751	248.063	18.113
		Cwts. Dry Matter	47.347	50.851	45.221	6.305
		Cwts. Crude Protein	7.714	8.518	7.752	.768
						TOTALS.

N.B.—As shown in Appendix I., there was no cuttable growth on the unploughed moor-mat area, when cage clippings were taken in the period 14/8/51-2/10/51. In the same period, yields varying from approximately 33-42 cwts. per acre of nutritious green herbage were being produced from the re-seeded areas. Consequently, where re-seeded, the grazing season had been considerably extended.

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