

NOTES ON PASTURE MANAGEMENT

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A THESIS PRESENTED TO THE GRADUATE
COMMITTEE OF THE VIRGINIA POLY-
TECHNIC INSTITUTE IN APPLICATION
FOR THE DEGREE OF MASTER OF
SCIENCE.

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MAY 1915.

Pasture Management.

This review of the methods followed in the management of pastures has been taken from books by English, French, German and American authors and from experiments carried out in those countries. We will first note some of the methods advocated for the improvement of pastures worn out by use and neglect, considering especially the mechanical treatment, the fertilizers used, the varieties of grasses for seeding and reseed⁽¹⁾ing and the ways in which these grasses are sown and finally the rates at which pasturing should be allowed as shown by the effects on the stands of grass.

First-mechanical treatment; Under some conditions when the land is comparatively level and suited for cultivation it is best to plow up the old pasture, cultivate with different crops for several years and then reseed⁽¹⁾. Under the majority of circumstances however this is not practicable and it is best to improve the pasture without breaking it up. The best results have been secured from loosening the old sod, if it is thick, with the disk or spring-tooth harrow, going over the land thoroughly several times. This loosens the sod, letting in air and moisture and cuts up the roots and sod, all of which tends to cause a fresh growth of new shoots.

A number of experiments show that where disking has been done and new seed sown on native pastures the new seed have been crowded out by fresh growth from the old plants which points to the value of the disking.⁽²³⁾

Other beneficial results from disking and harrowing are a thorough pulverization of the soil forming a mulch, a distribution of the droppings of the animals and the destruction of the eggs and larvae of injurious insects.⁽²⁵⁾

If bare spots occur it is well to harrow them, sow seed (native if

possible) and harrow again. Use a smoothing harrow for covering. Harrowing should never be practised unless a good sod has been formed for more plants will be killed by it than benefitted. The thicker the sod however, especially when moss is present, the more thorough should be the harrowing. (3)

Some French experiments show good results from a thorough opening up of the sod and a heavy liming at the same time. This treatment is especially beneficial for clover and aids nitrification. (6)

In preparing land for pasture deep plowing is advisable, from 6 to 9 inches perhaps and subsoil about 6 inches in addition for no more plowing will be possible for years afterwards in the case of permanent pastures, and it is well to have the soil permeable. After plowing disk until weeds are destroyed and a firm even seed bed has been secured. An application of manure should be well harrowed in. For fall sowing, plowing and harrowing should be done in mid-summer and the harrowing should follow within a few hours of the plowing to preserve moisture. Just before sowing there should be more harrowing in both directions followed by rolling. After sowing either cover with a smoothing harrow or roll according to the nature of the soil. If however the land is of such a character that it tends to bind, rolling should be avoided. This applies also just before rains. (5) (8)

In the case of spring sown pastures rolling should be practised after sowing, after the first cutting in the fall and several times the following spring. It consolidates the soil, enables the plants to get in closer touch with the soil particles and reburies grasses up-rooted by the freezing and thawing taking place during the winter. With spring sowing it is well to plow, harrow and then plow up rough in the fall and leave until spring when the mechanical treatment is completed. As a rule the longer the interval between the first breaking ^{of} the soil and sowing the seed the better. This

applies in all cases because the soil is more easily pulverized after an interval and particularly with spring sowing, all through the winter more moisture is preserved, and when a sod has been turned under there is time for humus formation. On heavy soils the roller is generally best for covering the seed, but on dry loam soils the harrow is to be preferred. A heavy harrow on loose soils and some smooth harrow on firm soils. If the soil is light and clotty the roller is of very material advantage, used before seeding instead of the harrow.

The English very generally advocate spreading well rotted manure in September followed by the smoothing harrow and sowing seed on top of this. Large seed should be harrowed in, and small seed harrowed lightly and rolled.

The usual practise in France is to sow the grasses with some cereal as wheat. If however ~~the~~ the sowing is done in the spring the land is harrowed when the wheat is two or three inches high and seed are then sown and rolled. Rolling should be repeated several times before the following Xmas. In the north of France sowing on snow is often practised, seed are harrowed and rolled afterwards. For native pastures disk harrowing and dragging are generally recommended. In all the experiments referred to disking is almost invariably advised, except where the ~~seed~~sod is very thin. (26)

We will next consider some of the fertilizers used and the effects produced. Experiments in England and Scotland emphasize the value of Basic slag as a top dressing, Barnyard manure, and on certain soils, Kainit.

The following are some of the individual experiments; On a black peat soil containing a good deal of moss 1000 lbs of Basic Slag and 800 lbs of Kainit were very beneficial but the same application to a light soil was ineffective. A comparison of Basic Slag with a mixture of Superphosphate and lime favored the slag. Three or four years were required for the best results.

On a light sandy loam in Scotland well supplied with lime and well suited to white clover, applications of, 1, Basic Slag, 2, Basic Slag and Kainit and 3, Ground Limestone were made. The Slag alone was profitable.

An experiment at Reading, England, emphasizes the advantages of a mixed fertilizer for pastures over one ~~compound~~ ^{composed} of a single ingredient. A mixture of 100 lbs of N. of Soda, 500 lbs of Basic Slag, 200 lbs of Kainit and 16 loads of Barnyard manure increased the yield of hay cut from a pasture mixture by over a ton per acre while a larger quantity of manure alone, increased the yield ^{about} 3/4 of a ton and Basic Slag alone 1/2 a ton.

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On a damp heavy clay soil containing an abundance of organic matter and N. but little lime, the results were calculated from the increase in weights of sheep fed. The best results were from 1000 lbs of Basic Slag and the next best from Superphosphate and lime. Other applications were not profitable.

M. J. Sutton of London recommends as a dressing for old pastures a compost of one half manure and the other half a mixture of road scrapings, coal and wood ashes, and hot lime mixed with pond mud. the whole well mixed and applied at the rate of 10 cu. yards per acre. (11)

In France a very similar compost is widely used and applied every three or four years and in between, applications of ~~500~~ 50--100 lbs of nitrate of soda, 500--600 of Thomas Slag and 100--200 Kainit. (13)

An experiment in Essex, England, gave excellent results from 400 lbs of Basic Slag, and a mixture of 400 lbs of Superphosphate of lime and 200 lbs of N. of Soda applied on alternate years. Basic Slag alone was profitable on poor clay soil. At Cambridge, England, the value of a pasture was tripled by feeding decorticated C. S. cake to sheep grazing it. On nearly all kinds of soil Basic Slag gave best results as the first step towards improvement

but in order to make the best use of it the pasture should contain considerable clover. On a clay loam soil 250 lbs of superphosphate and 50 lbs of sulphate of potash gave better returns than basic slag while N. of Soda and Barnyard manure were unprofitable.

In New Zealand an experiment was conducted to test the effect of fineness of division on the fertilizing value of Basic Slag, which is rather insoluble. Passed through screens having 100, 60, and 30 ~~wires~~^{meshes} to the square inch the returns in grass were respectively 17,800, 17000, 16600 lbs as compared with a yield of 12600 lbs untreated. In the same experiment the results were better from the slag than from the Superphosphate and much better than from an application of burned lime, (20) (6).

The yield of hay on an old pasture unfertilized for 25 years was increased from 1216 lbs to 4496 lbs by an application of Kainit and Superphosphate.

where

In Germany ~~when~~ marsh lands are relied on for most of the pastures a very much run down ^A tract of land was materially improved by ammonium sulphate but gave poor results on a pasture in fair condition. The latter was more improved by phosphoric acid and lime. (4). In Switzerland potash fertilizers were found to be always of benefit and essential where nitrogen and phosphates had been used. (21).

The French recommend Eschatop dressing for permanent pasture on heavy soils 250 lbs superphosphate and 250 of N. of Soda; for light soils 250 of Superphosphate and 190 of guano and 130 Kcl.

Other experiments in England resulted as follows; As a top dressing for a calcareous loam, Kainit, Superphosphate and N. of Soda; on a poor clay ^{soil} with a hard subsoil phosphatic fertilizers were of most value while basic slag was superior to bone meal. On stiff clay 600 lbs Basic Slag and 100 lbs

of N. of soda were most successful while barnyard manure was equally as good. A light stoney soil was most improved by 10 tons of barnyard manure and this amount was of more value than 15 tons.

Experiments on run down pastures in this country demonstrate the value of a dressing of barnyard manure every three or four years and small applications of phosphoric acid and potash, always using lime when the drainage is poor. Experiments recorded from the increased weight of sheep gave much the same results as in England, Basic Slag giving the largest returns.

In Nebraska it was found that plots well manured in the fall stood drought much better than those not manured. A 200 lb dressing of N. of Soda in the spring was also beneficial.(17). N. Y. experiments recommend barnyard manure in small quantities at frequent intervals.(19).

In New England good results were obtained from Slag meal and high grade sulphate of potash and from 200 lbs muriate of potash and 350 of N. of Soda and 400 lbs of acid phosphate.

Three combinations much used in Germany are; 1, Liquid manure and Superphosphate, 2, Bone meal and Kainit, 3, Thomas Slag and Kainit.(5).

In South ~~Wales~~ it was found that Basic Slag gave better returns when used alone than with lime, due to the fact that lime probably neutralized organic acids that would otherwise have rendered the slag available.

Joseph F. Wing gives as a good treatment for improving a pasture the following; Apply ground limestone, disking afterwards to loosen the sod and work in the lime. Then dress with 500 lbs of Bone meal, 400 lbs of acid phosphate and either 200 lbs of N. of Soda or sow 4 lbs of Red and 2 lbs of white clover per acre. He advocates rotating the different animals in the pasture and warns against applying sheep manure to sheep pasture on account of parasites. (15).

wet land. Orchard grasses ~~were~~ ^{was} slow in getting a good stand and did best on land that had been plowed. None of the clovers used made good stands and the conclusion was that they were not well adapted to the mountain conditions. Timothy also was too easily injured by trampling.

Taking up the grasses in some detail we find that timothy is short-lived and should be mixed with the clovers for permanent pasture. Timothy and red top go well together, as a stand of the former can be quickly secured and the latter is more permanent. In wet meadows red top and alsike clover make a good combination. Red top does well on an acid soil and is less injured by trampling than some of the other tall grasses. As orchard grass grows in bunches it is usually filled in with clover. It makes a rapid growth when once started. It is not best for wet soils. Tall oat grass is deep rooted and a good drought register but as its foliage is bitter, not more than one fifth of a mixture should be composed of this grass. Italian rye grass is short lived and should be avoided for permanent pastures but makes a good temporary pasture sown with red clover. Kentucky Blue grass should make up the major part of mixtures for permanent pastures. Canada Blue grass is especially good on clay soils and will thrive under more adverse conditions than the Kentucky. (15). Just as timothy and red clover are the standard for uplands, red top and alsike are for wet lowlands. (9). A mixture recommended for permanent pasture in Virginia is Orchard grass, 10 lbs, red top, 5 lbs, tall meadow oat grass, 12 lbs, white alsike and red clovers, 5 lbs each. (18): another is; Orchard grass, 5, red top, 5, meadow fescue, 5, Tall oat, 5, white and Japan 2 each. A series of experiments in N. Y. State gave the following results; One plot was sown to 20 lbs each of Kentucky Blue grass and red top--after four years 80% was red top, 10% blue grass and the rest clover and weeds. Another

plat sown to 8 lbs each of Kentucky blue, meadow fescue, meadow fox-tail and red top after three years contained 30% of Ky. blue, 30% red top, 10% of meadow fescue, 20% meadow fox-tail and 10% weeds.

The results of a Tennessee experiment with orchard grass justify the use of one fifth of a bushel of red clover seed per acre with the orchard grass, and finds the average life of an orchard grass pasture to be from 5 to 7 years.

For the most part the grasses used in English pastures differ from those commonly used in America. Since English pastures are among the best in the world it may be worth while to review some of those that seem best. Especial emphasis is laid upon perennial rye.(8). White clover is universally used-it seems to open up the soil, enriches it with organic matter and aids nitrification.

In regard to seeding old pastures the seeds of timothy, white clover, cocksfoot, yarrow etc. go readily through roots of the old grass to the soil. They should be sown just after harrowing and rolled. Great emphasis is laid on having a large number of different grasses in a mixture for permanent pasture. They generally advise sowing about 10 or 12 grasses and 4 clovers. Among the varieties that have proven of most value are red top, meadow fox-tail, crested dogs-tail, cocks-foot, orchard grass, the fescues, perennial rye, timothy and rough stalked meadow grass, and the legumes, trefoil, alsike, red clover, white clover, sainfoin, yarrow etc. Meadow fescue should be sown only in low rich meadows while yellow oat grass, crested dogstail and sheeps fescue are excellent for calcareous uplands. Perennial rye forms a thick compact sward invaluable both on account of the bulk of the grass produced and its quality. (7).

There are certain English pastures that have been noted for years as the best in England. Some are said to cause the cattle grazing them to produce excellent butter, others are known as cheese pastures etc. An experiment was conducted to determine the composition of these pastures. Samples of the turf were taken and allowed to grow under as nearly natural conditions as possible until the individual grasses could be recognized. Most of them contained the same constituents to a large extent, but in varying proportions.

The following mixture was in a pasture noted for feeding but not fattening cattle and had this composition;

1. On a stiff moist plastic clay of a yellow brown color in Kent;

Graminae 90%, in which were approximately Rye grass 80%, Dogstail, 8%, timothy 7%, Bent grass, 1%, meadow foxtail, 1%, meadow barley, 1%, and Yorkshire fog, 1%.

Legumes 8% all white clover

Miscellaneous, 2%--narrow leaf plantain, mouse ear, chickwood, butter cup etc

Next we have a pasture in Dorset noted for fattening cattle without other food. The soil was a loam resting on a stiff blue clay. Its composition follows;

Graminae, 80%---Rye grass, 76%, Rough cocksfoot, 13%, Dogstail, 5%, Yorkshire fog, 3%, Bent grass, 1%, Rough stalked meadow, 1%, Sheeps fescue, 1%, and Yellow oat grass, 1%.

Legumes, 5%--White clover, 50%, purple and meadow clover, 50%.

Miscellaneous, 15%,-Chickweed (mostly), butter cup, hawfs foot, plantain, speedwell, etc.

Another noted for fattening in Dorset on a stiff clay soil with a slaty clay sub-soil;

Graminae, 100%, Rye-grass, 77%, Yorkshire fog, 9%, Bent, 8%, Meadow foxtail, 3%, Dogstail, 2%, Timothy, 1%.

Legumes---A trace of white clover.

Miscellaneous---A trace of chick-weed and butter cup.

A pasture in Ireland on a light brown loam above carboniferous limestone was noted for supplying both increase of bone and fat to the animals feeding on it.

Graminae, 49%---Rye grass, 66%, Bent, 27%, Yorkshire fog, 6%, and 1% of Rough cocksfoot, dogtail, sweet scented vernal, meadow grass.

Legumes, 2%--Mostly purple clover with some white.

Miscellaneous, 49%--Hawksbit, Butter-cup, plantain and chick-weed, nearly equal amounts of each.

Another pasture in Derby with a compact chocolate colored loam soil of alluvial origin on a gravel sub-soil was noted for the milk production of its dairy cows.

Graminae, 18%-- Rough cocksfoot, 33%, Yellow oat grass, 20%, sheep fescue, 18%, Bent grass, 12%, Dogstail, 7%, Sweet scented vernal, 7% and Yorkshire fog, 3%.

Legumes,-----A trace of Birds foot, trefoil, and white clover.

Miscellaneous, 82%, mostly common sorrel, earth or ~~pigment~~ ^{hig nut} and buttercup.

We next have a pasture in Wiltshire on a light brown friable loam soil known for its butter production.

Graminae, 45%, Sheeps fescue, 57%, Yorkshire fog, 15%, meadow fescue, 11%, Rye grass, 10%, Bent grass, 6%, Sweet vernal, .5% and dogstail .5%.

Legumes, 3%---Purple clover and Birdsfoot trefoil

Miscellaneous, 52%--Plantain made up 6/7 of these and the rest were common sorrel, butter-cup and chickweed.

The next two pastures were noted for their cheese production. The first in Leicestershire on a stiff rich brownish clay soil.

Graminae, 58%.----Rye grass, 67%, Rough cocksfoot, 26%, Bent grass, 6%, timothy, 5% and dogstail ;5%.

Legumes, 42%---White clover, 95% and the rest purple clover.

Miscellaneous-----A trace.

The other cheese pasture occurred in Somerset on a light brown loam with some gravel.

Graminae, 88%. Rye grass, 86%, timothy, 10%, Yorkshire fog, 3% and a trace of meadow fox tail and rough stalked meadow.

Legumes, 6%-----White clover.

Miscellaneous-----Buttercup.

One other pasture in Herefordshire was especially good for fattening sheep. It was a very old upland pasture on a rich red friable loam;

Graminae, 88%-----All rye grass.

Legumes--~~12%~~-----All white clover.

Miscellaneous-----None. (12).

Some mixtures commonly used in France are; On calcaneous clay soils-- English perennial rye, 25 lbs, meadow fescue, 25 lbs, timothy, 25, white clover, 25 lbs and meadow grass 25 lbs. These should mature at different periods. For dry highlands-- English rye, 25 lbs, cocksfoot, 25 lbs, ordinary clover, 10 lbsm hybrid and white clover, 5 lbs each and sainfoin, 25 lbs.

For light sandy soils--Woolly soft grass, 5 lbs, Sheeps fescue, 12 lbs, ray grass, 40, Orchard grass, 15 lbs, white clover, 5 and Hybrid clover 3 lbs, (27). Another mixture recommended for the Eastern United States is; timothy, 15 lbs, Ky. blue, 10 lbs, meadow fescue, 5, red clover, 7, alsike, 6 lbs, and white clover, 2 lbs.

In general the following rules apply to the quantity of seed to be sown;

1. Harsh climates require more seed,
- 2, Grasses that increase by root stock require less seed,
3. The better the preparation of the soil for seeding, the less seed are required.
4. The larger the number of grass seed in the mixture the less relative amount of each should be used.
5. In permanent pastures sow larger amounts of the most adaptable seed.
6. The quantity of seed required increases with the size of the seed.
7. In semi-arid climates sow sparsely (10).
8. When climate is suited to corn, sow pastures in fall, otherwise in spring (16).

The next point is the rate at which pasturing should be allowed.

First of all grazing must be prohibited early in the spring when the ground is wet and if possible when the plants are reseeding. A large tract of mountain grazing land in the West was much improved by fencing in about one fifth of the total area each year before the beginning of the seeding period, and this was protected until the seed had matured and been disseminated. Animals were then turned in and were much benefited by the good pasture at the end of the season (2). For the good of both animals and

grass it is well to graze horned cattle first, then horses and finally sheep as this gives an even cropping of the turf.

An objection to very early pasturing in the spring in addition to the wet lands is the fact that the root growth depends on the presence of leaves and consequently they should not be cropped too closely. It is usually best to mow grass the first year and perhaps the second. Sheep should always be kept from a young pasture as they graze too closely, but they are very beneficial after the 3rd year and help to thicken the stand (8). A few horned cattle in a sheep pasture will help to maintain an even sod by eating the tufts of grass. Animals should be started on the poorer pastures and work up, or much grass will be refused. Pasturing should not be carried too late into the fall as a little growth is needed for winter protection and for a start in the spring. Nor should pasturing be allowed when the ground is wet and frozen. There is much difference of opinion as to whether very close grazing should be allowed. Those who are opposed claim that close grazing weakens the plant growth through loss of leaves, exposes the soil surface, causing evaporation and consequent loss of moisture, and removes winter protection (10). Others claim that close grazing thickens the stand more than ~~anything~~ anything else. The whole question of pasture management is an unsettled one and much remains to be done before definite rules can be laid down.

- (1) "Revegetation of Overgrazed Range Areas"--Arthur W. Sampson.
- (2) "Natural Revegetation of Depleted Mountain Grazing Land", A. W. Sampson.
- (3) "U. S. D. A. Bureau Plant Industry. Bulletin 114--126, "The Reseeding of Depleted Range and Native Pastures"--David Griffiths.
- (4) "Deut, *handw.* Presse" pp. 331---Hendricks.
- (5) Exp. Station Records Vol. XVI. pp. 969.
- (6) ~~_____~~
- (7) "Permanent Pastures"---M. J. Sutton.
- (8) "The Conversion of Arable Land to Pasture"----W. J. Malden.
- (9) "Grasses of N. America"-----Beal.
- (10) "Grasses and How to grow them"-----Thomas Shaw.
- (11) "The Management of Grass Land"-----Arthur Roland.
- (12) "The Herbage of Old Grass Lands"----W. Fream.
- (13) "La Semaine Agricole".
- (14) "Manurial Exps. on Pasture Land"-----Univ. College of N. Wales.
- (15) "Meadows and Pastures"----Joseph F. Wing.
- (16) "Plantes Fourragères"-----C. V. Garola.
- (17) Exp. Station Record--(Nebraska) Vol. XVI.
- (18) "Southern Planter"--July, 1913.
- (19) U. S. D. A. Bureau Plant Industry, Cir. 49.
- (20) "Vol. XXIII." "Manuring Pastures in New Zealand."
- (21) Exp. Station Record, Vol. XVII, pp. 954.
- (22) "V. pp. 707.
- (23) "VII. pp. 27.
- (24) "IX.
- (25) Arizona Exp. Sta. Bul. 57.
- (26) "Permanent and Temporary Pastures"----M. J. Sutton.
- (27) "Herbages and Prairies Naturel"-----Boitel.

Other references from which much of this material has been secured are the following;

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Toogoods' Treatise on Pastures and Pasture Plants. V. S. D. A. Buls. 111--120.

"Presfoin et Betail en Algerie," J. Massol.

"Bri~~stol~~^{ish} Grasses" ---Wm. Curtis.

"Prairies Artificielle" ---Vianne.

"Notice sur la Culture des Graminées propres à faire des Prairies, Pâtures, etc" ----A. Desort.

"Improvement of Pasture Land without Breaking up" John Douglas.

Donaldson on Manures, Grasses and Farming.

"Manuel Practique de Culture Fourragère"-C. and H. Deniffe.

"The Improvement of Mountain Meadows" ----J. S. Cotton.

"Pastures" J. G. Smith U. S. D. A. Farmers' Buls, 51--75.

Exp. Station Record Vols. XIII, XXIV, XIV, XVIII, XXIV.

Grazing Experiment.

The experiment, the results of which are recorded below, is being conducted for the purpose of determining the best methods for the management of blue grass pastures under conditions similar to those existing at Blacksburg, Virginia.

The effects of disking and of harrowing the sod are compared with results observed on plots having no mechanical treatment.

The alternate grazing of pastures is compared with continuous grazing.

Similarly the effects produced by heavy and by light grazing are compared with observations of the effects on the stands of grass and the gains made by animals grazing upon them.

For carrying out this experiment a typical tract of land has been selected, rolling in character, unplowed for about twelve years, and the sod composed for the most part of blue grass and red top.

Two experiments have been conducted under similar conditions, side by side, with the object in view of checking each other.

In the first experiment the results are obtained from clipping the grass from plots, variously treated, drying, and weighing the yield. For this purpose six (6) one-fiftieth ($1/50$) acre plots were arranged and designated, A, B, C, D, E, F, respectively.

Plot A. was disked at intervals and clipped every ten days.

Plot B. was untreated and clipped every ten days.

Plot C. was harrowed with a spike-tooth harrow, and clipped every ten days.

Plot D. was untreated and allowed to mature its grass.

Plot E. was disked and harrowed and clipped every twenty days

Plot F. was left untreated and clipped every twenty days.

A comparison of A and B then will decide the value of disking. A comparison of C and B will give the value of harrowing, while a comparison of A, B, and C with D, E and F will decide as to light versus heavy grazing.

In the second experiment actual field conditions have been observed.

Eight two and one half ($2\frac{1}{2}$) acre fields were fenced off, the character of the ground being practically the same in each. Each field extends a short distance into a strip of woods for shade where fresh water was provided. These fields were designated A, B, C, D, E, F, G, H, and were treated as follows:

Field A was disked at intervals in such a way as to cut the sod but not completely turn it.

Field B was left untreated and grazed alternately every two weeks with field A.

Field C was harrowed with a spike-tooth harrow at intervals

Field D was ^{un}treated and grazed alternately every two weeks with Field C.

Field E was disked and harrowed.

Field F was left untreated and grazed alternately with Field E.

Field G was grazed heavily and Field H lightly up to 1914 when the treatment was reversed.

The animals grazing the fields during the various years of the experiment are designated below in tabular form.

Years	Fields				
	A & B	C & D	E & F	G	H
1908	9 sheep	9 sheep	9 sheep	6 sheep	4 sheep
1909	4 steers	4 steers	4 steers	2 steers	1 steer
1910	" "	" "	" "	" "	" "
1911	" "	" "	" "	" "	" "
1912	" "	" "	" "	" "	" "
1913	" "	" "	" "	" "	" "
1914	3 heifers	3 heifers	3 heifers	1 heifer	2 heifers

In order to compare the results secured from these experiments, they, both from the small plots and from the fields, are presented below in the form of tables.

Results from one-fiftieth acre plots.

Years.	Plots and Treatment.				
	A	B	C	E	F
	Disked, clipped every 10 d.	Untreated Clipped every 10 days.	Harrowed with spike-tooth harrow. Clipped every 10d.	Disked & harrowed. Clipped every 20 da.	Untreated Clipped every 20 days.
1909	1459.5	2243.5	2034.5	1965.5	2603.
1910	1781.5	1869.	2000.	1675.	1812.5
1911	733.5	875.	754.5	748.5	792.5
1912	790.	760.	921.5	961.	1096.5
Average wt. clipped in 4 years.	1191.1	1436.8	1427.6	1337.5	1576.1

Results from Field Experiment.

Animals-Year	Disked	A	Untreat- ed	B	Harrow- ed	C	Untreat- ed	D	Disked & Harrowed	E	Untreat- ed	F	Grazed Heavi- ly	G	Grazed Light- ly	H
Sheep	1908	92	137	160	2	96	107	64	153							
Cattle	1909	362	471	441	330	551	404	488	255							
"	1910	554	357	337	365	250	442	648	328							
"	1911	598	186	192	596	213	780	484	274							
"	1912	259	383	343	380	279	413	345	229							
"	1913	297	346	299	175	no data	no data	285	246							
"	1914	334	249	270	410	284	327	186*	233*							
Average for 7 years.		357	304	291	322	279	412	364	239							

*186 lbs. added in column H, and 233 in column G.

A study of the results secured from the small grass plots emphasizes these points: that disking the sod reduces the yield of grass decidedly; that the use of the spike-tooth harrow produces neither a decrease nor an increase in yield; that the effect of a combined treatment of disking and harrowing is noticeably harmful. Since the harrowing alone was harmless, this again points to the evil effect of disking the sod.

Since the average yields from the plots clipped every twenty days were slightly larger than from those clipped every ten days, we would say that light grazing was preferable. However, as the differences were slight nothing very definite can be said about this point from the above.

A survey of the results secured from the field experiments is as follows: Disking increased the yield slightly but so little as to be almost negligible. Harrowing produced a slight decrease in yield, while the field on which disking and harrowing were combined was very decidedly injured.

A comparison of the average yield of the first six fields which were alternately grazed, with that of the last two grazed continuously, is perhaps in favor of the alternate grazing, but this difference is not great.

The most striking feature of the experiment is noted in the results of the treatment of Fields G and H. With the single exception of the year 1908 when sheep were used, heavy grazing has produced very superior yields, and in 1914 when the treatment of these fields was reversed, grazing H heavily and G lightly, the yields were reversed accordingly.

We may conclude then from the results as a whole that the mechanical treatment of pastures produces but little effect, but is, if anything, rather detrimental; that alternate grazing may be very slightly superior to continuous grazing; and finally, moderately heavy grazing is superior to light grazing, both as to yield of grass and its freedom from weeds.