HEATHER HAY HOUSES HEALTH

by the Author of Garden First in Land Development

The story of a fascinating

LAND RECLAMATION

which will be brought within the ambit of practical economics when the

DERATING

clauses of the

LOCAL GOVERNMENT BILL, 1928

H. H. H. H.

To the

CONSERVATIVE GOVERNMENT,
1924—1929.

THIS BOOK IS DEDICATED, UNDER A DEEP SENSE OF GRATITUDE, BY ONE OF THE UNNUMBERED BENEFICIARIES THAT THE DERATING OF FARM LANDS AND BUILDINGS IS DESIGNED TO ASSIST.

HEATHER - HAY HOUSES - HEALTH

BEING A DESCRIPTION OF LAND RECLAMATION NEAR THE NEW FOREST, AND LEAVES FROM THE LIFE OF A LAND LOVER,

—— BY THE AUTHOR OF ——

"GARDEN FIRST IN LAND DEVELOPMENT."

With a Chapter by

DR. BERNARD DYER, D.Sc., F.I.C., F.C.S.

ON CHEMICAL MANURES SUITABLE FOR CULTIVATED HEATH.

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CONTENTS.

NOTE: Chapter XI. is on somewhat different lines, and may not interest some to whom the rest of the book appeals; whereas it is hoped that others, who are not interested in reclaiming the waste will find Chapter XI. worth reading for itself. Neither class need feel aggrieved, as, by printing both the little works together, and so, it is hoped, doubling the number of purchasers, it will be possible, through the sweet reasonableness of the publishers, to sell the two brochures at the price of one.

LIST OF ILLUSTRATIONS.

N.B.— All the photographs were taken or plans drawn on Hampshire Heath.

General Introduction.

OF the millions who have travelled from London to that well governed Borough on the South Coast where Sir Dan Godfrey's orchestra makes excellent music, many thousands must have wondered why the New Forest still remains uncultivated. If they were to dig up a little of the top soil and crush it, their surprise would certainly not diminish, for the earth would remind them of what the gardener uses for potting greenhouse plants in. Why, therefore, it is asked, should not considerable portions of this vast space be brought under the plough?

The subject is of supreme importance at the present juncture, because, *if ever there was a psychological momentum for doing anything with heathland, it is now that Mr. Winston Churchill has given an entirely new impetus to the reclamation of waste ground. By the brilliant inspiration of that illustrious statesman, a business-like way has at last been discovered of helping agriculture so substantially, that a considerable area of that part of our native soil, which, hitherto, it has not paid to till, will be cultivated when the Chancellor's derating proposals become law.*

Without attempting to give a definite reply to the question referred to in the first paragraph, the following pages will describe, in simple terms and, it is hoped, popular style, the technical details of an effort that has been going on for the past eight years to reclaim a portion of some 1360 acres of typical New Forest country.

When writing, an author must decide whether he will disclose his identity. Anonymity always seems to have a taint of cowardice about it, unless modesty makes such obscurity imperative; but, in the present instance, to disclose unnecessarily either the writer's name or the address of the place written about might savour of advertisement. And there is another reason

for his remaining incognito. It would have been difficult to attain even the modicum of use that it is hoped the little volume may prove to be, without touching on controversial subjects and, consequently, criticising the policy and actions of others; and those others, not being all politicians whose names are household words, might not have remained unidentified if the critic himself had been published. So a compromise has been decided on. A *nom de plume* will be used, but any one, who is seriously concerned in reclaiming the waste, or who, in the public interest, desires to pour well-merited condemnation on the writer, can trace him, if he or she consults a book called "Garden First in Land Development." Oh no, Kind Reader, this is not a dodge to sell another book, as it is out of print, and—in order to save Sherlock Holmes trouble—a copy may be seen at the Bournemouth Public Library and one is in that of the Surveyors' Institution. A *nom de plume* has also this advantage, that it allows the writer, without being conspicuously egotistical, to enjoy a pastime which sometimes gains in delight as old age advances, viz., talking about himself. The pseudonym of "Psi" has been chosen for three reasons; (a) it is short; (b) it is rather typical of an unknown quantity; (c) it enables the reader to tell at a glance both the extent and limit of the writer's studies in Hellenic classical literature. For, like most men, he has, in his day, played different parts; and a few leaves from the life of a Land Lover will show the road that led him to spend most of his time for the past eight years in so uphill and comparatively unexplored an undertaking as the reclamation of a barren waste, which had probably never been cultivated since the waves swept the sand and swirled the shingle into kopjes.

Towards the end of the reign of George III., two Grandfathers were born where Devonshire marches with Cornwall. One believed that, in order to enjoy life it was necessary to live well, and the other began

life by keeping race-horses and ended by the rest of the family keeping him. The result was that, from reasons of economy, two Grandsons, Chi and Psi, were day boys at a Public School, which education, though in many ways inferior to the boarding sort, certainly gives more scope to personal initiative and enterprise. For Chi and Psi lost little possible fun or sport, sometimes, among other eccentricities, walking a mile to shallow ponds to obtain skating after two nights hard frost and back to 8 o'clock breakfast before the sun softened the ice. Chi's Cadet Corps Enfield carbine for garden small birds with No. 2 shot to increase its range !, when Psi was only eleven years old, led to performances crammed with thrills for the sportsmen ; and, even a lessening of prestige amongst the neighbours was countered by the evidence the complaints afforded of the flat trajectory of the old muzzle loader. Later, Psi and three school fellows with their ferrets and pack of terriers were well known in that part of the country, and there was probably not a gamekeeper for miles round, with whose face distorted by anger the boys were unacquainted with.

When the time came for the lad to leave school and go to Cambridge, with a view to Holy Orders for which he had been destined, he proposed, as an alternative, a career of Veterinary Science ; for, interwoven with an overmastering love of Nature and the Countryside, his two ideas about a desirable profession were, first, to escape turning over the hated pages of Smith's Latin Dictionary, and, secondly, that happiness depended almost entirely on horses and sport. In proof of which it may be mentioned that as soon as his savings reached the sum of £18, he invested them in one of the best hunters in the Burstow Country with a correspondingly wicked temper, though he had neither the nerve nor physical fitness to ride the animal to hounds. As a compromise he went to learn something of farming for a short

time before drifting into an indenture with a firm of Architectural Surveyors and Auctioneers; and, when each was little past his twenty-first birthday, a fellow pupil and Psi started to practise on their own account.

Why the public trusted such juvenile professionals must always remain a mystery; but, within a fortnight, an unknown guardian articled his ward to the new firm. Youngsters often wonder why the Father paid a premium, in order that his Son might work for nothing; but, as soon as the position is reversed, and the full-blown man, with a clientele of his own, finds a string of presentable youths each begging the acceptance of a three-figure cheque for the privilege of giving his services during a term without salary, the advantages of the arrangement are too obvious to require any explanation. Psi and his Partner, in the new-found delight of being their own masters, treated work as it should be treated, with the ardour of a sport, often sticking at it till bedtime and on Saturday afternoons. Within twelve months they had secured the lease of one of the two most central and prominent buildings in a delightful old, more or less country, town of 100,000 inhabitants. It had four stories including a front office and two partners' well-lighted rooms on the ground floor. On the other side of the street was an interesting old place erected by Archbishop Whitgift, and immediately in the rear a block of half-timber houses where Ruskin spent some of his early years.

Alas! almost all the old-time relics of that ancient town have disappeared. The main influence in Local Governing Bodies has usually been that of the most important tradesmen of the place, who, in this instance, naturally decided to widen their quaint old street, rather than make a cheap by-pass road to accommodate increased traffic.

When those old buildings were pulled down, a chastely exquisite Elizabethan stoneware jug, that shows to the greatest advantage a medal bloom in

its most perfect phase of possible beauty, was discovered in the ruins. It is now in the writer's study, where it is treasured far beyond its intrinsic value—first, because it is not improbable that the great Art Preacher, struck by its exceeding grace, pinched the vessel in his boyhood before his idea that art and morals are inseparable had fully developed and, in later life, forgot where he had buried the thing ; and, secondly, because the little jug, in the serene environment of Hampshire Heath, helps to blot out of mind a noisy, greasy, trammy mass of traffic and London-like shops, and brings back a vision of between 60 or 70 years ago. There are quaint old thoroughfares with great pollarded trees on the public paths, small bow-window shop fronts, and the school of old Miss F. who was remarkable chiefly for the smallness of her stature compared with the size of her chignon, into the top of which she always inserted a spare pair of spectacles. Psi sat next a little girl with a huge cascade of long frizzy hair, and, every time she gave it a little flaunt, pieces would get into his eyes and mouth and down inside his collar, but, as the maiden was two years older and could read and do sums, annoyance invariably gave place to pride. A very few of the oldest residents wore swallow-tail coats of pale blue or dark brown box cloth with high collars, the Sign of the old Inn was suspended right across the main street, and the seer of the vase attended the Old Parish Church before it was burnt down on Christmas Eve, 1867, and all the bells except the tenor one were melted.

"I often think of those *Nodyorc* bells
Whose tones so wild, would,
In days of childhood,
Fling round my cradle their magic spells."

But, after eight or ten years work, Psi took to travelling abroad, and each time, on returning, the office collar rubbed a little sore place. His morning

hours were reduced to from 9 to 9.30, and his favourite hack was jokingly re-named " Business," so that the clerks could tell impatient clients that the Governor was out on her.

And then the call of the open air became irresistible and he retired altogether from business, except so far as the steadfast prosecution of certain hobbies can be so called, and devoted himself to land problems of different kinds.

Some years previously Chi and Psi had spent a week or so driving and picnicking in the New Forest, and although the pony which had been bought at Tattersall's " quiet to ride and has been driven," bolted on the return journey and smashed the cart and harness to little bits, the recollection of that arcadian time in the Forest never faded, and, towards the end of 1920 Psi obtained possession of what, for the purposes of this book, will be called Hampshire Heath, and so, once more, got back to the land.

There can be few more attractive hobbies than the active ownership of ground, and the optimist, who is not devoid of imagination, can see in it great possibilities. In this instance it seemed only necessary to keep the plough and harrow going with plenty of basic slag and other artificial manures to turn the barren heath into smiling meadows. More intimate acquaintance with the problem showed that, if there was one thing the soil had an objection to, it was (with the exception of *Molinia coerulia*) grass, and that the nearest approach to a smile that cultivation could produce was when the sand grinned through the shallow top spit. However, after some years' effort, without a day off, except Sundays, Good Fridays and Xmas days, some approach to complete success has been reached, sufficient at any rate to induce agriculturalists and horticulturalists to enquire how it is done, and farmers to take a long look at the work in progress and the verdant growth as they drive by on market days. It is therefore hoped that, if agri-

culture becomes once more an economic industry, the following description of the methods successfully employed on Hampshire Heath to turn the unprofitable waste into an appetitive sward will add a little to any information on the subject of land reclamation that has hitherto been available as the result of practical experience in this country.

The book has been written rather in diary fashion, and scraps have been added to the various chapters as the items came to mind, at odd times of the day and night during the past two years ; hence there will probably be found some lack of rhythmic sequence. For simplicity, Psi is referred to as the author, but that in no way detracts from the importance and value of the chapter on Artificial Manures, which Dr. Bernard Dyer has been so good as to add out of the rich stores of his knowledge on the subject.

Introduction to Chapter I.

THIS chapter has been kindly contributed by Dr. Bernard Dyer in answer to the author's request, in order that readers of this little book may have before them the most authoritative scientific and technical opinion available at the present time in this country on the subject of chemical manures suitable for reclaimed heaths. Dr. Dyer himself is too well known to need any introduction, but it may be recalled that he is Official Agricultural Analyst for Hants and nine other Counties, in which areas he has been a very helpful friend to the farmers ; and his many writings on agricultural chemistry are read and esteemed far beyond the said counties. As there is a certain amount of political and other disputable matter in parts of the book, it is only fair to Dr. Dyer to say that such parts have not come under his notice.

CHAPTER I.

The Manuring of Reclaimed Heath-Lands.

By Dr. Bernard Dyer.

WHEN by clearing and by mechanical labour the land under reclamation has been brought into what may be called tillable condition, the next task of the reclaimer is to decide how best to feed the crops that he proposes to raise on it. Provided that the soil is sufficiently retentive of moisture and, on the other hand, that it has been so dealt with that it is not damp and water-logged, any kind of sandy soil, if it contains nothing inherently pernicious, may, in theory, carry and mature crops provided that sufficient plant food be present for their need, and given the incidence of a normal and normally distributed rainfall; but unhappily the last condition cannot be commanded and would be a limiting factor in a soil that consisted of mere sand, even with the help of abundant and complete chemical fertilisers.

There must be present in the soil something that will absorb and hold sufficient moisture to prevent plants from wilting in hot and dry weather, viz., humus or vegetable mould. This will be present in the soil of most heath-lands in some proportion or other from the long accumulated *debris* of past natural wild vegetation. This vegetable mould or humus will in itself also contain some supply of the chemical elements of plant food—phosphate, potash and nitrogen. The former two may be present in but small quantities, the latter mainly in a form in which it is not immediately useful or available. But under the influence of mechanical cultivation and the consequent aeration and especially of the application of

lime, it will form a gradual source of naturally produced nitrates and so contribute a quotum of available plant food. But in most cases the contributions made to the quantity of readily available plant food by the soil itself, even under good tillage and management, will be insufficient to yield crops that will afford remuneration adequate to the justification of the enterprise of reclamation. If one could command an unlimited supply of farmyard manure or of rotten stable manure, one would use it with confidence and in abundance for any crop on such land. But farmyard manure is only produced on a farm that is already in the full swing of cultivation and is not an article purchasable in the open market. Town stable manure which used to be the mainstay of the market gardener was once easily obtainable anywhere and especially near large towns for not a great deal more than the cost of carriage and cartage, and it could be bought in advance and stacked until it rotted and mellowed, making an ideal application for a sandy soil. But now the motor engine has so far extinguished the horse as to make stable manure a real luxury and anyone setting out to bring heath-land under the plough and turn it into smiling meadow or pasture or into good arable land must look for aid to what, by convention and arbitrary use of terms we usually call "artificial" fertilisers.

The writer has been honoured by the enterprising author of this little book with the request to offer some suggestions as to the fertilisers most likely to be useful on reclaimed heath-land and he has assented to the request, but not without considerable diffidence; because, although, for a great many years, he has been engaged in experimenting and observing the effect of fertilisers and in doing his best to advise his farming friends in many counties as to their use under a great variety of conditions, these conditions have for the most part been those of the already established farm. He has in earlier days seen farm land long notorious

for its poverty become rich and fertile when the gospel of chemical fertilisation, thitherto unknown to its holders, has brought salvation; and he knows pastures rich in clover and lush grasses which were formally meagre and infested with bents and weeds of every kind known to poor pastures; but, unfortunately he cannot claim any personal experience of heath-land reclamation. His suggestions must, therefore, be based on the information he has from time to time gathered from what has been done in this direction abroad and on general principles so far as guidance of these may be regarded as safely acceptable.

He feels that this apologia must be made before he proceeds to assume the courage of recording the suggestions about to be made which, however, he trusts may not be without some measure of practical utility.

Sandy heath-lands are usually poor in lime, and lime is an essential element for healthy farm vegetation. The term "farm vegetation" is used to distinguish between farm crops and the natural vegetation which flourishes on heath-lands. Gorse and heather and plants botanically allied to heather flourish where there is so little lime that it may almost be said to be absent. Such plants are known as "calcifugous," i.e., lime-shunning. The gardener knows that an azalea or a rhododendron (botanical cousins to the heaths) suffers if the bed in which it grows is allowed to share in the dressing of lime which may be good for the rest of his garden. And there are certain wild grasses that, if not actually lime-shunning, will grow where lime is all but absent. So a fen or heath may be gloriously covered with its own natural vegetation, but will be infertile for farm plants by reason of its scarcity of lime, even apart from any other consideration. Lime, therefore, would seem to be one of the prime factors in the "taming" of sandy heath

Lime is used agriculturally in various forms. Burnt lime finely ground, or burnt lime slaked and weathered are very largely used. In these forms lime is powerfully alkaline when applied to the soil, and such forms are best adopted for use on clay land. But the writer is disposed to think that the milder form of carbonate of lime is, on the whole, more suitable for the case which we are considering. Carbonate of lime is usually applied in the form of ground chalk, or of finely ground limestone. In any case it should be applied in a finely divided state and not in lumps. The writer has examined specimens of a very useful form of finely divided soft carbonate of lime which, he understands, is obtainable in Hampshire as a by-product from the softening of hard water. The reason that carbonate of lime is preferable in our case to burnt or caustic lime, is that it can be used in a much larger quantity without any risk of harm from what is called "burning." It is not possible to overdo the application of carbonate of lime as might very easily be done with burnt or slaked lime; and, therefore, a big dressing even up to ten or more tons an acre can be given which will last for a good many years. Carbonate of lime is gradually soluble in rain water under the influences prevailing in the soil and is gradually washed away in a solution of the soil drainage water. But taking one year with another, the loss of carbonate of lime in this way does not on the average exceed about seven cwt. per annum, so that a dressing of 10 tons per acre of carbonate of lime will not be completely exhausted for about twenty years. It might here be noted that the particular form of carbonate of lime that has been mentioned contains a substantial quantity of water. In the case of one sample examined the mixture amounted to not far short of 30 per cent., so that in order to get ten tons of pure carbonate one would have to use about fourteen tons of the moist substance. A smaller quantity may, of course, be used, the dressing being

repeated sooner than if a larger quantity had been used. In any case, the lime should be spread evenly over the surface of the land and well worked into the soil in the preliminary operations of ploughing and sub-soiling. This liberal application of lime should have a good effect not merely in the correction of acidity, but in aiding in the decomposition of the organic remains in the soil.

The use of Basic Slag as a source of phosphates has been found of very great value on a large scale in the reclamation of moorlands on the continent, where it has been used in conjunction with potash salts, and with the growth of green crops "ploughed in" to form humus. Basic Slag is good for all crops, but it is especially useful in the rapid development of pasture land, being particularly favourable to the growth of clover. It should be used in the initial stage of preparatory cultivation and should be applied as a heavy dressing—not less than 10 cwt. per acre of best grade of slag, but more if a lower grade is used. Such a dressing will make itself felt for several years and is more effective than the same quantity divided up into several annual dressings. The slag should be well worked into the ground and not left merely sprinkled on the surface.

If the reclaimed land well worked and limed and slagged is to be sown with grass it is desirable that a gentle and effective supply of nitrogen should be provided and this, at this stage, will probably be best applied in the form of four cwt. per acre of fish-guano which should be well mixed with one cwt. of sulphate of potash, and then evenly distributed with a mechanical manure distributor in the preparation of the seed-bed and, therefore, prior to sowing the seed. As to the mixture of grass to be sown a good seedsman should be consulted as to the best mixture for very light land. But white clover—preferably the very useful variety known as "wild" white clover—should be a constituent of the grass mixture,

and also some birdsfoot trefoil which helps to make good "bottom." In the second year, that is to say the first year of cutting or grazing, one cwt. of sulphate of ammonia evenly distributed will prove useful. There need be no fear of applying sulphate of ammonia or nitrate of soda to hay land or pasture. There is or used to be a prevalent idea frequently expressed and reiterated that rapidly acting nitrogenous manures, like sulphate of ammonia and nitrate of soda, were inimical to clover. This under the ordinary conditions of farming is quite a mistake. Although well established clover gets nitrogen from the air through its root nodules it is, nevertheless, in its young state especially, as responsive to nitrogenous manure like sulphate of ammonia and nitrate of soda as are the grasses themselves. It is not necessary here to discuss how and why this misapprehension grew up; but it has been largely due to the misinterpretation of experiments carried out for scientific purposes under conditions differing from those which normally prevail on farm land.

The recent and now very active move in the intensive cultivation of pasture land by means of the use of sulphate of ammonia or nitrate of soda is to be welcomed as tardy recognition of truths that some of us have been trying for many years to bring home more extensively to the owners of grass-land. For a long time the farmer has been mistaught, on authority that it was difficult to disregard, that provided he treated his grass-lands with phosphates and potash the clovers by means of their root nodules would obtain from the atmosphere all the nitrogen needed to keep up a healthy growth of grass.

On very light and sandy land sulphate of ammonia is probably preferable to nitrate of soda as it does not wash down so easily. Until the grasses are well established and deep rooted there is a danger of the nitrate getting out of range of the young roots if its application should happen to be followed by a heavy

rain-fall; whereas sulphate of ammonia is better retained by the surface soil and only nitrifies gradually.

If the big dressing of slag recommended has been given, no more phosphatic manure need be given to permanent grass-land until after a lapse of say three seasons, when the ground may be refreshed by an additional dressing of a few cwts. of slag which might be repeated again after two or three years according to the condition of the grass. But one cwt. of sulphate of potash should be applied every other year preferably in the autumn, the sulphate of ammonia dressing being given in the spring.

As to arable crops, various schemes of cropping may obviously be adopted and each of these will require its own system of manuring. Possibly already some local experience may be existing as to the suitability of this kind of land (of course, if well treated) to carry wheat. Certainly heath-land is far from being typical "wheat-land"; but the growth of wheat should be possible and we here give it—though out of turn—"first mention" because it is the ancient symbolic crop of arable land.

It would, however, scarcely be desirable to start with wheat right away; it would probably be preceded by a crop of clover or a crop of vetches consumed on the land or ploughed in.

Clovers and vetches belong to the botanical tribe of *Leguminosae* which also includes lucerne, sainfoin, peas and beans. All plants of this family have a peculiarity which is not possessed by other farm crops. If the roots of any of these plants are examined, they will be found to have growing on them warts or nodules. These nodules are full of bacteria which have the special power of taking up from the air in the soil atmospheric free nitrogen and combining it in such a form that the host-plant can make use of it for building up its nitrogenous constituents—first amides and finally proteins or albuminoids. Other plants than the *Leguminosae* are dependent

upon combined nitrogen, that is nitrogen in the form of ammonia or more commonly in the form of nitrates derived either from the organic matter of the soil, or from such manures or fertilisers as may be used to furnish the nitrogen necessary for their growth. When a leguminous crop like clover dies, or is reaped or " fed off," it leaves behind it in the soil a crop of roots rich in nitrogenous matter, gathered from the free source of the air. When the soil is ploughed up these rootlets die and decay and furnish what is practically equivalent to a dressing of farm-yard manure for the next crop. That is why clover is so excellent a preparation for wheat. In an ordinary pasture the clovers by means of bacteria in their root nodules are always gathering free nitrogen and as they are always forming new roots the old roots, as they die and decay, furnish manure for the grass plants with which they are in contact, so that clover is an especially useful constituent in pasture or meadow land. But as has been already pointed out, clover, although very independent as regards nitrogen when in its mature condition, is far from disdaining nitrogen help in its early stages.

One of the advantages of choosing a leguminous crop like vetches or sainfoin, when a green crop is to be grown for ploughing in, is that in addition to all the carbonaceous matter it contains and imparts to the soil, it also holds a large quantity of combined nitrogen obtained from the air whereby the soil is enriched in nitrogen as well as humus when the crop is ploughed in. Mustard, often used for green manuring, returns to the soil the nitrogen extracted from it but no more.

This little digression has arisen from the expression of the supposition that prior to wheat, if one intends growing it, one should grow a clover crop. Clover, however, is not usually sown by itself. It is sown with or immediately after a crop of spring corn (oats or barley) amongst which it establishes itself as a sort

of carpet, as the corn does not shield it too much from the sun, and it goes ahead after the field becomes a stubble. We will assume, then, oats to have been sown, followed by clover, the heath-land having been prepared by tilling, liming and slagging as already indicated for grass-land. The dressing of fish guano and sulphate of potash should also be given before sowing the oats. We then start with a well manured oat crop with clover sown among it for the next year. Whether the oats do or do not get a top dressing, or whether the fish guano will prove sufficient nitrogenous dressing for them depends a good deal upon the soil, and the grower must judge from their appearance when the blade is well forward. A full green colour as the growth advances shows a sufficiency of nitrogen; a pale colour is generally an indication that some more would be desirable. Oats are particularly responsive to nitrate of soda and one cwt. of nitrate of soda as a top dressing should give good results. A second cwt. should the season be moist, will probably be well repaid especially if it is desired to get a heavy straw crop as well as a good crop of grain, for as our heath-land is now presumably being converted into arable, plenty of straw will be a good asset for increasing the production of much coveted farm yard manure. The clover that will follow the oat crop should not need a further dressing, and should make a good preparatory crop for the wheat which will be sown in the autumn on the broken up clover ley after the clover has been hayed or preferably fed off by sheep or stock. Alternatively to clover, vetches may be grown and either fed off on the land or ploughed in as green manure. Wheat, in either case, should then need no more fertilisers except one top dressing of one cwt. of either sulphate of ammonia or nitrate of soda. A very large area of wheat would probably not be attempted until experience shows whether the land proves adaptable for wheat. Light land may not always be able to carry the wheat

crop even if well treated. It may be that oats prove more satisfactory and if so, there seems no reason why oats should not be taken a second time in a four course rotation ; or barley might be an alternative though this is generally grown after the root crop. After the grain crop, whichever it be, a crop of roots or cabbages would probably follow and should the root crop be swedes or white or yellow turnips, three cwt. of superphosphates and one cwt. of muriate of potash should be sown in preparing a seed bed, and one cwt. of sulphate of ammonia per acre may be sown evenly between the rows if singled out. In the case of swedes the dressing may be two cwt. per acre.

If cabbages or kale be grown in place of turnips the same treatment may be given as regards superphosphate and muriate of potash. The land having been originally well dressed with slag, according to our supposition, three cwt. of superphosphate will be enough. Under ordinary circumstances where there was no earlier dressing of slag, one would increase the superphosphate to four cwt. for cabbages. Two dressings of nitrate of soda should be given between the rows, one and a half cwt. per acre after the plants are well established and another one and a half cwt. later on.

If the root crop should be potatoes, three cwt. superphosphate and one cwt. of sulphate (not muriate) of potash and one cwt. of sulphate of ammonia should be well mixed together and dribbled long in the furrows in which the potatoes are planted. After the potatoes are well up another cwt. of sulphate of ammonia should be sown between the rows ; and, according to discretion, a further one cwt. might be given at the time of earthing up. All this is on the assumption that no farm-yard or stable manure is available. If there be any it is to the root crop rather than any other crop in the rotation that it should be given, partly as an insurance against the effect of possible

drought. If such a dressing is given the nitrogenous top dressing will be correspondingly less lavish. After turnips or cabbages and potatoes, oats or possibly barley may follow. If the roots or cabbages have been consumed on the land, barley should not need fertilisers beyond perhaps a small top dressing of sulphate of ammonia or nitrate of soda, but if the crop were potatoes, which would necessarily be removed from the land without returning anything to it except the haulm, a nitrogenous top dressing will almost certainly be needed.

It will have been noticed that superphosphate has been specially recommended for turnips and cabbages and potatoes, although superphosphate is an acid manure and acid manures are not usually recommended for light soil, poor in lime; but it must be remarked that we presume *that the soil has already had a good inital dressing of lime* as well as of slag and that we are not suggesting the application of superphosphate on what may be called virgin heath in its unlimed state. It may be asked why more phosphatic manure after the large initial dressing of slag? The answer is that turnips and cabbages and potatoes are very dependent upon an ample supply of immediately available phosphoric acid, in the very early stages of their growth and that the good start given to them by a special abundance of phosphate near the seeds or sets is a great factor in their subsequent welfare. There is no danger (always assuming the initial liming) of souring of the soil. Even if the land had not been limed, superphosphate would be preferable to more slag for potatoes which grow well even in slightly acid conditions of soil.

If a miscellaneous vegetable farm is to be started on market gardening lines, the methods of fertilising vary for the different crops. Carrots and onions for example, should never be grown (in the absence of farm yard or stable manure) without a special dressing of potash as well as of nitrogen and phosphate. And

the market gardener should give phosphate every year, superphosphate four cwt. per acre, or basic slag five cwt. per acre, the one in one year, the other in another year, so that these two fertilisers alternate with one another.

This part of the subject (vegetable gardening) is too large to attempt to discuss within the limits of this general chapter, but anyone enterprising enough to start market gardening on reclaimed heath-land will find a good deal of information as to the general fertiliser requirements of most of the vegetable crops in a little work in which the writer has chronicled the results of more than twenty years of experimental field work on the manuring of vegetables carried out by himself and his friend, the late Mr. Shrivell, on the farm of the latter, with the aid of a grant placed at their disposal during the period by the Chilian Nitrate Committee. (This little work, called "The Manuring of Market Garden Crops," is obtainable from Messrs. G. Street & Co., Ltd., 6, Gracechurch Street, London, E.C. 3, at the price of 1/- post free).

PLATE I.

The Agent's Heathery Home.

CHAPTER II.

Fencing and Tree Stump Pulling.

ONE of the first things to be seen to on Hampshire Heath was the enclosure of the area within a proper fence in order to define clearly and permanently its boundaries, to keep cattle in or out and to prevent, as far as may be, trespass. The best materials were iron and wire, taking into consideration their costs. Strong iron 6ft. standards from Government surplus stock were to be had at about £50 per thousand, and fifteen tons of old telegraph wire were bought from the Railway Company. The worst part of this type of fence is that the wire, being old, is not very strong and also that it requires tarring. The quickest way of surmounting the latter drawback is to use a pad of sacking in the hand instead of a brush, as by this means the wire is covered all round in one motion. Two of the most potent reasons for fencing in land of this description are :—

A. Because sometimes there is an inclination on the part of people living near to regard it as common land, believing that by turning out stock on it for a certain length of time they may be able to claim a prescriptive right to do so. This view is correct, provided the landowner was aware or should have been aware of the trespass and took no steps to stop it.

The owner of land is bound by common law so to fence in his ground that his cattle cannot trespass on his neighbour's property. Any question as to who is responsible for fencing farm lands from heathlands can usually be settled ; First by the owner of the farm land having been in the habit of maintaining the fence along his boundary ; and Secondly by the presumption that the Lord, when granting the former

the privilege of enclosing some land, would have been practically certain to have made it a condition that the said farmer should make and maintain a fence (see Gale on Easements, 9th Edition, p. 411). The principal harm that cattle do, if allowed to stray over the heath, is to mutilate seedling and young Scotch Firs. It is difficult to imagine that resinous pine needles tempt the palate of a sensible cow and neither would they, if there was plenty of grass to eat; but, in winter and spring, there is little herbage left on the heath, and though heather appeals to horned stock after a shower of rain, a continuance of that food is, one can understand, not very attractive. The mouthfuls of fir twig that cattle bite off do not kill the trees, but they give them a set-back and reduce their chances of making shapely specimens. And although the commercial worth of such poor quality timber, after reaching maturity, would be small, its value during the intervening years as shelter and ornament in a district that is becoming more populated must be great.

B. Because of the terrible risk of heath fires, due to a slight act of carelessness on the part of the trespasser: a smoker's match or cigarette end may start a blaze that will burn for months. It sounds harsh to keep all people off the land for this latter reason, seeing that some may be non-smokers, but how can those responsible for the upkeep of the property distinguish abstainers a mile off without a two mile walk over rough ground to find out? Again the harmless class would tempt the dangerous to walk in the former's footsteps, and if no trespassing is allowed those who use nicotian abstinence will at any rate have the satisfaction of knowing they have not caused a weaker brother or sister to offend.

The expensive straining posts called either "terminals" or "intermediates" that were in vogue when iron and wire fencing first came into use are not necessary. All that is required for straining at each

end being one stout standard for the upright and another bolted on to it for a stay. The former should have holes to admit of long ½in. bolts being inserted at such spaces apart as it is intended the wires should be, and the highest hole should be an inch from the top. These long bolts require eyelet holes at the smooth end for fixing the wires to that they may be strained tight by the nuts. The stay should have six inches at the bottom flattened out and turned sideways to form an abutment, and, the same at the top to allow that end to rest flat against and be bolted to the upright. If much strain is given the wires, one or two shovelfuls of concrete must enclose the foot of each terminal and stay. The smith charges 3/- a dozen for forging these stays, which includes punching the bolt holes. The standards are usually 9 feet apart but, when the cost has to be severely restricted, it is sufficient to fix them 18 feet apart, provided the wires are laced together by two or three upright strands at even distances between each pair of standards; always remembering that unless animals are tethered by the mouth few fences will restrain them. There is one thing about wire fencing, in country districts, that, to some people, is a great objection; it stops or at any rate seriously interferes with riding to hounds. To foot packs it is of course no obstacle, provided no barbed wire is used, and the Courtenay Tracy Otter pack, about 15 couples of beautiful hounds, meet at intervals by the side of Hampshire Heath.

Yesterday, the Home Office reported that the Home Secretary had been appealed to from several quarters on the subject of stag hunting and he had, without showing any lack of humanity, stated the fact that no legislation against sport could be passed, unless it was desired by the majority of the Nation. The following incident may perhaps help a little to form public opinion, on a subject about which different persons will express divergent views. More than

fifty years ago Psi, with others, recaptured a carted deer in his Father's garden; and although, from frequent use of dogs and ferrets, he was accustomed to pain in wild animals as inseparable from field sports, the memory of that hunted creature's acute distress has never left him. The sweat dripped from the poor brute's matted coat, its tongue almost touched the ground as it protruded from its hanging head and blood oozed freely from its nostrils. In these days, the public conscience on cruelty to animals seems, if anything, almost over-sensitive, and those who have been proved guilty of an offence of the kind are often attacked without mercy, and, under these circumstances, it is strange that the hunting of tame stags should be allowed. It is possible that the intemperance of some of those, who plead the cause of animals, has weakened the influence of the dumb creatures' friends. Animals cannot, as a rule, suffer physical pain to the same degree that we do. A rabbit, that has been badly shot at, will run off just as fast on three legs; a pheasant that has lost a leg will pick up a living on one foot without surgical aid; a puppy will not leave off lapping its bread and milk because its tail is docked; it is said that a horse, lame from spavin, and that does not gradually work sound on the road, feels no pain; and many horses that limp slightly in their trot possibly do not feel so much distress as we imagine from the very fact that, by slightly halting, they keep to a certain extent from hurting the diseased foot or limb. On the other hand, a rabbit pursued by a stoat, and before its enemy has come near it, suffers apparently the most excruciating agony; and many of those who are most voluble in advertising their kindness to animals, keep cats that put young birds and rabbits to death by torture. The whole subject is a very difficult one and should be approached without sentimentality on one side or selfish bias on the other.

Another kind of fencing is necessary, and that is wire-netting to keep out rabbits, which do much injury to grass and other green crops and are fatal to most young trees and shrubs. Vegetables or flowers can be replaced but, when the bark of a tree is nibbled round, the growth of years is wasted. A few shrubs such as rhododendrons are immune. Scotch fir and silver birch are usually untouched in their wild state, but cannot be guaranteed to be safe from an attack when artificially planted; and, if a branch of *Pinus Scotia* that has grown up amongst rabbits is cut or broken off, the bunnies will skin all the rind off the limb after it has withered. When hard pressed for food they will eat the bark of beech trees that have passed their 50th birthday. Yellow broom is considered a great delicacy by burrowing rodents of the hare family, and the skin of laurels and fruit trees always makes their mouths water. It is curious that the excrement of rabbits seems in Nature to have no beneficial effect on plants, but rather the reverse, and the grass and plants they do not eat they retard. The damage that rabbits can do to pasture is amazing, and it is useless to attempt to reclaim portions of heath-land without first surrounding them with rabbit-proof fencing. England would not seem like home without wild rabbits, but, to be quite candid, the pretty little creatures never look their best except when doing the grand circle in the presence of an intimate dog, man and gun. The wire-netting that is used here is, as a rule, 3ft. wide, 19 guage, 1½in. or 1⅝in. mesh but a 2in. mesh for the upper half would be sufficient. Where there is an iron and wire fence, the netting is attached to it by bending a little of the top of the netting over a strand of fencing wire here and there; otherwise it is fixed to hazel stakes not less than 4ft. long, which may be bought direct from the wood-cutter's at from 5/- a hundred delivered. They can be bought at this low figure because, for the purpose in question, they may be too stout or too

crooked for broom handles. If they are stout enough it is well to split them down the middle; not only to double the number, but a split stake rots slower than a whole one. One or two wires are strained and fixed along these wood stakes to give greater stability, and to fix the netting to. The Forestry Commission recommend turning the bottom 6in. of netting outwards on the surface of the land and fixing it down with a sod of earth every few feet, though where the fence is likely to remain more than two years they now let the bottom 6ins. into the ground, but still with a curve outwards. Both plans are based on a rabbit's habit of trying to scratch its way under the base of the fence quite close to it, though a rat's greater cunning would teach it to start its excavations further from the obstacle to be undermined. There is usually a difficulty in preventing the rabbits from entering a netted field under the gate, as the bottom rail is about 6 ins. off the ground, and if the netting reaches down to the earth it is liable to become bent up. The best methods appear to be either to lay down an old railway sleeper as threshold or to fasten a small strip of wood or light iron on to the bottom of the netting when it will hang loose and, though resting on the ground, will give sufficiently to allow the gate to be opened over uneven ground. All this netting business adds considerably to planting outlay, and it has other drawbacks; the galvanizing perishes so quickly nowadays that the netting only lasts a very short time when exposed to the air, though the part underground will be sound for perhaps twenty years, and the short bits of rusted wire that fall apart are dangerous to ruminants who may unconsciously pick them up when grazing near the plantation. When men are using bind wire for fixing they should be very careful to put short ends in a bag or their pocket as it is most dangerous to leave them about. Fencing must of course include gates, and five barred oak ones at about 22/- each are still good, but concrete

posts which are quite easy to make have rather superseded oak ones. Very cheap rough gates may be made out of dilapidated iron hurdles by cutting off one foot and reducing the other to the single straight spike. This last can revolve in a small hole in a little block of sunk concrete, and an upper hinge can be made of a stout wire loop that includes the gate and passes round a terminal in the iron and wire fence. A considerable saving in labour and material may be effected by screwing in an iron hole-scoop, instead of digging holes for posts or for concrete bases for iron standards, as the hole can be kept to the smallest desired diameter. A tool of this sort is also very useful for testing the subsoil or finding out at what depth water may be obtained if not many feet down. One of the most useful hand tools that have been invented of late years is a wire-cutter that will go through ⅜in. of iron as though it were cheese. These tools are probably old army stock and the cost is only 3/6 each. Various types of bars are made with which to strain fencing wire; it is usually a very simple contrivance about 3ft. long with turned points at one end that give a non-slipping point d'appui against the straining post, and, near the same end, is a hole to admit and grip automatically the wire. This gives a powerful leverage by grasping the opposite end of the bar. Of late years all sorts of angle iron have been sold as fence standards and a definite specification should be insisted on, or the holes either too large or too small may be found at odd distances apart, or the six foot lengths may turn out to be too heavy to lift in comfort, or so light as to bend when rubbed against by a cart horse or bullock. Even if the standards are blacked over before they are delivered by the vendors, they should be coated with gas tar previous to being employed in a fence. This work ought to be carried out some time before the standards are used, so that the tar may first become dry and not soil the men's hands and clothes. It is hard lines

on working men to lose "time" on account of bad weather, and if fence standards are stored under cover, there is always something for those employed on the estate to do when it rains. It is well to have a clear agreement on this point, as there is a sort of tacit understanding that when the weather is too bad to be out in, it is useless to attempt any occupation except that of waiting for the sun to shine. Then again the tarring can be done in the way described without messing the men's garments, as the irons are laid on rests and the top ends are left uncoated to hold them by. Other tarring work is very dirty and the men so employed are paid 6d. a day extra for soap, in the same way that they are paid 1/- a day extra for sowing soot or basic slag, both of which are bad to handle when they are used on young seeds that would be damaged by the weight of a manure drill and the necessary horse labour.

Stump Pulling.

AFTER fencing, the next piece of work that confronts the developer of heath-land is the getting rid of old tree roots. In a sand soil, Scotch Firs seed and grow naturally and, when they are not destroyed by fire, the seedlings, in course of time, form full sized trees to be cut down for timber; though the wood, having been grown in sand, is lacking in resin and colour and in lasting properties. This felling, of course, leaves the roots in the ground and, until decayed, they form a great obstacle to the cultivation of the land; besides which they constitute a possible harbourage for insect pests. In the Colonies the boles are felled at a height convenient to the feller, say three feet above the surface of the soil; but at home, wood being of greater value, the axe is laid unto the root of the trees, with the

result that no natural trunk leverage is left for pulling the roots over. There are various methods of removing tree roots, the chief being explosion and various mechanical devices including haulage by a steam engine.

Enquiry was therefore made to the Government department dealing with the subject, who had probably received similar applications, and they most kindly held a competition to test the various methods. A representative from Hampshire Heath attended to watch the proceedings. There was a marked absence of colonial exhibits, due no doubt to the above described difference in the sort of stump to be removed; and the machine that seemed far the best was the "Terra" patent Swedish machine which was then for the first time exhibited in England. It is worked on a combination of lever and pulleys by man-power, two men of average strength being sufficient to pull up a ball of roots and soil with a 12ft. diameter, on one condition, that the roots are sound; if they are decayed the tackle may of course break away. Hampshire Heath was so taken with the contrivance that the proprietors of it were induced very reluctantly to part with their sample machine straight away as this was the only one in England.

From the great power that is generated, it will be understood that this machine, simple as it looks, is not entirely fool-proof, but it only requires common sense and practice to ensure its working well, and on this estate four men are employed so as to be on the safe side. To show how large a proportion of the force used is exerted by the machine; when the men find it hard to make the stump start rising they do not strain at all but wait, and after a few moments the miniature earthquake begins apparently of its own accord. Care should be taken not to anchor the wire rope to the bole of a tree that is not to be destroyed, unless the trunk is thoroughly protected, or the rope will cut right through the bark and the sight of the

wound will reproach the careless one every time he passes that way. In whatever manner tree stumps are removed they leave open holes in the ground, that cause some labour to fill up and, even so, a good deal of the top soil will have become mixed with the sand. On Hampshire Heath most of the trees were cut down after a disastrous fire that occurred so long ago that many of the roots are becoming very rotten, and, as a rule, it is customary at this date to risk ploughing without any formal stump pulling first, merely digging out by hand the more obvious roots; and so, the machine is now rarely used. The fact that the Ministry of Agriculture organised the competition of contrivances for stump pulling is only another instance of their anxiety to do everything in their power to help and advise the poor farmer; and, although Parliament has not seen fit to tax the people's bread, it has done a very great deal for the cultivator of the soil in other ways such as the guarantee now afforded as to the quality of feeding stuffs, seeds and artificial manures and the ease and economy with which an analysis of such things and soils may be obtained through the Government Department.

A full report of the competition above referred to may be obtained from the Ministry of Agriculture and Fisheries, 10, Whitehall Place, London, S.W. 1, by asking for Miscellaneous Publications No. 35, post free 2/6. The various devices were classified as follows:—

1. Manual devices—Hand Mattocks, grubbers, and other hand tools. Levers, pulleys, windlasses and timber jacks.
2. Horse power pulleys and windlasses.
3. Steam and internal combustion power—winding drums and donkey engines.
4. Explosives, gelignite, dynamite, tri-nitro-toluene, ebulite, amatol, liquid air and other explosive agents.

5. Destructive devices (a) fire, charcoal burning, burning with the assistance of highly inflammable liquids (b) introduction of acid into tree stumps with the object of causing rapid disintegration of the roots.

The following methods were excluded from the list for the adequate reason that the officers in charge of it, after making full enquiry, came to the conclusion that those means were not suitable for stump pulling in this country. The rejected devices were, donkey engines, burning methods such as charcoaling and the disintegration of stumps by chemicals.

CHAPTER III.

Subsoiling and Grass Production.

AS a rule the soil here is barely six inches deep, composed largely of sand with a certain amount of peat interlaced with heather roots and here and there those of bracken or, especially in damp spots, the bunched fibres of forest grass. One would imagine that by turning over the soil the heather roots would soon rot and form the humus of which the ground is so deficient, but nothing of the kind happens. These roots seem to be made of wire that may gradually rust away but has no intention whatever of kindly turning into vegetable mould. Their only use when cleared off the ground is to form the foundation of roads and paths, and so, by one of Nature's wise coincidences, provide the reinforcement needed by the particular type of earth that bred them. In patches, there is a certain amount of clay in the subsoil, but generally speaking it is pure sand, except in those few spots where there is gravel or shingle. Now, one would imagine that a great depth of sand would allow water to rise freely from below or to drain quickly from above, but that is not so ; and the reason for this is generally assigned to the fact that a hard stratum of black pan or callus about two inches thick is almost always present in the sand at an average depth of nearly two feet from the surface. This pan certainly interferes with the rise and fall of moisture. Beliefs vary as to its origin and, if one may express an unscientific opinion, it is that some elements from peat and heather including iron of sorts have precipitated to a certain depth and then become solidified. It appears to be largely composed of humus or something like it, for on exposure to the air it quickly disintegrates and can

be mixed with advantage with the top soil. But in the writer's opinion the pan ought not to be saddled with the whole responsibility of stopping drainage. First of all, many years of debris from heather and from heath fires have left a thin skin on the surface of the land that becomes almost non-porous when saturated. Then there is the more potent factor that the coarser gritted sand has, during the lapse of many centuries, become almost a solid mass. In rock formation there are usually little cracks near the surface that assist drainage, but this sand, by settling its different sized grains into the most compact space possible, is a kind of almost watertight concrete. It may have space enough between its component parts to hold sour gasses, but not enough for a quick flow of water. Now every one knows that most plants can only grow where water is able to circulate freely, and this is specially so in the New Forest area, where the configuration of the surface has usually only very slight variations of altitude. If correctly treated this class of land can grow excellent crops, but it is unusually sensitive to climatic conditions, and a garden that in a dry season will show some bare patches will possibly be overcrowded in a wet one. It will therefore be plain that subsoiling is necessary and the following pages will deal with this subject.

The object aimed at on Hampshire Heath was to stir the ground to a depth of 2 feet without mixing any of the top soil with the lower strata, and this with the minimum of expense in power. To carry out such work properly by hand would cost between £50 and £60 per acre as the usual charge in this district for trenching to a rather less depth is £40 per acre. After making enquiries from various implement manufacturers there seemed at that date to be no subsoiler on the market that quite answered the requirements of Hampshire Heath, so it was decided to experiment independently.

In 1921 a powerful tractor was bought at a farm sale for £80, and also a four-furrow plough and a disc harrow to go with the tractor. A special plough and subsoiler were designed, the former to plough a furrow 18 inches wide, and a long and narrow deep cultivator to follow on in the furrow alternately with the plough. The subsoiler had three rows of tines, each 4 inches longer than those next in front. By taking one turn round with the plough and then one in the furrow with the subsoiler, it was reckoned that the earth could be stirred to a depth of 24 inches and 1 foot 6 inches wide without mixing the sand with the top spit. The plough answered well and proved capable of removing a sod 18 inches wide by a depth of 6 to 8 inches according to the thickness of the soil at the part under treatment; and this would leave the cultivator only 16 to 18 inches of the substratum to stir up, each row of tines doing its share of breaking a hitherto unbroken mass. These implements took the best part of a year to construct at the foundry, and before the subsoiler was finished the tractor came to grief. The manufacturers of it had stated that an expenditure of £80 would make it equal to new and this outlay was agreed to, but unfortunately, two days after the repairs were finished, the wretched thing went off with a terrific bang in the cultivated field where it was operating and never did another stroke of work. It is difficult, for a person, whose ignorance of mechanics is only equalled by his dislike of intricate machinery, to give a technical account of what had happened; but it appears that the deceased belonged to a genus called "internal combustion," so no one was surprised that, when the engineering experts came to make a post-mortem examination of the tractor's inside organs, they were unable to find any. The sole advice they could proffer was to sell the remains. Unfortunately one could only give the same warranty as the Tattersal pony was bought under, viz., "Has been driven" and after full advertise-

ment in the London and provincial papers, the solitary bid that was received was £6 10s. on rail, which offer was accepted, showing a total loss of £233 10s. Tractors are said to have had their day—they have certainly had a very short one on Hampshire Heath. This was unfortunate as they do the work quickly, economically and, so far as the disc harrow is concerned more efficiently than when horses are employed. The rough surface of the raw heath requires a very strong tractor to stand the bumps as there is a network of deep cart tracks, centuries old.

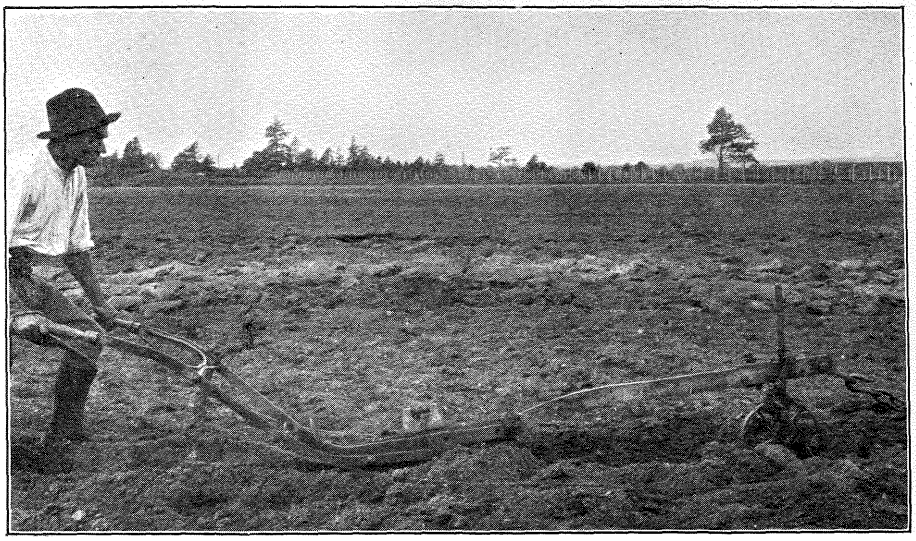
One of the pleasures of estate work is the economic utilisation of materials on the place. After taking up room that might have been more profitably employed for some years, the tractor plough and disc harrow have both become useful once more; the former by yielding up parts towards the construction of a horse subsoiler, and the disc harrow, having been deprived of its four outer round plates on each side, was lightened sufficiently to bring it within the power of a pair of horses to pull. The harrow's work is, however, now rather less efficient, not only because it covers less ground, but the superior speed of the tractor caused the discs to pulverize the soil much more thoroughly. One of the best features in a disc harrow is experienced in the preparation of a seed bed, when it is undesirable to bring rubbish or green or other long manure to the surface; and last autumn, a field, which had been laid down five years previously, without subsoiling or any thorough treatment, had become so foul that it was ploughed up, rolled, lightly harrowed with short spike harrows, crumbed up with the discs and then sown with rye, which, with clover hay at £8 a ton is this year very useful. A quantity of young heather, rushes and forest grass was underground, but with a little help the rye did very well and it has now been made into hay for chaff or ploughed in. The rubbish is only partly rotted and as it would not

be practicable to clean the ground thoroughly, it is being sown with spring tares that, if all's well, will either be cut or fed off by sheep or lambs or ploughed in. In preparing for the tares the disc harrow was again most valuable, as it made a very fair seed bed without disturbing the ploughed in green manure. Experience has shown that the natural poverty of this soil may be discounted to a large extent by increasing its depth and, before laying down to grass, the ground will be formed into lands as elsewhere described by ploughing towards their centres, throwing on the top soil from intervening wide ditches and carting all the soil from the headlands on to the lands; in fact most of this groundwork will be done at the sowing of the tares as these seeds are so difficult to cover unless ploughed in. Some years ago, at Garden First, tares were sown and very badly harrowed in, but, fortunately, they had been corvusined with the original mixture and, a week or so afterwards, a wood pigeon was shot from one of the adjoining woods and its crop contained 27 acorns and not a single tare. Two acres of tares are now up; in one that received sulphate of potash and superphosphate they are double the height of those in the acre not so treated. A photo of the last of this patch of tares and oats—grown without farmyard manure or any residue thereof—is shown on plate II. The excellence of hay made from tares and oats is less appreciated than the difficulty of making it, and few operations tax the resources of the farmer more severely. To begin with tares are so easily soaked by rain that it requires very fine weather to dry the stems; on the other hand almost the whole process must be carried out in winrows, for directly the leaves dry they are so brittle that a great proportion of them shatters. One always has this consolation to fall back on, viz., that if the weather turns out wet one can still plough in an excellent more or less green manure.

PLATE II.

The end of a fine crop of Tares and Oats.

PLATE III.



Two photos of a Subsoiler, one at work, and one raised out of the ground.

And now, after experimenting for some years to find the best design for a horse subsoiler, an implement has been turned out at a very trifling cost that does the work admirably. In a light or sandy soil a pair of heavy cart horses can plough and subsoil nearly half an acre a day of virgin ground to a depth of two feet, which costs, say, £3 an acre, and the top spit is kept entirely free from the underlying stratum. The reader must please be patient when simple little economies are discussed in detail, because the very essence of successful land reclamation is that the work shall be carried out on a commercial basis or as nearly so as possible. Photographs of the subsoiler that, after other experiments, is now in use, are shown on plate III. It was made from an old plough; the mould-board, share, coulter and small wheel were removed, and one of the shares from the disused tractor plough was connected to the beam of the reconstructed implement by bolting on to both one of the shanks that had previously attached the share to the tractor plough. The writer has never come across any other kind of subsoiler that was able to go lower than 18 inches beneath the surface with a pair of horses.

The chief trouble at one stage was that when the subsoiler was buried up to its back-bone the back of the unfortunate ploughman was bent two-double. This went on for some time, because it seemed that if the handles were raised to a comfortable height for holding while the centre of the implement was doing its work under ground they would be too high up when the subsoiler was raised at the end of each furrow. The latter operation however occupies but a very small part of the time, so the arms of the implement were bent up eighteen inches and, by keeping the thing partly on its side when the share is lifted and holding on to the arms some way below the handles, the man manages the turns very well.

This work is the limit for a pair of heavy horses and it is usual to go along each furrow at least twice and, more often than not, three times, raising the wheel each time to drop the wide arrow-headed tine a little further. Before starting in a fresh furrow, the wheel is lowered again and care should of course be taken to mark the upright shank of the wheel with chalk, to ensure that the same depths are alway respectively worked to, unless a different substratum is encountered. Three horses abreast have been tried for this work, but it was unsatisfactory as one of the animals trod the ridge into the furrow.

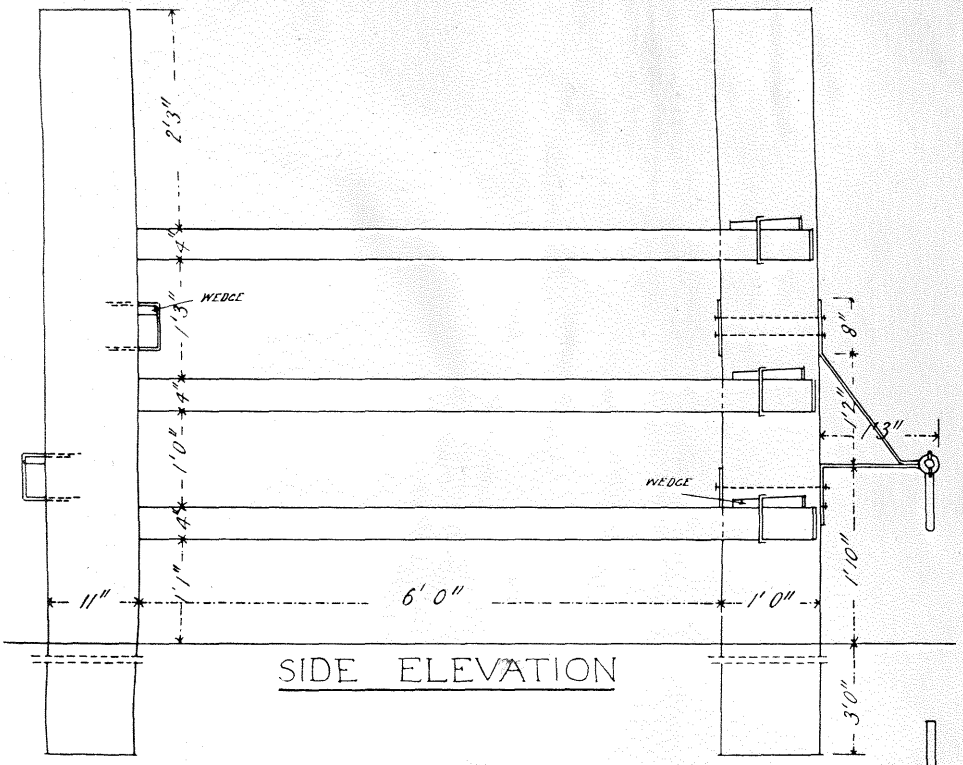
While talking of horses a few words may be said about shoeing rough ones. A big high couraged cart mare that has been working daily on Hampshire Heath for some years is, without the least intention to be vicious, exceedingly touchy about her hind legs below the hock, and she became so unpopular with the neighbouring smiths that it was necessary to send her several miles to be shod at a place where there were shoeing stocks. Because she made such a point of having her stable companion with her and two men were needed besides the smith, each occasion cost something like £2. So a forge was built on the estate and some shoeing stocks erected, and, as it was found so difficult to obtain the details of such plant, a plan, elevations and a photo of this one are given respectively on plates IV., V. and VI. The horse is led blindfolded into the stocks and then the rails which had been removed are replaced. Ropes over and under the animal are fastened to the rails and the foot to be shod is secured round the fetlock by a rope with a running noose slightly padded and covered with soft leather. Then the rope is passed twice round the windlass and wound up till the foot is rightly placed for the smith. Unfortunately, on the day these photos were taken, the mare struggled so hard that she jerked the handle out of the helper's hands and it swung round and broke his arm in two places. Since that,

PLATE IV.

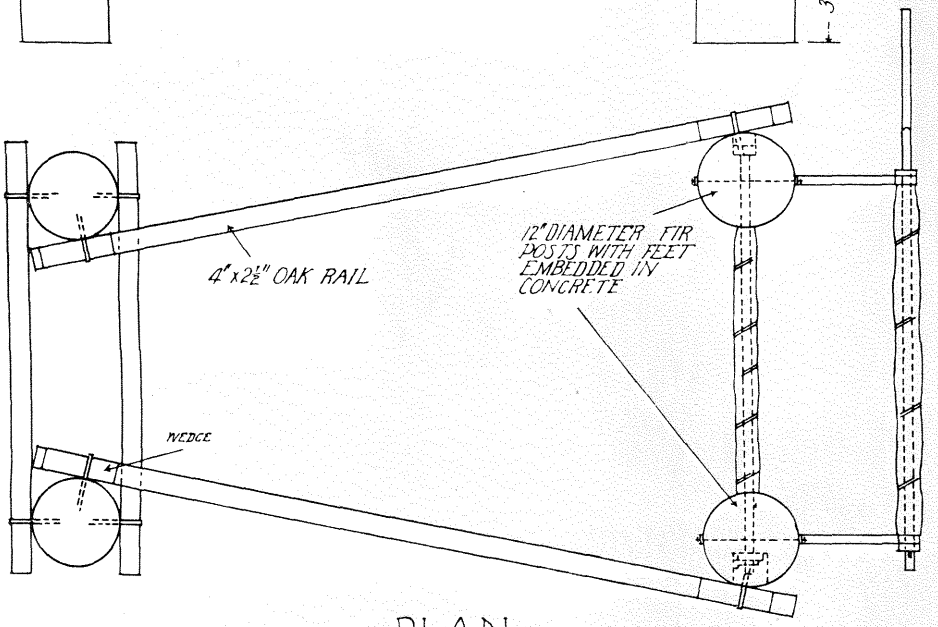
Shoeing Stocks.

Designed from particulars obtained from various sources.

PLATE V.



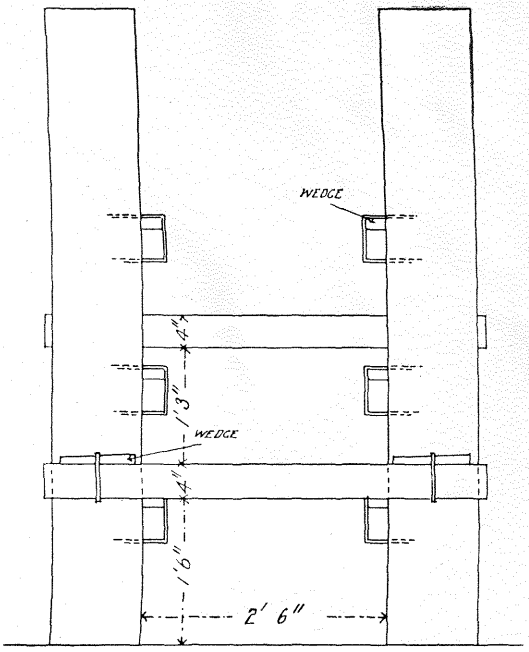
SIDE ELEVATION



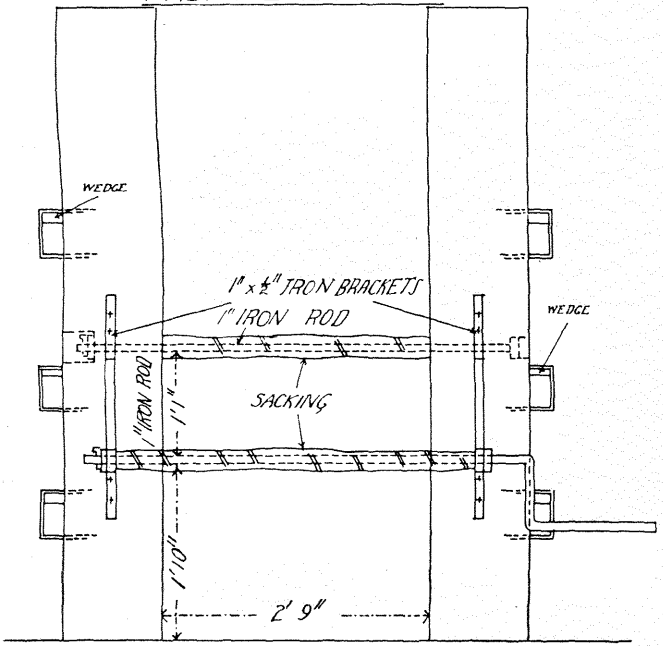
PLAN

Plan and Elevation of Shoeing Stocks

PLATE VI.



FRONT ELEVATION



BACK ELEVATION

Elevations of Shoeing Stocks.

the handle has been lengthened so that two men can hold it at once, but, in making a new set, it might be advisable to construct a ratchet in connection with the windlass.

The subsoiler that was constructed for working with the tractor was fitted with wheel screws which made the adjustment of the height of the tines a simpler and pleasanter process than applying on each occasion a wrench on a hard used nut. In adapting a plough for this work a very strong one should be used or something will soon give way, and if the beam becomes broken it seems almost impossible to mend it. It is advisable to add several pounds avoirdupois to the frame to steady it and keep it in its place, and in the photo here shown it will be seen that a seven pound weight and spiked bar have been wired on.

The natural grass on the heath is Forest Grass (*Molinia Coerulea*), which grows freely, particularly so in the lower parts. It has been the custom to deride this plant as quite useless for forage for live stock, even calling attention to the fact that it is used by the inhabitants of the Arctic regions for making ropes. By the courtesy of the Ministry of Agriculture, Psi was furnished in 1922 with the following extract from the Bulletin of the International Institute of Agriculture, Rome, as to German experiments in making hay with *Molinia Coerulea* :—

> The hay is regarded as of inferior quality, and has hitherto been used for litter only.
>
> In the authors' feeding experiments, the first sample of this hay was so much lignified, that the sheep tested refused to touch it, even after fasting for several days ; whereas a Russian native horse (Panjepferd) ate it readily.
>
> *Molinia Coerulea* when cut very young, and at once dried, was eaten without the slightest hesitation. Its crude nutritive content regarded as percentage of dry matter is as follows :—

Organic matter 94.58, crude protein 15.34, refined protein 15.11, nitrogen free extracts 50.67, crude fats 2.33, crude cellulose 26.24, refined ash 5.42. The following percentages of these substances were digested on an average: Organic matter 65.5, crude protein 71.8, nitrogen free extracts 64.9, crude fats 27.9, crude cellulose 66.3. *Molinia Coerulea* hay is thus very rich in protein, but poor in crude cellulose. From the above coefficients of digestibility, the starch value of this forage is 30.6, which is equal to that of good quality meadow hay with a high protein content. When lignified, it should be used for litter only.

Practical experience on Hampshire Heath has shown that, from the latter part of May till the end of August, Forest Grass will support horned stock well. In fact they sometimes put on more flesh with it than they did when turned out on artificial pasture, such as clover and rye grass seeds. The dry stalks of Forest Grass should be burnt during the off season, or the new young blades will not be easy for stock to bite until the tender leaves are about a foot high. *Molinia Coerulea* is, however, a difficult plant to get rid of, as it makes a huge mass of root, grows with an awkward bunch of stalks, seeds profusely, and rots slowly. The seeds are very large and remain on the plant for some months, and the idea came to mind that where this grass grew in water it called aloud for a duck farm. One pictured those marvellous layers earning their own living for several months in the year without trouble to themselves or expense to their employer, just sitting lightly on the limpid surface and, by wriggling their long necks round the grass stems, introducing the nutritious grain into their flail-like mandibles. But it did not work; for one thing ducks don't thrive on stagnant water.

Now, the system that has been adopted on Hampshire Heath to obtain good grass for pasture and a moderate hay crop is as follows: First of all the

heather is burnt off, unless it is long enough to be of value for brooms, road-making or thatch, when it may pay for cutting. The burning off requires skill and care. It must on no account be done in dry weather with a high wind or the whole country-side may soon be alight. On the other hand when wet, the stalks won't fire, so one must hit on the happy medium. The best way of setting the heather ablaze is to have a small receptacle such as a coffee-pot with the addition of an extra spout about 2 feet long of unsoldered iron or brass. A long wick is inserted in the spout and the pot partly filled with paraffin. This arrangement will enable one man to do the work of two or three who are only provided with matches.

It is not advisable for a single worker alone to burn heather, unless there is a safe fire belt of some sort all round. Each of the men is armed with a good branch of Scotch fir, which experience has shown to be one of the best weapons for beating out the flames when they have reached the desired limits; and it was interesting to see recently in some pictures in "The Times," showing forest fires in the Antipodes, that the Colonists were using branches of trees there, for the same purpose. The patent fire extinguishers are also very useful in case of emergencies and several are kept here in readiness; but a big fire would require a large number, and it might pay to make up a large extinguisher, by using a loaded water-cart and the right proportions of sulphuric acid and bi-carbonate of soda to squirt out a stream of bubbles producing the necessary carbon dioxide gas, but it would need to be a strong water container to stand the pressure. These extinguishers act by destoying the air, without which fire cannot burn, and they are therefore of little use in a high wind, and when a fire of tall heath or worse still of furze is raging furiously, the extinguishers may not put it out, but they make it possible for men to approach with boughs and beat it out. As hinted elsewhere, the proposed abolition of farm rates will

no doubt do away to some extent with disastrous heath fires as, in future, it will probably pay to burn off the heather and use the land for rough grazing, or by degrees bring some of it under cultivation. With oil colours great artists represent, on canvas, heather landscapes of surpassing beauty. Another distinguished artist, Sir Harry Lauder, by his own unique blend of laughter, pathos, and a song as mellow as that of any birdie with a yellow bill, can paint word pictures of melting loveliness about heather bells and wee burrnies. Etched with the point of an agricultural tin-tack, heather in the Lowlands produces the visual impression of rubbish.

After ridding the land of heather stalks, it is ploughed and harrowed to remove the roots, and the question arises whether it is better to clean the land before subsoiling or subsequent thereto. If the cleaning is done first there is the risk that in dry weather some of the friable brown soil may roll back into the furrow and become mixed with the grit underneath, which of course cannot happen if the subsoiler is used while the top coat is in the form of a hard clod. On the other hand; if the order is reversed a great deal of trampling and carting over the subsoiled area cannot but cause the newly disintegrated sand to become more consolidated again and thus impede the drainage that has been acquired at some cost and trouble. And it is astonishing how soon the confined clean coarse grit, through having no vestige of humus or vegetable substance amongst it, will become more or less coagulated. On the whole, therefore, it seems better to clean out the heather first and then, avoiding very dry weather, see to the subsoiling. Moreover during drought the subsoil is naturally harder to break up. One of the advantages which this class of land possesses is that it can be harrowed almost as soon as the rain leaves off, which often gives the heath farmer a long start in front of the occupier of stiff land. The claying of light land has long been practised in some parts of

the country, but though it is useful to have stiffer ground underneath and the more friable on top, it is not desirable to bury the clay, but to allow it to be disintegrated and mixed with the surface stratum by the weather. To bury the tenacious substance whole may do harm, as the lumps will retain their size and form for years and possibly impede drainage. Where there are many earth worms the clay and sand would become mixed more quickly, but such worms are not numerous in heath-land.

If one ploughs up pasture, one leaves the fallow sufficient time to rot the vegetable fibres, so that they may turn into humus and enrich the soil. As it is useless to attempt to gain the same end by a similar process in the case of heather the only thing to do is to harrow it out. The point that it is desired to stress is the fact that it is much easier to do this immediately after ploughing, for if some time elapses between the use of the plough and the harrow or cultivator, it will be found that, instead of rotting, in the meantime the clots will have hardened and become tougher. The best plan is to clean in the afternoon what has been ploughed in the morning; and this is why local tillers of the soil would rather make a garden by digging a patch of virgin heath than to have the ground ploughed for them free of expense. The next operation is to spread 10 or 15 cwt. of basic slag per acre, and, if thought desirable, some kind of lime, powdered chalk for choice, with at times a potash fertilizer, a few months after which comes the expensive part. If a really good crop of grass is desired, it can best be obtained by ploughing in at a shallow depth about 30 loads of farmyard dung per acre, which supplies at one time nearly all the chemical and organic food the plants require including the important one of humus.

This summer (1927) is admittedly a record one for white clover, but, even so, a field which was laid down in the spring with pacey grass and Dutch clover

on the above lines has done very well, for it has been cut twice this season, and now lambs are folded to fatten on it, but are quite unable to keep pace with the vegetable growth, and a thick fourth crop is quickly growing. It is true that this spot had been laid down roughly when the estate was first started and some stock turned out there, but having not been subsoiled or manured originally the result was very poor. The lambs referred to were bought at Blandford Fair on 8th September, 1927, at 49/6 each and the first draft were sold at Wimborne Market on 1st November, 1927, at 63/-, and a fortnight later some made 65/6, a decent profit on $1\frac{3}{4}$lb. of cake a day, but not enough to balance in addition the cost of folding which however was well covered by the value of the manure. The folds were shifted three times a day which entailed much labour, but the dressing and treading that sheep afford are highly beneficial to this soil. Since writing the earlier part of this paragraph, the same field fed stock nearly all the winter, till closed in February and has this year (1928) produced a good hay crop. One of the most noticeable features in the pasture now provided, compared with that produced by the rough and ready methods adopted when these experiments began, is the length of time during which good feed may be obtained. In the early days, any extremes of weather turned the grass brown, whereas now it is green nearly all the year round, though it must be admitted we have not during the last few years experienced a severe drought like that of 1921. This year (1928) more lambs were bought, but the price paid was much too high and they showed a considerable loss.

How far success can be obtained, without farmyard dung to start with, has not yet been completely proved; it will certainly be necessary to use green manures for humus and trust mainly to clovers and not grass for some time. This year an area that had been so treated gave a fairly good crop. The beneficial effect of chicken dung once or twice a year, as a top

PLATE VII.

Grass-fed Lambs.

dressing, for this type of grassland cannot be over-estimated. It should be used with care, especially if it has not been stored during a period, and if it is left on the ground in undisturbed lumps they may injure the herbage. Seeds feed on their own bodies for a short time, but that supply of food is soon exhausted and, at the weaning stage, it is often necessary in soil of this description to give the vegetable babies some special nursery milk. For this purpose nothing seems so excellent as a slight dusting of chicken dung, powdery dry. In reclaiming heath-land of the ordinary type little polite attentions like the foregoing must not be neglected, for the soil, not unnaturally, requires watching much more closely than if it had been under cultivation for many years. Those areas, where there is some clay or clay mixture near the surface, do not require nearly as much care, after proper subsoiling and drainage have been carried out.

One must not shirk the fact that before the practice of reclaiming heath-land becomes general much information is required by means of practical experiments in the use of weedless artificial manures without the aid of weed impregnated farmyard dung in producing good pasture. One has to bear in mind the absolute necessity of providing humus, and in Prussia and Belgium they appear to trust to lupins. These were tried here in 1921, but, due mainly to the abnormal heat and drought, intensified no doubt by lack of experience, they were a complete failure. Holland seems to be in the forefront of heath reclamation and by the courtesy of the Secretary to the Royal English Arboricultural Society, the writer has been able to see some particulars of such work both in the Netherlands and in Ireland. The Netherlandschi Heidermaatschappij appear to have done great things, but the information they furnished, though useful as an indication of what can be accomplished in the afforestation of heaths, did not go sufficiently into practical details to be suitable for quoting in the present circumstances. In this district

it has been the rule to look to rye ploughed in, as a first crop, but in the writer's experience, rye, on newly cultivated heath, requires almost as much coddling as tares, on the raw ground ; and the generosity with which tares or, as they are called here, " vatches," not only produce abundance of top growth with so much protein in it that it is unnecessary and even wrong to give stock cake concurrently, but at the same time bedizen their little toes with uncut diamonds or nitrate nodules, makes one favour that form of green manure. The last tares sown here have grown most luxuriantly and the seeds, bought from an old established firm of seedsmen at Croydon, with whom the writer has dealt for more than 50 years, seem to have had 100 per cent. germination.

Basic slag, that great and lasting fertilizer, is always used, but it should never be applied too near to a dressing of dung or other ammoniacal nitrogenous manure on account of the free lime that slag contains. It is best to put the slag on some time before the other manure, but this raises a slight difficulty ; slag is a surface dressing and, by the above method, the part that is not incorporated with the soil by the harrow must necessarily be ploughed under with the organic manure, unless an extra ploughing is given. So far, no exact data appear to have been published as to the length of time that should elapse under certain conditions on given soils between the use of dung and slag or lime of any kind. One hopes that among all their other valuable work the Ministry of Agriculture will in the near future experiment both on this question and also on the length of time which should elapse between the slagging of pasture and the turning out of in-calf horned stock thereon. Lime itself is absolutely fatal to farmyard or chicken dung. Some poultry farmers sprinkle the dropping board with ground lime, and experience here has shown that, so treated, the manure is no more a stimulant than peat moss before it has been through the stable. Sand is sometimes

recommended for sprinkling the boards, but it is so heavy that it adds greatly to the cost of cartage and has of course no soil value on a sandy heath. Chaff or a little dry mould is perhaps the best substance to bed the fowls with, as far as the user of the residuary product is concerned.

White clover is more of a forage plant than a hay crop, and suits sheep on Hampshire Heath very well indeed but, with horned stock, it is apt to scour them or give then hoven when fresh grown. A veterinary surgeon gave his opinion that this was specially so here, in consequence of the deficiency of chalk in the soil, and advised dressing the land with that substance. Instead of always following his excellent advice, a small quantity of powdered chalk has, when necessary, been mixed with the cotton cake that the beasts receive, and this has had a very beneficial effect. Chalk can be obtained from a Company at Wimborne, who use lime to soften their water, which lime in the process reverts to chalk or carbonate of lime. When dry it is in a powdery form, and so immediately available for plant food. To test its efficiency for farm use a sample of this kind of chalk was sent to the Ministry of Agriculture analyst, who reported on it favourably for the modest charge of seven shillings as the farmer's share of the fee. The worst part of such chalk is the large amount of moisture it nearly always holds. This increases the cost of haulage, and while wet it cannot be finely distributed as, of course, it should be. It will take a long time to dry in a big heap, but if put out on the land in small heaps and moved a few times in dry windy weather the moisture soon evaporates. Then, one needs a still day to roll and harrow it in, or much of the fine powder blows away.

Sheep do not appear to scour as soon as horned stock, and the difficulty with the latter is probably increased by the fact that having been accustomed to run on heath-land, where the heather and other

food is binding, they feel the change to lush young grass more than they otherwise would. This subject is all the more important now that so much interest has been aroused by the new system of not allowing pasture to reach more than 3 inches or 4 inches in height and forcing its rapid growth. The fact that the young leaf contains more nutriment than herbage with a greater proportion of stalk is of little use if the new leaf scours. Moreover, clover is a staple product in new pasture on erstwhile heath-land as, without it, rye grass quickly becomes emaciated unless frequently dressed with strong nitrogenous manures. Great care is necessary on this soil not to let stock graze too close or they will pull up the young and finer grasses by the roots. A system of grazing horned stock, that has been found very useful here, is tethering by a swivel chain and pin. It has the following advantages: It breaks in young heifers; it gives fresh feed each day; it ensures grass being fed off as the farmer likes, and not patchily at the will of the animal; it permits cattle to be turned out on lush young feed where, if allowed to roam they would, expecially when the wind is in the east, quickly resemble balloons in appearance. The drawbacks are: (1) time involved; (2) lack of shelter in storms; (3) the worst of all, attacks by warble flies. These little wretches need combined action or some new discovery for their eradication. On the Channel Islands where tethering is nearly always practised, they do not appear to suffer at all from warbles, which is probably due in the main to water, which the flies abhor, surrounding small areas of land. The writer has, however, been told that some parts of France are also immune. What benefit the new winter clover, so popular in Australia, will be to our heaths remains to be seen.

Many farmers are carefully reading all the information they can about intensive grazing, and puzzling their brains as to how they can apply it in actual

practice. How can they adjust the balance between head of stock and acreage of feed? How can they, as advised, alternate sheep and cattle on the same well-fed land, without allowing the usual time for sweetening, in view of the dislike cattle exhibit to feed after sheep? Those who wish to use nitrogenous artificial manure will be glad to know that a Gas Company not far from Hampshire Heath is only making the neutral brand of sulphate of ammonia, which is safe to use on peaty soils.

Attempts have been made to turn stock out on the moor, but so far with only partial success. As an experiment 10 Welsh runts (2-year-old steers) were brought up from the Principality, as they are supposed to manage on poor pasture if they have free range. It was a complete failure, as they declined to touch anything but the very best, and, even so, to top them up on decent grass land was a difficult and expensive business. Then 80 grey-faced lambs were obtained from Scotland. They were quite prepared to make themselves at home on a heather and forest grass diet, but their long wool became so frequently entangled in the briars and brambles that the cost of looking after them over so wide an area would have been prohibitive. They fattened well on good grass, and their little carcasses were as rich as the price they secured was poor. A bunch of Guernsey heifers from Cornwall did well on the heath, though one of them slipped her calf, owing possibly to their feeding for a time on pasture that had recently been slagged. There is no doubt heifers do much better than steers on poor ground, and it is advisable to buy, if possible, those that have been brought up on a moor. One such made £25 at the local market a few weeks ago before calving and she only cost £7 10s. 12 months previously.

A little knowledge is a dangerous thing, and it would be difficult to find a subject where this proverb could be more appropriately used than in treating of artificial manures. The risk of applying chemical

dressings improperly seems even greater on heathland than on other kinds as, there, *principia vitae* is low and the balance of plant foods easily upset. Within the past month, three cwt. of superphosphate were applied per acre to one-year-old strong clover seeds and the dressing burnt off temporarily about 25 per cent. of the leaves and stalks. It might have been better to apply some lime or powdered chalk first, but the former is usually disastrous here except on fallow, and it was thought that the chalk would be too slow in action to be of any use. Moreover, the field had been slagged 12 months before, which it was hoped would be sufficient to neutralize any acidity in the soil. This instance is quoted to warn readers that any remarks that Psi makes about artificial manures should be taken with a grain of salt as being largely the outcome of his own fallible notions and limited experience; and it should be mentioned that the rest of the book was almost completed before chapter 1 was seen, or modesty should have prevented such repeated strictures on lime.

Late this summer, 1928, seven additional acres which have not previously had any farm-yard or stable manure are being laid down to grass. They have been subsoiled, cleaned and dressed per acre with 15 cwt. of 40 per cent. slag; and one cwt. of sulphate of potash per acre will be added in a few days. Six tons of chalk per acre are being carted on, and, as it becomes dry, it is again reduced to its powdery state by the chain harrow, and then worked in by the tine harrow and the cultivator. Two acres of this ground have been under first rye and then tares this year, and this part will have three or four loads of dust-dry chicken dung per acre harrowed in just before sowing; but the other five acres, being virgin heath, will have about 30 loads of horse dung per acre, the greater part of which manure has come from a distance. It was bought cheap at 3/- per ton on rail, then there is 5/- to add for railway freight and,

PLATE VIII.

Horse-drawn Earth Scoop.

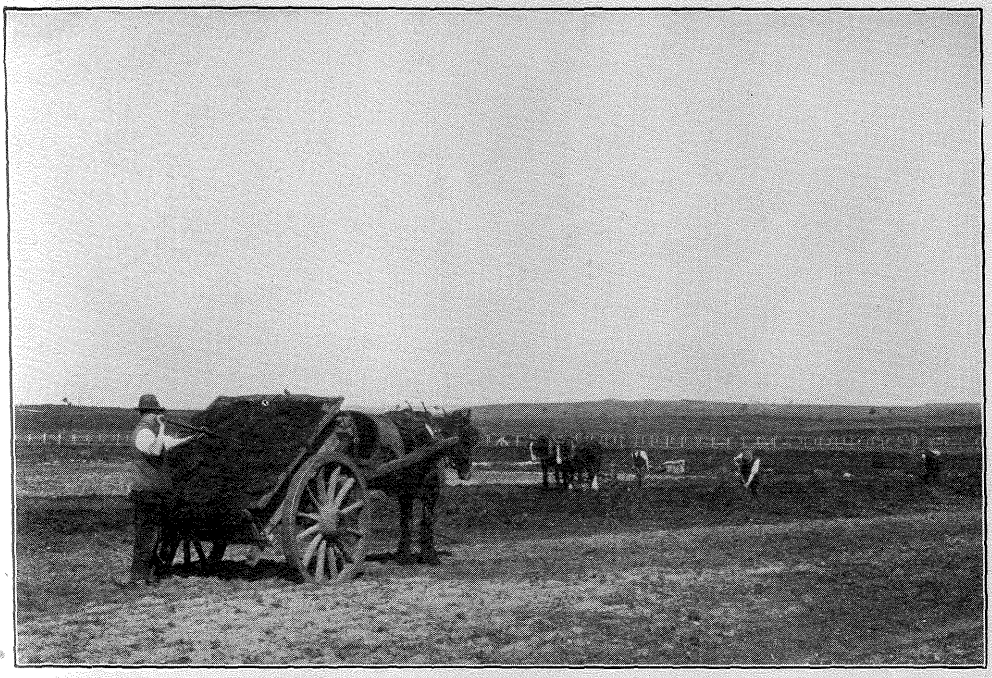
say, 2/6 for cartage from the station. If the manure merchants do not step in and raise their prices, the Government's reduction in farm rail rates will be a great help in buying manure.

It has been the writer's policy to rely mainly on rye grass and white clover for new pastures, as he has found perennial pacey more permanent than its reputation warrants. This time, however, the mixture given below is to be sown, based largely on a prescription in "Farm Crops," a useful recent addition to the farmer's library. Although the seeds will be "corvusined" to prevent wastage from birds, it will be noticed that a fairly liberal amount of seed is used, for that helps to keep down weeds and produce, at an early date, a thick sward. The whole site is of course to be enclosed with wire-netting forthwith where not already protected from rabbits. The ground is all set out in lands 24 feet in width, divided by shallow ditches which are first formed by the earth scoop shown on plate VIII. This useful implement saves an immense amount of manual labour, and, on testing its capabilities to-day it was found that a trench 140 yards long, 2 feet 6 inches wide and about six inches deep took one horse and two men one and a half hours to construct, the earth removed being taken to the centre of the land on the side of the ditch. It is rather hard work and the men change every hour or so, in order that one man need only take a couple of shifts a day. The shovel can hold two navvy-barrow loads of earth, which should first be reduced to a fine condition by the harrow, etc., and some skill is required in using the implement to the best advantage; for instance, the horse must keep moving while the scoop is unloading its burden, or the man behind would have to do the tipping-up part with his own strength, instead of slightly raising the handles so that the nose of the shovel sticks into the ground and the horse then pulls it over.

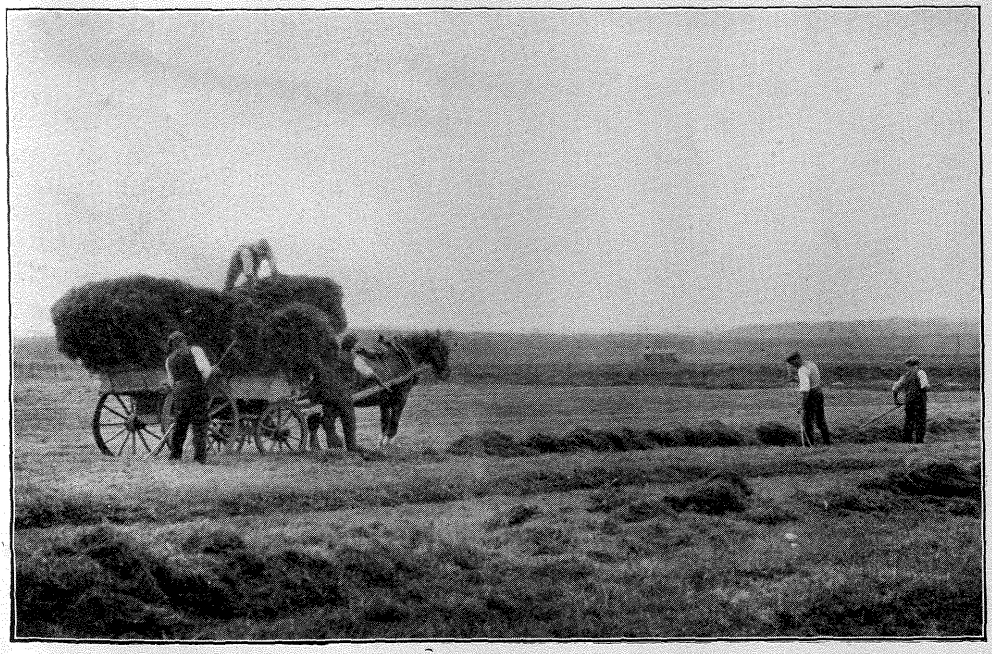
LIST OF SEEDS.	lbs.
Permanent Rye Grass ...	56
Cocksfoot	56
Tall Oatgrass	56
Smooth Stalked Meadow Grass	14
Provence Lucerne ...	14
Hard Fescue	14
Sheeps Fescue	14
Birdsfoot Trefoil ...	14
Chicory	14
Crested Dogstail ...	28
Kidney Vetch	28
White Clover (New Zealand)	56
Burnet	14
Ribbed Grass	14
	7)392
	56

i.e., Half cwt. per acre. And now in December, 1928, it can be stated that the two acres without any stable dung have turned out at least as well as the five that had been so dressed.

It seems unsatisfactory to close the above remarks about grass production on heath-lands without saying something more definite about the financial propects of such work. One statement can be made without hesitation, and that is, that in the early years the experiments carried out on Hampshire Heath entailed considerable expense with hardly any return. During the last year or so, with the experience bought, an entirely different stage has been reached, and the results obtained have now, it is considered, justified recent expenditure. The success has in fact been as gratifying as, after so much abortive effort, it was unexpected, for the new meadows not only smile, but seem as ready to burst into laughter and song as a valley thick with corn. And it only needs a pretty conceit to enable one to look forward to the time



Preparing a Seed Bed in April, 1928.



Picking up the last load of hay cut and raked about two months later.

when future topographers will refer to Hampshire Heath as " the rich alluvial plains that skirt the banks of the great Southern Railway." It is therefore hoped that such information as these pages contain may, at least, offer a jumping-off place, to enable others to undertake reclamation work with profit to themselves and advantage to the nation. Though the work described has been carried on by Psi solely on heath-ground, there can be little doubt that subsoiling in the way described could be applied with great advantage to a fair proportion of arable land, where the sub-stratum is suitable. In such cases the heavy initial expense would be cut out, and the cost of subsoiling alone, spread over a number of years, would be a very small matter compared with the increased annual returns from the improved soil. And one of the chief advantages the nation will derive, from the de-rating of farm land, is the inducement to farmers to improve their holdings when there is no fear the Assessment Committee of the Local Authority will substitute scorpions for whips directly the agrculturist shows the least sign of prosperity. One could, of course, increase the size of this little volume almost indefinitely by repeating what can be read in other farm books, but the idea has been to restrict, as far as may be, the advice given, to such items as the writer has himself discovered or his own experience has taught him to be specially useful when applied to heath-land, and therefore worth stressing.

CHAPTER IV.

Arboriculture and Horticulture.

The hart he loves the high wood,
The hare she loves the hill;
The knight he loves his bright sword,
The lady loves her will.

A young man was asked the secret of his popularity with the girls and he replied, "It's all done by kindness." Dame Nature is feminine. She responds quickly to gentle urbanity and politeness, but she will have her own way. It is useless to try to force Nature against her wish, and anyone who attempts to reclaim heath-land, and refuses to recognise this, will come to grief. Madame has made up her mind that some of her children are chalk lovers and some chalk haters and she very much resents any contradiction on this point. To try to grow rhododendrons on chalk is folly and heather madness. On the other hand there are certain trees and shrubs that do particularly well on sandy peat and it is wise to be satisfied in the main with these. Scotch Fir stands out pre-eminently here as the right thing in the right place, but it is a mistake in a scheme of land development to think that one can dig up the beautiful and robustly healthy young self-sown firs, that spring up all over the ground, and easily and successfully transplant them. A few may live an invalid life, but the majority will die unless they are shifted as babies, or transplanted with a large ball and well cared for subsequently, because the sand allows them, when young, to send a tap root straight down and to this they appear to look for a large share of their nourishment. Scotch Firs grown in a nursery on chalk do not make this kind of root and may be moved after a stay of eight or ten years in one spot, without

losing more than one per cent. provided they are shifted in April with a small ball, just as the new twigs begin to push. Scotch Firs can be purchased when 12 inches to 18 inches high, at a nursery, so cheaply that their cost delivered is probably less than the expense of digging up odd specimens on the heath with the necessary care, and provided they have been moved within the last year or so and have not been too sheltered there should be no failures, especially if they come off high ground. The chief drawbacks to *Pinus Scotia* are the sad noise adults make in the wind and the way they poison what is under them. Their good qualities include contempt for whipping by Silver Birch and, on quiet, moist, warm, summer days, when trout rise lazily, a luscious perfume of freshly cooked blackberry and apple tart.

Perhaps the most arborically useful of all trees here is the Silver Birch, as its extreme beauty is matched by its hardy and (under cultivation) rapid growth. A variety with a larger and more poplar-like leaf and known as *Betula populifolia* has a more opulent appearance. Birch in a wild state is almost as free from injury by rabbits as Scotch Fir is, but, when cultivated here, it is very liable to attack by caterpillars, particularly those of the magpie moth who on being disturbed add insult to injury by their absurd habit, when young, of lining the edge of a leaf, and all standing on their heads in the form of an S one behind the other. A peculiarity of this tree is its liability to bleed, when cut, and experts differ as to whether less harm will be done by using the knife in winter or summer; but, beyond a little siding up in early life, who would be vandal enough to lop, or still more to top, this arboricultural gem? Its timber is useless for fencing as it rots at once. Another tree that does very well here is Mountain Ash which grows at great speed and flowers and berries freely even when quite young, and its autumn leaf tints are grand. Its numerous suckers must be ruthlessly cut out, or

the tree will become stag-headed. Acacia is well pleased with us and its awkward habit of growth and easy fracture are more than compensated for by its most graceful foliage and glorious blossoms. It grows very rapidly in the nursery and its long thorns make it impossible to hoe between the ranks. Broom planted as seedlings, so small that it is difficult to escape hoeing them up by accident, will reach four or five feet in the first season. Furze is only too thankful to be allowed a footing and one of the best wind screens for a garden or tennis court is a furze hedge on the top of a bank. In building a house a quantity of earth is often removed from the site or other excavations and this comes in for the bank to be covered with a few inches of soil mostly at the top. No gale can penetrate this kind of fence and it does not create the draughts that wood or brick structures do. Its chief disadvantage is its liability to catch fire, and for this reason it is inadvisable to allow heather to grow right up to it. It is also subject to injury by frost and therefore should be pruned as soon as possible after its flowering season is over. The Hampshire Heath tennis courts are surrounded by banks and furze hedges on three sides and macrocarpa trees on the fourth. The relative costs and advantages of the different sorts of hard courts were gone into and, taking into consideration the expense of upkeep, the gravel court, tarred, won. It should have a gradient both ways of $\frac{1}{2}$ inch in ten feet, rising from each end for the first 10 feet and then falling towards the net. Alder grows like a weed, in damper parts; but privet, so rampant in many districts, will, without extravagant attention, only linger and die on heath-land, though sulphate of potash helps it somewhat. Laurel thoroughly enjoys this district and *caucasica* or *rodundifolia* on a slight bank with a little manure will call aloud its affluence. Azalias, with sufficient shelter, are well content, and rhododendrons are quite healthy in enclosed areas, but though

they do not like to be water-logged, they are inclined to fret after a moister and deeper peat. Camelias in sheltered spots usually stand the winter here. Sweet briar does exceedingly well. A hedge was planted last season with seedling common sweet briar on both sides of a new road, and this autumn, with the aid of a little liquid and other manure, most of the bushes are about three feet high and well branched. The exceptions are mostly where the rabbits have traded round the bushes, as the presence of these little rascals seems to poison plants even if the vegetation is not eaten. *Cupressus macrocarpa,* unless potted or very young, dislikes moving intensely but, once established, it grows in this district at a great pace. These evergreens need to be staked or supported in some other way until they are well established and, curiously enough, though they sway heavily in the wind, they are comparatively free from injury through rubbing against the top end of the sticks they are tied to. If they are staked or wired they must be kept under careful supervision, as the diameter of the stems increases so very rapidly that the string or wire soon cuts in badly, and the upper part of the shrub is then apt to snap off in the wind. Other kinds of trees are not usually staked here but, if they need support, they are wired to three pegs at even distances. This obviates all risk of stakes rubbing holes in the bark of the tree, and the only care needed is to shift the cord or wire that surrounds the stem every year or so lest, as before mentioned, it eats into the bark owing to the growth of the sapling.

In converting heath-land to building purposes much tree planting is desirable, not only for its arborical beauty and the privacy it affords, but wind is a great enemy to gardening and renders trees or hedges necessary in exposed positions if horticultural success is aimed at. Two or three small nurseries have been laid out at Hampshire Heath, and they are most useful because the cost of trees when very

young is quite small in proportion to the price charged at the trade nurseries for older specimens. The seedling sweet briars referred to above cost £6 per 1,000, but older plants, though no larger than the seedlings became in a few months, were quoted at £17 10s. per 1,000. Again, the trees in a private nursery can be given plenty of room to grow into shapely specimens; they can be transplanted with a ball of earth and, owing to the proximity of the site to be laid out, with a minimum exposure of the roots to the air. This season belts of trees and shrubs totalling nearly a mile in length have been planted, including one along the main road for about a quarter of a mile. This last has been set back 15 feet from the present frontage to allow for street widening; and the front row comprises Rhododendrons of sorts, Azaleas in variety, Guelder Rose, Mock Orange, Prunus Pissardii, Scarlet Oak; the middle row, Laurel, Spanish Chestnut, Austrian Pine, Cupressus erecta viridis, Spruce and Douglas Firs, Scotch Fir; the back row includes Silver Birch, Acacia, Mountain Ash. The top soil from the 15 feet setback was thrown on to the belt to give a greater depth of mould, and all the larger trees and shrubs were obtained from the home nurseries.

News has just come that the gypsies are busy carting holly from an outlying part of the estate as it is December 3rd. To-morrow is Sunday, so no doubt they will make good, but on Monday gas tar will be sprayed on some of the best berried trees, if any are left as this makes the greenery less marketable and, further, makes it much easier to trace the thieves. Years ago, on the chalk hills at Garden First there was a wood thickly studded with large box trees and at certain seasons the "box gitters," as they were called in the vernacular, became very energetic. The keeper who had a horribly savage dog chased them once or twice but nothing seemed to stop the rascals till the tar device was thought of and that proved a

most successful deterrent. That dog was like an Irish water Spaniel but much larger. It was fastened to a long heavy chain and fed largely on raw meat and, when any one but its master came near it, it would try so hard to get at the person that it would stand on its hind legs and put back its lips, and one could both see and hear its teeth champing. After a time it was thought unsafe to keep it in case it broke loose, but though it was so fierce, if a gun was fired in its neighbourhood it would at once bolt into its kennel—probably it had once felt some shot corns. The very night after it was destroyed the keeper's ferrets were stolen and after that some thieves broke into the Agent's office which was at the keeper's cottage. They were unable to break open the safe and, out of spite, emptied the ink-bottle on to the leather seat of his chair, a particularly nice armed one from Hampton's. Some time after that, thieves, probably the same men, broke into the house one night when practically all the silver had been left out after a party and were so pleased with what they obtained that they took a large rosebowl off the piano and never spilt a drop of water till they were out of doors. Taking the two incidents together, one cannot help thinking that the visitors had strains of humour and gentleness in their blood, though it must be admitted that on the latter occasion one of them detached and carried during his visit a heavy iron bar from one of the windows. Many of the stolen goods were wedding or presentation gifts and as such will always be regretted ; otherwise the relief of having practically no real silver in one's house is very pleasant—burglars please note.

Reading over the foregoing paragraph with reference to box trees, calls to mind an interesting experiment at Garden First. Psi always found it difficult to keep away from sales of nursery stock, and one day bought 500 little Box Trees for a mere song, and they were put in a nursery and grew well, but apparently without any particular object. Then

the head gardener, who had a very good eye, began to clip many of them into ornamental shapes, and did so biennially for twelve years. Still they seemed to have no object in life, till one day Mr. A. E. Potheroe was walking through the nursery and explained the value of the crop to his host. The shrubs were sent in waggons to Messrs. Protheroe & Co.'s London sale-rooms and realised nearly £400.

In planning a nursery care should be taken to allow the horse hoe to be used in the early stages, first by keeping the ranks not less than 3 feet 6 inches apart and then by giving room enough at the head-lands for the narrow specially caparisoned horse and implement to turn. This might mean the loss of a little ground but, here, the top spit is removed from the headlands and used to raise the site to be planted after it has been formed into lands about 30 feet wide. By this means, as explained elsewhere, an extra depth of soil is secured and good drainage ensured.

As to garden produce most vegetables do well, particularly potatoes; raspberries and strawberries yield excellent crops and carnations and violets flourish to their heart's content but all these things must be trenched or subsoiled for and manured. The most potent fertilizer, leaving out the humus element, is droppings from the fowl house board; this valuable substance should be stored for a time and kept bone dry. If used fresh it may have a bad effect on certain plants. Useful information about this kind of dressing and also other fertilizers may be found in the Ministry of Agriculture booklet called "Collected Leaflets on Manures and Manuring." Carrots thrive but onions do not. Cabbages, peas, beans and such things will yield fine crops on any but very dry seasons. As to flowers, roses blossom very freely, though they are usually a little deficient in heart; but the formation of rosebeds in which to grow exhibition blooms is here, as in nearly all localities, a matter of artificial manufacture to a more or less

definite specification. It is to be hoped that a serious attempt will be made to grow flowers, such as violets, bulbs, carnations, etc., on this land. Violets certainly do remarkably well and, if planted together with very small silver birch, they would obtain the half shade the flowers delight in and the well shaped specimen trees would be growing quickly in value and later find ready purchasers at good prices ; one labour of hoeing would keep, at the same time, birch and violets clean. Speaking with very little knowledge of the subject, one would imagine the soil is not deep enough to grow and perpetuate very fine tulips and hyacinths, but daffodils thrive and multiply so well and freely here that a large harvest of flowers could be guaranteed. In the Scilly Isles the price of land for bulb culture is as much as £1,000 per acre and, by protection from wind, picking the buds before they open, to save damage by rain, and other precautions the growers seem to do very well. In the season in this part of England it is possible to buy a large bunch of wild lilies of the valley for 3d. which shows how freely they grow, and markets further afield would no doubt pay higher prices.

This is perhaps an opportunity to say something about the relative positions, at the present time, of reclamation of heath for afforestation and the like process for grazing and agriculture. Within the last few years the Forestry Commission have been acquiring considerable tracts of barren land on terms that suited the owners—a rent of about 2/6 per acre, the freeholder retaining the sporting rights and, a very important item, being relieved from all rates. Altering the laws of the land is like altering the plans of a house ; the improvement in one direction is so liable to do harm in another ; and the question now is whether the enormous benefits to be derived through the new relief from agricultural rates will not lessen in some slight degree the desire of landowners to take advantage of the terms offered by the Forestry Commission.

But, surely, Forestry, which in this country always smacks of theoretical statistics and political window dressing, stands second to agriculture in regard to the National welfare.

As a final exhortation to heath gardeners, they are entreated not to cultivate more than they are certain they can look after well. Heath-land is cheap, and the temptation is to scratch a bit here and a bit there and chance what the result is; and the consequence is that the whole premises are unprofitable and look untidy. If, on the other hand, a small area had been trenched and manured, an excellent result might have been obtained, and the surrounding heath would have made an excellent setting for the floral jewels.

All colours here attain their highest value owing to adjacent neutral tints, the softly brilliant light and its effect both on the object looked at and the retina of the observer, and the purity of the air that leaves unstained a bird's or butterfly's plumage and a flower's petals.

CHAPTER V.

Poultry Farming and the Sanitary Rabbitry.

THIRTY or forty years ago a man who talked of going in for egg production on commercial lines was looked on with suspicion by his fellows, and not without reason, for at that time it was practically impossible for hens to produce sufficient eggs to pay for the labour and food they needed, and a not uncommon poultry farmer of that date is delightfully taken off in P. G. Wodehouse's "Love Amongst the Chickens." At the Harper Adams Agricultural College recent laying trials 1,746 pullets yielded an average of 186.2 eggs a bird and 161 ducks gave an average of 225.2. The figures available cover only 48 weeks, but these show that the average monthly cost of feeding a pullet for four weeks was 9½d., and a duck 1/2, while the average monthly value of eggs produced was 2/3 for a hen and 3/2 for a duck. One recorded contest comprised 3,197 competitors. In a recent Dorset county test a White Wyandotte pullet laid 310 eggs in 336 days and by the end of a complete 12 months she had produced 331 eggs.

According to Sir Charles Howell Thomas, Permanent Secretary to the Ministry of Agriculture, we consume annually £47,000,000 worth of eggs and poultry of which only about half is spent on the products of this country.

The brains of many people in many countries have for some time been focussed on the problem of increased egg production, and their strenuous efforts have been lightened here and there by humourous touches such as Lord Dewar's experiment in crossing a queen bee that laid 3,000 eggs in an afternoon with a White Leghorn, or the patent laying box with a hole in the

bottom and a sloping tray underneath, so that when the hen got up and saw no result she immediately laid another egg. Not long ago the "Times" had a special article on the poultry farmer's life and it was aptly headed "A Man's Job." It is a life of hard out-door work, both mind and body healthily occupied, and with enough speculation to give it a pleasant tang; but, to be successful, it must be all absorbing from early morn to dewy eve and beyond. The few noted breeders who can obtain £5 5s. apiece for cockerels and pullets from their famous strains may make a very good income, but apart from its value as a healthy, pleasant and useful out-door occupation, it is questionable whether the average poultry farmer makes as much profit as he could do by putting an equal amount of labour, thought and capital into some other industry. All the same the financial prospects of egg production on scientific lines are infinitely better at the present time than those of the ordinary agriculturist and stock breeder.

This is not the place to describe details of management of the civilised descendants of *Gallus Ferrugineus*, but three points of importance in its connection with land cultivation may be stressed. Keep the droppings dry and—forgive the repetition—do not use lime on the dropping boards. Much has been said recently in the press about the value of lime as a manure but, in soils where nitrate is needed and supplied in a form having alkaline reaction, concurrent lime is fatal. Lastly, do not go in largely for poultry and at the same time buy and store chicken dung, as, if there happens to be any epidemic amongst the local fowls, that is the best way of introducing it to the home stock. And now one must touch on a rather delicate subject, if this is to be a faithful statement regarding the reclamation of heath-land. However much one may admire the excellent qualities that the successful poultry farmer displays, his business is as a rule difficult to carry on without some slight detriment to the

development on Garden First lines of a residential district. The erection of too obvious square wooden posts to support almost invisible wire-netting, the construction of fowl houses with lean-to-roofs, the lack of time for gardening, all of which one sometimes sees on a poultry farm, and the thoughtless and untidy way in which cocks and hens always leave their feathers about do not make an aesthetic appeal to the prospective purchaser of a building site for his own private occupation ; finally the thought that at 3 a.m. on summer mornings, when it is too warm to shut the window, a chanticleer chorus next door will start crowing decides him to go elsewhere. Surely, with all the thought now centred on the poultry industry, someone will soon produce a silent breed of cockerel and earn the thanks of millions yet to be : dumb-waiters have been on the market for years so why not dumb-roosters ? The soft motherly cluck with which a hen announces something accomplished, something done, annoys no one.

This does not mean that chicken farming must be taboo ; but merely that it is wiser to restrain it to outlying parts of an estate. And the foregoing needs perhaps a little qualifying, because there are some spots, sheltered by matured hedges and ornamented with a few old trees, that, provided the fowl houses are modest and restrained, may, if not too noisy, be used as a poultry farm amongst private houses quite happily. Fowls appear to obtain much animal nourishment from off the heather but their food bill is decreased and their health and yolks are improved by the laying down to grass of a portion of the farm. There is of course an excellent market for both eggs and table birds, as Hampshire Heath is only ten miles from the centre of that part of the coast where hotels and boarding houses, full all the year round of hungry and purse blown visitors, stretch in a practically uninterrupted line as far as Croydon Town Hall is from Hyde Park corner.

The Sanitary Rabbitry.

DURING the war everything was done at Garden First as in all other places to cut down expenses and increase by ever so little the food supplies. Grass fields were sown with oats. A favourite old mare that, after carrying her master about 15,000 miles without a single mistake, had been pensioned off for seven years and had reached the ripe age of 30 or thereabouts was together with a pack of beagles, killed, and loose boxes were turned into rabbitries. These last were quite successful in the production of a large stock of healthy bunnies, and considerably reduced the labour of "cleaning out." Four-fifths of the trouble of keeping tame rabbits is caused by the need for the daily turning out of their apartments; and, even then, the sanitation is primitive and the health of the occupants in consequence very uncertain. Hence the subsequent evolution of the sanitary rabbitry. A concrete shed was erected with a corrugated iron roof lined on the under side with a thatch of straw that was kept up with wire netting and strand wires attached to the underside of the purlins. This form of roof gives greater resistance to extremes of temperature than ordinary thatching, for in winter there is no evaporation from wet straw and, in the summer, the outer covering of the roof can be whitewashed. The righteous indignation of the art critic, when corrugated iron is mentioned, is apt to be a little over-done when, in the country, it is properly treated for roofs. It should have one or two thick coats of tar which, while wet, is thickly dusted over with coarse sand. This takes away the smugness of its corrugations and, in a few years time, it acquires some resemblance in softness of tone to the old Devonshire slate roofs, especially if the rough concrete walls of the building are whitewashed. The first rabbitry on the new plan was an oblong shaped building with a

span roof and, while we are on the subject of shed design, a few remarks may be useful as to the shape of these erections, for, without due care, they may do much to destroy the beauty of Rural England. In plan the length should always be in some proportion to the width say 18 feet by 12 feet and the height should never be disproportionately great; in fact, as far as country appearance goes, the eaves can hardly be too low, and, if the door, which should not be higher than necessary, is placed at one end and not at the side, the eaves can be kept down to about 5 feet or 5 feet 6 inches with advantage. The roof should, from an aesthetic standpoint, always be a span one and not a lean-to, and the fact that corrugated iron can be laid almost flat without letting in the rain, should not, even in the good cause of economy be made an excuse for an angle of much less than 40 degrees. Feather-edged boards with brown wood preservative certainly look much better than iron for the sides, and Stockholm tar for wood and gas tar for iron are, considering their respective costs and advantages, the best preservatives from rot and rust. Possibly most people do not quite realise the beautiful colours that tarred iron exhibits. And now to come to the special feature in sanitation. There was room for a row of hutches on each side of the interior of the first shed, with space down the middle to allow the attendant to walk and attend his charges. The hutches had small mesh wire-netting fronts, including doors along the whole width of the hutch, and the divisions between them were of the same wire. This netting ran up into the roof, so that with the latter and the wall of the shed it completely enclosed the sides, front and top of each hutch. The floor was also made of small mesh wire-netting which was covered with a little straw, but so that all excrement could past freely through. The bottom of the hutches was about four feet above ground and, two feet below that,

a channel, the same depth from back to front as the hutches, was made of wood covered with a composition of cement and sand to which was added pudlo or one of the other mixtures that water abhors. The channel should slope from the back and front to the middle of it and also from both ends of the shed to the centre. There is a hole at the lowest point of each channel, making an opening of about six inches in diameter and under this hole a pail is placed. The result is that everything in the way of solid excrement or liquid product passes at once through the hutch floor and runs down the channel into a receptacle, the daily removal of which is the only part of the sanitary system that is not entirely automatic. If the contents of the pail are not needed for the garden a few drops of carbolic make the air absolutely devoid of any rabbity scent. The health of the stock kept on this system is unusually good. All the time it was used either at Garden First or Hampshire Heath there was not a single case of illness, but when one of the rabbits had to be kept apart in an ordinary wooden hutch the animal which had cost £5 died. It was a Flemish Giant which variety are not at all clean in their habits. The rabbits seemed perfectly happy on elevated wires. The sleeping or nesting compartment was formed in each instance of a small barrel laid flat on its side with the open end towards the back, and a small spy-hole door was made in the bottom of the barrel, facing the front of the hutch. After each litter is old enough to be disturbed, the barrel can with ease be taken out and thoroughly cleansed or whitewashed. The large prices paid nowadays for some kinds of rabbit skins and the new inventions for transforming the pelts of ordinary bunnies into fashionable wraps combine to make rabbit farming well worth the attention of amateurs. The recently introduced industry for the production of beautiful Angora wool has gained a footing on Hampshire Heath and one farm has been started for 500 bunnies, who in

their passive way are as busy as bees in producing wealth for their owners, for he also serves who only stands and waits. The little creatures are kept under the most healthy and luxurious conditions and probably look on their hair brushing as the happiest two minutes of the day. The annual value of the Angora rabbit wool crop in this country appears to have grown from £290 in 1922-23 to £12,520 in 1926-27. The foregoing sanitary rabbitry is particularly adapted for Angora wool farming as it should in addition minimise the chances of sawdust and other deleterious tiny substances becoming entangled in the long fine wool. Since writing the foregoing there appears to have arisen a glut in the Angora market, owing to the phenomenal rise in the popularity of the industry and the limited market for the raw material, but let us hope the latter will soon improve.