ROTHAMSTED RESEARCH

Power for Cultivation and Haulage on the Farm

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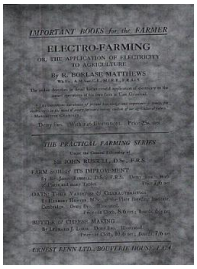

Practical Experience of Power on the Farm

E. Porter

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in a modern machine, apart from fair wear and tear, calling for the replacement of worn parts by new ones. If the care which I have advocated is not given regularly, abnormal wear and tear will take place, heavy costs for renewals will be incurred, and the value of the machine will rapidly depreciate. I would again urge owners of tractors to treat their machinery as they would treat their animals. If they do so, they will find themselves well repaid.

PRACTICAL EXPERIENCE OF POWER ON THE FARM

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Shifnal, Salop

I PROPOSE to deal in this paper with the application of power in my immediate district, and chiefly on my own farm of 330 acres, of which about 225 are under cultivation. The soil is a sandy loam, and with three exceptions the fields are fairly level. The farming in the district is based chiefly on corn, cattle and sheep; there are some farmers who produce milk, and some grow potatoes on part of the root break. My practice has been to depend chiefly on the live-stock department—on sheep, pigs and poultry—and on the arable land; to widen the range of crops by growing a considerable acreage of potatoes, carrots, parsnips, peas and green vegetables, in addition to corn and the usual roots. I have grown sugar-beet during the last three years. My farming, therefore, may be described as semi-intensive—organized, it may be added, as a business proposition.

The following figures, extracted from the annual reports of the Ministry of Agriculture, show a steady decline in the number of horses on farms in England and Wales:

	Horse-Power	
	Horses, Mares and Colts	*Acres of Arable Land*
1911-1915 . . .	1,165,000	11,131,000
1916-1920 . . .	1,134,000	11,805,000
1921-1925 . . .	1,064,000	11,144,000
1925 . . .	967,000	10,682,000
1926 . . .	927,000	10,548,000
1927 . . .	894,000	10,310,000

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The decline in numbers is evidently related to the shrinkage in the area of arable land, but the introduction of the commercial motor for industrial haulage has restricted very considerably the market for horses, resulting in a considerable fall in the number of foals bred on the farm. The Ministry, however, draws attention in the 1927 returns to the fact that the decline in breeding has been nearly stopped. Are we to conclude from this that horse-power in industry and on farms has been brought down under present conditions to the lowest point compatible with efficiency? It may be so; I am afraid, however, that I cannot give a satisfactory answer.

What are the chief reasons for the retention of horses on the farm? The reply is that horses are a handy and really effective source of power. They are the farmer's trusty friends in all weathers, and in all situations—on wet land, on sloping or hilly land, in chain work or shaft work, and are always able to give reliable service. They are slow, but they are very sure.

Cost of Horse per Working Year

	£	s.	d.
Food	25	4	0
Shoes, repairs to harness and sundry expenses	6	5	0
Risk	4	0	0
Depreciation	4	0	0
	£39	9	0

I find, therefore, on my farm, where it is possible to work horses about 260 days in the year, that the cost per day is about 3s.

Cost of Ploughing per Acre

	Acres per Day	s.	d.
Two horses with one-furrow plough	¾	18	0
Two horses with one-furrow plough	1	13	6
Three horses with two-furrow plough	1½	11	0
Three horses with two-furrow plough	2	8	6

By using a three-horse team and a double-furrow plough the cost of ploughing is brought down very considerably, and the same principle can be applied with economical results to other implements. One of the most recent improvements is the "Gower" two-horse root drill. It is adapted for sowing mangolds, sugar-beet, swedes, and similar seeds, over four rows at one operation, thus covering the ground at twice the speed of the ordinary mangold drill; a further gain being that the ridges are made at the time of sowing.

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Each ridge is made by two concave breasts converging from front to back, and the seed is deposited at the required depth immediately in front of the closing ridge. A special feature of the "Gower" drill is its capacity of working when the surface is wet after a shower.

Another valuable implement for ridge work is the pole ridger, carrying three bodies, which reduces the cost of ridging for potatoes by 50 per cent., and earthing-up by 66 per cent.

There is no reason to believe that the efficiency of horse-drawn implements will not be increased still further.

Engine Power on the Farm

Steam Tackle.—Steam ploughing and cultivating in this district are usually done by contract, the price per acre being 16s. to 18s. for ploughing, and 15s. to 16s. for cultivating twice, and 8s. per acre for harrowing twice. The farmer provides the necessary water and about 15 cwt. of coal per day.

The cost per acre is evidently not less than with horses, but there is of course the very decided advantage of rapid execution of the work.

The charge for mole draining is 9d. per chain, measured along the drain.

Tractors.—Tractors are now within the financial capacity of the average man, and it is probable that with the general-purpose tractor we shall see very considerable developments in the near future. At the present time farmers have not quite sufficient confidence in tractors; they know of too many now lying on the scrap-heap, and they know also of heavy bills for repairs, and of much valuable time lost in waiting for renewals of broken parts. Depreciation is a very heavy charge against the tractor. At their best, however, tractors are invaluable in times of pressure because of their speed and of their capacity for working continuously over long periods when it is necessary for arrears of work to be overtaken, or to make the most of periods of favourable weather.

During the last seven years I have used a Wallis tractor, which I have found comparatively easy to handle; it has sufficient speed and power, and is evidently economical of fuel. It is able to travel fairly well on loose ground, and, speaking not as an engineering expert, I have always considered that this power of easy travel is due to its light weight, to the width of its wheels, and its wedge-shaped gripping spuds.

The most suitable kinds of work for a tractor are, in my experience, the hauling of the two-furrow plough, the cultivator, and the self-binder; for belt-work it is excellent. In ploughing there is a certain loss of control over the plough itself—operated as it is from

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the front—and this lowers to some extent the efficiency of the work, especially on ground sloping sideways. I have not found harrowing and rolling very suitable work for the tractor because of the wheel-tracks, especially after crops have been sown, as subsequent harrowings fail to touch the young weeds growing along the tracks, and grass and clover seeds falling on these tracks are difficult to cover with sufficient soil. The hauling of the grass-mower has not been quite satisfactory; the wheels of the tractor travel along the edge of the swath, compressing the newly cut grass and rendering the work of the swath-turner more difficult. This defect could be improved by a more careful co-ordination of function between tractor, mower, swath-turner and horse-rake. A further difficulty has been the breaking of the cutting knives and several axles. A point in favour of horses is that they usually pull up when obstructions are met with, and the bill for repairs is correspondingly less than when tractors are used. Perhaps our implement makers will design a more suitable mower?

The hauling of the self-binder is perhaps the most suitable harvesting job for the tractor, as this is killing work for horses on hot days. My binder is a Massey Harris, and cuts a width of six feet. The speed attained is greater than with horses, and the knives cut smoothly in consequence. There have been no breakages due to the tractor which could not equally well be due to horses. There is a loss of cutting width when turning the corners, and it has been necessary for the man in attendance to cut them back with the scythe. There is a device, I believe, which enables the binder to cut the corners more completely, but I have not seen it in use. In difficult cutting, or in a crop of variable length, it is necessary to have a man or a boy on the binder itself; the driver of the tractor, however, being frequently able himself to manage the work of cutting after being well started.

The question of designing wider implements for tractor use in corn and grass harvesting has often been in my mind; but for English conditions and with crops which are often above the average it is difficult to see at the moment how these heavier crops could be handled economically by such implements. It would be a much simpler proposition with lighter crops, and in such cases wider implements could be operated with advantage.

The Tractor of the Future.—The improved tractor must, in my opinion, be of the general-purpose type—of light weight, of simple construction, easy to start, handy in the field and well protected from dust and grit, both inside the engine and about the bearings of the travelling wheels. The tractor must be powerful enough for the work, with low fuel and oil consumption, not too noisy when working, and backed by an efficient repair service.

The driver's comfort must be considered; a suitable platform

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and seat must be provided; the driving wheels must also be well guarded to keep the dust away from the driver in dry weather.

This improved tractor must be in the charge of a capable man, sufficiently skilled to keep the tractor running under reasonable conditions. When the tractor is in the shed it will be necessary to provide him with suitable alternative work, which will stand the higher rate of wages that must be paid him.

Cost of Working a Tractor.—The cost of ploughing with the tractor does not appear, in my experience, to be cheaper than with horses when the latter are pulling a two-furrow plough. I have not kept complete costings, but my driver has given me the following figures for fuel and oil consumption for a 21-acre field which, in comparison with the figures for other fields on the farm, seem to be typical: paraffin, 25 gallons; petrol, 5 gallons; lubricating oil, 4½ gallons, and about 1 lb. of grease.

Depreciation works out at about £45 per year, and, allowing 90 working days, the average figure is 10s. per day. As ploughing is heavier work than binding I propose to charge the ploughing at the rate of 12s. 6d. per day, and the lighter work at 7s. 6d. per day.

Repairs have averaged about £18 per year, which equals 4s. per day. I propose to charge 5s. per day against the ploughing.

Summary

	s.	d.
Fuel, oil, etc.	2	3
Depreciation (2½ acres per day)	5	0
Repairs	2	0
Wages (piece-work)	3	0
Cost per acre	12	3

If we assume that the charge for repairs is the same per day whether a larger or smaller area is ploughed, we can bring down the cost per acre from 12s. 3d. to 9s. 9d. by increasing the area ploughed from 2½ acres to 4 acres.

Harvesting.—The cost of cutting and tying the same field when in oats worked out at about 6s. per acre when calculated at the rate of 10 acres per day, and about 5s. 2d. per acre when 15 acres are cut per day, which is about the same cost as with horses.

Thrashing.—For belt-work I have found the tractor most satisfactory. As against the steam engine, the tractor depreciates more rapidly, and is not so useful in moving the thrashing-box. The drum appears to be operated as steadily with the tractor as with the steam engine, and in fuel consumption the tractor has a distinct advantage. About 5 gallons of paraffin and ¾ gallon of petrol appear to be sufficient for a day of eight hours, and with steam the

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coal consumption is about 15 cwt. per day, and, in addition, water must be constantly supplied. The cost of fuel in the case of the tractor is about 5s. 6d., and, allowing 5s. for the heavier depreciation of the tractor, we have the total of 10s. 6d. against, say, 20s. for coal and 5s. for the work of carrying water, making a comparative figure of 25s. for the steam engine. For thrashing on the farm the tractor is undoubtedly an economical power unit. The sawing of timber for firewood in winter is a side-line of considerable importance.

Motor Cultivation.—I have often wondered why so little progress has been made with motor ploughs and cultivators, as it seems that control from the rear has distinct advantages. As a grower of roots on ridges of various sizes I have often seen the young growing plants damaged by the treading of horses. If one had a very light motor-cultivator which could travel between the rows, and operate tines, blades, discs, or other attachments, a great deal of damage could be avoided. Plants in the field may, of course, be destroyed in other ways than by horses, but it is important to realize that, in the case of sugar-beet, with roots having an average weight of 1 lb. (not very large roots), growing uniformly in rows of 18 in. and singled at 9 in. apart, the crop would weigh 17 tons per acre, which is about double the average yield, and indicates that considerable loss occurs in most cases.

Haulage of Farm Produce

I claim to be a lover of horses, but after being thrown headlong into the road on more than one occasion I was driven to the conclusion that it was safer to drive a motor-car than a horse along the surface of a modern road and I made the change-over, though with some reluctance at the time.

Now, I have also taken the farm horses off the road, and the haulage to station and market is done by hired motors.

My nearest station is four and a half miles away, and a local lorry owner has undertaken to haul manures, feeding-stuffs, and various kinds of produce in bags, at the rate of 4s. per ton, but it appears that a powerful competitor will shortly offer to do the same work at a lower rate. The usual load at the 4s.-per-ton rate is from 25 to 30 cwt., but occasionally 2 tons.

By using horses and moving a crop of potatoes at the rate of 7½ tons in two days with one team, I estimate that the cost per ton would be about 3s. 9d. per ton—slightly lower than with the motor. Owing, however, to the greater speed and convenience of the motor, I prefer to keep the horses working on the land.

Sugar-beet is collected from the farm by the railway company's own lorries, unloaded at the station into railway trucks, and sent

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by rail to the factory at Kidderminster, at a cost of 3s. 10d. per ton for collection to the station, and 3s. 6d. per ton for railway freight, which makes 7s. 4d. per ton from farm to factory. For road haulage a contract price with a private firm was 7s. 6d. per ton from farm to factory. I have reason to believe that both these contract rates will be lower during the coming season. The beets have, of course, to be carted from the fields to a loading deck adjacent to the hard road, and assistance is given when loading the lorry at the deck.

Summarized haulage costs to Station—4½ miles distant

Horses (2½ ton loads)	3s. 9d. per ton
Light motor-lorry (1¼-1½ ton loads)	4s. per ton
Heavy motor-lorry (6 ton loads)	3s. 10d. per ton

My chief market town is Wolverhampton, which is fourteen and a half miles away. The following figures represent the charges from the farm to the market and to various depôts in the town:

Potatoes in bags (2 ton loads)	8s. per ton
Potatoes in hampers (2 ton loads)	10s. per ton
Carrots, parsnips, peas and cabbages (1¼ ton loads)	10s. per ton
Sheep and pigs (about 15 sheep)	15s. per load

An economy of some importance resides in the fact that these light lorries can take their loads of from 25 to 30 cwt. direct from the field, except when the ground is soft immediately after rain, when it is necessary to bring out the horse, and cart the load to firmer ground. Heavy motors must always remain on the hard road when being loaded.

The cost per ton when produce is sent to Wolverhampton by road to the station, and thence by rail, is about 15s., delivered to the market, which is, of course, quite an impossible figure.

Summing up, it will be seen that it is still difficult to reduce the cost of many kinds of field work to a point lower than is possible with horse-power, yet I am convinced that a general-purpose tractor, used in conjunction with horses, is a combination which under present conditions gives that variety of power which makes for high efficiency on our medium and large-sized arable farms. There are times when the value of the work done, say, during a spell of favourable weather, makes the actual cost of the job seem extraordinarily well worth while, and these are the times when the tractors give their best service, which may in some cases mean the difference between success and comparative failure.

For road haulage, horses are too slow, and are rapidly being

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superseded by motors. I feel, however, that it is better for most farmers to hire rather than to purchase a motor, as, in these days of telephones, there is no difficulty in bringing a motor to the farm almost at any time, which is a wonderful convenience.

In conclusion, it is obvious that mechanical power applied to agriculture is an important factor making for the improvement of farming conditions—a factor which may prove to have a very special appeal to the oncoming generation—and if in this way we can raise the standard of life on the countryside it will be due very largely to the skill and resource of our agricultural engineers. I hope that their efforts on behalf of agriculture may still further result in "better farming, better business, and better living."

ROTARY TILLAGE

By R. D. MOZER

Simar Rototillers

The subject of "Rotary Tillage" is not a simple one and is not easily condensed, and I must confine myself to stating a few facts and deductions which may prove to be the basis for subsequent developments of this intricate matter. In certain phases of farm management the question is relatively simple—harvesters, automatic milking machines, and many other power-driven implements are manufactured along more or less standard lines, and often there remains only the problem to choose such machines as will give long life and continuous service.

In the department of tillage operations, however, the problem is more difficult. As a general rule, the farmer knows instinctively that such-and-such processes will yield certain results, but there is a wide gap between the process and the final result, and he is accordingly loth to change anything from his former methods, because he cannot foresee step by step what effect will follow the introduction of new methods at any stage of his operations. Hence the difficulties facing the agricultural engineer are very acute.

The first problem to be faced in connexion with the application of power to tillage operations is the nature of the power which should be used, but that is a problem which is beyond the scope of this paper. The second problem is whether the mechanical unit should be designed so as to make use of conventional tillage implements, or whether the implements themselves should be re-designed to fit in, as it were, with the usual consequences of the generation of power by mechanical means. Within the latter category we find

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