

improve the vitamin-A potency of maize. This work also failed to demonstrate any important effects of sprouted maize on the contents of vitamin B (complex), of B₂, or C of milk. In any case it is well established that the cow does not require either of these factors in her food.

After the discovery of the anti-sterility vitamin E in 1922, sprouted oats was widely recommended as a means of combating sterility. Experimental work to test this recommendation has not been convincing, and it is now believed that vitamin E is of much less importance for many animals than the original work with rats suggested. Henke [8] performed carefully controlled experiments with cattle and found no improvement in fertility after feeding sprouted oats; and his results with pigs were indefinite and not significant. Many sources of vitamin E are now known, e.g. wheat germ, and it appears quite unnecessary to sprout grain in order to obtain ample supplies.

Recently, some American workers have described a new dietary factor in young spring grass which they refer to as the 'grass-juice factor', and claim that it passes into the milk [9], an observation which has not yet been confirmed by other workers. It seems improbable, however, that the factor is present in sprouted grain, for the American workers reported that fresh oat-grass which had been grown in a greenhouse was inactive as a source of the 'grass-juice factor'.

One obvious change brought about by sprouting grain is the conversion of a dry food to a succulent one. This is sometimes considered to be an advantage, but most students of nutrition believe that succulence unaccompanied by other dietary factors is of little or no value.

The general conclusion which may be drawn, therefore, is that if any nutritional improvements result from the sprouting of grain, such improvements have not yet been demonstrated, and therefore may be assumed to be very small, non-existent, or inoperative under normal conditions of cattle management.

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AGRICULTURAL METHODS ADOPTED IN THE ROTHAMSTED CLASSICAL AND MODERN FIELD EXPERIMENTS

J. R. MOFFATT

(Farm Manager, Rothamsted Experimental Station, Harpenden)

THE purpose of this paper is to put on record the agricultural methods used on the experimental plots at the Rothamsted Experimental Farm. The methods are varied in detail from time to time as new equipment suitable for small-plot work becomes available, but until recently there have been very few suitable implements marketed. Within the last year or two several mechanically drawn implements suitable for the small farmer and market-gardener have been placed on the market, and it is hoped that some of these may be adopted for use on the plots.

Classical Experiments

The same general methods are adopted in all classical corn experiments, and a detailed account of the methods adopted on Broadbalk wheat-field will apply, with minor modifications, to all other classical corn crops.

Broadbalk wheat.—One of the main difficulties encountered when growing wheat continuously is the fact that the crop occupies the ground for at least ten months of the year, so there is very little time for cleaning the ground. One of the best methods of keeping down annual weeds is to break up the stubble in some way immediately after harvest in order to get a tilth that will encourage the weed seeds to germinate. These are then destroyed by the subsequent operations. From time to time various methods have been adopted, but since 1930 the general practice has been to give a single ploughing without the preliminary use of the cultivator. All tractor-implements tend to carry soil over from one plot to the next when worked across the rows, and now all operations (except harrowing and rolling) are done up and down the plots. In the autumn of 1934 and 1935 double ploughing was tried, once immediately after harvest and once shortly before sowing. This plan worked very well the first year but failed in 1935. Since then only one ploughing has been done, and this is carried out as soon as possible after the crop has been carted. The field is left in the furrows until shortly before drilling, and is then worked well.

The first operation after harvest is the application of dung to Plot 2. This is weighed at the farm in carts, and the correct amount is carted to each section of the plot. While this is being done, one of the experimental staff spreads a thin layer of dung around the edges of the sections of the plot, so that when the farm men go spreading they can spread evenly inside the demarcated area.

The plots are always ploughed in pairs. A ridge is set on the path between two of the plots, and then the plough works round and round until the two plots are finished and half of each outside path is done.

The other pairs of plots are treated in the same manner. The next time the field is ploughed, the starting ridge is set on the path where the finishing furrow was left at the previous ploughing. This ensures that the soil from the plots is thrown out at one ploughing and back again when next ploughed, so that the soil is not gradually moved from one plot to the adjoining one. The furrows are then left until October, when the field is usually cultivated.

The next operation is the marking out of the field. There are two large permanent white posts at each end of the field which give the top and bottom boundaries of the plots. Each section is also marked by a similar post along the south side of the field. In the centre of each path between the plots at both ends of the field is a small oak peg sunk into the ground below the depth to which cultivation implements will work. Whenever the corners of the plots have to be found these sunk pegs are first found, and knowing the width of the path the positions of the corners are easily marked, small hazel pegs being used. These are driven down until only a few inches show above ground, so that they can be found fairly easily for drilling, and yet are seldom pulled up or broken by implements when working the soil before drilling. Whenever the plot-corners have to be marked afresh the sunk pegs are always unearthed. Chaining is done only to give the approximate positions of the sunk pegs, as with chaining there is always some slight possibility of error. To eliminate the measuring of each individual path-width a wooden rod is used on which the width of the paths is marked. This same rod has the path-widths of all the classical fields marked on it, for a similar procedure is used for marking out all the classical fields.

The next major operation is the application of manures. These may be applied either directly on the plough furrows, or at any intermediate stage of working, the deciding factor being the strength of the wind. For this operation a calm day is needed to ensure that the manures are not blown on to other plots, and, profiting by past experience, we choose the earliest opportunity of applying them, no matter how much or how little the ground has been worked. The same manures go on to each plot every year, and the set of the distributor is known which will sow nearest the quantity for each plot. The Field Superintendent supervises the weighing, sieving, and mixing of the manures in the manure-shed at the farm. The components of the mixed manure are weighed out separately, checked, and then passed through a sieve; they are then mixed, bulked up with silver sand to the correct volume for each plot, and remixed. The mixtures are bagged and labelled with a small wooden peg carrying the plot-number. The floor is swept clean and each plot is finished before another one is started. We find it better to sow by volume rather than by weight. The manures are then carted to the field, and the bags for each plot are put on the headland opposite the appropriate plot under the supervision of one of the experimental staff. The distributor used is of the rising hopper type. As the machine is drawn forward the hopper is gradually raised so that the top of the manure is always in contact with a revolving star-wheel, the position of which is fixed. The star-wheel pushes the manure over the side of the

hopper in a fairly even flow. The speed at which the hopper is raised can be controlled by varying the size of the worms and gear-wheels by which the drive is taken from the main wheels to the ratchet on the hopper. The drive and the setting of the implement are quite positive, and so if the same setting is used the same amount of manure is applied each year. This is the only machine of several that have been tried which will sow artificial seeds accurately in both damp and dry states. A large cloth is spread on the ground just off the end of the plot, and the manure-distributor is drawn on to the cloth and filled there. The manure in the hopper is levelled off, and the hopper is wound up so that the top of the manure just touches the star-wheel. The star-wheel is given a few turns by hand and the distributor is ready. When the machine needs refilling the operation is repeated, the cloth being moved to the distributor. When the whole of the plot has been covered, the distributor is taken back to the cloth and the hopper emptied on to it. The manure on the cloth is then sown by hand as evenly as possible over the whole plot.

Next comes the final working-down to the seed-bed, and the aim is to get a fairly fine but firm tilth with no knobs much bigger than a hen's egg. The implements used and the number of operations of course depend upon the season. This final preparation of the seed-bed obliterates all plot-boundaries, and the small hazel pegs put in before the distribution of the manures have to be found again before drilling. This is usually done quite easily, but sometimes some of the pegs are broken off by the tractor, in which case they have to be positioned again from the sunk pegs.

For drilling, one side of each plot has to be marked out with pegs to ensure that the drill is kept straight and on the plot. Surveying-poles are placed at the top and bottom corners of the plot, and six or eight intermediate white pegs or surveying-poles are then sighted into line. The near wheel of the drill is kept in line with the pegs, the horseman concentrating his attention on this while one of the experimental staff sees that the drill is sowing properly at the correct depth. Once one edge of the plot is drilled, the rest of the plot is drilled in the usual manner while the pegs are being sighted into line for the next plot. There is always the same number of rows per plot, but unfortunately the number of rows is not a simple multiple of the spouts of the drill, so that when most of each plot has been sown the drill has to go back and put in the three extra rows to complete the plot. To do this all the spouts on the drill with the exception of three have to be shut. The same variety of seed, dressed to kill the spores of seed-borne diseases, is used each year, but new seed is always obtained. The seeding-rate is about three bushels to the acre. The seed is harrowed in and left to the mercy of the birds and weather.

In spring, usually March or April, the nitrogenous top-dressings are applied, but the plots do not have to be marked out for this operation as the wheat plant is showing up clearly. The plots are then harrowed, either lengthwise or crossways, to break up clods and surface-pans, and to kill off as many weed seedlings as possible. The light Cambridge

roller is then used to compact the soil around the roots of the plant, and to push down the flints so that they will not catch the knife of the binder.

Later, the ends of the plots and the headlands between the sections are marked off with a plough, and the top and bottom headlands are ploughed to keep them clean. During the spring and summer the paths between the plots have to be kept horse-hoed to subdue the weeds.

Fallow section.—The field is divided into five sections and one section is fallowed each year. A headland is left between the sections so that implements working the fallow do not turn on the part of the plot from which yields are recorded. The headlands between the cropped sections are marked off, and the crop is discarded at harvest. The fallow section is worked down with the rest of the field in the autumn, but it is not manured and not worked again until the spring. By this time many weed seeds have germinated and these are killed off by surface cultivation. In late April or May it is usually ploughed and again worked several times until June or July, when a second ploughing is done. Then more workings are given right up to harvest. Usually just two extra ploughings are given, so that the ridges and furrows are in the same positions as on the cropped sections. The chief weeds we have to combat are slender foxtail (*Alopecurus agrestis*), commonly known as blackbent or blackgrass, and poppies, though the latter seem to have been greatly reduced during the last few years. Both these are annual weeds and the method of working the fallow is satisfactory in keeping them under. The fallowing method we adopt would not be efficacious against perennial weeds like couch grass. Wild oats are now very prevalent on Sections I and II of the dunged plot and on the odd strip on the northern side of the field. It is almost impossible to combat this weed in the cropped sections, as it is not easily seen until the flowering stage, and as the seed ripens before the wheat it either sheds itself or is knocked out by the harvest operations.

Shortly before the field is cut the Field Superintendent goes round all the plots and makes notes of any outstanding features, such as laid plots and bird damage, and these remarks are subsequently entered in the White Book in the Library. Before the cutting of the plots is started the crop from the headlands between the sections has to be scythed out or cut with the binder, and carted to the outside of the field. The cutting is done with a power-driven self-binder, i.e. the drive of the binder is taken from the power take-off of the tractor. The plots are usually cut in groups of about six, three being cut going down the field and three coming up, but the number of plots per group depends upon whether there are any badly laid plots which have to be cut against the way the crop is lying. A division has to be made by hand or by a small reaping-machine between each of the groups so that the tractor can pass down without running on the standing corn. The binder throws the first two rows of sheaves on to the adjoining plot, and, to avoid any error when the sheaves are thrown back on to their correct plots, different-coloured binder twine is used for each pair of plots. The places where the sheaves

fall off their plots are raked back by hand. The changing of the twine between each pair of plots causes a little delay, but possible mistakes are avoided by the use of the different colours. When the binder comes to the end of each section the tractor stops, but the binder is kept turning over until all the corn is thrown out. If any of the plots are badly laid, men with forks or sticks have to lift the crop off the ground so that the knife of the binder can get under the straw. Any long straw left by the binder has to be scythed off, and if, as sometimes happens, the crop is 'laid all ways', the whole plot may have to be scythed.

When the sheaves have all been thrown back on to their correct plots by the experimental staff, they are stooked or shocked, about eight sheaves being put in each shock.

There is seldom more than one cartload to any plot of any one section. One man pitches the sheaves on to the cart, one man loads, and another man with a horse-rake rakes up behind them, so that the whole of each plot is cleared up before another is begun. All the work is carried out under the supervision of one of the experimental field staff. The appropriate plot-label is then put on the cart and another man leads the cart away to the stack.

At the bottom of the stack some old straw is placed to keep the sheaves off the ground, followed by a layer of sheaves from the headlands. Over this layer a large Hessian sheet is spread. When the first load arrives at the stack, a cloth is spread on the ground close to the stack, and the cart is drawn on to it. The cart is unloaded, and the sweepings from it are kept on the cloth, which is then passed up and put on the stack. The label peg is put under the last sheaf in the centre and another cloth is spread over the top of the sheaves. The process is repeated until all the produce from the plots is carted, the operation being always supervised by one of the experimental staff. A layer of sheaves from the headlands is placed over the whole stack when finished to keep off birds from the plots. The stack is now always made under the Dutch barn at the farm buildings.

Threshing is now done as soon as possible after harvest to avoid losses through rat-damage. Up to a year or so ago it was left until December, i.e. when the autumn land operations were completed. However, in 1937 the rat-damage in the stack was so severe that last year threshing was done in September. It is very inconvenient having to do this threshing under cover at that time of the year because the operation needs all the men and all the experimental staff on the farm, and it means that what is really a wet-day job is being done when the soil is dry and when outside work should be in full swing. However, it is hoped to have a rat-proof barn erected in the near future which will enable all experimental corn crops to be stored safely until most of the outdoor work is finished.

For the threshing one man and one of the experimental staff are needed on the stack to pass the sheaves on to the drum; another man cuts the bands and feeds the sheaves into the drum, while another attends to the delivery spouts and carries away the threshed grain to be weighed. Other men pass the threshed straw as it comes from the

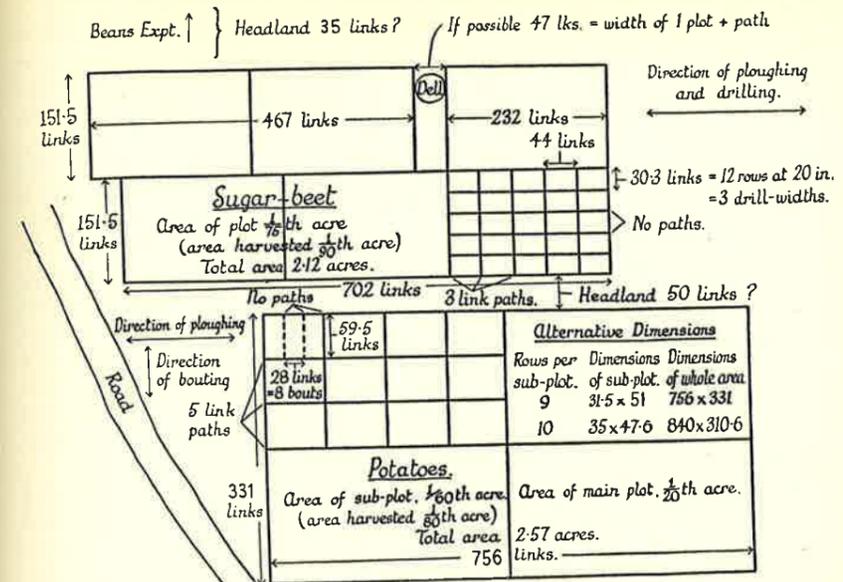
machine on to a cart, which is then taken to the weigh-bridge. The cart is then unloaded at the straw-stack while another cart is being filled at the machine. The assistant on the stack sees that all the sheaves down to the parting-sheet have been threshed, and then the sheet with the loose ears and grain is passed on to the platform of the machine. This is then swept so that all loose ears and grain go into the drum. An interval of 10 minutes is allowed to elapse before the next plot is started, during which the drum continues to revolve, so that there is no carry-over of grain from one plot to the next. During the interval the rest of the straw is cleared away, the chaff and cavings are gathered up and weighed, and everything is prepared for the produce from the next plot. The chaff and cavings, which contain most of the weed seeds, are then carted away for burning or are used for covering outside potato or mangold clamps. The grain is taken to the barn and weighed, and several bushel weights are taken from each plot. A sample of grain is taken from each plot for the determination of the dry-matter content, and a portion of 1,000 gm. approx. is dried, bottled, sealed, labelled, and taken to the laboratory for storage. A sample of the straw is also taken from each plot and is chaffed at the farm. The dry-matter content is determined and about 150 gm. of the dried sample are stored in tins, which are labelled and later taken to the laboratory.

During the winter months the dates of all operations on the field, a table of quantities of manures applied to each plot, together with any notes, are entered in the White Book which is kept in the Library. The field labels, of which there are about 53 for Broadbalk alone, are painted and stencilled during the winter months.

Annual and Rotation Experiments

The ideal position for annual experiments is the most even site on the field which is normally carrying the crop on which the experiment is to be made. For many reasons this is impracticable, and so one field is set aside each year and as many annual experiments as possible are fitted into it. There are more annual experiments than one field can carry, but the management of the farm is greatly helped by reducing the number of fields carrying experiments. All the non-classical arable fields carry annual experiments about once in five years, for there is a rule that at least four years must elapse before an experimental site can be used again. During the four intervening years no artificials other than nitrogenous top-dressings are applied, so that there should be no accumulation of phosphate or potash which might mask the manurial effects looked for in the experiments. A dressing of dung is usually given to the fields for the first or second crop after the experimental year.

The annual experiments are normally planned by a sub-committee of the Field Plots Committee, and the rough plans of proposed experiments are placed before the full committee. If they are approved, they go back to the sub-committee for determining sizes and arrangements of plots and rates of manuring. Next, the positions of the various experiments in the field set apart for annual experiments have to be decided, and this is done on the field. Alternative dimensions of plots are often given so that the best



Plan of experimental field, giving detailed measurements and working data.

can be made of the available space. The chosen sites have to be free from dells, and the lay-out has to be planned so that any prominent ridges or furrows left from previous ploughings come on the paths of the experiment.

Once the site and plot-dimensions are finally determined, a base-line is laid down the overall length of the experiment. Right angles are set off from the ends of the base-line by means of a crosshead, and the overall width of the experiment is measured along these lines. The corners of the plots around the outside edges of the experiment are marked out with hazel pegs, chaining being used to determine the positions of the plot-corners. When complete plot-boundaries are needed, as for manure-sowing, lines are laid from peg to peg in one direction and small marks are drawn by a hand-hoe. This marks the plot-boundaries in one direction. For the cross-boundaries, lines are laid from peg to peg across the hoe-marks. Thus only one row of plots is marked out at any one time, and after the manures have been applied to this row of plots the lines are moved on to the next. Manures are always applied on the small plots by hand, as there is no distributor which can do the job satisfactorily. Many of the plots receive different quantities of manure, and the specified quantity has to go on each plot even to the nearest quarter of an ounce. If a small distributor was used the setting would have to be altered a great many times for each experiment, and the hopper would need emptying after going over each plot so that the remaining manure could be sown by hand. It is far quicker to do the whole operation by hand.

If the experiment is for one year only, no permanent or semi-permanent marks are put down. However, if the experiment is to last some

years, sunk pegs are placed in the ground to mark the corners. If there is only a possibility of following it up in the second year, small angle-iron pegs are placed in the hedges in line with the outside boundaries; these enable the boundaries of the experiment to be picked up quite easily should they be required.

If the drilling follows directly after the sowing of the manures, the hoe-marks are used as the lines to which the drill is kept, but if, as more frequently happens, the hoe-marks are obliterated by the final preparation of the seed-bed, lines are laid along the plot-boundaries in the direction of drilling, or white pegs are sighted in. Only one edge of each row of plots has to be lined up in this way, as we now arrange that the plot-width is a simple multiple of the number of spouts on the drill at whatever spacing is used. For annual beet and bean experiments the spacing between rows is usually 20 in., as this is about the minimum width that a horse-hoe can work late in the season without damaging the plant. The beet plants are singled to about 9 in. between the plants early in June. Corn crops are sown at 6 in. spacing.

For potato experiments the same general method is adopted for marking out the site, but manures, both dung and artificials, are applied after the ridges have been drawn out. The ridges are carefully kept to the same width, and each plot has the same number. The potatoes are planted on top of the manures. To get even spacing of the sets and the same number of sets per row, chains, to which pieces of coloured string are tied, are laid along the top of the ridges. One man works each side of the chain and places a set opposite each piece of string.

As early as possible in each season a white peg is placed on each plot. On this peg is stencilled an abbreviated description or symbol of the experiment and plot-treatment. The key to the treatment-symbols is placed in a glass-fronted frame at one corner of the experimental area, so that it is a fairly easy matter to determine the exact treatment any particular plot has received.

In the early days of the annual plots, all corn plots were cut with a scythe and then tied by hand. Later, a rack machine was used. This is much like a mowing-machine but has a slatted wooden rack behind the knife on to which the corn falls. The man on the seat rakes it off whenever enough for a sheaf has collected. In 1928 the self-binder was used for the first time and to-day this method is still being used, though of course with a more modern machine. The tractor-drawn binder stops at the divisions between the plots and clears itself before passing on to the next plot. Different-coloured strings are used for the small plots so that the sheaves can be thrown back on to their correct plot.

After stooking the plots are raked with hand-drags. When the corn is fit for carting the whole produce from each plot is thrown on to a large Hessian sheet, the corners of which are then tied together. The plot label-peg is put in the bundle, and the bundles are loaded on a cart and brought home to the barn. Until 1937 the horse-waggon was used for this carting, but the floor of it is so high that it needed several men to load the bundles, for though they rarely weigh more than 2 cwt. they are bulky things to handle. About six of the bundles could be brought

home on each load. In 1938 a large-bodied, low-loading cart or trailer running on rubber tyres was built. It can be drawn by a horse or tractor. The low floor makes loading very much more easy, and nearly twice the number of bundles can be brought home on each load. With the sides up, the cart can go through gateways, but as there are no gates on the routes from the rotation experiments and seldom any from the annual experiments, the side boards are made to open outwards so that they can be used as extensions of the floor-space.

Threshing is carried out during the harvest operations as there are not enough sheets for all the plots. Some plots must therefore be threshed so that the sheets can be used again. The threshing is done by a small, simple machine built for the work, and is driven by an electric motor. Since 1928 the following method of threshing has been adopted. The total produce of a plot is weighed while still in its sheet on a spring balance suspended from a tripod. The bundle is opened and the sheaves are fed through the drum. The corn alone is weighed, the weight of straw being obtained by difference. Samples of grain and straw are taken for dry weights and for stock purposes from the rotation experiments, whilst dry weights are determined on both grain and straw from all annual experiments.

Lifting of sugar-beet usually starts early in November, but the operation takes a long time owing to the scarcity of casual labour which is needed for the job. Shortly before lifting starts the number of plants in each plot is counted. The plants are then loosened in the soil by a beet-lifter, but care has to be taken to see that the lifter does not carry roots beyond the plot-boundaries. One gang of men follows to lift the beet from the ground, each man taking two rows at a time. The beet are knocked together to remove most of the adhering soil and then both beet are put down in one row. On our heavy soil, in November and December, knocking the roots together rarely removes much of the soil, and more frequently each individual root has to be scraped with a knife. Samples of beet are taken from the rows after cleaning; they are weighed and sent to the laboratory for a sugar-determination. Another gang of men follows; they pick up the beet one by one on the point of a beet-knife, and snip off the leaf and the crown. The tops drop into a bath, which, when full, is taken and emptied into a larger bath on the weighing scales. The roots are also thrown into a bath, which, when full, is emptied into a larger bath on the weighing scales.

Lifting operations on mangolds and swedes are very similar to those on the beet crop, but being shallow-rooted plants no preliminary loosening is necessary. Each man pulls, cleans, and tops his own row. If the plots are large the tops only are weighed in the field, the roots being weighed in carts at the farm weigh-bridge when they are carted off the field.

Until 1928 the potatoes from small plots were lifted by hand-forks, boys and men being employed to pick up the tubers, rub them clean, and take them to the weighing scales. After each plot had been lifted, each row was again forked over and any remaining potatoes were picked up. The lifting of the potatoes is now done by a mechanical potato-digger, which is pulled by the tractor. Revolving tines on the digger

knock off most of the adhering soil, and the potatoes are then picked up and bagged. With this method several supervisors are necessary at plot-divisions to see that no potatoes are spun from one plot to another. After each row of plots is finished, the soil is harrowed, so that any potatoes that were covered are seen and picked up. The supervisors also see that the produce from the plots goes into the correct bags, which are labelled with the plot-number. This operation is now further complicated by the presence of two guard-rows of potatoes between each strip of plots. These rows have to be dug out and the tubers bagged separately from those dug from the plots; and this small strip of land has then to be harrowed before we can start the next row of plots. The grading of the potatoes according to size usually takes place at the farm buildings and the three grades are weighed separately. The same riddle-sizes are used each year so that any differences in the proportions of each grade from year to year can be noted. The potatoes are sampled as they are sorted, the samples being taken from the ware grade only.

The harvesting of hay crops is a fairly simple matter. The grass is cut by a mower, care being taken to see that grass is not carried over from one plot to another. It is usually turned by hand, though if the area is big a mechanical tedder may be used. When ready for carting the hay is forked into heaps and the plot is raked over. The weighing apparatus is moved from heap to heap and the produce is weighed. Until 1937 a big wooden tripod and platform were used, which needed three men to move them from plot to plot. Recently a neat little implement has been lent to us which is mounted on rubber wheels and can be moved quite easily by one man. A small net is used for holding the hay instead of the clumsy tripod platform. The actual weighing is also considerably speeded up by the use of this implement.

Notes of all experiments are made by the Field Superintendent and entered in notebooks. The weights of the produce from the plots are also entered in the books as they are taken; and all these data are subsequently analysed by the Statistical Department.

The position of every experiment carried out is recorded in the following manner. On each field there are numbered 'permanent posts', the positions of which are known and fixed. They may be gate posts, concrete fencing posts, or concrete posts set up specially for the purpose. They are painted black and white in cross bands so that they may be seen easily from a distance. The imaginary lines between these permanent posts are called 'post lines', and in most fields two or more of these lines cross. Every year the position of each experiment is measured from these post lines and the measurements are recorded so that at any future time the exact position of any previous experiment can be picked up. Every year a map is made of each field carrying annual experiments, giving the position of each experiment in the field. The map used is a photographic enlargement from an ordnance-survey map, and as it is drawn to scale, no measurements are inscribed on it. However, rough plans with detailed measurements are also kept. The maps are bound and kept for reference.

(Received June 15, 1939)

THE TICKS OF EAST AFRICA

PT I. SPECIES, DISTRIBUTION, INFLUENCE OF CLIMATE, HABITS AND LIFE-HISTORIES

E. ANEURIN LEWIS

(Veterinary Research Laboratory, Kabete, Kenya Colony)

Ticks have been referred to as 'the scourge of East Africa'. The phrase is rather exaggerated. Yet the abundance and vitality of the pests did not fail to impress the early travellers in East Africa: big-game hunters have written of the 'loathsome' creatures on every species of wild animal; and the pioneer settler-farmers quickly discovered that ticks provided one of the most serious problems of stock-raising. Furthermore, the development of native reserves and native agriculture has been hindered by the ravages of ticks; the improvement of indigenous stock has been impeded by difficulties in controlling the pests; and the free movement of cattle has been restricted because ticks convey and transmit organisms of fatal diseases.

Seventy-four known species of ticks have been collected and recorded from three British East African territories. In the report of the Veterinary Department, Uganda, Mettam listed 40 authentic species from Uganda, and the writer has added 4 more. Forty-seven species have been recorded from Tanganyika Territory, whereas 58 species (including sub-species) have been collected in Kenya Colony—excluding *Ornithodoros megnini* and *Margaropus winthemi*, which have been taken off imported cattle at Mombasa, the chief port of entry to Kenya and Uganda. At least a few more species have been collected but not described, and there are many specimens which, on account of morphological variations, cannot definitely be assigned to any particular known species. As Warburton wrote in 1912, 'there are what appear to be a considerable number of species *in the making*'.

The 74 species are apportioned to 12 genera as follows: 10 belong to the genus *Ixodes*, 7 to *Haemaphysalis*, 2 to *Dermacentor*, and 20 to *Rhipicephalus*. *Hyalomma* is represented by 7 species or sub-species according to Schulze's (1930) classification and, in addition, a species in the new genus, *Hyalomma*. *Boophilus* has 1 species, and *Aponomma* 2, one of which is represented by 2 sub-species; *Amblyomma* has 15 species and *Ornithodoros* and *Argas* comprise 4 and 3 species, respectively.

At least 18 of these ticks have been incriminated in the transmission of diseases, but many more are of interest if only from a purely scientific point of view. The abundance of tick material and the scope for ecological studies provide numerous problems that await investigation; and it would be well to bear in mind the remark of G. H. F. Nuttall (1905): 'Experience has shown that new and fruit-bearing knowledge is seldom revealed to those whose sole purpose is merely utilitarian.'

Of the 74 species (shown in the following list), the life-history of 34 appears to be known. The larvae and nymphae of 46 have never been