MANURES AND MANURING OF PEPPER[1]

By

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Considering the great extent to which the pepper soils leech and exceedingly quick rate at which the organic matter disappears from them and also the exhaustive demands of this perennial garden plant on nutrients from the soil, the question of systemetic manuring becomes one of an absolute necessity in the management and care of pepper gardens. So great an importance is given to this item that even in times when the price of pepper had gone down very low manuring had seldom been neglected, however, due to that economic compulsion the quantity of dung per plant in majority of the cases had been reduced or applied once in two years. It is certain that the neglected gardens take at least three years of proper manuring to come back to the original stand. It has also been noticed that plants that are properly nourished could withstand the diseases and pests better.

The manure for pepper as universally used by the gardeners throughout the district is a mixture of buffalo dung and burned earth. Usually the proportion of burned earth is more than that of the dung, however, there is no hard and fast rule as to this. It mainly depends on the amount of dung available, and on the financial capacity of the individual gardener.

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1 — *In continuation of the paper, "Glimpses of the Pepper Cultivation in Thailand"; Bulletin of the Thailand Research Society. Vol. XIV No. 1.*

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Soil dug out from buffalo wallow[3] is at times added to the usual mixture of dung and burned earth, or used as a substitute for the dung.

Aside from this annual manuring the gardens receive a special treatment at an interval of four to five years. That year the usual manuring is not done; but instead the soil from nearby forest land, which has been under a cover of natural vegitation for some years, is brought by cart-loads and spread all throughout the garden, raising the land to about ten centimeters. In case if that is not practicable, the soil from nearby places which have not been cultivated for some years, or preferably soil scraped out from buffalo wallow is spread instead. This practice gives a sort of a change in the general routine and very probably serve to balance the pH of the soil, and supply certain nutrient elements, perhaps not found in the dung in adequate proportion.

Irrespective of the fact that the manure used in pepper cultivation is principally dung and burned earth, there have been instances when other organic manures have been looked for and used as substitutes for buffalo dung, or in combination with the latter.

Different manural ingredients, the way they are obtained mixed, and used.

Buffalo Dung: This is the organic manure universally used

3 — *Buffalo wallowes are found in many places especially on land which is not a private property. These are depressions in which water from the surrounding area collect during the rainy season. The buffaloes that graze nearby wallow in such pits and leave a considerable amount of excreta in them before they come out. To start with these pits are generally small; but by continuous wallowing and removal of the rich soil to a depth of nearly ten inches from the bed for manural purposes each year, these wallows increase in size and depth within a few years, in as much as some look like small ponds during the rainy season. When the water dries out the mud on the bed cracks and big clods of rich crust thus formed are easily dug out when needed.*

in pepper cultivation and there are various sources from which it is obtained. Generally it is collected by the paddy farmers of the surrounding low lands where buffaloes are plentiful. As in other parts of Thailand, here this is principally a draught animal, both male and famale, used in rice cultivation or hauling 'kwien'– a kind of two wheel cart. The paddy farmers there collect the dung in any feasible way they can to be ultimately sold as manure for pepper plants.

The way in which the dung is stored by these paddy farmers is indeed not as it ought to be. It is invariably left exposed to the rain and sun in a heap; but wherever possible these heaps are made under the shade of big trees which afford a certain amount of protection. The manure thus stored cannot always be old and well rotted; but it is a mixture of dung collected from time to time, and it is this stuff that is carted and sold to the pepper gardeners during March and April.

Grazing grounds near about the pepper gardens do provide a certain amount of dung and is collected in much the same way as by the paddy farmers. It is during the rainy season when such grounds get covered with some sort of poor grasses, that the pepper gardeners let loose their buffaloes to graze. The children, who are generally in charge of these cattle, collect the dung and store it in heaps which grow bigger and bigger daily. Many such dung heaps could be seen on the grazing grounds, left exposed to rain and sun. However, the ground is first scrapped and a circular ridge is made which encircle the dung heap; thereby preventing the possible loss by washing during heavy rains.

The buffaloes are kept not merely as draught animals. Many gardeners who have ample ground space maintain a herd just for their dung. A special enclosure without any roofing is made within the garden grounds for the purpose of confining the animals during the nights. As a precautionary measure the enclosure is well bunded to prevent the rain water from running into it. The dung and urine that accumulate daily get mixed with the soil trampled

by the animals, and specially during the rainy days the floor turns into a deep mass of puddled earth. Once a year, that is before the rains, the contents of the enclosure including some soil are dug out and used as manure for pepper; and for other garden and vegitable crops, if there be enough to spare. These enclosures after a period of a few years are rendered useless as the ground level within is lowered considerably. Consequently a new enclosure is made and the old one may be dumped with garden refuse from time to time.

It is thus shown that there are various sources from which the buffalo dung is obtained, the way it is collected and stored before finally applied to the pepper plants as manure. A scientist might look upon these ways of collecting and using the dung as very unscientific. To a certain extent it may be so; but considering this question from an economical and practical point of view they could certainly be but utterly wrong. Mr. Cero's remarks[4] on storing manure by the pepper gardeners are worth considering, especially his suggestion for erecting a roof over the cattle enclosures, provided it would not interfere with the breeze which help in driving the mosquitoes, which might deprive the buffaloes of the rest they badly need, away.

As for the dung collected in heaps on the grazing grounds, nothing could be better than the practice already in vogue. These dung heaps have a conical shape and a little rain water that might ultimately find its way inside them, may do more good than harm, in as much as the biological activity whichis greatly favoured. The sun's heat will of course penetrate and affect but a thin layer on the surface. Hence on the whole the loss due to these natural agencies could not be very great. Once the grazing season is over,[5] that is in

4 — *'Fertilizing Materials & Pepper Fertilization' — Cero M. M. — Siam Science Bulletin No. 1.*

5 — *These grazing grounds are, in almost all the cases, lands which have not been brought under cultivation due to the exceedingly poor fertility. Once the rainy season is over and the dry winds from the North start blowing, the poor kind of grass which grew ordinarily, stops growing further, hence no more grazing is done. See foot-note 3, B.T.R.S. Vol. XIV No. 1, April 1944, — page 5.*

November and December, these dung heaps are carted by the respective farmers to their gardens and kept under the shade of a tree, whereever possible, and invariably covered over with grass, paddy straw or with some such material.

The main bulk of the pepper gardeners, however, depend solely on the manure that they purchase from distant places and cart it to the place where burned earth has been prepared, only a few days before it is actually mixed with the above earth. It would thus be seen that building a permanent manure shed as suggested by Mr. Cero would not be quite practicable not to talk of the difficulties experienced in having to unload the manure at the shed and then carry the same to the place where burned earth has been prepared for final mixing. Be that as it may, the analysis of the samples of dung collected just at the time of their being mixed with the burned earth have shown that it is rich in nitrogen which ranges from 0.9 to 1.1 percent.

Treatment of dung before applicatien :– Within a few days after the dung has been brought to the garden it is heaped with burned earth in distinct layers. A layer of burned earth is placed first, then that of the dung and so on. The topmost layer is always that of the burned earth. Mixing with a chakhrao – a kind of a digging hoe having a very sharp blade – starts after some days, care being taken to break the big pieces of dung thoroughly; and just for this reason a gardener will always wait till the heap is first wetted twice or thrice by the rain. This mixing is complete in three or four hoeings and the manure is ready for application. The above mixture of manure is regarded as ideal if the quantity of dung and burned earth are in equal proportion. In actual practice the proportion of dung used is generally less as compared to that of the burned earth.

Cow Dung : Cow dung is used but by a very few gardeners, who rear them mainly for their dung. It is used in much the same way as the buffalo dung, no special preference being given to either of them.

Leaf Mould : The use of leaf mould as manure for pepper is unknown to the gardeners of Chantaburi and there have been no instances when this has been used as manure for pepper in the same way as is done in India. However, during the usual operation of weeding, weeds of all sort including the fallen pepper leaves are scraped and burried in the soil irregularly between the pepper rows. As told by a very reliable source, cecemum used to be grown as a green manure crop between the pepper rows by gardeners here and there, only when the plants were young. Leaf mould specially prepared and applied to the pepper plants in combination with the burned earth at the Experimental Station proved very encouraging, the plants making a wonderful growth. Leaves collected under the trees of various sorts and left to disintegrate in a pit for about six months had been used in this particular case. Each plant received two basket-full of such leaves with an equivalent quantity of burned earth.

Bat Guano : At a time when the price of pepper was rather high bat guano had been tried on several occasions by a well-to-do gardener. The same had been carted from the caves in a limestone hill known as Khao Wong. Due to the long distance of this hill from the pepper growing district of Tha-mai, the cost of carting the guano from these caves was very high, hence its use had not become wide spread. This particular gardener used the guano at the rate of approximately half a kilogram per plant, with the usual mixture of dung and burned earth, as an extra stimulant. He claimed that the yield of plants thus treated was high compared to the untreated ones.

Pig Manure : This has been used by certain few Chinese gardeners who raise pigs for the market. This is used in combination with the burned earth in the same way as the buffalo dung. Reports received from reliable sources reveal that this manure is very effective. Within a few days from the time of application one could observe the sudden change in the general vigour of the plants. However the effect is not lasting as is the case with the buffalo dung;

and since it is not available in sufficient quantities everywhere, its use is made by those few gardeners who rear the pigs.

Horse Manure: It had seldom been used ordinarily; but when the same was available almost free of charge, as a result of the military establishment at Chantaburi that some gardeners used it in place of the buffalo dung. The horse manure had also been tried at the Experimental Station in combination with the burned earth, and from the results it could be said that this manure could be a very good substitute for buffalo dung.

It should be noted that no matter whatever be the organic manure used it is always first mixed and well seasoned with the burned earth, and the mixture then applied at the rate of two basketful per plant. This quantity may be increased or even doubled with advantage. Due to the considerable quantity of earth used at each manuring operation, year after year, the level of the ground rises gradually and after about twenty years one would have to step up on to the pepper plot as by that time the ground is raised to about one meter.

Commercial Fertilizers: As to the commercial fertilizers there have been no instances of their being used by the gardeners for pepper. Certain manural experiments conducted at the Experimental Station with leguminous crops, have distinctly shown that with the exception of super phosphate most of the commercial fertilizers, including the well known N.P.K. mixtures, have proved harmful in the red soils; but each of these responded and crop growth wonderfully encouraged when used in combination with lime. With pepper plants these fertilizers, with or without lime, were no better than the ordinary organic mixture used by the local gardeners; and in the case of one treatment where only the commercial fertilizers, with neither the burned earth nor the dung were used the plants made a very poor growth and many of them died by the end of the first year of the experiment.

However, the author is of the opinion that the commercial fertilizers, if judiciously used in combination with the regular organic manures, ought to invigorate the plants and increase the yield in general, and recommends the following manure mixtures.

Manure Mixtures Recommended for Pepper

Mix. No.	Leaf Mould K. gram	Dung K. gram	Burned Earth K. gram	Bone Meal K. gram	Super-phosphate Gram	Ammo. Sulphate Gram	Wood Ash Gram
1	–	10 to 15	20 to 30	1 to 2	–	5 to 10	–
2	–	15 ,, 20	10 ,, 15	–	20 to 50	5	5 to 10
3	–	10 ,, 15	–	1 to 2	10 ,, 30	10 ,, 15	10,,15
4	20 to 30	–	20 to 30	1 ,, 2	–	5	–

The amouts of manures and fertilizers are per plant per year.

Ammonium sulphate should be mixed just before application, especially in case of mixtures containing burned earth or ash, as a precaution against the loss of nitrogen from this fertilizer.

Mixture No. 3 would be found very useful where the preparation of burned earth is either difficult or not practicable for any reason especially that of the unavialability of material for burning. Mixtures which do not contain burned earth, should be mixed in the usual way with the ordinary earth if the manure has to be applied as described below.

Besides the above mentioned manural ingredients human excreta in liquid form has been used by certain few gardeners, from time to time as top dressing, to invigorate and force the plants. If proper composting methods are followed as is recommended by Albert Howard, human excreta ought to make a very rich manure in combination with all sort of garden refuse.

Method of applying the manure to the pepper vines

With the exception of liquid manures used as top dressing on

rare occasions, all manures after having been mixed with the burned earth are burried under the soil at the foot of each plant.

Pits are dug on two sides of the plant, —not all round it—and then filled with the manure mixture at the rate of two baskets (about 40 kilograms) per plant. The remainder of the pit is completely filled with the soil previously dug out. The following year similar pits are dug, this time on the other two sides of the plant and the rich manure earth then dumped into them. Where the planting has been done rather close, the space left between the two adjoining pits is hardly enough for two separate pits; consequently one long pit is dug between the two plants. See Figs. Nos. I to V.

The main advantage of burrying the manure deep as described above is that the loss due to surface run off during heavy rains is entirely prevented. Moreover a certain amount of root prunning is affected and when the manure mixed earth is dumped in, the cut or the injured portion of the roots sprout vigorously being in direct contact with the manure.

It would naturally be surprising to some as to the reason for manuring only the two sides of the plant and not all simultaneously. The fact that the holes are dug to a depth of not less than 35 cm., considerable amount of roots are injured, torn or cut. Thus the injury done to the root system would be enormous and a general set back in growth would be inevitable, if a trench, that deep, were to be dug all around the foot of the plant. Whereas when the manuring is done the way described above, the major portion of the roots remain intact. Besides the manure, which contains a fair amount of organic matter, ought to maintain its fertility for more than a year and so there is more reason for keeping the sides manured during the previous year intact.

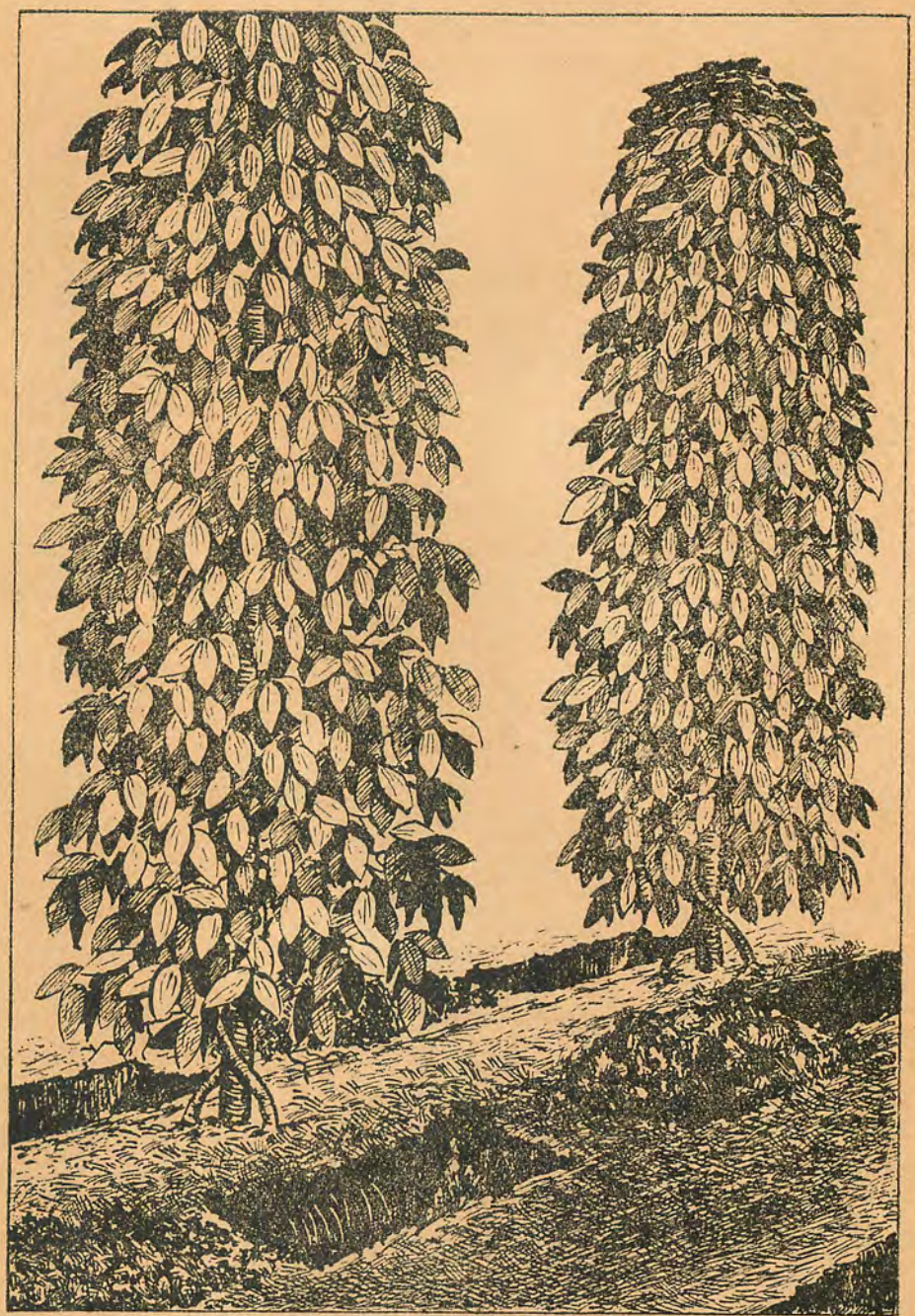

Fig. 1.

Fig. 1. The way the pits are dug by the side of the pepper plants. It is in these pits that the mixture of dung and burned earth is dumped and then covered with the soil dug out seen by the side of the pits. Note the exposed roots.

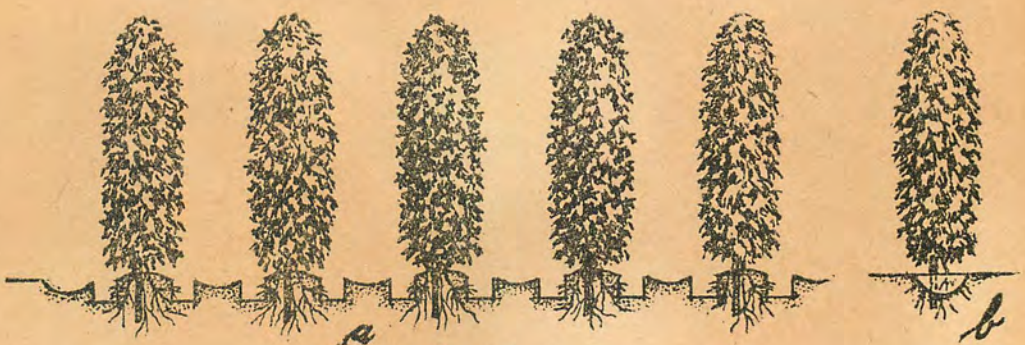

Fig. 2.

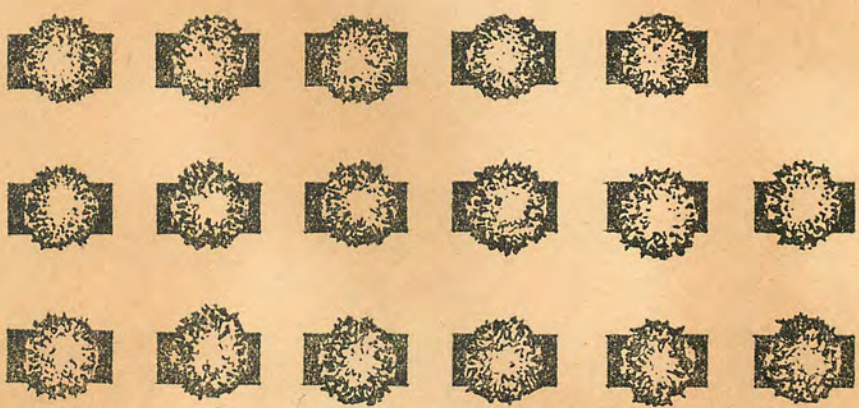

Fig. 3.

Fig. 4.

Fig. 2. (a) Sectional view of a row of pepper plants giving an idea as to how deep the pits are dug.
(b) The pit when viewed from the other side.

Fig. 3. Pepper rows as seen from above. The black rectangular patch on each side of the plant indicates the pit.

Fig. 4. The pepper plants in this row having been planted rather close one long pit is dug between the plants.

Fig. 5 Pits dug by the side of a young pepper-plant for manuring.

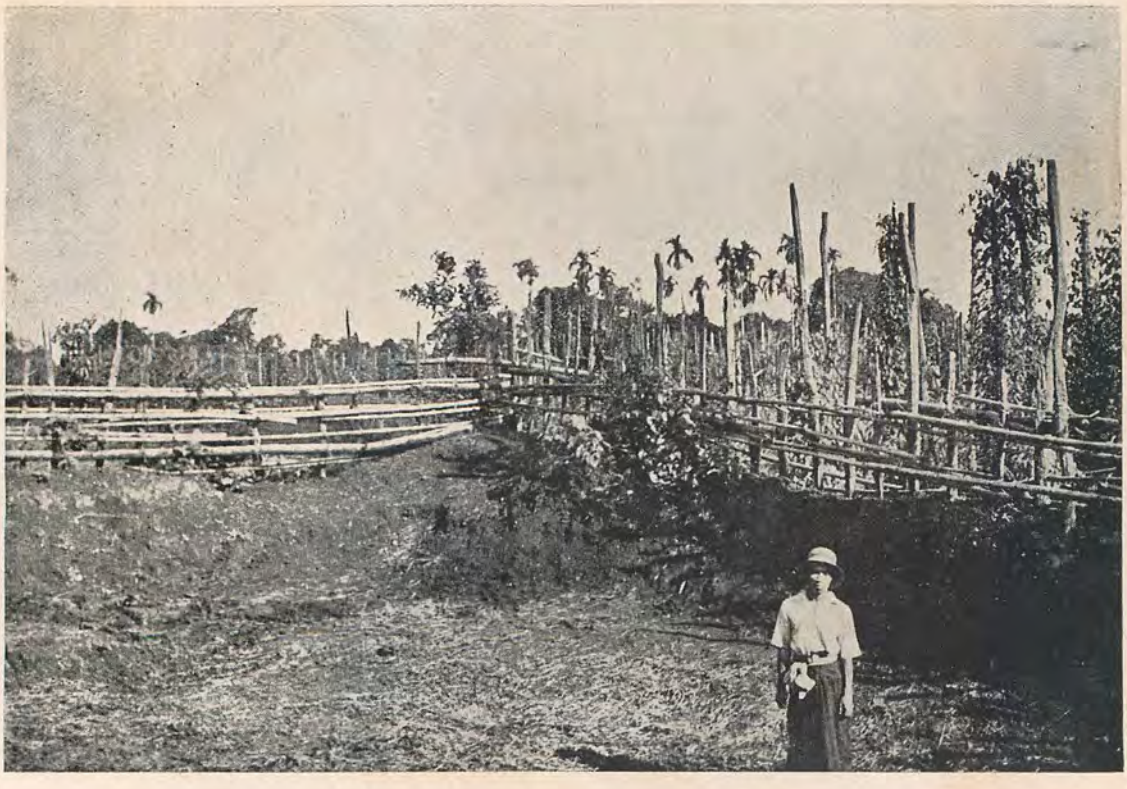

Fig. 6 Enclosure for buffaloes. Note the depth of the beddue to continuous removal of dung and earth