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Coconut Manuring—

TIME AND METHOD of APPLICATION of MANURES

By

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SUFFICIENT evidence has now been accumulated to prove that coconut palms do respond to manuring, particularly under the conditions obtaining on the West Coast of India wherein lies the major coconut belt of the country. To get the best results out of manuring, however, a number of factors require to be given due consideration. The right kinds and optimum dosages of fertilisers have to be first decided, taking into account the soil type, its inherent fertility, climate, age of the crop, etc. The next step should be to put the manures into the soil where they will do the maximum good, because it is not enough to apply the right kind and amount of manures; they must also be applied at the right time and in the right way.

Detailed information regarding the manures to be used and their dosages for the coconut palm may be found elsewhere in this issue. In this article it is proposed to deal only with matters relating to time and method of application of manures. It may be mentioned in this connection that these aspects in so far as they relate to coconut,

have not been investigated in any great detail in India or elsewhere and any comments offered are based on *apriori* grounds, general principles of fertiliser application and the nature and peculiarities of the coconut palm.

General Considerations

The best method and time of application of fertilisers depend upon the kind and amount of fertilisers used, age of the crop, soil, climate and various other factors. These have to be so adjusted as not only to ensure that the nutrients required by the crop are present in the soil in available form in sufficient quantities and in the proper balance throughout the growth period, but also to satisfy the extra demand of the crop for any particular nutrient that may arise at some stages during the growth of the crop. How actually are the time and method of application of fertilisers influenced by different factors is briefly discussed below.

1. Kinds of fertiliser.

Individual nutrient elements behave differently in the soil and a good knowledge of their peculiarities as related to soil types and crops is necessary for the efficient use of fertiliser materials.

(i) *Nitrogen.* Soil is only a "frugal custodian" of nitrogen and, therefore, the main problem with this element is to ensure that it is available as and when the crop requires it. Nitrogen is largely available in ammoniacal and nitrate forms. Nitrate nitrogen is easily soluble in water and becomes available to the plants immediately after application. It is not fixed by the soil and is, therefore, liable to be leached out by rain or irrigation water.

Nitrogen in the ammoniacal form on, the other hand, is lightly absorbed by the soil and is, therefore, less likely to be lost by leaching. It comes into use only gradually after being converted into nitrate form by soil micro organisms, which does not take place rapidly in cool weather or when properly placed.

Urea which has of late come into prominence as a concentrated source of nitrogen will take some days after application to the soil to become available to plants. During this period it is likely to be lost through leaching if the soil is wet. It is, therefore, not advisable to use it when the soil is likely to remain wet for a couple of days after application.

Though broadcast application is satisfactory with nitrogenous fertilisers, ploughing under may be more helpful in regions of low rainfall.

(ii) *Phosphoric acid.* This is available in water-soluble form such as in superphosphate or in slowly available form as in bonemeal or rock phosphate. When water-soluble phosphate is applied to the soil it gets fixed up in the form of new phosphatic compounds from which the plants cannot readily extract and use it. The fixation is specially great in soils having an abundance of active iron and aluminum compounds. Fixation also depends upon the thoroughness of mixing of the fertilisers with the soil; the more thorough it is mixed, the more thorough is the fixation and the less available it is to crops. This generally happens when the fertiliser is applied broadcast and ploughed in. The phosphate gets fixed up on the surface itself and move downward into the soil only very slowly with the result that relatively few plant roots are able to utilise it. If, on the other hand, the same quantity of phosphatic fertiliser is placed in basins or narrow bands, fixation takes place only in that portion which is in contact with the soil; the rest remains in an available form

for the crop. It is thus seen that relative value of localised application is intimately connected with the fixing power of the soil.

In contrast to the above, broadcast application has been shown to advantage in the case of phosphatic fertilisers such as bone meal and ground rock phosphate where thorough mixing with the soil is necessary to promote more rapid solution and greater availability.

Another method of utilising phosphatic fertilisers which has of late assumed importance is to apply the fertiliser to the green manure crop to be turned under in preference to the crop direct. This has been reported to increase the availability of phosphate as well as to promote more efficient fixation of atmospheric nitrogen, thus adding to the fertility of the soil.

(iii) *Potash.* Potassic fertilisers also undergo some sort of fixation process in the soil though not to the same extent as in the case of phosphorus. Fixation is more in soils with high clay content. It is also accelerated by wetting and drying. Because of this, localised placement of potassic fertilisers is usually preferable to application by boardcasting.

Potassic fertilisers show more mobility in the soil than phosphates. Therefore, in sandy soils and regions of heavy rainfall some potassium may be lost by leaching. This effect can be reduced by applying the manure in two or three split doses instead of in one dose.

(iv) *Organic manures.* The usefulness of applying bulky organic manures both for the improvement of soil structure and as a reserve source of plant nutrients is now well recognised. This is of particular importance to coconut soils which are very deficient in organic matter. In order that the plant foods contained in the organic manures become available, they have to first undergo decomposition by microbial activity which can proceed satisfactorily only under conditions of good aeration, optimum moisture content, etc. It is, therefore, essential to see that manures of this sort are incorporated into the soil only when and where satisfactory conditions for their full decomposition can reasonably be expected. The time required for decomposition may vary from 3 weeks to a month.

Bulky organic manures in undecomposed condition may prove injurious, particularly in sandy soils by increasing further the drainage and aeration of such soils. The possible adverse effect of the manures in immobilising under unsatisfactory conditions the nitrogen of the soils and causing temporary nitrogen starvation has also to be kept in mind. In light soils the bulky organic manures should be buried deeper than in heavy ones.

2. Soil types.

The coconut palm is being raised on a variety of soil types such as littoral sand, red and sandy loams, laterite and gravelly laterites, alluvium of the river estuaries, reclaimed soils of the back water areas of Travancore-Cochin etc. These soils differ widely in texture, structure, chemical composition, soil reaction, etc. and these also have to be taken into consideration in deciding upon the best time and method of application of manures. For example, in sandy soils which are open and porous application of manures in split doses may be preferred. Again, in the laterite and loamy soils of the West Coast which are very acidic in reaction, localised application of water-soluble phosphate and potassic fertilisers may be better than broadcast application.

3. Climatic effects.

The coconut palm is found grown under widely varying climatic conditions, parti-

cularly in respect of rainfall. On the West Coast it grows under conditions of very heavy rainfall (annual precipitation varying from 100 to 140 inches) whereas in States such as Mysore, Bombay and Bengal it is perfectly at home even though the annual rainfall is considerably less than that on the West Coast. Practically the entire coconut acreage is under rainfed conditions and because of this factor, time and method of application of fertilisers assume added importance.

Since rainfall conditions are liable to show considerable variations from year to year, a specific period for manuring applicable to all areas or for all years cannot be stated except to emphasize in a general way the fact that manuring should be done only when there is sufficient moisture in the soil. Experience has shown that climatic environment is having a greater influence than soil treatment on the performance of the coconut palm.

4. Peculiarities of the coconut crop.

The Coconut palm is a perennial crop living to an age of 80 to 100 years or more depending upon environmental conditions. It comes to bearing in 6 to 7 years after planting and from then onwards it continues to yield regularly almost every month right through the year and all through its life. There is thus a continuous demand for plant food throughout and it should be the endeavour to adopt proper time and method of application which will ensure that the soil is kept always at a high level of fertility. In the early stages of growth of the palm the root zone will not have expanded much and hence application of manures has to be done only in a limited area round the seedlings or young palms.

5. Rates of application

When heavy applications of manure are made, injurious effects are likely, particularly in sandy soils, when nitrogenous and potassic fertilisers are applied in narrow basins or bands. These fertilisers increase the salt content of the soil solution much more than phosphatic fertilisers. Placement of fertiliser will show better effect at light than at heavy dressings.

6. Mathod of application

Different methods of application of manures such as broadcasting, basin or trench-application are possible with the coconut and are also being practised by growers. In broadcasting, the fertiliser is spread over the entire soil surface and incorporated into the soil. This can be adopted where the coconut palms are planted close and are not growing along with other kinds of trees; also when heavy dressings of fertiliser are contemplated and when the soil has not got much of fixing power for phosphorus and potash. This method enables a larger area to be covered quickly and at less cost, factors which are important when large areas are involved and climatic conditions do not remain favourable for long. The disadvantageous features are,

(i) weeds are also stimulated and it would be difficult to control them satisfactorily;

(ii) fixation of plant food is more; and

(iii) less concentration per unit area affecting intake.

When only small quantities of fertilisers are involved, mixing the manures with sand or earth will help in uniform distribution while broadcasting.

For localised applications, which appear more suited to the coconut, linear trenches, circular basins or trenches can be used. Linear trenches in-between rows of trees may be adopted for burying bulky organic manures; but otherwise, it has nothing much to commend itself. Circular basin or trench-application is to be preferred for the following reasons:

(i) the highest concentration of roots being close to the palms, results in maximum utilisiation of nutrients;

(ii) there is less fixation of phosphorus and potash as the fertiliser comes in contact only with the minimum amount of soil particles;

(iii) by the deeper placement, the fertiliser is in moist soil and it remains more available to the crop during rainless periods.

Another method which appears to be of some importance is the plough sole placement of fertilisers. In this method the fertiliser is placed in a continuous band at the bottom of the furrow in the process of ploughing. Each band gets covered as the next furrow is formed. In coconut gardens this method can be used for the application of phosphatic fertilisers as a basal dressing for the green manure crop.

7. Application of straight vs mixed fertilisers

Since the coconut soils in general are deficient in all major plant nutrients, application of suitably compounded manure mixutres will be more useful and cheaper. If, however, deficiency is limited to only one nutrient application of straight fertilisers containing that nutrient will alone be necessary.

Recommendations

Based on the general considerations discussed in the previous paragraphs, the following guiding principles for application of fertilisers to coconut are drawn up. Obviously, it will be difficult to make specific recommendations for the crop growing under a multiplicity of soil, climatic and management conditions, particularly because no reliable experimental data are available.

1. Where the crop is raised purely under rainfall conditions manuring should be done only when there is sufficient moisture in the soil. It should not be done when there is heavy rain or under dry soil conditions.

2. In regions such as the West Coast which is having the benefit of both the south-west and north-east monsoons, manuring is best done in August-September, when there is usually a lull period between the two monsoons. When the rainfall is limited to one monsoon season only, it is better to manure at an opportune time halfway through. If the application is delayed to the fag end, there is the risk of not getting any rains subsequent to fertiliser application.

3. In backwater areas of Kerala State where the water table remains high throughout the year, manuring may be done towards the end of the north-east monsoon rains.

4. Green manure crops raised *in situ* in the coconut gardens on the West Coast may be turned under during August-September. Green leaves, compost or cattle manure may be applied in June-July or August-September.

5. In closely planted and pure coconut gardens, manures may be applied broadcast and ploughed in. In all other cases, they may be applied in circular basins or trenches and covered up.

6. In sandy soils, fertilisers, particularly nitrogenous and potassic ones may be applied in split doses instead of in one dose.

7. Mixtures of guaranteed analyses marketed by reputed fertiliser firms may be utilised where growers find difficulty in procuring component fertilisers and compounding mixtures for their own requirements.