

DEPARTMENTAL NOTES

SOME NOTES ON SPRAYING AGAINST PLANT PESTS AND DISEASES

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GENERAL

SPRAYING is one of the most important measures in controlling pests and diseases, especially in the orchard. In all progressive fruit-growing countries spraying is undertaken as a routine measure and is regarded as a valuable form of insurance. Spraying in Ceylon is in its infancy but there are indications that in the near future the more progressive growers will adopt this useful practice.

Spraying as a feature of disease control is well recognised. When satisfactory results are not obtained, the fault usually lies in the inefficient application of the spray. Accuracy as to time and method are essential for success, and of course the correct materials must be employed to deal with the particular pest or disease to be overcome.

Spraying is by no means easy or pleasant work. It must be done intelligently or the time and labour involved will be wasted. It is hoped that the hints given in these notes will indicate how some of the unpleasant features of the operation may be eliminated. In an undertaking that is neither easy nor pleasant, the adoption of expeditious and systematic methods enables the work to be accomplished in the minimum time and with the expense of the least possible energy.

Successful spraying involves first of all a knowledge of the pests and diseases to be overcome. The most effective remedies against these enemies and the proper time and method of using such remedies must be known. Those who do not know must take advice from those who do. A thorough attention to the smallest details is essential. When failure results it may often be attributed to the disregard of one or more of these important factors. Dry spraying or dusting will not be considered in these notes.

PRINCIPLES OF CONTROL BY SPRAYING

Plants are liable to attack by *insect pests* and *fungus diseases*, which for the purpose of these notes include diseases caused by bacteria, besides by other troubles which are outside the scope of the present subject.

From the present standpoint, *insects* may be considered in two principal classes.

1. Chewing insects or those that eat their food—*e.g.*, caterpillars, beetles, etc.

2. Sucking insects or those that derive their nourishment by sucking plant juices—*e.g.*, aphids, scale insects, etc.

Chewing insects can usually be controlled by the use of a 'stomach poison' such as lead arsenate which is sprayed on to the plants on which they feed. Sucking insects must be controlled by a 'contact insecticide' such as an oil emulsion or nicotine extract. Such insecticides must be brought into direct contact with the insect which is then killed, usually by suffocation.

Fungus diseases are caused by very low forms of plants which contain no green matter. *Parasitic fungi* can also be considered as falling into two large groups.

1. Fungi that exist on the surface of the plant.
2. Fungi that remain within the plant tissues and periodically produce spores or 'seeds' which appear on the surface of the host.

Fungi of the first group, of which *Oidium* is an example, are killed by the direct action of fungicides. Plants attacked by *Oidium* can therefore be actually cured by spraying. Fungi of the second group are much more difficult to deal with. A fungicidal spray can destroy only the spores which are produced on the surface but does not affect those parts of the fungus within the plant tissues. Spraying against such fungi must therefore be *protective* rather than *curative*. Spraying cannot bring back to life plant tissue which has already been killed by a parasite. If this fact is realised at the outset the objects and effects of spraying will be better understood and undue disappointment prevented.

The chief objects in spraying are to destroy fungi and insects present on the plant surface and to prevent healthy plants from being infected. These objects are attained in the first instance by the spray fluid coming into direct contact with the enemies; in the second instance by the spray forming a poisonous protective covering on the surface of the plants and either by killing fungus spores which come in contact with it or by poisoning insects which feed on the sprayed plants.

SPRAYING MACHINES

1. GENERAL

Years of experience have improved and evolved spraying machines which to-day are highly efficient and simple to operate.

To obtain the best results spraying machinery should be in perfect working order, otherwise disappointment and waste of time and labour will result. A spraying machine, like any other machine, will function efficiently and last in proportion to the care given to it. If it does not function properly the cause should be ascertained and the defect immediately remedied. With proper attention, a sprayer should last for several years.

Before choosing a spraying machine a number of factors has to be taken into consideration. Acreage to be sprayed, age and size of plants, frequency of applications, character of the land which has to be worked, labour and water supply are a few such considerations.

The types of spraying machines available vary from the small hand-atomizer of about 1 pint capacity to large motor operated power-sprayers which eject 10-20 gallons of spray per minute. The type of machine chosen should be suitable for each individual requirement.

Purchasing 'cheap' spraying equipment and materials is false economy; they will cost considerably more in the end. In purchasing any sprayer it is necessary to obtain also at least essential spare parts. If the sprayer is purchased through local agents they must be in a position to supply immediately any spare part.

2. TYPES OF SPRAYING MACHINES

These will be considered under two classes: machines that are suitable for the small or amateur grower, and those that are suitable for the professional orchardist. The small hand-atomizers, bucket-pumps and knapsack-sprayers fall within the first category. Barrel sprayers mounted on wheels, single or double-action hand and motor power sprayers are most suitable for the commercial orchardist.

(i) *Hand-Atomizer*.—The 'Flit' type of sprayer is a good example of the hand-atomizer. It is the smallest of the hand-sprayers and being light and convenient to handle is very useful in the small kitchen and flower garden; it is also suitable for *small* individual fruit trees.

Two types of these machines are available—continuous and direct action. The former is preferable as the nozzle and its feeder are detachable and facilitate cleaning. These parts are fixed in the direct action type. The continuous action type of hand sprayer costs about Rs. 2.25.

(ii) *Bucket-pump*.—This type of sprayer is composed of a bucket or some other container for the spray solution and a pump to which is attached a rubber hose terminating in a metal extension rod on to which is screwed a nozzle. Many bucket-pumps are supplied with an inadequate length of hose and it may be necessary to purchase an extra length of hose to allow of easy working.

Bucket-pump sprayers cost from Rs. 15/- to Rs. 150/- nett and are suitable for small gardens containing fair-sized herbaceous areas and for small groups of young orchard trees.

(iii) *Knapsack-sprayers*.—These machines are strapped on the back for operation. Two types of these sprayers are made. In the ordinary type the operation of pumping and spraying has to be done simultaneously so that both hands of the operator are engaged. This is very laborious work and is a great disadvantage.

A great improvement on the above type is the pneumatic knapsack-sprayer. The tank is filled with the spray solution and air pumped in and retained under pressure before spraying, thus saving much labour.

These sprayers are especially useful for working in the small orchard. For tall trees which cannot be reached with the standard equipment, bamboo-lance extensions are available.

Knapsack-sprayers cost from about Rs. 40/- for the ordinary type to about Rs. 120/- for the improved pneumatic models.

(iv) *Barrel-sprayers* mounted on wheels, operate on the same principle as the bucket-pump but have a greater capacity and are more powerful. They are useful on flat land and have a somewhat greater capacity for work than the pneumatic sprayers but involve greater labour to operate.

(v) *Power-sprayers* are either manually operated or motor operated. They consist essentially of a powerful single or double-cylinder pump mounted on a wooden base. Two or more leads of hose one of which is connected to the supply of spray solution, are attached to the pump. These machines cost from about Rs. 300/- and upwards and are very suitable for the commercial orchard.

The motor power-sprayer is much more powerful than the hand operated machine but is complicated, much heavier and costs considerably more. It is, however, eminently suited for the work it is intended to perform—*i.e.*, spraying very large and highly developed orchards. The hand power sprayer can work a fair acreage and for Ceylon conditions may take the place of the motor-sprayer when the latter cannot be afforded.

4. CARE OF SPRAYING MACHINES

Spraying machinery should be kept in perfect working order. One of the chief causes of breakdown is due to the machine not being thoroughly washed out with clean water immediately after use. *This point cannot be too strongly emphasised.* Sprayers should be washed out at least twice with clean water by operating them in the usual manner; sprayer tanks should be first filled with water and thoroughly shaken before doing so. After this all taps and joints should be lubricated with a drop of oil and all other metal parts wiped over with an oily rag. Makers' instructions with regard to the maintenance of machines should always be carried out.

Before starting out for the day's work, the machines should be tested to ensure that they are in perfect working order.

WASHERS

Faulty washers and loose joints are the most common cause of trouble in sprayers. These defects are easily remedied by replacing old washers as a routine measure with well greased new ones and by tightening up loose joints, if necessary, with a spanner.

Leather washers should always be used in preference to rubber washers which are unsatisfactory for Ceylon conditions. Spare washers should be well greased and always kept in stock.

NOZZLES

Most sprayers are supplied with at least two types of nozzles, each intended for a special purpose. The correct nozzle for spraying plants ejects the liquid in the form of a fine mist.

Blocking of nozzles is a common trouble and is often the result of inadequate straining of spray solutions and use of dirty vessels. Internal corrosion of metal parts due to inadequate washing also causes nozzle blockage.

Hoses are made of a rubber composition and are sometimes reinforced externally with a spiral of wire. Kinking the hose should be avoided as this would ultimately damage it and cause leakages. Spare hoses are a necessity.

Extension spray rods are usually made of brass and need little attention beyond thorough washing out after use and an occasional external cleaning. They should be light and not too long otherwise they become unwieldy. The stop-cock on the handle should be kept oiled for easy manipulation. Angle-bend extensions are a great advantage in spraying.

SPRAY MIXTURES

1. PREPARATION

Many ready-made fungicides and insecticides are available on the market. The use of reliable preparations will save much time and expense involved in the preparation of home-made materials which cannot always be relied on. It will always pay to get the best materials possible, though the claims made by the proprietors for each preparation cannot always be substantiated.

In preparing sprays the required quantities of materials should be measured *accurately*. To do this it is essential to have vessels holding known quantities. An apothecaries' measure (preferably enamelled) marked at least in ounces and a large vessel holding a definite quantity such as $\frac{1}{2}$ or 1 gallon are sufficient. A balance for weighing is also useful. Spoons, bottles, etc. vary considerably in capacity and it is not advisable to depend on them for measuring quantities.

Vessels containing the stock or concentrated spray materials should always be thoroughly shaken before diluting with water for spraying; it is not advisable to allow such diluted mixtures to stand for any length of time.

To save time and labour it is often convenient to combine two or more fungicides and insecticides and thus obtain a dual purpose spray mixture. Care should always be taken to see that combinations are compatible and that the correct proportions of each are maintained. It is safest to follow carefully the directions supplied with each spray material.

Lastly, it is essential *always* to strain spray mixtures before use. This will prevent nozzle blockage.

2. APPLICATION OF SPRAY

Spray solutions should be applied with the correct type of nozzle as indicated earlier. Spraying should as far as possible be done in the early morning or late afternoon as the spray is liable to scorch foliage in strong sunshine. Foliage must be sprayed on *both* surfaces to ensure success. An angle-bend spray rod is essential for this. The spray material should cover adequately every part of the plant, just sufficient being applied for the purpose without waste. There should be a minimum drip off the leaves after spraying.

With most plants, partly owing to the presence of hairs and oil on their surface, the spray fluid instead of spreading evenly forms into drops and often falls off. This difficulty is overcome by adding some substance to the spray mixture to make it spread evenly and adhere to the plant. Casein compounds, resin, flour paste, and soap, are some of the agents used for this purpose.

In actual practice a perfect film of spray material over the entire surface of the plant is probably never obtained, but this is the ideal to be aimed at.

Plants in full bloom must not be sprayed—in such cases adjust the spraying programme so that the plants receive an application immediately before the flowers open and soon after the fruits begin to form. Spraying should not be done when the foliage is drenched after rain or heavy dew—the leaves should be allowed to dry before spraying is commenced.

Spraying should be repeated to replace the material as it gets washed off by rain or loses its efficacy and to cover each burst of young foliage. Time and frequency of spraying depend on the individual pest or disease. Generally speaking it is advisable to spray at short intervals (once in 7-10 days) during periods of rapid growth.

It is not sufficient to spray only diseased plants. *All* plants must be sprayed otherwise unsprayed ones may prove fertile lodgings for infection.

System and method in spraying are very necessary. Working up rows of plants and always starting with each tree at approximately the same position will save overlapping of applications which in total may involve much waste of time, labour and material.

CONCLUSION

It is not justifiable to abandon spraying because immediate benefits are not forthcoming. Repeated applications may be necessary to obtain the desired results. It is suggested that, in order to avoid disappointment, expert advice be sought before spraying is undertaken.