

CLASS 3

CULTIVATION SUBSTRATES OR MEDIUMS

In the previous class it was explained that there are many appropriate containers of different sizes, materials and prices to make a popular hydroponic garden. In this class we will study the types of cultivation substrates or mediums that must be used, their main characteristics and ways to use them. In every country there are materials available, discarded by some industries or provided abundantly and economically by nature.

Characteristics of a good substrate

Substrates should be very resistant to degrading or to weathering meteorized and it is preferred that they contain no soluble mineral substances so as not to alter the chemical balance of the nutritive solution to be applied (as will be explained later). The material should not be a carrier of any form of live macro or micro organisms, to decrease the risk of spreading diseases or causing harm to the plants, to animals or to the people who will consume them.

The most recommendable characteristics of a good substrate are:

- that the particles of which it is composed are of a size not less than 0.5 and not more than 7 mm
- that it retains a good quantity of humidity (see retaining capacity of different materials in the soil in Annex II), but they should also facilitate runoff of excess water from watering or rain
- it should not retain a great deal of humidity in the surface
- it should not decompose or degrade easily
- its colours should preferably be dark
- it should not contain nutritive elements
- it should not contain micro organisms harmful to human or plant health

- it should be abundant and easy to obtain, transport and manage
- its cost should be low
- it should be light (see the density of the different substrates in Annex III).

Materials already tested in several developing countries and which meet most of these requirements are classified as follows:

Substrates of organic origin

- rice hull
- sawdust or shredded shavings of yellow woods.

When wood residues are used, it is preferable that these are not of pine or of red woods, because these contain substances which may affect the roots of the plants. If it is only possible to obtain material of this type of wood, the sawdust or shavings must be washed with abundant water and left to ferment for some time before using it. The total mixture should not contain more than 20% of this material. If rice hull is used it is necessary to wash it, leave it to ferment well, and wet it before planting or transplanting during ten to twenty days, depending on the climate of the area (less days in hotter climates) (see video). The characteristics, physical and chemical properties and advantages of rice hull are described in Annex IV.

Substrates of inorganic origin

- Burnt mineral coal scoria
- Volcanic scoria or tufa
- Sand from clean rivers or streams which do not have a high saline content
- Fine gravel
- Coarse sand

When coal scoria, volcanic tufa or river sand are used, these materials must be washed four or five times in large containers, to

eliminate all small floating particles. The substrate is ready to be used when the water from washing comes out clear. If the quantities of substrate needed are very large, sieves or screens may be used during washing to retain particles larger than half a millimeter. Particles over seven millimeters should also be excluded.

Excess particles of sizes below the minimum indicated make drainage of water surpluses difficult, and consequently, limit root ailing. Larger sizes keep smaller seed from germinating, such as celery and lettuce seeds, and also decrease the consistency of the substrate. The forementioned limits retention of humidity and the correct formation of bulbs, roots and tubers.

Some coal or volcanic scoria have very high acid levels and some sands (as the sand from the sea) have very low levels (they are alkaline). These materials must be washed very carefully, until no acid or basic remain.

If it is not possible to condition these materials to acidity levels slightly acid or close to neutrality through washing (pH 6.5-7.0) it is preferable to exclude them and use other materials. This is preferable to hindering the effectiveness of the different solutions to be applied and, therefore, the development of the crops in a PHG.

Mixtures

All the materials mentioned may be used alone. Nevertheless, some mixtures have been tested successfully, in different proportions, for the cultivation of over thirty plant species.

The recommended mixtures according to trials carried out in several developing countries are the following:

- 50% rice hull with 50% coal scoria
- 80% rice hull with 20% sawdust
- 60% rice hull with 40% river sand
- 60% rice hull with 40% volcanic scoria

In the PHG system with solid substrate, the plant's root grows and absorbs water and nutrients which are applied daily to the solid material mixture.

In the liquid substrate or floating root method, water is used for the same purpose, permitting root development, and the absorption of additional water and nutritive substances. This system is only recommended for the cultivation of different varieties of lettuce, celery and sweet basil. Other crops have been tried but results have not been satisfactory everywhere, due to which we prefer not to generalize the recommendation.

Cultivation systems in solid or liquid mediums will be explained in detail in Class N° 5.



PHOTOGRAPH 21

Substrates must be well mixed, in the proper proportions according to available components.

