

slag is an excellent phosphatic fertiliser for the vineyard and may be used in place of superphosphate or bone-dust. It is preferable to use the three fertilisers in rotation.

As a general practice the application of phosphatic fertiliser with the cover crop and of potash and lime when the crop has been turned in in the early spring is recommended.

Functions of Plant Foods

Nitrogen is the nutrient which all plants need to grow leaf and wood. An ample supply of nitrogen promotes rapid growth of vine, characterised by an extensive area of dark green leaves and thick canes. Where a deficiency of nitrogen exists, growth is slow and weak and the leaves have a sickly, yellowish-green appearance. Excessive nitrogen has the bad effect of diverting most of the energy of the vine to producing wood and foliage and as a result the fruiting is impaired.

Phosphoric acid stimulates root development and for this reason a liberal dressing of phosphatic manure is particularly desirable for young vines. It encourages fertility and the setting of fruit and promotes early ripening. Liberal dressings of phosphate appreciably enhance the quality and sweetness of grapes and this is reflected in the improved quality of the wine made from them.

Potash promotes the ability of the plant to form carbohydrates (starches, sugars). It is the predominant stimulator of ripening of fruit and wood. It imparts strength and long life to vines and builds up resistance against pest and disease attack. Potash deficiency is revealed by flimsy, dull, anaemic leaves, badly-filled bunches of improperly-coloured fruit, or spongy wood lacking substance. The acidity of the grapes is reduced by neutralisation of the acids with potash absorbed from the soil as maturation proceeds. Considerable amounts of potash are also retained in the canes, so there is a steady and progressive depletion of the soil's reserves, which must be replenished sooner or later to maintain healthy growth. On potash-starved soils growth response to additions of potassic fertiliser is slow and investigations have shown that it may take heavy doses for three seasons to achieve results.

Lime, apart from being an essential plant nutrient, improves the mechanical condition of the soil and renders other plant foods available by displacing them from combinations in the soil. It also neutralises organic acids formed in the soil by decomposition of plant growth. If the soil becomes too acid, phosphoric acid ceases to be available and toxic elements like aluminium become more easily available. However, the excessive use of lime will make the soil reaction alkaline and certain trace elements such as manganese, iron, zinc, and boron, which are all very essential to the vine, will become entirely unavailable.

The pH (a measure for the intensity of the acid reaction of the soil) should be 6.0 to 6.5 and the exact lime requirement is the amount of lime needed to adjust the pH accordingly. This can be determined precisely only by a trained scientific worker with special equipment.



A vineyard under a cover crop of lupins.

It should be appreciated that the correct use of fertilisers is an exacting business and careful scientific application is necessary to achieve and maintain maximum soil fertility.

Green manuring supplies humus and where leguminous crops such as lupins, beans, and peas are grown they may contribute as much as 80 to 100lb. of nitrogen, the equivalent of 4 to 5cwt. of sulphate of ammonia, to the soil. Though the humus resulting from green manuring makes a valuable contribution to the soil, it should be realised that the contribution is comparatively small and hardly more than sufficient to maintain the existing humus content of the soil. It is a misapprehension to suppose that an impoverished soil can be rendered fertile with humus derived from green manuring alone, as the small gain does little more than compensate for the continuous depletion occurring under cultivation. The only way materially to improve the humus content of an impoverished soil is by heavy dressings (10 tons to the acre) of farmyard manure or compost.

In addition to removing considerable quantities of water from the soil in winter and helping to counteract waterlogging, good green crops absorb soil nutrients during growth and reduce losses caused by leaching. The salvaged plant foods are returned to the soil when the green crop is turned in and become available to the vines.

A crop such as lupins, which have a vigorous, penetrating root system, tends to break up consolidated layers of soil and improve drainage.

Trace Elements

Instances of abnormal growth due to a deficiency of trace elements are rare.

Boron: In the South Island a case of unhealthy vine growth concurrent with fruit that was not uniform in size and developed a rot was investigated by the Cawthron Institute and

proved to be due to boron deficiency. This was successfully remedied by the addition of borax at the rate of 2oz. per vine every 5 years. Overseas reports have referred to the condition as "hen and chickens" and describe one of the symptoms to be bunches in which part or whole consists of undersized, seedless berries. A spray consisting of 4lb. of borax per 80 gallons of water, applied 2 to 3 weeks before blossoming, is an alternative treatment.

Zinc: Stunted vines in parts of South Australia were found to be suffering from zinc deficiency. As a corrective measure the pruning cuts were painted with a zinc sulphate solution (1½lb. of zinc sulphate to 1 gallon of water). A condition in fruit trees termed "little leaf" and in citrus "mottle leaf" is caused by a lack or unavailability of zinc in the soil and is corrected by using a zinc sulphate spray (5lb. of zinc sulphate and 2½lb. of hydrated lime per 100 gallons of water).

Iron: On soils with a high lime content iron is rendered insoluble by the alkaline reaction and vines growing there will suffer from a physiological disease, typified by a yellowish-green to yellow colour of the leaves, called chlorosis. On French vineyards this trouble was remedied by applying a strong solution of iron sulphate immediately after pruning. The action is explained by the fact that the sap pressure of the vine progressively falls in autumn and when it starts to recede the pressure becomes negative so that any liquid swabbed on to cut surfaces made by pruning will be absorbed into the body of the vine. Symptoms similar to those of chlorosis are produced by wet and badly-ventilated soils and also, as previously mentioned, by a lack of potash or nitrogen.

A deficiency of other trace elements could cause abnormal growth, but there is little on record of sufficient importance to warrant comment.