

the frost risk period has passed. A cover crop or heavy weed growth at this period increases the risk of having the crop frosted. Throughout the summer light, shallow cultivation should be carried out to keep down excessive weed growth, which robs the trees of soil moisture.

About mid-January a cover crop should be sown to assist in keeping the organic content of the soil at a high level. Oats, barley, ryecorn, and blue lupins are all useful plants as cover crops. Seed is sown at the rate of  $1\frac{1}{2}$  to 2 bushels per acre. In sowing the cover crop it is advisable to apply 2cwt. of superphosphate mix per acre to assist it to become established as rapidly as possible.

In low-rainfall districts, such as Central Otago, the growing of cover crops can rob the fruit trees of essential moisture if adequate irrigation is not available. Many growers are now using straw or hay spread over the soil in late spring at approximately one bale per tree to maintain the humus content of the soil under these conditions. This material is well rotted down by the following spring, when it is worked into the soil. This strawing down is also beneficial in areas where cover crops cannot be grown successfully.

Cover crops or mulches should be incorporated in the soil sufficiently early for them to have rotted completely before bud movement of the trees begins. When such material is breaking down it tends to cause a temporary shortage of available nitrogen in the soil. If a cover crop must be turned in at this stage, when nitrogen starvation would be detrimental to the trees, a quickly available nitrogenous fertiliser, such as sulphate of ammonia, should be broadcast to maintain the nitrogen supply.

Soils of a fairly heavy type should be ploughed up to the trees on both sides in autumn and left in the rough through winter, when the action of frosts will assist greatly in making them easier to work. On heavy soils the run-off of surface water is greatly facilitated if a deep furrow is left in the centre of each row after ploughing.

### Manuring

The quantity and quality of fruit produced from an orchard depend largely on the fertility of the soil and its management, and through the judicious use of fertilisers a high level of soil fertility can be maintained.

No definite recommendations can be made as to the quantity of any particular fertiliser that should be applied to orchard trees; the fertility of the soil and the vigour of the trees, which vary considerably, determine the amount and kind of fertiliser required to ensure maximum production.

If any one of the three main elements, nitrogen, phosphorus, or potassium, is in very short supply, this deficiency will show in the foliage; therefore the condition of the tree is the best guide as to what fertiliser should be used.

**Nitrogen** promotes strong wood growth, larger foliage, and assists in the setting of fruit. The tree's requirement of nitrogen is greatest in the early part of the growing season, and it is usually at this period that it is in short supply, particularly if a green crop or straw has been incorporated



Eighty-year-old trees in Central Otago bearing good crops of fruit.

in the soil and is in an unrotted condition. An excess of nitrogen is liable to cause soft, sappy growth and make the tree more susceptible to an attack of disease. The fruit is also inclined to be soft and loses much of its keeping quality.

A deficiency of nitrogen causes the foliage to change to a yellowish green and may produce such symptoms as stunted growth, small leaves, poor fruit set, or early defoliation.

Nitrogen is very readily leached from the soil, and therefore should be applied in late winter or very early in spring, so that it is available to the tree 3 weeks before blossoming.

Nitrogen applied so that it becomes available to the tree only in the later part of the season tends to delay fruit maturity.

**Phosphates** assist plant growth, particularly in the early stages, by stimulating root activity. They are also connected with fruit bud development and fruit maturity. A deficiency of phosphate causes poor root action and a dull green and bronzed appearance of the older leaves.

**Potash** improves plant fibre and builds up resistance to disease. It counteracts the effects of excess nitrogen and improves the colour and keeping quality of the fruit. Potash is essential for the production of carbohydrates such as starch and sugar. The foliage of trees starved of potash is dull green. Leaf scorch and early defoliation are further symptoms of a lack of this mineral.

Nitrogen, phosphorus, and potassium are all essential for the development and health of the tree and fruit; therefore a complete fertiliser which contains these three elements is much

better than a manure which contains only one or even two of them.

Phosphates and potash are taken up by trees in greater portions during the early stages of development in spring. They also take some time before they become available to the trees, which makes it necessary to apply them before spring growth begins.

A number of fertilisers can be used to supply the three main elements required. Sulphate of ammonia, superphosphate mix, and sulphate of potash are those usually applied to orchard trees to furnish nitrogen, phosphoric acid, and potash. Blood and bone is also used to a great extent. The main point to consider in the purchase and use of fertilisers is the percentage of suitable plant constituents in them.

Quantities applied per tree must be varied, using the appearance of the individual tree as an indicator of its requirements, bearing in mind not only the crop to be matured in the current season, but also the encouragement of growth for provision of future fruiting wood. For some trees 4lb. would be sufficient, while others may require up to 12lb. to maintain them in good condition.

**Liming:** Lime supplies the element calcium which is necessary for tree growth. It improves the texture of heavy soils, thus making them easier to work, and reduces or neutralises soil acidity. The reduction of soil acidity encourages the growth of beneficial soil organisms. Most New Zealand soils are somewhat acid and lime can be applied with safety, but in Central Otago the position is reversed. Most of the orchard soils there are inclined to be alkaline or have an excess of lime. The addition of lime to an alkaline soil increases the alkalinity and also tends to make