

nitrogen fertilization and horticulture

Horticulture comprises widely varying crops, e.g. vegetables, early potatoes, fruit, bulbs, floricultural and arboricultural crops. These crops are not only grown outdoors, but also in glasshouses. In 1960 the area covered with glass amounted to 5000 ha in the Netherlands, divided into 4000 ha for vegetables, 500 ha for floriculture and 500 ha for fruit.

The duration of the growing period of horticultural crops is very different. Purslane for instance is ready for sale within a few weeks. Spinach takes about two months. Strawberries on the contrary are grown from 2 to 3 years. An orchard only starts producing from the fourth year onwards and nowadays it is not continued for longer than 20 years.

Vegetables are sown or planted in spring, summer or autumn. In this intensive cultivation more crops than one a year are grown. Some crops do not occur in summer and they are grown in the winter months, as e.g. daffodils, tulips, winter cauliflower and winter spinach. Lettuce may be grown all through the year. Horticultural crops are grown for their leaves, leaf stalk, stem, flower, fruit, seed and root, tuber or bulb.

The type of soil on which horticulture is practised also shows a wide variation from sandy soil to heavy clay soil. The humus content varies from 2 to 45 per cent.

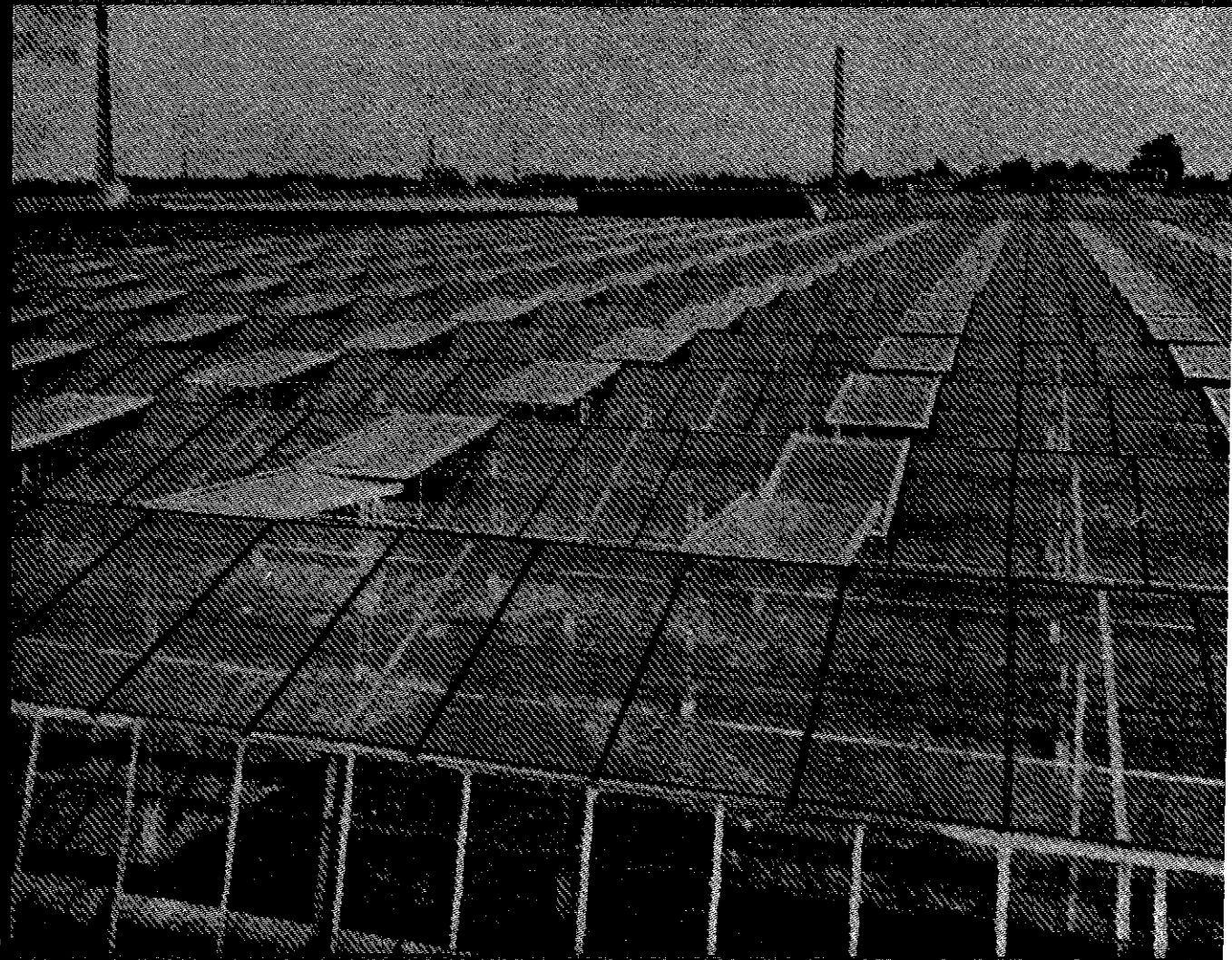
Accordingly, it is obvious that there can be no question of a uniform nitrogen fertilization in horticulture. Each plant species and variety has a certain nitrogen requirement,

which has to be met by fertilization, dependent on the nitrogen content and other properties of the soil, cultivation measures, growing period and weather. The nitrogen requirement of the crop is not constant during its development. A moderate amount of nitrogen is generally required in the early stage. For the development to a mature plant a considerable amount is needed, but nitrogen excess may retard the beginning of the generative phase (flowering) in tomatoes. With strawberries for instance the foliage may develop at the expense of fruit production. After flowering the development of the fruit demands much nitrogen. During this phase also much attention should be paid to an ample potassium supply, because otherwise the quality of the fruit will suffer.

In a perennial crop, excess nitrogen should not be applied in the autumn. Any young wood formed at this time ripens too late and often is more susceptible to damage by frost. In glasshouse culture the crop will develop too weakly after nitrogen fertilization in the dark winter months and thus it will be more susceptible to fungi. During the winter period proportionally more potassium should be available than nitrogen.

In the production of spring lettuce when the temperature rises and daylength increases, nitrogen requirement will be larger than in the autumn culture, when the days shorten and temperature falls.

Soil types differ in their nitrogen content and



nitrogen availability. Moreover, the sterilisation of soil against soil diseases which is often used in horticulture, influences this capacity.

In general more nitrogen is applied in horticulture than in agriculture. We may well question why this should be. The following causes may be mentioned:

1. The expense of fertilizers is of little consequence in intensive horticulture. A slight yield increase after fertilization soon pays.

2. The following crop is well-fertilized, so that the total amount of fertilizer annually applied is high.

3. The generally high organic matter content in horticultural soils, reached by heavy applications of organic manure or already present by nature, increases the production level of the plant and demands as well as tolerates a heavier fertilization of nitrogen.

4. Because of heavier phosphate and potassium fertilization, more nitrogen should be applied to obtain a balanced nutrient supply.

5. In glasshouse culture the moisture economy of the soil is in control by the application of overhead irrigation. More nitrogen is needed as a result of the increased production. The easy method of supplying water, however, also leads to excessive use and leaching of nitrogen.

6. The uptake of nitrogen by the crop may be considerable. For instance, 175 kg of nitrogen per ha is needed to produce 70 tons of tomatoes.

7. In intensive horticulture generally few waste leaves are left on the field after harvest in view of the risk of diseases; in tomato growing the roots are removed with due care. Consequently, little nitrogen is returned to the soil.

The advice on nitrogen fertilization of horticultural crops has been regionally constructed with the aid of experimental field results and practical experience. In 'Stikstof' number 6, 1962, devoted to nitrogen fertilization of agricultural crops, KUIPERS already explained what

factors cause deviations in the average optimal application. Soil analysis on water soluble nitrogen in the furrow has of old been the basis used for nitrogen fertilization in glasshouse horticulture. In outdoor horticulture the analysis figures of water soluble nitrogen are much lower and more a subject to fluctuations from weather conditions. In fruit growing the determination of the C/N-ratio in the layers 0-5 and 5-20 cm throws light on the extent to which the processes of composition and decomposition of organic matter in a grass sward have reached an equilibrium. In a young grass sward there is a build up of organic matter and insufficient nitrogen application may cause a nitrogen shortage for the fruit. The nitrogen content of apple leaves in August, supplies information on the nitrogen supply to the tree and an indication with regard to the fertilization in the next season.

In horticulture fertilizers are not generally applied in one dressing. It is possible to take into account the stage of growth of the crop by applying a top-dressing. Too much growth at the beginning which may be at the expense of flowering is avoided, while scorching of the roots by a concentration which is too high as a result of a heavy dressing is avoided. The application can be done after planting when the roots are well-established, as with bulbs on light soil and strawberries. In lettuce growing a crop very sensitive to a too high salinity of the soil, sometimes organic nitrogen manures are applied. These supply nitrogen slowly and do not increase the salt content of the soil unduly. The top-dressing is adjusted to the exterior condition of the plant. Periodic soil analysis on nitrogen, potassium and the extract after ignition has strengthened the basis of top-dressing in glasshouse culture. In top-dressing special attention is paid to the nitrogen-potassium ratio being available to the crop.

The top-dressing is applied in solid form, e.g. with cauliflower a small application to each plant. The fertilizer may also be applied with

the irrigation water. A modern way of application is to apply the fertilizer via the sprinkler system in a concentration of 0.1—0.15 per cent. Advantages are, next to labour saving, an even distribution and a better penetration into the soil.

Application may be regulated by means of measuring the conductivity of the solution. Spraying a solution of urea with the object of stimulating the nitrogen uptake by the leaves was popular for some time in fruit-growing. The kind of nitrogen usually applied is ammonium nitrate limestone. For some crops, such as spinach, calcium nitrate is preferred. In fruit growing on soils rich in lime, ammonia sulphate is preferred, because this may reduce iron deficiency. Compound fertilizers are often used in glasshouse culture. Besides nitrate of lime, ammonium nitrate limestone, compound fertilizers and potassium nitrate can also be used as a top-dressing. Chlorine containing compound fertilizers are not generally used. For fertilization by means of the sprinkler system fertilizers completely soluble in water are desirable. Organic manures, such as farm-yard manure which also contain ni-

trogen, are used to improve the structure and tilth of the soil. In the advice on fertilization little account is taken of the nitrogen in organic manures. In spring with early crops little nitrogen is liberated. Organic nitrogen manures such as blood meal are used for some crops as well.

The intention of this article has been to express how varied is the problem of nitrogen fertilization in horticultural crops. First of all there is the wide variety of crops which, moreover, are grown on many different soils. Generally a large quantity of nitrogen is used in horticulture, especially with intensive crops, still there are large differences in requirement.

Nitrogen fertilization should not only meet the total demand, but should also be adjusted to the growing stage of the crop. Basical-dressing and top-dressing are distinguished. Finally, in nitrogen fertilization not only should attention be paid to the yield, but also to the quality. Therefore, a correct ratio between nitrogen and the other nutrients, especially potassium, is of great importance.