

Irrigation Systems

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INTRODUCTION

Plants need water and fertilizer at the right time, in the right amount, and at the right pH level. The optimum fertilizer concentration and pH level differ by season, plant species, and plant age.

POSSIBILITIES FOR DISTRIBUTION OF LIQUID FERTILIZER

Liquid fertilizers can be distributed by the following methods:

- 1) **Water-driven pump.** This provides for direct injection of liquid fertilizer into the irrigation system and is a cheap solution.
- 2). **Mechanical mixers.** These provide the possibility of mixing more than one stock solution and for control of the fertilizer concentration.
- 3) **Computer-controlled mixer.** This provides the possibility of mixing more stock solutions and controls fertilizer concentration and acidity for each combination of stock solutions. Control of the acidity is important to ensure that the fertilizer components are available in a chemical form that plants can take up.

WHY USE COMPUTER-CONTROLLED FERTILIZATION

With an AMI fertilization computer it is possible to irrigate with eight different fertilizer compositions, with different EC values (= fertilizer concentrations) and eight different pH values.

Fertilizer Concentration. The EC value is important for the proper growth of plants. If the EC value is too low, plants do not get enough fertilizer, growth and the plant quality are reduced, and the resulting plants are more prone to attack by fungi and other pests.

If the value is too high, plants cannot absorb enough water for evaporation. This causes stomata (guard cells) closure which inhibits photosynthesis.

The optimum EC value changes during the day. When solar radiation is high, the EC value should be lowered. Computers have the facility to lower the EC value automatically in relation to solar radiation. The fertilizer composition stays the same but the level of the different fertilizers is lowered.

When irrigating outdoor plants, rainfall decreases the concentration of fertilizer in the soil water. Measurements in a Swedish forest nursery showed that a moderate rainfall, one that lasted half an hour, lowered the EC value from 3 to 1.5. Therefore, it is necessary to irrigate with a higher EC value in the water after a rainfall. It is therefore necessary to have a number of recipes where the pH value and fertilizer composition is the same but the EC value differs.

pH Value. The pH value indicates the acidity or alkalinity of the irrigation water. If pH becomes too low or too high, the uptake of many minerals decreases. Low pH (e.g., pH = 4.5) affects the uptake of ions, such as calcium, potassium, and

molybdenum. A high pH (e.g., pH = 8.0) diminishes uptake of phosphorus, manganese, and boron. If the pH is too low or high, it is necessary to increase the amount of fertilizer to ensure that plants get all the nutrients they need. Therefore, correct pH values save fertilizer.

The optimum pH is generally between 5.5 and 7.0, with the optimum value varying from species to species. For example, tomatoes have an optimum pH of 5.8, whereas begonias have an optimum pH of 6.5.

Fertilizer Composition. When you grow different species at the same time, you need to be able to give each species the right fertilizer composition. Instead of either giving all plants the same fertilizer composition, or mixing as many different solutions as needed, you can mix a limited number of stock solutions and then instruct the computer how to mix these stock solutions so they fit the different plant species.

QUALITY AND QUANTITY

Plants must grow fast and steady to maintain a high level of quality and quantity. If plant growth is slowed because of either poor climate conditions or incorrect fertilization, both quality and quantity are influenced. The shape of the plants may be altered and flower number may be reduced or aborted. Delayed cropping time makes production more expensive and poor quality results in lower prices—therefore, profitability is reduced.

RECIRCULATION

When fertilization is computer controlled it is also possible to recirculate the water, which additionally saves fertilizer. Water recirculation research has shown a 30% savings in irrigation water and 50% of the fertilizers used.

It is possible to have different irrigation solutions separated. The computer can then automatically take the recirculated water from the proper basin and mix with fresh water and fertilizer needed for each of the irrigation solutions.

LABOUR REDUCTION

The AMI computer saves labour. The computer starts automatically when needed based on weather information. Different plant species may require different conditions and once these conditions are determined, the computer will control irrigation of each plant type. The AMI computer can be used for all types of irrigation—drip watering, benches, sprinklers, etc.—and all types of media—rockwool or grodan, perlite, NFT, etc., including normal soil.

With a personal computer connected to the AMI computer, it is possible to obtain surveys of all the irrigation settings and collect data on each irrigation cycle.