MICROIRRIGATION IN GREEN HOUSE

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ABSTRACT

Green house is a complex microclimate system control structure. The important functions are controlling, humidity, temp, light, air velocity and the other variables including moisture supply to plants. The substratum may be natural or artificially constructed. Then different crops have different physiological and growth requirement. Then the subject requires dealing with the aspect f micro irrigation, which may be drip, drip-tape, with different variations, micro-sprinklers and overhead micro sprayers.
Micro irrigation has to be done for crops grown in green house. There does not seem to be ample literature narrowing the study variables to arrive at some simple conclusions.

To investigate interaction the variables of these two complex systems and to arrive at some meaningful conclusion of utility is not an easy job. The attempt generally is to study the water requirement and yield increase of some important crops grown in greenhouse as compared to their performance in open field. Commonly irrigation is provided by furrows overhead sprinklers, micro sprinklers or drip irrigation. Micro-irrigation thus has to be done for crops grown in green house depending on the crops, climatological conditions imposed and method of application the water requirement, would differ.
The present paper is a review paper giving an insight of the use of micro irrigation in greenhouses, with special reference of works in Japan.

INTRODUCTION

Crops that can not be grown in open field conditions, have to be grown in green houses.to construct a green house is expensive. Therefore only important crops which require climatologically control are mostly grown in green houses. Once grown in greenhouses besides climatological control, irrigation has also to provide to the crops. Irrigation has to be provided by standard methods with proper modification. Commonly irrigation is provided by furrows overhead sprinklers, micro sprinklers or drip irrigation.
In the recent past there has been a large scale application of greenhouse. In Japan under high conditions of rainfall. Keeping moisture conditions suitable for crop growing is a big problem. From the view of controlling soil moisture is easier than drainage. In normal cultivated soils salt accumulation does not occur. However it is a major problem in green houses in Japan. In the present discussion a review has been made of Japanese green houses and other Conventional Green houses.

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REVIEW OF GREEN HOUSES IN JAPAN

There has been a growing area of green house culture in Japan. About 40% of vegetables used to be produced in green house culture. Japanese green houses have been developed to take care of special features not common in field conditions They are designed for climatic conditions of high humidity and rainfall in summer and low temperatures and and frost in winter. Conditions because of rainfall salts do not occur with crops in field conditions. However salts appear in field s growing. There are two methods of controlling Salinization . The first method is ponded leaching and the second is replacing old soil with new soil.

Generally three types of green houses are prevalent... In one only air temperature is controlled. A good portion about 405 green houses has heating facilities. In The second type besides air planting beds temperature is also controlled. The third type has none of these facilities

The soil surfaces are mulched for proper irrigating reducing evaporation to control temperature and to reduce weeds. Other than green hoses tunnel type vinyl houses are also used along with mulching to control climate near the crops. They are economical as to construct and they utilize rain water efficiently. Equipments used are micro irrigation consisting of drip tubes biwalls, drip tapes, Emission devices used are nozzle type, orifice types, multihole tubings and micro sprinklers. Lying is done underground, over crop or as suspended system. These are commonly used along with some type of mulches.

Crops grown are vegetables sweet potato, ginger celery, eggplant, cawliflowers, tomato red pepper etc.

Among fruits, they are melons, grapes, mangoes, strawberry

Salt occurrence in green house and their remedy

It does not occur in natural field conditions. But it is a major problem in green houses of Japan. The increase in salt concentration is due to high application of fertilizers and lack of salt leaching which is taken care under field cultivation with high rainfall. the EC is found to vary as 0.15 to ds/m 0.94 for different crops with a mean of .73 whereas it is 0.20 ds/m.

Application of green manure, and green straw reduces the EC. Deep plowing to 60cm depth is also helpful. Organic manures application like peat moss, vermiculate is also helpful.

Water use in green house

The dfferent variables in artificial environment create complexity in estimation

Evapotranspiration may be given by

$ET = Kc\ ETo$

Where

ETo= Reference evaporation

Kc = Crop coefficient constant

$Kc = Kcrop\ Ksoil$

Where Kcrop and Ksoil are coefficient for crop and soil factors. Kcrop depends on crop height crop density and climate etc. energy used for transpiration is mainly solar radiation. The ground coverage rate by crop canopy was used to estimate periodical changes in crop factor coefficient

A soil plan atmospheric model was developed and evaporation were calculated of each growing stage. The relationship between crop factor coefficient and the ground coverage rate was formed as

$$K_{crop} = (a_1 GC)^{0.5}$$

Where a_1 a constant depending on vegetation condition and GC is is ground coverage rate

Soil factor coefficient(Ksoil) can be expressed as

$$K_{soil} = a_2 \exp(-a_3 GC)$$

Where a_2, and, a_3 are constants depending on vegetative condition?

By putting Kcrop and Ksoil in equation 2 and by putting Kc into equation 1 the evapotranspiration rate from crop field was estimated as partly irrigated

REVIEW OF OTHER CONVENTIONAL GREEN HOUSES

Ahluwalia et al Studied of drip irrigation of tomatoes in greenhouse at Punjab Agricultural University Ludhiana. The study has shown early maturity and higher yields to the extent of 53.4 percent in green house compared to open field irrigation. The average increase in irrigation water use efficiency was 33.3 percent with better quality production

Rezuwan Kamaruddin,(1906)Developed a Micro Drip-Fertigation System under a naturally ventilated tropical greenhouse. The system supplies precise amount of water and fertilizer solution direct to the root zone that increases field efficiency, crop productivity and quality. In addition, it reduces soil diseases and labor requirements which are very crucial in the vegetable production.

The system consists of irrigation controller, nutrient solution tank, electrical pump, filter, valve, pressure gauge, connector, distribution pipes, adapter and drippers. A fertilizer recipe by using cooper formulation was also developed and tested for capsicum production under the greenhouse in the lowlands. The capsicum was planted in the coco peat growth media. Water with fertilizer solution was automatically supplied to the root for 20 minutes at 6 times per day. The performances of capsicum growth in terms of stem diameter, plant height and leaf width against time were measured. The relationship between the leaf and stem growth against time were found to be linear, while the height versus time was exponential.

found of $H=5.79e^{0.24T}$, $D=0.32T + 0.65$ and $W=0.37T + 1.93$ respectively. In addition, their coefficients of determinations were found strong relationship of $R^2=0.995$, $R^2=0.998$ and $R^2=0.983$. Stem and leaf growth were increased as electrical conductivity (EC) increased from 1.7 mS/cm to 2.5 mS/cm increased. At all time the pH value was maintained between 5.5 and 7.0. The temperature, wind speed, relative humidity, light intensity and carbon dioxide were found to be in the range of 30-40 ^{0}C, 0.5-3.0 m s^{-1}, 53-83 %, 1.0-6.0 x10^3 W m^{-2} and 300–400 ppm throughout the days respectively.

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Gulshan Mahajan and Singh K.G. (2005) studied effect of drip irrigation and fertigation at Punjab Agri University Ludhiana on tomatoes in green house. Drip Irrigation at 0.5X Epan along with fertigation of 100% Nitrogen resulted in increase of fruit yield by 59% over control (recommended practice inside the green house and by 116.8% over control (recommended practice) outside the green house respectively. The drip irrigation of 0.5xEpan irrespective of fertigation treatment could save 48.1% of irrigation water and

resulted in 51.7 % higher fruit yield than recommended practice inside the green house. The net profit and yield per mm of water used were estimated to be highest for the treatment of drip irrigation at 0.5 xs Epan in conjunction with fertigation at 125% of recommended Nitrogen among different treatments

Sangama and Singh (2005) studuiedVase life of 9 gerbera cultivars of double from cut flowers grown under poly house at Punjab Agricultural University Ludhiana. The results showed that seasonal effect on vase life of all gerbera cut flowers wee found highly significant. Maximum vase life of 5.74 days was obtained during December. . Minimum. Minimum vase life was found vase life of 5.74 days was obtained during April. Minimum vase life of 7.27 days was found with cut flower Diablo. Temperature and humidity inside the playhouse and room temperature varied and their effects on vase life of gerbera cut flowers were found significant

CONCLUSIONS FROM REVIEW

1) Japanese green houses are designed for climatic conditions of high humidity and rainfall in summer and low temperatures and frost in winter to take care of problems of salts occurring in green houses which do not occur in field conditions because of high rainfall. A method to estimate transpiration and soil surface evaporation was developed
2) The studies in Punjab India, has shown early maturity and higher yields to the extent of 53.4 percent in green house compared to open field irrigation. The average increase in irrigation water use efficiency was 33.3 percent with better quality production

3) A study of Micro Drip-Fertigation System in Malaysia in a tropical greenhouse equipped wit supply of precise amount of water and fertilizer solution direct to the root zone demonstrated that for the capsicum growth, the relationship between the leaf and stem growth against time were found to be linear, while the height versus time was exponential.

4)In a study at Punjab Ludhiana, it was found that the drip irrigation of 0.5xEpan irrespective of fertigation treatment of tomatoes could save 48.1% of irrigation water and resulted in 51.7 % higher fruit yield than recommended practice inside the green house. The net profit and yield per mm of water used were estimated to be highest for the treatment of drip irrigation at 0.5 xs Epan in conjunction with fertigation at 125% of recommended Nitrogen among different treatments

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