3-1-2012

Optimizing Greenhouse Corn Production: Summary

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Purdue Methods:

Optimizing Greenhouse Corn Production

Our greenhouse staff combined old and new techniques into a growth system for optimizing corn production in greenhouses and growth chambers. Nutrient deficiencies are reduced and seed yield increased using automated drip irrigation delivering fertilizer solution to a root media of calcined clay, or porous ceramic. Other topics include using growth regulators to keep plants short and storing cut tassels to lengthen pollination period.

The system is easily adopted. It eliminates the need for the cumbersome handling of field soils (digging, drying, grinding and pasteurizing). It also eliminates the need for soil mixing equipment. Watering frequency and fertilizer formulation are constant over the life of the plants, and supplemental fertilizers are not required. In most cases, transplanting was not required and watering labor reduced to simple inspection of the system.

Results of 24 controlled studies are summarized into FAQ format for ease of understanding. Photographs of the techniques and statistical analysis of data are provided. Note that the studies were not peer reviewed. We offer very little new discovery here—most of the techniques were pioneered by Purdue faculty, other facilities or NASA. We've simply integrated them into a repeatable, reportable and scalable plant growth system for corn that can be adopted across facilities, independent of their level of technology. Below is a table summarizing our recommendations, according to the preferred watering method.

We would like to acknowledge the following companies for their support with this research by donation of products:

Chapin Watermatics Inc., USA, Water Town, NY
Controlled Pharming Ventures, Inc., Marengo, IN
Dow AgroSciences, Zionsville, IN
Landmark Plastic Corporation, Akron, OH
Myers Industries Lawn & Garden Group, Akron, OH
Premier Horticulture, Quakertown, PA
Profile Products LLC, Buffalo Grove, IL
Sun Gro Horticulture, Bellevue, WA
The Scotts Company, Marysville, OH
OHP, Inc., Mainland, PA

This document is based on materials originally posted to the Purdue University HLA Department Plant Growth Facility web site: http://www.hort.purdue.edu/hort/facilities/greenhouse/CornMethod.shtml

Purdue Methods: Optimizing Greenhouse Corn Production

	Root media	Container	Irrigation Frequency	Irrigation duration**	Fertilizer***	Spacing	Lighting
Recommended: Drip irrigation, Computer controlled	Turface calcined clay*	Nursery container, 8.3 – 11.3 liter volume	3 times daily, daytime only	30 sec. on; pause 5 min; 30 sec. on	General purpose, 400 ppm N, every irrigation	Stalks minimum 30-cm apart. Twin rows	Daily minimum 12 moles in greenhouse, 25 moles in chamber
Recommended, easily adopted: Drip Irrigation, No computer control	Turface calcined clay OR 1:1 Profile / soilless mix	Nursery container, 8.3 – 11.3 liter volume	12 times daily, day & night	2 – 5 minutes, battery timer	General purpose 200-400 ppm N, every irrigation	Stalks minimum 30-cm apart. Twin rows	Daily minimum 12 moles in greenhouse, 25 moles in chamber
Sub-irrigation, Computer controlled	Turface calcined clay	Nursery container, 8.3 – 11.3 liter volume	3 times daily, day only. Flush monthly.	Until saturation	General purpose, 200 ppm N, every irrigation	Stalks minimum 30-cm apart. Twin rows	Daily minimum 12 moles in greenhouse, 25 moles in chamber
Hose watering	1:1 field soil / soilless mix OR 1:1 Profile / soilless mix	Nursery container, 8.3 – 14.2 liter volume	As needed. Flush monthly.	Until substantial run-through	General purpose 200-400 ppm N, every irrigation	Stalks minimum 30-cm apart. Twin rows	Daily minimum 12 moles in greenhouse, 25 moles in chamber
Constant sub-irrigation	Turface calcined clay	Nursery container, 8.3 – 11.3 liter volume	Keep tray full. Flush monthly.	n/a	General purpose 200 ppm N, every irrigation	Stalks minimum 30-cm apart. Twin rows	Daily minimum 12 moles greenhouse, 25 moles in chamber

* For simplicity, we refer to the larger-sized clay granules by the trade name Turface and the smaller size granules by Profile. No endorsement intended.
**Drip systems will vary with flow. Our system had a high flow rate, a constant stream from drip emitter.
***Formulation should be based on domestic water quality. Preferably should have extra calcium.

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