From the Ground Up-
Field Soil Considerations

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This presentation will highlight common irrigation distribution problems in container nurseries and discuss “Best Management Practices” which improve irrigation efficiency. Well design irrigation systems save water supply resources, electrical power used to pump irrigation supplies and reduce handling practices required to capture and recycle irrigation supplies. Additional information and presentations related to this subject can be found on the NCSU Nursery Science Website.

Riparian buffers are natural vegetative filters that can protect streams and public watersheds from soil erosion, nutrients and pesticides that might otherwise enter natural conveyances from agricultural fields.

Harvesting field nursery stock removes significant amounts of soil from fields. After nursery stock is harvested, fields must be prepared for planting the next cycle. Soil analyses document changes in soil fertility and altered physical characteristics since top soil is removed by digging and subsoil is brought to the surface during field preparation.

Field Nursery- Important Characteristics

*Drainage-

*Soil Profile -

8 to 10 inches well drained

A soil tube can be used to assess drainage characteristics of fields. In a column of soil extracted with a soil tube, changes in color, odor, moisture retention, and soil texture provide evidence of the fields suitability for production of nursery crops.

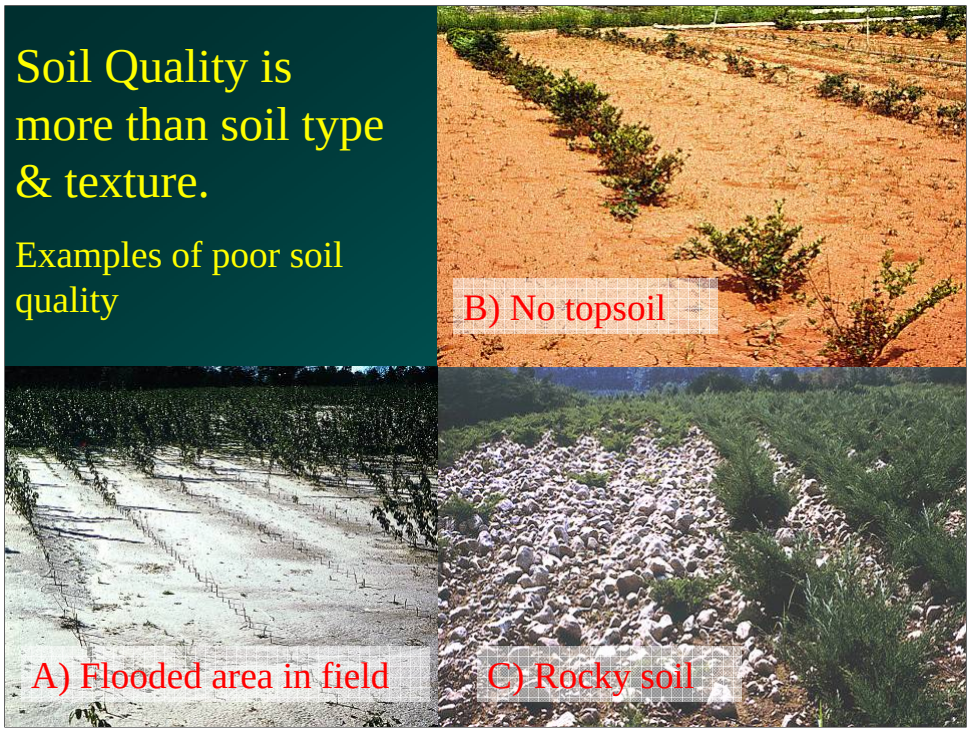
Soil Quality Is:

- The fitness of a specific soil to function within it surroundings, support plant and animal productivity, maintain or enhance water and air quality and support human health and habitation

NRCS

http://www.statlab.iastate.edu/survey/SQI/squinfo.shtml

Soil quality encompasses many physical and chemical characteristics of soil. Since subsoil may have different soil quality characteristics than top soil, field nursery producers must assess the characteristics of the soil for each new crop cycle and employ practices that nurture soils..



Some fields offer major challenges for production of nursery stock. Assessing field soil characteristics including drainage, soil texture, erosion potential and soil fertility are required to successfully produce nursery stock. Nursery stock requires 3 to 5 years to grow to marketable size. Since crops remain in fields for several years, seasonal high water tables, flooding potential and nutrient availability must be anticipated. Choices of crops which best tolerate conditions of marginal fields is important for success. Some fields are not suitable for production of nursery stock.

So What is Soil Quality? Really?

- Soil that has good aeration, moisture retention, fertility and biological diversity.
- Soil aggregate size is one of the most important characteristics

Soil nurturing practices increase productivity of field nursery soils.

Soil tests and drainage evaluation is required to determine the usability of some fields.

Reducing erosion in field nurseries is necessary to prevent further loss of topsoil. End of row vegetative strips and grassed drive roads are effective practices to reduce erosion in field nurseries.

Rip rap will slow water down and cause swirling in front of the rock which may help settle soil or it may cause a wash in front of the rip rap depending upon the velocity of the stream. Therefore several rows of rip rap would be required on steep slopes.

Bare soils should be planted with cover crops or turf type grasses to reduce soil susceptible to wind erosion. Grass strips planted adjacent to erosive channels can trap soil moving off fields. Rock rip-rap placed in channels will reduce the velocity of storm water moving down slopes. Sediment is trapped in front of rip-rap barriers and also helps reduce further channeling.

Gravel on main drive roads reduces dust and loss of soil by wind and traffic !

Excessive tilling leaves top soil loose and susceptible to wind erosion.

Loss of Soil Quality by

Compaction

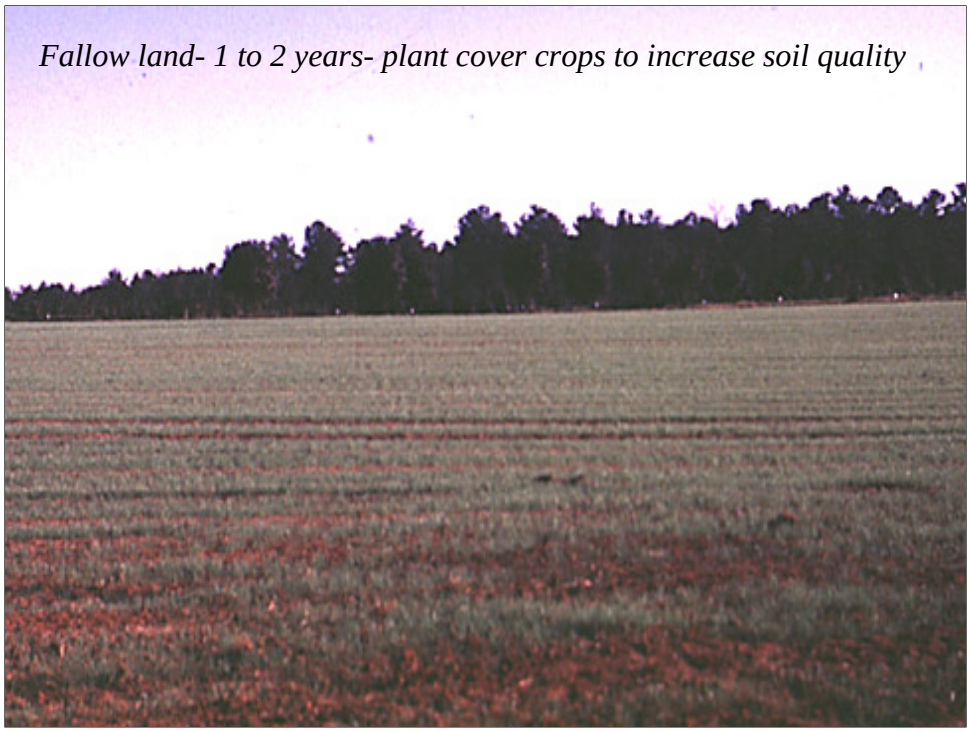
Loss of air space, water holding capacity, water penetration.

Frequent Tilling

Loss of soil aggregation, micro-flora, wind erosion,

Heavy equipment compacts soils and changes drainage characteristics in the field. Frequent tilling during crop production cycles reduces soil aggregation and increases erosion potential in fields. Alternative practices for weed control should be considered.

Planting on a contour across slopes and use of vegetative aisle covers reduces soil erosion in fields.



Planting cover crops and allowing field to lay fallow for up to a year before planting may improve soil quality characteristics including soil aggregation. Cool season cover crops include small grain crops such as wheat, rye or annual rye.

Compost added as organic matter

Adding Organic matter such as composted yard wastes, composted animal wastes and other organic materials available locally can be used to increase organic matter in soils. Addition of organic components may increase soil aggregation, soil drainage and soil fertility of field soils.

Cover Crops should provide 70% coverage of soil. Cover crops are usually mowed before seed heads are mature

Buckwheat can be used as a fallow cover crop for nursery fields.

Small grain cover crops are planted in fall and winter months and tilled into the soil in spring or summer months to increase organic matter, drainage, and soil aggregation in field soils.

Corn used as a summer cover crop during 1 to2 fallow years to organic matter of soil

Summer cover crops planted in fallow fields offers the opportunity grow large amounts of biomass, that can be incorporated into soils to improve soil quality.

Cover crops need to be managed so that they don’t become a problem the following year during production cycles.

Hybrid sudan grass can be planted as a summer cover crop to stabilize open or bare soil to reduce erosion.

Hybrid sudan grass is a very fast growing cover crop that can be planted in spring, mowed before seed head development and incorporated into topsoil to increase organic matter, soil aggregation and other soil quality factors.

Planting cover crops and allowing field to lay fallow for a year before planting may improve soil quality characteristics including soil aggregation.

Soil soiling fields as a step in field preparation for planting can increase drainage and aeration of field soils.

Cover crops grown in fallow fields and in open areas between nursery rows are mowed and incorporated into the soil to increase aeration, drainage and fertility of nursery fields.

Plant cool season vegetation in aisles -reduce bare soil exposure

Winter cover crops planted in aisles between rows of nursery crops stabilizes soil reducing erosion during winter months and incorporated during spring or summer months to increase organic matter and aggregation of field soils.

Summer cover crops planted in aisles stabilizes soil between rows. Summer cover crops should be mowed before seed heads dispurse seed.

Soil Stabilization
Erosion Control
Soil Quality
BMP's

Use perennial vegetation in aisles

Perennial grasses or clover are an alternative choices for vegetative aisle covers. Perennial aisle vegetation reduces furrows created by tractor and equipment tires when fields are wet.

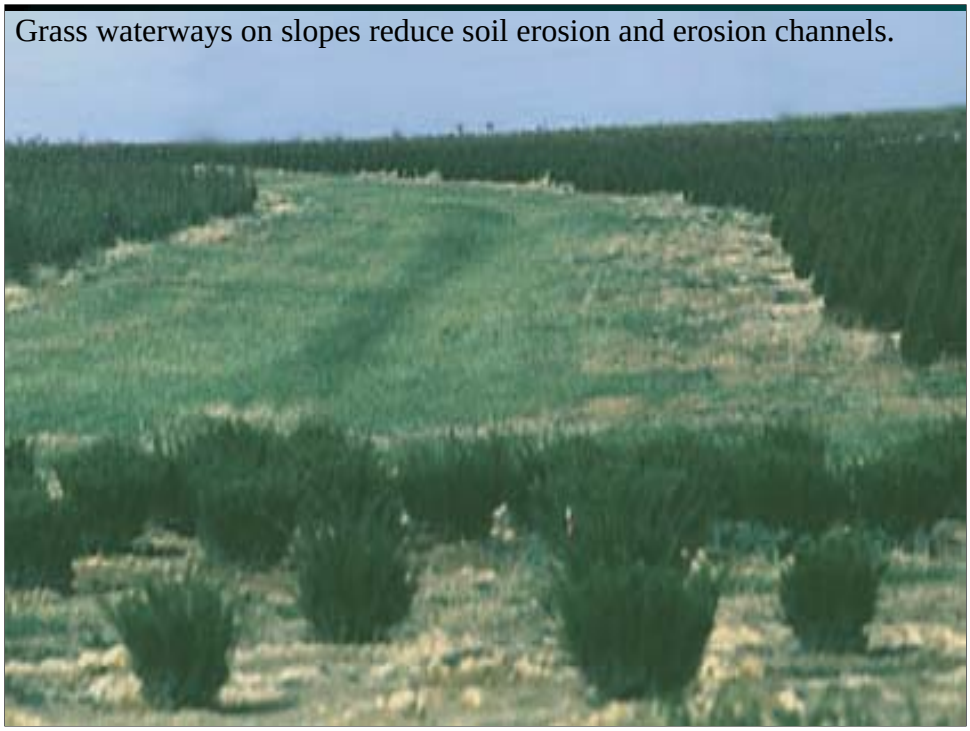
Aisle vegetation covers are important to reduce erosion and movement of soil. Clover used here may not survive hot summer weather in some areas.

Drive roads and aisles planted with perennial cover crops reduce soil erosion and reduce ruts caused by equipment used in fields.

Mowing and maintenance is require for cover crops to reduce competition for soil moisture and to reduce habitat of rodents and other pest species.

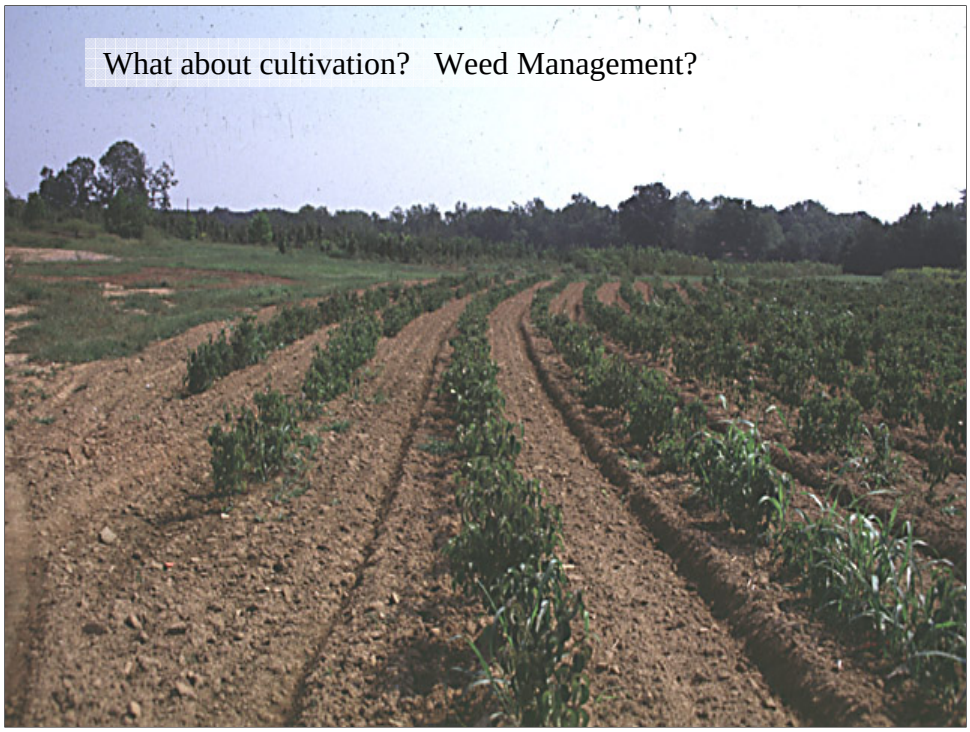
Grassed waterways and end of field border strips reduce soil erosion and provide stable shoulders at field edges for turning equipment and movement of equipment in and out of fields.

Grass waterways on slopes reduce soil erosion and erosion channels.



Grassed waterways on slopes between nursery blocks reduce erosion and movement of soil from field production areas. Field border strips located at the edge of fields prevent movement of soil off site and reduce potential movement of soil and nutrients into natural conveyances and watersheds. Field equipment should be lifted at the edge of the grass strip to avoid damaging grass strips.

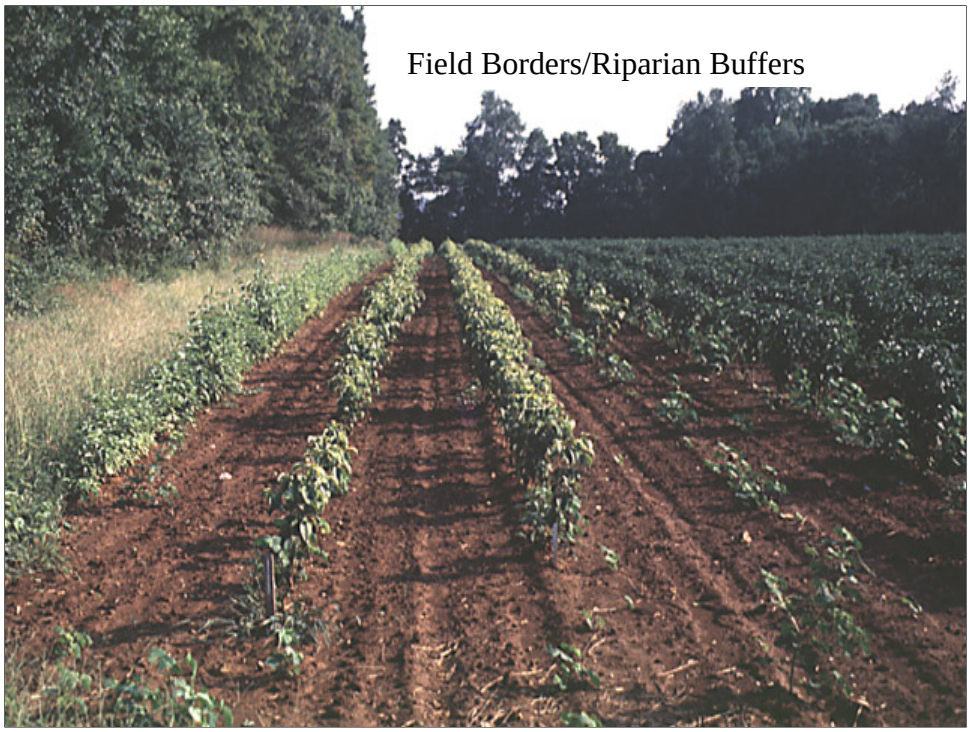
Grassed waterways and end of field border strips reduce soil erosion and provide stable shoulders at field edges for turning equipment and movement of equipment in and out of fields.



Cultivation during the first year after planting can be used for weed control however planting vegetative aisle row covers should be developed in subsequent years to reduce soil erosion. Preemergence and postemergence weed management programs should be planned for in row weed control.

Planting density [spacing of plantings in rows and distance between rows] is dictated by the marketing program based upon the size of plants to be sold. Plant spacing should allow for plants to grow to marketable size with only edges of canopies touching adjacent plants. Aisle widths should allow enough space for equipment to move between rows throughout the entire production cycle. Planting aisle cover crops reduces soil erosion and provide a stable surface for equipment during production activities without equipment making ruts in the field between rows. Drip irrigation is considered a “Best Management Practice” for field production of nursery crops.

Use vegetation to reduce bare soil exposure



Filter border used as riparian buffers strips need to provide at least 70% soil surface coverage and a minimum of a 12 foot width to prevent off site movement of soils and nutrients.

Steep slopes should be planted on the contour rather than rows running down slopes. Field border strips seen in this slide will intercept soil moving from planted field areas, however movement of soil from steep slopes is inevitable resulting in loss of fertile topsoil from field areas.

Hose reel pull irrigation systems are used in many field nurseries, however they require as much as 350 gallons of water per minute to operate. During droughts, irrigation supplies are often limited and adequate irrigation supplies are not available. In addition, these irrigation systems wet all soil surfaces in the field, therefore weed seeds germinate ready increasing weed pressure and weed management practices.

Drip Irrigation

- Efficient
- Environmentally friendly
- Reduces mortality
- Increases growth per year

Drip irrigation is considered as a “Best Management Practice” for field production. Water is deposited at the root system. Research studies have shown that more roots are harvested when plants are dug in drip irrigated fields. Weed pressure is also less of a problem in aisles and non-crop areas since irrigation is only applied in crop rows.

Drip Irrigation

- Drip provides the ability to FERTIGATE with irrigation,placing fertilizer at the roots of crops in the row.
- Fertigation is an environmentally conscious method to raise field grown nursery stock

100 • Nursery Notes

Fertigating Field Grown Nursery Crops

Richard E. Bir and T. E. Bilderback
N.C. State University

Fertigation is the process of applying water soluble fertilizers to plants through a drip or trickle (low volume) irrigation system. Drip or trickle is the only irrigation system available that applies fertilizer solutions efficiently enough to be used in field nurseries. While it is possible to inject fertilizer into overhead systems, problems with fertilizing areas other than crop plants plus potential nutrient runoff make fertilizing through these systems impractical. Because drip irrigation systems depend upon tiny openings for the delivery of water to plants, totally soluble fertilizers must be used as well as fertilizers that will not precipitate to form solids in the irrigation lines. Otherwise lines will become clogged. All irrigation systems through which any chemical is applied must be equipped with proper backflow prevention. Not only is this a good idea, it is the law.

Injectors: Almost any system that can inject a solution into a water line can be used to inject fertilizer into a drip irrigation line. However, the injectors that have become most popular are those that are operated by water pressure rather than electronically. For smaller systems, a venturi-type system can be used which draws fertilizer solution from a tank by differential pressure. The most common of these is the "hozon." Nurseries larger than 0.5 acres will probably be better served by systems that use water to drive a piston pump or hydraulics to draw fertilizer solution from a tank because of their far greater capacity and dependability.

Fertilizers: Little research is available as a guide in determining how much or how often fertilizer should be applied to woody nursery crops. Currently, we are suggesting the soil be analyzed and needed nutrients including minor elements, calcium, magnesium, phosphorous and potassium be applied when tilling the soil in preparation for planting. By doing this, the only fertilizer that should be needed will be nitrogen. In areas where soils or special needs of the crop dictate other nutrients are required, they may be used.

Drip Irrigation for Field Grown Nursery Crops

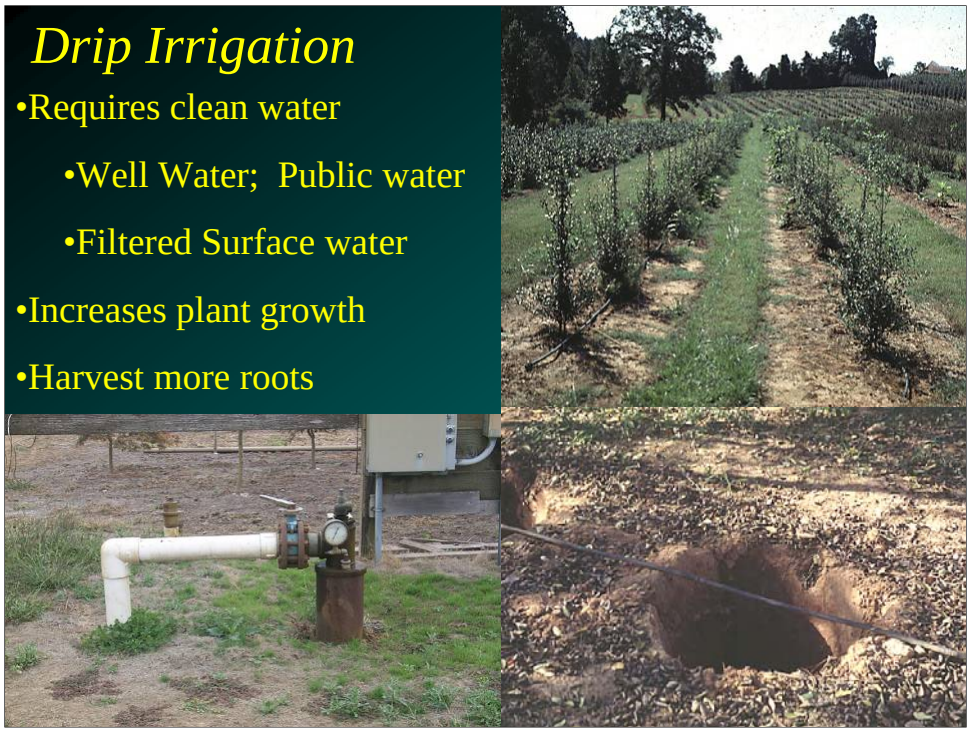
Richard E. Bir and T.E. Bilderback
N.C. State University

Drip or trickle irrigation has increased rapidly in popularity since the 1960s, due to improvements in plastics and plastic manufacture, and in the last decade new technology has increased the adaptability and efficiency of low volume/low pressure irrigation. Two major factors have influenced the conversion of nurseries to drip irrigation: (1) Water resources must be used more efficiently as demands on fresh water increase, and (2) Research has demonstrated that some crops can be produced more rapidly, with greater uniformity and less plant loss during the first year and more roots

more efficient in supplying water to roots and will result in a greater number of roots being produced in an area where they will be harvested and sent to the customer. When irrigating through drip irrigation, water is delivered very gradually, at rates approximating 1 gal. per hour per emitter rather than the gallons per minute delivered by some overhead systems. For this reason, drip must be run for a longer period of time than overhead to adequately irrigate a crop. Water is delivered through small tubing at low pressures so that clogging of the system by any kind of suspended particles is much more likely to occur.

Factors to consider: When deciding to use drip irrigation, ask yourself what you expect from the irrigation system. By asking a few questions before you purchase and install a system, major expenses, frustrations and disappointments can be avoided. For example, if you expect to get frost protection from irrigation, drip irrigation will not work. If you expect to feed liquid fertilizers or pesticides through

An additional advantage of drip irrigation systems in field production is the ability to ‘fertigate’ crops where nitrogen and other soluble nutrients can be delivered directly to the root zone on field grown nursery stock. Fertigation is an environmentally compatible nutrient application technique since nutrients are immediately applied to the surface of the soil and infiltrates into the root zone for uptake by roots. Potential of nutrient movement out of the nursery row is very low, thus reducing any environmental impact to public watersheds.



Drip irrigation requires high water quality with low mineral content and free of sediment. Field nurseries with access to wells are ideal for use of drip irrigation systems. As observed in the tree pit shown at the lower right of the slide, a tree was harvested and no large transport roots are observed at the edge of the pit, providing evidence that most of the root system was harvested when the plant was dug.

From the Ground Up:Building Field Soils

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That’s all folks!