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.
Field Nurseries lose soil due to the nature of the business!

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.
Soil Quality is more than soil type & texture.

Examples of poor soil quality

A) Flooded area in field
B) No topsoil
C) Rocky soil

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!
Loss of Soil & Nutrients

Farming Practices

Excessive tilling leaves top soil loose and susceptible to 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.
What about topography?  Contour Farming?
Grassed aisles?

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.
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 to 2 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.
The greatest effect of cover crops is not increasing organic matter but increasing soil aggregate size, which increases bio-diversity, aeration and percolation!

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.
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 disperse seed.
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 required 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.
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.
Use vegetation for row ends to prevent erosion

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.
Aisle Row Covers?

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 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.

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 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.
That’s all folks!