

Crop Profile for Peaches in North Carolina

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General Production Information

- The acres of bearing age peach trees in North Carolina are estimated at 2,500 to 3,000 (estimate from Mike Parker and David Ritchie).
- The production of fresh market peaches in North Carolina in 2005 is estimated at 11 million pounds (estimate from National Agricultural Statistics Service).
- North Carolina peaches are sold through fresh markets, a large percentage of them through roadside retail stands and farmers' markets. Little, if any marketing is done through large grocery store chains.

Production Regions

Historically, North Carolina peaches have been produced mostly in the Sandhills region of Montgomery, Moore, Richmond, and Anson counties. At present, the Sandhills have the largest concentration of peaches, but acreage has declined significantly during the past 20 years in this region (but is still significant). Peaches now are planted over much of the state, mostly in small orchards of less than 25 acres, from the coastal plain to the lower mountains, as farmers diversify their farming and marketing.

Production Practices

Peaches grown in North Carolina are planted in a wide range of soil types. In the coastal plain, they are

grown in sandy-loam and heavier silt-type soils. In the Sandhills, peaches are grown on sandy to sandy-loam soils. In the upper Piedmont and lower mountains, they may be planted in well-drained clays. The sites suggested for planting are those that have a reduced probability of crop loss from spring frost/freeze conditions.

The North Carolina peach industry, as well as the industry in other southern peach-producing regions, has to contend with the peach tree short life (PTSL) complex. PTSL is most common to peach-replant sites and results in premature tree death usually first observed in the fourth to fifth year after planting. PTSL is most common in areas where peaches are planted in light, sandy soils. To minimize the potential for PTSL losses, orchard sites on light, sandy soils should not be replanted to peaches for 4 to 5 years, be fumigated before planting, and trees should be a *Guardian* rootstock.

In addition, nematode assays are encouraged to determine preplant recommendations, such as use of soil fumigation, and postplant nematicide usage. However, the rootstock *Guardian* is reported to be tolerant to root-knot and ring nematodes and to PTSL. Under close experimental scrutiny in the Southeast as well as in many grower trials, *Guardian* is a promising rootstock.

Fruit thinning is a major cost for peach producers in the eastern U.S. Many of the eastern-bred cultivars have a very high-bloom density to minimize crop loss from spring frost/freeze conditions. However, early and judicious thinning is required to maximize fruit size with fruit spaced at least 6 to 8 inches apart. In a full crop season, only 10 percent of the blossoms are required for an optimal crop, and 90 percent must be removed by hand. Thus, growers incur significant labor expense.

Supplemental irrigation is encouraged. Drought during the 4 weeks preceding peach maturity, when 40 to 60 percent of fruit growth occurs, will significantly reduce fruit size and result in reduced yield, fruit quality, and economic returns.

Worker Activities

(The following information was taken from the March 2004 Georgia and South Carolina Peach Crop Profile and adapted for North Carolina peach production.)

Peaches are highly dependent on hand labor, especially during the pruning, thinning and harvest season. Peaches must be hand thinned twice, normally between 30 and 60 days after fruitset, removing up to 90% of the total number of potential fruit, in order to achieve marketable fruit size. Pruning is done in the dormant season before seasonal application of chemical protectants begins. In some orchards in some years “summer pruning” is done to improve fruit color, but insufficient labor often precludes this.

Peach trees are normally maintained within a weed free strip. Most orchards are maintained with bare ground beneath the trees, and grass or volunteer vegetation between the rows. Middles, in orchards where sod is present, are mowed about several times during the growing season using tractor-mounted

equipment. Pre-emergent herbicides are applied using tractor-mount equipment, as are any applications of post-emergent herbicides and those applied post-season. A small percentage of orchards maintain bare ground throughout the orchard. Although tillage is not recommended it is still practiced by a few growers as a means of weed control.

Post-harvest applications of insecticides for peachtree borer are made with hand guns in August and September. During dormancy (November to February), oil is applied to control scale insects. This process is done using an orchard airblast sprayer.

The peach crop is harvested by hand.

Insect and Mite Pests

The major arthropod pests of peaches in North Carolina can be divided into four principal categories, based on the nature of their damage. These are fruitworms, borers, catfacing insects, and chronic feeders. Fruitworms and catfacing insects are of greatest economic importance because they reduce the yield of marketable fruit. They are controlled primarily by 4 to 6 early-season applications of broad-spectrum insecticides.

Borers and chronic feeders may cause less direct fruit damage, but they can increase tree mortality and reduce the lifespan of a commercial orchard. These pests tend to occur sporadically. During outbreaks, additional pesticide applications are usually necessary for suppression.

Fruitworms

Historically, the plum curculio (*Conotrachelus nenuphar*) has been the most pernicious pest of peaches in North Carolina. The oriental fruit moth (*Grapholita molesta*) is also present, but it is seldom common enough to cause serious damage. Recommendations for control of fruitworms in North Carolina suggest biweekly applications of azinphosmethyl, phosmet, permethrin, or esfenvalerate. Complete control in the fruit can be obtained with proper use of these compounds. Also, by coordinating sprays with weevil migration and oviposition, it is possible to use fewer sprays in most years.

Catfacing insects

Several Hemipteran species can cause scarring and deformation (catfacing) of the fruit due to cell injury from their piercing-sucking mouth parts and digestive enzymes. In North Carolina, these catfacing insects include the tarnished plant bug (*Lygus lineolaris*) and stink bugs in the genera *Acrosternum*, *Euschistus*, *Thyanta*, and *Nezara*.

Most of these pests are active, migratory insects that usually do not reproduce on peaches. Recommended control involves weekly use of azinphosmethyl, permethrin, esfenvalerate, or phosmet from petal-fall to shuck-off and then biweekly applications until 3 to 4 weeks before harvest. But even this vigorous schedule fails to give adequate (more than 95 percent) control unless it is combined with a weed-management program that suppresses legumes (e.g., clover, vetch) and winter annuals (e.g., henbit, chickweed) in the orchard ground cover.

Borers

Larvae of the peachtree borer (*Synanthedon exitiosa*) and the lesser peachtree borer (*S. pictipes*) can seriously weaken or kill peach trees. Preplant treatment of nursery stock with endosulfan followed by yearly sprays of endosulfan or fenvalerate during the first week of September gives good control of these pests. Since resistance to endosulfan has been suspected in some North Carolina orchards, rotation of these pesticides is recommended.

Synthetic sex pheromones are commercially available for both species and are sometimes used for population monitoring. Mass trapping and mating disruption have not been tested extensively in North Carolina because of their expense and increased labor input.

The shot hole borer (*Scolytus rugulosis*) and ambrosia beetles (*Xyloborinus*, *Xyloborus*, *Xylosandrus* spp., etc.) may attack and injure commercial peach trees. Populations of these pests tend to build up in dead or diseased wood. Clean, cultural practices and prompt removal of prunings and other dead wood usually prevent serious outbreaks of these insects.

Chronic feeders

Aphids, mites, scale insects, and beetles are chronic pests that may occasionally cause economic damage to peach trees. Under favorable conditions, these pests are controlled by good orchard management and by the recommended spray schedule for fruitworms and catfacing insects. In outbreaks, often due to weather, additional pesticide applications may be necessary to achieve control.

The black peach aphid (*Brachycaudus persicae*) may be a problem on very young trees, but damage can be prevented by preplant soil fumigation that kills both the subterranean aphids and the symbiotic ants that tend them.

The European red mite (*Panonychus ulmi*) and the two-spotted spider mite (*Tetranychus urticae*) seldom reach economically damaging levels on peaches until mid to late summer in North Carolina. Populations often build up on weeds in the ground cover and move to peach trees late in the year when preferred hosts begin to age. Hexakis, chloropyridazin, and clofentezine are effective miticides.

Japanese beetles (*Popillia japonica*) and green June beetles (*Cotinis nitida*) are nuisance pests that feed on ripe fruit near harvest time. They are generally controlled with a pre-harvest application of carbaryl.

Of all the chronic feeders, scale insects are the most frequent problem in North Carolina orchards. These may include the white peach scale (*Pseudaulacaspis pentagona*), the San Jose scale (*Aspidiotus perniciosus*), and Forbes scale (*A. forbesi*). When growers follow the recommended spray schedule for fruitworms and catfacing insects, there is seldom a buildup of scales on late-maturing varieties. However, an application of endosulfan in September, or two applications of a dormant oil spray, may be necessary on early season varieties.

Insecticide and Miticide Use Estimates for Peaches

Estimates of insecticide use are not available for peach production in North Carolina. However, insecticide use data for South Carolina are available from the U. S. Department of Agriculture's National Agricultural Statistics Service (U. S. Department of Agriculture, National Agricultural Statistics Service. 2004. Agricultural Chemical Usage: 2003 Fruit Summary. August 2004.).

Current Insecticide and Miticide Recommendations for Peaches

Current North Carolina Cooperative Extension Service recommendations for insecticide and miticide use on peaches (including information on formulations, application rates, and precautions/limitations) are provided in the following table from the *North Carolina Agricultural Chemicals Manual*:

Table 7-8: Peach and Nectarine Spray Guide
(<http://ipm.ncsu.edu/agchem/chptr7/708.pdf>)

Table 7-9: Relative Effectiveness and Safety of Various Insecticides for Peach Insects
(<http://ipm.ncsu.edu/agchem/chptr7/708.pdf>)

Diseases

Several fungal-, bacterial-, and nematode-caused diseases can have significant economic impact on peaches (and nectarines) in North Carolina. The two most important fungal diseases of fruit are brown rot (*Monilinia fructicola*) and peach scab (*Cladosporium carpophilum*). The fungal disease leaf curl (*Taphrina deformans*) occurs very sporadically.

Other fungal diseases, such as anthracnose (*Colletotrichum* spp.) and constriction disease (*Phomopsis amygdali*), seldom occur in North Carolina. Rhizopus (*Rhizopus stolonifer*) and Gilbertella rot (*Gilbertella persicaria*) of fruit can be a problem when fruit are allowed to overripen and sanitation

practices are poor. Bacterial spot (*Xanthomonas arboricola* pv. *pruni*) can cause serious economic fruit loss on highly susceptible cultivars and on other cultivars when weather conditions are wet, especially during the 3- to 4-week period following bloom. Bacterial canker caused by *Pseudomonas syringae* pv. *syringae* is associated with the PTSL complex. Root-knot nematodes (*Meloidogyne* spp.) can severely affect tree establishment, and the ring nematode *Criconebella xenoplax* is associated with premature tree death in the PTSL complex.

Brown rot

Brown rot poses the greatest disease risk for loss of peach fruit; however, its occurrence can be sporadic being highly dependent upon warm, moist conditions. Although *M. fructicola* causes blossom blight, the greatest impact occurs from the fruit-rot phase. Fruit rapidly increase in susceptibility as ripening begins (2 to 3 weeks before harvest), which extends through harvest. If the weather is favorable and no control practices used, losses from brown rot can approach 100 percent of the crop. Successful control of brown rot depends on use of cultural and pesticide controls beginning before bloom and continuing through harvest. Insecticides to reduce insect wounds also reduce brown rot. There are numerous fungicides labeled to control brown rot, some of which are mostly used early in the growing season, whereas others are used in the final 2 to 3 weeks before and during harvest.

Resistance to fungicides has not become a significant problem in peaches in North Carolina. Resistance-management strategies continue to be strongly emphasized.

Approximately 50 percent of the acreage would receive at least one fungicide application during the bloom period; two applications may be used if the bloom period is extended and weather conditions are wet. One of the following fungicides would be used at this time: captan tank-mixed with thiophanate-methyl, or the use of chlorothalonil. Although it is recommended that the demethylation-inhibiting (DMI) fungicides not be used for blossom blight, some growers may apply propiconazole, fenbuconazole, or tebuconazole if the weather is favorable for blossom blight. After the bloom period and until approximately three weeks before harvest, captan or captan tank-mixed with another fungicide such thiophanate-methyl or a DMI, is the fungicide most commonly used in "cover" sprays of captan. Sulfur is used if disease pressure is low.

Fruit are most susceptible to brown rot starting about three weeks before harvest, with susceptibility increasing as fruit ripen. During this period, 1 to 3 fungicide applications are made, depending on weather conditions. These fungicides would be one of the DMIs—propiconazole, fenbuconazole, tebuconazole, or captan. Because of the increasing risk for resistance to the DMI and QoI fungicides, when brown rot pressure is high, the first preharvest application may be thiophanate methyl tank-mixed with captan. Cultural practices that remove sources of overwintering inoculum play an important role in reducing losses to brown rot.

Peach scab

Unlike brown rot, peach scab occurs every year in North Carolina, and control depends almost exclusively on effective fungicides. Primary infection occurs during the four-week period following bloom, and use of fungicides during this time is critical for control. Symptoms do not become visible until 5 to 7 weeks after infection (late May until early June), when the use of a fungicide is of little value. Mild infections are mostly cosmetic, but if no fungicides are used, scab can be severe. This results in cracking of the fruit skin, which also can allow infection by the brown rot fungus and secondary fungi.

Fungicides used for scab control are chlorothalonil (which cannot be used later than shuck split), captan, and sulfur. Thiophanate methyl tank-mixed with captan and applied in the application at shuck split is very effective for scab control. Additional sprays for scab control consist of captan or sulfur applied on a 2 to 3 week schedule depending upon weather conditions. Azoxystrobin (Abound) and trifloxystrobin (Flint) have good activity against scab, but have limited use because of cost and little efficacy advantage over captan. In the case of Abound, it is preferred that this fungicide be used as part of the brown rot fungicide resistance management strategy rather than against.

Leaf curl

This fungal disease is most likely to occur when weather conditions during bud emergence are wet and cool. It can be adequately controlled with a single fungicide application before bud swell, using ferbam, ziram, chlorothalonil, or copper-containing products. Fungicides (e.g., captan) used during the previous growing season lessen the severity of leaf curl the following spring. Peach and nectarine cultivars vary greatly in susceptibility, and not all cultivars need to be sprayed.

Bacterial spot

The risk of loss from bacterial spot occurs when susceptible cultivars are grown in light, sandy soils. There is a vast range in susceptibility to bacterial spot among cultivars. During the last several decades, more growers have been using cultivars developed for regions where bacterial spot is not a concern. This has resulted in increased losses (approaching 100 percent on highly susceptible cultivars) from bacterial spot and the use of bactericides to reduce fruit loss.

Copper-containing bactericides are used from bud swell through late bloom, and oxytetracycline is used after bloom. Also, low rates (1.0 to 0.5 ounce per acre) of metallic copper used alone or tank-mixed with oxytetracycline are used post-fruit set in the cover sprays. Use of copper in cover sprays poses a risk of phytotoxicity to foliage, which can cause premature defoliation. Alternatives to oxytetracycline and copper such as plant activators (eg, Actigard) and biologicals so far have not provided promising results.

Bacterial canker

No chemical sprays are applied solely for this disease, although copper-containing compounds may be labeled for use.

Fungicide Use Estimates for Peaches

The fungicides (and bactericides) most commonly used on peaches in North Carolina are captan (Captan 50W, Captec 4L), sulfur (wetable powder and flowable formulations), chlorothalonil (Bravo Weather Stik 6F), thiophanate-methyl (Topsin M 70WSP), propiconazole (Orbit 3.6EC and PropiMax 3.6EC), fenbuconazole (Indar 75WSP), azoxystrobin (Abound 2.08F), ziram, copper-containing materials, oxytetracycline (Mycoshield 17W). For peach scab control, captan and sulfur are used on at least 95% of the fruit bearing acreage. One to two applications of chlorothalonil are used on about 10% of the acreage for blossom blight and scab control prior to shuck split. Thiophanate-methyl is used as one to two applications tank-mixed with captan either as a bloom, shuck split, or a preharvest spray for blossom blight, scab, or brown rot control on approximately 20% of the acreage. Propiconazole is used one to two times at bloom and/or at preharvest on approximately 80% of the acreage for blossom blight and brown rot control. Fenbuconazole is used one to two times for brown rot control on approximately 10% of the acreage. The “newer” fungicides such as azoxystrobin, trifloxystrobin, and pyraclostrobin + boscalid (Pristine) are used on less than 5% of the acreage. Copper materials are used as a single dormant application for control of leaf curl (about 20% of the acreage) and bacterial spot as one to five applications on less than 5% of the acreage. Oxytetracycline is used one to five times for bacterial spot control on less than 5% of the acreage. Ziram is used as a single application for leaf curl on approximately 10% of the acreage and two to four applications for “red spot” and “sooty peach” on less than 5% of the acreage.

Current Fungicide Recommendations for Peaches

Current North Carolina Cooperative Extension Service recommendations for fungicide use on peaches (including information on formulations, application rates, and precautions/limitations) are provided in the following table from the *North Carolina Agricultural Chemicals Manual*:

Table 7-8: Peach and Nectarine Spray Guide
(<http://ipm.ncsu.edu/agchem/chptr7/708.pdf>)

Table 7-10: Relative Effectiveness of Chemicals for Disease Control on Peaches and Nectarines
(<http://ipm.ncsu.edu/agchem/chptr7/708.pdf>)

Nematodes

Nematodes are of concern where peaches are planted in light, sandy soils and in land that was previously

planted to peaches or other crops that are susceptible to root-knot nematodes. Two nematodes, root-knot and ring, are most commonly associated with damage to peach trees. The effects of root-knot are most damaging during tree establishment and can result in tree death the first or second year or trees that survive but do not become productive. The ring nematode, although not as damaging to recently planted trees as the root-knot, can predispose trees to premature death in the third or later years as part of the PTSL complex.

Nematicide Use Estimates for Peaches

Practices such as the "10-Point Management Program" are important in managing nematodes. Chemicals available are very limited. For preplant control, the nematicide of choice and the most commonly used is the fumigant dichloropropene (Telone II). Dichloropropene (used on less than 100 acres per year) is used where peaches are to be planted in sandy soils and root-knot and ring nematodes are a problem.

After the orchard is established, treatment is limited to fenamiphos (Nemacur), the only nematicide labeled for use in established peach orchards. Fenamiphos receives almost no use on peaches in North Carolina.

Current Nematicide Recommendations for Peaches

Current North Carolina Cooperative Extension Service recommendations for nematicide use on peaches (including information on formulations, application rates, and precautions/limitations) are provided in the following table from the *North Carolina Agricultural Chemicals Manual*:

Tables 7-11 and 7-12: Nematode Control on Peaches
(<http://ipm.ncsu.edu/agchem/chptr7/708.pdf>)

Weeds

There is a direct relationship between tree growth and the level of weed control. The use of herbicides has resulted in effective weed control and, consequently, has increased tree growth and/or yield. Weed control is important in newly planted as well as established orchards. In juvenile peach orchards in those years before commercial production, weed control has resulted in increased fruit production. Larger trees have initially greater fruit-producing capacity.

While weeds compete with trees for water and nutrients, they also can serve as alternate hosts for other pests. Winter annual weeds are known to harbor catfacing insects. These insects can distort fruit shape and lower quality. Controlling winter annual weeds is part of an integrated approach to managing catfacing insects.

Mechanical Control

Weeds are mechanically removed in some production regions. However, this can have undesirable effects on the trees. Clean cultivation has been shown to eliminate surface-rooting of peach trees. However, eliminating vegetation by maintaining a herbicide strip in the tree row promotes surface rooting. Cultivation also may result in increased erosion in rolling terrain and in soils with low infiltration rates.

Chemical Control

Growers make 2 to 3 herbicide applications each year. These applications consist of at least one preemergence herbicide in combination with a postemergence, nonselective herbicide, followed by additional applications as needed and a winter application of 2,4-D for broadleaf weed control. Currently, the number of herbicides registered for use in orchards is limited. Some weed species could be managed more effectively with additional herbicide registrations. The loss of any herbicide would harm the industry.

Preemergence herbicides:

Simazine (Princep and others)

This material is widely used by peach growers for preemergence weed control. It provides economical, effective preemergence broadleaf weed control. It is sometimes tank mixed with oryzalin or norflurazon for residual annual grass control.

Diuron (Karmex)

This herbicide provides residual control of annual broadleaf and grass weeds. It is sometimes tank mixed with terbacil or norflurazon for more broad spectrum control.

Terbacil (Sinbar)

Sinbar is nearly always applied as a tank mix partner with diuron. The combination of these two herbicides provide the most effective preemergence weed control of any herbicide combination in mature, producing orchards.

Norflurazon (Solicam)

Solicam is applied as a tank mix partner with simazine or diuron for expanded control of annual grasses and suppression of nutsedge.

Oryzalin (Surflan and others)

Oryzalin has long been the standard for newly planted orchards and is used in established orchards as a tank mix partner with simazine for improved preemergence control of annual grasses.

Flumioxazin (Chateau)

Flumioxazin is a new herbicide that currently is registered for use in non-bearing orchards only. It is fast becoming a popular choice for weed control in newly planted orchards. A pending registration for use in bearing orchards is expected in the future. It provides broad spectrum, long lasting residual control of annual broadleaf and grass weeds.

Postemergence herbicides

Paraquat (Gramoxone Max)

This material is another nonselective herbicide and is used to control emerged annual broadleaf and grass weeds. Paraquat also will suppress perennial weeds.

2,4-D

This material is applied to control winter annual broadleaf weeds. Winter annual weeds can harbor catfacing insects, which can cause fruit distortion and reduce fruit quality. Control with 2,4-D is part of an integrated approach to keeping these insects at bay.

Glyphosate (various formulations)

Glyphosate is used for non-selective weed control in established orchards during winter and spring. It is broad spectrum and effectively controls annual and perennial weeds postemergence.

Sethoxydim (Poast) or Fluazifop (Fusilade)

Growers use one of these two herbicides for controlling perennial grass weeds like bermudagrass or Johnsongrass. They are effective and can be used safely in orchards during the summer.

Sod-herbicide strips:

The most commonly used approach to managing weeds is the sod-herbicide strip. The area in the tree row, beneath the trees, is maintained weed free with herbicides, while the row middle is seeded in a cover crop or a permanent sod is established.

Herbicide Use Estimates for Peaches

Estimates of herbicide use are not available for peach production in North Carolina. However, herbicide use data for South Carolina are available from the U. S. Department of Agriculture's National Agricultural Statistics Service (U. S. Department of Agriculture, National Agricultural Statistics Service. 2004. Agricultural Chemical Usage: 2003 Fruit Summary. August 2004.).

Current Herbicide Recommendations for Peaches

Current North Carolina Cooperative Extension Service recommendations for herbicide use on peaches (including information on formulations, application rates, and precautions/limitations) are provided in the following table from the *North Carolina Agricultural Chemicals Manual*:

Tables 8-11B: Chemical Weed Control in Fruit Crops - Tree Fruits

(<http://ipm.ncsu.edu/agchem/chptr8/814.pdf>)

Contacts

David F. Ritchie
Extension Specialist
Department of Plant Pathology
North Carolina State University
Campus Box 7616
Raleigh, NC 27695
Telephone: (919) 515-6809
E-mail: david_ritchie@ncsu.edu

Michael L. Parker
Extension Specialist (Tree Fruit)
Department of Horticultural Science
North Carolina State University
Campus Box 7609
Raleigh, NC 27695-7609
Telephone: (919) 515-1198
E-mail: mike_parker@ncsu.edu

Kenneth A. Sorensen
Extension Specialist
Department of Entomology
North Carolina State University

Campus Box 7626
Raleigh, NC 27695-7626
Telephone: (919) 515-1662
E-mail: kenneth_sorensen@ncsu.edu

John R. Meyer
Professor
Department of Entomology
North Carolina State University
Campus Box 7613
Raleigh, NC 27695-7613
Telephone: (919) 515-1659
E-mail: john_meyer@ncsu.edu

Wayne E. Mitchem
Extension Specialist (Weed Management)
Department of Horticultural Science
North Carolina State University
Mountain Horticultural Crops Research and Extension Center
455 Research Drive
Fletcher, NC 28732
Telephone: (828) 684-3562
E-mail: wayne_mitchem@ncsu.edu

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On-Line Resources

North Carolina Peach and Nectarine Disease and Pest Management Guide
(<http://ipm.ncsu.edu/peach/NCGuide.pdf>)

Fruit/Nut Disease Information Notes
(http://www.ces.ncsu.edu/depts/pp/notes/Fruit/fruit_contents.html)

Fungicide and Nematicide Tests. Volumes 55 (year 2000) to present. APSnet.
(<http://www.apsnet.org/online/FNtests/>)

Horticultural Information Leaflets – Commercial Tree Fruits
(<http://www.ces.ncsu.edu/depts/hort/hil/trfruit-index.html>)

Peaches, Horticultural Commodity of North Carolina
(<http://www.agr.state.nc.us/markets/commodit/horticul/peaches/>)

Prepared by:

David F. Ritchie, Michael Parker, Kenneth A. Sorensen, John R. Meyer, Wayne E. Mitchem and Stephen J. Toth, Jr. (ed.)