

MINERAL NUTRITION AND MANAGEMENT

Fruit Crops Management

Hort 421/521

Spring 2008

General nutrition:

- Deckers T, Schoofs H. 2002. Nutrition practices in the Belgium fruit industry. *HortTechnology* 12(1): 32-37.
- Faust M. 1989. Nutrition of fruit trees. In: *Physiology of temperate zone fruit trees*. John Wiley & Sons, New York. Pp 53-132.
- Kramer SB, Reganold JP, Glover JD, Bohannan BJM, Mooney HA. 2006. Reduced nitrate leaching and enhanced denitrifier activity and efficiency in organically fertilized soils. *Proc Natl Acad Sci US* 103(12): 4522-4527.
- Peryea FJ. 1995. Fruit tree nutrient cycles: replacing what you took out. *Proc 91st Wash State Hort Assoc meeting*. Pp 105-110.
- Peterson AB, Stevens RG (eds). 1994. *Tree fruit nutrition – shortcourse proceedings*. Good Fruit Grower, Yakima, WA
- Stiles WC. Nitrogen management in the orchard (Chap. 4). Pp 41-50.
- Stiles WC. Phosphorus, potassium, magnesium, and sulfur soil management (Chap. 6). Pp 63-70.
- Neilsen GH. Phosphorus on replant orchards (Chap. 7). Pp 71-77.
- Neilsen GH, Neilsen D. Tree fruit zinc nutrition (Chap. 10). Pp 85-93.
- Peryea FJ. Boron nutrition in deciduous tree fruit (Chap. 11). Pp 95-99.
- Bramlage WJ. Physiological role of calcium in fruit (Chap. 12). Pp 101-107.
- Raese JT. Preharvest calcium use and effects on apples and pears (Chap. 13). Pp 109-122.
- Neilsen GH, Parchomchuk P, Neilsen D. Fertigation of fruit trees: The B.C. experience (Chap. 21). Pp 191-199.
- Reganold JP, Glover JD, Andrews PK, Hinman HB. 2001. Sustainability of three apple production systems. *Nature* 410: 926-930.
- Shear CB, Faust M. 1980. Nutritional ranges in deciduous tree fruits and nuts. *Horticultural Reviews* 2: 142-163.
- Swietlik D. 2002. Zinc nutrition of fruit crops. *HortTechnology* 12(1): 45-50.
- Swietlik D, Faust M. 1984. Foliar nutrition of fruit crops. *Horticultural Reviews* 6: 287-355.
- Tagliavini M, Marangoni B. 2002. Major nutritional issues in deciduous fruit orchards of northern Italy. *HortTechnology* 12(1): 26-31.

Apples and pears:

- Batjer LP, Rogers BL, Thompson AH. 1952. Fertilizer applications as related to nitrogen, phosphorus, potassium, calcium and magnesium utilization by apple trees. *Proc Amer Soc Hort Sci* 60: 1-6.
- Bramlage WJ, Drake M, Lord WJ. 1980. The influence of mineral nutrition on the quality and storage performance of pome fruits grown in North America. In: Atkinson D, Jackson JE, Sharples RO, Waller WJ (eds). *Mineral nutrition of fruit trees*. Butterworths, Sevenoaks, United Kingdom. Pp 29-39.

- Cheng L, Dong S, Fuchigami LH. 2002. Urea uptake and nitrogen mobilization by apple leaves in relation to tree nitrogen status in autumn. *J Hort Sci Biotechnol* 77: 13-18.
- Cheng L, Fuchigami LH. 2002. Growth of young apple trees in relation to reserve nitrogen and carbohydrates. *Tree Physiol* 22(18): 1297-1303.
- Dong S, Cheng L, Scagel CF, Fuchigami LH. 2003. Root damage affects nitrogen uptake and growth of young Fuji/M.26 apple trees. *J Hort Sci Biotechnol* 78(3): 410-415.
- Dong S, Cheng L, Scagel CF, Fuchigami LH. 2004. N uptake, soil retention and loss of soil-applied $^{15}\text{NH}_4$ $^{15}\text{NO}_3$ in young Fuji/M.26 apple trees with different N status. *J Hort Sci Biotechnol* 79(3): 395-399.
- Dong S, Cheng L, Scagel CF, Fuchigami LH. 2005. Timing of urea application affects leaf and root N uptake in young Fuji/M.9 apple trees. *J Hort Sci Biotechnol* 80(1): 116-120.
- Dong S, Shu H. 2004. Sheep manure improves the nutrient retention capacity of apple orchard soils. *Acta Hort* 638: 151-155.
- Ebel RC, Caylor AW, Pitts JA, Wilkins BS. 2000. Mineral nutrition during establishment of Golden Delicious 'Smoothie' apples on dwarfing rootstocks and interstems. *J Plant Nutrition* 23(8): 1179-1192.
- Fallahi E, Colt WM, Fallahi B, Chun I-J. 2002. The importance of apple rootstocks on tree growth, yield, fruit quality, leaf nutrition, and photosynthesis with an emphasis on 'Fuji'. *HortTechnology* 12(1): 38-44.
- Forge TA, Hogue E, Neilsen G, Neilsen D. 2003. Effects of organic mulches on soil microfauna in the root zone of apple: implications for nutrient fluxes and functional diversity of the soil food web. *Applied Soil Ecol* 22: 39-54.
- Jackson JE, Palmer JW, Perring MA, Sharples RO. 1977. Effects of shade on growth and cropping of apple trees. III. Effects on fruit growth, chemical composition and quality at harvest and after storage. *J Hort Sci* 52: 267-282.
- Karlidag H, Esitken A, Turan M, Sahin F. 2007. Effects of root inoculation of plant growth promoting rhizobacteria (PGPR) on yield, growth and nutrient element contents of leaves of apple. *Sci Hort* 114: 16-20.
- Merwin IA, Stiles WC, van Es HM. 1994. Orchard groundcover management impacts on soil physical properties. *J Amer Soc Hort Sci* 119: 209-215.
- Neilsen GH, Hogue EJ, Meheriuk M. 1999. Nitrogen fertilization and orchard-floor vegetation management affect growth, nutrition and fruit quality of Gala apple. *Can J Plant Sci* 79(3): 379-385.
- Neilsen D, Millard P, Neilsen GH, Hogue EJ. 1997. Sources of N for leaf growth in a high-density apple (*Malus domestica*) orchard irrigated with ammonium nitrate solution. *Tree Physiol* 17: 733-739.
- Neilsen D, Neilsen GH. 2002. Efficient use of nitrogen and water in high-density apple orchards. *HortTechnology* 12(1): 19-25.
- Neilsen GH, Neilsen D. 2003. Nutritional requirements of apple. In: Ferree DC, Warrington IJ (eds). *Apples: Botany, production and uses*. CABI Publ., Wallingford, United Kingdom. Pp 267-302.
- Neilsen GH, Neilsen D, Hogue EJ, Herbert LC. 2004. Zinc and boron nutrition management in fertigated high density apple orchards. *Can J Plant Sci* 84: 823-838.
- Oliveira MT, Merwin IA. 2001. Soil physical conditions in a New York orchard after eight years under different groundcover management systems. *Plant & Soil* 234: 233-237.

- Palmer JW, Dryden G. 2006. Fruit mineral removal rates from New Zealand apple (*Malus domestica*) orchards in the Nelson region. *New Zealand J Crop Hortic Sci* 34: 27-32.
- Peryea FJ. 1995. Think zinc! *Good Fruit Grower* 46(3): 33-35 (Feb 1).
- Peryea JF. 2005. Comparison of commercial boron spray products applied at the pink flowering stage on 'Fuji' apple. *HortScience* 40(5): 1487-1492.
- Raese T. 1995. Tree fruit nutrition II: Soil pH and apple tree growth. *Good Fruit Grower* 46(5): 42-44 (March 1).
- Raese T. 1995. Effects of calcium sprays and nitrogen fertilizers on apple and pear. Proc 91st Wash State Hort Assoc meeting. Pp 111-128.
- Raese JT. 1998. Response of apple and pear trees to phosphate fertilization: A compendium. *Commun Soil Sci Plant Anal* 29(11-14): 1799-1821.
- Raese T. 1999. Apple and pear trees respond to NPK fertilizers. *Good Fruit Grower* 50(2): 36-41 (Jan 15).
- Raese T. 1999. Soil pH and bitter pit in apples. *Good Fruit Grower* 50(9): 15-16 (May 1).
- Raese T. 1999. Calcium enhances condition of stored d'Anjou pears. *Good Fruit Grower* 50(14): 32-33 (Sept).
- Raese T, Drake SR. 1997. Calcium sprays, harvest, and storage impacts on pear. *Good Fruit Grower* 48(17): 70-73 (Dec).
- Raese JT, Drake SR. 2000. Effect of calcium spray materials, rate, time of spray application, and rootstocks on fruit quality of 'Red' and 'Golden Delicious' apples. *J Plant Nutrition* 23(10): 1435-1447.
- Rogers BL, Batjer LP, Thompson AH. 1953. Seasonal trends of several nutrient elements in 'Delicious' apple leaves expressed as a percent and unit area basis. *Proc Amer Soc Hort Sci* 61: 1-5.
- Sanchez E. 1995. Developing a nutrition program for new orchards. *Good Fruit Grower* 46(8): 45-46 (April 15).
- Sanchez E. 1995. Postharvest zinc sprays: are they effective? *Good Fruit Grower* 46(16): 52-53 (Nov).
- Sharples RO. 1980. The influence of orchard nutrition on the storage quality of apples and pears grown in the United Kingdom. In: Atkinson D, Jackson JE, Sharples RO, Waller WJ (eds). *Mineral nutrition of fruit trees*. Butterworths, Sevenoaks, United Kingdom. Pp 17-28.
- Tartachnyk II, Blanke MM. 2006. Effect of delayed fruit harvest on photosynthesis, transpiration and nutrient remobilization of apple leaves. *New Phytologist* 164: 441-450.
- Toselli M, Flore JA, Zavalloni C, Marangoni B. 2000. Nitrogen partitioning in apple trees as affected by application time. *HortTechnology* 10(1): 136-141.
- Toselli M, Thalheimer M, Tagliavini M. 2004. Leaf uptake and subsequent partitioning of urea-N as affected by the concentration and volume of spray solution and by the shoot leaf position in apple (*Malus domestica*) trees. *J Hort Sci Biotechnol* 79(1): 97-100.
- Tromp J. 1983. Nutrient reserves in roots of fruit trees, in particular carbohydrates and nitrogen. *Plant & Soil* 71: 401-413.
- Vedina O, Toma S. 2000. Forms of microelements in apple leaves under different conditions of iron and zinc nutrition. *J Plant Nutrition* 23(8): 1135-1143.
- Walsh BD, MacKenzie AF, Buszard DJ. 1996. Soil nitrate levels as influenced by apple orchard floor management systems. *Can J Soil Sci* 76: 343-349.

Cherries and stone fruits:

- Christiansen MD, Walker DR. 1964. Leaf analysis techniques and survey result on sweet cherries in Utah. Proc Amer Soc Hort Sci 85: 112-117.
- Esitken A, Pirlak L, Turan M, Sahin F. 2006. Effects of floral and foliar application of plant growth promoting rhizobacteria (PGPR) on yield, growth and nutrition of sweet cherry. Sci Hort 110: 324-327.
- Hansen M. 1997. Less nitrogen proves beneficial in stone fruit. Good Fruit Grower 48(8): 29-30 (April 15).
- Melakeberhan H, Bird GW, Jones AL. 2001. Soil pH affects nutrient balance in cherry rootstock leaves. HortScience 36(5): 916-917.
- Neilsen GH, Neilsen D, Kappel F, Toivonen P. 2005. Nutrient and water management of high density sweet cherry. Acta Hort 667(2): 337-344.

Grapes:

- Delgado R, Martín P, del Álamo M, González M-R. 2004. Changes in the phenolic composition of grape berries during ripening in relation to vineyard nitrogen and potassium fertilisation rates. J Sci Food Agric 84: 623-630.
- Olalla M, Fernández J, Cabrera C, Navarro M, Giménez R, López MC. 2004. Nutritional study of copper and zinc in grapes and commercial grape juices from Spain. J Agric Food Chem 52: 2715-2720.
- Peyrot des Gachons C, Van Leeuwen C, Tominaga T, Soyer J-P, Gaudillère J-P, Dubourdieu D. 2005. Influence of water and nitrogen deficit on fruit ripening and aroma potential of *Vitis vinifera* L cv Sauvignon blanc in field conditions. J Sci Food Agric 85: 73-85.
- Sivilotti P, Bonetto C, Paladin M, Peterlunger E. 2005. Effect of soil moisture availability on Merlot: From leaf water potential to grape composition. Am J Enol Vitic 56(1): 9-18.
- Volder A, Smart DR, Bloom AJ, Eissenstat DM. 2005. Rapid decline in nitrate uptake and respiration with age in fine lateral roots of grape: implications for root efficiency and competitive effectiveness. New Phytologist 165: 493-502.