Container Nursery Nitrate Nitrogen Runoff: A Six-State Summary

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INTRODUCTION

The environmental awareness of society necessitates that nursery operators understand and justify the nutrient management strategies used in production of container-grown plants. Due to the large amount of fertilizer used in container-plant production, nutrient runoff is a potential source of surface and groundwater pollution. Wright and Yeager (1980) have demonstrated that NO_3-N leaches from a pine bark medium fertilized with ammonium nitrate and Yeager et al. (1980) determined that 'Helleri' holly grown in a pine bark medium and fertilized once a week with 300 ppm nitrogen (N) in the irrigation water utilized 19% of the N applied. In further studies by Yeager (unpublished) 31% of N, surface-applied as Osmocote (18-6-12), was used by dwarf yaupon holly (plant plus medium) grown in a greenhouse for 26 weeks. Hershey and Paul (1982) evaluated N loss from chrysanthemum containers fertilized with a surface application of Osmocote (14-14-14) and found that 15% to 29% of the N released from Osmocote leached in 11 weeks. These laboratory and greenhouse studies indicated that NO_3-N leaches from the growth medium; however, data are not available that document the loss of NO_3-N from the plant production area. Thus, the impact of container plant production on surface or groundwater pollution is not known. A study was conducted in 1990 to survey NO_3-N concentrations of container plant production

area bed runoff, reservoirs or ponds that contained runoff, wells on nursery property, and surface water discharged from the property or border.

PROCEDURES

Two or three samples were taken at each collection point that included bed runoff, reservoirs or ponds containing runoff water, wells, and property borders. Samples were collected at approximately 6-week intervals during the 1990 growing season in the states of Alabama, Florida, New Jersey, North Carolina, Ohio, and Virginia. In each state one to five nurseries were sampled that used either controlled-release fertilizers or controlled-release fertilizers supplemented with solution fertilizer in the irrigation water. Controlled-release fertilizers used at these nurseries included those in which nitrogen release was influenced by substrate moisture, temperature, or biological activity. Container plants grown at the nurseries sampled generally included one-, 2-, and 3-gal hollies, junipers, and azaleas as well as a few deciduous plants at some locations.

SUMMARY OF RESULTS

Data averaged over sampling time and nurseries in each state indicated that runoff from production beds where only controlled-release fertilizers were used had an average NO_3-N level of 8 ppm with a maximum of 33 ppm recorded. Samples obtained within a few weeks of fertilization usually contained the highest NO_3-N concentrations, while samples obtained several months after fertilization were usually below 10 ppm NO_3-N, the federal drinking water standard (Anon., 1982). This does not mean that all controlled-release fertilizers resulted in runoff NO_3-N levels greater than 10 ppm immediately following fertilization; however, the time of sampling relative to fertilizer application is an important consideration in interpreting results for production-bed runoff.

Controlled-release fertilizers supplemented with solution fertilizers resulted in average bed runoff of 20 ppm NO_3-N with a maximum of 135 ppm recorded. Nitrate N concentrations in surface reservoirs that contained runoff from areas fertilized with controlled-release fertilizer and controlled-release supplemented with solution fertilizer averaged 4 and 6 ppm, respectively, with a maximum of 20 and 23 ppm, respectively. Nitrate N in surface water leaving the property averaged 5 ppm for both fertilization programs with a maximum of 20 and 30 ppm, respectively, recorded for water leaving the property of nurseries using controlled-release fertilizer supplemented with solution fertilizer and nurseries using only controlled-release fertilizer. Average and maximum NO_3-N of well water for nurseries using only controlled-release fertilizer and nurseries using controlled-release and supplemental solution fertilizers were 5 and 7 ppm and 17 and 55 ppm, respectively.

These data provide a benchmark for developing and implementing efficient management practices and fertility regimes that minimize nutrient loss from the nursery producing container-grown woody ornamental plants. Considerable research is needed to provide specific recommendations for using fertilizer efficiently in the nursery.

Based on these data and our experiences with nutrient management, we recommend the following management practices.

1) Monitor NO_3-N levels of the container medium, production-bed runoff, well

water, runoff water in collection reservoirs, and water discharged from the property. Maintain records and develop a data base of information to justify changes in the fertility program.

2) Monitor irrigation duration. Excess irrigation can contribute to NO_3-N runoff.

3) Determine efficiency of irrigation systems and modify systems as needed to improve efficiency.

4) If controlled-release fertilizers result in excessive NO_3-N levels in runoff immediately following fertilizer application, consider applying controlled-release fertilizers to beds or crops sequentially over an extended period of time rather than fertilizing all plants within a runoff area within a short time.

5) If you use reservoirs to capture runoff and rain water, you may need to line reservoirs and ditches to prevent groundwater contamination. Several connected reservoirs may facilitate more biological degradation than a single reservoir.

6) Use grass filter strips in surface waterways.

7) Calibrate spreaders and other fertilizer application equipment.

8) Place solution fertilizer tanks on concrete aprons that surround the tank and will contain spills. Check specific state regulations regarding construction details.

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