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2807 Binion Road  
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## Effects of N and K Ratios on Growth of Holly Fern (*Cyrtomium falcatum*)

C.A. Conover and K. Steinkamp

Holly fern, (*Cyrtomium falcatum*), are grown by the foliage plant industry in central Florida for use in landscape plantings, interiorscape beds and as potted specimen plants. Holly fern were not included in the extensive research that produced our fertilizer recommendations for production of acclimatized foliage plants. In 1990, our research showed use of a 3:1:2 N-P-K fertilization ratio for production of most acclimatized foliage plants when using soilless media. However, there are some exceptions to this general rule. In two different experiments, maidenhair fern (*Adiantum raddianum* K. Presl) and bird's-nest fern (*Asplenium nidus* L.) grew better when plants received more K compared with N (Poole and Conover, 1982; Poole and Conover, 1978). The following experiment was conducted to find the optimum N:K ratio, N rate and K rate for production of quality holly fern.

On November 8, 1994, small holly fern plants growing in 72-cell pack trays were transplanted into 6-

inch (15-cm) standard tub pots using Fafard #4 growing medium amended with 1 lb/yd<sup>3</sup> (.593 kg/m<sup>3</sup>) Micromax. Plants were maintained in a greenhouse where maximum light intensity was about 1500 ft-c (285  $\mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$ ) and air temperatures ranged from 65 to 90°F (18 to 32°C).

Sixteen treatments consisting of 4 nitrogen (N) rates (600, 1200, 1800 or 2400 lbs/A/yr) were combined with 4 potassium (K) rates (600, 1200, 1800 or 2400 lbs/A/yr) in a factorial experiment, with six replications per treatment. Fertilizer treatments began on November 15, 1994, and plants were fertilized weekly with 100 ml (3.4 oz) liquid feed made from concentrated stock solutions. All fertilizer formulations tested contained phosphorus at 400 lb/A/yr.

Plant height and width were measured on November 16, 1994, again on February 15, 1995, after three months of growth, and for the final time on May 19, 1995, after six months growth. The plants were visually graded on May 16, 1995. Electrical conductivity and the pH of leachate collected from the container growing medium were determined after three and six months of growth. The experiment ended on May 19, 1995.

## Results

Both growth and quality improved greatly when the nitrogen rate was increased from 600 to 1200 lbs/A/yr. Further increases in N rate produced smaller plants with little improvement in plant quality. Holly fern quality, as reflected by plant grade, was not influenced by potassium fertilization, but plants getting the high K rate were smaller compared with plants receiving less K. Interaction of N and K fertilizer treatments did not significantly affect plant quality, growth, or pH and electrical conductivity levels in growing medium leachate.

As nitrogen rate increased, the pH of growing medium leachate decreased. After three months growth the electrical conductivity of growing medium leachate showed an increase as N rate increased, but after six months growth, this effect disappeared. Potassium did not affect pH of growing medium leachate but the electrical conductivity of the leachate increased as K rate increased.

For production of good quality plants and to reduce excess fertilizer ion accumulation in growing medium, N fertilization rate should not exceed 1200 lb/A/yr. Since application of more than 1200 lb/A/yr N, did not improve plant growth and quality, and high K rates slowed plant growth, we recommend use of a standard 3:1:2 ratio fertilizer for holly fern.

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**Table 1.** Effects of nitrogen (N) or Potassium (K) fertilization rate on growth and plant of holly fern.

N rate, g/6-inch pot/yr	Growth <sup>Z</sup> (cm) Feb 15	Growth (cm) May 19	Plant grade <sup>Y</sup>
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1.39	23.0	36.8	3.2
2.46	23.0	41.4	4.1
4.17	22.0	39.4	4.5
5.56	20.0	38.3	4.4
Significance <sup>X</sup>			
linear	**	ns	**
quadratic	ns	**	**
cubic	ns	*	ns
K rate, g/6-inch pot/yr			
1.39	22.2	39.7	4.0
2.46	23.1	39.9	4.1
4.17	21.4	39.1	4.0
5.56	20.7	37.1	4.1
Significance <sup>X</sup>			
linear	ns	*	ns

<sup>Z</sup>Plant size was defined using the formula: (height + width + width) ÷ 2) ÷ 2). Initial size, measured on November 16, 1994, average 10.6 cm. Size after three months of plant growth was measured on February 15, 1995 and size after six months of plant growth was measured on May 19, 1995. Plant growth on February 15 was determined using formula: Plant size after three months growth - initial plant size = growth. Plant growth on May 19, 1995 was determined using the formula: plant size after six months growth - initial size = growth.

<sup>Y</sup>Plants were graded based on a scale of 1 = dead, 2 = poor quality, usable, 3 = fair quality, salable, 4 = good quality, and 5 = excellent quality, on May 16, 1995.

<sup>X</sup>ns, \*, \*\*; Nonsignificant at P = 0.05 or significant at P = 0.01, respectively.

**Table 2.** Effects on nitrogen (N) or Potassium (K) fertilization rate on pH and electrical conductivity of growing medium leachate collected from containers on holly fern<sup>Z</sup>.

N rate, g/15-cm pot/yr	pH		EC (µmhos/cm)	
	1.39	6.0	6.2	2926

2.46	5.6	6.2	4713	1664
4.17	5.2	6.0	7214	1554
5.56	4.9	5.2	8145	2404
Significance <sup>Y</sup>				
linear	*	*	*	ns
quadratic	*	*	ns	ns
cubic	ns	ns	ns	ns
K rate,g/15-cm pot/yr				
1.39	5.4	5.9	3982	1184
2.46	5.4	5.9	5668	1555
4.17	5.4	5.9	6468	1667
5.56	5.5	5.9	6797	2857
Significance <sup>Y</sup>				
linear	ns	ns	**	**

<sup>Z</sup>Electrical conductivity and pH levels of growing medium leachate collected from containers of holly fern were determined from leachate collected on February 17, 1995, after three months growth, and on May 18, 1995, after six months plant growth.

<sup>Y</sup>ns, \*\*; Nonsignificant or significant at P = 0.01, respectively.

## References

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