# Potential for Phytotoxicity of Pennant Magnum 7.62 EC (S-Metolachlor) On Red Hot Poker (*Kniphofia uvaria* 'Border Ballet')

By

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Project: Interregional Research Project #4
Project Number 23838A – June 22, 2004

Acknowledgements: Ahmet Gulcu

Donors/Supporters:
Yoder Bros./Green Leaf Perennials, Lancaster, PA

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| PR.NO. : | 23838A |
| TRIAL: | 1 |
| DATE: | 6/22/04 |

## IR-4 ORNAMENTAL DATA REPORTING FORM

| | |
|---|---|
| **Investigator** (Name, Address, Phone#, e-mail, etc) | Dr. Heiner Lieth<br>Department of Plant Sciences<br>University of California<br>One Shields Ave.<br>Davis, CA 95616<br>Ph 530-752-7198<br>FAX 530-752-1819<br>Email: jhlieth@ucdavis.edu |
| **Location of Trial** | University of California, Davis CA |
| **TRIAL TYPE:** (field, container, greenhouse, etc) | Field Container |
| **Chemical - Common Name** | S-Metolachlor |
| **- Formulation** | EC, 7.62 lb. a.i./gal |
| **- Batch Number** | |
| **- Product** | Pennant Magnum 7.62 EC |
| **- EPA Registration Number** | 100-950 |
| **- Manufacture** | Syngenta |
| **USE INFORMATION**<br>**- Plant Common Name** | Red Hot Poker |
| **- Plant Scientific Name** | *Kniphofia uvaria* 'Border Ballet' |
| **- Pest (s)** | Weeds |
| **Soil Type or Type of Potting Mix:** | **UC Mix**<br>**a)%Sand: 30 b)%Silt: c)%Clay: d)%OM: 70 e)%pH: 6.5** |
| **Enter each DATE for:** | **Seedling: Emergence: Transplanting: 3/22/04** |
| **Enter each SPACING for:** | **Plant or Pot: 6 inches Row: 6 inches** |
| **Enter each SIZE for:** | **Pot: 4-inch Plot: 50 sq ft** |
| **Experimental Design:** | Randomized complete block (3 blocks X 4 reps) |
| **Number of Reps:** | 12 reps total for each treatment |

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## APPLICATION PARAMETERS

| | |
|---|---|
| **Type of Application:** (aerial, ground, foliar, drench, ppi, chemigation, broadcast, directed, etc) | Foliar spray |
| **Number of Applications:** | 2, 30 days apart |
| **Application Type:** | Manual spray bottle |
| **Nozzle Type/Size:** | |
| **Nozzle Pressure:** | |
| **Delivery Rate:** | |
| **Calibration Date(s):** | |

## APPLICATION SUMMARY

| APPLICATION DATE | RATES (a.i./A) (Be sure to provide units) | Brief Description of Growth Stage (Dormant, New Growth Present, Bud, etc) |
|---|---|---|
| 5/11/04 | 0, 2.1, 4.2, 8.4 lb. a.i./A | 7 weeks post- transplant, actively growing |
| 6/10/04 | 0, 2.1, 4.2, 8.4 lb. a.i./A | 11 weeks post- transplant, actively growing |

**RAINFALL/IRRIGATION RECORDS:** INCLUDE RAINFALL/IRRIGATION INFORMATION (printouts, IR-4 forms, etc.)
See Table 1

## OTHER PESTICIDES, FERTILIZER, LIME AND ADJUVANTS USED:

| PRODUCT | AMOUNT | DATE |
|---|---|---|
| Osmocote 19-6-12 | 3 grams per 4-inch pot | 5/10/04 |

**NARRATIVE SUMMARY OF METHODS AND RESULTS: (Use more pages if needed)**

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## Materials and Methods

***Plant Material and Culture*.** Young plants of *Kniphofia uvaria* 'Border Ballet' were received from Yoder Bros. on March 15, 2004. These were transplanted to 4-inch pots containing UC Mix on March 22, 2004 and maintained in a greenhouse under natural day length for 7 weeks until the experiment began on May 11, 2004. For the experiment, the plants were transferred to a 60% shade house in the outdoor nursery at the Environmental Horticulture Dept. at UC Davis. The plants were watered as needed (at least once daily) during the 6-week experiment with tap water. Fertilizer in the form of Osmocote (19-6-12) was added at the rate of 3 grams per 4-inch pot on May 10, 2004. Environmental conditions during the 6-week experiment from May 11, 2004 to June 22, 2004 are summarized in Table 1 as data recorded at the nearest CIMIS (California Irrigation Management Information System) station (Davis #6).

***Experimental Procedure*.** Forty-eight plants were randomly chosen and individually tagged for treatment with 0, 2.1 lb/A (1X), 4.2 lb/A (2X) or 8.4 lb/A (4X) Pennant Magnum 7.62 EC (s-Metolachlor) with 12 replicates per treatment. These dosages were prescribed in IR4 Ornamental Protocol 001 dated 3/04 (Appendix A). The plants received the first of two foliar spray applications of the material on May 11, 2004. The second application was made 30 days later on June 10, 2004 using the same method. The plants were arranged in a randomized complete block design with 3 blocks and 4 treatment replicates per block. Phytotoxicity ratings and plant height were taken at days 0, 7, 14, 30 and 42 (June 22, 2004). Visual phytotoxicity evaluations were based on a numerical rating scale ranging from 0 (no injury) to 10 (complete kill) (Table 2). Plant height (cm) was measured from the container soil surface to the top of the canopy.

***Statistical Analysis.*** For each variable, the change in the variable from the start of the experiment was computed. Statistical analyses were carried out on these variables to determine if the application of herbicide affected growth and phytotoxicity index values.

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## Results

***Phytotoxicity.*** Phytotoxicity index values averaged less that 0.2 for all treatments at all observation dates (Table 3, Figure 1, Appendix B).

***Plant size.*** The height of *Kniphofia* plants increased by 13.6 to 18.2 cm over the course of the experiment (Table 3, Figures 1 and 2, Appendix C). There were no treatment effects of the herbicide Pennant Magnum on plant height at any time during the study.

## Discussion

Pennant Magnum caused no phytotoxicity on *Kniphofia* at any of the concentrations tested. There was also no reduction in growth due to the application of this product.

**GOOD RESEARCH PRACTICE STATEMENT:**

**I acknowledge that I have read and followed the IR-4 Research protocol and completed this trial following good agricultural practice, or reported any deviations (note any changes from authorized protocol in narrative).**

**SIGNATURE (PRINCIPAL INVESTIGATOR)** _____

**Date Completed:**

**If submitted, using e-mail, please provide e-mail address and send confirming receipt.**

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**Table 1. Environmental conditions during the phytotoxicity trial of Pennant Magnum 7.62 EC on *Kniphofia uvaria* 'Border Ballet'. Data recorded at the nearest CIMIS station (Davis #6).**

| Date | CIMIS ETo (in) | Precip (in) | Sol Rad (Ly/day) | Avg Vap (mBars) | Max Air Temp (°F) | Min Air Temp (°F) | Avg Air Temp (°F) | Max Rel Hum (%) | Min Rel Hum (%) | Avg Rel Hum (%) | Dew Pt (°F) | Avg wSpd (MPH) | Wnd Run (miles) | Avg Soil Temp (°F) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5/12/2004 | 0.28 | 0 | 669 | 7.8 | 81.8 | 54 | 66.4 | 67 | 19 | 35 | 38.1 | 7.7 | 186 | 57.8 |
| 5/13/2004 | 0.24 | 0 | 661 | 10.8 | 82.9 | 46.7 | 65.1 | 86 | 17 | 51 | 46.7 | 4.3 | 103.4 | 58.4 |
| 5/14/2004 | 0.24 | 0 | 630 | 11.2 | 85.2 | 47.4 | 66.3 | 87 | 26 | 51 | 47.5 | 4.3 | 104.7 | 58.9 |
| 5/15/2004 | 0.23 | 0 | 591 | 12 | 82.2 | 52.3 | 66.5 | 79 | 36 | 54 | 49.4 | 5 | 120.1 | 59.3 |
| 5/16/2004 | 0.26 | 0 | 650 | 10.6 | 81.4 | 51.1 | 65.4 | 79 | 28 | 50 | 46.1 | 6.7 | 161.1 | 59.6 |
| 5/17/2004 | 0.25 | 0 | 656 | 10.8 | 73.2 | 50.3 | 60.5 | 82 | 42 | 60 | 46.5 | 9.9 | 239.4 | 58.5 |
| 5/18/2004 | 0.22 | 0 | 651 | 10.4 | 74.8 | 48 | 61.6 | 88 | 30 | 55 | 45.5 | 4.4 | 106.9 | 58.2 |
| 5/19/2004 | 0.24 | 0 | 638 | 11 | 78.5 | 46.8 | 63.9 | 86 | 35 | 54 | 47 | 5.6 | 134.2 | 58.7 |
| 5/20/2004 | 0.23 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/21/2004 | 0.23 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/22/2004 | 0.23 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/23/2004 | 0.24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/24/2004 | 0.24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/25/2004 | 0.24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/26/2004 | 0.24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/27/2004 | 0.24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/28/2004 | 0.24 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/29/2004 | 0.25 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/30/2004 | 0.25 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/31/2004 | 0.25 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/1/2004 | 0.25 | 0 | 845 | 12 | 91.7 | -- | 81.8 | 84 | 21 | 32 | 49.3 | 4.8 | 115.8 | -- |
| 6/2/2004 | 0.27 | 0 | 685 | 13.3 | 91.7 | 55.1 | 72.8 | 81 | 24 | 48 | 52.2 | 4.3 | 103 | 60.8 |
| 6/3/2004 | 0.24 | 0 | 646 | 12.9 | 87 | 52.7 | 68.3 | 86 | 31 | 55 | 51.4 | 5 | 119.7 | 61.4 |
| 6/4/2004 | 0.24 | 0 | 634 | 12.8 | 87.8 | 50.3 | 68.3 | 88 | 34 | 54 | 51 | 4.5 | 109 | 61.6 |
| 6/5/2004 | 0.25 | 0 | 665 | 12.7 | 88.9 | 49.9 | 70.5 | 73 | 30 | 50 | 50.9 | 4.1 | 99 | 61.9 |
| 6/6/2004 | 0.3 | 0 | 682 | 11.1 | 90.7 | 58.2 | 74.2 | 72 | 23 | 38 | 47.2 | 6.1 | 148.2 | 62.5 |
| 6/7/2004 | 0.27 | 0 | 695 | 10 | 81.2 | 50 | 66.3 | 81 | 21 | 45 | 44.4 | 6.1 | 148.4 | 61 |
| 6/8/2004 | 0.23 | 0 | 641 | 9.1 | 74.9 | 49 | 62.3 | 79 | 31 | 48 | 42.2 | 4.6 | 111.6 | -- |
| 6/9/2004 | 0.25 | 0 | 661 | 11.3 | 78.7 | 46.7 | 63.5 | 86 | 35 | 56 | 47.8 | 6.5 | 156.1 | -- |
| 6/10/2004 | 0.23 | 0 | 669 | 12.6 | 79.3 | 51.5 | 64.6 | 85 | 37 | 61 | 50.8 | 5.4 | 130.8 | -- |
| 6/11/2004 | 0.25 | 0 | 672 | 11.8 | 83.1 | 50.2 | 67.3 | 86 | 26 | 52 | 48.9 | 4.1 | 99.5 | -- |
| 6/12/2004 | 0.25 | 0 | 666 | 12.4 | 87.6 | 52.2 | 70.1 | 83 | 27 | 49 | 50.2 | 4.4 | 106.2 | -- |
| 6/13/2004 | 0.26 | 0 | 674 | 13 | 89.6 | 54.3 | 72.6 | 76 | 27 | 48 | 51.5 | 3.8 | 92.2 | 60.9 |
| 6/14/2004 | 0.33 | 0 | 680 | 11.9 | 95.9 | 58 | 77.1 | 78 | 14 | 38 | 49.2 | 6.6 | 160.1 | 61 |
| 6/15/2004 | 0.39 | 0 | 681 | 10.5 | 97.7 | 67.7 | 83.5 | 49 | 17 | 27 | 45.7 | 9.5 | 228.4 | -- |
| 6/16/2004 | 0.33 | 0 | 873 | 12.9 | 94.6 | -- | 80.7 | 64 | 22 | 36 | 51.4 | 8.3 | 200.1 | 60.9 |
| 6/17/2004 | 0.28 | 0 | 759 | 13.2 | 81.6 | 56.3 | 67.5 | 75 | 40 | 57 | 51.9 | 7.4 | 179.5 | 60.6 |
| 6/18/2004 | 0.27 | 0 | 755 | 13.3 | 83.6 | 52.8 | 67 | 84 | 32 | 59 | 52.1 | 6.6 | 158.8 | 60.8 |
| 6/19/2004 | 0.27 | 0 | 758 | 13.8 | 83.1 | 52.1 | 66.9 | 85 | 38 | 61 | 53.2 | 5.9 | 142.6 | 61.2 |
| 6/20/2004 | 0.27 | 0 | 742 | 13.7 | 87.2 | 51.9 | 68.2 | 86 | 33 | 58 | 53 | 5.4 | 129.3 | 61.9 |
| 6/21/2004 | 0.28 | 0 | 732 | 14.2 | 88.3 | 53.7 | 70 | 83 | 35 | 57 | 53.9 | 5.9 | 142.2 | 62.4 |
| 6/22/2004 | 0.27 | 0 | 736 | 13.9 | 84 | 55.1 | 67.7 | 83 | 39 | 60 | 53.3 | 7 | 169.4 | 62.5 |
| 6/23/2004 | 0.28 | 0 | 723 | 13.2 | 87.3 | 53.1 | 67.9 | 86 | 29 | 57 | 51.8 | 6.6 | 159.5 | 62.4 |
| 6/24/2004 | 0.28 | 0 | 742 | 12.7 | 87.4 | 53.9 | 69.4 | 82 | 30 | 52 | 50.8 | 5.5 | 133.4 | 62.5 |

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**Table 2. Numerical plant damage rating scale used for phytotoxicity determinations.**

| Rating | Description of plant damage |
|---|---|
| 0 | No damage |
| 1 | No visible damage but unintended (non-permanent) impact |
| 2 | Slight leaf/tissue damage (curling leaves, necrosis, etc.) |
| 3 | Marginal chlorosis on some leaves (damage on up to 10% of plant) |
| 4 | 10% – 20% of plant damaged |
| 5 | Significant damage to much of plant (30% - 40%) |
| 6 | 40% – 60% of plant damaged |
| 7 | Chlorosis or necrosis on most of plant (60% - 70%) |
| 8 | Abscised leaves, branch dieback |
| 9 | Tissue severely damaged (80% - 100% of plant) |
| 10 | Complete kill |

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**Table 3. Summary of results for *Kniphofia uvaria* *'Border Ballet'* treated with 0, 2.1, 4.2 or 8.4 lb./A Pennant Magnum 7.62 EC. Cumulative changes over time are reported for phytotoxicity index, plant height, plant width and volume index. Different letters within a column indicate significant differences between treatments (P < 0.05). "Yes"/"No" refers to significant treatment effects at the 5% level. Means ± SE (n = 12).**

**Herbicide: Pennant**

Phytotoxicity Increase after:

| Treatment | 1 week | no | 2 weeks | no | 4 weeks | no | 6 weeks | no |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a |
| 1X | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a |
| 2X | 0.00 ± 0.00 | a | 0.17 ± 0.17 | a | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a |
| 4X | 0.00 ± 0.00 | a | 0.17 ± 0.17 | a | 0.00 ± 0.00 | a | 0.00 ± 0.00 | a |

Height Increase after:

| Treatment | 1 week | yes | 2 weeks | no | 4 weeks | no | 6 weeks | no |
|---|---|---|---|---|---|---|---|---|
| 0 | 8.33 ± 2.48 | a | 7.67 ± 2.44 | a | 11.42 ± 2.48 | a | 17.25 ± 2.06 | a |
| 1X | 1.33 ± 1.62 | b | 4.25 ± 1.71 | a | 9.08 ± 3.47 | a | 13.63 ± 3.33 | a |
| 2X | 3.92 ± 1.22 | ab | 5.00 ± 2.72 | a | 8.83 ± 2.60 | a | 18.17 ± 2.52 | a |
| 4X | 3.63 ± 1.19 | ab | 6.08 ± 2.21 | a | 11.08 ± 2.85 | a | 16.79 ± 3.55 | a |

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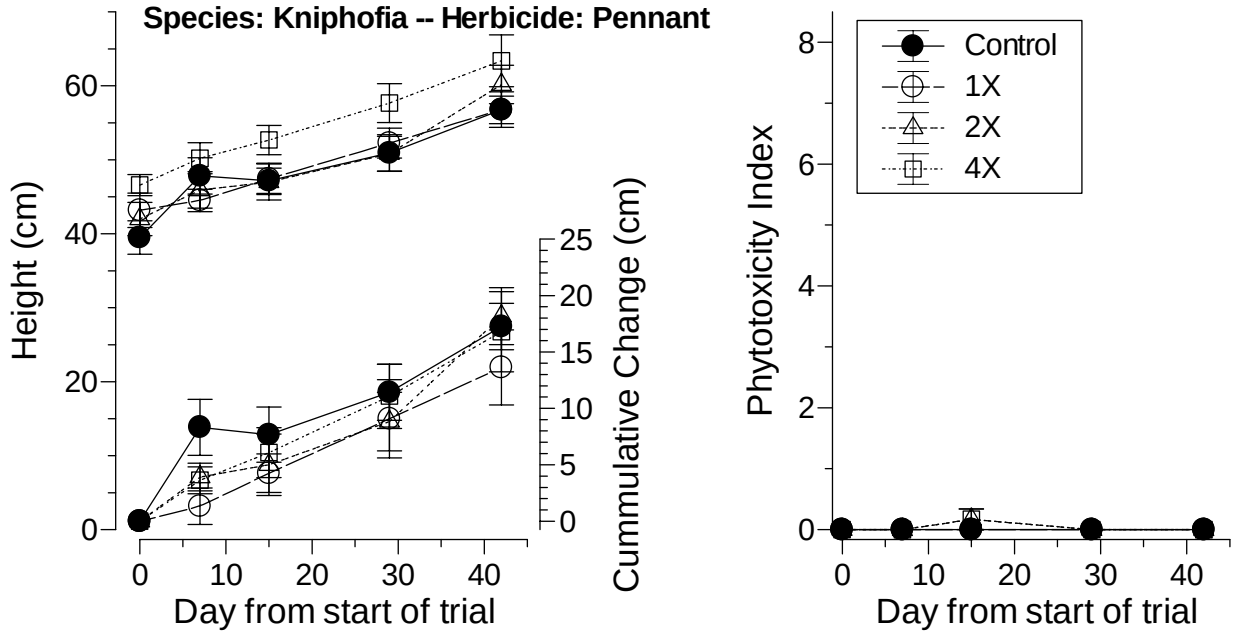


**Figure 1. Summary of results for *Kniphofia uvaria* 'Border Ballet' treated with 0, 2.1, 4.2 or 8.4 lb./A Pennant Magnum 7.62 EC. Both means and cumulative changes over time are plotted for phytotoxicity index, plant height, plant width and volume index. SE bars shown (n = 12).**

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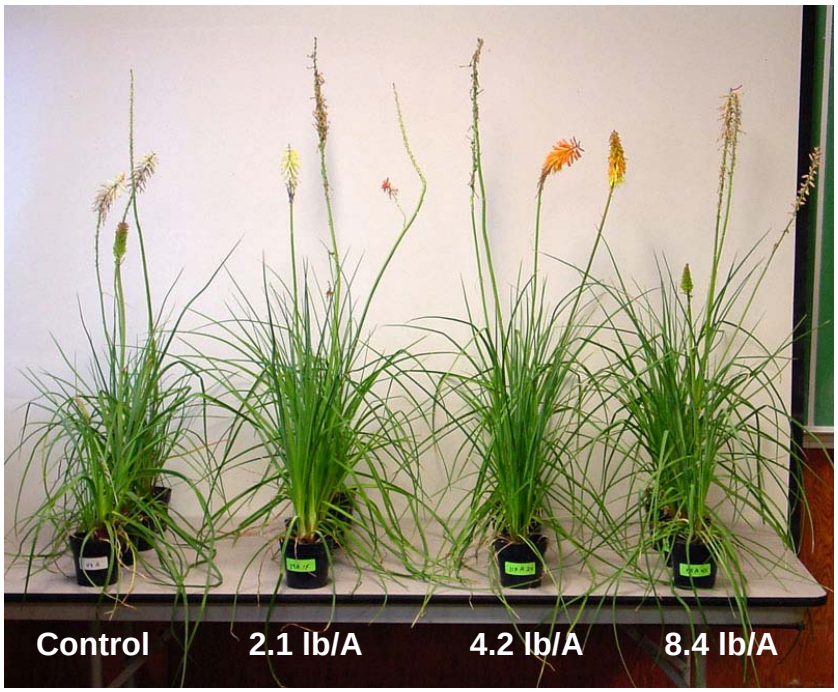
**IR-4 ORNAMENTAL DATA REPORTING FORM**




**Block A**


**Block B**

**Figure 2. *Kniphofia uvaria* 'Border Ballet' plants six weeks after two applications of 0, 2.1, 4.2 or 8.4 lb./A Pennant Magnum 7.62 EC. Applications were made at Week 0 and Week 3.**

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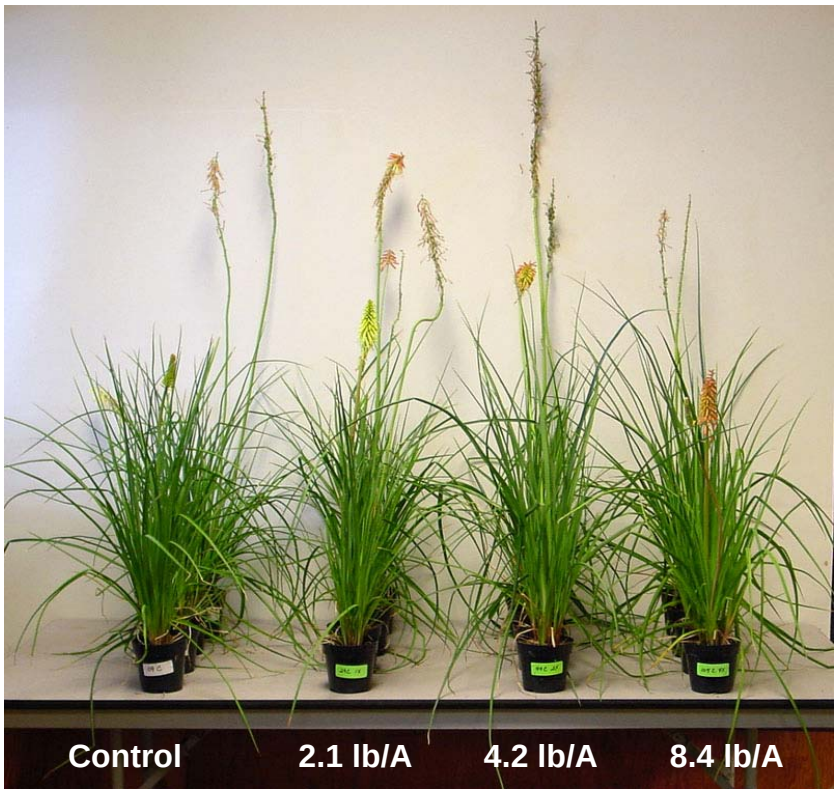
**IR-4 ORNAMENTAL DATA REPORTING FORM**




**Block C**

**Figure 2. *Kniphofia uvaria* 'Border Ballet' plants six weeks after two applications of 0, 2.1, 4.2 or 8.4 lb./A Pennant Magnum 7.62 EC. Applications were made at Week 0 and Week 3.**

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## IR-4 ORNAMENTAL DATA REPORTING FORM

## APPENDIX A

**PHYTOTOXICITY TO HERBACEOUS PERENNIAL PLANTS WITH PRE-EMERGENT APPLICATIONS OF PENDULUM, PENNANT MAGNUM AND SNAPSHOT**

Date: 3/04
**Ornamental Protocol Number: 001**
General label directions: Refer to product labels.

Research program:
Pest(s)/Plants – As attached.
Pesticide (common name and trade name) – Refer to treatment list shown below.

**For label, material & if needed spray oil surfactant contact:**
BASF, Kathie Kalmowitz, 919-785-9659, email: kalmowk@basf-corp.com (Pendulum)
Dow AgroSciences, Mike Melichar, 317-337-4982, mwmelichar@dow.com (Snapshot)
Syngenta, Dave Ross, 336-632-6411, david.ross@syngenta.com (Pennant Magnum)

Experimental design:
Plot size (must be adequate to reflect actual use condition)
Replicates Minimum of 4 Treatment Units
Controls (untreated controls to be included in all experiments)

Application: **PENNANT MAGNUM 7.62 EC SNAPSHOT 2.5TG PENNANT MAGNUM 7.62EC -OR- PENNANT MAGNUM 7.62EC**

| Dosages - | | | | |
|---|---|---|---|---|
| 1x | 2 lbs.ai/A | 2.5 lbs.ai/A | 2.5 lbs.ai/A (fine soil) | 2.1 lbs.ai/A (medium/course soil) |
| 2x | 4 lbs.ai/A | 5.0 lbs.ai/A | 5.0 lbs.ai/A (fine soil) | 4.2 lbs.ai/A (medium/course soil) |
| 4x | 8 lbs ai/A | 10.0 lbs.ai/A | 10.0 lbs.ai/A (fine soil) | 8.4 lbs.ai/A (medium/course soil) |

Active Ingredient: Pendulum (s-Metolachlor), Pennamt Magnum (s-metolachlor), Snapshot (isoxaben+trifluralin).
Volume - Minimum of 10 gal/A for liquid applications.
Timing - 2 applications, 30 Days Spray Interval. Take initial counts, then efficacy and crop safety at 7, 14, 30 (then 2nd appl.) and 42 DAT.

Reports:
Method of application: (treatments should be made over the top of the plants using application equipment consistent with conventional commercial equipment). Report completely on experimental design and method of application. Report plant size height x width before treatment and throughout the experiment.
Weather – Maintain temperature and precipitation (including irrigation) data.
Soil type – Identify soil type used in experimental area.
Product – When submitting data, include EPA registration number of product used.
Efficacy – Data should include both actual counts and percent control as well as an indication that infestation was light, heavy, etc. Record all application and evaluation dates.
Phytotoxicity – Record phytotoxicity data at all rates. Use a 0-10 scale. 0 = No Phytotoxicity 10 = complete kill.

**Please direct questions data to: IR-4 Project, 681 US Highway #1 South, North Brunswick, NJ**
**Phone: (732) 932-9575., Ext. 629.**

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## IR-4 ORNAMENTAL DATA REPORTING FORM

## APPENDIX B: PHYTOTOXICITY REPORT FORM: Visual Rating

| KNIPHOFIA | | | 5/11/2004 | 5/18/2004 | 5/26/2004 | 6/9/2004 | 6/22/2004 |
|---|---|---|---|---|---|---|---|
| **Rate** | **Block** | **Rep** | **Phyto** | **Phyto** | **Phyto** | **Phyto** | **Phyto** |
| Ctrl | A | 1 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | A | 2 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | A | 3 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | A | 4 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | B | 1 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | B | 2 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | B | 3 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | B | 4 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | C | 1 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | C | 2 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | C | 3 | 0 | 0 | 0 | 0 | 0 |
| Ctrl | C | 4 | 0 | 0 | 0 | 0 | 0 |
| Mean | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Std. Dev. | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | |
| PM-1X | A | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | A | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | A | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | A | 4 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | B | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | B | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | B | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | B | 4 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | C | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | C | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | C | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-1X | C | 4 | 0 | 0 | 0 | 0 | 0 |
| Mean | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Std. Dev. | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | | | | | | | |
| PM-2X | A | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | A | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | A | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | A | 4 | 0 | 0 | 2 | 0 | 0 |
| PM-2X | B | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | B | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | B | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | B | 4 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | C | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | C | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | C | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-2X | C | 4 | 0 | 0 | 0 | 0 | 0 |
| Mean | | | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 |
| Std. Dev. | | | 0.00 | 0.00 | 0.58 | 0.00 | 0.00 |
| | | | | | | | |
| PM-4X | A | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | A | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | A | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | A | 4 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | B | 1 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | B | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | B | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | B | 4 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | C | 1 | 0 | 0 | 2 | 0 | 0 |
| PM-4X | C | 2 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | C | 3 | 0 | 0 | 0 | 0 | 0 |
| PM-4X | C | 4 | 0 | 0 | 0 | 0 | 0 |
| Mean | | | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 |
| Std. Dev. | | | 0.00 | 0.00 | 0.58 | 0.00 | 0.00 |

**NOTE: DEFINE MEASUREMENT OF PHYTOTOXICITY, OR INDEX OF INJURY (0=NO INJURY, 10=COMPLETE KILL)**
**See Table 2**

| | |
|---|---|
| **PR.NO. :** | **23838A** |
| **TRIAL:** | **1** |
| **DATE:** | **6/22/04** |

# IR-4 ORNAMENTAL DATA REPORTING FORM

## APPENDIX C: PHTOTOXICITY REPORT FORM: Plant Height (cm)

| **KNIPHOFIA** | | | 5/11/2004 | 5/18/2004 | 5/26/2004 | 6/9/2004 | 6/22/2004 |
|---|---|---|---|---|---|---|---|
| **Rate** | **Block** | **Rep** | **Height(cm)** | **Height(cm)** | **Height(cm)** | **Height(cm)** | **Height(cm)** |
| Ctrl | A | 1 | 34.0 | 55.0 | 51.0 | 50.0 | 49.0 |
| Ctrl | A | 2 | 58.0 | 51.0 | 46.0 | 59.0 | 66.0 |
| Ctrl | A | 3 | 36.0 | 48.0 | 47.0 | 40.0 | 48.0 |
| Ctrl | A | 4 | 27.0 | 33.0 | 33.0 | 37.0 | 50.0 |
| Ctrl | B | 1 | 41.0 | 52.0 | 54.0 | 57.0 | 54.0 |
| Ctrl | B | 2 | 36.0 | 39.0 | 44.0 | 40.0 | 52.0 |
| Ctrl | B | 3 | 36.0 | 42.0 | 53.0 | 61.0 | 64.0 |
| Ctrl | B | 4 | 39.0 | 53.0 | 53.0 | 60.0 | 63.0 |
| Ctrl | C | 1 | 36.0 | 39.0 | 42.0 | 51.0 | 63.0 |
| Ctrl | C | 2 | 40.0 | 64.0 | 47.0 | 56.0 | 56.0 |
| Ctrl | C | 3 | 49.0 | 52.0 | 45.0 | 45.0 | 55.0 |
| Ctrl | C | 4 | 42.0 | 46.0 | 51.0 | 55.0 | 61.0 |
| Mean | | | 39.50 | 47.83 | 47.17 | 50.92 | 56.75 |
| Std. Dev. | | | 7.85 | 8.52 | 5.94 | 8.51 | 6.40 |
| | | | | | | | |
| PM-1X | A | 1 | 42.0 | 49.0 | 49.0 | 52.0 | 56.0 |
| PM-1X | A | 2 | 46.0 | 40.0 | 48.0 | 56.0 | 61.0 |
| PM-1X | A | 3 | 31.0 | 35.0 | 35.0 | 61.0 | 65.0 |
| PM-1X | A | 4 | 31.0 | 41.0 | 33.0 | 45.0 | 46.0 |
| PM-1X | B | 1 | 39.0 | 45.0 | 51.0 | 52.0 | 50.0 |
| PM-1X | B | 2 | 39.0 | 44.0 | 55.0 | 65.0 | 67.0 |
| PM-1X | B | 3 | 51.0 | 44.0 | 47.0 | 50.0 | 43.0 |
| PM-1X | B | 4 | 55.0 | 54.0 | 55.0 | 46.0 | 56.0 |
| PM-1X | C | 1 | 52.0 | 49.0 | 55.0 | 46.0 | 58.0 |
| PM-1X | C | 2 | 51.0 | 46.0 | 52.0 | 59.0 | 70.0 |
| PM-1X | C | 3 | 37.0 | 39.0 | 47.0 | 53.0 | 59.0 |
| PM-1X | C | 4 | 44.0 | 48.0 | 42.0 | 42.0 | 50.5 |
| Mean | | | 43.17 | 44.50 | 47.42 | 52.25 | 56.79 |
| Std. Dev. | | | 8.09 | 5.21 | 7.39 | 7.01 | 8.33 |
| | | | | | | | |
| PM-2X | A | 1 | 26.0 | 34.0 | 41.0 | 47.0 | 52.0 |
| PM-2X | A | 2 | 45.0 | 49.0 | 54.0 | 56.0 | 52.0 |
| PM-2X | A | 3 | 49.0 | 51.0 | 49.0 | 53.0 | 57.0 |
| PM-2X | A | 4 | 43.0 | 39.0 | 34.0 | 50.0 | 60.5 |
| PM-2X | B | 1 | 52.0 | 58.0 | 36.0 | 43.0 | 56.5 |
| PM-2X | B | 2 | 41.0 | 47.0 | 45.0 | 45.0 | 58.0 |
| PM-2X | B | 3 | 43.0 | 40.0 | 44.0 | 41.0 | 61.0 |
| PM-2X | B | 4 | 38.0 | 46.0 | 47.0 | 56.0 | 51.0 |
| PM-2X | C | 1 | 33.0 | 39.0 | 48.0 | 51.0 | 58.0 |
| PM-2X | C | 2 | 35.0 | 35.0 | 43.0 | 40.0 | 61.0 |
| PM-2X | C | 3 | 50.0 | 58.0 | 62.0 | 63.0 | 82.0 |
| PM-2X | C | 4 | 49.0 | 55.0 | 51.0 | 65.0 | 73.0 |
| Mean | | | 42.00 | 45.92 | 46.17 | 50.83 | 60.17 |
| Std. Dev. | | | 7.84 | 8.54 | 7.64 | 8.16 | 9.01 |
| | | | | | | | |
| PM-4X | A | 1 | 57.0 | 63.0 | 43.0 | 51.0 | 51.0 |
| PM-4X | A | 2 | 40.0 | 41.0 | 42.0 | 59.0 | 63.0 |
| PM-4X | A | 3 | 48.0 | 51.0 | 51.0 | 55.0 | 54.0 |
| PM-4X | A | 4 | 50.0 | 55.5 | 58.0 | 66.0 | 68.0 |
| PM-4X | B | 1 | 44.0 | 51.0 | 59.0 | 67.0 | 68.0 |
| PM-4X | B | 2 | 44.0 | 48.0 | 50.0 | 55.0 | 67.5 |
| PM-4X | B | 3 | 49.0 | 51.0 | 62.0 | 60.0 | 84.0 |
| PM-4X | B | 4 | 45.0 | 44.0 | 59.0 | 72.0 | 52.5 |
| PM-4X | C | 1 | 53.0 | 62.0 | 60.0 | 66.0 | 85.0 |
| PM-4X | C | 2 | 41.0 | 51.0 | 48.0 | 51.0 | 59.0 |
| PM-4X | C | 3 | 43.0 | 44.0 | 52.0 | 50.0 | 62.0 |
| PM-4X | C | 4 | 45.0 | 41.0 | 48.0 | 40.0 | 46.5 |
| Mean | | | 46.58 | 50.21 | 52.67 | 57.67 | 63.38 |
| Std. Dev. | | | 5.00 | 7.29 | 6.81 | 9.11 | 12.13 |