16th Annual Invasive Species Workshop

Results from recent knotweed studies in the Pacific Northwest

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Two trials were recently conducted on knotweed species in Washington. The first was a trial testing the ability of foliar-applied glyphosate and imazapyr to translocate into and inhibit shoot growth from excised rhizomes. This trial was conducted at the WSU Northwestern Washington Research and Extension Center near Mount Vernon, Washington during 2010-11 and repeated in 2012-13. Bohemian knotweed (*Polygonum* x *bohemicum*) shoots were dug in the summer and grown in greenhouse pots for six weeks, then single plants were transplanted in September into wading pools filled with potting soil and buried up to their rims in the field. Herbicides (1.2 g ai glyphosate and 0.24 g ai imazapyr, equivalent to 2.5 ml Rodeo® and 1 ml Habitat®) were mixed with 0.25% nonionic surfactant and water to make 100 ml of solution and applied to each knotweed plant the following year when plants were beginning to bloom (late August) or post-bloom in autumn (mid October). Plants were dug 24 or 72 hours after treatment (HAT) and rhizomes placed in flats of potting soil in the greenhouse for five weeks, after which shoots and rhizomes were counted and dry biomass determined. In the second trial, a foam-dispensing applicator (manufactured by Green Shoots®) was used to determine whether that type of application may enhance herbicidal control of knotweed. Bohemian knotweed near Mount Vernon, Washington, and Himalayan (*P. polystachyum*) near Skykomish, Washington, were treated in July, 2014 and control was monitored for the next 12 months. Herbicides tested were glyphosate (Rodeo®) at 2%, imazapyr (Habitat®) at 0.75%, aminocyclopyrachlor + chlorsulfuron (Perspective®) at 4 oz/a and aminopyralid (Milestone®) at 7 fl.oz/a. Results from both trials will be discussed in this presentation.

Results from Recent Knotweed Studies in the Pacific Northwest

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The “Swimming Pool Studies”

- Fill wading pools with potting soil
- Transplant knotweed into pools in late summer so they will establish prior to winter
- Allow knotweed plants to grow the next year until the proper timing, then apply herbicide to foliage
- Dig rhizomes and observe how effectively the herbicide translocates into the rhizomes (herbicide should inhibit shoot growth)

Swimming Pool Knotweed

- 2010-11 Trial
- 6-week-old transplants of Bohemian knotweed were moved from the greenhouse to the pools in September, 2010
  - 100% survival (!!)
- Plants overwintered in the field

Swimming Pool Knotweed

- Bohemian knotweed treated in late August (first bloom) or mid October (post-bloom)
  - Foliar glyphosate at 1.2 g (2.5 ml Rodeo) or 0.24 g imazapyr (1 ml Habitat) applied per plant
  - Product was mixed with 0.25 ml nonionic surfactant and water to make 100 ml
- Rhizomes dug at 24 or 72 HAT
  - Placed in flats in the greenhouse
  - After five weeks of growth, rhizomes were measured, shoots counted, and dry weight of both determined

Swimming Pool Knotweed

- The experiment was repeated in 2012-13
- Same treatments and measurements as in 2010-11
- Treated August 27 (first bloom) or October 14 (autumn), 2013
- Completely random design with four replicates both years
  - Replicated in the field; replicates were maintained in the greenhouse
  - Means separated using Fisher's Protected LSD ($P \leq 0.05$)

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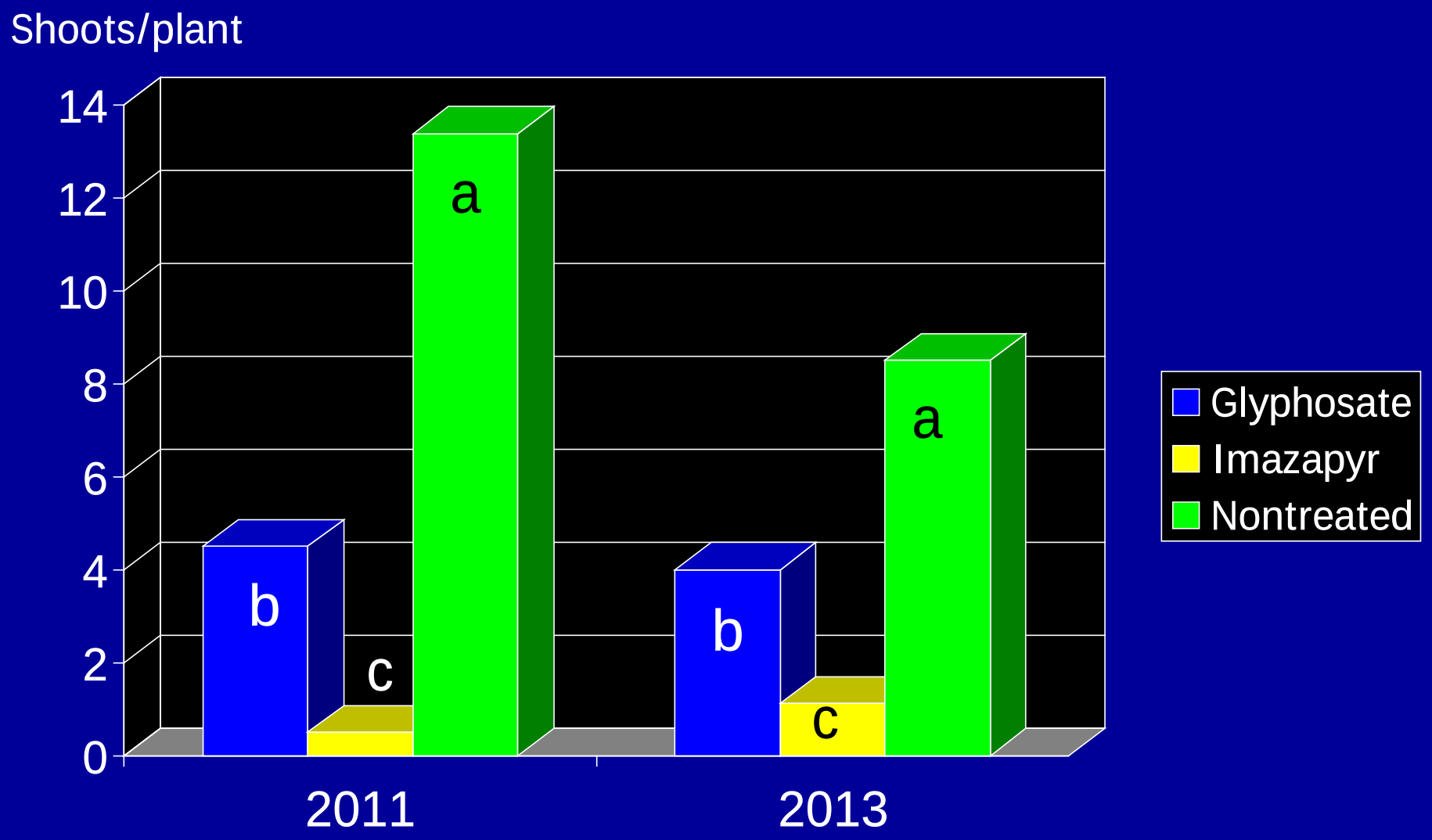
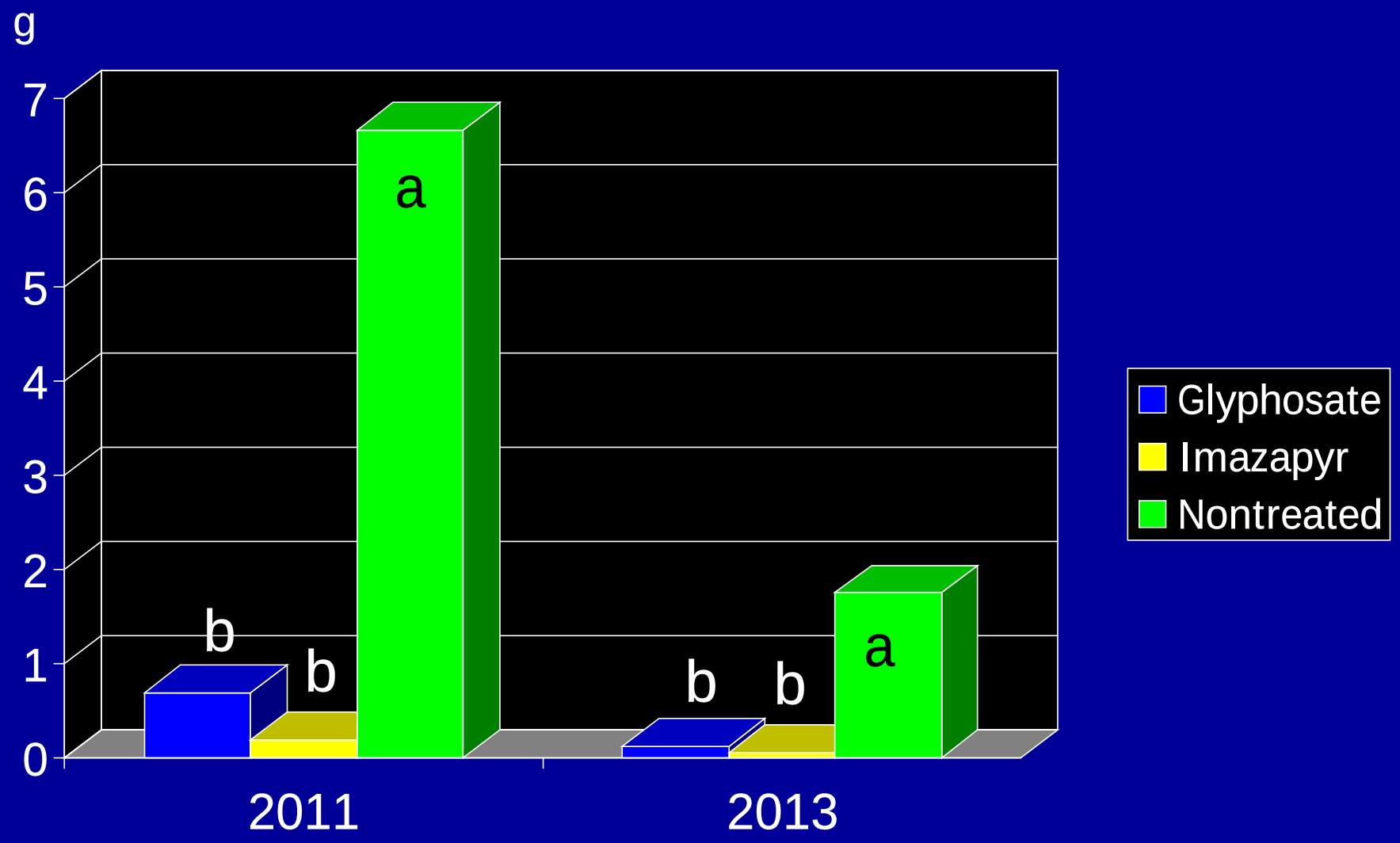
Rhizome Production By Year

- Overall rhizome number
  - In 2011, knotweed plants from both timings produced 7.9 rhizomes per plant (including secondary rhizomes, or rhizome branches)
  - In 2013, knotweed plants only produced 4.5 rhizomes per plant
- Overall rhizome length and weight
  - In 2011, knotweed rhizomes averaged 349 cm (11.5 feet) long and weighed 42.3 g
  - In 2013, knotweed rhizomes averaged only 145 cm (4.8 feet) long and weighed 16.2 g

Knotweed Shoot Number



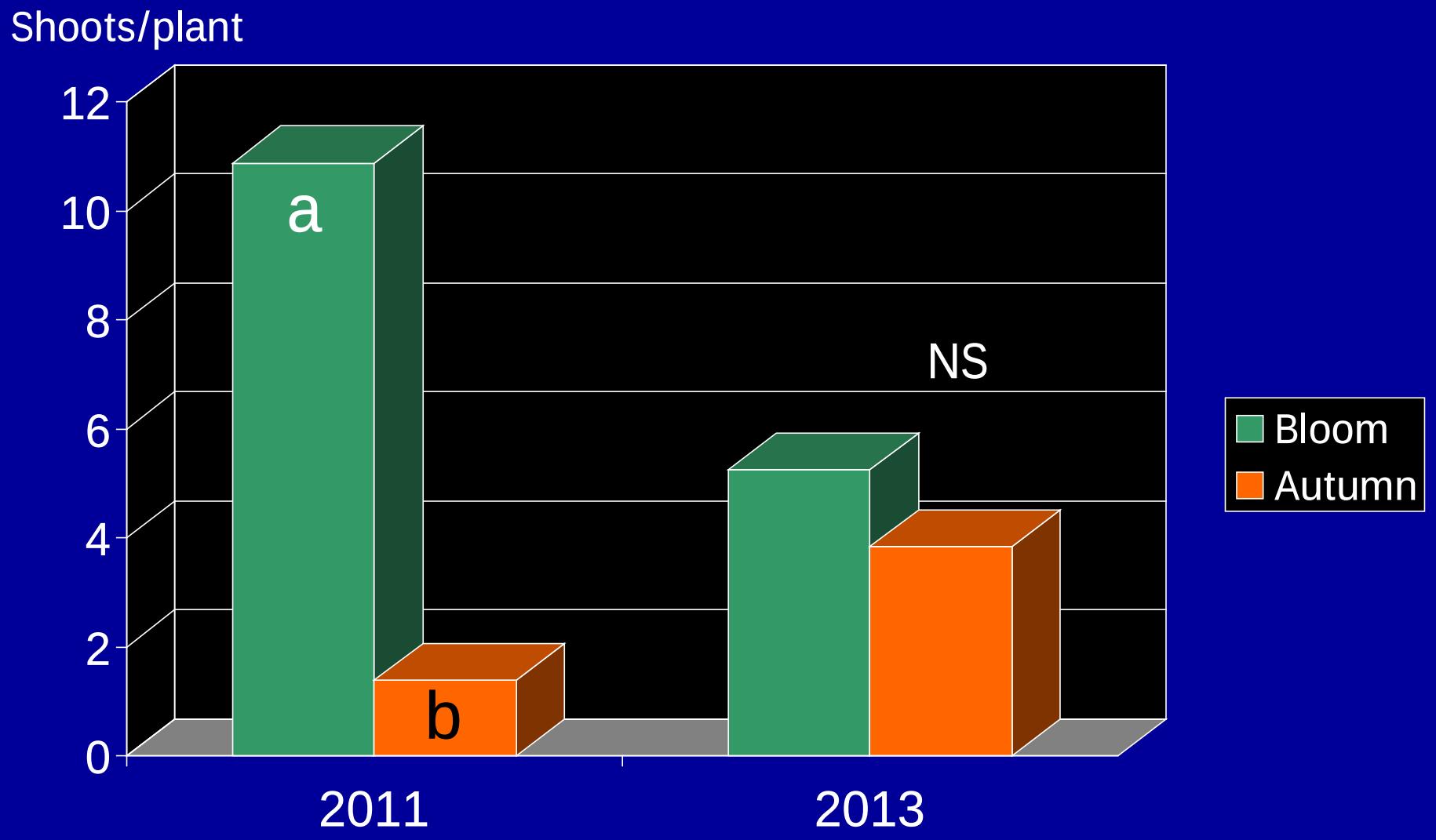
Knotweed Shoot Biomass



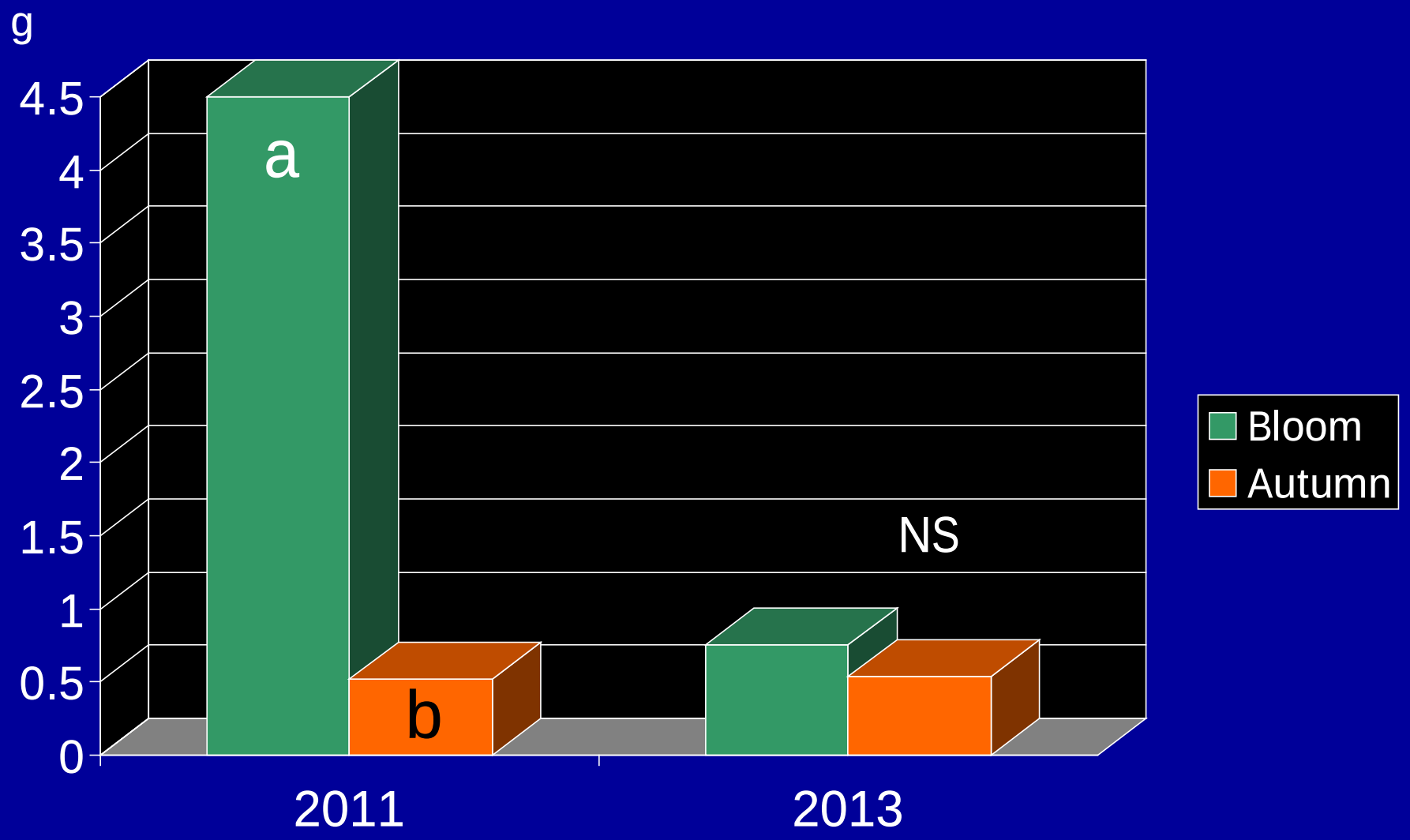
Herbicide Effects At Five Weeks

- Shoot number
  - Reduced by imazapyr 96 and 87% in 2011 and 2013, respectively
  - Reduced by glyphosate 66 and 53% in 2011 and 2013, respectively, less than for imazapyr in both years
- Shoot weight
  - Reduced by imazapyr 97% in both years
  - Reduced by glyphosate 90 and 93% in 2011 and 2013, respectively, similar to imazapyr in both years

Knotweed Shoot Number



Knotweed Shoot Biomass



Herbicide Effects At Five Weeks

- Herbicides were about 8 times more effective at suppressing shoot growth when applied in the autumn than at first bloom in 2011; no difference in 2013
- Herbicides were similarly effective at suppressing shoot growth at 24 HAT as at 72 HAT
  - There was a trend towards greater suppression of shoot biomass at 72 HAT
  - This trend was less obvious with shoot number, particularly in 2013

Summary

- Seasonal growing conditions apparently play a very large role in Bohemian knotweed rhizome production
  - Plants in 2011 produced nearly twice the number of rhizomes that were 2.5 times as long and heavy as rhizomes from plants grown in 2013
- Nontreated knotweed rhizomes produced 66 to 83% fewer shoots when dug in autumn than when dug from blooming plants, although shoots resulted from rhizomes dug at both timings

Summary (cont.)

- At tested doses, imazapyr reduced knotweed shoot number slightly more than did glyphosate
- Shoot biomass was reduced 97% by 0.24 g imazapyr/plant in both years, while reductions with 1.2 g glyphosate/plant were 90 to 93%
- Translocation rates of the two herbicides were similar, although knotweed shoot biomass tended to be lower at 72 hours as compared to 24 hours

Killer Foam for Knotweed Control?

- New spray unit under development by a Minnesota company (www.greenshootsonline.com) that uses surfactant to create a shaving cream-like foam that may improve contact time and uptake of herbicides
- I tested this sprayer on Bohemian and Himalayan knotweed

2014-15 Trials

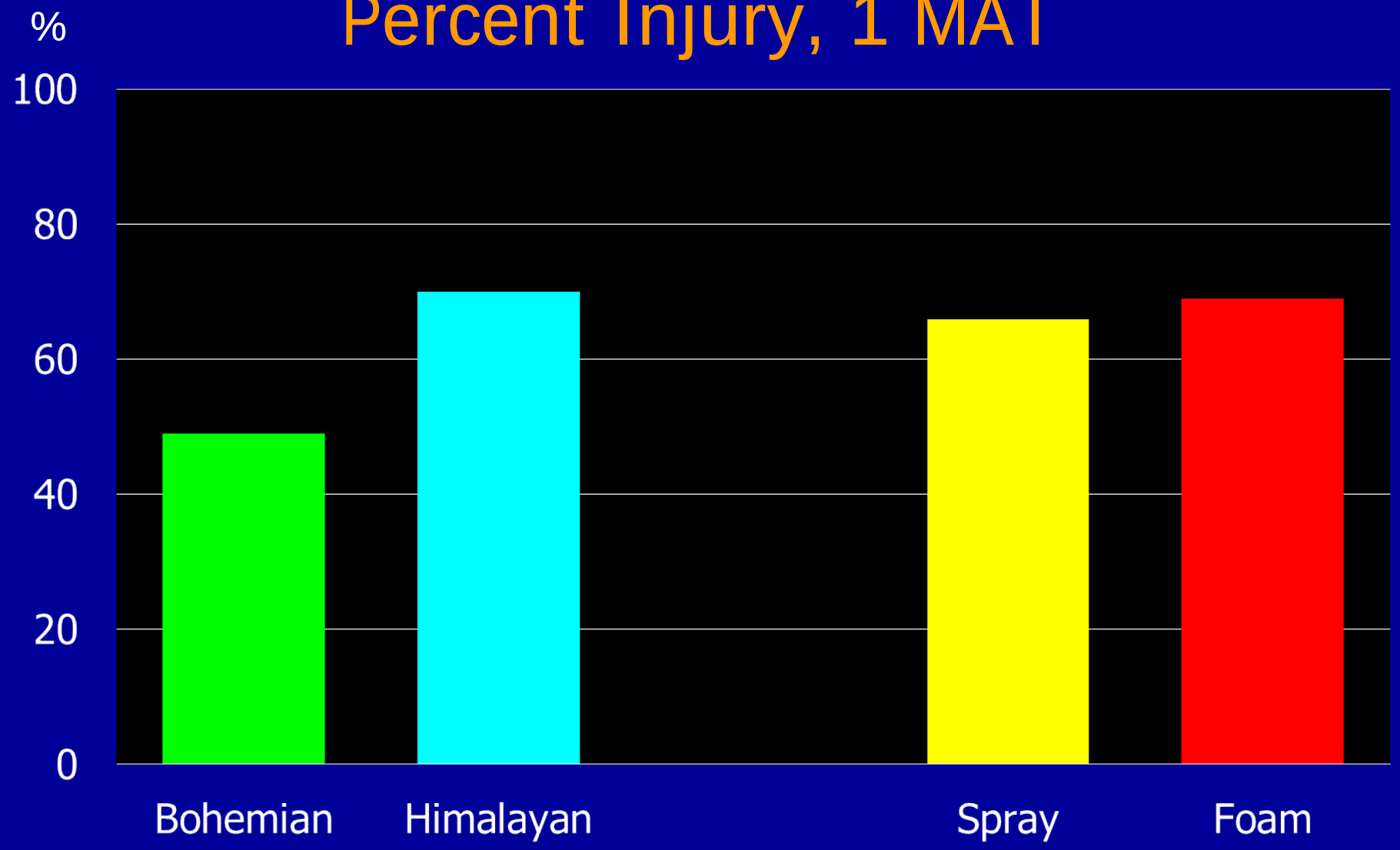
- Bohemian Knotweed (Mount Vernon)
  - Applied July 28
- Himalayan Knotweed (Skykomish)
  - Applied August 5
- Both sites treated in bud stage (no flowers yet opened)
- Herbicides tested were Rodeo, Habitat, Perspective, and Milestone
- Spray at 2 L/400 ft^2 ; foam at 1 L/400 ft^2

Typical backpack spray operation

Foam applicator

Preliminary Data

Percent Injury, 1 MAT



Nontreated Check

Nontreated Check

Rodeo Spray (12 MAT)

Rodeo Foam (12 MAT)

Nontreated Check

Habitat Spray (12 MAT)

Habitat Foam (12 MAT)

Nontreated Check

Perspective Spray (12 MAT)

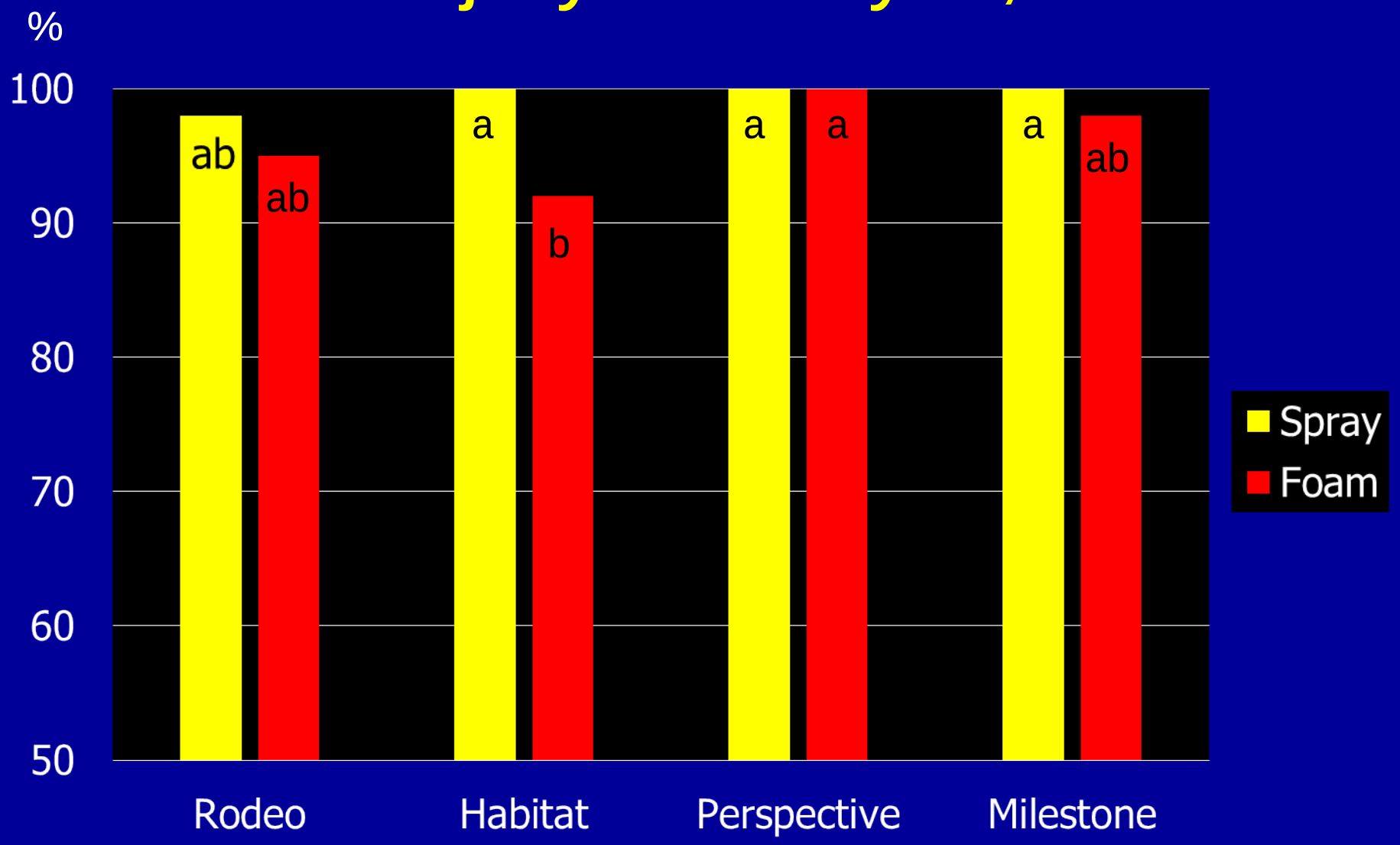
Perspective Foam (12 MAT)

Nontreated Check

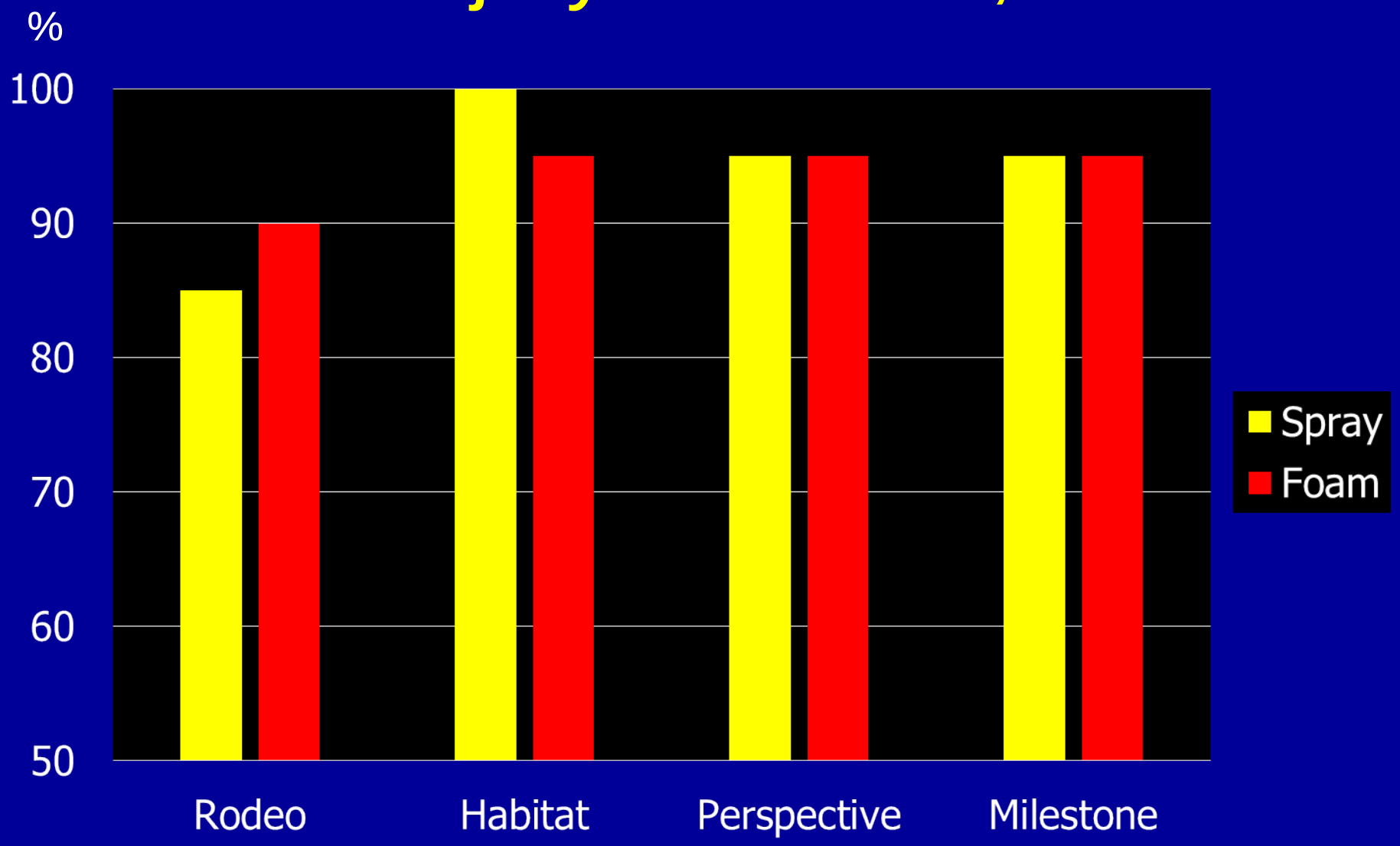
Milestone Spray (12 MAT)

Milestone Foam (12 MAT)

Percent Injury Himalayan, 10 MAT



Percent Injury Bohemian, 10 MAT



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