Herbicide Resistance in the US

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DANISH SEED CONFERENCE NOVEMBER 2015

Resistance

- What is resistance
- Resistance globally
- Resistance in the US
- Impact of herbicide resistant crops on resistance
- What's next for resistance management

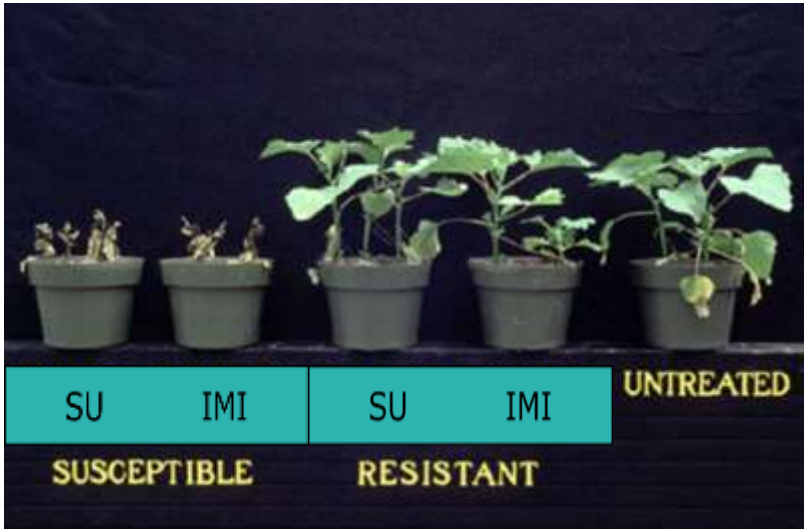
Herbicide Resistance

- Herbicide resistance is the heritable response of a plant to survive a herbicide treatment to which the wild type was susceptible.

- Simply – the herbicide used to work on a population and now it does not.

Herbicide Cross-resistance

- Cross-resistance is resistance to other herbicides with the same site of action.
  - example: sulfonylureas and imidazolinones (Group B)

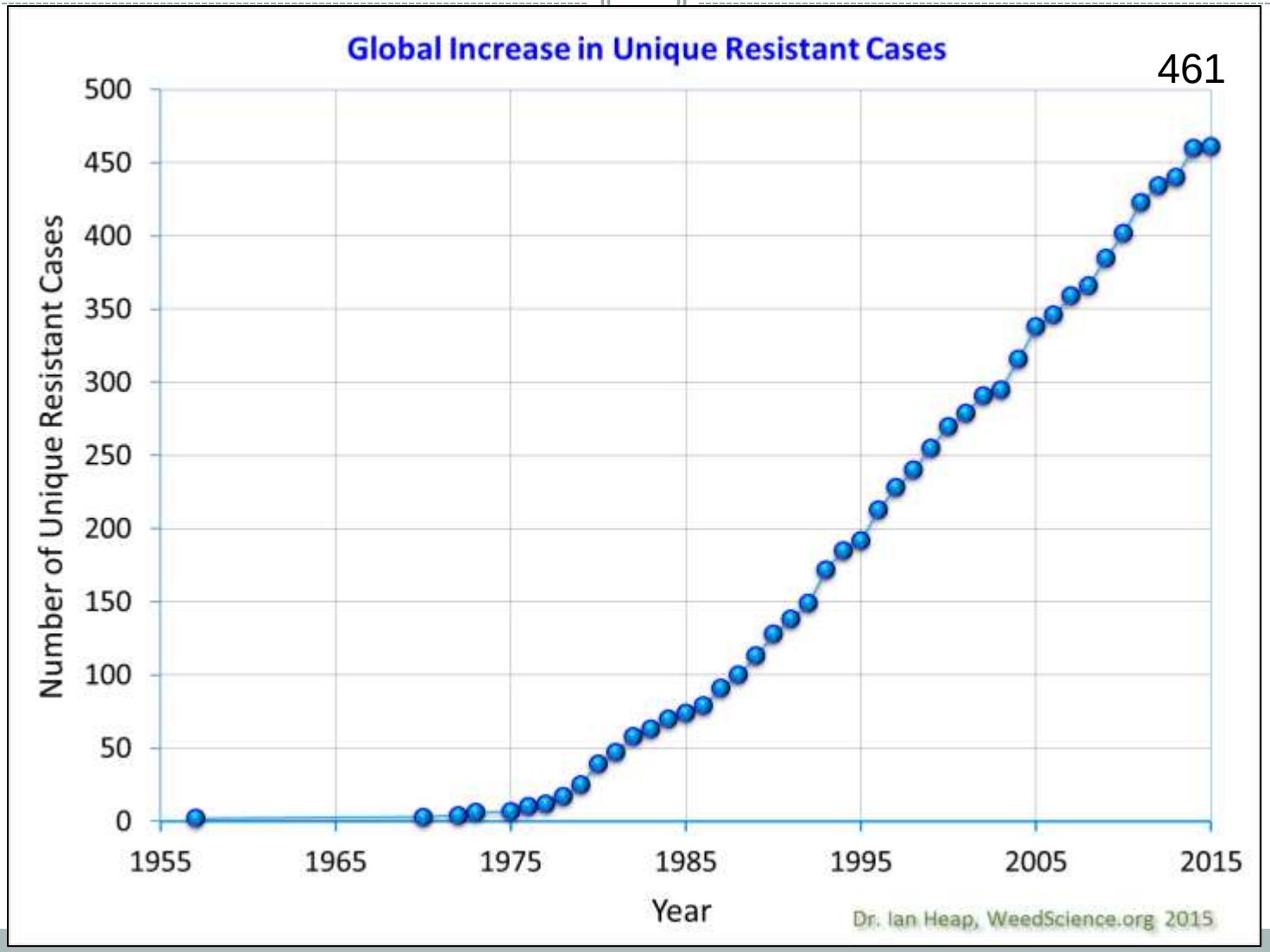


Example of cross-resistance – Dallas Peterson, Kansas State University

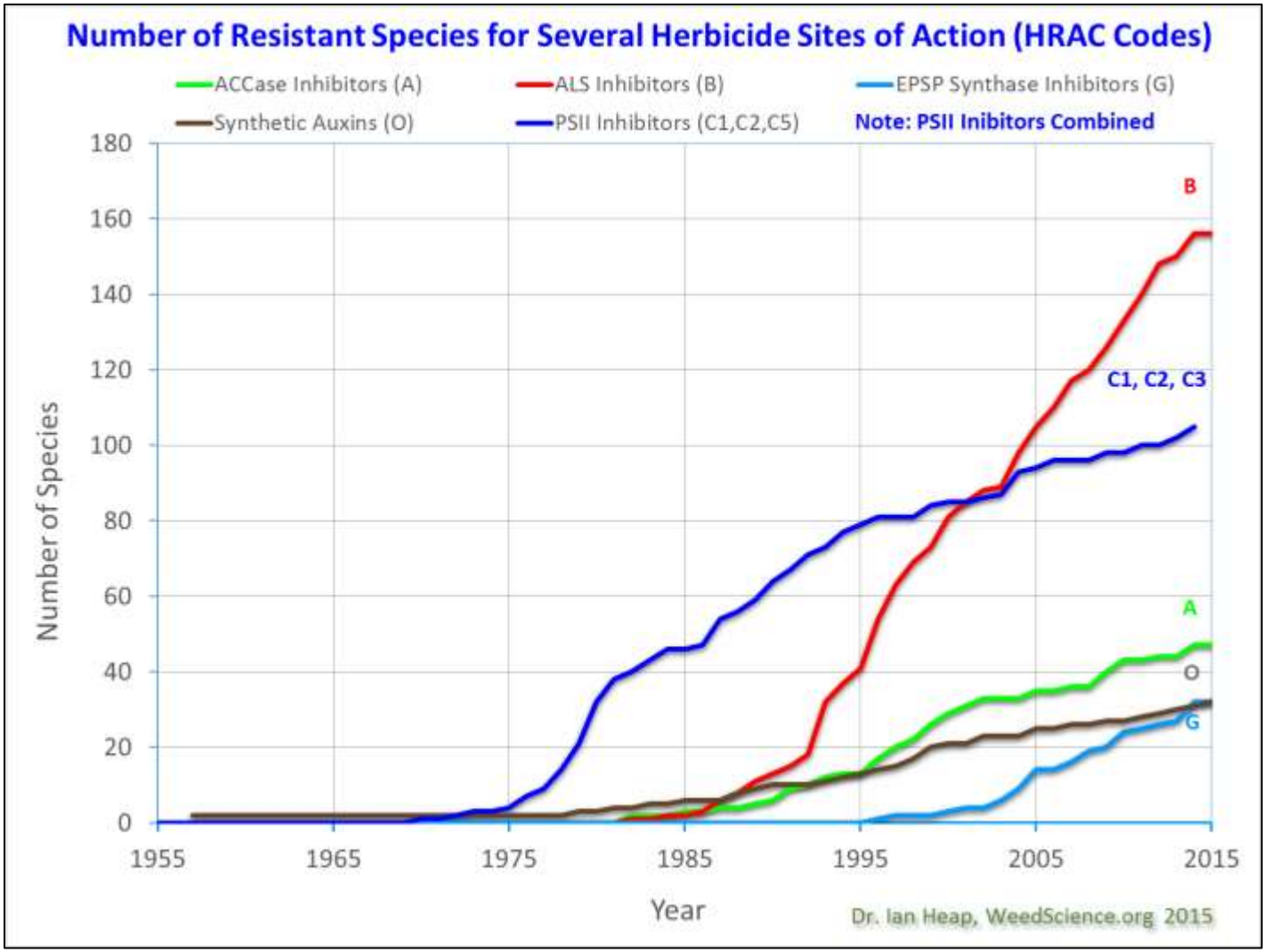
Herbicide Multiple-resistance

- Multiple-resistance is resistance to two or more chemically unrelated herbicides with different sites of action.
  - example: aryloxyphenoxy (Group A) and sulfonylurea (Group B)

Resistance at the Global Level



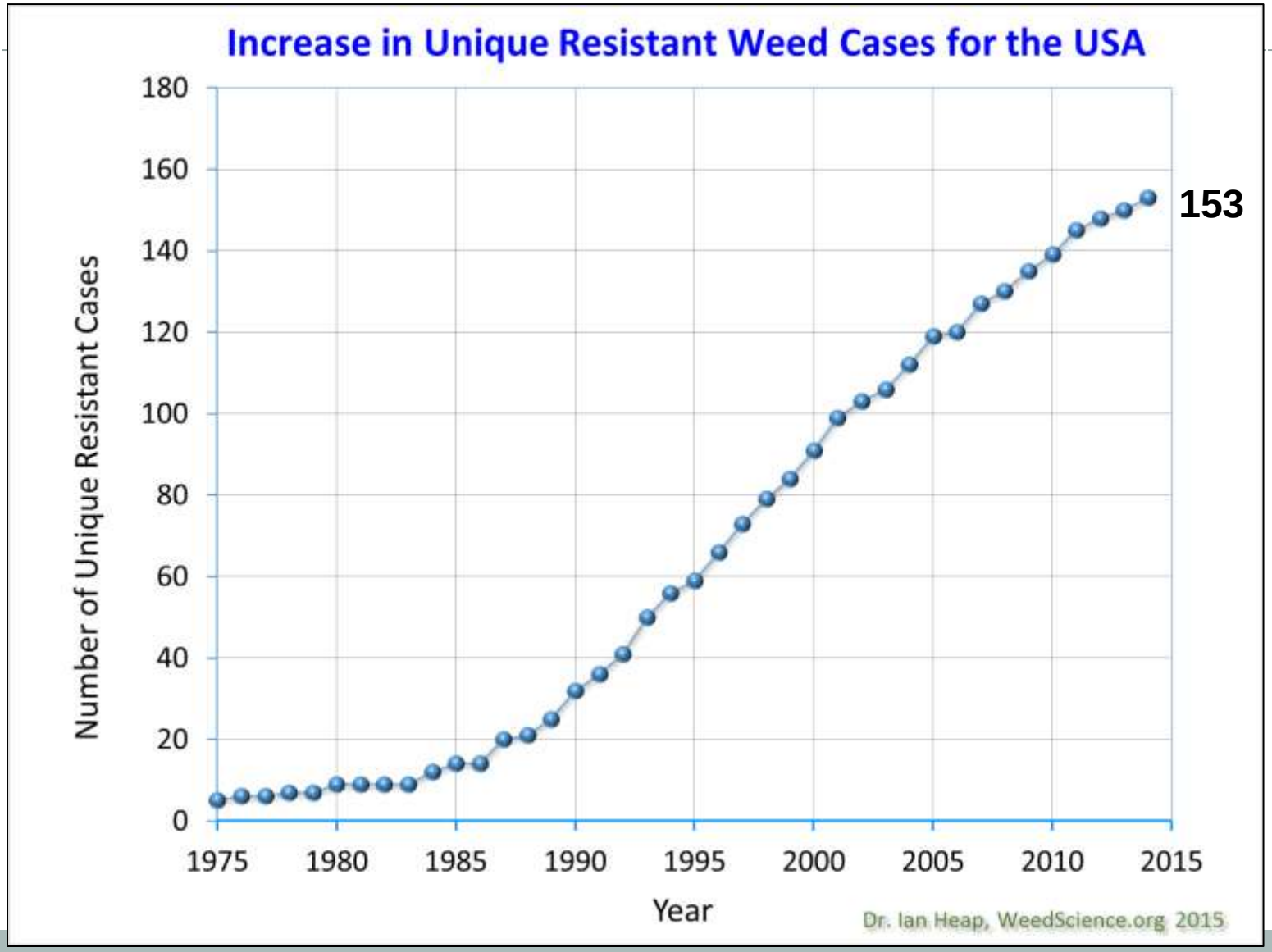
Comparison by Sites of Action



Resistance in the US

- First resistant weed was identified in the US in 1970.
  - *Senecio vulgaris* resistant to simazine
- Resistance became a major area of research in the US to the detriment of other areas of research.

Resistance in the US



Why So Many Cases in the US

- Heavy reliance on herbicides in most cropping systems.
- More than 90% of crop acres in the US are treated with herbicides every year.
- Herbicide treadmill is continuing

Resistant Weeds in Oregon By Species

- *Amaranthus retroflexus* (C1)
  - terbacil
- ***Avena fatua*** (A)
  - diclofop, fenoxaprop
- ***Bromus tectorum*** (B)
  - imazamox, sulfosulfuron
- *Capsella bursa-pastoris* (C1)
  - Hexazinone
- *Camelina microcarpa* (B)
  - chlorsulfuron
- *Kochia scoparia (B, G)*
  - chlorsulfuron, glyphosate
- ***Lolium multiflorum*** *(A, B, C2, G, H)*
  - many
- *Lactuca serriola* (B)
  - chlorsulfuron
- ***Poa annua*** (C1, C2, N)
  - atrazine, diuron, ethofumesate
- *Salsola tragus (B)*
  - chlorsulfuron
- *Senecio vulgaris* (C1)
  - bromoxynil

Herbicide Resistant Crops

- The introduction of glyphosate resistant crops (Roundup Ready) and the increased use of glyphosate quickly led to selection of resistant species.
- 14 species in the US with glyphosate resistance
- Most selected in Roundup Ready crops

Herbicide Resistant Crops

- Herbicide resistant crops
  - Increased selection pressure from glyphosate
  - Will not change with the introduction of crops with other resistance traits
  - Likely the problem with become worse with stacked resistance trait
- The selection pressure will increase

What's Next for Resistance Management

- Must change how herbicide resistant crops are deployed across the landscape.
- Questions being asked about increased regulation of herbicides specific to resistance at the national level.
  - Limiting use of some products
  - Increased reporting requirements for resistant weeds
- In particular, multiple-herbicide resistant weeds will be the most challenging.

Herbicides are Not Renewable Resources