

# Weed control without synthetic herbicides

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- 2010 NY State passed “Child Safe Playing Fields Act”
  - “pesticides cannot be applied to school or day-care playgrounds, turf, or playing fields”
  - Allows for emergency applications.
- Dec 15, 2011 NJ “Safe Playing Fields Act” bill advances from Assembly Envir. & Solid Waste Committee
  - State Senate & Assembly need to pass it by Jan 9, 2012

# Outline

- Definitions
- Weed prevention
- Alternatives to synthetic herbicides
- 2009-11 Research project

# Definitions:

## Synthetic herbicides

Man-made chemicals such as 2, 4-D, quinclorac, dicamba, dithiopyr

## Organic weed control

Using alternatives to synthetic herbicides to control weeds.

# Weed prevention

- Dense, actively growing turf out-competes most weeds
- Use cultural practices to encourage turf
  - Proper fertility, drainage, irrigation, cultivation, mowing, etc.
- Use “clean” seed, nursery stock, & mulches
- Regularly overseed desirable grasses (late summer/early fall)

“An ounce of prevention is worth a pound of cure” Ben Franklin



# Alternatives to synthetic herbicides

- Do nothing
- Hand-pull
- BioHerbicides
- Thermal products
- Organic chemicals
- Other

# Do nothing

- Least expensive method
- Customer must accept
- Naturally
  - Some areas get few weeds ( $< 20\%$ )
  - Some areas get many weeds ( $> 80\%$ )

- No herbicides
- 20 % weeds





# Black medic



# Crabgrass



# Hand pull

- Can be expensive!
- Difficult to remove all parts of certain weeds
  - Clover
  - Ground ivy
  - Dandelion
- Easier to pull when moist or wet soils

- Vineyard GC, Martha's Vineyard (Jeff Carlson)
- Weed control is “final frontier” in organic turf
- Hand-pulls weeds
- Fill void with soil/seed mix
- 4 people 40-50 hrs/week
- $(4 \text{ people})(45 \text{ hrs/wk})(20 \text{ wks})(\$12/\text{hr}) = \$43,200$



Nana Amankwah, Slavic Grecu, Kwame Kankam and Igor Turcan

# Wild onion



# Dandelion



# Purple deadnettle in mulch



# Hand-pull tools

- Weed Twister, Dandelion digger, Dandelion terminator
- \$15-\$40





# BioHerbicides

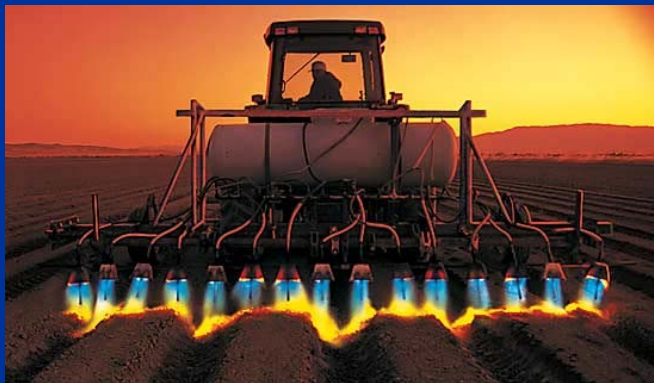
## ■ Sarritor

- Canada
- Naturally occurring dandelion control
- *Sclerotinia minor* fungus
- Excretes oxalic acid which is toxic to dandelions
- Effectiveness?
  - Dr. Watson, McGill University
  - Siva et. al 2011, Univ. of Guelph



# Thermal weeders

- Use heat or flame
- Various techniques to supply the heat
- May require repeat application
- Auburn Univ, 2011
  - Flaming to reduce weed seed before turf establishment.



- Electro Weeder
- Inserts a heated spike into weed
- Apply for 3-7 seconds
- \$120



- Weed Torch
- Propane
- Open flame
- \$35



- Green Steam
- 660 degree steam kills plants
- Repeat application
- \$4600



<http://www.greensteam.ca>

- Weed Dragon – Flame weeder
- Apply when weed is 1-4 inches
- \$50 - \$200



- Easy & Effective "Natural" Weed Control
- Convenient, Simple & Lightweight Design
- Adjustable Flame
- Non-Slip Grip
- Uses 1 Pound Propane Cylinders & is Fuel Efficient
- Durable Steel Construction
- Comes Fully Assembled

- Infra-Weeder
- Propane
- \$260



- Sunburst flame weeder
- Propane
- Boils water applied to leaf





- The Waipuna hot foam system
- Organic hot foam weed control
- Large carbon footprint
- Requires heating a tank of water
- \$ ?
- Availability ??



# Organic chemicals

“Processed from naturally occurring products”

- Vinegar (Acetic acid)  $C_2H_4O_2$
- Clove oil (about 85% Eugenol)
- Eugenol (extract from clove, cinnamon, basil, or bay leaf)
  - $C_{10}H_{12}O_2$
- Citric acid  $C_6H_8O_7$
- Lactic acid  $C_3H_6O_3$
- Corn gluten meal
- Fatty acid soaps
- Fe HEDTA
  - Synthetic chelate
  - Organic molecule binding Fe

# Other: Spot treat with salt

- E-zee Weeder
- Sweden
- Dehydrates & kills plant
- “organic” ???
- \$30



Applicator tip

# 2009-11 Research Project

# Objective

To evaluate broadleaf weed control in turfgrass using various alternatives to synthetic herbicides.

# Materials & Methods

# The site

- Doylestown retention basin
- Receives no broadleaf weed control
- Mowed 1X/week at 3 in.



# Treatments: Selective vs Non-selective

1. Hand pull weeds
2. Burnout II spot treat
3. Weed-A-Tak spot treat
4. Vinegar spot treat
5. Compost topdressing
6. Corn gluten meal
7. Glyphosate spot treat
8. Burnout II spot treat then seed P. rye.
9. Synthetic Herbicide
10. Organic compound X spot treat
11. Ortho's Iron spot treat
12. Propane torch spot treat
13. Bayer Fatty acid spot treat
14. Borax
15. Control

Non-selective - injure or kill grass



# 2009 Treatments

# Application Date

- |     |   |                          |
|-----|---|--------------------------|
| 1.  | Hand pull weeds                         | Sep 13, 20 *             |
| 2.  | Burnout II spot treat                   | Sep 13, 20 *             |
| 3.  | Weed-A-Tak spot treat                   | Sep 13, 20 *             |
| 4.  | Vinegar spot treat                      | Sep 13, 20 *             |
| 5.  | Compost topdressing                     | Sep 13, 29 **            |
| 6.  | Corn gluten meal                        | Sep 13 **                |
| 7.  | Synthetic Herbicide                     | Sep 13, 20 *             |
| 8.  | Burnout II spot treat then seed P. rye. | Sep 13, 20 (seed only)** |
| 9.  | Organic compound X spot treat           | Sep 13, 20 **            |
| 10. | Glyphosate spot treat                   | Sep 13, 20 *             |
| 11. | Control                                 |                          |

\* Only remaining weeds spot treated on Sep 20.

\*\* Entire plot treated.

# 2010 Treatments

# Application Date

1.	Hand pull weeds	Sep 25, Oct 8 *
2.	Burnout II spot treat	Sep 25, Oct 8 *
3.	Weed-A-Tak spot treat	Sep 25, Oct 8 *
4.	Vinegar spot treat	Sep 25, Oct 8 *
5.	Compost topdressing	Sep 25, Oct 8 **
6.	Corn gluten meal	Sep 25, Oct 8 **
7.	Glyphosate spot treat	Sep 25, Oct 8 *
8.	Burnout II spot treat then seed P. rye.	Sep 25, Oct 8 * (seeded 9 Oct)
9.	Synthetic Herbicide	Sep 25, Oct 8 *
10.	Organic compound X spot treat	Sep 25, Oct 8 *
11.	Ortho's Iron spot treat	Sep 25, Oct 8 *
12.	Propane torch spot treat	Sep 25, Oct 8 *
13.	Bayer Fatty acid spot treat	Sep 25, Oct 8 *
14.	Control	

\* Only remaining weeds spot treated on Oct 8.

\*\* Entire plot treated.

# 2011 Treatments

# Application Date

1.	Hand pull weeds	Aug 29, Sep 12 *
2.	Burnout II spot treat	Aug 29, Sep 12 *
3.	Weed-A-Tak spot treat	Aug 29, Sep 12 *
4.	Vinegar spot treat	Aug 29, Sep 12 *
5.	Compost topdressing	Aug 29, Sep 12 **
6.	Corn gluten meal	Aug 29, Sep 12 **
7.	Glyphosate spot treat	Aug 29, Sep 12 *
8.	Burnout II spot treat then seed P. rye.	Aug 29, Sep 12 * (seeded 14 Sep)
9.	Synthetic Herbicide	Aug 29, Sep 12 *
10.	Organic compound X spot treat	Aug 29, Sep 12 *
11.	Ortho's Iron spot treat	Aug 29, Sep 12 *
12.	Propane torch spot treat	Aug 29, Sep 12 *
13.	Bayer Fatty acid spot treat	Aug 29, Sep 12 *
14.	<b>Borax</b>	Aug 29, Sep 12 *
15.	Control	

\* Only remaining weeds spot treated on Sep 12.

\*\* Entire plot treated.

Site: Doylestown Hunt, Doylestown, PA

Forest

Rep 1

10	11	4	15	5	9	2	14	1	13	7	8	3	12	6
----	----	---	----	---	---	---	----	---	----	---	---	---	----	---

Rep 2

1	12	14	2	8	6	15	7	9	10	4	5	11	3	13
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Rep 3

4	3	8	14	10	7	13	9	2	6	15	1	12	5	11
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Rep 4

11	1	12	5	10	4	14	15	3	6	13	7	2	8	9
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ROAD

- Randomized Complete Block Design
- 4 Reps.
- 16 ft<sup>2</sup> plots

# Evaluating weed control

- % weed by species in each plot
- 0, 1, 2, 7, 14, 21, 28, 42, 70 DAIT  
(Days After Initial Treatment)
- Stats. done on % weed cover
- Converted to % weed control

$$[1-(Y/X)] * 100$$

X = % weed cover in each plot before initial treatment

Y = % weed cover on a specific DAIT



16 % Weeds:

5 % Broadleaf plantain

4 % Dandelion

2 % Nutsedge

2 % Knotweed

2 % White clover

1 % Oxalis

# Treatments



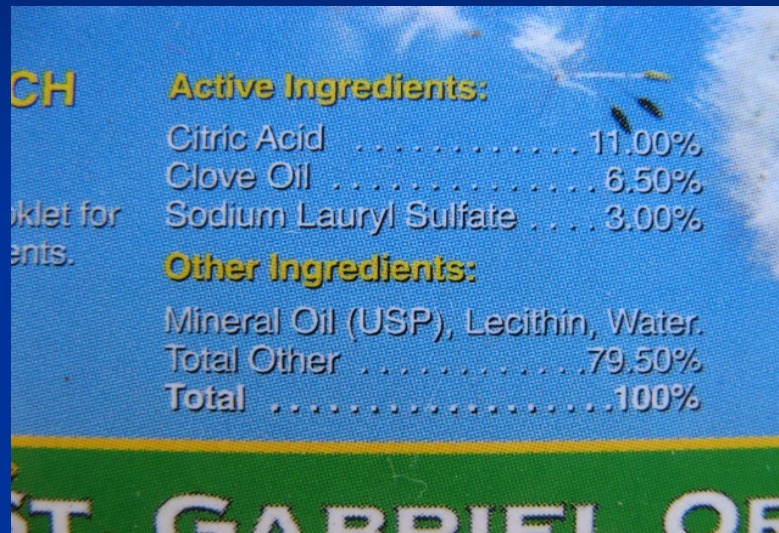
## Hand pull weeds

- 0 DAIT conditions in 2009
  - Soil very moist
  - Weeds easier to pull
  - Able to get full plant





## Burnout II - Ready to Use (RTU)



CH

Active Ingredients:

Citric Acid	11.00%
Clove Oil	6.50%
Sodium Lauryl Sulfate	3.00%

Other Ingredients:

Mineral Oil (USP), Lecithin, Water.	
Total Other	79.50%
Total	100%

oklet for  
ents.

ST GABRIEL OR

- 1.9 gal / 1000 ft<sup>2</sup>



## Weed-A-Tak (RTU)

*This product has not been registered by the United States Environmental Protection Agency. Natura Products represents that this product qualifies for sale under the Federal Insecticide, Fungicide, and Rodenticide Act.*

<b>Active Ingredients:</b>	
Eugenol .....	2.0%
2-Phenethyl-Propionate .....	2.0%
Corn Gluten Meal .....	2.0%
<b>Inert Ingredients:</b>	
Vinegar / Hydrogenated Castor Oil	
Wintergreen Oil / Water .....	96.0%

Call Toll Free: **1-800-523-2680**  
or visit our web site @ [www.naturaproducts.com](http://www.naturaproducts.com)

- 1.5 gal / 1000 ft<sup>2</sup>



## 5% Acetic acid

- Diluted 1:1 with water
- 1.4 gal vinegar / 1000 ft<sup>2</sup>



## Compost topdressing

- DVC animal + plant waste
- 0.16 inches applied
- 1.4% N
- 4.2 lbs N/1000 ft<sup>2</sup>





Corn gluten meal    99%    10-0-0

- Pre-emerge effects
- 62 lbs/1000 ft<sup>2</sup> (6.2 lbs N)
- Multiple applications “required” \$\$\$

- Applying corn gluten meal to plot



# Glyphosate (Roundup)

- 2 gal / 1000 ft<sup>2</sup>



# Burnout II + seed perennial ryegrass after 2<sup>nd</sup> application



+



- 1.9 gal / 1000 ft<sup>2</sup>



# Agway Lawn Weed Killer (RTU)

ACTIVE INGREDIENTS	
* 2, 4-D .....	(CAS No. 94-75-7) .. 0.593%
** Mecoprop.....	(CAS No. 7085-19-0) 0.287%
*** Dicamba.....	(CAS No. 1918-00-9) 0.066%
OTHER INGREDIENTS.....99.054%	
Total.....	100.000%

THIS PRODUCT CONTAINS

* 0.493%	2,4-Dichlorophenoxyacetic Acid Equivalent
** 0.237%	2-(2-methy-4-chlorophenoxy)
*** 0.055%	3,6-Dichloro-o-anisic Acid Equivalent
* Isomer Specific by AOAC Methods	Propionic Acid Equivalent

EPA Est. No. 4-NY-1      EPA Reg. No.4-401-7138

■ 2 gal / 1000 ft<sup>2</sup>



## Organic compound X

- Extracted from an organic material
- Diluted 1:5 with water
- 2.7 gal / 1000 ft<sup>2</sup>



# Ortho's Iron HEDTA (RTU)

ACTIVE INGREDIENT	
Iron HEDTA (FeHEDTA) .....	1.5%
OTHER INGREDIENTS .....	98.5%
Total .....	100.0%

- 1.5 gal / 1000 ft<sup>2</sup>
- Fiesta, Iron X, Bayer Natria...



## Propane torch spot treat

- Burn surface plant parts
- 16 oz gas covers 500 ft<sup>2</sup> ???



## Bayer's fatty acid soap (RTU)

Active Ingredient:	
Ammoniated soap of fatty acids . . .	3.68%
Other Ingredients . . . . .	96.32%
Total	100.00%

- 1.9 gal / 1000 ft<sup>2</sup>



## Borax household cleaner

- Sodium tetraborate
- 10 oz / 1000 ft<sup>2</sup>



# FIFRA exempt Active Ingredients

## NY and NJ? “Safe Playing Fields Act” Minimum Risk Pesticides

- Castor oil
  - Cedar oil
  - Cinnamon and cinnamon oil
  - Citric acid
  - Citronella and citronella oil
  - Cloves and clove oil
  - Corn gluten meal
  - Corn oil
  - Cottonseed oil
  - Dried blood
  - Eugenol
  - Garlic and garlic oil
  - Geraniol
  - Geranium oil
  - Lauryl sulfate
  - Lemongrass oil
  - Linseed oil
  - Malic acid
  - Mint and mint oil
  - Peppermint and peppermint oil
  - 2-Phenethyl propionate
  - Potassium sorbate
  - Putrescent whole egg solids
  - Rosemary and rosemary oil
  - Sesame and sesame oil
  - Sodium chloride Sodium lauryl sulfate
  - Soybean oil
  - Thyme and thyme oil
  - White pepper
  - Zinc metal strips
- Others listed by NY & NJ
- Boric acid
  - Silica gel
  - Diatomaceous earth
  - Vinegar (on Inert list not AI list)
  - Fe HEDTA (not on any list)

<u>Treatment</u>	<u>Product \$</u> <u>per 10,000 ft<sup>2</sup></u>
Hand-pull	0
Burnout II	183
Weed-A-Tak	240
Vinegar	15
Compost	40
Corn gluten meal	450
Synthetic herb.	68
Burnout + seed	240
Glyphosate	93
Organic X	
Ortho's Fe	240
Torch	60
Fatty acid	240
Borax	10
Control	0

\* Based on retail prices



# Results

2011 Study

# 2 hours after application



- Weed-A-Tak
- Burnout II



Control



Torch

2 DAIT



Ortho Fe



Fatty acid

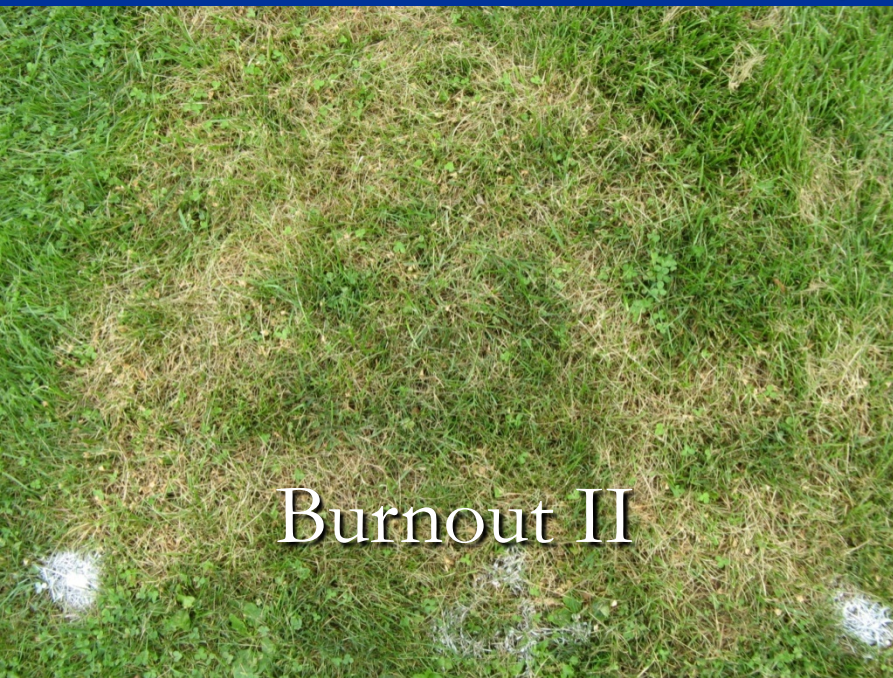


Vinegar

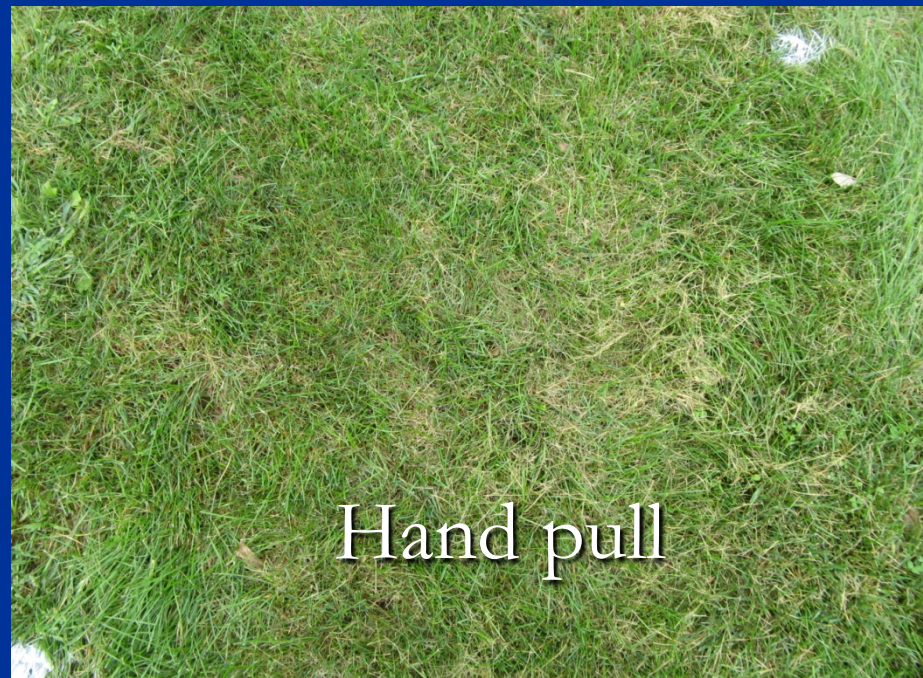


Weed-A-Tak

7 DAIT



Burnout II



Hand pull

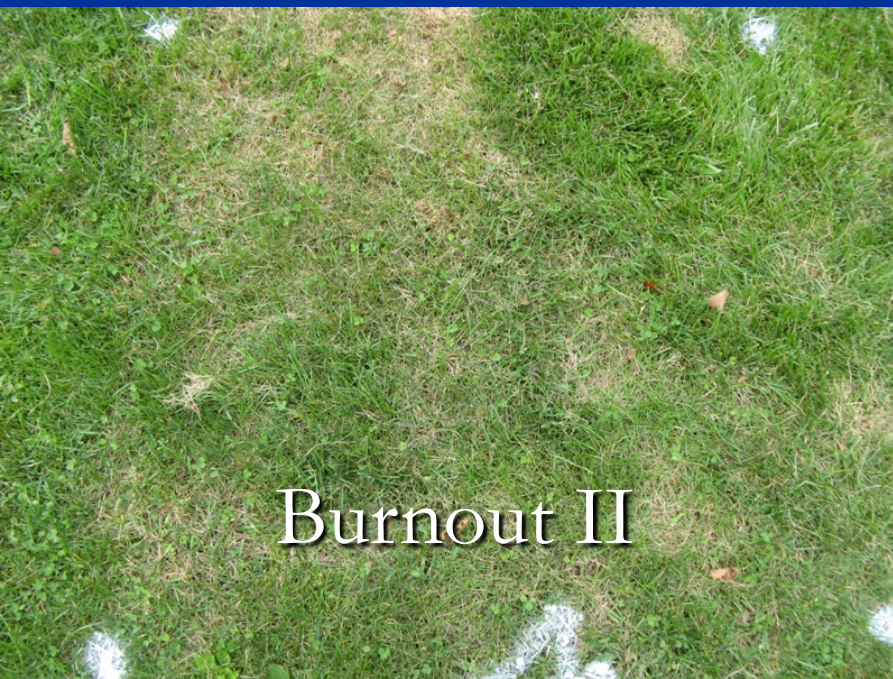


Vinegar



Weed-A-Tak

21 DAIT



Burnout II



Hand pull



Vinegar



Weed-A-Tak

70 DAIT

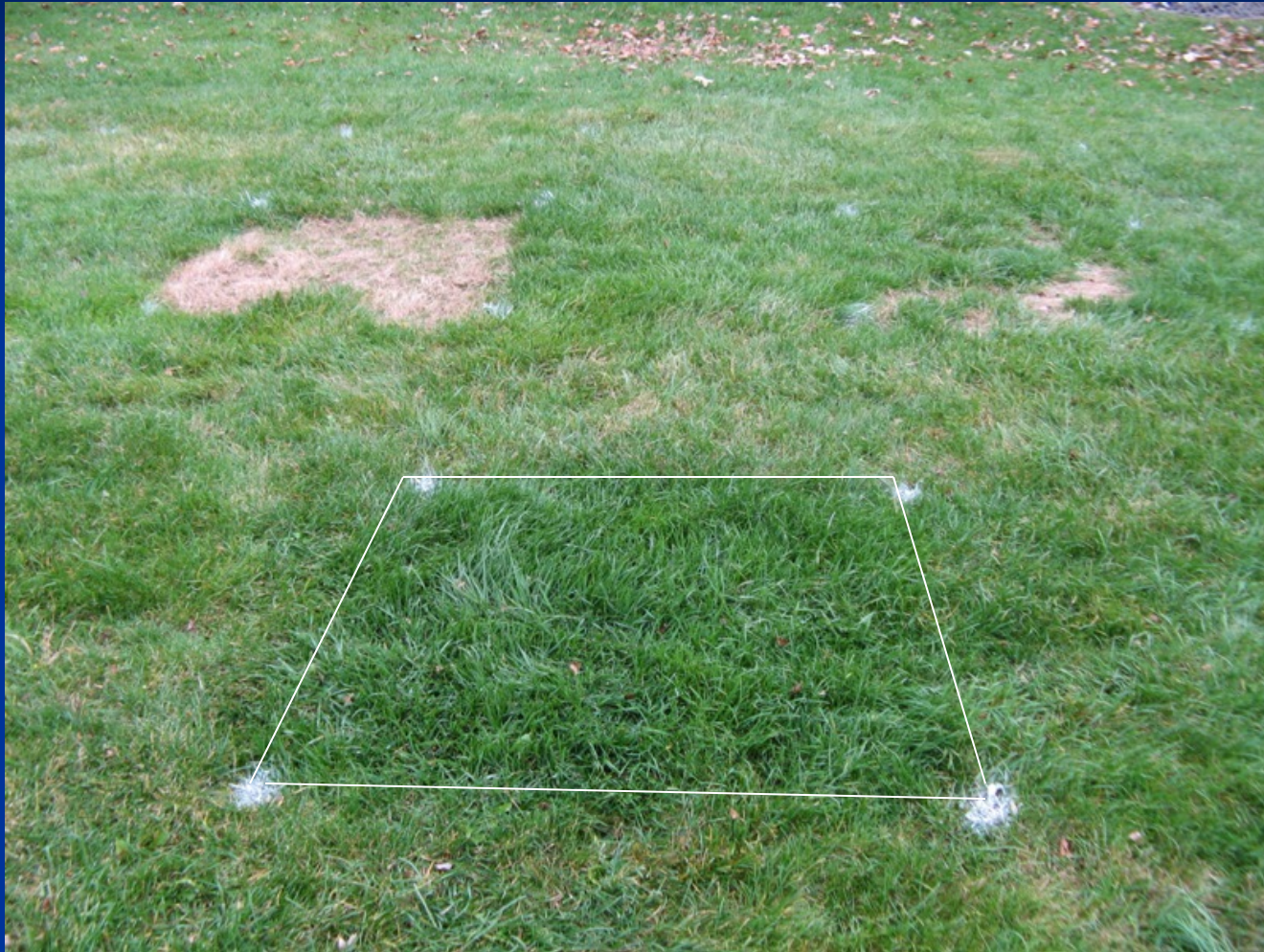


Burnout II



Hand pull

# 70 DAT



Corn gluten    Color = 9



7 DAIT



21 DAIT

## Weed-A-Tak



28 DAIT



70 DAIT





7 DAIT



21 DAIT

# Organic X



28 DAIT



70 DAIT



0 DAIT



1 DAIT



7 DAIT



21 DAIT



35 DAIT



70 DAIT

# 2011

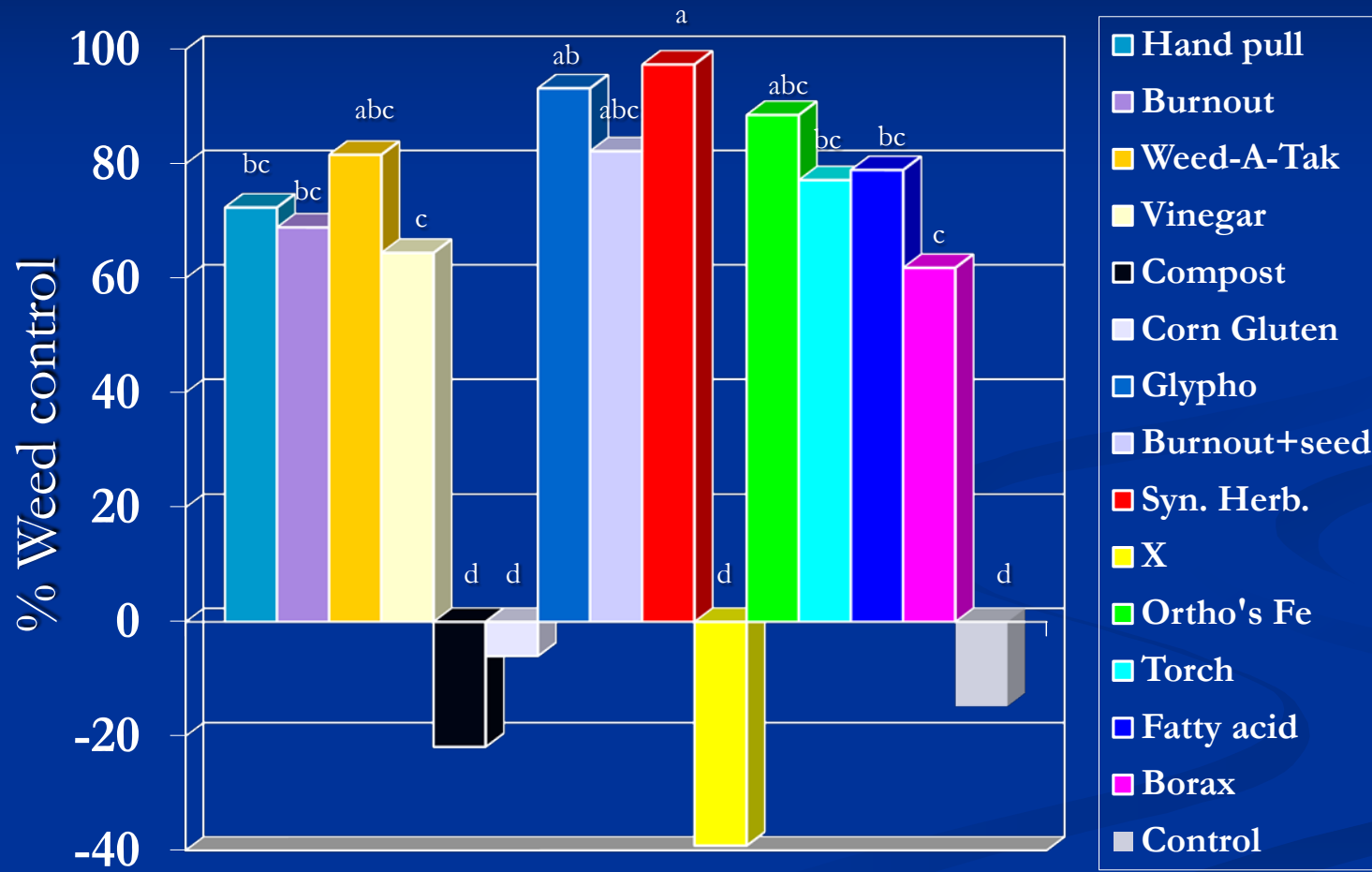
Percent Weed Cover (%)									
Treatment	0 DAIT	1 DAIT	2 DAIT	7 DAIT	14 DAIT	21 DAIT	28 DAIT	42 DAIT	70 DAIT
Hand pull	26 a*	1 a	1 a	6 ab	10 ab	3 abc	7 bc	10 ab	10 ab
Burnout	30 a	8 abc	6 abc	7 ab	12 abc	6 abc	9 bc	14 b	17 abc
Weed-A-Tak	22 a	5 ab	4 ab	5 a	7 a	2 ab	4 abc	7 ab	10 ab
Vinegar	34 a	21 bcdef	20 cde	22 bcd	26 bcde	10 bc	12 c	16 bc	17 abc
Compost	32 a	32 ef	32 e	34 d	38 def	38 d	39 d	43 d	40 cd
Corn Gluten	38 a	38 f	38 e	38 d	41 ef	39 d	40 d	38 cd	31 bcd
Glypho	37 a	37 a	37 e	5 a	5 a	2 ab	3 ab	17 bc	30 bcd
Burnout+seed	27 a	9 abcde	7 abcd	11 abc	16 abcd	3 abc	5 abc	5 ab	6 a
Syn. Herb.	19 a	19 bcdef	19 de	12 abc	3 a	1 a	1 a	2 a	3 a
X	40 a	40 f	40 e	42 d	53 f	53 d	56 d	54 d	44 d
Ortho's Fe	26 a	26 def	12 bcd	7 ab	7 a	1 a	3 abc	4 ab	5 a
Torch	23 a	23 cdef	5 abc	8 ab	10 ab	3 abc	5 bc	11 ab	14 ab
Fatty acid	29 a	11 abcde	8 abcd	9 ab	13 abc	3 abc	6 bc	15 bc	13 ab
Borax	33 a	33 f	33 e	27 cd	29 cdef	11 c	13 c	16 bc	15 abc
Control	36 a	36 f	36 e	36 d	41 ef	39 d	41 d	40 d	38 cd

\* Means followed by same letter within column are not significantly different.

Stats done with square root transformed data and separated with Tukey's HSD ( $\alpha = 0.05$ )

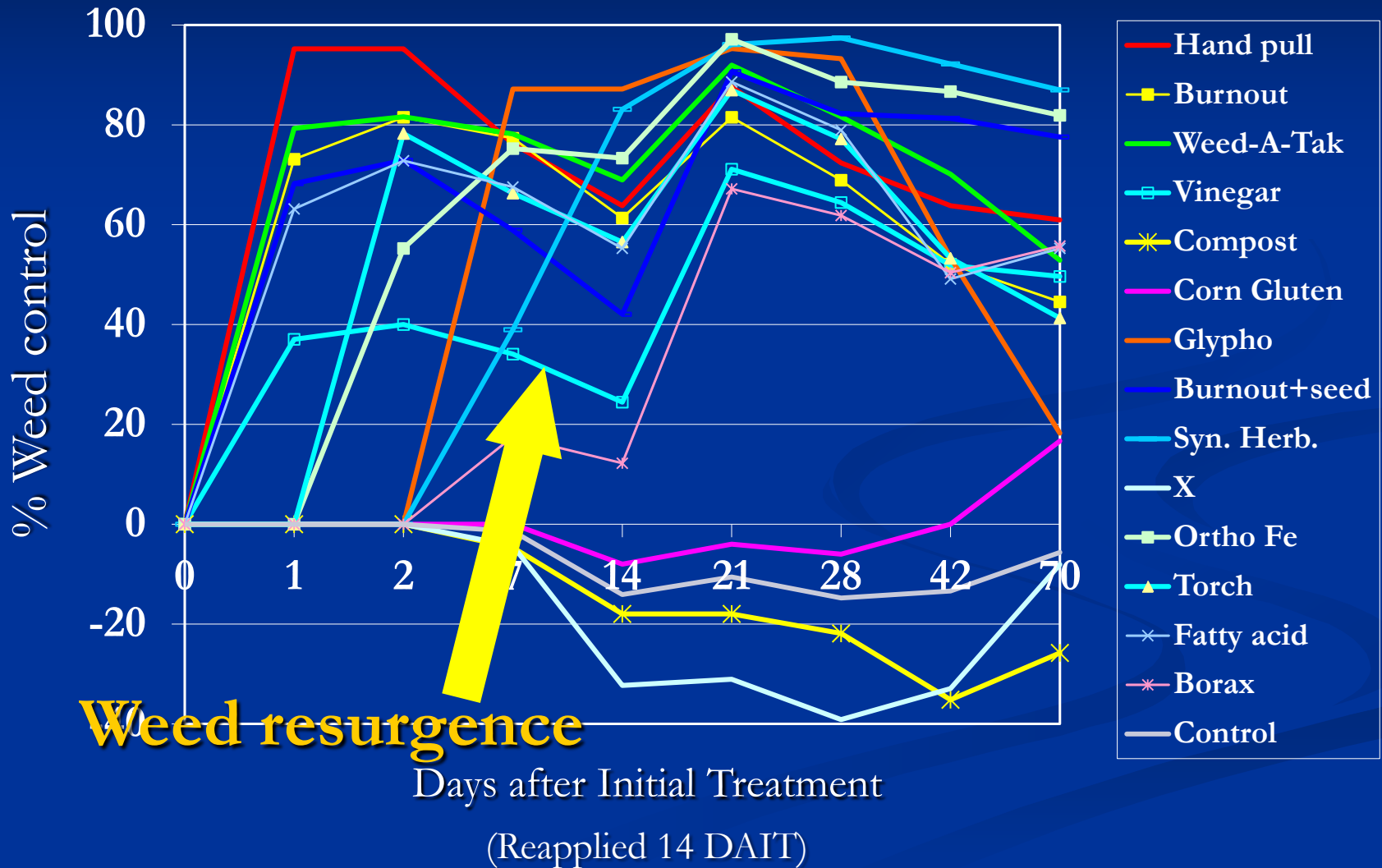


# 2011 Percent weed control: 28 DAIT



Means separated with Tukey's HSD (0.05)

# 2011 Percent weed control



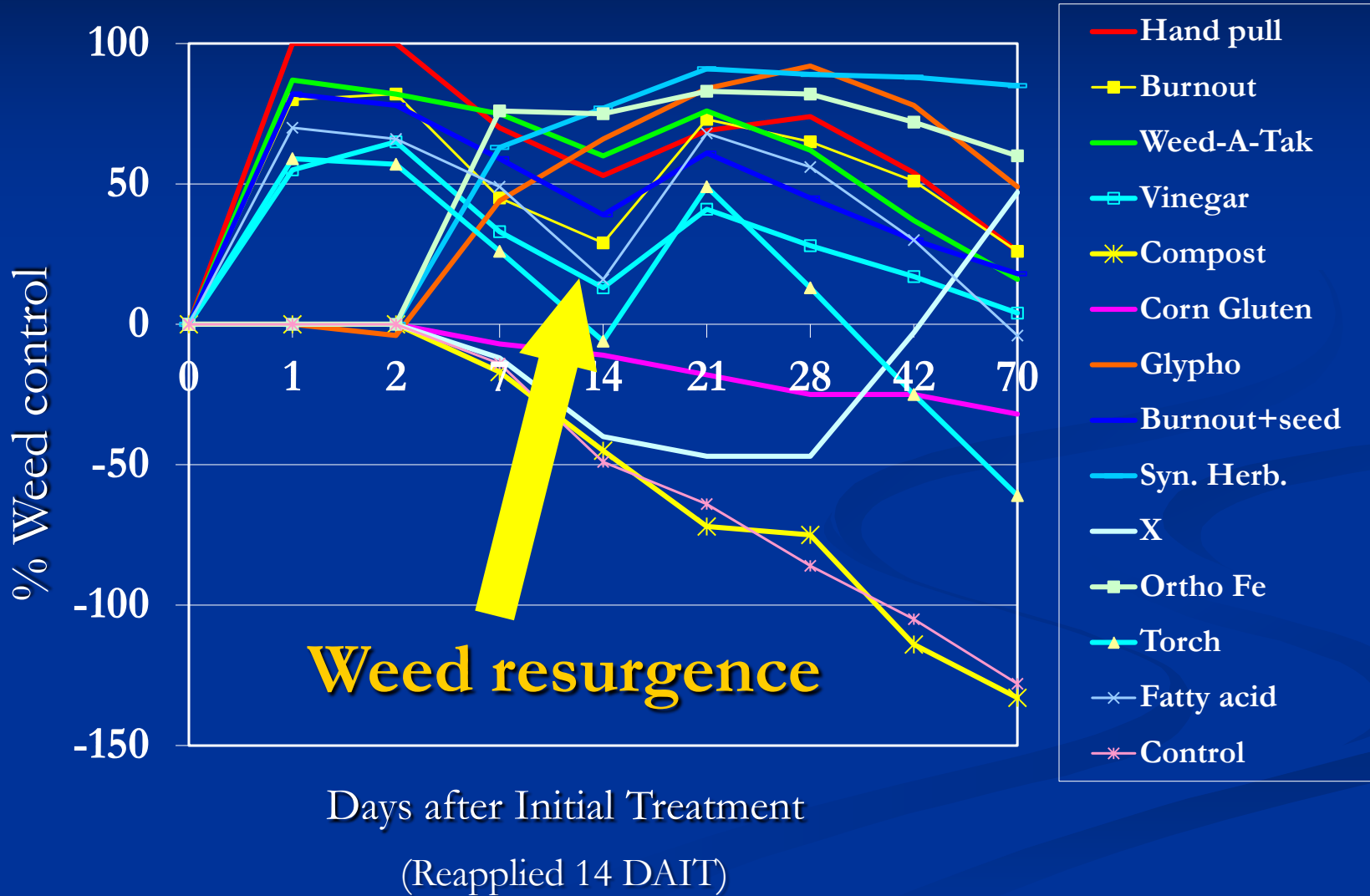
# Weed resurgence



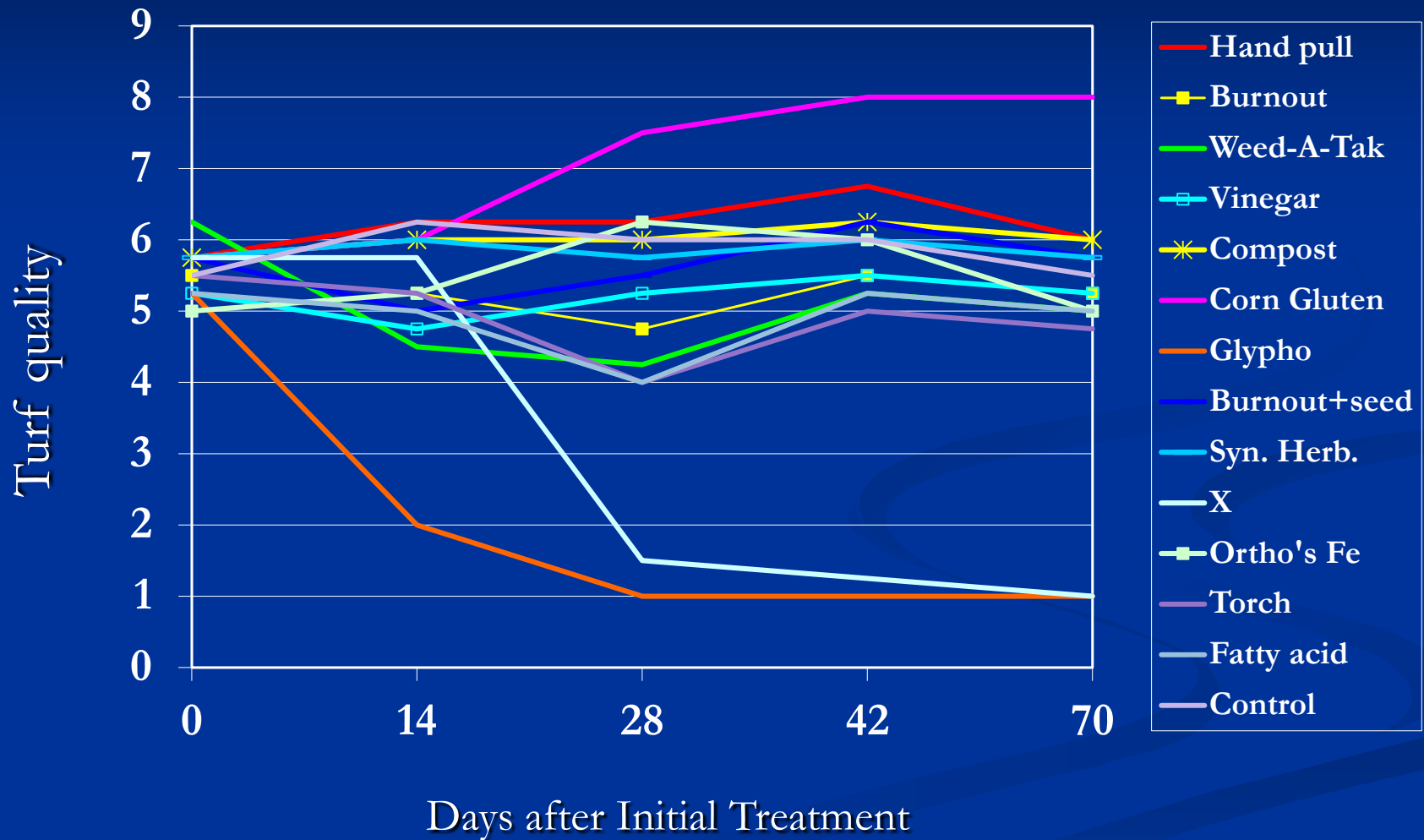
21 DAIT



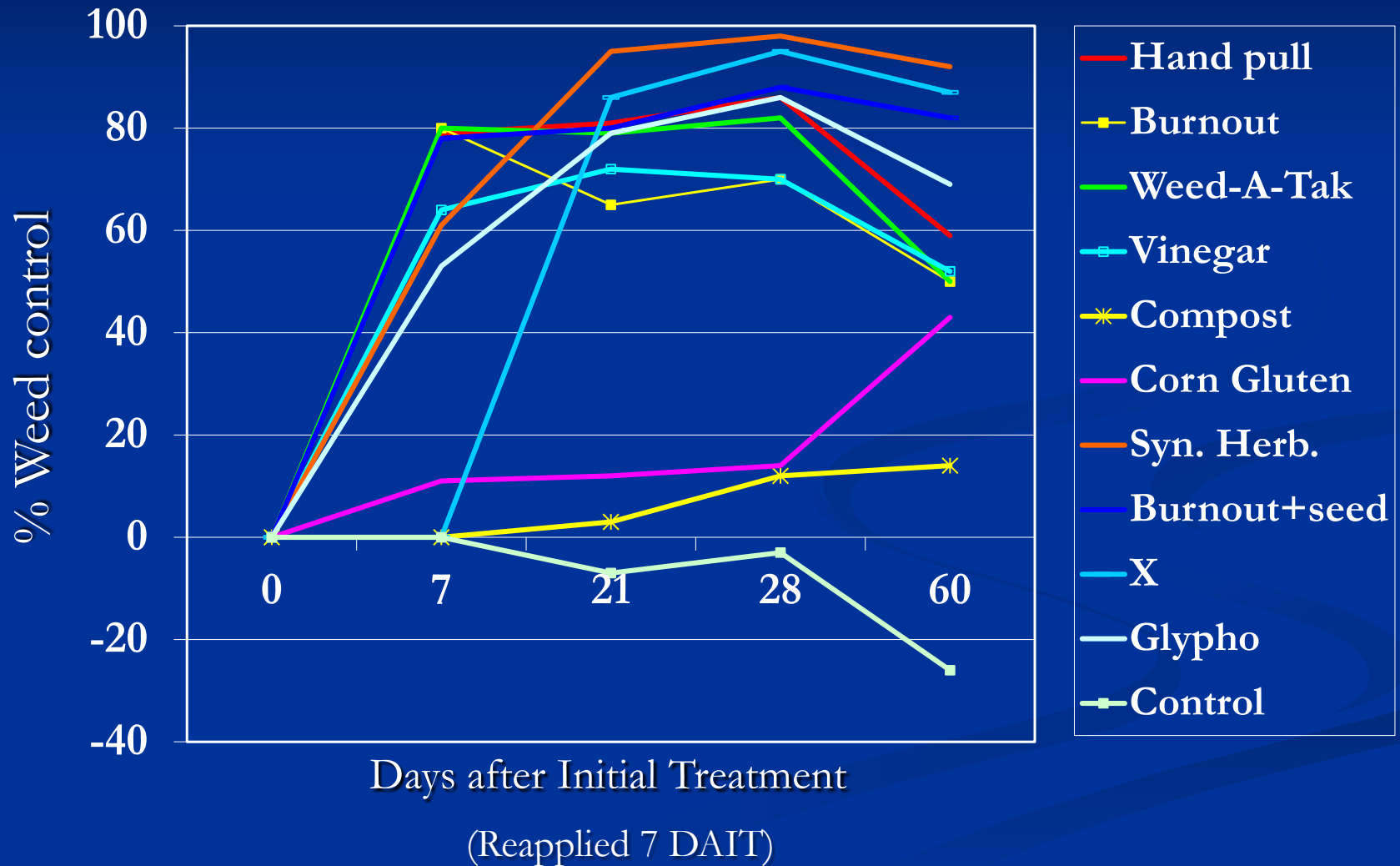
# 2010 Percent weed control



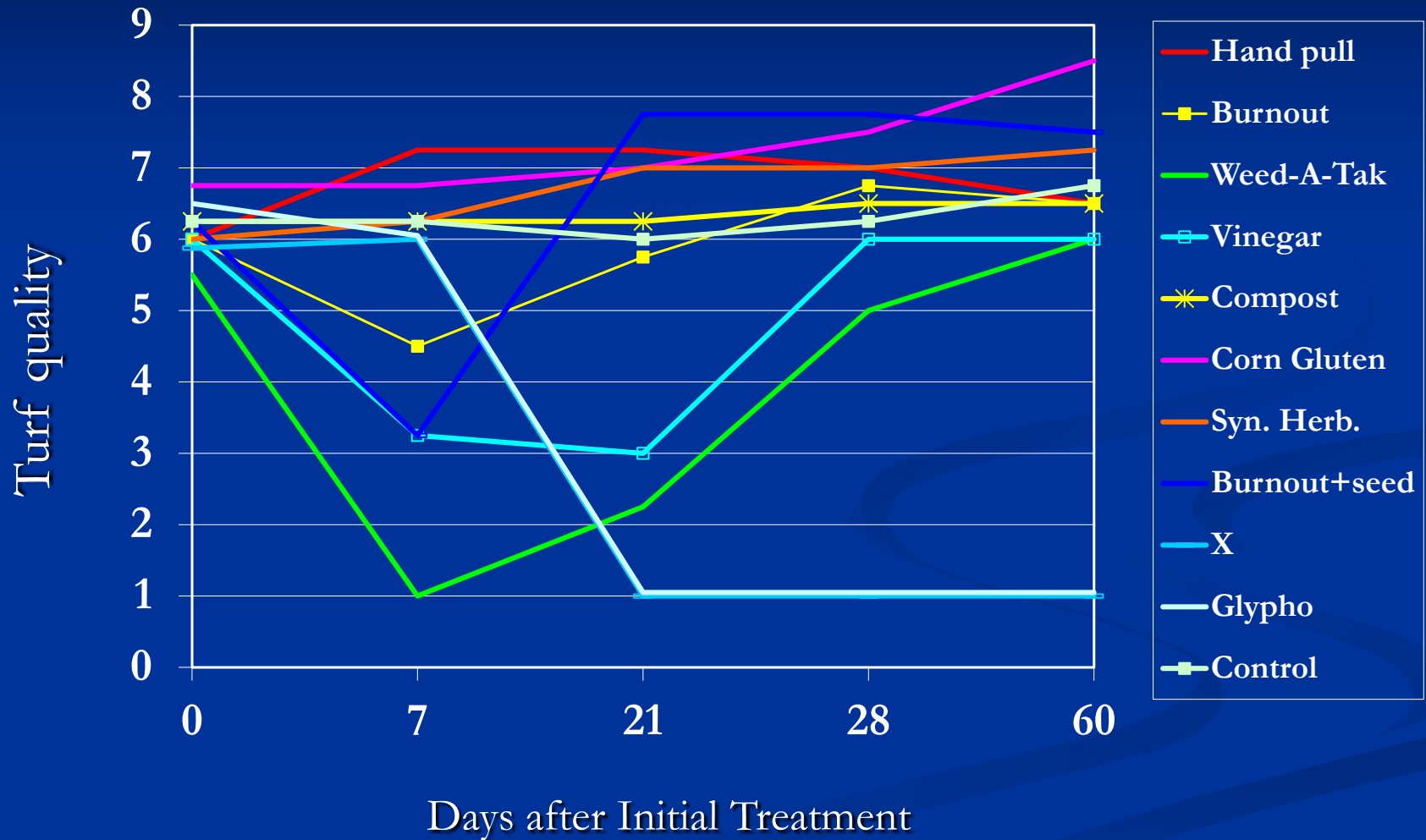
# 2010 Turf quality



# 2009 Percent weed control



# 2009 Turf quality





Controlled weeds without reducing turf quality.

Controlled weeds with temporary reduction in turf quality

1. Hand pull weeds
2. Burnout II spot treat
3. Weed-A-Tak spot treat
4. Vinegar spot treat
5. Compost topdressing
6. Corn gluten meal
7. Glyphosate spot treat
8. Burnout II spot treat then seed P. rye.
9. Synthetic Herbicide
10. Organic compound X spot treat
11. Ortho's Iron spot treat
12. Propane torch spot treat
13. Bayer Fatty acid spot treat
14. Borax (1<sup>st</sup> yr)
15. Control

# Results Summary

- Most methods resulted in  $> 60\%$  control.
- Multiple applications may be necessary—weed resurgence.
- Various methods injured or killed grass as well.
- Various methods controlled weeds as well as synth. herb.
  - Fe HEDTA (Ortho's iron) shows promise
  - Seeding into dead spots increases control and quality

# Incorporating into turf program

- Experiment with methods & products
- Cost analysis (products & labor)
- Customer analysis
  - Do they want it?
  - What quality of turf will they accept?
  - Will they pay more?

# Summary

- Definitions
- Weed prevention
- Alternatives to synthetic herbicides
- 2009-11 Research project

Share your story and comments:

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