Sunflower response to KIH-485

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NSA Research Summary

- KIH-485 – what is it?

- NSA Research Timeline:

  2004-2005 – researchers saw selectivity

  2006 – NSA funded standard protocol

  2007 – Study repeated for validation

  2008 – KIH-485 + Spartan

KIH-485

KIH-485 (pyroxasulfone) – Kumiai America

- PPI/PRE corn herbicide (rainfall needed)
- 2.8 to 5.6 oz ai/A (60 WDG)
- Unknown mode of action
- Compare to acetanilides – Dual, Lasso, etc.
- Excellent corn / soy safety
- Season-long grass and broadleaf weed control.
- Few rotation restrictions

Poor cocklebur, ragweed, sunflower control

Conclusions – 2004-2005

- KIH-485 weed efficacy is = or > at rates 3 to 8 times lower than other labeled products
- Active in coarse, medium, and fine textured soils

- KIH-485 controlled:

foxtail
lambsquarters
redroot pigweed
wild mustard
kochia
nightshade
wild buckwheat
common ragweed
marshelder

common cocklebur – 13-30% at 4.3 oz/A

NSA Proposal

- Weed control demonstrated
- Question – Are sunflower tolerant?

- 2006 – 2007 Objectives:

  Sunflower response to KIH-485

  Regional trials

  7 Esteemed Weed Scientists

NSA Proposal

- Regional Sunflower Herbicide Study
  - Mike Moechnig — SDSU, Brookings, SD
  - Curtis Thompson — KSU, Garden City, KS
  - Phil Stahlman — KSU, Hayes, KS
  - Brian Olson — KSU, Colby, KS
  - Dallas Peterson — KSU, Manhattan, KS
  - Alan Helm — CSU, Julesburg, CO
  - Brian Jenks — NDSU, Minot, ND
  - Richard Zollinger — NDSU, Fargo

NSA Proposal

- 2006-07 Regional Snfl Herbicide Protocol
  - KIH-485 rate by soil type

Medium texture	Coarse texture
2.8 oz/A	2.1 oz/A
3.5 oz/A	2.8 oz/A
4.2 oz/A	3.5 oz/A
7 oz/A	5.6 oz/A

Apply according to normal practices at location
No-till, conventional, Clearfield, Express Resistant

2006 Summary

- Sunflower injury from KIH-485:

6 of 8 researchers = 0% injury at
1X, 2,X, and 3X rates

	Colby KS	Minot ND
	---------- % snfl injury ---------	
1X rate	3	8
2x rate	4	17
3X	10	20

No apparent yield penalty

2007 Summary

- Sunflower injury from KIH-485:

6 of 8 researchers = 0% injury at
1X, 2,X, and 3X rates

	Highmore SD	Minot ND
	---------- % snfl injury ---------	
1X rate	0	1
2x rate	3	3
3X	15	7

No inj at later evaluations / No apparent yield penalty

Peterson – Manhattan, KS – 06-07

	Lacg		Paam		Vele	
	---------- % control ----------					
KIH-485	06	07	06	07	06	07
2.4 oz	92	97	95	95	70	72
*3.5 oz	94	99	96	98	80	87
4.2 oz	98	99	96	99	84	92
5.6 oz	98	99	99	99	90	95
Dual Mag (LR)	-	97	-	93	-	0
Spartan (LR)	-	53	-	95	-	57
Untreated	0	0	0	0	0	0
LSD (0.05)	6	6	6	3	12	11

* = x rate for soil type.

Control ratings averaged over four evaluations.

Acetanilide Herbicides

- Lasso, Dual, Outlook, Harness/Surpass:

What weeds controlled?

Control annual grasses: foxtail, barnyardgrass

Broadleaf weed: pigweed species, nightshade?

Olsen - Colby, KS – 2006-2007

	Tupw-06	Tupw-07	Puncturvine-07
	---------- % control ----------		
KIH-485			
2.1 oz	97	99	99
2.8 oz	99	99	99
3.5 oz	99	99	99
5.6 oz	99	99	99
Untreated	0	0	0
LSD (0.05)	ns	ns	ns

* = x rate for soil type.

Control ratings averaged over all evaluations.

Thompson – Tribune, KS - 2006

	Koch	Ruth	Tupw	Rrpw	Puvi
	---------- % control ----------				
KIH-485					
2.4 oz	65	83	93	90	86
*3.0 oz	70	91	95	90	88
4.8 oz	63	94	95	92	91
6 oz	71	93	98	99	92
Untreated	0	0	0	0	0
LSD (0.05)	ns	ns	ns	ns	ns

* = x rate for soil type.

Control ratings July 20, 2006

Conditions were dry after application.

Stahlman – Hays, KS – 2006

No weed control reported in 2007

	Grft	Koch	Tupw	Rrpw	Prsp
	---------- % control ----------				
KIH-485					
2.4 oz	83	38	95	93	85
*3.0 oz	94	53	98	98	85
4.8 oz	93	63	99	95	85
6 oz	94	62	95	99	85
Untreated	0	0	0	0	0
LSD (0.05)	ns	16	ns	ns	ns

* = x rate for soil type.

Control ratings July 17, 2006 = 59 DAA.

Conditions were dry after application.

Moechnig – Highmore, SD – 06-07

	2006		2007	
	Grft	Koch	Grft	Wioa
	-- % control --		--% control --	
KIH-485				
2.8 oz ai/A	85	89	90	80
*3.5 oz ai/A	88	88	91	85
5.6 oz ai/A	93	87	98	94
7 oz ai/A	94	93	97	91
Untreated	0	0	0	0
LSD (0.05)	7	ns	7	6

* = x rate for soil type.

Zollinger, Valley City, ND - 2007

			Weed Control %			
	Rate	Snfl	Yeft	Wioa	Ebns	Mael
KIH-485	2.8 oz	0	99	55	99	55
	*3.5 oz	0	99	55	99	55
	5.6 oz	0	99	96	95	85
	7 oz	20	99	99	99	99
KIH + Spart	2.8 + 3 oz	2	99	99	99	99
	3.5 + 3 oz	0	95	90	99	99
	2.8 + 4 oz	7	99	95	99	99
	3.5 + 4 oz	8	99	99	99	99
Control		0	0	0	0	0
LSD (0.05)		3	ns	5	3	9

* = x rate for soil type

Howatt - HRS Wheat Tol. to KIH-485

	Rate	Wheat 6/13	Wheat 6/28	Yeft
	(ai/A)	- % injury -		% control
KIH-485	1 oz	0	0	92
	1.5 oz	0	0	95
	2 oz	0	0	96
	2.8 oz	0	0	98
	3.5 oz	0	0	99
Control		0	0	0
LSD (0.05)		-	-	2

Howatt - Oat Tolerance to KIH-485

	Rate	Oat 6/19	Oat 6/29
	(ai/A)	---- % injury ----	
KIH-485	3 oz	96	99
	4 oz	99	99
Mesotrione	3 oz	0	0
Brox+Pyrsulfatole	3 oz	0	0
Control		0	0
LSD (0.05)		1	-

Can KIH-485 control wild oat control in wheat?

Zollinger – Prosper, ND - 2006

	Yrft	Rrpw	Colq	Hans	Corw
	---------- % control ----------				
KIH-485					
2.8 oz ai/A	75	70	77	80	42
*3.5 oz ai/A	78	91	92	88	62
4.2 oz ai/A	88	96	96	91	78
7 oz ai/A	86	97	97	94	83
Untreated	0	0	0	0	0
LSD (0.05)	9	4	8	7	6

* = x rate for soil type.

Control ratings averaged over 9, 21, and 35 DAA.

Conditions were dry after application.

Zollinger – Valley City, ND - 2006

	Snfl	Mael
	% injury	% control
KIH-485		
2.8 oz ai/A	0	82
*3.5 oz ai/A	0	91
4.2 oz ai/A	0	92
7 oz ai/A	5	93
Untreated	0	0
LSD (0.05)	ns	ns

* = x rate for soil type.

Injury and control ratings averaged over 7, 14, and 42 DAA

Conditions were dry after application.

Conclusions – 2004-2005

- KIH-485 weed efficacy is = or > at rates 3 to 8 times lower than other labeled products
- Active in coarse, medium, and fine textured soils

- KIH-485 controlled:

foxtail
lambsquarters
redroot pigweed
wild mustard
kochia
nightshade
wild buckwheat
common ragweed

common cocklebur – 13-30% at 4.3 oz/A

06-07 Weed Control Summary

- Weeds controlled (80-99%):

Grasses	Broadleaf weeds	
foxtail	pigweed	amaranth
crabgrass	lambsquarters	velvetleaf
wild oat	kochia	puncture vine
	nightshade	Russian thistle
	buckwheat	c. ragweed
		marshelder

NSA Proposal

- Weed control demonstrated

- 2008 Objectives:

  Sunflower response to

  KIH-485 + Spartan

  Regional trials

  7 Esteemed Weed Scientists

NSA Proposal

KIH-485 + Spartan

- Weaknesses of Spartan =

  wild buckwheat, cocklebur, lanceleaf sage, common mallow, marshelder, mustard species, hairy nightshade, prickly lettuce, ragweed, and other large-seeded broadleaf weeds

Herbicide synergism (i.e. Atrazine)

08 NSA Herbicide Protocol

	Soil texture		
	Light	Medium	Heavy
KIH-485	2.1 oz	2.8 oz	3.5 oz
	2.8 oz	3.5 oz	4.2 oz
	4.2 oz	5.6 oz	7 oz
Spartan	3 fl oz	3 fl oz	3 fl oz
	4 fl oz	4 fl oz	4 fl oz
KIH + Spart	2.1 + 3 floz	“	“
	2.1 + 4 floz		
	2.8 + 3 floz		
	2.8 + 4 floz		
	4.2 + 3 floz		
	4.2 + 4 floz		

Zollinger – Valley City, ND - 2006

	Rate	Sunflower			Mael
		7 DAA	14 DAA	42 DAA	
	(/A)	---------- % injury ----------			% control
KIH-485 + Spartan	2.8 oz 3 fl oz	11	8	0	94
KIH-485 + Spartan	3.5 oz 3 fl oz	8	3	0	93
KIH-485 + Spartan	2.8 oz 4 fl oz	22	18	0	91
KIH-485 + Spartan	3.5 oz 4 fl oz	12	9	0	94
Untreated		0	0	0	0
LSD (0.05)		6	10	0	4

2008 Summary

- Sunflower injury from KIH-485 + Spartan:

8 of 8 researchers = 0% injury –

Spartan alone

KIH 485 alone

Spartan + KIH 485 in all combinations

No apparent yield penalty

Helm – CO - 2007

	Sunflower			
	Dand	Koch	Ruth	Amar
KIH 485 + Spartan	---------- % control ----------			
*2.1 + 3 oz	7-82	92	95	95
2.8 +3 oz	10-83	95	92	93
2.1 + 4 oz	12-80	93	93	93
2.8 + 4 oz	7-80	95	93	90
Control	0	0	0	0
LSD (0.05)	-	3	3	2

* = x rate for soil type

Injury data averaged over 18, 39, and 48 DAA

Garden City, KS - Thompson

		% Weed Control		
	Rate	Koch	Rrpw	Puvi
KIH-485	2.8 oz	74	80	35
	3.5 oz	83	85	35
	5.6 oz	88	91	50
Spartan	3 fl oz	99	91	51
	4 fl oz	99	99	63
KIH + Spart	2.8 + 3 floz	99	99	73
	2.8 + 4 floz	99	99	76
	3.5 + 3 floz	99	99	74
	3.5 + 4 floz	99	99	79
	5.6 + 3 floz	99	99	84
	5.6 + 4 floz	99	99	90

Hays, KS - Peterson

		% Weed Control			
	Rate	Tupw	Puvi	Lcgr	Stgr
KIH-485	2.8 oz	81	50	70	73
	3.5 oz	73	63	80	95
	5.6 oz	99	84	97	99
Spartan	3 fl oz	63	35	35	28
	4 fl oz	78	63	60	48
KIH + Spart	2.8 + 3 floz	99	60	63	65
	2.8 + 4 floz	95	58	78	83
	3.5 + 3 floz	99	50	78	75
	3.5 + 4 floz	98	48	75	85
	5.6 + 3 floz	95	63	75	85
	5.6 + 4 floz	86	38	81	68

Minot, ND - Jenks

		% Weed Control	
	Rate	Wibw	Prpw
KIH-485	2.8 oz	47	67
	3.5 oz	58	71
	5.6 oz	70	81
Spartan	3 fl oz	90	80
	4 fl oz	92	84
KIH + Spart	2.8 + 3 floz	86	93
	2.8 + 4 floz	90	95
	3.5 + 3 floz	95	98
	3.5 + 4 floz	97	99
	5.6 + 3 floz	96	98
	5.6 + 4 floz	92	97

Brookings, SD - Moechnig

		% Weed Control	
	Rate	Grft	Wibw
KIH-485	2.8 oz	75	67
	3.5 oz	83	68
	5.6 oz	90	80
Spartan	3 fl oz	50	63
	4 fl oz	65	75
KIH + Spart	2.8 + 3 floz	86	81
	2.8 + 4 floz	88	85
	3.5 + 3 floz	90	83
	3.5 + 4 floz	88	85
	5.6 + 3 floz	92	83
	5.6 + 4 floz	93	85

Valley City, ND - Zollinger

		% Weed Control	
	Rate	Fxtl barley	Mael
KIH-485	2.8 oz	40	43
	3.5 oz	50	53
	5.6 oz	60	89
Spartan	3 fl oz	30	27
	4 fl oz	40	43
KIH + Spart	2.8 + 3 floz	67	73
	2.8 + 4 floz	53	65
	3.5 + 3 floz	72	77
	3.5 + 4 floz	72	81
	5.6 + 3 floz	50	63
	5.6 + 4 floz	72	80

Hays, KS - Peterson

		% Weed Control			
	Rate	Tupw	Puvi	Lcgr	Stgr
KIH-485	2.8 oz	81	50	55	63
	3.5 oz	73	63	58	90
	5.6 oz	99	84	70	99
Spartan	3 fl oz	63	35	23	28
	4 fl oz	78	63	55	50
KIH + Spart	2.8 + 3 floz	99	60	50	63
	2.8 + 4 floz	95	58	65	65
	3.5 + 3 floz	99	50	58	85
	3.5 + 4 floz	98	48	65	93
	5.6 + 3 floz	95	63	53	88
	5.6 + 4 floz	86	38	65	65

06-07 Weed Control Summary

- Weeds controlled (80-99%):

Grasses	Broadleaf weeds	
foxtail	pigweed	amaranth
crabgrass	lambsquarters	velvetleaf
wild oat	kochia	puncture vine
stinkgrass	nightshade	Russian thistle
	buckwheat	c. ragweed
		marshelder

Summary 06-08

- Sunflower safety has been documented to KIH-485 (3 to 5 years - up to 8 locations / yr)
- Sunflower safety has been documented to KIH-485 + Spartan (1 year only - 8 locations)
- KIH-485 controls several grass and broadleaf weeds IF activated by rainfall
- KIH + Spartan combinations controls several weeds but antagonism may occur with some species

Summary 06-08

- Registrant = Kumiai
- Registration sequence:

  Corn + soy = 2010

  Wheat = 2011 - ?

  Other crops = ?

- Access to major chemical companies = ?

Future of KIH-485

- Access to major chemical companies = ?
  - Selective distribution
    - Corn and soy to Company X
    - Minor crops to Company Y
    - Other discovered uses to Company Z
- Access to suppliers / distributors = ?
  - Coalition of generic companies = ?
- Labeled on sunflower = ?
- Proposal by NDSU / NSA / IR-4 / NDDOA

KIH-485 study at Prosper